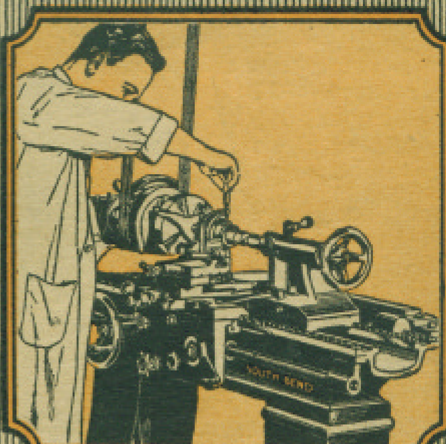
Auto Mechanics Service Book

Showing Modern Machine Methods for the Service Station Shop



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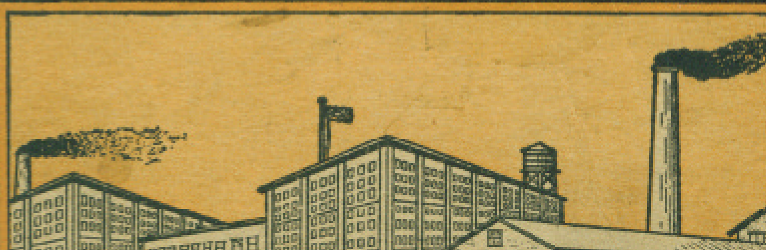

Machine Shop Practice

In the Modern Service Station Shop

This handbook outlines the latest shop practice and methods used in the large, modern service station shops for servicing the mechanical parts of automobiles, trucks, buses and airplanes, of all makes and types, with accuracy and precision.

The mechanical units of the modern automobile, truck, bus and airplane, such as the engine, transmission, differential, ignition system, brakes, ball bearings, roller bearings and other parts, are all built to meet the most exacting standards of accuracy and precision.

The back geared, screw cutting lathe, being a precision tool, is employed in the manufacture of these parts: therefore, it is logical that when these parts are to be repaired, the work should be done with the same type of equipment.

Those wishing additional information on the correct mechanical equipment for the service station shop, or on lathes, tools, attachments, etc., should write for booklets illustrated and described on pages 94 and 95 of this service book.

AUTO MECHANICS SERVICE BOOK NO. 66

Price, 25 cents, postpaid

Coin or Stamps of any country accepted

South Bend Lathe Works

666 East Madison St. South Bend, Indiana, U. S.A.

The South Bend Lathe

for use in the

Service Station Shop — Electrical Shop
Garage Shop — Brake Service Shop
General Automotive Repair Shop
Truck and Auto Fleet Owner Shop

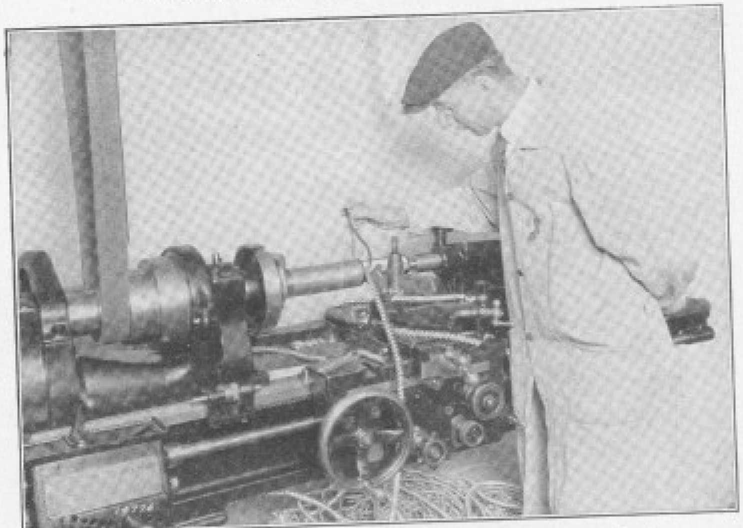

Fig. 1. Turning a Shaft in a 16-inch Quick Change Gear Lathe

A Few Major Jobs That Can Be Done on South Bend Lathes

Truing armature commutators.
Refacing valves.
Finishing semi-machined pistons.
Chucking work.
Cutting screw threads.
Making shafts.
Milling and keyway cutting.
Grinding.
Making bushings.
Drilling, boring, reaming.
Filing and polishing.
Truing brake drums.
Testing and truing crankshafts.
Making axles and drive shafts.
Boring connecting rods.
Making valve stem guides.
Machining flywheels for ring gears.
Facing clutch discs.
Truing gear flanges.
Making mandrels and adapters.
Balancing wheels.
Undercutting mica.
Taper turning and boring.
And hundreds of other jobs.

Principal Service Station Shops Using South Bend Lathes

Service Station Shops	Number of Shops
Buick Service Stations	172
Cadillac Service Stations	47
Chevrolet Service Stations	229
Chrysler Service Stations	77
Dodge Service Stations	285
Ford Service Stations	304
Graham-Paige Service Stations	44
Hudson-Essex Service Stations	109
Hupmobile Service Stations	24
Nash Service Stations	56
Oakland Service Stations	47
Oldsmobile Service Stations	121
Packard Service Stations	30
Reo Service Stations	37
Star and Durant Service Stations	71
Studebaker Service Stations	105

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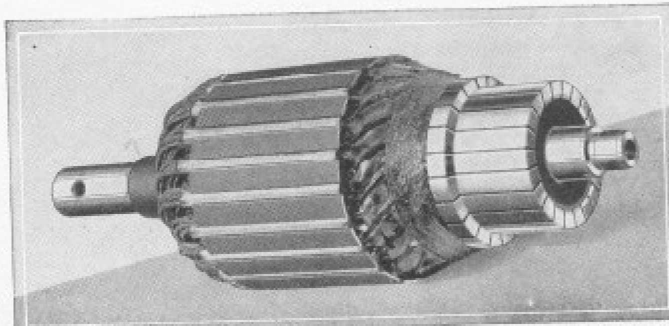


Fig. 6. Armature Commutator That Has Been Turned True in the Lathe

Servicing the Armature

In the 9-inch Back Geared Screw Cutting Lathe

The commutator of an armature in the generator and starting motor needs truing from time to time because its surface becomes worn uneven by the brushes. The mica insulation of an armature commutator is harder than the copper segments it separates. Constant use will wear down the copper and leave the mica projecting above the surface. The commutator must then be turned true and the mica undercut; starting motor commutators, however, are not undercut.

Truing the Armature Commutator is done by mounting the armature between centers in the lathe and taking a light cut with a turning tool across the surface of the commutator. Before any machining operation is performed on the commutator, the armature shaft should be tested between lathe centers to see that it runs true. The truing operation is described in the following paragraphs.

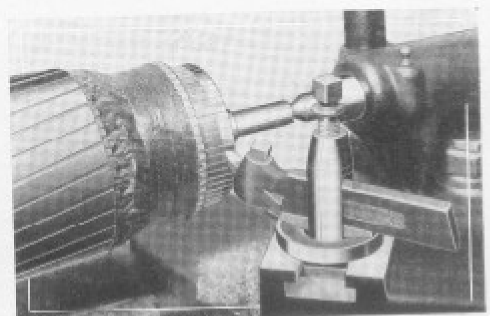


Fig. 7. Close-Up of Tool Turning the Commutator

Testing and Straightening the Armature Shaft is done by placing the armature between centers in the lathe and revolving it by hand. If the shaft is not true, mark the "high spot" with chalk, remove the armature from the lathe and place the shaft on an anvil. Tap it gently on the "high spot" with a wood mallet. Test and mark again. This operation should be repeated until the shaft is perfectly straight and runs true.

Fig. 8. Marking High Spot on a Bent Armature Shaft

Truing the Commutator.—Armatures with worn commutators require one or two cuts across the commutator to true up the face, depending upon the wear received. Usually a commutator can be trued in about five minutes. The carriage power feed should be used when turning the commutator as it causes the tool to cut smoothly and will leave the surface true and smooth.

Before mounting the armature in the lathe, see that center holes in armature shaft are clean. Attach a lathe dog to the end of the armature shaft opposite the commutator and place the armature between centers. Be sure to place a drop of oil on the tail center point.

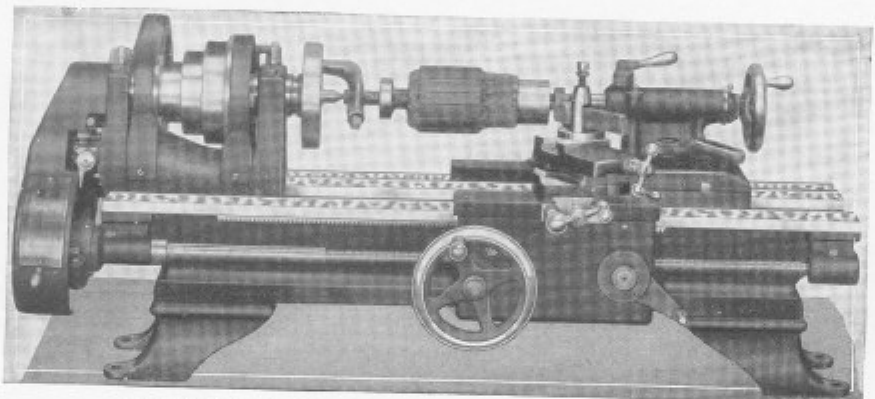


Fig. 9. Truing the Commutator of an Armature in a 9-inch Lathe

Setting the Turning Tool.—Set the cutting edge of the turning tool even with the center point of the tail center. Bring the point of the tool up against the commutator lightly. Move the carriage back until the tool clears the commutator. Start the lathe, throw in the power feed and take a light cut across the commutator from right to left. Repeat this operation until the commutator is true.

The Correct Spindle Speed for truing commutators on the 9-inch lathe is approximately 410 revolutions per minute. To obtain this speed, throw out the back gears and put the belt on the middle step of the spindle cone.

The Correct Power Feed for turning the commutator is obtained on a 9-inch lathe by placing a 16 tooth gear on the stud and a 92 tooth gear on the lead screw. Then mesh the 16 tooth gear into the large compound idler and the 92 tooth gear into the small compound idler gear. For operating the power feed of the lathe, see page 23 in the book "How to Run a Lathe."

For Polishing the Commutator take a small piece of No. 00 sandpaper and hold it lightly against the commutator surface while it is revolving at a high speed. Keep the sandpaper in this position until the desired finish has been obtained. Never use emery cloth for this purpose. Sandpaper produces the proper finish desired on the commutator and is not likely to cause damage during the polishing process.

Restoring Damaged Center Holes in an Armature Shaft.—When the center hole of an armature shaft has been damaged it is necessary to restore it so that the armature can be held accurately for truing the commutator, straightening the shaft or other repair operations. To restore center holes it is essential to use a lathe equipped with compound rest and center rest.

Fig. 10. Restoring a Damaged Center Hole in an Armature Shaft

Machining a Center Hole True.—Battered or damaged center holes are restored in the following manner: Place one end of armature shaft in universal lathe chuck and the other end in center rest. See Fig. 10. Adjust jaws of center rest until center of the shaft is approximately true with the point of the tail center. See page 58 of "How to Run a Lathe."

Set a finger boring tool in the tool post and adjust the edge of the cutting tool to a height exactly even with the point of the lathe centers. Set the compound rest at the 60 degree angle mark. Oil the center rest jaws well. Start the lathe and remove only enough stock to make the center hole run true, taking very light cuts by turning the compound rest screw by hand. When one center hole is machined true, reverse the armature and repeat the operation on the other end. See Figs. 11 and 12.

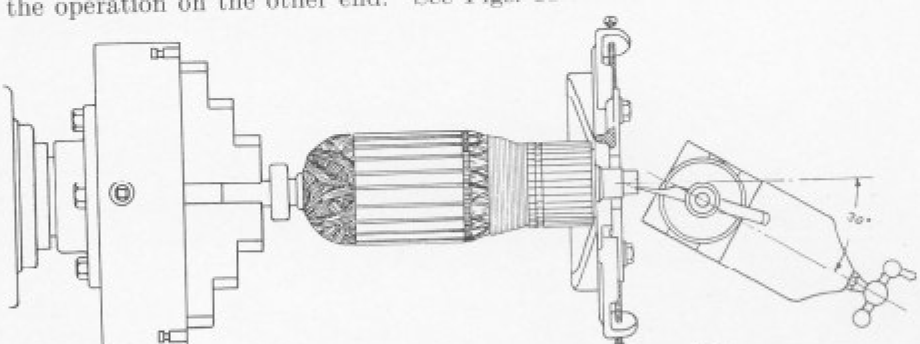


Fig. 11. Position of Compound Rest for Restoring Center Hole

Drilling New Center Holes.—Sometimes armature shafts do not have center holes. In such cases it is necessary to center drill each end of the shaft before turning the commutator true. The set up of the work for restoring center holes described in the preceding paragraph may be applied for setting up the job. A combination drill and countersink and drill chuck held in the tailstock spindle may be used for drilling the new center holes, or follow method shown in Fig. 15 on page 7.

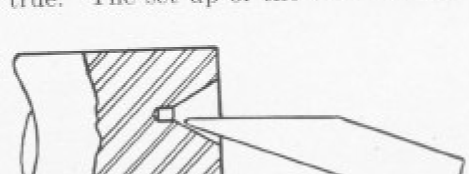


Fig. 12. Angle of Finger Tool for Machining

Types of Mica Undercutters

For the 9-inch Back Geared Screw Cutting Lathe

The No. 201 Electric Rotary Type Mica Undercutter has a disc cutter to remove the mica from between the commutator segments. The cutter disc is mounted on an extension shaft attached direct to the shaft of the motor.

Electric Rotary Undercutters are adjustable for all sizes of commutators. The electric mica undercutter is a very important attachment for the lathe in a service station that handles commutator work. The mica must be undercut to prevent excessive sparking of the commutator. This rotary type of undercutter is for the same purpose as the shaper type of undercut except that it is operated by a motor.

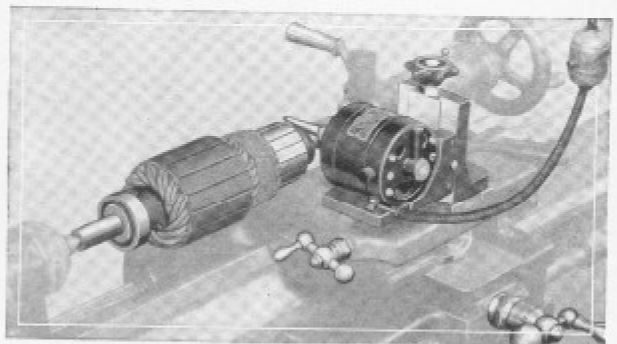


Fig. 13. The Electric Rotary Type Mica Undercutter

Shaper Undercutter.—Use of the shaper type of mica insulation undercutter is an excellent method of removing surplus mica. When using this undercutter the armature is mounted between centers and the undercutter is fastened to the tool rest and traversed the full length of the mica strip by means of the hand feed wheel of the carriage.

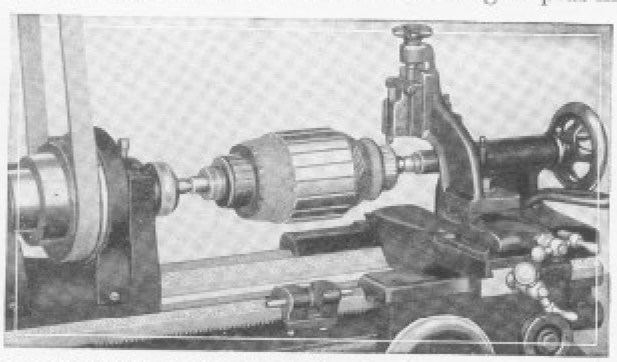


Fig. 14. Undercutting Mica Insulation of an Armature Commutator with a Shaper Type Mica Undercutter

The tool cuts only on the forward stroke. It is held in a clapper box and lifts up on the back stroke.

How to Operate the Shaper Type Undercutter.—Place the armature between centers. Set the tool vertically central over the lathe center points. Bring the first mica section into line with the cutting tool. The tool should travel the length of the mica. Return the carriage and rotate the armature by hand to the next section of mica. Continue this operation until finished. Each section of mica should be undercut to a depth of 1/64-inch below the surface of the commutator. The tool should remove the mica cleanly without tearing it. If the tool tears the mica the cut is too heavy or the cutting edge is dull. Take a small piece of sandpaper and polish commutator after undercutting.

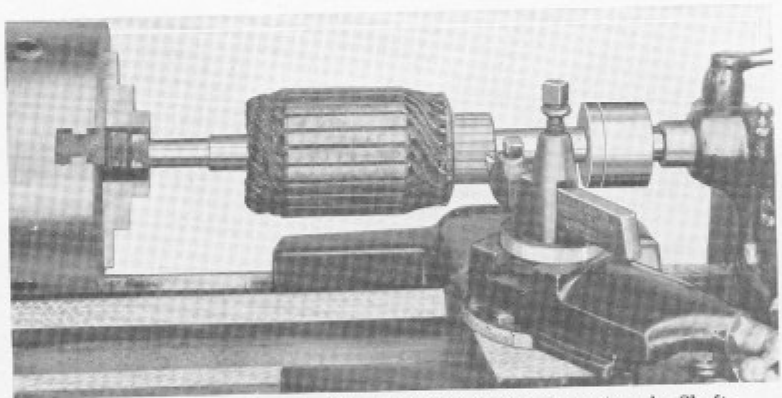


Fig. 15. Truing an Armature Commutator Without Centering the Shaft

Truing Commutator Having Shaft Without Center Holes.—Armatures often arrive in the shop having shafts with no center holes. To true the commutator without centering the shaft, we mount the armature as shown in Figure 15, illustrated above. Place one end of the armature shaft in a universal geared scroll chuck mounted on the lathe spindle and place the other end of the shaft in a bushing which is fitted into a holder which fits the taper of the tailstock. The armature mounted this way is held true in about the same position as when it is in its bearing in the motor. The operator may then proceed to true up the commutator as instructed on pages 3 and 4.

Bushing and Holder to Fit Armature Shaft.—The drawing at the right shows details of the holder and bushing for supporting the armature shaft which is not centered and which is illustrated above. The bushing can be made of soft steel or cast iron. One can have a number of bushings to fit armature shafts of various diameters.

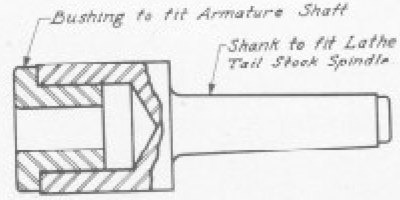


Fig. 16. Holder and Bushing for Supporting Shaft

Cutting Wires from Armature to Permit Re-Winding.—The illustration herewith shows an armature mounted between centers in the lathe with a cutting tool in the tool post cutting the wires to permit removal from the armature before rewinding.

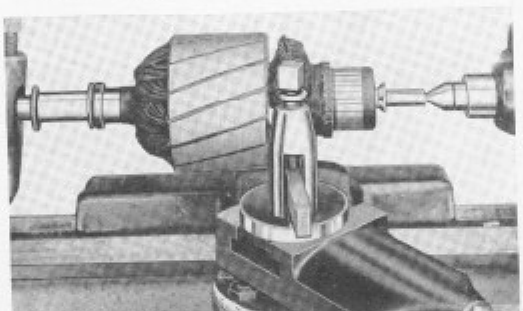


Fig. 17. Cutting Old Wire from Armature

The armature is revolved slowly between centers in the lathe and the tool fed carefully. This is a rapid method of cutting the wiring without injury to the armature.

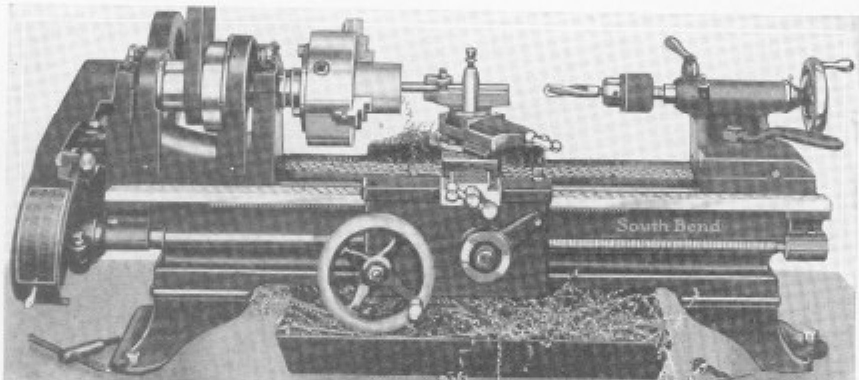


Fig. 18. Boring a Bushing in a 9-inch Lathe

Making Bushings

In the 9-inch Back Geared Screw Cutting Lathe

Every service station occasionally is required to make its own bushings for some repair job. The making of these bushings necessitates the use of a back geared screw cutting lathe on which the entire job can be done.

Bushings from Bronze Castings.—Sometimes we make the bronze bushings from a bronze casting that is about $\frac{1}{8}$-inch larger than the finished work. Occasionally it is made from a bronze casting that is about eight or ten inches long and in this case we put the bar casting in the chuck, let it pass into the lathe spindle and project from the chuck just far enough to machine the full length of the bushing as is described below. The method used to make a bushing depends upon the size of the material from which the bushing is to be made.

When making a small bushing in the lathe it is customary to machine the job complete in one set-up. The bushing is rough turned, drilled, bored, reamed, finished turned, and then cut off at the proper length.

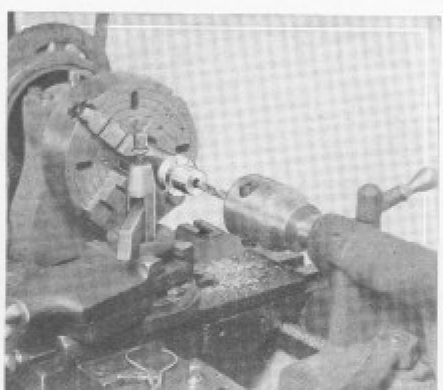
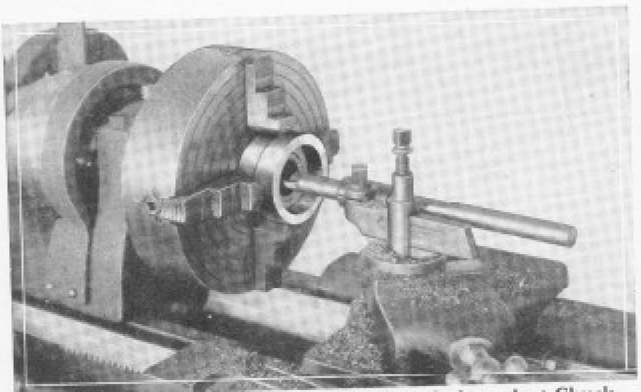


Fig. 19. Drilling the Bushing

Details of the Operations.—Place the rough casting of the bushing in the chuck, allowing it to project far enough to be machined. See Figure 19. Adjust chuck jaws to make the casting run true. Face the end and rough turn the outside diameters to within $\frac{1}{16}$-inch of the finished dimensions. The same tool may be used for both facing and turning. Then cut the work off to the correct length.



The illustration at the left shows a large bushing held in a 4-jaw independent chuck mounted on the spindle of the lathe. A boring bar is held in the tool post. This bar is fed through the hole to true it up.

The bushing can be of any kind of metal, such as bronze, brass, aluminum, cast iron, etc.

Fig. 20. Boring a Bushing Mounted in an Independent Chuck

Drilling, Boring and Reaming the Bushing.—Place a drill chuck in the tailstock spindle. Use a drill 1/16-inch smaller than the finished size of the hole. Drill the hole 1/4-inch deeper than the length of the bushing. Take a boring cut to true up the hole and then ream it to the correct diameter. Both the drill and the machine reamer should be fed by turning the tailstock wheel by hand. Cut bushing off and allow 1/32-inch on each end for finishing.

Press bushing on a mandrel, using a little machine oil on the mandrel so the bushing can be easily removed when finished. Attach a lathe dog to the mandrel and place it between centers. Turn bushing and shoulder to finished diameters and face ends to exact length. See Fig. 21.

Care must be taken throughout the machining operations to see that accurate measurements are maintained. It must be remembered that the degree of accuracy attained in the work will determine the performance of the machined bushing when it is placed in the engine.

This illustration shows a bushing which has been bored and reamed, mounted on a mandrel between centers in the lathe for turning to the correct diameter.

This method of finishing the outside diameter of a bushing is used whenever the length of the material from which the bushing is made will not permit it being turned to size in the chuck.

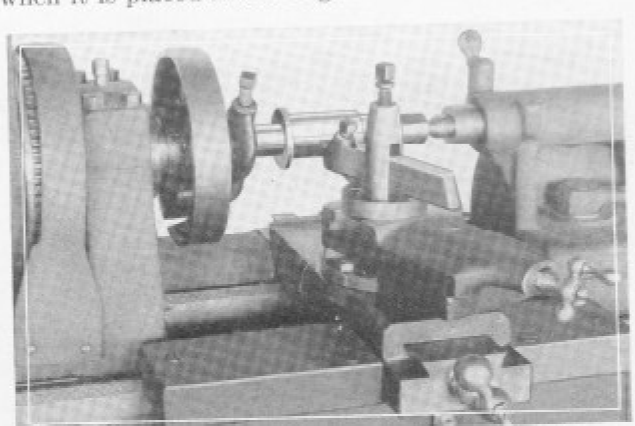


Fig. 21. Turning a Bushing mounted on a Mandrel

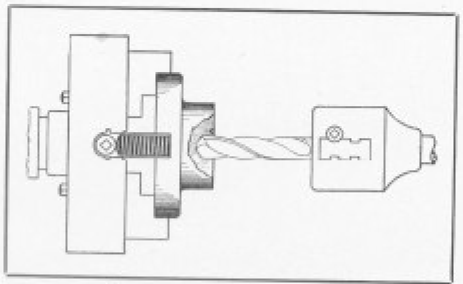


Fig. 22. Drilling a Bushing

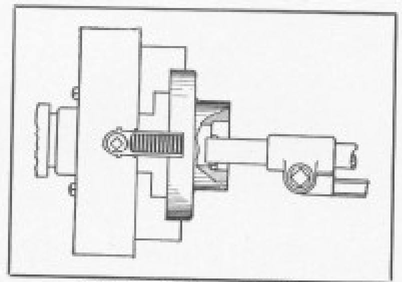


Fig. 23. Boring a Bushing

The operation in Fig. 22 shows the method of drilling a large bushing. The casting is held in the independent chuck mounted on the head spindle. The drill is held in a drill chuck fitted into the tail spindle of the lathe. The casting is revolved, the drill is stationary and is fed into the work by the hand wheel of the tailstock.

After the bushing is drilled, a boring bar is put into the tool post of the lathe as shown in Fig. 23, and a few light cuts taken to true up the hole. Enough stock should be left for reaming. A sizing reamer is held in a drill chuck mounted in the tail spindle. The work is revolved and the reamer fed slowly through the hole, using the hand wheel of the tailstock. Two or three thousandths of metal is sufficient to leave for the reamer to cut.

New bushings of all kinds and sizes can be quickly made in the lathe, also worn or damaged bushings can be reconditioned and new parts made when necessary.

* * *

Information on the kinds of tools to use, how to grind and set them, different spindle speeds, automatic feeds and other details of this work are illustrated and fully described in the South Bend Lathe Works book "How to Run a Lathe."

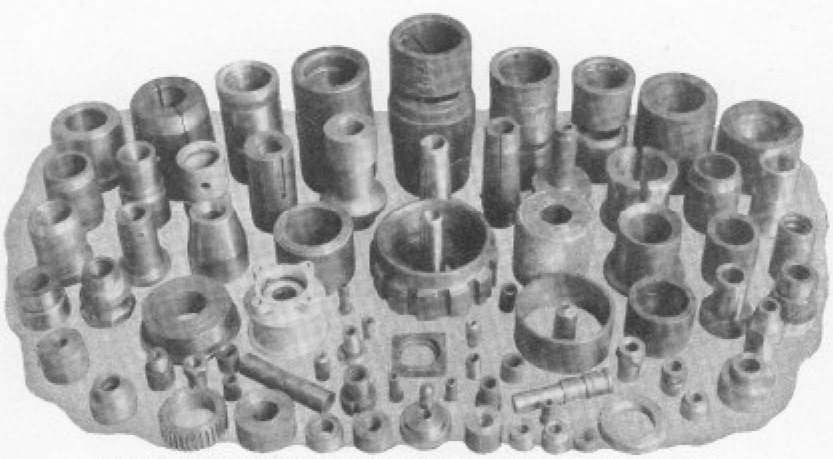


Fig. 24. Various Types of Bushings Made in the 9-inch Junior Lathe

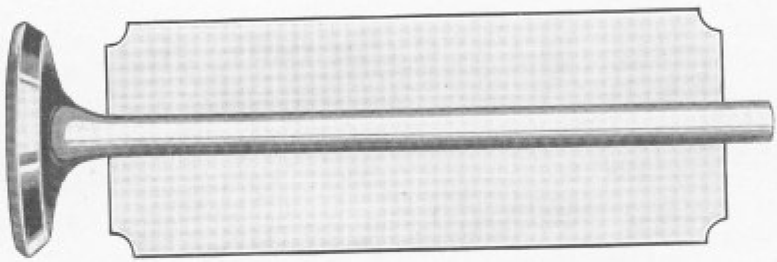


Fig. 25. Refacing Valves by Turning is Four to Six Times Faster than Grinding

Refacing Valves

In the 9-inch Back Geared Screw Cutting Lathe

The Modern Method of refacing valves in the service station shop is to true them in the lathe by machining with a cutting tool. The principal reason is that machining is from four to six times quicker than grinding and will do just as good a job. The time required to reface a valve by machining or turning in the lathe will average about two minutes for each valve. This includes setting it up in the lathe, refacing it by taking one or two cuts, and removing it from the lathe. The only equipment needed is a lathe and an ordinary turning tool; the job will be perfectly true, as the compound rest permits the tool to be set at any desired angle.

Tungsten, Silichrome and Mild Steel and Cast Iron Valves for automobiles, buses and trucks, ranging in size from the Ford Model A valve to the Mack Truck valve, can be refaced easily and quickly by machining in the 9-inch Junior New Model South Bend Back Geared Screw Cutting Lathe. The cutting tool is made of a high quality, high speed steel that will cut easily.

A Valve Made of a Metal that is too hard for a cutting tool to machine would be too hard to use in the motor, because the first explosion which pressed the valve on its seat in the block, would cause the valve head to snap off like glass. Valves that have been used for a long time are covered with a carbon that is hard, but even these valves can be turned and machined by high speed cutting tools and the job done quickly, leaving a smooth, clean surface on the face of the valve.

In Addition to Truing Valves, the lathe can be used for hundreds of other jobs that come into the modern service station. The 9-inch Junior New Model South Bend Back Geared Screw Cutting Lathe is not a single purpose machine but is a universal tool which will reface valves, turn armatures, machine pistons, make bushings and do a hundred and one different kinds of jobs that come up every day in the modern service station shop. The skilled mechanic knows the advantages of the back geared screw cutting lathe because of its universal application.

Valve Refacing does not require a large, expensive lathe. The 9-inch screw cutting lathe will reface valves with the greatest accuracy. It is a precision tool that will do the finest work your shop may require.

The refacing of valves is almost a daily job in the average service station. Handling this work in the lathe is very simple, as may be seen from the paragraphs following.

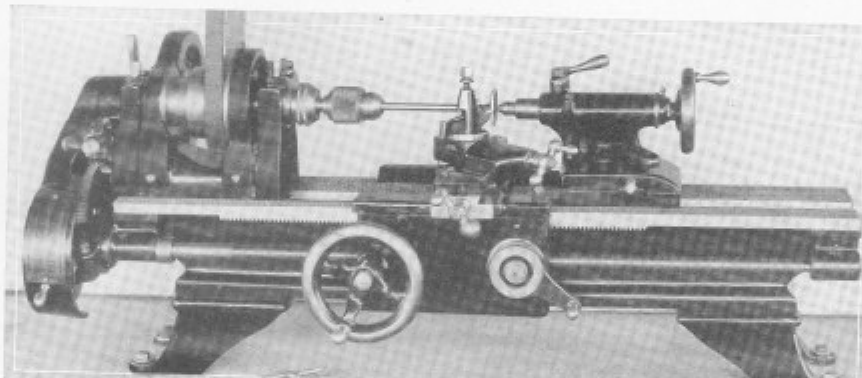


Fig. 26. Truing the Face of a Valve by Turning in a 9-inch Lathe

Mounting a Valve in the Lathe.—The end of the valve stem is held in a drill chuck mounted in the headstock spindle of the lathe and the valve head is centered by the tailstock center. This is the correct way to hold a valve for refacing and insures a degree of accuracy that cannot be approached by any other method.

Gives Valve a Perfect Finish.—With the compound rest set at the desired angle, take one or two light cuts with a turning tool. Feeding the compound rest screw by hand will true the face with precision accuracy. The turning tool will leave the surface as smooth as can be obtained by grinding and will do the job in one fourth the time.

Turning Valves, Faster Than Grinding.—Facing a valve by turning in the lathe is better than grinding because it can be done four times faster, and the turned finish can be made equally as smooth as a ground finish. A valve can be refaced by turning in the lathe in about two minutes.

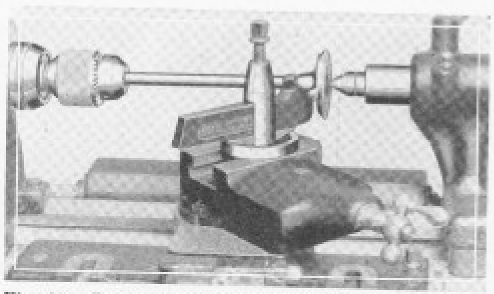


Fig. 27. Refacing a Valve at a 45 Degree Angle by Turning Using a Three-Jaw Drill Chuck to Hold Valve

Truing Makes Face, Head and Stem True.—The face of a valve turned in a lathe will be concentric with the axis of the valve stem. This is due to centering the valve head with the lathe tailstock center while it is being refaced—the original position in which the valve was held when it was manufactured.

Before a valve is refaced it should be tested to see if the stem runs true. If the stem is bent it should be straightened before the valve face is machined. This is described below.

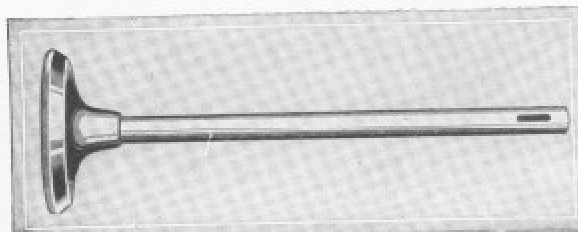


Fig. 28. A Valve Refaced by Turning in a Lathe

How to Test and Straighten Bent Valve Stems.—Place the valve in the lathe, as shown in Figure 29 illustrated below. Revolve the valve by hand. If the valve head and stem are not concentric it will readily be apparent to the eye. Mark the "high spot" on the stem with a piece of chalk. Straighten the stem by holding it on an anvil and tapping the "high spot" lightly with a mallet. Place the valve in the lathe again and repeat the operation until the stem runs true. The valve is then ready for refacing.

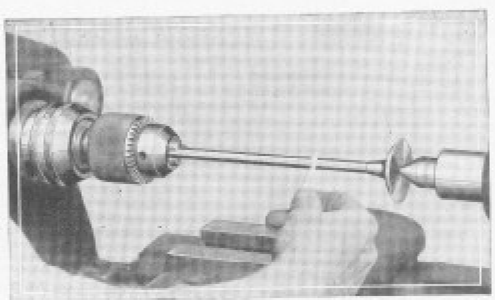


Fig. 29. Testing a Used Valve Stem in the Lathe

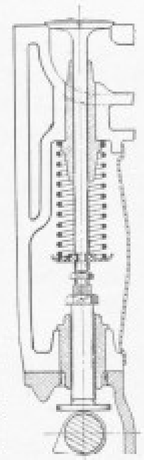


Fig. 30. Valve Properly Seated

Perfect Alignment Maintained.—Figure 30 illustrates a finished valve perfectly seated. This valve was refaced in the lathe according to the South Bend method as described in this chapter. Note the true alignment from the center of the valve head through the center of the valve guide bushing. The valve face has a perfect bearing on the valve seat.

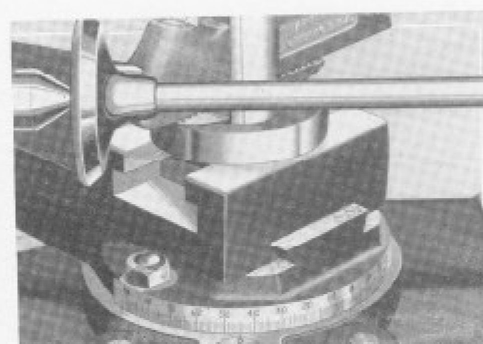


Fig. 31. Close-Up of Compound Rest of Lathe at 45 Degree Angle for Refacing Valves

Figure 31 shows a close-up of the graduation of the compound rest which enables the operator to set the compound rest at the angle desired.

Mounting Valves Without Centered Heads

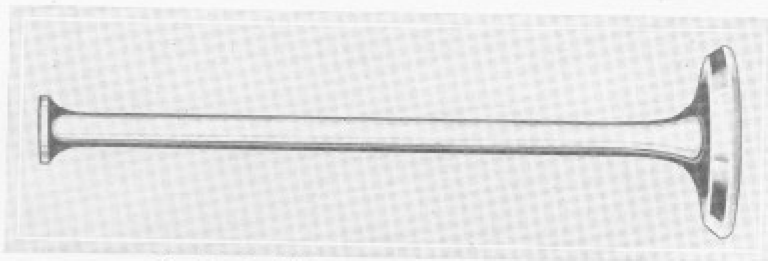


Fig. 32. Ford Valve Without Center Hole in Head

Valves Without Center Hole in the Head.—The above illustration shows a valve without a center hole in the head. There are two methods of refacing this type of valve in the lathe. One is to hold the valve in a hollow spindle drill chuck mounted in the lathe as shown in Figure 34. The spindle of this drill chuck being hollow permits the valve stem to pass through as far as desired, the chuck then grips the valve stem as near the valve head as possible and the operator proceeds to reface the valve as described in the previous pages.

The other method is to center drill the valve head and reface it as illustrated and described on Pages 12 and 13. The centering operation for the valve head is described on Page 15. We recommend the valve be centered for refacing because centering the head permits the valve to be faced more accurately.

Fig. 33. Hollow Spindle Drill Chuck

Hollow Spindle Drill Chuck.—The illustration in Figure 33 shows a cross section of a three-jaw drill chuck fitted with a hollow spindle which fits the taper of the lathe spindle. It also shows that the chuck jaws open wide enough to permit the end of the valve stem to pass through the chuck. The jaws may then be clamped to the valve stem which holds the valve true.

Holding a Model A Ford Valve with Mushroom End.—This method holds the valve rigidly while it is being refaced. The compound rest is set to the correct angle and the tool is fed across the face of the valve by hand. Time required to true the valve will average from two to three minutes. General instructions for truing valves with centered heads, as described in the previous pages, should be followed.

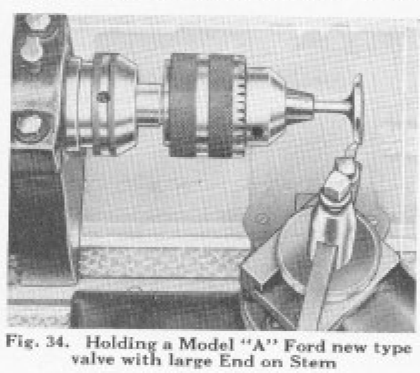


Fig. 34. Holding a Model "A" Ford new type valve with large End on Stem

The Compound Rest Set at the Correct Angle.—Figure No. 35 shows a valve without the center hole in head mounted in the three-jaw drill chuck which in turn is mounted in the lathe spindle. The cutting tool is fed in at the correct angle and the cutting edge of the cutting tool should be the exact height of the tailstock center point in order to get the true taper. The valve should be held tightly in the chuck and the cutting tool fed by the compound rest screw. The cut may be taken both by feeding in and feeding outward.

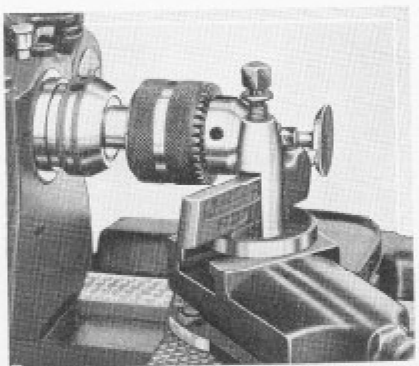


Fig. 35. Refacing a Valve without Centered Head, such as Ford, Chevrolet, and Whippet

The revolutions per minute of the valve while being faced depend upon the kind of material the valve is made of. A cast iron valve will permit a faster speed than a soft steel valve and the cutting speed of a tungsten valve should be much slower than that of soft steel. For further information on this subject, see book "How to Run a Lathe" under the heading of "Cutting Speeds".

Drilling a Center Hole in a Valve Head.—We recommend centering the valve head as shown in Fig. 36, especially if one has the time, because this insures accuracy. It is the correct method for holding the valve while refacing. This method has been explained in the preceeding two pages. It insures concentricity of the machined surface with the axis of the valve stem because when the face is concentric the stem operates in the valve stem guide more efficiently.

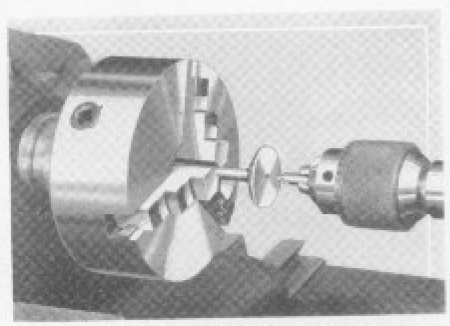


Fig. 36. Centering a Valve Head held in Chuck

To center the valve head, grip the valve stem in a Universal Geared Scroll Chuck mounted in the spindle nose of the lathe as shown in the illustration. Or the valve may be held in a hollow spindle three-jaw drill chuck. Another drill chuck is placed in the tailstock of the lathe holding a countersinking drill. Start the lathe and feed the countersinking drill to the valve head by using the hand wheel feed of the tailstock. Be sure to have the valve head running true before starting the drill. Then feed the drill in to the proper depth.

The combination center drill is a drill that may be purchased at any machinists supply store and it is made in two grades, one carbon steel and the other high speed steel. This drill is illustrated and described in our lathe catalog No. 89-A and in book "How to Run a Lathe". These drills are inexpensive and can be purchased direct from us if desired.

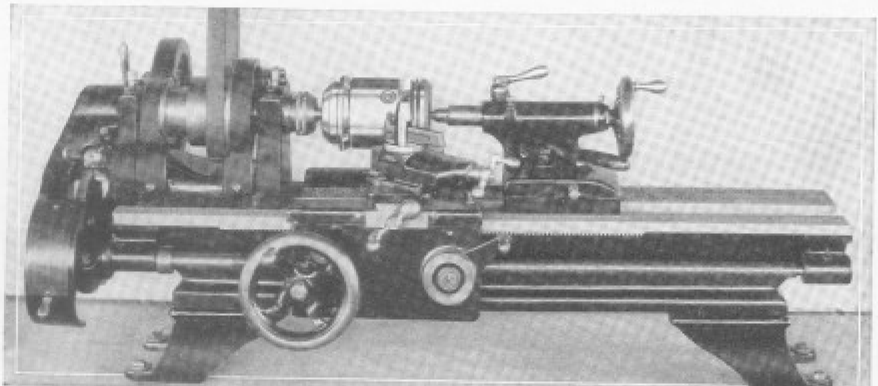


Fig. 37. Machining a Piston to Finished Diameter in a 9-inch Lathe

Finishing Semi-Machined Pistons

In the 9-inch Back Geared Screw Cutting Lathe

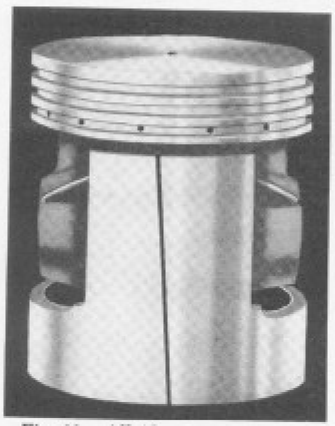


Fig. 38. All Aluminum Piston

Semi-Machined Pistons are made of gray iron and aluminum alloy castings, partially machined, and in this unfinished condition they are shipped to the service station by the piston manufacturer. The semi-machined piston is finished to size in some operations, such as; bored for wrist pin hole, head centered and faced, inside of skirt beveled and grooves turned for piston rings.

The diameter of the semi-machined piston is left approximately 1/8-inch oversize so that it may be finished in the service station to fit the various sizes or bores of the cylinders of automobiles, buses and trucks. There are two methods of finishing semi-machined pistons by turning or grinding.

Finishing Semi-Machined Pistons is a precision job, and for the service station shop the screw cutting lathe is the ideal tool for the work. Using the lathe turning method, the piston is finish machined, which gives it a smooth, porous surface more easily lubricated and far superior to surface obtained by grinding.

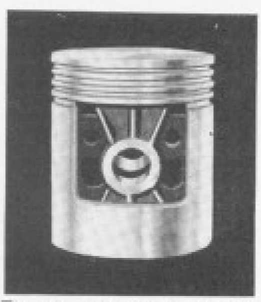


Fig. 39. The Permite Strut Type Piston

The piston is held in the lathe by an adapter in the headstock spindle and by the tail center, the most accurate and practical way to hold a semi-machined piston for finishing.

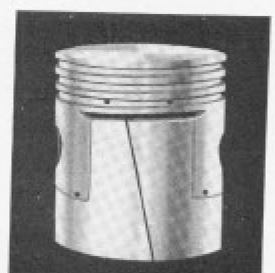


Fig. 40. The Permite Spiral Slot Piston

Servicing the Piston in the Lathe.—Pistons of every design, every metal, and any size, can be easily, quickly and accurately finished on the back geared screw cutting lathe.

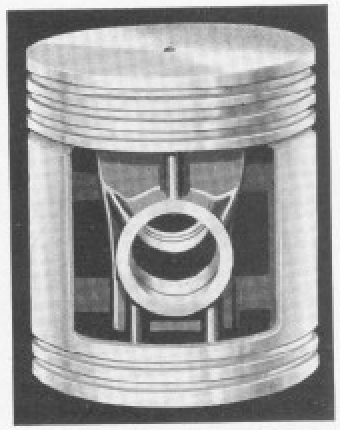


Fig. 41. Steel Strut Piston

With a lathe, the mechanic can accurately finish turn and fit pistons faster than by any other method.

Pistons also may be accurately ground in the lathe, but the heat from grinding, even when only very light cuts of .001 are taken, will sometimes make the piston warp. Turning does the work four times faster than grinding and does not generate the heat that is so detrimental.

The speed and accuracy in finishing a piston depends largely on the method used in holding it for machining. Using the No. 44 Piston Adapter in the lathe, permits the piston to be machined with a speed and accuracy that could not be obtained with any other method. It is the same method as is used by the manufacturers, that is, the skirt is supported by the beveled edge and the head held and supported by the center hole.

The Piston Adapter is simple in construction and easy to handle. The mechanic can remove the piston from the lathe, test it in the cylinder to which he is fitting it, and quickly replace it in the lathe for further machining without destroying the accuracy of set-up in any way.

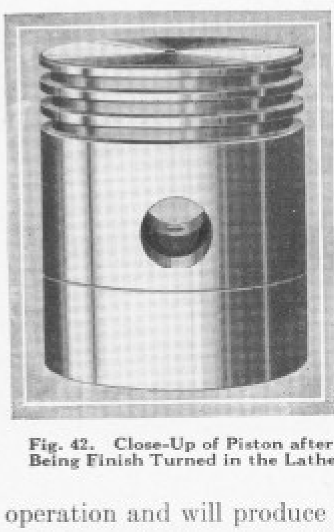


Fig. 42. Close-Up of Piston after Being Finish Turned in the Lathe

Some of the Semi-Machined Pistons, especially the alloy split pistons, are connected by a metal gate in the casting. This gate is not to be removed until the piston has been completely machined and fitted.

The gate holds the casting in form which permits machining and if the gate has been removed, the casting cannot be machined on the adapter without inserting a drop of solder which will act as a gate for further machining.

It is, therefore, necessary to be sure that the piston is finished to correct dimensions before removing the gate.

The Lathe is the Universal Tool for automotive repair work. Modern automobile service stations all over the country are using the lathe for finishing semi-machined pistons, because it is practical, fast and economical in operation and will produce an extremely accurate job.

The great advantage of the lathe is that it can be used to handle many classes of work in addition to finishing pistons.

The lathe can be used for truing commutators, refacing valves, making bushings and hundreds of other jobs, without additional tools or attachments.

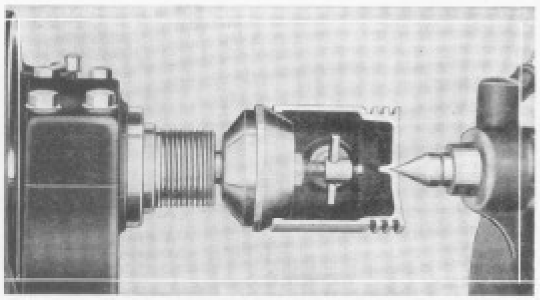


Fig. 43. Cross Section of a Piston Mounted on a No. 44 Piston Adapter Ready for Machining

Application of the No. 44 Piston Adapter.—The illustration in Figure 43 shows a piston correctly mounted in the lathe on the piston adapter for turning. The piston has been cut away to show the application of the adapter. Note how the skirt end of the piston is centered on the cone ring; how the driving dog is adjusted for driving the piston and the piston head centered by the tailstock center. This method insures perfect alignment of the piston for machining in the lathe.

All sizes and makes of pistons, ranging from $2\frac{5}{8}$ to $5\frac{1}{4}$ inches outside diameter, cast iron or alloy, solid or split skirt, can be machined quickly and accurately on this adapter when mounted in the 9-inch lathe.

The No. 44 Piston Adapter with Rings

Fig. 44

The above illustration shows the No. 44 Piston Adapter Shank, Cone Rings and Driving Dog. One end of the shank is tapered to fit the headstock spindle of the lathe. The other end is machined to receive the cone rings. The driving dog screws in the threaded hole in the end of the shank and may be adjusted to fit any size piston. One ring, No. 2D, the most popular size, is furnished with the Adapter. Extra rings may be supplied as shown below.

Price, No. 44 Piston Adapter Complete with Shank, Driving Dog and One Cone Ring, No. 2D, for 9-inch Lathe.................................$12.00

Specifications and Prices of Additional Cone Rings

Cone Ring Number	Will Hold Piston Outside Diameter	Price, Extra Cone Rings
1D	$2\frac{5}{8}$ to $3\frac{1}{4}$ in.	$2.50
2D	$3\frac{1}{4}$ to $3\frac{7}{8}$ in.	2.50
3D	$3\frac{7}{8}$ to $4\frac{3}{4}$ in.	2.50
4D	$4\frac{1}{2}$ to $5\frac{1}{4}$ in.	2.50

Centering a Piston Head

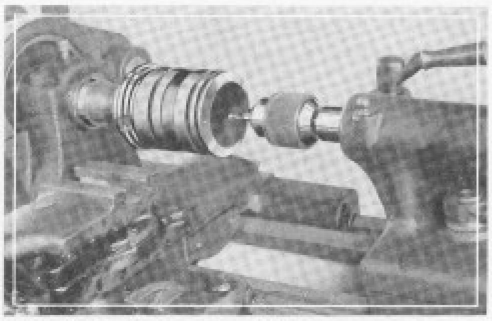


Fig. 45. Piston as Mounted for Drilling Center Hole

Pistons That Do Not have a center hole in the head end should be center drilled for the lathe center before being machined.

To drill a center hole in the piston head, place the piston on a No. 66 Adapter, as in Fig. 46, and mount the assembly in the headstock spindle and with a countersink drill in the tailstock, drill the center hole, as in Fig. 45. Then replace the tail center, mount and ream the skirt bevel.

The No. 66 Adapter, that is shown in Fig. 46, is for center drilling pistons. The piston fits snugly on the seat section of the step ring, and is placed so that a pin may be run through the ring bolt. Turning the adapter shank draws the piston tight on the step ring and holds it true.

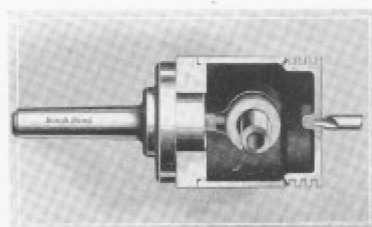
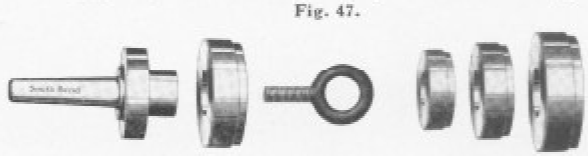


Fig. 46. Piston Mounted on No. 66 Adapter

The No. 66 Piston Adapter with Rings

Fig. 47.



Adapter Shank 2C Ring Bolt 1C 3C 4C

One end of the shank is tapered to fit the headstock spindle. The other end is machined for rings. The same shank fits both No. 44 and No. 66 Adapters. The ring bolt screws in the threaded hole in the shank and may be adjusted to any size piston. One ring, No. 2C, is furnished with Adapter. Extra rings furnished as listed below.

Price, No. 66 Piston Adapter Complete with Shank, Driving Dog and One Ring, No. 2C, for 9-inch Lathe..........$12.00

Specifications and Prices of Additional Step Rings

Step Ring Number	Will Hold Piston Outside Diameter	Price, Each Step Ring
1C	2⅝ to 3¼ in.	$2.50
2C	3¼ to 3⅞ in.	2.50
3C	3⅞ to 4¾ in.	2.50
4C	4½ to 5¼ in.	2.50

Mounting the Adapter and Piston in the Lathe.—Mount the No. 44 Piston Adapter in the spindle nose of the lathe. Place the cone ring on the adapter and adjust the driver in position to come in contact with the wrist pin boss inside of the piston. Mount the piston skirt on the cone ring and let the tail center of the lathe enter the center hole in the piston head. Lock tailstock on bed of lathe and with tailstock hand wheel adjust tail center to fit in the head of the piston. Be careful not to force the piston too hard against the cone adapter ring and spread the skirt. Be sure to put a drop of oil into this center hole before entering the tail center. Now lock the tailstock spindle with the binding screw.

Testing Piston to see if it is Round.—Semi-machined pistons sometimes become warped while standing in the dealer's stock. To correct this distortion, the inside edge of the piston skirt is reamed to make this beveled edge true so that when it is placed on the cone ring of the adapter the piston will center correctly. The preceding paragraph tells how to mount the piston on the adapter in the lathe.

Before proceeding with the machining of the piston it is well to test it to see if it is round. Mark the beveled edge on the inside of the piston skirt with a piece of chalk. Then place the piston back on the adapter in the lathe and bring up the tail center so that the piston rests snugly on the cone ring.

With the left hand, hold the cone ring from turning and with the right hand turn the piston on the cone ring. Then remove the piston, examine the beveled edge and if the piston is out of round it will show on the high spot through the chalk surface.

To True the Bevel Edge of the Piston.—Place the correct size reamer on the No. 44 Piston Adapter Shank and mount the piston as shown in Figure 48. Pass a wooden peg through the wrist pin hole of the piston and turn the piston slowly with the left hand. (Do not start the lathe spindle.) At the same time feed the piston against the reamer by turning the tailstock hand wheel with the right hand. Remove only enough stock with the reamer that the beveled edge will be round and true.

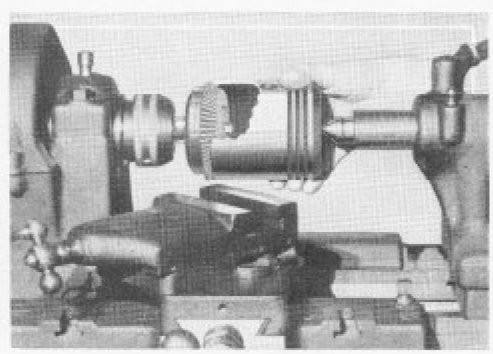


Fig. 48. Reaming Bevel of Piston Skirt in the Lathe

If considerable stock is to be removed in order to true up the beveled surface of the piston skirt, start the lathe, using a very slow speed, and ream by power.

Piston Skirt Reamers are furnished in four different diameters as illustrated on following page. The holes in the piston skirt reamers are machined to fit the No. 44 or the No. 66 Piston Adapter Shank and are interchangeable. Each of the reamers has a hole drilled in the back of it which slips over the pin driven in the face of the shoulder of the adapter shank. This pin serves to lock the reamer in a fixed position on the shank.

Piston Skirt Reamers and Shank

Fig. 49.

Reamer Fits Short End of Adapter Shank

1R 2R 3R 4R

Piston Skirt Reamers

Specifications and Prices of Piston Skirt Reamers

Reamer Number	For Reaming Pistons Outside Diameter	Price, Each Reamer
1R	$2\frac{1}{2}$ to $3\frac{1}{8}$ in.	$ 7.50
2R	$3\frac{1}{8}$ to $3\frac{3}{4}$ in.	9.00
3R	$3\frac{3}{4}$ to $4\frac{3}{8}$ in.	11.00
4R	$4\frac{3}{8}$ to 5 in.	13.00

Prices of Skirt Reamers Do Not Include Piston Adapter Shank. See page 18.

Finishing Semi-Machined Pistons in Full Sets.—When preparing to machine pistons in sets, mount the first piston in the manner described on page 20. Be sure that the skirt fits snugly on the piston adapter cone ring, and that the tail center in the piston head is adjusted to hold it firmly in position. Grind and set the cutting tool for the roughing cut.

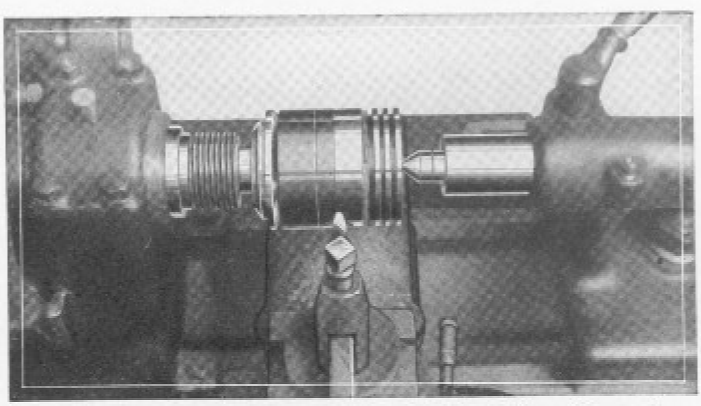


Fig. 50. Taking a Finishing Cut on a Semi-Machined Piston Mounted on the No. 44 Piston Adapter in the Lathe

The preliminary operation on the first piston, which is taking the roughing cut over the entire piston, should be applied to each piston of the set before changing the position of the cutting tool. For example, after taking a roughing cut on piston No. 1, mount piston No. 2 and take a similar roughing cut and continue this operation until each piston of the set has been given the roughing cut without changing the adjustment of the cutting tool.

After piston No.1 is placed in the lathe for turning, the roughing cut should always be deep enough so it will cut below the scale. Continue this operation on all of the pistons, allowing the power feed of the carriage to feed the tool from left to right, or towards the tailstock, so that the pressure of the cutting tool will not force the piston skirt against the cone ring and spread the skirt when the roughing cut is taken. If the piston is more than 1/8" oversize, two roughing cuts should be taken on the entire set. The roughing cut or cuts should remove surplus stock to within .010 of an inch of the finished diameter.

When all of the pistons have been given the roughing cut it is advisable to ascertain with a micrometer or calipers the exact diameter of each individual cylinder and then finish the pistons to fit their respective cylinders. This should be done because of the slight difference of measurement between cylinders of a motor block that has been reground or rebored.

For rough turning of the pistons the carriage feed of the lathe should be from fifteen-thousandths (.015") to twenty-thousandths (.020") of an inch per revolution of the lathe spindle and for the finishing feed, from three thousandths (.003") to six-thousandths (.006") of an inch per revolution of the lathe spindle.

After all of the pistons have been rough turned by the above operations, start a light or finish cut on the first land of piston No. 1, feeding the tool from right to left or toward the headstock, using the automatic longitudinal carriage feed. This finishing cut should be the exact diameter of the first land when finished. Let this cut be taken from the head of the piston to the first ring groove. Repeat this operation on each of the other pistons and cut to the depth necessary for the individual land.

Recommended Spindle Speed.—The spindle should be operated with back gear drive and the spindle cone belt on the second step of the cone for the 9-inch lathe. This will give the proper cutting speed for semi-machined pistons. For the selection of the proper tool and its adjustment to the correct height for turning and cutting, as well as information on the correct speed of the piston, see booklet "How to Run a Lathe," where this subject is fully illustrated and explained.

Clearances for Various Types and Sizes of Pistons.—The information, various tables and illustrations included on this and the following two pages have been supplied by the McQuay-Norris Manufacturing Co., makers of all kinds of automobile pistons. If you follow these charts closely you will be able to attain close precision in your work.

Semi-machined pistons, when sold by the manufacturer, are machined with the exception of the skirt diameter, ring lands and the final reaming of the pin holes to fit the pins. All production operations necessary at the factory are performed while the piston is mounted on centers, with the skirt end of the piston on an adapter and the head end held on the tail center.

The cone adapter ring used to hold the piston in the lathe has a 60 degree angle for the skirt end of the piston. The tailstock center has a 60 degree point for the head end of the piston. All semi-machined pistons have a 60 degree chamfer machined in the inside edge of the skirt end, and it is advisable to ream this chamfer before doing any machining on the piston. This re-chamfering operation corrects any error in the roundness of the chamfer that may have developed in shipping or handling.

Clearance of Cast Iron Pistons (All Types)

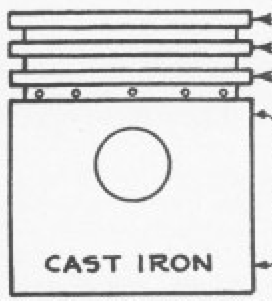


Fig. 51. Cast Iron Piston

CYL. BORE	2½ to 3	3 to 3½	3½ to 4	4 to 4½	4½ to 5	5 to 5½	5½ to 6
TOP LAND	.011	.013	.015	.017	.019	.021	.023
2ND LAND	.008	.009	.011	.012	.014	.016	.018
3RD LAND	.006	.007	.008	.009	.010	.011	.012
SKIRT	.002¾	.003¼	.003¾	.004¼	.004¾	.005¼	.005¾

The Amount of Piston Clearance shown in the tabulation is based on each inch of diameter of the piston. For example, the skirt clearance should be about .001 inch for each inch diameter of cylinder bore. For a cylinder with a bore of 3 inches in diameter, the piston skirt when finished, should be 3 inches in diameter less .003 of an inch.

On four land pistons the fourth land clearance should be the same as the third land. The skirt clearance rule given above applies to pistons with or without skirt rings below the wrist pin.

Figuring Clearances.—The proper clearance for each finished piston is very important. The first thing to do is to measure the diameter or bore of the cylinders into which you are to fit the pistons. Then figure the clearance you wish to allow for each piston, keeping in mind the different clearances to allow for the various lands and the skirt.

Measuring Cylinders and Pistons.—The bore or diameter of a cylinder may be measured with an inside micrometer caliper, a cylinder gauge that reads in thousandths of an inch, or an ordinary inside spring caliper and then transferred to an outside micrometer. The piston can be measured with a micrometer caliper or an outside spring caliper.

In figuring the clearance between the piston and the cylinder, some mechanics make the last measurements by machining the piston so that it fits the cylinder with a thickness gauge or a piece of paper of the required thickness.

Clearances for Aluminum Alloy Pistons.—The table of clearances shown on page 24 gives the exact amount of clearance to allow in the cylinder for the lands and skirt of an aluminum alloy piston.

A comparison of the clearance allowances given in this table and the clearance allowances given in the table for cast iron pistons on page 23, will show considerable difference in the two.

Care should be taken not to confuse the clearance allowances given for cast iron pistons with the clearance allowances for aluminum alloy pistons.

Clearance of Steel Strut Aluminum Alloy Pistons

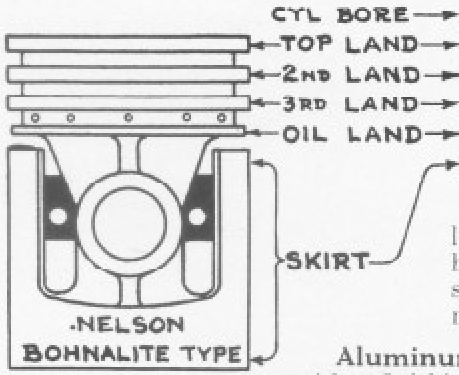


Fig. 52. Steel Strut Aluminum Type of Piston

2½ to 3	3 to 3½	3½ to 4	4 to 4½	4½ to 5
.016	.018	.020	.022	.024
.010	.012	.014	.016	.018
.010	.012	.014	.016	.018
¹⁄₁₆" Less Than Standard Bore Dia.				
.002	.002¼	.002¾	.003	.003¼

These pistons must not be completely slotted until finished and wrist pin hole reamed. The upper skirt remains solid. At lower end of slot remove metal tack.

Aluminum Alloy Piston with Skirt Slots.—After finishing the skirt diameter and lands to the proper size (see tables above) the skirt slots requiring finishing can be completed with a heavy hack saw blade. All skirt slots are not machined alike. Pistons with slots should be installed with the vertical skirt slots on the right hand side of the cylinder when looking at the motor from the front end of the car.

After finishing the land and the skirt of the Lynite type of piston to the proper cylinder size, remove the metal tacks at the top and bottom of the vertical slot with a hack saw blade. This type of piston must have its vertical slot completely open from head cross slot to the bottom of the skirt.

Measuring Diameters of Pistons and Cylinders.—In Figure 53 is shown the application of the outside micrometer measuring the diameter of the piston in thousandths of an inch. This is done while the piston is still mounted on the adapter in the lathe. (The lathe should not be in operation while measuring.) If the micrometer shows that the piston is oversize, the necessary amount of machining should be done. Then measure it again. Be careful not to take too deep a cut before the next measuring operation. The micrometer graduated collars on the cross feed screw and the compound

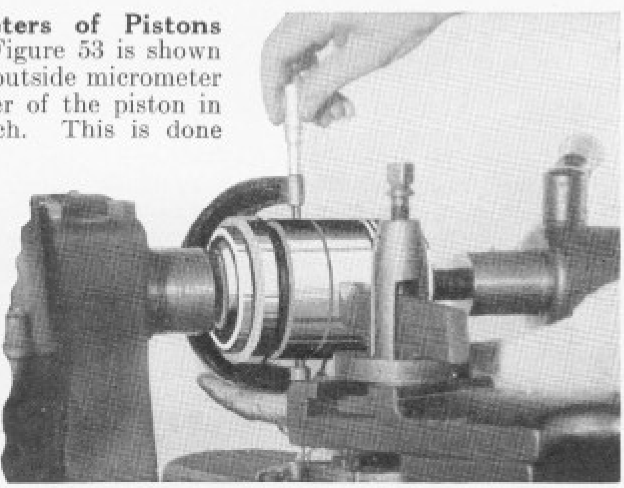


Fig. 53. Measuring Diameter of Piston with Micrometer Calipers

rest screw will permit adjustments of the lathe cutting tool to be exact to the thousandth of an inch so the mechanic can maintain the utmost accuracy when turning the piston to its finished diameter.

Measuring Cylinder Bore With Inside Micrometers.—To determine the correct diameter of the finished piston, measure the cylinder bore with an inside micrometer as shown in Figure 54. Transfer the size of the bore to an outside micrometer and subtract from that diameter the amount of clearance for each diameter of the lands and skirt of the piston as shown in the tabulation of the charts on pages 23 and 24.

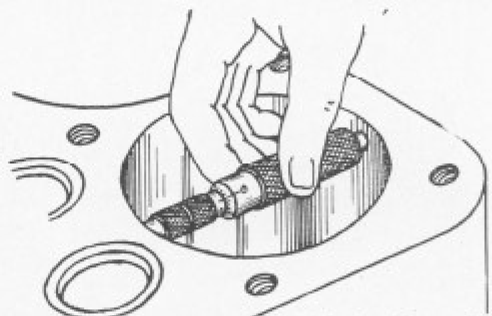


Fig. 54. Measuring Finished Cylinder Bore with Inside Micrometer

The result will be the correct size to finish the lands and skirts of the piston. Cylinder bore measurements taken with inside micrometers should always be transferred to outside micrometer to correct any possible inaccuracy of the inside micrometer.

The South Bend Method of Finishing Pistons

The South Bend Method of truing semi-machined pistons is the most practical method because it is four times faster and does a better job than by grinding.

Permits the operator to remove the piston from the lathe, test it in the cylinder and replace it on the adapter without destroying the accuracy of the set-up.

Speeds up the work—with a little experience the mechanic can machine a set of six pistons to the finished diameter in about forty-five minutes.

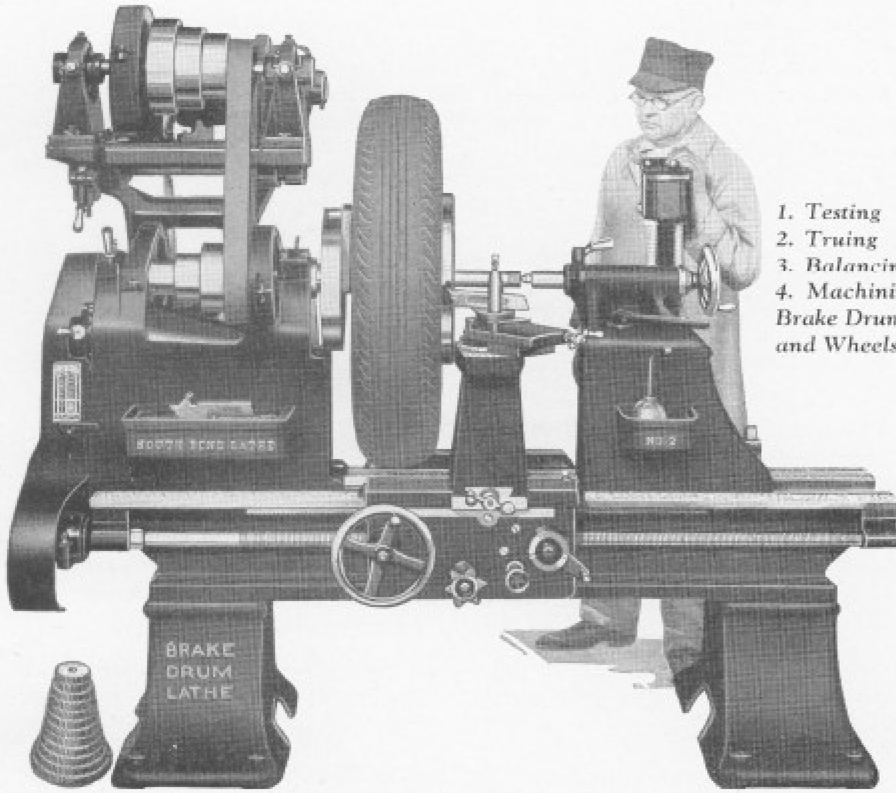
Enables the operator to turn the piston to its finished size in one roughing cut and one or two finishing cuts.

Insures uniformity when machining a set of pistons because only one set-up is needed for roughing and one set-up for finishing the skirt and each land.

The surface obtained by turning the piston makes a better contact with the cylinder wall than the ground surface because it will hold a greater film of oil.

Holds the piston firmly and accurately between the center points of the lathe in the same manner as they are held when being manufactured.

The turned surface of a piston is never impregnated with the grit of a grinding wheel.



1. Testing
2. Truing
3. Balancing
4. Machining
Brake Drums
and Wheels

Fig. 55. New Model South Bend Brake Drum Lathe with Silent Chain Motor Drive

Brake Drum and Wheel Service

Brake Drum and Wheel Service Work for automobiles, buses and trucks is of growing importance because of the tremendous increase in traffic, improved road conditions and laws regulating traffic. This new business is rapidly expanding and offers unusual opportunities for service and profit to the shop with the correct equipment to handle this work.

The South Bend Method of servicing brake drums and wheels is based on the scientific principle of the self-centering mandrel and bearing adapters which automatically center the wheel, brake drum and hub.

This Method Insures the utmost accuracy and precision. It also permits the handling of all sizes, types and makes of automobile, truck and bus wheels—all kinds of brakes, including two-wheel and four-wheel, contracting and expanding, air and hydraulic types—and can be applied to all models of motor vehicles, both old and new.

The Best Modern Method for servicing brake drums and wheels, and the most practical and economical equipment for this work, now being used in some of the largest and most successful service station shops, garages and brake service shops in this country, is described and illustrated in this book.

The Back Geared Screw Cutting Brake Drum Lathe, Silent Chain Motor Drive or Countershaft Drive, is the ideal tool for brake drum and wheel work because this work requires accuracy and precision. This lathe is practical for all of the operations that are necessary when testing and balancing wheels, testing, truing and machining brake drums.

The Lathe Uses a self-centering mandrel fitted with universal bearing adapters which permits the mechanic to swing the wheel, with tire attached, between centers in the lathe. All machining done on the brake drum and wheel will be concentric with the axis of the hub, because the mandrel and bearing adapters are supported at each end by the lathe centers and hold the wheel in exactly the same position as when it is in actual use.

Two Types of Drive are Available for this lathe, countershaft drive and motor drive. If the shop is equipped with a line shaft, the countershaft drive is more practical. If there is no line shaft, we recommend the motor drive.

The Size of the Lathe required depends on the class of work to be done. The No. 302 or No. 2 lathe, which takes 36-inch wheels, is the popular size for servicing autos and medium sized buses and trucks. The length of bed may be either six or eight feet. The longer bed length is used for general purpose work as it permits 51-inches between centers and will handle drive shafts.

No. 303 and No. 3 Lathes, which swing a tire, 42-inches in diameter are for heavy duty truck work. The ten-foot bed is recommended, as this allows 62-inches between centers, a very desirable size for the large shop that may do considerable general repairing of buses and trucks.

1. Testing
2. Truing
3. Balancing
4. Machining
Brake Drums
and Wheels

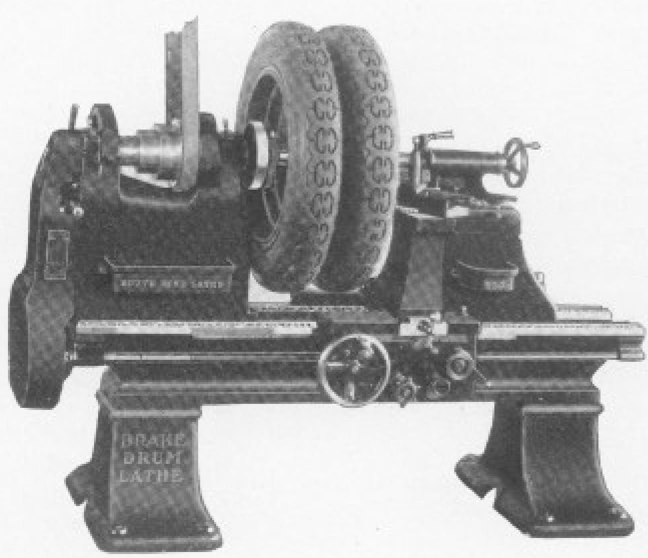


Fig. 56. New Model South Bend Brake Drum Lathe with Countershaft Drive

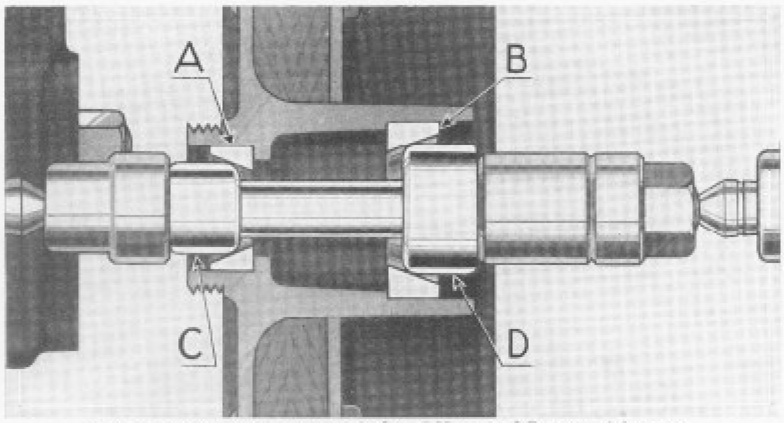


Fig. 57. Self-Centering Mandrel and Universal Bearing Adapters in Timken Bearing Cups

South Bend Straight Mandrels and Adapters

The Self-Centering Mandrel and Adapter Method of mounting wheels in the lathe for testing, truing and machining, is based on the scientific principle of using the bearing cups in the wheel hub to line-up the wheel on the mandrel and adapters as it is when running on its own axle.

Explanation of Symbols in Above Illustration

A—Outer Timken Bearing Cup in the hub of the wheel.
B—Inner Timken Bearing Cup in the hub of the wheel.
C—Outer Universal Bearing Adapter in Timken Cup.
D—Inner Universal Bearing Adapter in Timken Cup.

To Fit the Wheel with a Straight Mandrel and Bearing Adapters. Remove from the wheel the bearing cones and bearings, but do not remove the bearing cups unless, upon examination, they prove to be unfit for further use. Wash bearing cups with gasoline or kerosene. Measure largest opening of each bearing cup and select adapters to fit the cups and a mandrel to fit the adapters.

Lay the adapter in the large bearing cup. Put mandrel through the adapter, bearing cup and hub. Turn wheel on edge so it rests on the tire and push the mandrel through the hub and put the other adapter on the mandrel. Screw up the nut so the bearing adapters are held firmly but not too tightly against the bearing cups. The assembly is then ready to be mounted between centers in the lathe.

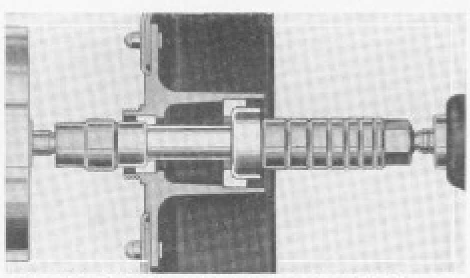


Fig. 58. Self-Centering Mandrel and Universal Bearing Adapters in Ball Bearing Cups

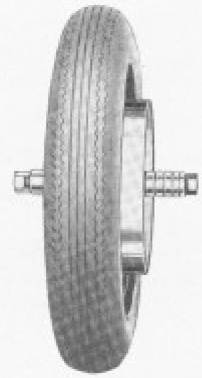


Fig. 59. Wheel Ready to be Mounted in Lathe

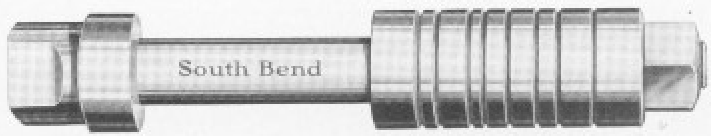


Fig. 60. Self-Centering Straight Mandrel with Spacing Collars and Nut

The Self-Centering Straight Mandrel acts as a temporary axle while the wheel is held between centers in the lathe. The rigidity and accuracy of a wheel thus held makes it practical for the mechanic to obtain close precision. Mandrels are fitted with spacing collars and a threaded nut to hold the bearing adapters firmly against the bearing cups. Straight mandrels with universal bearing adapters will fit front wheels of all automobiles, trucks and buses and all three-quarter and full-floating rear wheels.

Three Sizes of Straight Mandrels

No. 1800, for automobiles, light trucks and buses.
No. 1810, for trucks and buses of medium size.
No. 1840, for heavy duty trucks and buses.

Specifications and Prices of Self-Centering Straight Mandrels, Including Spacing Collars and Nut

Catalog Number	Diameter of Mandrel	Length of Mandrel	For all Adapters with	Weight of Mandrel	Code Word	Price of Mandrel
1800	1¼ inch	12 inches	1¼-inch hole	10 lbs.	Narde	$15.00
1810	1¾ inch	18 inches	1¾-inch hole	27 lbs.	Nlsae	20.00
1840	2½ inch	26 inches	2½-inch hole	83 lbs.	Nizel	30.00

Universal Bearing Adapters are used with straight mandrels to fit all sizes and types of wheels, except wheels with tapered hubs. Adapters have rounded corners which conform to both Timken Cups and Ball Bearing Cups. Adapters are made of cast iron and will not injure or strain the bearing cups.

No. 1801 Universal Bearing Adapters fit No. 1800 Mandrel. For diameters see tabulation below.
No. 1811 Universal Bearing Adapters fit No. 1810 Mandrel. For diameters see tabulation below.
No. 1841 Universal Bearing Adapters fit No. 1840 Mandrel. For diameters see tabulation below.

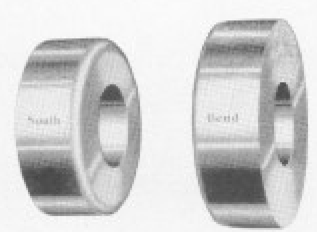


Fig. 61. Universal Bearing Adapters to fit Timken and Ball Bearing Cups

Specifications and Prices of Universal Bearing Adapters

Catalog Number	To Fit Mandrel	Outside Diameters of Universal Bearing Adapters					Diameter of Adapter Hole	Code Word	Price of Each Adapter
1801	No. 1800	1⅝, 2¼, 2⅞,	1¾, 2⅜, 3,	1⅞, 2½, 3⅛,	2, 2⅝, 3¼,	2⅛, 2¾, 3⅜,	1¼ in.	Nefas	$2.50
1811	No. 1810	2½, 3¾,	2¾, 4,	3, 4¼,	3¼, 4½,	3½, 4¾,	1¾ in.	Negel	3.00
1841	No. 1840	3½, 4¾, 6,	3¾, 5, 6¼,	4, 5¼, 6½,	4¼, 5½, 6¾,	4½, 5¾, 7	2½ in.	Narug	4.00

Correct sizes of Mandrels and Adapters for all wheels are listed on pages 45 to 49 inclusive.

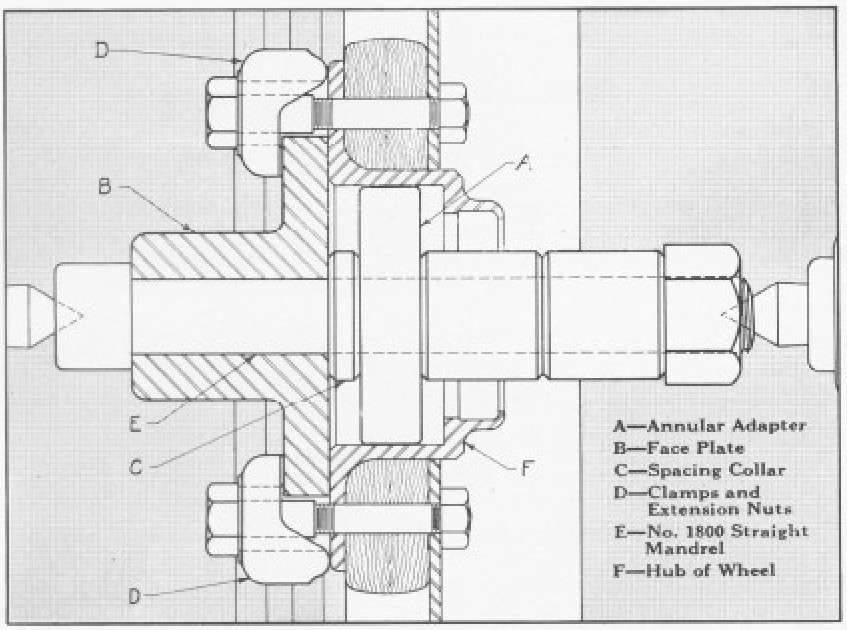


Fig. 62. Rear Wheel Fitted with Annular Ball Bearings Mounted on a Self-Centering Mandrel, Face Plate and Annular Adapter

The Straight Mandrel, Face Plate and Annular Adapter

Method of Mounting Wheels with Annular Ball Bearings.—Some automobiles are equipped with rear wheels fitted with annular ball bearings, such as the Buick, Chandler, Marmon, LaSalle and Willys-Knight. To mount wheels of this type, we have devised the Face Plate and Annular Adapter to fit the No. 1800 Mandrel as shown in the illustration above. This method of mounting the wheel is simple and practical, yet accurate because the annular bearing adapter "A" fits the mandrel and the hub accurately.

To Mount the Wheel place the face plate, "B," on mandrel "E." Put spacing collar, "C," and annular bearing adapter, "A," on the mandrel. Place the mandrel in the wheel so the hub bearing fits the annular bearing adapter "A"—this centers the wheel. Force the wheel against the face plate and put the remaining spacing collars on mandrel and tighten the nut.

The Flange of the Face Plate, "B," being of smaller diameter than the bolt circle, permits the mounting of any size wheel. Use the wheel clamping bolts to fasten wheel to the face plate with extension nuts through the clamps, "D." Most wheels have from six to twelve bolts in the hub. For clamping the face plate to the wheel, only use half of the bolts—for example, if wheel has six bolts, then three clamping bolts are sufficient; if eight, four bolts should be used.

Illustration No. 1 shows a wheel hub mounted on the self-centering mandrel, face plate and annular adapter. A section of the hub has been cut away to show the application.

Illustration No. 2 is a side view of the same hub showing the method of clamping the face plate to the wheel.

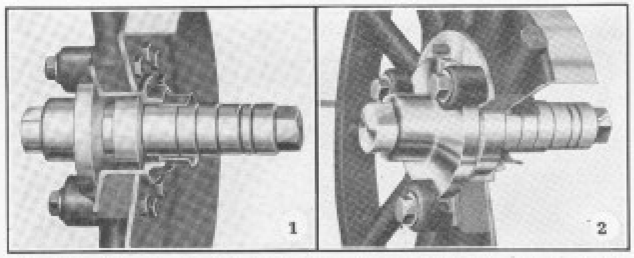


Fig. 63. Showing Application of Face Plate and Annular Adapter

The Application of the Self-Centering Mandrel, Face Plate and Annular Bearing Adapter in the above illustrations can be compared with the illustration and symbols on the opposite page. The hub of the wheel is centered on the annular adapter, "A." The wheel is squared by being clamped securely to the face plate, "B." This holds the wheel rigid and accurate on the mandrel for swinging the wheel between centers in the lathe.

Fig. 64. Face Plate

The Face Plate is made of cast iron, accurately machined all over and fits on the No. 1800 Straight Mandrel; only one face plate is necessary for all makes of cars.

The Annular Adapter is made of cast iron. It is accurately machined to fit the hub and is the same diameter as the annular bearing used in the hub.

Some wheel hubs have a common diameter, as Buick Master 6-120 and Willys-Knight 66 and 66A, and require Annular Adapter No. 1807-C, size 4.3307 inches diameter. In some cases only one car model requires a given size. All five makes of cars use the same face plate and No. 1800 Straight Mandrel.

Fig. 65. Annular Adapter

Price and Specifications of Face Plate

Cat. No.	To fit Mandrel	For use with Annular Adapter	Outside Dia.	Dia. of hole	Code Word	Price of Face Plate
1807	1800	**1807C**	6 in.	1¼ in.	Nafog	**$5.00**

Prices and Specifications of Annular Adapters

Cat. No.	To fit Mandrel	Diameter of hole	Diameters Furnished	Code Word	Price Each Annular Adapter*
1807C	1800	1¼ in.	From 3 in. to 5 in.	Nadum	**$3.00**

*When ordering specify catalog number, make and model of car, also number and make of annular bearing.

For No. 1800 Straight Mandrel, see page 29.

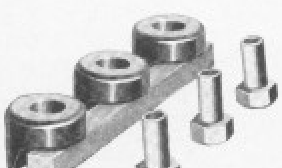


Fig. 66. Clamps and Extension Nuts

The Clamps or Lugs and Extension Nuts for clamping the wheel to the face plate are shown in the illustration at the left. The extension nuts are made of steel; threaded to fit S. A. E. standard ½-inch bolts, and are case hardened.

Catalog No. 1807A—Set of three clamps and extension nuts, Code Word "Nyrae", Price $2.00

Extra Clamp and Extension Nut, Price .... .75

Taper Mandrels for Mounting Rear Wheels

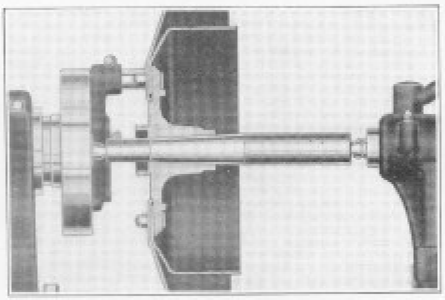


Fig. 67. Set up of a Rear Wheel fitted with a Self-Centering Taper Mandrel

The Taper Mandrel is used only for mounting semi-floating rear wheels between centers in the lathe. It fits the taper hole in the hub, shown in the illustration at the left, the same as the axle of the car.

Two Taper Mandrels, a "regular" and a "special" are made. The "regular" mandrel fits most makes of wheels. The "special" mandrel fits only a few makes of wheels.

Each Taper Mandrel, whether "Regular or Special," will fit from one to about twenty various wheels because the tapered hole in the wheel hub varies but little in diameter in many different makes of wheels. The taper mandrel may enter some wheel hubs only a little ways, and it may enter some other wheel hubs much further, but in both cases it will be a practical fit if one-half of the wheel hub has a bearing on the taper of the mandrel.

Fitting the Taper Mandrel.—Choose the mandrel with the correct degree of taper, put a little machine oil on it, and slip the mandrel into the hub. Tap the mandrel with a babbit hammer to make it fit tight, which it will do if there is no burr in the hub. If there should be a burr in the hub it should be reamed out.

Dimensions of Taper Mandrels

Fig. 68.

A—Small Diameter of Taper
B—Large Diameter of Taper
C—Length of Taper
D—Length of Mandrel

Taper Mandrels are self-centering, just the same as Straight Mandrels, and when the wheel is fitted tightly on the taper of the mandrel it will be concentric with the axis of the wheel hub, even if only one-half of the width of the hub has a bearing on the taper.

Specifications and Prices of Regular Taper Mandrels

Catalog No. of Mandrel	Specifications of Mandrels					Weight of Mandrel	Code Word	Price of Taper Mandrels
	Diam. "A"	Diam. "B"	Length "C"	Length "D"	Taper per ft.			
1820	1"	1 3/8"	6"	13 1/4"	3/4"	5 lbs.	Numbe	**$7.50**
1821	3/4"	1 1/4"	6"	11 7/8"	1"	4 lbs.	Novel	**7.50**
1822	1"	1 1/2"	6"	13 1/4"	1"	6 lbs.	Nasim	**8.00**
1823	1 1/4"	1 3/4"	6"	15"	1"	9 lbs.	Nough	**8.00**

Specifications and Prices of Special Taper Mandrels

1828	1 3/4"	2 1/2"	9"	18"	1"	20 lbs.	Nurse	**$11.00**
1830	2"	3"	12"	26"	1"	36 lbs.	Nudge	**15.00**
1824	11/16"	1 1/16"	6"	11 7/8"	1 1/2"	4 lbs.	Nuper	**7.50**
1825	1 1/8"	2"	7"	15 3/4"	1 1/2"	11 lbs.	Nasal	**9.00**
1826	1 1/2"	2 1/2"	8"	18"	1 1/2"	20 lbs.	Nerve	**11.00**
1827	1 1/2"	2 1/4"	9"	18"	1"	18 lbs.	Nymph	**11.00**

Actual Time for Truing a Brake Drum

A rough estimate of the time required to true any average brake drum is ½-inch width of surface per minute. Actual turning or machining time for truing one brake drum on the South Bend Brake Drum Lathe is shown below. This time does not include mounting or dismounting the wheel.

Automobile, Light Truck or Bus

Truing Time, 5 Minutes

Brake Drum Size, 10½ x 2 inches.
Front Wheel of Chevrolet with 4-wheel brakes.
Tire Size, 30 x 4.50 inches.
Lathe Used for Work, No. 2 or No. 302.

Medium Size Truck or Bus

Truing Time, 12 Minutes

Brake Drum Size, 18 x 5⅜ inches.
Rear Wheel of SF-46 2-ton International Truck.
Tire Size, 34 x 7 inches.
Lathe Used for Work, No. 2 or No. 302.

Heavy Duty Truck or Large Bus

Truing Time, 15 Minutes

Brake Drum Size, 17 x 6 inches.
Rear Wheel of Model K41 10-ton G. M. C. Truck.
Tire Size, 40 x 8 inches.
Lathe Used for Work, No. 3 or No. 303.

It is best to have a floor crane or chain hoist to mount truck and bus wheels if one man operates alone. When mounting heavy wheels in the lathe a small crane will enable one man to do the job nicely.

Size of Lathe and Mandrel and Adapter Equipment

No. 2 or No. 302 Lathe — The automobile dealer handling three or four makes of automobiles and light trucks, can service the brake drums and wheels of these cars with a No. 2 Brake Drum Lathe and about a $50.00 carefully selected equipment of self-centering mandrels and adapters.

No. 2 or No. 302 Lathe — The brake drum and wheel service shop that takes care of all makes and types of wheels for automobiles, buses, and medium size trucks requires a No. 2 Brake Drum Lathe and about a $75.00 carefully selected equipment of self-centering mandrels and adapters.

No. 3 or No. 303 Lathe.—The shop that wishes to service brake drums and wheels of heavy trucks and buses in all sizes and types, in addition to automobiles and light trucks, requires the No. 3 Brake Drum Lathe with a carefully selected, self-centering mandrel and adapter equipment amounting to about $125.00.

One Operator with a South Bend Brake Drum Lathe can service a fleet of 150 buses and trucks without loss of schedule trips and keep the stock room supplied with parts. It is the most used and profitable machine in the shop, because of its general utility.

South Bend Method of Truing Brake Drums

Servicing a Brake Drum and Wheel.—When an automobile, truck or bus arrives for wheel or brake drum service, remove the wheel with the tire attached. Make a test to locate the cause of the trouble unless the exact trouble is known.

Testing takes only a few minutes and will promptly and accurately determine for the mechanic the real cause of the trouble. It will also prevent mistakes and the loss of time and labor on parts not affected. The proper tests to make are listed in order below. Instructions of how to proceed with each test and operation are also given in proper sequence.

Five Major Tests and Operations.—Make the first test listed below before mounting the wheel on a mandrel. After the wheel is mounted on the mandrel and placed between centers in the lathe, the remaining tests and operations may be made:

1. **Test the bearing cups in the hub.**
2. **Test and balance the wheel, with tire attached.**
3. **Test and true the surface of the brake drum.**
4. **Test and true the hub flange.**
5. **Test and true the wheel felloe.**

The Brake Drum Should Never be Detached from a wooden spoke or disc wheel for testing and truing. With a wire wheel, the assembled hub and brake drum must be detached from the wheel for machining because of its construction.

Test and Operation No. 1. Testing the Bearing Cups.—When the wheel has been removed from the automobile, truck or bus, take out the bearings, but leave the bearing cups in the hub. Wash out the hub and bearing cups with gasoline or kerosene.

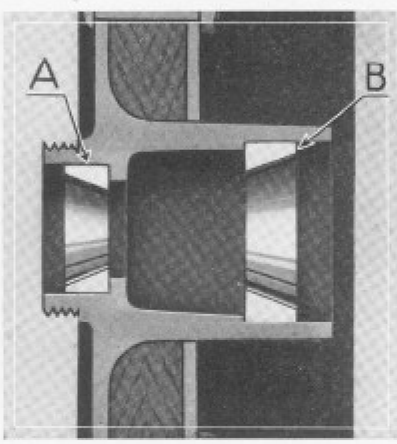


Fig. 69. Cross Section of Wheel Hub showing Timken Bearing Cups In Place

Examine each bearing cup to see if it is worn, cracked or otherwise unfit for use. Test the seating of each bearing cup with a hammer and a nail set. Try five or six points around the cups. The sound will indicate whether the cups are seated solidly against the hub shoulders.

Fit the wheel with a mandrel and bearing adapters. The wheel is now ready to be placed between centers for the next test and operation.

The universal bearing adapters fit into the bearing cups in the same manner as the bearings do. If the bearing cups are worn or cracked and are to be replaced, it should be done before doing any other work on the wheel or drum. Then when the wheel is mounted on the mandrel and adapters between centers in the lathe for further testing and machining, the conditions will be the same as when the wheel is mounted on its axle shaft.

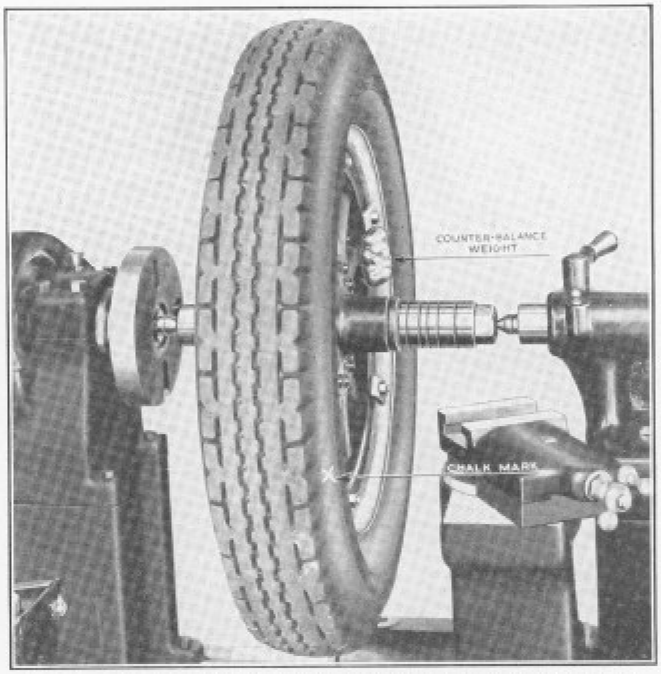


Fig. 70. Balancing an Automobile Wheel in the Brake Drum Lathe

Test and Operation No. 2. Balancing the Wheel. Fit the wheel with a mandrel and bearing adapters and swing it between centers in the lathe. Rotate it by hand several times and see if it will stop at several different positions. If not, the wheel is out of balance. Have some putty handy. Tail center should be loose enough so that any heavy added weight will rotate the wheel and make the heavy part come to rest at the bottom.

Make a chalk mark on the side of the tire which will indicate the heavy point. Now take about 2 or 3 ounces of soft putty and place it on the felloe or rim diametrically opposite the chalk mark. Rotate the wheel until the chalk mark and putty are in a horizontal plane—that is, in a line across the center of the wheel. Now if the putty is of sufficient weight to balance the wheel, then the wheel will remain in that position. If the putty is not heavy enough, the wheel will rotate the chalk mark to the bottom again.

It may be that the putty is not located in the right position. It may have to be changed forward or backward; a little testing will determine the correct position of the putty.

When the wheel is in perfect balance, mark the position of the putty. Remove the putty and weigh it. Select a piece of iron equal in weight to the putty and attach this iron to the felloe by two small cap screws fitted tightly into the felloe so that they will not jar loose when the wheel is in operation on the car. With the metal fastened securely to the felloe, the wheel is balanced.

Fig. 71. Truing an External Band Brake Drum Mounted on a Straight Mandrel with Universal Bearing Adapters

Test and Operation No. 3. Testing and Truing the Brake Drum Surface.—Before machining a brake drum be sure that the drum is securely fastened to the wheel. Place a piece of rubber belt about 2 inches wide around the circumference of the brake drum. If the inner surface of the drum is to be machined, this belting should be held in place by a spiral spring hooked together at the ends.

The reason for using the rubber belt when machining is because it eliminates noise and vibration or chattering during the machining process and helps the tool produce a smooth cut. See Page 41 for description of rubber belts and springs.

Attach the wheel driver to the face plate so that its stud will extend between the spokes of the wheel. If it is a disc wheel let the stud extend through one of the openings in the disc first and then fasten the wheel driver securely to the face plate.

Place the lathe belt on the second largest step of the spindle cone, put the back gears in mesh and start the lathe. Be sure that the turning tool is set so that the cutting edge will reach to the full depth of the brake drum. Adjust the cutting edge of the tool so it will just touch the surface of the revolving brake drum. This will indicate immediately how much the drumis out of true, if any. Run the carriage back until the tool is free of the drum.

With the cross feed, advance the cutting tool three or four thousandths of an inch towards the surface of the brake drum that is to be trued. Then without changing the adjustment of the tool, bring the carriage forward until the point of the tool is up to the edge of the drum.

Start the automatic feed of the carriage and take a chip across the entire face of the drum. If the drum is badly worn it may take several chips to true it up, depending on the amount of wear, but let the last chip be a very smooth finishing chip.

Before taking the finishing chip the tool should be ground sharp and keen with a slightly rounded nose, so the finishing cut will leave a smooth surface on the drum.

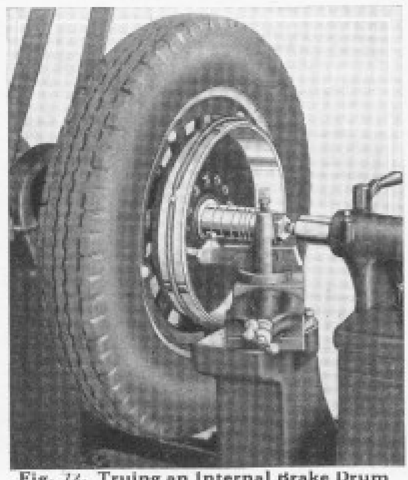


Fig. 72. Truing an Internal Brake Drum Mounted on a Straight Mandrel with Universal Bearing Adapters

Facing Hub Flanges on the Brake Drum Lathe

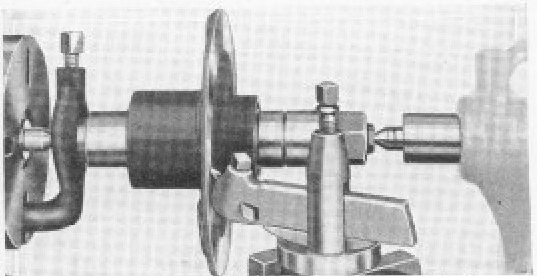


Fig. 73. Truing Hub Flange of Wood Wheel

Test and Operation No. 4. Testing and Truing Hub Flanges.—Remove flange from the wheel and mount it between centers in the lathe in the same manner as when mounting a wheel. Test machined side of flange for being true before doing any machine work.

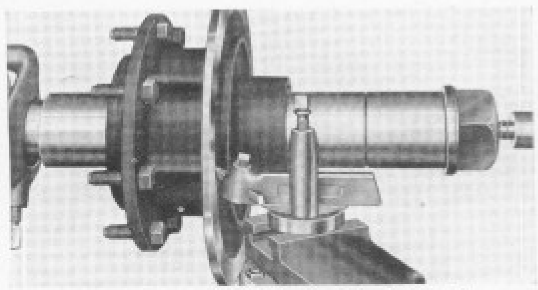


Fig. 74. Truing Hub Flange of Budd Wheel

The side of the flange should be machined if it is not true, but take light cuts and remove only a sufficient amount of stock to make the flange true up. The outside of the flange, if machined, should be polished lightly.

Testing and Truing Wheel Felloe

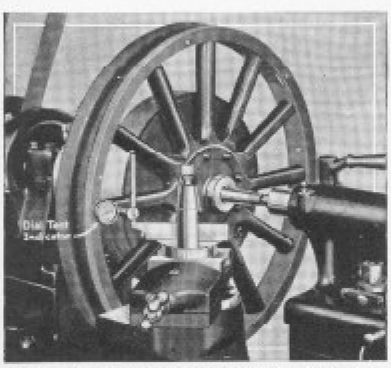


Fig. 75. Testing Face of Wheel Felloe with a Dial Test Indicator

Test and Operation No. 5. Testing and Truing Wheel Felloe.—Remove tire and rim from wheel. Mount wheel on mandrel with adapters and swing it between centers in lathe. Start lathe and move cutting tool forward until it just touches the face of the felloe. If felloe is true, the tool will mark it evenly all the way around.

If the felloe shows an uneven mark, it should be machined true. Polish the felloe lightly after machining. Another method of testing the wheel felloe is with a dial indicator, as shown in Fig. 75. The rim surface of the felloe may be tested and trued in the same manner.

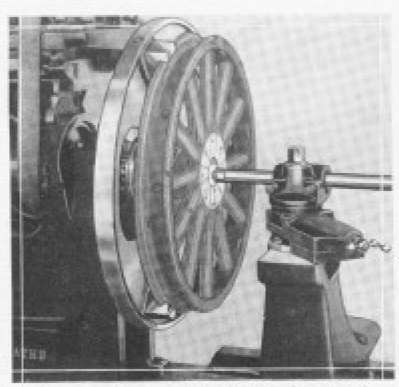


Fig. 76. Boring Wood Wheel for Hub

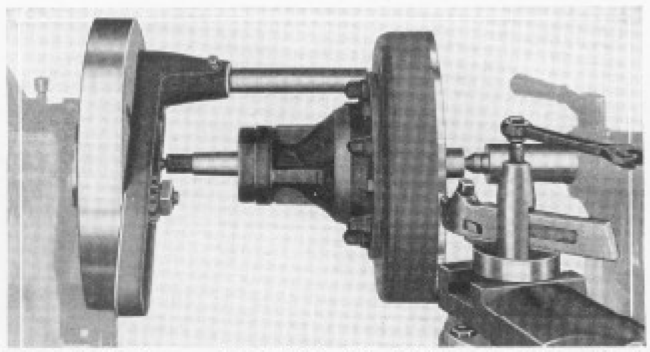


Fig. 77. Brake Drum and Hub of Wire Wheel Mounted on Taper Mandrel

Truing Brake Drums of Wire Wheels

Truing the Brake Drum of a wire wheel is shown in the illustration above. Note that the brake drum and the hub assembly, without the tire and rim, is mounted on a taper mandrel. This hub is from an annular ball bearing type of wire wheel but the face plate and annular adapter were not necessary in this case because the hub is tapered and a regular taper mandrel could be used.

The Brake Drum Assembly for Wire Wheels is different than it is for wood or disc wheels. On wire wheels the brake drum is attached to the hub. To test and true the brake drum of a wire wheel, remove the assembled hub and brake drum from the wire wheel and mount it on a mandrel. Proceed with the testing and truing of the brake drum in the same manner as for other wheels. See Test and Operation No. 3 on Page 36.

The Hub Design in wheels with annular ball bearings sometimes differs when wire wheels are used instead of wood or disc wheels. In some instances the hub of the wire wheel can be mounted on the taper mandrel, as illustrated and described above, which centers the hub and brake drum accurately without using the face plate and annular adapter method shown on pages 30 and 31.

Wire Wheel Construction is such that any machining done on the brake drum will be concentric with the axis of the hub when the assembly is mounted between centers in the lathe. The stud is adjusted to drive from one of the bolts on the flange, or a lathe dog can be attached to the mandrel. The former method is preferred. Brake drums should not be detached from wood or disc wheels for truing, but only with wire wheels as already described above.

When the Hub and Drum Unit are taken from the wire wheel for truing the brake drum in the lathe, the work can be done in either a brake drum lathe or in any regular lathe that has the swing necessary to give the assembly clearance over the bed of the lathe. The straight mandrel with universal bearing adapters may be used, or the taper mandrel, or the straight mandrel and face plate adapter, depending of course, on the design of the hub in the wheel to be trued. For a description of these types of mandrels and adapters see pages 28 to 32.

Various Jobs for the South Bend Brake Drum Lathe

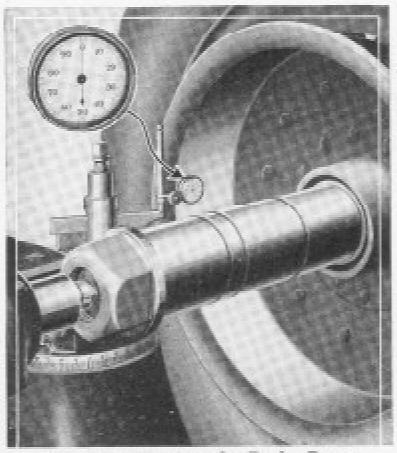


Fig. 78. Testing the Brake Drum

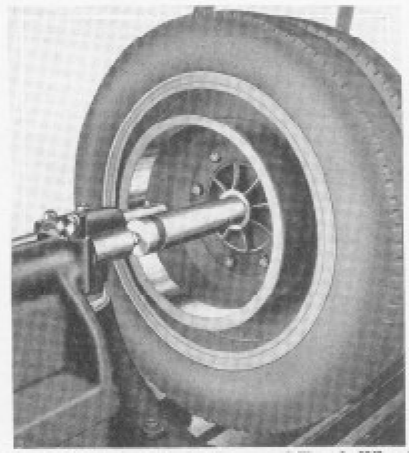


Fig. 79. Truing Brake Drum of Truck Wheel

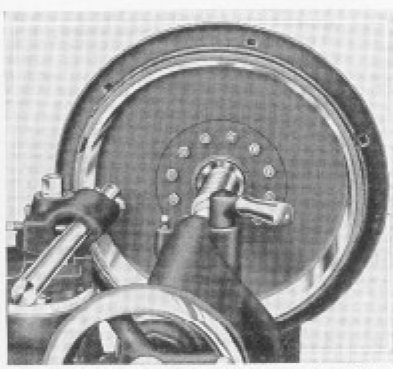


Fig. 80. Truing Lincoln Car Brake Drum

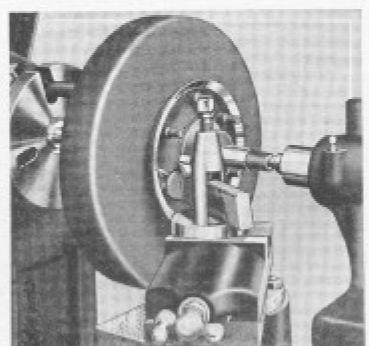


Fig. 81. Truing Buffalo Wheel Flange

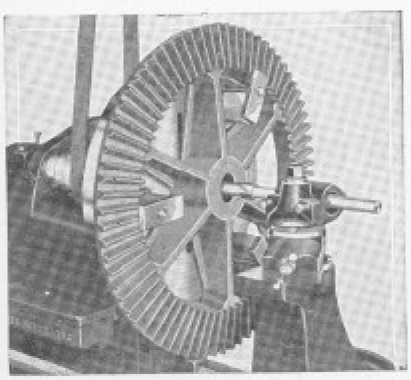


Fig. 82. Boring Out Large Bevel Gear

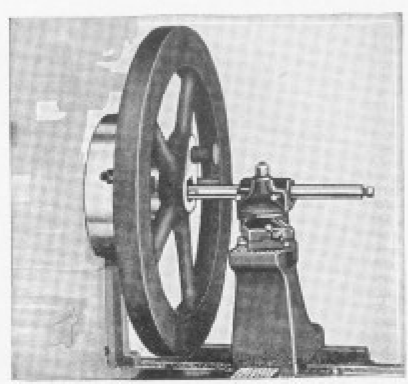


Fig. 83. Boring and Bushing a Fly Wheel

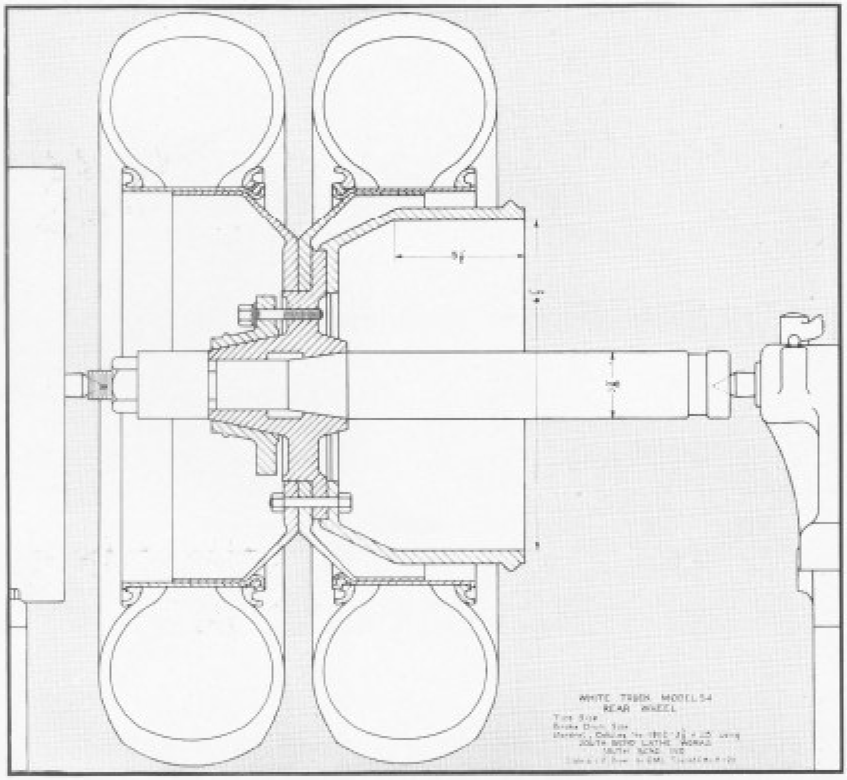


Fig. 84. Cross Section View of a Rear Dual Wheel fitted with Combination Mandrel for Wheel of a Heavy Duty Truck

Combination Straight and Taper Mandrel

The above illustration is shown in cross section in order to explain the application of the combination mandrel. Wheel designs are not standardized yet and it is probable that a truck will come to the shop occasionally for service where a special mandrel will have to be machined on the lathe to fit the wheel hub.

These Special Mandrels can be made by the operator in the lathe and fitted to the job. Instructions are given on Pages 42 and 43 for the making of mandrels and adapters, and the inexperienced mechanic following these instructions, can pick up an old shaft from the junk pile and make up his mandrel to accommodate the work he has on hand.

The mandrel shown in the above illustration is for the rear wheel of a White Truck Model 54. The mandrel is 3⅜″ in diameter and 28″ long. It is made of mild steel.

The mounting of a dual wheel like the above requires a No. 3 or No. 303 South Bend Brake Drum Lathe. With a lathe of this kind the skilled mechanic can handle any brake drum or wheel job that comes to the shop.

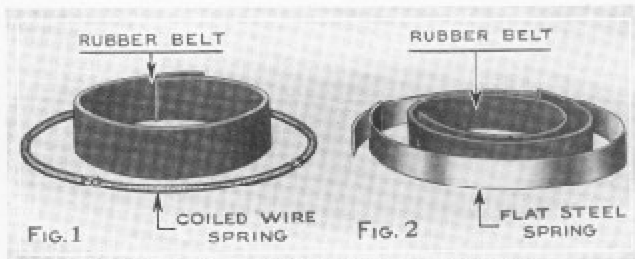


Fig. 85. Springs and Belts to Eliminate Vibration

Rubber Belts and Springs to Eliminate Vibration

Vibration and Chatter, which is liable to occur when machining the thinner brake drums, can be practically eliminated by the use of rubber belts and springs to muffle the drums while being turned. It is obvious that in order to do accurate, precision work, there must be no vibration.

For Internal Expansion Brake Drums, the wide rubber belt and coiled spring shown in Figure 1 above, are slipped over the outside of the drum, the spring holding the rubber belt in position. When drawn taut, this gives the drum added support or reinforcement and practically eliminates the tendency to vibrate.

For Band Brake Drums, the narrower belt and flat steel spring shown in Figure 2 above, are slipped inside the drum, the spring being used to hold the belt in place. The tension of this spring, together with the cushion effect of the rubber belt takes up any tendency to vibration.

Special Boring and Turning Tool

Brake Drum and Wheel Work calls for turning large diameters and working in places that would be inaccessible with standard tools. Use the special boring and turning tool for truing large brake drums, truing center holes, boring bushings in large gears, flywheels, etc.

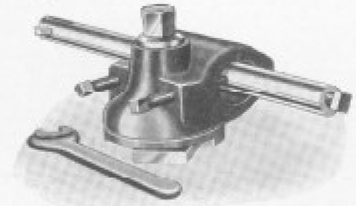


Fig. 86. Special Brake Drum Boring and Turning Tool

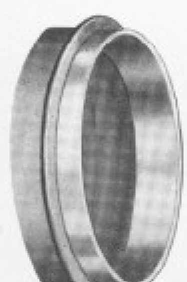


Fig. 87. Metal Liner Partly Fitted in a Brake Drum

Metal Liners for Brake Drums

Brake Drums that are Worn can be fitted with metal liners to give them added life and service. The liner should be finished on both inside and outside circumferences. To fit a metal liner, mount the wheel with brake drum attached on a self-centering mandrel between centers. Machine the drum so the liner will fit snugly. The liner should then be attached to the drum by screws or rivets. After the liner is attached to the brake drum it should be trued up on the brake contact surface concentric with the axis of the hub.

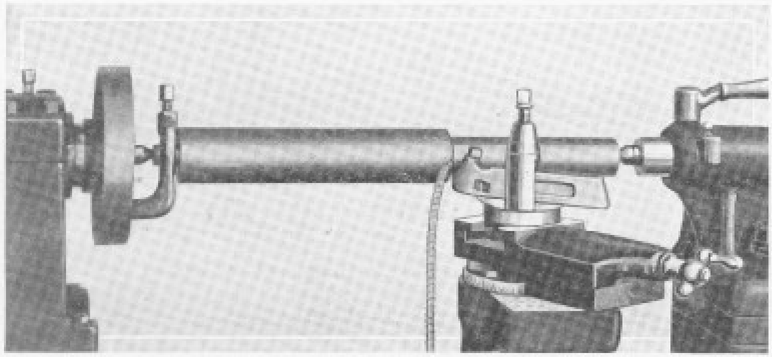


Fig. 88. Making a Mandrel for Mounting Front or Rear Wheels

Making Mandrels and Adapters in the Service Shop

The Average Operator who has not had much lathe experience should have little, if any, trouble in making mandrels and adapters in the lathe. For emergency jobs, or during slack times in the shop, he can make up a few mandrels and adapters that are necessary for the regular run of work.

When the Emergency Job comes into the shop and there is no mandrel in stock that will fit, the operator should remove the wheel, find out what kind of a bearing is in the hub. Then select a piece of steel or an old shaft, cut it off to the correct length and locate the center holes in each end of the shaft. This operation is fully described in book "How to Run a Lathe" which accompanies the equipment of the lathe.

The Operator can Proceed with the turning of the mandrel whether it be straight or taper by studying the turning operations in the book "How to Run a Lathe." Speeds of the lathe spindle, how to grind and set cutting tools, the correct cutting feeds, how to cut screw threads, and much other information can be secured from "How to Run a Lathe."

In the Making of Adapters for the straight mandrel, cast iron or mild steel may be used. Cut off stock to the correct size and chuck it in the lathe, then drill a hole as near as possible to the size of the mandrel leaving about ⅛ of an inch to finish with a boring tool so that the hole will be true. Then face the adapter true while it is still in the chuck. Make an arbor on which the adapter will fit tightly and drive the adapter on the arbor and machine it to the correct diameter and length while the arbor is between centers in the lathe.

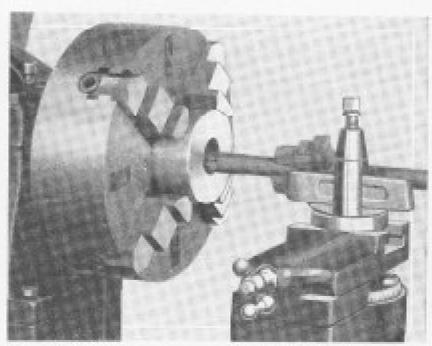


Fig. 89. Making a Bearing Adapter for Use on a Straight Mandrel

For Making Collars for the straight mandrel proceed in the same way. These collars may be made of either cast iron or mild steel. It is necessary that the sides of the collars be parallel so that they will hold the adapter firmly.

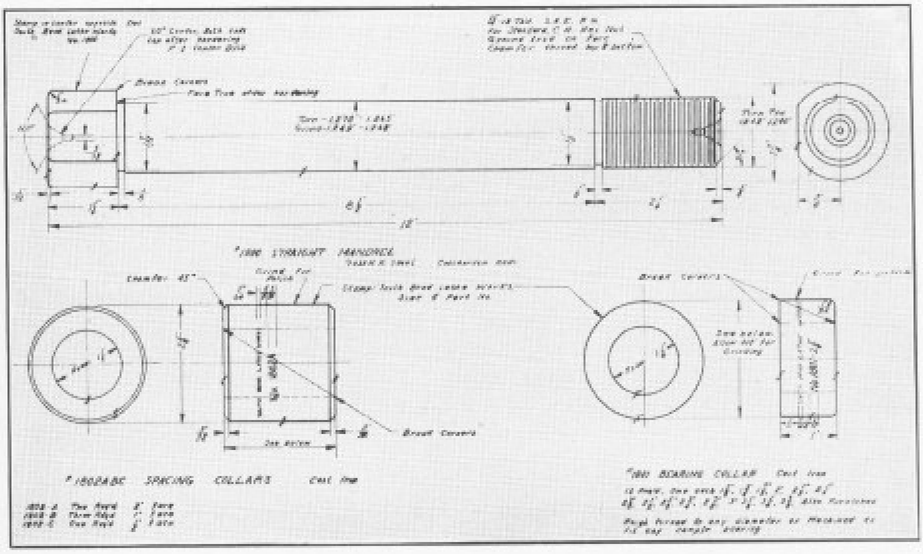


Fig. 90. Reduction of a Drawing for Making a Mandrel

Detail Drawing of a Straight Mandrel

The above is a detailed drawing of the No. 1800 South Bend straight mandrel, one of the collars and universal adapter. The material is soft steel. Cut the material off to the proper length, face it on each side with a side tool and take a roughing cut over the entire length of the mandrel and then finish to the correct dimensions. Then cut a thread on the end of the mandrel, but before cutting the thread, see if there is a nut of any kind in the shop that you can use on the mandrel. Or if not, see if there is a tap in stock for tapping a nut about the size required for the mandrel. After you find a finished nut, cut the thread on the mandrel to fit this nut. Or if you are going to use a tap, make the nut first and then tap it out so that you can cut the thread of the mandrel to fit the tapped nut.

Instructions for All These Operations, with tables for turning, will be found in book "How to Run a Lathe" and if followed carefully, the operator can do an excellent job.

For Mandrels Used to Any Extent it is well to harden the ends to preserve the center holes. To do this, heat the ends until they become a dark cherry red, then drop a small piece of cyanide of potassium in the center hole. The cyanide will dissolve slowly and be absorbed. After the centers have received a thorough coat of cyanide, again heat ends slowly for about one minute and then plunge into cold water. The center holes should then be lapped clean.

The Center Holes should be hardened after the arbor is rough turned. The arbor should then be put back in the lathe, finished to the correct dimensions and the end threaded for the nut.

Small Equipment of Mandrels Services Many Wheels

Only a Small Investment in Mandrels and Adapters Required for the Average Service Station Shop

Very Few Mandrels and Adapters are necessary for the average brake and wheel service shop, because one mandrel, the No. 1800 with universal bearing adapters, will handle the front wheels of practically all makes and models of automobiles, the rear wheels of several makes and models of automobiles and also the wheels of many makes and models of light and medium size trucks and buses.

In the Mandrel and Adapter Equipment listed below, we show three mandrels, two taper and one straight, with a set of eight bearing adapters for the straight mandrel, that will handle the wheels of 62 makes and models of automobiles, trucks and buses. This is the equipment recommended for the No. 2 and No. 302 Brake Drum Lathe.

$51.00 Mandrel and Adapter Equipment

Services 62 Makes and Models of Automobiles, Trucks and Buses

	For Front Wheels	
1	No. 1800 Straight Mandrel	$15.00
8	No. 1801 Bearing Adapters with outside diameters $1\frac{5}{8}''$, $1\frac{7}{8}''$, $2\frac{1}{8}''$, $2\frac{1}{4}''$, $2\frac{3}{8}''$, $2\frac{1}{2}''$, $2\frac{5}{8}''$, $2\frac{7}{8}''$	20.00
	For Rear Wheels	
1	No. 1822 Taper Mandrel	8.00
1	No. 1823 Taper Mandrel	8.00
	Total Cost of Mandrels and Adapters	$51.00

The Price of Mandrel and Adapter Equipment for the average shop should not exceed from $55 to $60, for use with the No. 2 or No. 302 Brake Drum Lathe.

Many shops are taking care of a variety of automobiles, trucks and buses with less than the above amount invested in mandrel and adapter equipment.

The List of Automobiles, Buses and Trucks shown on the following pages, contains the makes and models of practically every automobile, bus and truck in use today.

This list is given here to assist the operator of the Brake Drum Lathe to select the correct size and type of mandrel and adapters to service the wheels and brake drums of the various types of motor vehicle that comes to the shop.

When a Very Old Make of Wheel comes into the shop, it may require a special mandrel and special adapters, and these can be made in the lathe by the operator. The hubs of automobile wheels are becoming more standard in size and type, which means that the equipment necessary for doing wheel service and brake drum work will eventually be cut down to a very limited amount.

How to Select Correct Mandrels and Adapters

For Servicing Wheels of any Model or Make of Car, Bus and Truck

The tabulation lists the makes and models of automobiles, buses and trucks, also the year in which they were built. Opposite the name of each vehicle is shown the correct size and type of self-centering mandrels and universal bearing adapters to use.

Straight mandrels with universal bearing adapters are used for front wheels and rear wheels, other than semi-floating type, of automobiles, buses and trucks. Taper mandrels are used for rear wheels of automobiles, buses and trucks having taper hole in hub.

Mandrels and Adapters for Automobiles

Name and Model of Automobile	Year Made	FRONT WHEEL			REAR WHEEL		
		Mandrel Catalog Number	Outer Adapter Diam. Inches	Inner Adapter Diam. Inches	Mandrel Catalog Number	Outer Adapter Diam. Inches	Inner Adapter Diam. Inches
Ajax 51	'25	1800	1 7/8	2 5/8	1822		
Ambassador D1	'24				1827		
Apperson 8	'25				1822		
Auburn 4-44	'26	1800	1 7/8	2 3/4	1826		
Auburn 6-66	'25-6	1800	1 7/8	2 1/2	1822		
Auburn 6-66A, 8-77	'26-7	1800	1 5/8	2 3/4	1824		
Auburn 6-66B, 8-88A	'28	1800	1 5/8	2 5/8	1824		
Auburn 115, 8-88, 110	'26-8	1800	2	2 7/8	1822		
Buick, Std. 6	'28	1800	2	2 7/8	1820		
Buick, 120", Master 6, 40-4-5-7	'24-8	1800	2 15/32	3 3/8	1800	F.P.A.	4.3307
Buick 127", Master 6	'24-8	1800	2 15/32	3 3/8	1800	F.P.A.	4.7244
Buick 47, 48, 49, 59, 54, 57, 58	'25-6	1800	2 19/32	3 3/8	1800	F.P.A.	4.3307
Cadillac, V65, 63, 61, 57, 59	'25-6	1800	2 1/2	3	1800	3 3/8	3 3/8
Case X	'24-7	1800	2	2 7/8	1823		
Case Y	'24-7	1800	2 3/8	3 1/4	1800	3 3/8	3 3/8
Chalmers 35C-7 Pass	'23-4	1800			1822		
Chandler 31A. Lt. 6	'27	1800	1 7/8	2 3/4	1800	F.P.A.	
Chandler 35-37, Royal 8, Big 6	'27-8	1800	1 7/8	2 3/4	1800	F.P.A.	
Chandler, Special 6	'27-8	1800	1 5/8	2 5/8	1800	F.P.A.	
Chandler Std. 6	'27				1821		
Chevrolet K25, AA, V, AB	'24-8	1800	1 3/4	2 17/32	1820		
Chrysler 60, 70	'24-7	1800	1 7/8	2 5/8	1822		
Chrysler 4-60, 58	'25-7	1800	1 7/8	2 5/8	1821		
Chrysler 80	'26-7	1800	2 1/8	2 3/4	1823		
Chrysler 50, 52	'27-8	1800	1 5/8	2 5/8	1822		
Chrysler 62, 72	'27-8	1800	1 3/4	2 5/8	1822		
Chrysler 80L, 80	'28	1800	2 1/8	2 7/8	1823		
Cleveland 40, 42, 43	'24-6	1800	1 7/8	2 5/8	1822		
Cleveland 31	'25-6	1800	1 5/8	2 5/8	1821		
Columbia Lt. 6 De Luxe Liberty	'23-4				1822		
Davis 71, 83	'24	1800	1 7/8	2 1/4	1822		
Davis 90, 91	'25-6	1800	2 3/8	2 5/8			
Davis 93	'26	1800	1 5/8	2 5/8			
Davis 94	'27	1800	1 5/8	2 5/8			
Diana	'26-7	1800	1 7/8	2 5/8	1800	2 7/8	2 7/8
Dodge	'25-7	1800	1 7/8	2 5/8	1822		
Dodge Sr. 6	'27-8	1800	1 7/8	2 5/8	1822		
Dodge Victory 6	'28	1800	1 5/8	2 5/8	1822		
Dort 4-6 Cyl	'22-5				1820		
Durant A-22, B-60	'24-7	1800	1 7/8	2 5/8	1821		
Durant E-80	'26-7	1800	2 1/8	2 3/4	1821		
Durant M, R, 2-18	'26-7	1800	1 5/8	2 5/8	1821		
Durant 55, 65	'28	1800	1 5/8	2 5/8	1821		
Durant 75, Big 6	'28	1800	1 7/8	2 5/8	1822		
Elcar 4-40, 4-50, 4-55, 4-60	'24-6	1800	2	2 5/8	1822		
Elcar 8-80	'25	1800	2 1/2	3			
Elcar 6-70	'27	1800	1 5/8	2 5/8	1824		
Elcar 81	'26-7	1800			1823		
Erskine 51	'27-8	1800	1 5/8	2 5/8	1821		
Erskine 8-82, 8-90, 8-78	'28	1800	1 5/8	2 5/8	1821		
Essex, All	'24-8	1800	2	2 1/4	1822		
Falcon Knight 10-12	'27-8	1800	1 7/8	2 5/8	1820		
Flint 55, 55-80, 40	'25-6	1800	2 1/4	2 7/8			
Flint B-60, 60	'26-7	1800	1 7/8	2 5/8	1822		
Flint E-80	'26-7	1800	2 1/8	2 7/8	1822		
Flint Z-18	'26	1800	1 5/8	2 5/8	1822		

Mandrels and Adapters for Automobiles—Continued

Name and Model of Automobile	Year Made	FRONT WHEEL Mandrel Catalog Number	FRONT WHEEL Outer Adapter Diam. Inches	FRONT WHEEL Inner Adapter Diam. Inches	REAR WHEEL Mandrel Catalog Number	REAR WHEEL Outer Adapter Diam. Inches	REAR WHEEL Inner Adapter Diam. Inches
Ford T	All	1800			1824		
Ford A	'28	1800	1 5/8	2 1/2	1824		
Franklin 10C	'24-6				1825		
Franklin 12-N	'27-8	1800	1 7/8	2 3/4			
Gardner 8-8A, 8B	'24-5	1800	1 7/8	2 5/8	1822		
Gardner 90, 95	'27-8	1800	2	2 7/8			
Gardner 75, 80, 85	'27-8	1800	1 5/8	2 3/8			
Gotfredson Taxi	'26				1823		
Gray	'22 5				1821		
Hudson, All	'24-8	1800	2 1/2	2 7/8	1823		
Hupmobile Big 8, E, E2, E3	'25-8	1800	2 1/4	2 7/8	1822		
Hupm'bile Century 6, 8, A, M, A1, A2, A3, A4, A5	'26-8	1800	1 7/8	2 3/8	1800	2 3/4	2 3/4
Jewett 23, 25, 50	'24-5	1800	1 7/8	2 1/4	1822		
Jewett, New Day	'26				1824		
Jordan L	'25-6				1822		
Jordan MX, H	'24	1800	2 1/8	2 1/2			
Jordan K, L, F	'24-5	1800	2 1/8	2 7/8	1800	3	3
Jordan R, RE	'26	1800	1 7/8	2 3/8	1824		
Jordan A, AA, Gt. Line 8	'25-7	1800	2 1/8	2 7/8	1823		
Jordan JE, Air Line 8, Little 8, JI, J, JJ	'26-8	1800	1 7/8	2 3/8	1822		
Jordan R, RE	'26	1800	1 7/8	2 3/8	1824		
Jordan 8, Blue Boy	'22-4	1800			1822		
Jordan 8	'25-6				1827		
Kissel 55	'23-4	1800	2 1/8	2 1/2	1822		
Kissel 55, 75	'25-6			2 7/8	1827		
LaSalle, All	'27-8	1800	2 15/32	3 3/8	1800	F.P.A.	4.7244
Lexington, Concord	'25				1822		
Liberty 10E	'24	1800			1822		
Lincoln 8	'24-8	1800	2 1/2	3	1800	3 3/8	3 3/8
Marmon 34, 74	'24-6	1800	2 1/4	3	1800	F.P.A.	4.7244
Marmon, Small 8, E-75, L-34	'27	1800	1 7/8	2 3/4	1800	2 3/8	2 3/8
Marmon, Little 8	'27-8	1800	1 5/8	2 1/2	1800	2 3/8	2 3/8
Marmon 78, T, NT78		1800			1800	2 3/8	2 3/8
Marmon 68	'28	1800	1 5/8	2 3/8	1800	F.P.A.	3.1496
Maxwell	'24-5	1800	1 7/8	2 3/8	Special	Taper	15/16" per ft.
McFarland Str. 8	'26				1827		
McFarland SV, Lt. 6	'25				1827		
Moon, Aero, 8-80, Sr. A	'26-8	1800	1 7/8	2 3/8	1800	2 7/8	2 7/8
Moon 6-40, 6-50	'24-5	1800	1 7/8	2 3/8	1822		
Moon 6-58	'24	1800	2 1/8	2 1/2			
Moon 6-58 London	'24-5	1800	2 1/8	2 7/8			
Moon Series A	'25	1800	2 1/8	2 7/8	1821		
Moon 6-60, 6-72	'26-7	1800	1 5/8	2 3/8	1800	2 3/8	2 3/8
Nash, Lt. 6, 3-37, Std. 6	'25-8	1800	1 7/8	2 3/8	1822		
Nash, Big 6, Adv. 6	'28-9	1800	2 1/4	2 3/4	1822		
Oakland, All Ame., 6-54, DO-6	'24-9	1800	2 5/64	2 7/8	1820		
Oldsmobile, 30, Sr. B, C, D, E	'24-7	1800	1 3/4	2 17/32	1820		
Overland Whip. 91-92-96	'28	1800	1 5/8	2 3/4	1821		
Overland 93	'25-6	1800	1 7/8	2 5/8	1820		
Overland K-66	'25-7	1800	2 1/8	2 1/2			
Overland, K-70	'25-7	1800	1 7/8	2 3/8			
Overland, K 4	'26-7	1800	1 7/8	2 5/8			
Packard, All	'24-8	1800	2 1/8	2 7/8	1823		
Paige, 6-70	'23-4	1800	2	2 7/8	1823		
Paige, 21	'25	1800	2 1/2	3			
Paige, 6-75	'26	1800	2 1/8	2 7/8			
Paige, 6-75	'21-4	1800	1 7/8	2 5/8			
Paige, 6-72	'26	1800			1823		
Peerless 70	'24-5				1827		
Peerless, 66, Typ. 23	'24	1800	2	2 7/8	1823	3 3/8	3 3/8
Peerless, 70	'24	1800	2 1/4	2 7/8	1800	3	3
Peerless, 70	'24-5	1800	2 1/4	2 7/8	1800	3 3/8	3 3/8
Peerless, 66-67	'24-5	1800	2 1/2	3	1823	3 3/8	3 3/8
Peerless, 72	'26	1800	2 1/8	2 7/8			
Peerless 60	'27	1800	1 5/8	2 3/4	1800	2 3/8	2 3/8
Peerless 72, 80, 90	'27	1800	1 7/8	2 3/8			
Pierce Arrow 80	'24-8	1800	2 3/4	3	1800	3 1/8	3 1/8
Pontiac, All	'25-9	1800	1 3/4	2 1/2	1820		
Reo, F, V	'24	1800	2	3	1800	3 3/8	3 3/8

Mandrels and Adapters for Automobiles—Continued

Name and Model of Automobile	Year Made	FRONT WHEEL Mandrel Catalog Number	FRONT WHEEL Outer Adapter Diam. Inches	FRONT WHEEL Inner Adapter Diam. Inches	REAR WHEEL Mandrel Catalog Number	REAR WHEEL Outer Adapter Diam. Inches	REAR WHEEL Inner Adapter Diam. Inches
Reo, T6	'24-6	1800	2	3	1800	3	3
Reo, Wolverine	'27-8	1800	1 7/8	2 5/8			
Reo, F. C.	'27-8	1800	1 7/8	2 5/8	1822		
Rickenbacker, All	'23-4				1833		
Rollins, G	'24-5				1824		
Star, C, F	'24-8	1800	1 5/8	2 5/8	1821		
Stephens, Sr. 10	'23-4	1800			1822		
Sterns, Knight SKL4, SKI6	'24-5	1800	2 1/8	2 7/8	1800	3	3
Sterns, B4	'23-6	1800			1825		
Studebaker, Dict. Lt. 6	'24-7	1800	1 7/8	2 5/8	1822		
Studebaker, Sp. 6	'24-5	1800	2	2 3/4	1822		
Studebaker, Big 6	'24-5	1800	2	2 3/4	1823		
Studebaker, Pres., Com.	'28	1800	1 7/8	2 5/8	1823		
Studebaker, Dict.	'28	1800	1 7/8	2 5/8	1800	2 3/4	2 3/4
Stutz	'28	1800	2 1/2	3	1823		
Velie, 58-60	'24-6	1800	2	2 1/2	1822		
Velie 50	'26-7	1800	1 5/8	2 3/8	1833		
Velie 60	'27	1800	1 7/8	2 5/8			
Velie 49	'28	1800	1 7/8	2 3/4			
Velie 88	'28	1800	1 7/8	2 5/8			
Velie 66, 77	'28	1800	1 7/8	2 3/8			
Wills Ste. Claire, 6 and 8	'24-5	1800			1825		
Willys Knight 64, 65, 67	'24-5	1800	1 7/8	2 5/8	1800	F.P.A.	4.3307
Willys K. 66, 66A	'25-8	1800	2 1/8	2 7/8	1800	F.P.A.	4.3307
Willys K. Std. 6, 70A	'28	1800	1 7/8	2 5/8	1800	F.P.A.	3.5433
Winton M-40	'23-4	1800			1827		
Yellow Cb. D1	'26	1800	2 1/8	2 7/8	1800	3 1/8	3 1/8
Yellow Cb. OV, T3, A2	'24-5	1800	2 1/2	3	1800	3 1/8	3 1/8

Mandrels and Adapters for Buses and Trucks

Name and Model of Bus or Truck	Year Made	FRONT WHEEL Mandrel Catalog Number	FRONT WHEEL Outer Adapter Diam. Inches	FRONT WHEEL Inner Adapter Diam. Inches	REAR WHEEL Mandrel Catalog Number	REAR WHEEL Outer Adapter Diam. Inches	REAR WHEEL Inner Adapter Diam. Inches
Acason Tr. 1t	'19-20				1827		
Acme 20 L	'24-6				1825		
Anderson	'23-4				1822		
Available Sr. L1	'25-6				1827		
Betz J, J3	'22-6				1827		
Biederman 30	'21-3				1827		
Buck 34-36	'25-6				1825		
Buffalo 9	'23				1826		
Chevrolet Utility	'25-8	1800	1 3/4	2 17/32	1823		
Chevrolet Lt. Del.	'25-8	1800	1 3/4	2 17/32	1820		
Chicago Tr. 1T	'25-6				1827		
Clark Speed A	'27-8	1810	2 3/4	3 3/8	1810	4 1/2	4 1/2
Clark Speed D	'27 8	1810	2 3/4	3 3/8	1810	4 1/2	4 3/4
Clinton 20	'24-6				1825		
Clydesdale 32-20-9-12	'20-4				1827		
Clydesdale 10A-12-14	'24-6				1825		
Commerce Bus Char. 10 Pass.	'22				1827		
Concord E-O	'25				1827		
Corbitt D22-C22	'23-6				1826		
Day Elder AN-G-GST	'24-6				1825		
Diamond T O4	'24-5				1825		
Dodge 3/4 T	'24-6				1822		
Dorris K2	'24-6				1827		
Duplex A-GH	'23-6				1826		
Fageol 56-Pass.	'24-6	1840	3 1/2	4 3/4	1840	4 3/4	5 3/4
Fageol 230A	'26	1810	2 1/2	3			
Fageol 235	'24-5	1810	2 1/2	3	1840	4 1/2	4 3/4
Fageol Intcy. 67 Pass.	'24-5	1810	2 3/4	3 3/4	1840	4 1/4	4 3/4
Fageol 4-6 cyl. 19 Pass.	'26	1810	3	3 3/4	1840	4 1/4	5 3/4
Fageol Intcy., 22 Pas. 3T	'24-6	1810	2 3/4	3 3/4	1840	4 1/4	4 3/4
Fageol 6 cyl., st. car, 29 pass. Intcy.	'25-6	1810	3 1/2	4 3/4	1840	4 1/4	5 3/4

Mandrels and Adapters for Buses and Trucks—Continued

Name and Model of Bus or Truck	Year Made	FRONT WHEEL			REAR WHEEL		
		Mandrel Catalog Number	Outer Adapter Diam. Inches	Inner Adapter Diam. Inches	Mandrel Catalog Number	Outer Adapter Diam. Inches	Inner Adapter Diam. Inches
Fageol, 4 cyl., spdcar, 29 pass.	'25-6	1810	2¾	3¾	1840	4¼	5¾
Fageol, 4 cyl., Intcy, 22 Pass.	'25-6	1810	2¾	3¾	1840	4¼	5¾
Fageol, 4-T, 454-490	'25-6	1810	3	3¾	1840	4¾	5¾
Fageol, 6-T, 690-645	'26	1840	3½	4¼	1840	5¾	6¼
Federal S-27	'26				1828		
Federal EK	'26-7				1822		
Federal 5T, X-2, 4, 5, 6, 7	'23-8				1840	5¾	6¼
Federal W-2, 3, 4	'23-8				1840	4¾	5¾
Federal S-1, 2	'25-6				1828		
Federal FW-2, FK, F6, FW	'24-8				1823		
Federal 1 KD, UL4, U4, U2, BB7, 2BG	'28				1840	4¼	4¼
Federal S26, T6B, S25	'28				1840	4	4
Federal T21, T20, S30, T2W, T6W	'26-8				1828		
Federal 3D6, 2KG, 3C6, UL7	'28				1840	5½	5½
Federal A6	'28	1800	2½	3	1826		
Ford Tr. All					1825		
Garford Bus KB	'25-6				1827		
Garford, 51D					1840	4¼	4¼
G. M. C. 2-T, T50, T40	'27				1840	4¼	4¼
Gary Tr. Exp. (1T)	'25-6				1827		
G. M. C. 2-2½T, K52, K41	'23-7				1840	4¼	4¼
G. M. C. K102, K101	'23-7				1840	5¾	6¾
G. M. C. K72	'26-7				1840	4¾	5¾
G. M. C. 1-T, T20	'27				1820		
Gotfredson 20B	'25-6				1827		
Graham Bros. SD	'27				1822		
Graham Bros. BD, ID, DD	'27				1823		
Graham Bros. YD, JD, ED, MD, LD, OD, TD	'27	1810	2½	3	1826		
Graham Bros. BE, IE	'28	1800	1⅞	2⅝	1825		
Graham Bros. SE	'28	1800	1⅝	2⅞	1822		
Graham Bros. YE, OE, TE, JE	'28	1800	2½	3	1826		
Graham Bros. BB	'24-6				1823		
Graham Bros. DE	'28	1800		2⅝	1822		
Graham Bros. ME, LE	'28	1800	2½	3			
Gramm-Bernstein 30	'23-5				1831		
Gramm-Bernstein 125	'23-5				1826		
Gramm Pioneer 30	'23				1831		
Hahn B2	'25-6				1823		
Hal-Fur D-E	'20-2				1827		
Harvey WFB, WFT	'23				1831		
Henderson 1¼T	'21-2				1827		
Independent HI	'23				1831		
Indiana 11, 11A, 11AX	'25-6				1823		
International SF46					1830		
Jeffrey 4-6 Cyl.	'20-6				1822		
Kelly-Springfield 2T	'20				1831		
Kenworth K	'23				1831		
Kissel 1T	'24-6				1825		
Kissel 20					1826		
King Zeitler 30	'24-6				1825		
Kleiber ¾T	'20-3				1827		
Krebs 24	'24-5				1825		
Lange Motor K	'26-8				1840	4	4
Lange Motor H	'26-8				1840	5½	5½
Lange Motor F	'26-7				1840	4¾	5¾
Lange Motor E	'26-7				1840	4¾	4¾
Lange Motor M	'28				1840	5¼	
Lange Motor L	'27-8	1840	4½	4½	1840		
Mack AL Bus	'26-7				1840	5¼	6
Mack 2-2½T					1840	3½	4¼
Mack AB Dual	'24-6				1840	4¾	4¾
Mack AB Bus	'26				1840	5¼	5¼
Mack AC 5, 6, 7½T	'25-6				1840	4¾	5¾
Mack 3½T 4 Spud	'24-6				1840	3½	4¾
Master 11 (1¼T)	'23				1827		
Menominee 1T	'23				1827		
Midland S	'20				1831		
Milburn Electric 43					1825		
Moreland AX, AXX, EXX, SX	'23-7				1840	4¼	4¼

Mandrels and Adapters for Buses and Trucks—Continued

Name and Model of Bus or Truck	Year Made	FRONT WHEEL Mandrel Catalog Number	FRONT WHEEL Outer Adapter Diam. Inches	FRONT WHEEL Inner Adapter Diam. Inches	REAR WHEEL Mandrel Catalog Number	REAR WHEEL Outer Adapter Diam. Inches	REAR WHEEL Inner Adapter Diam. Inches
Moreland AC, BX, EC	'24-6				1840	4¼	4¼
Moreland TX, AXX	'25-7				1840	5½	5½
Moreland RR, RC, 16 Pass.	'22-6				1827		
Mutual 2A					1831		
National FA, FB	'20-3				1827		
Nebraska 2½T	'26				1831		
Nelson Le Moon G1½, GPL 1½	'24-6				1825		
Nelson Le Moon GP 1	'25				1827		
Noble Motor Tr. 164, 166	'27-8				1840	5½	5½
Noble Motor Tr. 156	'27-8				1840	4¼	4¼
Noble Motor Tr. 134, 146B	'27-8				1840	4	4
Ogden A2	'24-6				1825		
Old Reliable B	'23				1831		
Olympic A	'27-8				1840	4¼	4¼
Olympic 3½T	'28				1840	4¾	5¾
Oshkosh F	'26				1840	5¼	5¼
Oshkosh H	'28				1840	4¾	4¾
Oshkosh R	'28				1840	4½	4½
Oshkosh M	'28				1840	4¼	4¾
Parker 1T	'22				1827		
Patriot 7R	'24-6				1825		
Peerless Tr. 680	'26				1822		
Pierce-Arrow R10	'26-7				1840	5¾	6¾
Pierce-Arrow XB, X-5, XA	'24-7				1840	4½	4½
Pierce-Arrow WD, WC	'21-7				1840	4¾	5¾
Pierce-Arrow 80	'24-7				1827		
Premier	'23-4				1827		
Rainier R29-31	'24-6				1825		
Reo DA, D6, V, V6, FA, FB, FE, FF	'25				1825		
Reo Speed Wagon	'23-6				1826		
Rowe CDW, GSW3	'23				1831		
Sandow 1T	'20-1				1827		
Sanford W25A, W25B	'23				1831		
Service 25 Speed Wagon	'25-6				1827		
Sheldon W 103					1826		
Signal NF	'21-3				1827		
Standard 56-1K 1½K (Det.)	'20-6				1827		
Stewart 10-16	'24-6				1823		
Stoughton F	'23				1831		
Studebaker Bus 20-25 Pass.	'25-6				1827		
Stutz 6-90, 6-95	'23-4				1827		
Super 50	'23				1831		
Traylor D	'23				1831		
Ultimate B	'23				1831		
USR	'23				1831		
United (Hi. Spec)	'23-4				1823		
United (Westcott B44, C44)	'23-4				1823		
United 15	'26				1823		
Ursus 1T	'21				1827		
Wachusett J-J6	'21-6				1827		
Walker-Johnson L	'22-4				1827		
Ward Electric WS2	'21-5				1825		
White 20-45, 20		1840	3½	4¾	1830A		
White 15-45, 15		1810	3¾	3⅛	1827A		
White 57, 15, 15B	'25-6	1810	3¾	3⅞	1823		
White 51A		1810	3¼	3¾	1830		
White 53		1810	3¾	4¾	1830		
White 56					1830		
White 50A, 51, 20A		1810	3½	3⅞	1830		
White Hickory E	'20-1				1827		
Wichita	'23				1831		
Will-Ste. Claire T-W6, B68, C-68	'25-6				1827		
Will Motors 38 Pass GY	'28	1840	3½	4¾	1840	4¾	5¾
Will Motors FW	'28				1840	5¾	6¼
Will Motors CSW	'28				1840	5½	5½
Will Motors ZW, 2W6	'27-8				1840	4¼	4¼
Will Motors ZW, 2W6	'27-8				1840	4¼	4¼

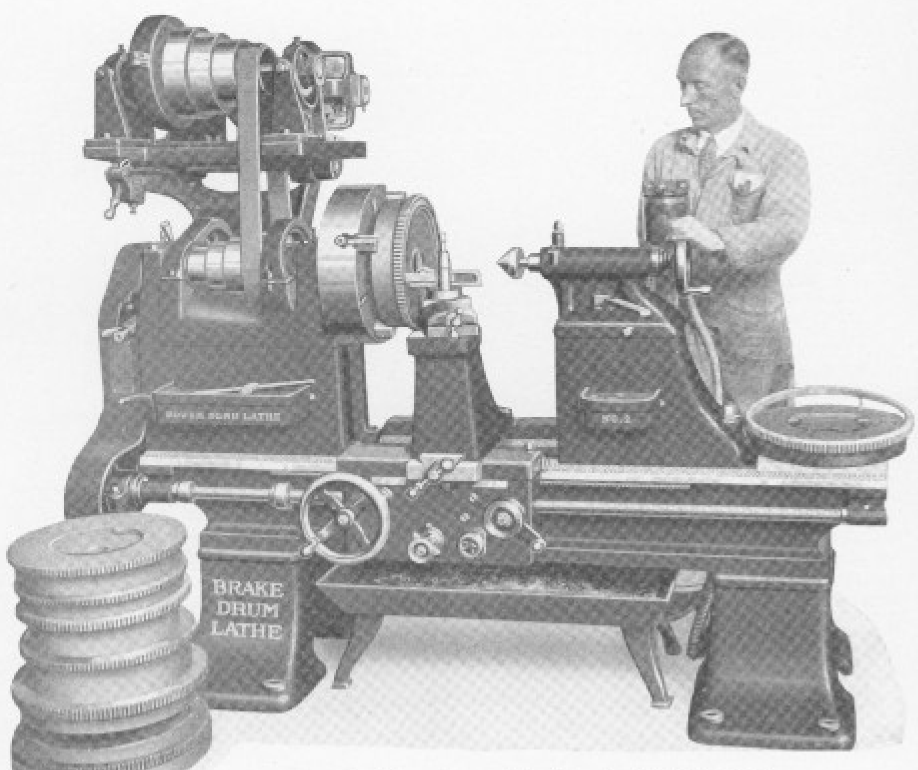


Fig. 93. One Operator can Machine about 25 Flywheels for Ring Gears in 8 hours

Turning Flywheels for Steel Ring Gears

The above illustration shows the New Model South Bend Brake Drum Lathe machining a flywheel that is to be fitted with a steel ring gear. The flywheel is held in the lathe chuck and a groove cut with a cutting-off tool just underneath the teeth, to remove the damaged teeth from the flywheel.

The cut under the teeth should be slightly deeper than the width of the gear teeth. Only tapping with a hammer is necessary to make the ring of undercut teeth drop from the flywheel.

With the teeth removed, the turned surface on the flywheel should be of larger diameter than the bore of the ring gear and also wider than the width of the ring gear so there will be a shoulder back of the ring gear when it is shrunk on the flywheel.

Turning the flywheel in the lathe is the most practical and economical way to do this work.

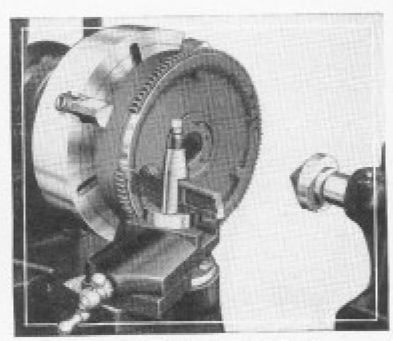


Fig. 94. Section of Flywheel Teeth Removed to show the Groove cut under the Teeth by Tool

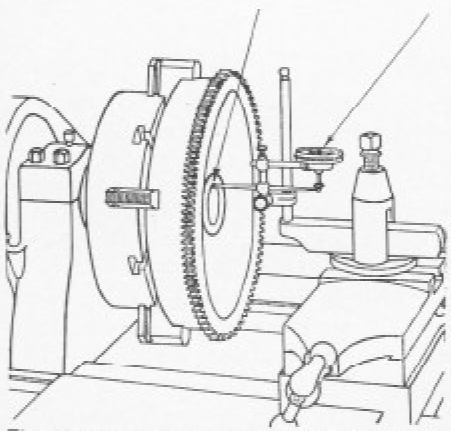


Fig. 95. Testing the Bore of the Flywheel to Determine if the Wheel is Running Concentric with the Axis of the Crankshaft

Chucking and Turning the Flywheel.—Place the flywheel in an independent four-jaw chuck. Use a pipe center in the tailstock spindle to support the flywheel and hold it approximately center and firmly against the jaws of the chuck. Fasten the tailstock, place the pipe center in tail spindle and let the point enter the center hole of the flywheel, the pipe center will center the flywheel and hold it in position. Then adjust each one of the four jaws of the chuck until they merely touch the diameter of the flywheel, then tighten each slightly one after another until the flywheel is held securely.

It is very important to true up the flywheel in the chuck so the hole in the wheel will run true and be concentric with the axis of the crankshaft. With a dial indicator held in the tool post, make a test in the hole of the flywheel hub.

For the correct spindle speed to turn the flywheel, engage the back gears and put the belt on the largest step of the spindle cone. The feed for turning the wheel should be reduced to the very finest possible.

When Machining the Flywheel, a shoulder should be turned to line up the ring gear face even with the face of the flywheel. If a shoulder cannot be turned, the wheel should be placed face down on a flat surface and the ring gear slipped on from the rear of the flywheel.

Ring gears are made in different sizes to fit the flywheels of the various makes of motors and are attached to the wheel by the process of being shrunk on. Shrinking the ring gear onto the flywheel is an effective method that requires no keyway or pin to hold it in place.

Manufacturers of Steel Ring Gears stamp on the side of each gear the exact diameter to machine the flywheel to receive the gear. They also publish a booklet of instructions describing how to heat the ring gear in order to expand it properly to fit the flywheel.

The instruction booklet also explains the manner of cooling or shrinking the gear on the flywheel and specifies the exact limits to which the diameter of the wheel should be turned in order to receive the gear.

We recommend the No. 2 or No. 302 Brake Drum Lathe for ring gear work. This work can also be done on the No. 3 or 303 lathe, but not satisfactorily on the No. 1 or No. 301 lathe.

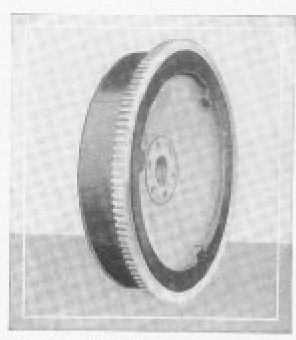


Fig. 96. The Finished Job—The Flywheel after being Machined to Finished Size in the Lathe and Fitted with the Steel Ring Starter Gear

Grinding Attachment for the Lathe

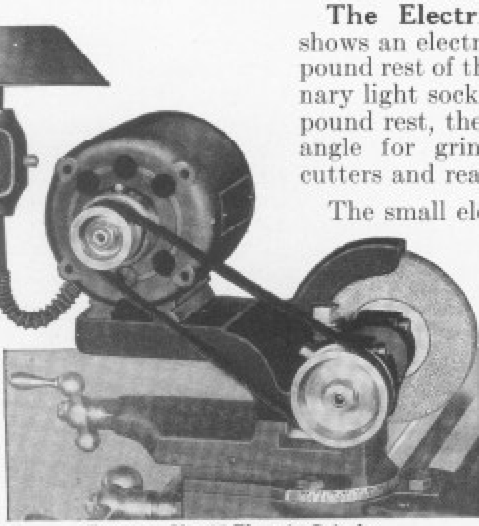


Fig. 97. No. 15 Electric Grinder

The Electric Grinder.—The illustration shows an electric grinder mounted on the compound rest of the lathe and driven from an ordinary light socket. Being attached to the compound rest, the grinder can be swiveled to any angle for grinding taper, bevel or straight cutters and reamers.

The small electric grinder is a useful attachment for a lathe, on such work as grinding and sharpening all kinds of reamers, cutters straight, taper or spiral, also for grinding of small hardened bushings and shafts.

The electric grinder should never be used for grinding knives or small tools. It gets the wheel out of true and ruins it for regular work.

The operation of a small grinder in the service station shop presents some problems to the beginner. It is not the purpose of the small grinder to take heavy cuts on the work or to remove excessive stock. On the contrary, the grinder should be used only to take light or finishing cuts because the grinding wheel is small and runs at high speed so that in taking a heavy cut the wear on the wheel is often greater than the amount of stock removed from the work in each cut.

The Depth of the Grinding Cut.—In using the grinder equipped with a wheel from 4″ to 6″ in diameter, the depth of the cut should not be more than .001″. That is, the diameter of the work should not be reduced more than .002″ on each cut. On the finishing cut .0015″ on the diameter of the work will leave a better finish. It is sometimes a good plan on cylindrical grinding to take one or two finishing cuts without making any adjustment on the wheel.

Machine the Work Instead of Grinding Whenever Possible.—Grind the work only when it cannot be machined. For example: when the work has been hardened or tempered, such as cutters, reamers, taps, etc., then we must grind, but on material such as soft steel, cast iron and other metals, it is much better to machine the work because machining is much faster than grinding the work with the small type of grinder used in the service station shop.

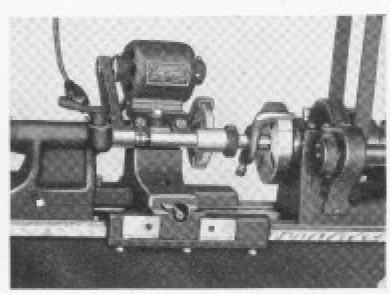


Fig. 98. Grinding a Hardened Steel Bushing

Practical Grinding Jobs

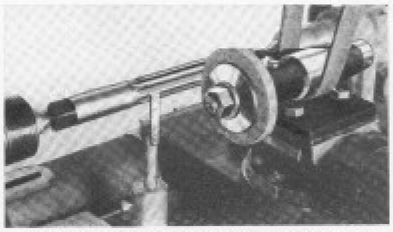


Fig. 99. Grinding a Straight Reamer

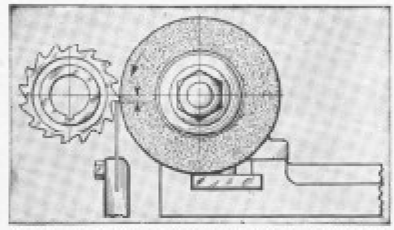


Fig. 100. Grinding Clearance on a Cutter

Grinding or Sharpening Hardened Reamers or Cutters, straight and bevel, requires care and skill on the part of the operator. The cut should be light; the adjusting stop that regulates the position of the cutting edge of the reamer flute should be set accurately so as to get the proper clearance on the cutting edge; the grinding wheel should be of the right grade to have the proper speed and run true..

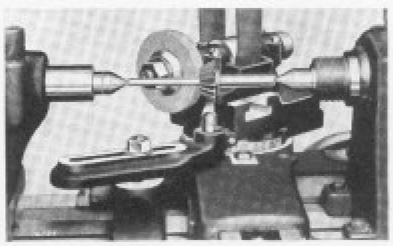


Fig. 101. Grinding an Angular Cutter

Grinding Angular Cutters in the Lathe.—The illustration shows the method of grinding angular cutters in the lathe. The cutter is placed on an arbor that is a snug fit and then mounted between centers in the lathe. Set the compound rest to the proper angle or taper of the cutter. Set the clearance stop to the proper height. Holding the cutter against the stop by one hand, feed the grinding wheel across the cutting edge of the flute. Repeat the operation on each flute.

Be careful not to take too deep a cut or it may heat the cutter and draw the temper. When grinding angles or tapers, see that the center of the grinding wheel spindle is on the same plane or at exactly the same height as the point of the lathe center.

Grinding a Spiral Cutter.—The illustration shows the method of grinding spiral cutters in the lathe. The cutter is placed on an arbor and mounted between centers in the lathe. Set the clearance stop at the proper height and hold the cutter against the stop with one hand feeding the wheel with the other. Rotate the cutter as the stop and grinding wheel is fed across the cutting edge of the flute. Repeat the operation on each flute.

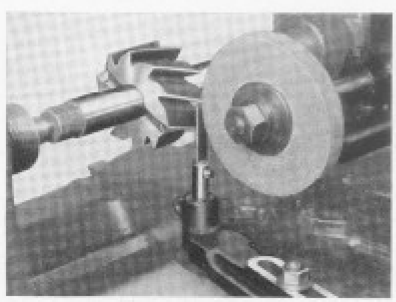


Fig. 102. Grinding a Spiral Cutter

Angular spiral cutters may be ground in the same manner by setting the compound rest to the proper angle or taper of the cutter.

Truing the Grinding Wheel.—A grinding wheel of 4″ to 6″ in diameter in continuous work will need truing up at least every half hour and sometimes oftener, depending upon the work. The way to true the wheel is with a black or commercial diamond as shown in the illustration. The diamond is held in a fixture, the grinding wheel is brought up to the diamond point and fed slowly across the face of the diamond. Two or three cuts are sufficient to true the wheel properly.

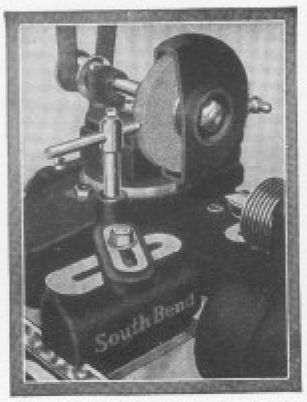


Fig. 103. Truing Grinder Wheel

Diamond Holder and Spring Cutter Stop

Fig. 104. Diamond Dresser for Truing Emery Wheel.

The adjustable holding fixture will hold the industrial diamond for truing wheels, and will also hold the cutter stop used when grinding cutters.

Fig. 105 Fixture for Holding Spring Stop and Diamond Dresser

Emery Wheel Speeds.—Grinding wheels are run in actual practice from 4,000 to 6,000 feet surface speed per minute.

Below we give the number of revolutions of wheels of different diameter for 4,000 and 5,000 feet surface speed per minute.

R.P.M. of Grinding Wheels at Various Surface Speeds

Diam. Wheel	1 in.	2 in.	3 in.	4 in.	5 in.	6 in.	7 in.	8 in.	10 in.	12in.
R.P.M. for surface Speed of 4,000 ft. . .	15,279	7,639	5,093	3,820	3,056	2,546	2,183	1,910	1,529	1,273
R.P.M. for surface Speed of 5,000 ft. . . .	19,099	9,549	6,366	4,775	3,820	3,183	2,728	2,387	1,910	1,592

Grinding Wheels for Various Kinds of Work.—There are various grades of grinding wheels, all of which are marked for special kinds of work, such as cast iron, steel, valves, hardened tools, etc. We give below a tabulation showing the grain and grade of wheels to use for different work.

Grade of Wheel for Various Metals

Kind of Work	Name of Wheel	Grain	Grade
Cast Iron	Crystalon	36	K
Steel	Alundum	46	M
Cutting Tools	Alundum	19	50-K
Valves	Shellac	60	3
Aluminum	Shellac	46	3

Truing Brake Drums by Machining vs. Grinding

Machining Brake Drums True is Recommended in the service station shop rather than grinding because it is five times quicker and does a better job. Grinding is unnecessary except as described in the next paragraph. The modern method of truing brake drums is by machining.

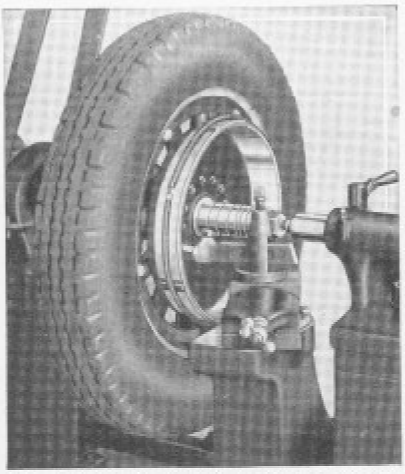


Fig. 106. Turning the Brake Drum is Faster and Does a Better Job Than Grinding

Grinding a Brake Drum is necessary only when the drum is of a material so hard that it cannot be machined, as an occasional cast steel drum where there are hard spots on the brake drum surface. Another exceptional case is where a truck or bus brake drum has become over-heated in operation, and during a rain storm, water is splashed on the heated drum. The drum being hot may be chilled by the water which may harden it in spots so that it is necessary to grind the drum to true it.

Grinding in the Service Shop is a very difficult operation because the grinding wheel must run true in order to get a smooth job. A cut of only one-thousandth of an inch can be taken with the grinding wheel which requires a lot of time to true the brake drum. The wheel is so small in diameter that often the wear on the wheel is greater in one cut than the stock removed from the work.

Grinding Brake Drums in the Manufacturing Plant, where brake drums are made, is resorted to in production work, but the drum is held in a large chuck and this permits the grinding wheel to be almost as large in diameter as the drum and from 2 to 3 inches in width. This wheel enters the drum when grinding because there is no axle shaft or mandrel to interfere. A cooling compound is continually flowing on the work while the grinding is being done, which prevents the drum from becoming heated.

This method cannot be used in the service shop because the drum should not be removed from the wheel. The wheel must be mounted on a mandrel in order to have the drum circumference concentric with the axis of the hub, therefore, the diameter of the grinding wheel must be small as it must pass between the mandrel and drum. Fig. 107, at the right, illustrates a grinding attachment which may be fitted to the compound rest of the lathe for grinding the drum if grinding is necessary.

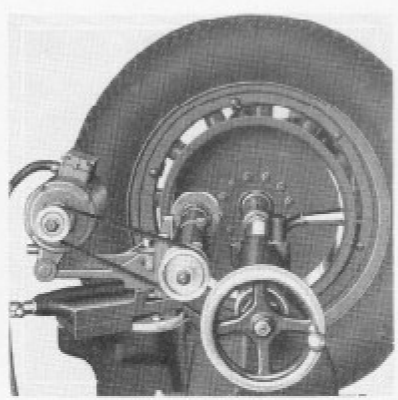


Fig. 107. Grinding a Brake Drum in the Lathe, in the Service Station Shop

Table of Decimal Equivalents

8ths, 16ths, 32nds and 64ths of an inch

8ths.	16ths.	32nds.	
1/8 = .125	1/16 = .0625	1/32 = .03125	17/32 = .53125
1/4 = .250	3/16 = .1875	3/32 = .09375	19/32 = .59375
3/8 = .375	5/16 = .3125	5/32 = .15625	21/32 = .65625
1/2 = .500	7/16 = .4375	7/32 = .21875	23/32 = .71875
5/8 = .625	9/16 = .5625	9/32 = .28125	25/32 = .78125
3/4 = .750	11/16 = .6875	11/32 = .34375	27/32 = .84375
7/8 = .875	13/16 = .8125	13/32 = .40625	29/32 = .90625
	15/16 = .9375	15/32 = .46875	31/32 = .96875

64ths.			
1/64 = .015625	17/64 = .265625	33/64 = .515625	49/64 = .765625
3/64 = .046875	19/64 = .266875	35/64 = .546875	51/64 = .796875
5/64 = .078125	21/64 = .328125	37/64 = .578125	53/64 = .828125
7/64 = .109375	23/64 = .359375	39/64 = .609375	55/64 = .859375
9/64 = .140625	25/64 = .390625	41/64 = .640625	57/64 = .890625
11/64 = .171875	27/64 = .421875	43/64 = .671875	59/64 = .921875
13/64 = .203125	29/64 = .453125	45/64 = .703125	61/64 = .953125
15/64 = .234375	31/64 = .484375	47/64 = .734375	63/64 = .984375

Table of Metric Linear Measure

10 Millimeters	=1 Centimeter
10 Centimeters	=1 Decimeter
10 Decimeters	=1 Meter
1 Centimeter	= .3937 inch
1 Decimeter	= 3.937 inches
1 Meter	=39.37 inches

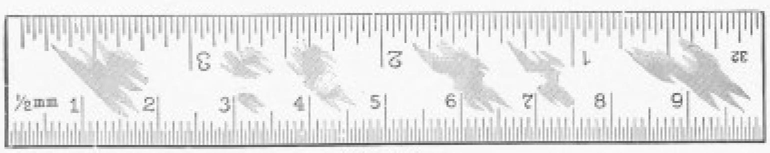


Fig. 108

Metric and English Linear Measure

The measuring rule herewith is graduated, one edge in the Metric system and the other edge in the English system. This shows at a glance the comparison of the fractions of the Metric and English units, the meter and the inch.

Equivalents of Millimeters in Decimals of Inches

1/10 mm = .00394″	8 mm = .31496″	18 mm = .70866″
1/5 mm = .00787″	9 mm = .35433″	19 mm = .74803″
1/2 mm = .01969″	10 mm = .39370″	20 mm = .78740″
1 mm = .03937″	11 mm = .43307″	21 mm = .82677″
2 mm = .07874″	12 mm = .47244″	22 mm = .86614″
3 mm = .11811″	13 mm = .51181″	23 mm = .90551″
4 mm = .15748″	14 mm = .55118″	24 mm = .94488″
5 mm = .19685″	15 mm = .59055″	25 mm = .98425″
6 mm = .23622″	16 mm = .62992″	26 mm = 1.02362″
7 mm = .27559″	17 mm = .66929″	

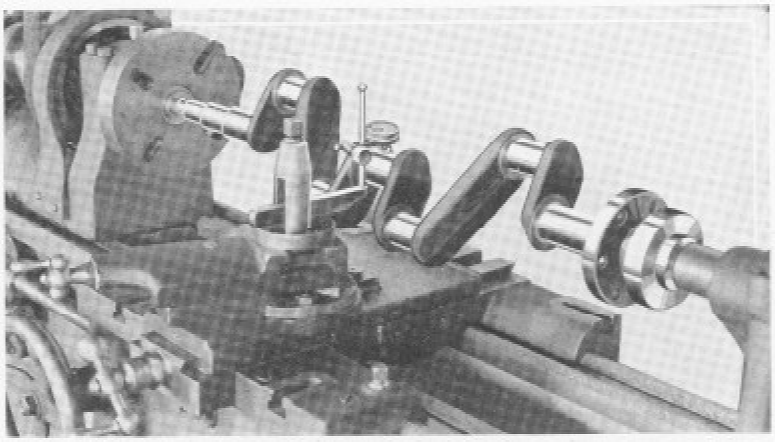


Fig. 110. Testing a Crank Shaft in the Lathe with a Dial Test Indicator

Testing and Truing the Automobile Crankshaft

A crankshaft is true when all other main bearings are concentric with the main bearings at each end of the shaft.

To Test Crankshaft Main Bearings.—See that the center holes of the shaft are true and clean. Let the shaft revolve easily between lathe centers, placing oil in both center holes. Place a dial test indicator in the tool post of the lathe and let the button of indicator rest on one end of the main bearings of crankshaft. Revolve the crankshaft by hand and read the dial of the indicator which will show if the bearing is out of true. Repeat this operation on each main bearing.

Test the Throw Bearings after the main bearings of the crankshaft are tested. These may be true in a sense and yet may be worn. The pound of the connecting rods will wear the throw bearings egg-shaped to a slight degree. The throw bearings of the crankshaft can be trued up by using the special truing tool as shown in Fig. 112, or by using a regular lathe tool and Norton centers as shown in Fig. 113.

If the main bearings of the crankshaft do not test true then a light cut should be taken over the center main bearings. Great care should be taken with this operation. After the center main bearing is machined true then place the center rest in the lathe and have the jaws support the main bearing just machined. Then machine all of the other main bearings, truing them up with the center rest still supporting the center bearing.

Fig. 111. Truing the Main Bearings of a Crankshaft

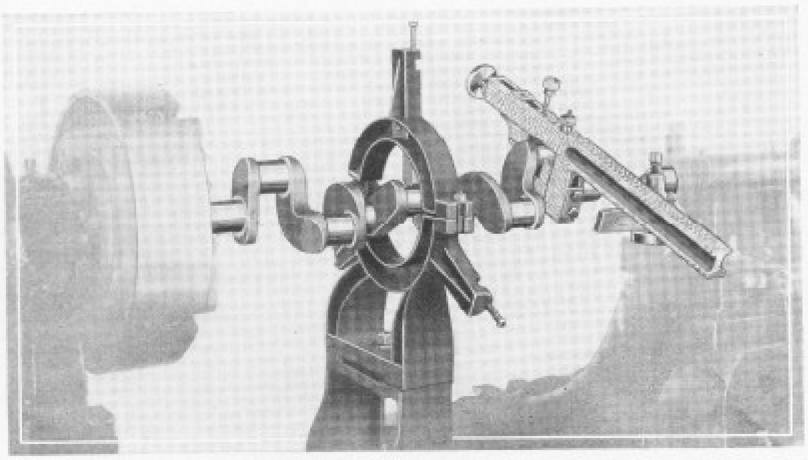


Fig. 112. Truing Throw Bearings on a South Bend Lathe with a Special Tool

Truing Throw Bearings with a Special Tool.—The illustration on this page shows the truing of throw bearings of the crankshaft with a special tool.

The special tool rides around with the throw bearing, the handle resting at all times on the lathe tool shank which is held parallel with lathe bed in the tool post. At the top end of the special tool is the hand wheel which feeds the cutting tool into the throw bearing. This wheel has a dial below it that is graduated in thousandths of an inch. The dial can be locked in any position by means of a set screw, thus making it easy to turn all the throw bearings to exactly the same diameter.

The throw bearing is held in the special tool by three supports. An adjustable bronze shoe forces it back against the two hardened steel plates in the "V" block. This shoe is kept tight by means of a hand screw which can be adjusted while the tool is cutting.

The cutting tool used is a forming tool, the width of the throw bearing. The corners are rounded to cut the fillets.

Operation in Truing Throw Bearings—Place the crankshaft with lathe dog attached between centers of the lathe and fasten lathe dog in face plate to hold shaft in place. It is advisable to polish the glaze off the throw bearings before truing them. The special tool is then fastened to the throw bearing and the cutting tool adjusted. Be careful not to feed the cutter to the throw bearing too fast. Feed it in enough to keep it cutting as the edge is soon destroyed if it slides over the throw bearing without taking a cut. Use a cutting lubricant freely.

By using the graduations on the hand wheel, it will be found easy to turn all throw bearings to the same diameter.

The shaft is rotated at the lowest speed with back gears in mesh, enabling the operator to clearly see the cutting operations at all times.

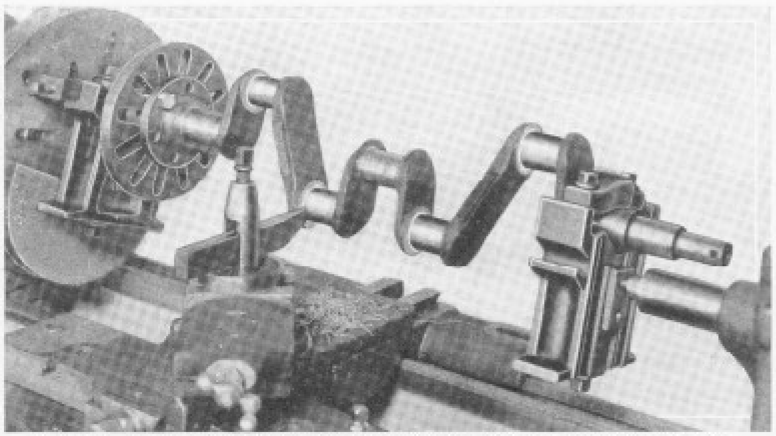


Fig. 113. Truing Crankshaft Throw Bearings using Norton Throw Centers

Machining the Throw Bearings of the Crankshaft.—The illustration above shows a crankshaft mounted between centers in the lathe and supported by Norton adjustable throw centers. The adjustable throw centers can be set in various positions so that all of the throw bearings on the crankshaft can be trued up by machining in the lathe.

The illustration shows throw bearing No. 2 being machined by a turning tool held in the tool post in the lathe. As the crankshaft revolves the turning tool takes a finishing cut and is fed by the carriage of the lathe.

When this cut is finished the tool is moved to throw bearing No. 3 which has the same axis as No. 2 just machined. This throw bearing is then trued up in the same manner.

The Crankshaft is Rotated at the slowest speed with back gears in mesh enabling the operator to clearly see the cutting operation at all times. A very light cut should be taken so as not to remove any more metal than is necessary to true up the throw bearing. By using the graduated collar on the compound rest to govern the depth of cut taken all of the throw bearings of the crankshaft can be machined to the same diameter.

Throw Bearings may be Tested by using the Norton throw centers. Place a dial test indicator in the tool post of the lathe and let the bottom of the indicator rest on the throw bearing of the crankshaft. Revolve the crankshaft by hand and read the dial of the indicator which will show if the throw bearing is out of true.

The Norton Throw Centers may be used for grinding crankshafts as well as turning, whether used in a grinding machine or on a lathe with grinding attachment.

Twisted or Bent Crankshafts are difficult for the ordinary mechanic to true or repair. This work can only be done by a skilled workman who has had considerable experience in crankshaft work and where equipment for crankshaft work is available.

We Recommend that servicing a crankshaft and its problems be referred to the factory where the crankshaft is manufactured, especially if the mechanic's experience in the service shop is limited.

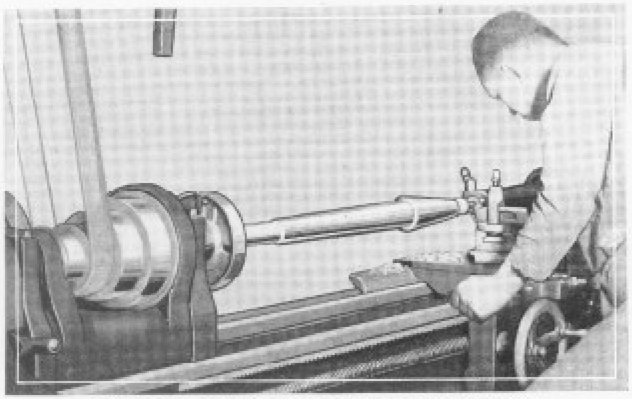


Fig. 114. Making an Automobile Axle in a Lathe

Testing and Making Axle and Drive Shafts

To Test an Axle or a Drive Shaft for straightness, place it between centers in the lathe, without a driving dog, first making sure that the center holes in the end of the shaft are clean and true.

Allow the shaft to be loose enough between centers so that you can spin it by hand. Spin it with the left hand and with the right hand place a piece of chalk against the revolving shaft and in that way you can locate the "high spots" if the shaft is not true.

To make a more careful test place a driving dog on the shaft and place it between centers as before. Place an indicator on the diameter of the machined surface of the shaft. The test dial will then register the amount of error that the bent shaft is out of true.

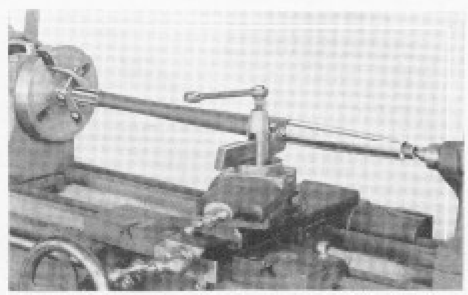


Fig. 115. Turning the Taper of an Axle Shaft

To Make an Axle Shaft.—Select a piece of steel the correct length and of sufficient diameter to turn up to the proper dimensions. Face and center each end. Attach the driving dog and place between centers in the lathe.

Machine both ends of shaft to the correct diameter and cut any recesses that are necessary. Care should be taken to see that accurate measurements are obtained on all bearing surfaces.

The Tapered Portion of the shaft should then be turned. This can be done by using the tailstock set-over, or if the lathe is equipped with a taper attachment this may be used.

Before Cutting the Screw Thread the part to be threaded should be turned to finished diameter. Arrange the lathe for thread cutting and cut the thread to fit the nut that is to be used.

The book "How to Run a Lathe" explains in detail the operations of facing and centering, taper turning, thread cutting, etc.

The Necessary Keyways can be Cut by using the milling and keyway cutting attachment. Keyways of all kinds can be cut with the aid of this attachment, which is shown on page 63 of this book.

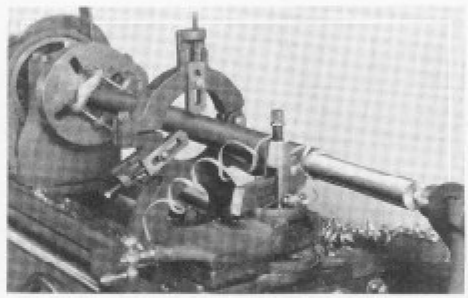


Fig. 116. Turning a Drive Shaft Supported by a Center Rest

Other operations required should then be done as some axle shafts have splines cut in one end, a hole drilled for cotter pin, etc. These are all explained in detail in book "How to Run a Lathe."

To Make a Drive Shaft.—The same general operations should be followed in making a drive shaft as in making the axle shaft as the only essential difference in the machining of the two shafts is in their length.

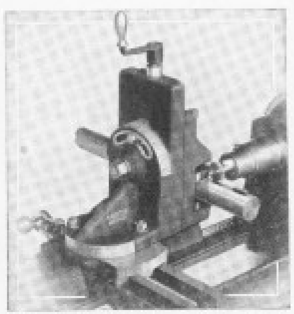


Fig. 117. Milling a Woodruff Keyway in a Steel Shaft

In truing the drive shaft, it may be necessary to support the work with a center rest while being machined. Adjust the jaws of the center rest so that the work is properly centered and revolves freely. Clamp the jaws in position and the work is then ready for machining. Oil should be used freely on the jaws of the center rest during the turning operation.

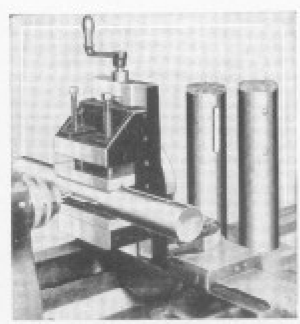


Fig. 118. Milling a Keyway with an End Mill

When taking a roughing cut on steel that has a scale upon its surface be sure to set the tool deep enough to get under the scale the first cut, because unless you do, the scale on the metal will dull the point of the tool.

When the work has been rough turned to within about $\frac{1}{32}''$ of the finished size, with a sharp, keen tool take a finish cut. Caliper carefully to be sure that you are machining the work to the proper dimension.

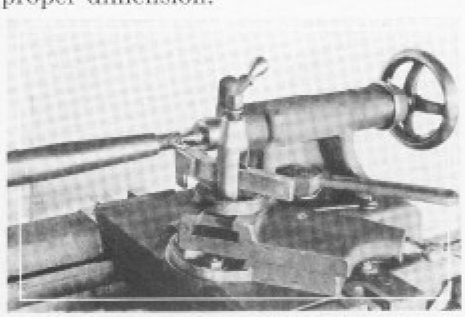


Fig. 119. Threading an Automobile Axle

For Turning Short Tapers the compound rest may be used instead of offsetting the tailstock. The compound rest is swiveled to the proper degree of taper and the taper is turned by using the compound rest screw.

When truing tapers the cutting edge of the tool should be set at the exact height of the center point of the lathe center.

Boring Connecting Rods In The Lathe

The illustration below shows a Connecting Rod Boring Attachment fitted to a 9-inch South Bend Screw Cutting Lathe. The attachment is made in sizes to fit any South Bend Lathe from 9-inch to 24-inch swing.

The equipment of the connecting rod boring attachment consists of the fixture which is fitted to the lathe saddle, boring bar and tools for boring and facing and two cone adapters for centering the crankshaft bearing of the rod.

Operations in Boring a Connecting Rod—Fasten the piston wrist pin in the wrist pin hole of the connecting rod. Place the rod in the attachment letting the wrist pin rest on the two "V's" as shown in the illustration. Pass the boring bar through the crankshaft bearing of the rod and insert the end of the boring bar in the head spindle of the lathe. Slip the taper cone on the tailstock end of the boring bar. Bring up the tailstock center to the end of boring bar and lock tailstock in that position. Move taper cone along the boring bar until it enters hole in the crankshaft bearing. Adjust cross feed screw until crankshaft bearing is centered by the taper cone. Fasten the adjusting screws on the wrist pin and the adjusting screws on either side of the connecting rod so as to hold the rod firmly in position.

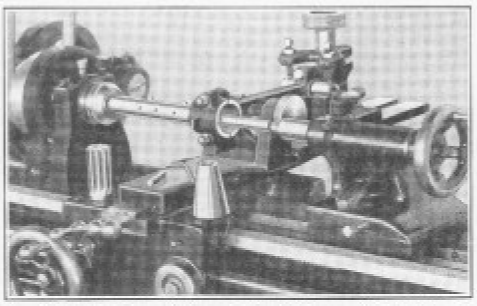


Fig. 120. Boring a Connecting Rod on a South Bend Lathe

With the connecting rod being in position, unlock tailstock, move it back and remove the taper cone from the boring bar. Adjust the fly cutters in the bar and take a cut in the bearing, feeding the work to the revolving cutters by using the automatic feed.

Boring a Set of Six Connecting Rods—There are two cutters in the boring bar about three inches apart, one of these cutters to make the roughing cut, the other to make the finishing cut. After the finishing cut is taken, then place reamer on the boring bar. This takes the standardizing or finish cut. Repeat this operation for each connecting rod in the set.

Do not move cross feed screw after machining first connecting rod until entire set of rods have been machined, because if the cross feed screw is moved, it will change the position of the connecting rod and that will make the distance between the wrist pin hole and the crankshaft bearing longer or shorter on the different rods. If cross feed screw is not moved during machining of the entire set of rods the center distance will be identical on all.

When boring is finished then use the cutter for facing each side of the bearing and for rounding the corners.

Milling and Keyway Cutting in the Lathe

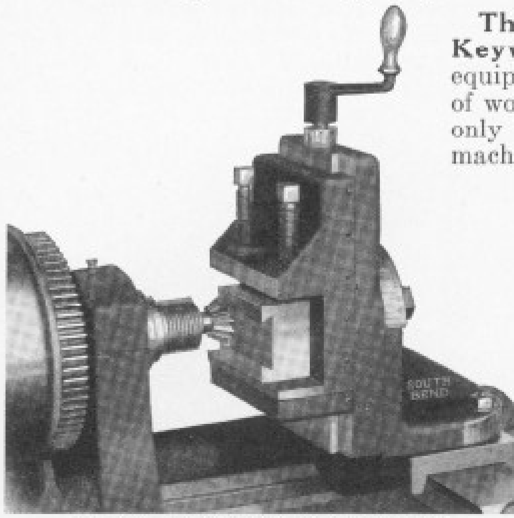


Fig. 121. Milling a Dovetail in the Lathe

The South Bend Milling and Keyway Cutting Attachment equips the lathe for doing a great deal of work that otherwise could be done only on a shaper or regular milling machine.

The base of the attachment is graduated in 180 degrees and can be operated at any angle on the horizontal plane, like the compound rest. The upright plate to which the vise is attached, swivels in a vertical plane and is graduated in degrees.

The vertical adjusting screw at the top of the attachment is equipped with a micrometer graduated collar.

A Screw Cutting Lathe fitted with the attachment and using various types of milling cutters makes an excellent equipment for the small shop that has not enough of this class of work to invest in a milling machine.

The attachment is fitted to the saddle by removing the compound rest top and swivel, and bolting the attachment to the base using the bolts that clamp the compound rest in position.

The Depth of the Cut is controlled by the feed of the lathe carriage, the length by the cross feed screw; and the graduated screw at the top takes care of the vertical adjustments.

The Milling and Keyway Cutting Attachment can be used for cutting keyways of all kinds—straight, taper, Woodruff, etc. It can also be used for squaring the ends of a shaft, cutting splines, milling dovetails, slots and hundreds of different jobs, both for tool work and repair work.

The milling attachment can be fitted with a horizontal vise fixture for holding small parts as illustrated in figure 122, and with a vertical vise fixture as shown in Fig. 124.

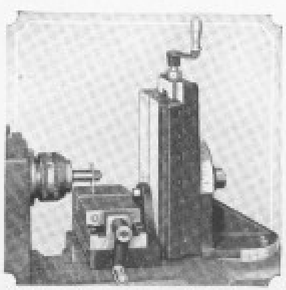


Fig. 122. Slotting a Screw Held in Horizontal Vise Fixture

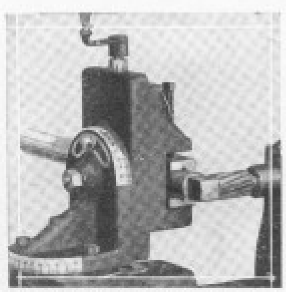


Fig. 123. Squaring the End of a Round Steel Shaft

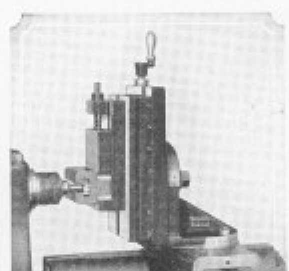


Fig. 124. Milling Attachment fitted with Vertical Vise Fixture

Drilling in the Lathe

Drilling With a Back Geared Screw Cutting Lathe is sometimes more practical than with the drill press. This method of drilling is used to advantage on many manufacturing and production jobs. The drill being in a horizontal position permits the chips to fall clear of the work.

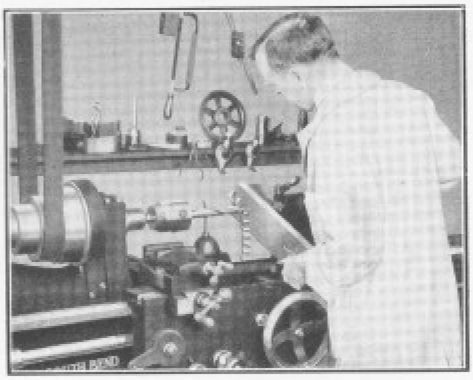


Fig. 127. Drilling a Steel Bar Held Against Drill Pad in Tailstock

In Figure 127 the illustration shows a drill chuck fitted to the headstock of the lathe and drilling thru a piece of flat steel. The operator feeds the work to the drill by means of the tailstock hand wheel.

The lathe shown is a back geared, screw cutting tool with a four-step spindle cone which permits eight spindle speeds. Four are direct belt and the other four are obtained thru the back gears. The back gear power is used for operating large drills.

In figure 128 the illustration shows the back geared, screw cutting lathe with the drill chuck fitted to the tailstock. The head stock is fitted with a universal lathe chuck which holds the work concentric. In this operation the work revolves and the drill remains stationary. This method is used for making bushings, etc. The drill is fed to the work by the handwheel of the tailstock.

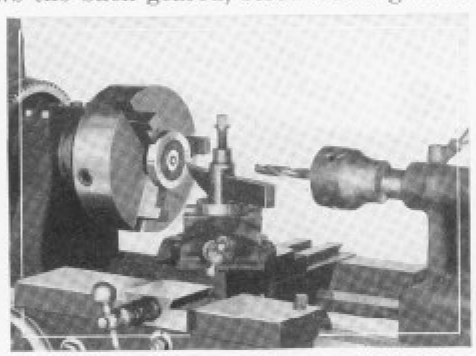


Fig. 128. Drilling and Facing a Gear Blank Held in a Three Jaw Chuck

Figure 129 shows the drill chuck in the headstock spindle and a crotch center fitted to the tailstock spindle. The crotch center permits round work to be drilled in this manner because it centers the work accurately.

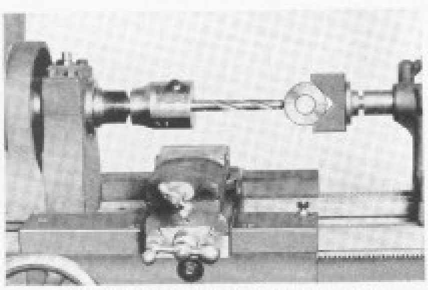


Fig. 129. Using a Crotch Center for Drilling Round Shafts

The skilled mechanic can suggest at least 100 different drilling operations in the lathe. The holes drilled will be accurate whether the work is held in the head spindle or the tail spindle because either spindle lines it up accurately.

Use of the lathe in drilling makes it stand out as a very versatile machine in the automotive service station and in a few minutes it can be set up to do some other type of work.

Filing, Polishing and Reaming in the Lathe

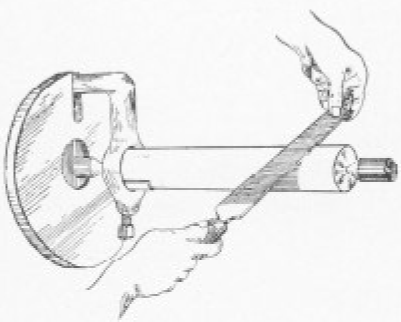


Fig. 130.—Filing in the Lathe

Filing in the Lathe.—In Fig. 130 the operator is filing a cylinder revolving on centers in the lathe, using a mill file. The left hand is holding the file with the thumb on top and the first two fingers underneath the end of the file. The right hand is holding the file with the thumb squarely on top of the handle and the fingers underneath. This is the proper way to hold a file for filing in the lathe or filing work in the vise.

When filing in the lathe, never use a file without a handle. Do not knock a file on the ways of the lathe to free it from chips. The best way to remove the fine chips from the file is to use a wire brush.

For Polishing Round Work, the work should revolve at high speed. Fold a piece of emery cloth around the file, put plenty of oil on the work and polish by the same motion used in filing.

When polishing in the lathe there should be some play of the work on the centers otherwise the tail center will heat. There should be also plenty of oil on the tail center.

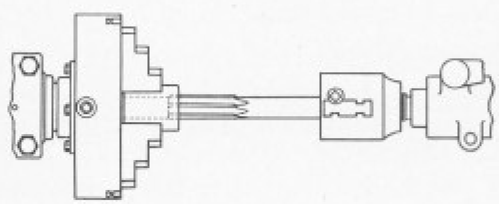


Fig. 131.—Using a Machine Reamer in the Chuck

Using a Machine Reamer in the Lathe.—Fig. 131 shows the application of a lathe chuck holding work and a drill chuck in the tailstock spindle holding a machine reamer. The reamer is fed through the work by the tailstock hand wheel.

Do not rotate a hand reamer or machine reamer backward because it will dull the edge of the cutting blades.

Tapping in the Lathe.—Fig. 132 shows the tapping of a nut in the lathe. The tap is inserted in the nut held in the lathe chuck. A tap wrench is used to keep the tap from turning and the shank end is centered on the tail center. The spindle is started on slow speed and the tap may be fed in with hand wheel of the tailstock, or for light work the entire tailstock may be pushed by hand.

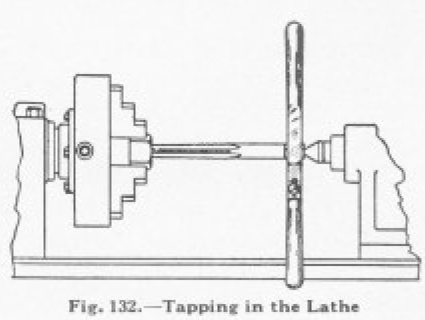


Fig. 132.—Tapping in the Lathe

Tempering and Hardening

Tempering a Lathe Tool.—In tempering a forged lathe tool made of crucible tool steel, care should be taken to heat it slowly and evenly for a distance of about two inches from the cutting edge. When the heated part becomes a cherry red, immerse the tool in cold water about 1½ inches from the cutting point. See Fig. 133. After the point has become cool, remove the tool from the water and polish the hardened surface with a piece of emery cloth, then wipe the surface with an oily rag. The heat in the shank of the tool will now drive the temper toward the cutting edge. When this edge becomes a brown straw color immerse the entire tool in cold water.

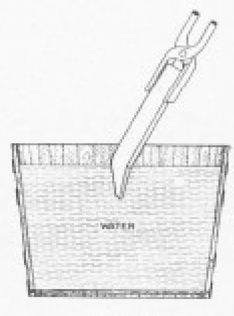


Fig. 133

Annealing a Piece of Tool Steel.—Heat the steel slowly and evenly to a dark red. Then place in box of lime or ashes, cover completely and let remain over night. In the morning the piece will be annealed ready for machining.

To water-anneal a piece of tool steel, heat slowly and evenly until a dark red. Then hold in the tongs in a shaded corner until all color has left the piece. Place a small pine stick against the steel. When the steel is cool enough so that it will not smoke the pine stick, then immerse the steel quickly into cold water and it is ready for machining.

Case Hardening.—To case harden a piece of machinery steel, for example, a ball race, heat the ball race in an even fire until the piece becomes a cherry red, take it out and sprinkle cyanide of potassium on the heated part where you wish it case hardened. The cyanide will dissolve slowly and be absorbed by the ball race. After the surface to be hardened has received a thorough coat of cyanide, place the ball race back in the fire and heat slowly for about one minute so that it will thoroughly absorb the cyanide, remove the piece from the fire and plunge it into cold water.

Hardening High-Speed Steel.—In hardening high-speed steel, gas or oil furnaces are generally used. The hardener operates two furnaces, one called the preheat furnace, having a temperature of about 1500°F., and the other the high heat or hardening furnace, temperature of from 2300°F. to 2450°F., depending on the nature of the steel. The work to be hardened is placed in the preheating furnace and, when heated through, is then transferred to the high heat furnace and brought up quickly to the hardening heat. The work is then quenched in oil or cooled in an air blast. High-speed steel is never quenched in water.

Examples of Machining in the Chuck on the Lathe

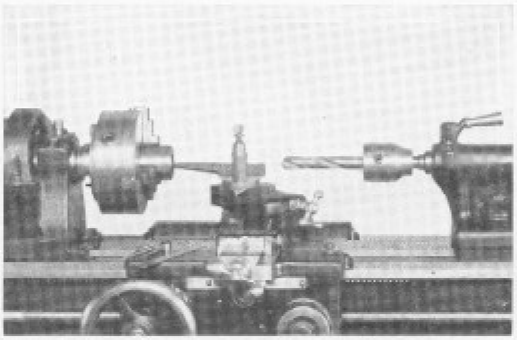


Fig. 134. Making a Steel Bushing held in a 3-Jaw Universal Chuck. The Drill is held in a 2-Jaw Drill Chuck

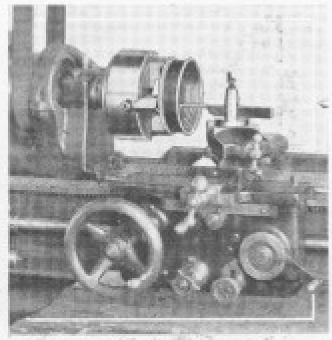


Fig. 135. Chasing the Threads of a Hub Cap held in a 4-Jaw Independent Chuck on the Lathe

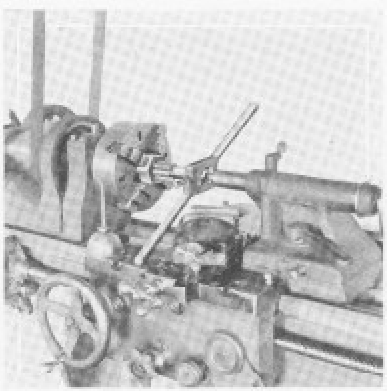


Fig. 136. Tapping a Large Nut Held in the Lathe Chuck. Tap is guided by Tailstock Center

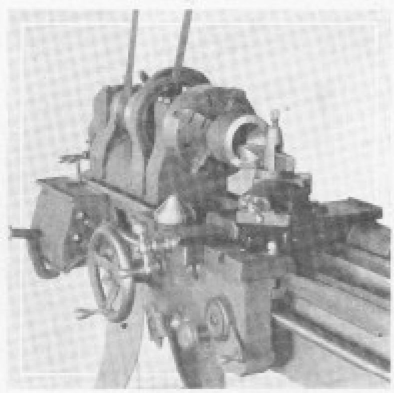


Fig. 137. Boring a Tapered Die held in the Lathe Chuck, using the Compound Rest to Determine Degree of Taper

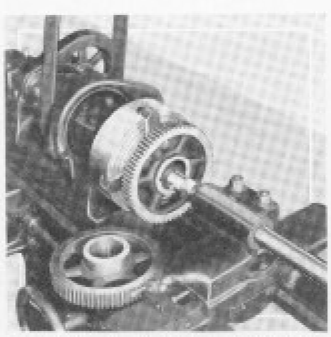


Fig. 138. An Emergency Job, Keyseating a Gear in the Lathe, held in an Independent Chuck

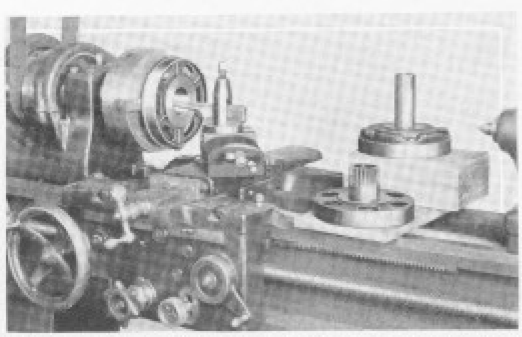


Fig. 139. Boring a Ford Transmission Drum in the Lathe, held in an Independent Chuck and Using a Finger Boring Tool

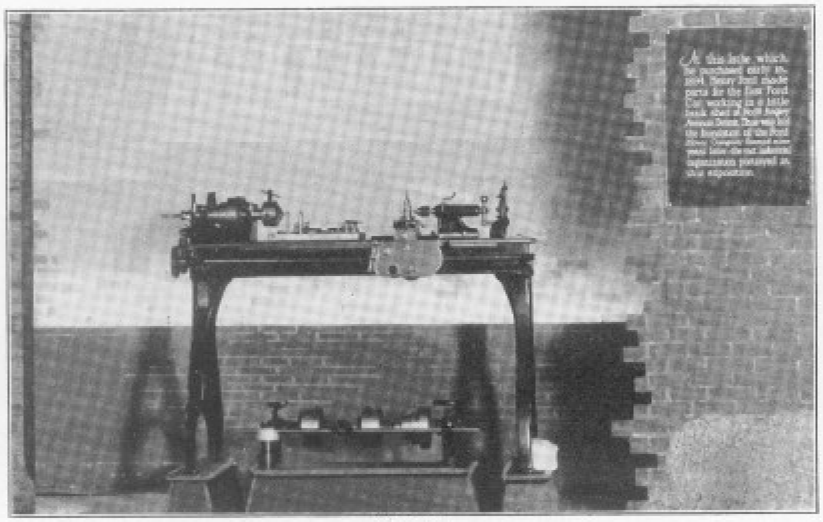


Fig. 140

Henry Ford's First Lathe

Used in Making Parts for the First Ford Car

The illustration above shows the back geared screw cutting engine lathe used by Henry Ford in building the first Ford automobile. The photograph was taken at the New York Automobile Show, 1927, where the lathe was put on display so that the thousands of visitors might see how Henry Ford got his start in building his tremendous organization.

The placard at the right of the lathe reads as follows:

> "At this lathe, which he purchased early in 1894, Henry Ford made parts for the first Ford Car, working in a little brick shed at No. 58 Bagley Avenue, Detroit. Thus was laid the foundation of the Ford Motor Company formed nine years later—the vast industrial organization portrayed in this exposition."

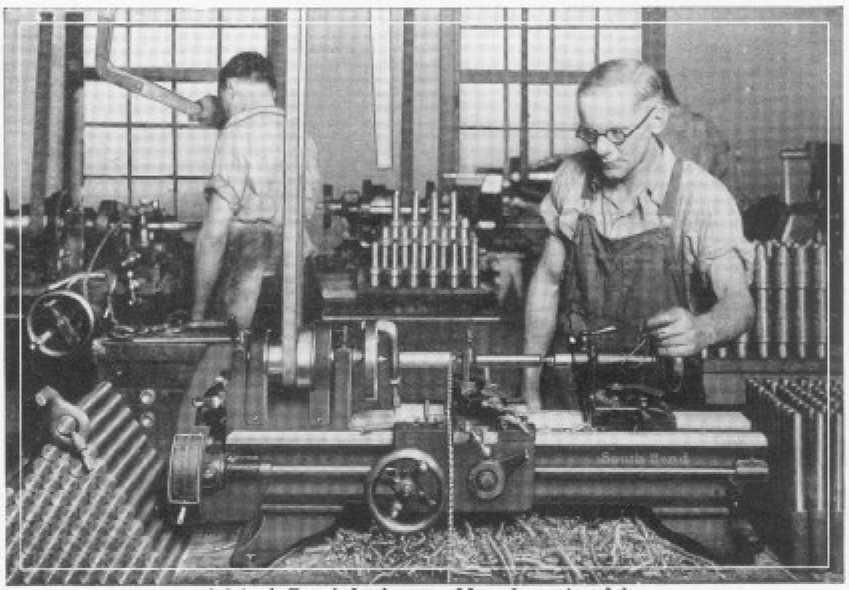
This lathe, as can be seen, is what is known as a "small lathe." The swing capacity is 11″ and it takes about 30″ between centers. On it Henry Ford made the principal parts for his automobile, machining the parts himself.

The Advantage of the Small Lathe

Small lathes, such as the 9″ and 11″ lathes, have always been used to excellent advantage by the skilled mechanic. The 9″ x 4′ lathe, for example, has the capacity for machining a shaft 6⅜″ in diameter and 29″ long. On chucking work a steel ring or flange 9¼″ in diameter can be machined in the chuck. The 9″ lathe may be fitted with a variety of attachments for the machining of small accurate work. Screw threads from 4 to 40 per inch, including 11½ pipe thread, can also be cut. One can readily understand how Henry Ford used to advantage a lathe of this type in building his first Model T car.

The Small Lathe as a Manufacturing Tool

The skilled mechanic prefers the small back geared screw cutting lathe for the machining of light work because the lathe can be used for making small accurate tools, jigs, and fixtures. It can also be fitted with a variety of attachments.



A 9-inch Bench Lathe on a Manufacturing Job

The Latest Shop Practice in the metal industry is to do small work on small machines because with this combination production is far more rapid and economical, accuracy is more easily maintained, the operator makes fewer mistakes and the original cost of the equipment used is much lower.

Many of Our Large Factories have batteries of small back geared, screw cutting lathes equipped with special tools for production of small parts. They find that this type of equipment is less expensive and far more productive.

Production Engineers in large plants manufacturing products such as sewing machines, typewriters, electrical parts, etc., are using small lathes for manufacturing operations that require the greatest accuracy and precision.

When One Job is Finished the screw cutting lathe can be set up for doing a different job, and can be kept in operation the year around. Many industrial plants are taking advantage of this fact and are using screw cutting lathes. Many plants are using these lathes in groups on production work and getting excellent results.

The Screw Cutting Lathe can be fitted with a number of practical attachments such as lathe chucks, drill chucks, draw-in collet chucks, taper attachment, grinding attachment, etc., all of which tend to make the lathe deserve its name of "The Universal Tool."

Training the Youth in Auto Mechanics

Thousands of schools are giving their young men mechanical training in machine work, auto mechanics, electrical, and airplane work to fit them for higher positions in industry.

Fig. 142. Auto Mechanics' Shop of High School at Grand Island, Neb.

This is the Age of Machinery—because of the radio, the automobile, the airplane, etc. The public school is the logical source to provide this training. Ten years hence the young man with mechanical training will have a decided advantage over the untrained man.

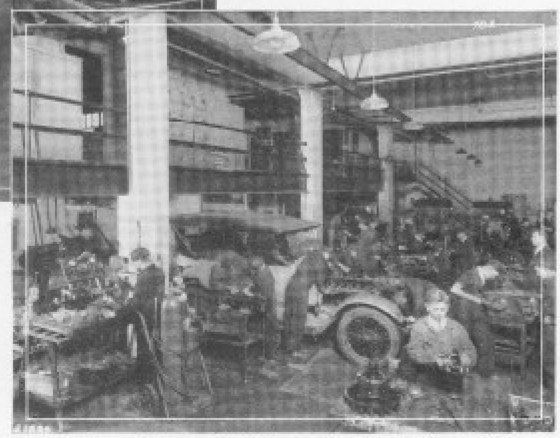


Fig. 143. Auto Mechanics' Shop of Boys' Vocational School South Bend, Indiana

The General Motors Corporation, recognizing the need of trained men, has founded its own school, known as the General Motors Institute of Technology, at Flint, Michigan. This school takes care of 2,500 students and has a waiting list of 6,000. A little booklet describing the activities at this school can be obtained by writing the school direct.

The Henry Ford Trade School, at the Highland Park Plant of the Ford Motor Company, at Detroit, Michigan, is another school organized to train their young employees. This school takes care of 3,000 boys and has a waiting list of over 8,000. A little booklet describing courses, educational methods, and all particulars, can be obtained by writing direct to the school.

The Hudson Motor Car Company, Detroit, Michigan, is starting a school with the object of graduating 25 to 50 boys a year. They will combine work in their own plants with part time study of such subjects as shop arithmetic, mechanical drawing, elementary metallurgy, and other subjects.

Many Other Manufacturers are operating their own training school, as: United Shoe Machinery Company, Peabody, Massachusetts; General Electric Company, Schenectady, New York; Studebaker Corporation, South Bend, Indiana; and others whose names space will not permit listing.

Precision Mechanical Units of the Automobile

Line Type Water Cooled Automobile Motor

This illustration shows a modern automobile motor. It is a complex unit of mechanism having several hundred parts, all of which must be accurately machined and fitted in order to produce a smooth running motor.

Servicing these motors requires the same care on the part of the automobile mechanic as is given in the factory when the motor is first built.

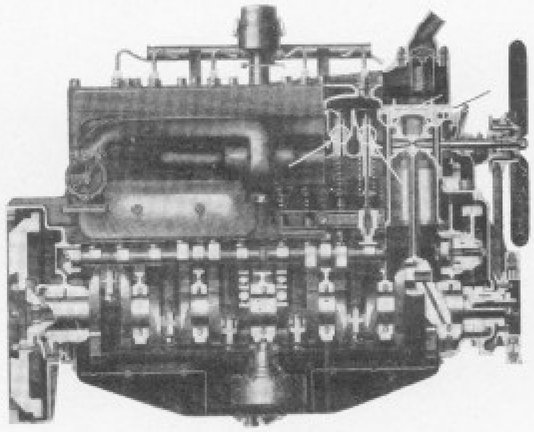


Fig. 144. Automobile Motor with Sections Cut Away to Show Construction

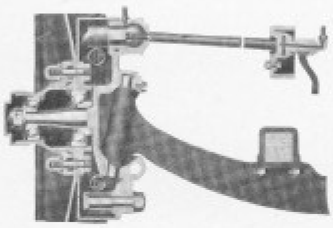


Fig. 145. Front Wheel and Steering Mechanism

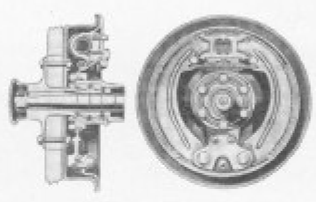


Fig. 146. Rear Wheel Hub and Brake Drum

The accurate machine operations in the modern automobile manufacturing plant are handled on precision tools, most of which are modifications of the principle of the back geared, screw cutting lathe. All automobile parts are made to the most accurate limits because the units operate with precision at high speed.

Fig. 147. The Differential

The Student in Auto Mechanics is taught the fundamental principle of the automobile motor and is given practical training in repairing and assembling the various units. Precision type equipment is used in these shops: thus the student is trained to become a skilled workman.

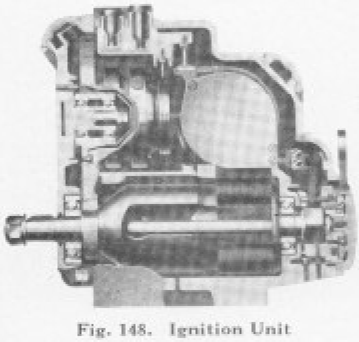


Fig. 148. Ignition Unit

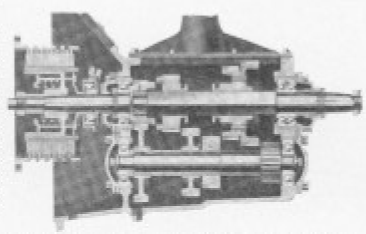


Fig. 149. Clutch and Transmission

Aircraft and Aeronautics

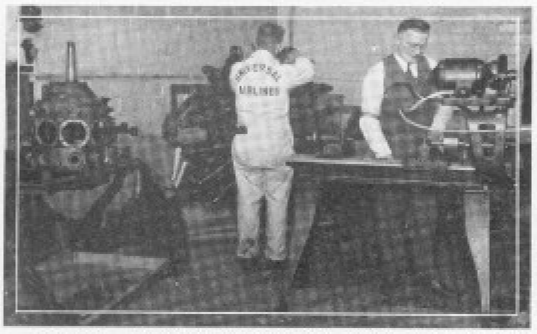


Fig. 143. Airplane Service Shop of the Universal Air Lines at the Chicago, Illinois Airport

Vocational Departments in many of the Public Schools are providing training courses in Aeronautics. Practical shop work such as, dismantling, assembling, repairing and servicing the airplane motor is given along with the theory of aerodynamics. Special attention is given in these schools to the precision methods that are used in manufacturing, maintaining and servicing the airplane and motor. Students trained in these school shops become skilled and efficient workmen with excellent opportunities for the future in this rapidly expanding industry.


Fig. 144. The Modern Airplane

The Aircraft Industry, with its manufacturing plants, maintenance shops and airports, offers great opportunities to the youth with mechanical training and a knowledge of aerodynamics. The Wright Brothers, Curtiss, Lindbergh, Byrd, Chamberlain and others have made it possible for the young man of today to make rapid progress in aeronautics if he has mechanical training and ability.

Servicing and Maintenance at Airports

The modern airport has every facility for maintaining, servicing and repairing aircraft of all kinds. The mechanical equipment used is the latest and most modern and is capable of handling the finest and most accurate work.

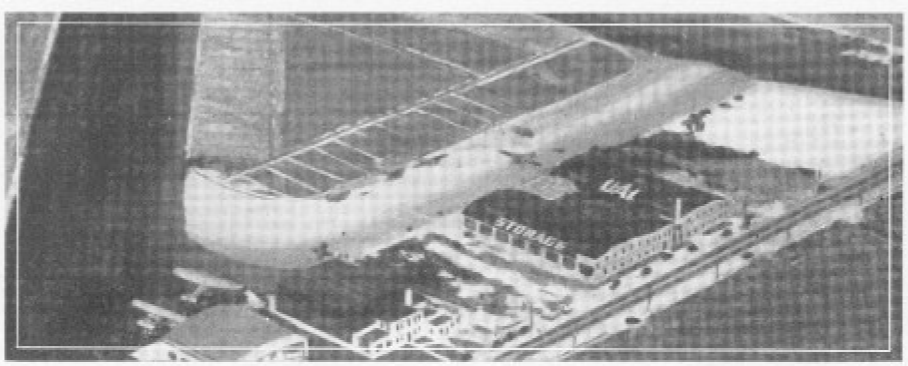
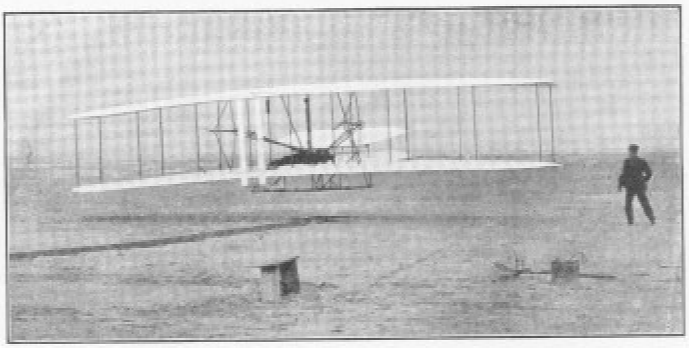


Fig. 145. Air View of Part of the Chicago Airport Showing Hangers and Service Shops

Aircraft and Aeronautics

The illustration at the right shows the first airplane, invented and built by Orville and Wilbur Wright of Dayton, Ohio, and flown for the first time in 1903 at Kitty Hawk, North Carolina.

Fig. 154



The Wright Brothers' First Flight

Mechanical genius and mechanical ability on the part of the Wright Brothers developed the first airplane motor and craft that actually flew. All the parts of this motor and plane needed to be built with the utmost precision and accuracy because of the necessity of being light and at the same time having ample power.

The first plane was built on the back-geared, screw-cutting lathe. This machine was necessary for turning out various parts of the first airplane motor. Today the lathe is the most widely used machine in the plants manufacturing airplane motors of the various types.

All parts of the airplane motor operate with precision; hence, they should be repaired and maintained on precision tools such as the screw-cutting lathe, which is capable of turning out the most accurate work.

Lathe used by the Byrd South Polar Expedition

Commander Richard E. Byrd and his associates recognized the necessity of the back-geared, screw-cutting lathe for maintenance and repair work when starting on the South Polar Expedition. Two South Bend Lathes were taken along—the 16″ size to be used on the base ship "City of New York," while the 9″ lathe is to be used at the various temporary bases set up on the ice to service the planes. The two sizes selected are capable of taking care of all mechanical devices aboard ship and the general need of the airplanes.

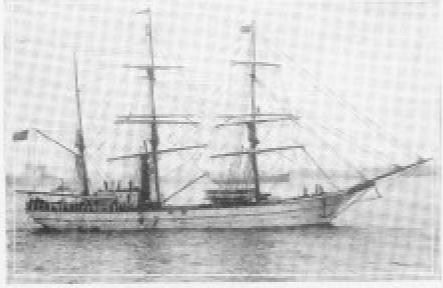


Fig. 155. Commander Byrd's base ship "City of New York" in New York Harbor just prior to sailing for the Antarctic

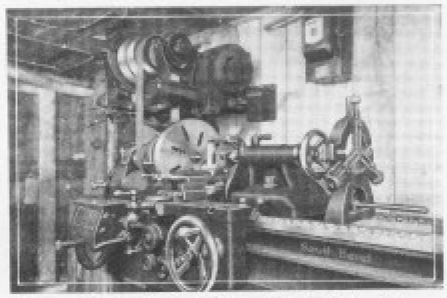
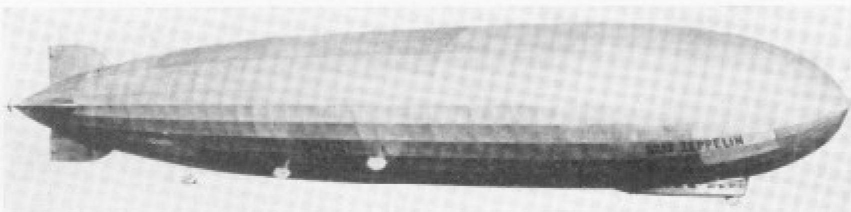


Fig. 156. The 16 inch New Model Motor Driven South Bend Lathe, ready for operation in the ship "City of New York"

Aircraft and Aeronautics



Underwood & Underwood

Fig. 157. The Graf Zeppelin Dirigible

The Largest Modern Dirigible, the Graf Zeppelin, which made the historic flight from Germany across the Atlantic Ocean to the United States and return, October, 1928, with passengers, mail and express. Captain Hugo Eckener commanded the airship. His training and ability were responsible for the success of the epoch making flight.

At the right is shown one of the airplanes to be used by the Byrd South Polar Expedition. This is one of the modern types used for mail, express, and passenger purposes.

Fig. 158. One of Byrd's Antarctic Airplanes

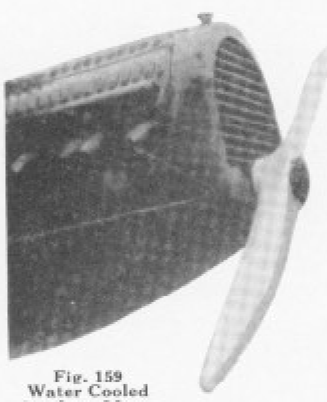


Fig. 159 Water Cooled Airplane Motor

The Airplane Motor is a highly complex and delicate unit of mechanism because it must have perfect balance, perfectly fitting parts, with a minimum of friction. It operates at high speed with low fuel consumption and develops tremendous power. The most modern methods are used to repair and service the various parts of these motors.

The Water Cooled line-type airplane motor, shown above, while similar to the automobile motor, is more highly developed and has less weight per horse power.

The New Radial Type of air-cooled motor, shown at right, has attained great popularity because of its low weight per horse power and dependability. Col. Lindbergh used this type of motor on his famous trans-Atlantic flight.

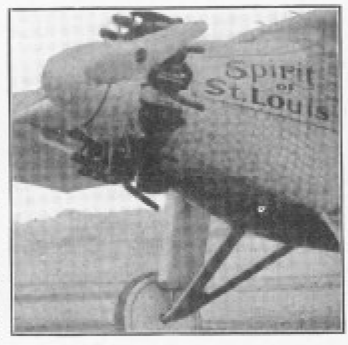


Fig. 160. Air Cooled Airplane Motor

Types of Airplane Motors

At the right is shown an illustration of a twelve cylinder, water cooled, "V" type motor which is the type used in many commercial planes and government planes. Low head resistance permitting higher air speed is the chief advantage of the water cooled motor.

Aeronautics students are given complete training on servicing and maintaining airplane motors in scores of schools in the United States.

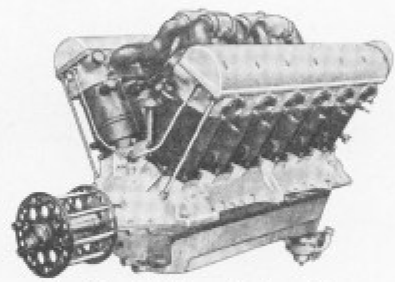


Fig. 161. "V" Type Airplane Motor

Radial Type Air Cooled Airplane Motor

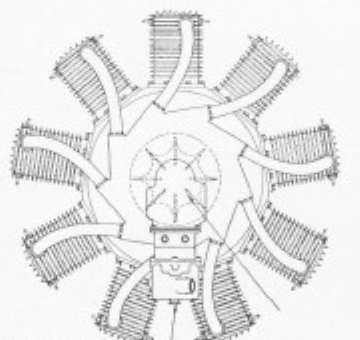


Fig. 162. Radial Type Airplane Motor

At the left is shown a line drawing illustrating the principle of the radial type air-cooled airplane motor using gasoline for fuel. This is the same type of motor as illustrated in Fig. 160 on page 74. The mechanical equipment used in manufacturing and servicing these motors must be capable of turning out work with the finest of accuracy and precision.

Radial Type Diesel Motor—Air Cooled

At the right is shown a line drawing of the recently developed Radial Type Diesel Motor for airplane use which uses crude oil for fuel. Note that no ignition equipment is used. Firing in the cylinders is accomplished by compressing the fuel oil and igniting it with the heat of compression. The parts are machined and fitted with extreme accuracy so as to hold this high compression in the compression chamber. These motors must be serviced with precision tools.

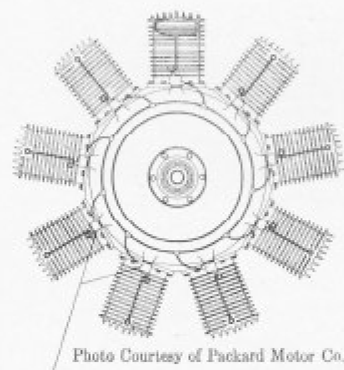


Fig. 163. Diesel Radial Type Motor

Size of Lathe for the Auto Repair Shop

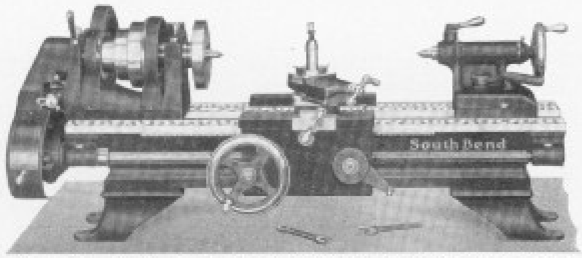


Fig. 169. 9-inch Junior, Back Geared, Screw Cutting Lathe

The 9-inch Junior New Model South Bend Lathe

For the Auto Repair and Service Station Shop

For the Small Shop.—The 9″ x 3′ Junior New Model South Bend Back Geared Screw Cutting Bench Lathe is the popular and practical size to use for small work. It is a precision tool that can be used to true commutators, make bushings, reface valves, finish semi-machined pistons, make small replacement parts, cut any kind of standard screw threads from 4 to 40 per inch, make precision tools and do general machine work with the finest accuracy.

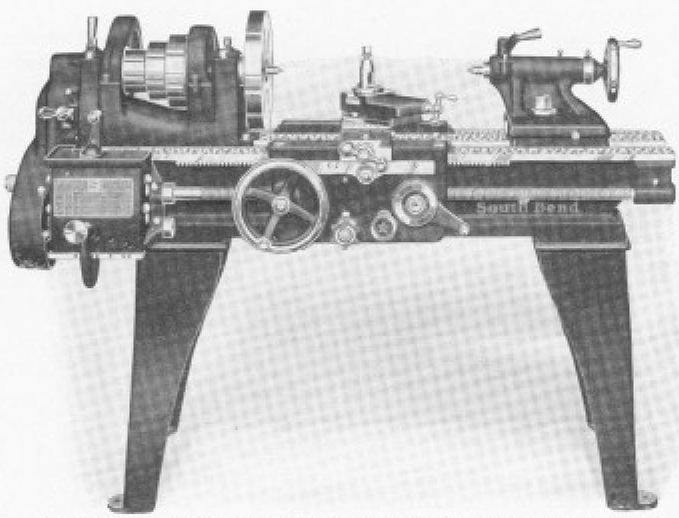


Fig. 170. 11-inch Quick Change, Back Geared, Screw Cutting Lathe

The 11-inch New Model South Bend Lathe

For the Auto Repair and Service Station Shop

For the Medium Size Shop.—For handling medium size work in any automotive repair shop, large or small, the 11″x4′ Quick Change Gear New Model South Bend Back Geared Screw Cutting Lathe is the popular and practical size to use. This lathe will handle all of the work done by the 9-inch Junior Lathe as well as heavier work because of its weight and power. It has automatic feeds and will cut standard screw threads from 2 to 112 per inch.

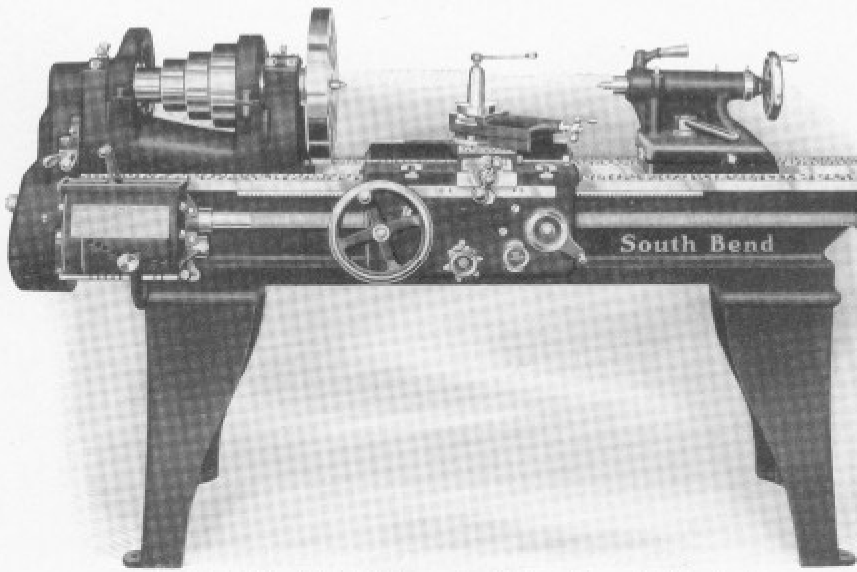


Fig. 171. 16-inch Quick Change, Back Geared, Screw Cutting Lathe

The 16-inch New Model South Bend Lathe

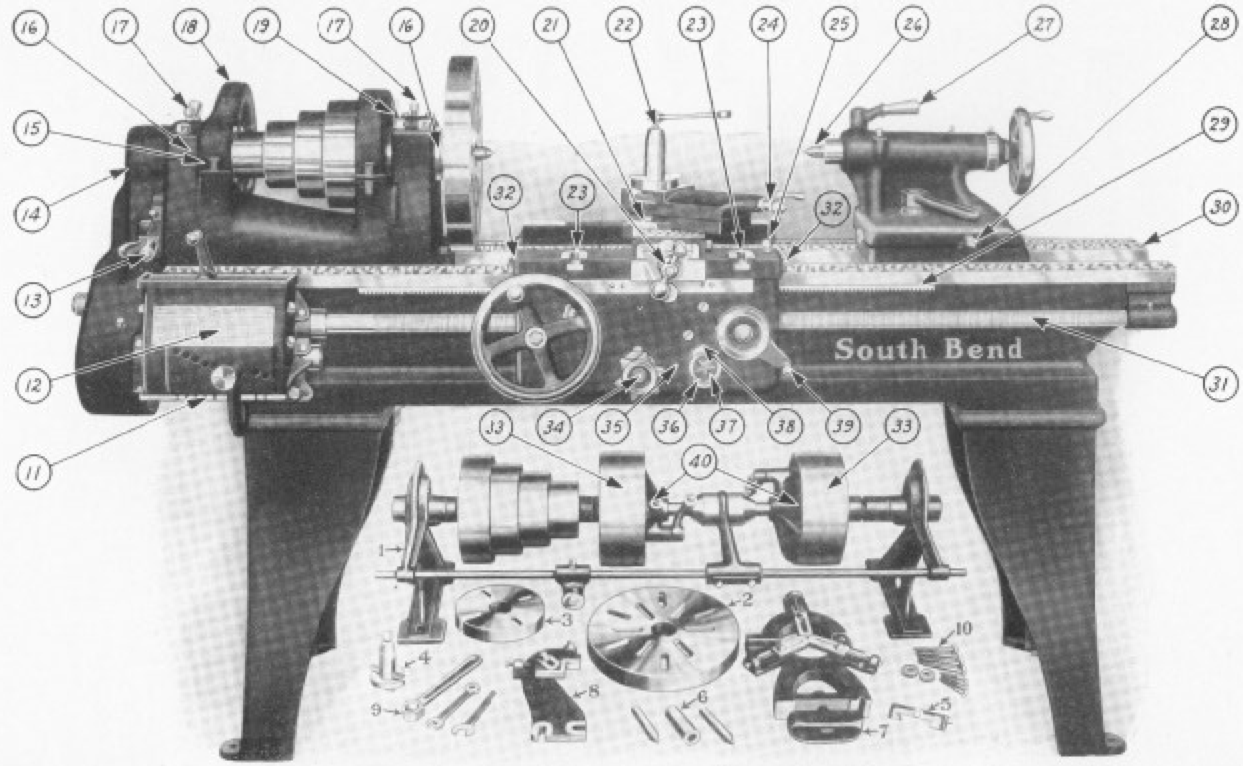
For the Auto Repair and Service Station Shop

For the General Repair Shop.—For the handling of general repair work, large or small, the 16″ x 8′ Quick Change Gear New Model South Bend Back Geared Screw Cutting Lathe is the popular and practical size to use for the Service Station Shop, Garage and Electric Shop, as it will do work on the big jobs and little jobs with equal ease. It has the power for heavy cuts, and the precision and accuracy for fine tool work. The swing and distance between centers permit it to be used for a wide variety of operations.

This lathe will handle all of the work that can be done on the 9-inch Junior and 11-inch Lathe, and in addition it will take care of all of the larger jobs that come into the average auto repair shop. The four-step spindle cone and back gears permit eight spindle speeds. The Quick Change Gear Box for numerous fine and coarse automatic cross and longitudinal feeds and exceptional power of this lathe, makes it an ideal tool for all classes of work. Its thread cutting range includes standard screw threads from 2 to 112 per inch.

16-inch Lathes are furnished in Quick Change Gear and Standard Change Gear types, countershaft or motor drive. The regular equipment included with 16-inch Lathes consists of: double friction countershaft, large face plate, small face plate, tool post complete, two lathe centers, spindle sleeve, adjustable thread cutting stop, center rest, follower rest, wrenches, lag screws and washers.

This lathe also can be equipped with attachments, such as, graduated taper attachment, draw-in collet chuck, oil pan, micrometer stop, thread cutting stop for the finest precision tool work.



Features of the New Model South Bend Back Geared Screw Cutting Lathe (Quick Change and Standard Change Gear Types)

1 to 10 —Equipment furnished with Lathe.
11—Quick Change Gear Box.
12—Index Plate for Threads and Feeds.
13—Quick-Acting Latch Reverse.
14—Special Carbon Steel Hollow Spindle.
15—Hardened and Ground Steel Thrust Collar.
16—Large Phosphor Bronze Bearings.
17—Patent Oil Cups prevent dust.
18—Back Gears well guarded.
19—Wrenchless Bull Gear Clamp.
20—Micrometer Cross Feed Screw Collar.
21—Compound Rest graduated 180 degrees.
22—Forged Steel Adjustable Tool Post.
23—"T" Slot for clamping work on Carriage.
24—Micrometer Compound Rest Screw Collar.
25—Carriage Lock for facing.
26—Tool Steel Lathe Centers.
27—Tailstock Spindle Lock.
28—Set-over Tailstock for taper turning.
29—Steel Rack, cut from the solid.
30—Semi-steel Seasoned Lathe Bed.
31—Precision Lead Screw, Acme Thread.
32—Shear Wiper and Oilers.
33—Countershaft Friction Clutch Pulleys.
34—Automatic Friction Feed Clutch.
35—Safety Device for Threads and Feeds.
36—Knob Position for Automatic Longitudinal Feed.
37—Neutral Position for Thread Cutting.
38—Position for Automatic Cross Feed.
39—Half Nut Lever for Thread Cutting.
40—Lubricating Cups in Clutch Pulleys.

Features of New Model South Bend Lathes

The 96 Sizes and Types of South Bend Lathes Have These Quality Features in Both the Quick Change Gear and Standard Change Gear Types

The Illustration on page 78 shows the New Model South Bend Quick Change Back Geared Screw Cutting Lathe. The features described below are enumerated and shown on the opposite page. The illustration shows a 16-inch x 6-ft. lathe but the same features and design apply to all sizes and types of New Model Lathes.

The New Semi-Steel Lathe Bed is a heavy gray iron casting 18 per cent steel which insures wearing qualities and strength. The bed is cross ribbed by box braces cast in at short intervals its entire length. The beds are rough planed, then seasoned for a period of four to six weeks, then finish planed and hand scraped.

The New Headstock is back geared. The four-step cone permits eight spindle speeds, four direct cone drive and four back geared drive. All gears are completely covered with gear guards to comply with all state laws. A quick acting bull gear clamp permits changing from direct cone drive to back geared drive or from back geared to direct cone drive without the use of a wrench.

The Four-Step Spindle Cone is used on all New Model Lathes, 13-inch size and larger, because the fourth or smallest step of the cone, is the most valuable. This small step on the cone is used on work in the industrial plant and in manufacturing more than the other three steps combined, as it permits the lathe to do a great variety of work which is so necessary in modern machine shop practice.

The New Headstock Spindle is made of a special quality high carbon spindle steel. It has a hole its entire length for machining rods and bars through lathe chuck and draw-in collet chuck. The steel thrust collar is hardened and ground.

The New Headstock Spindle Bearings of high quality **phosphor** bronze, are designed for heavy duty work and are adjustable for wear. The bearings are hand scraped to a perfect fit with the spindle. Patent oil cups insure an ample supply of oil to the bronze bearings.

The New Tailstock is heavy and rigid with a long bearing on the bed. It is provided with set-over for taper turning. The binding lever locks the spindle without disturbing the alignment of centers. The tail center is hardened and self-ejecting.

The New Carriage is strong with wide bridge and has "T" slots for clamping work for boring, and reaming. A locking device fastens carriage to the bed when using cross feed. Felt wipers are attached to the carriage to keep the "V" ways clean and oiled. The carriage is hand scraped to the lathe bed. The cross feed screw has Acme thread and micrometer graduated collar reading in thousandths of an inch.

The New Apron is provided with automatic friction cross feed and automatic friction longitudinal feed. The apron is also provided with half-nuts which are used only when cutting screw threads. The lead screw is splined to serve as a feed rod for operating the automatic friction feeds. The threads of the lead screw are used only when cutting screw threads. An improved automatic safety interlock prevents the half-nuts and the automatic feeds from being engaged at the same time.

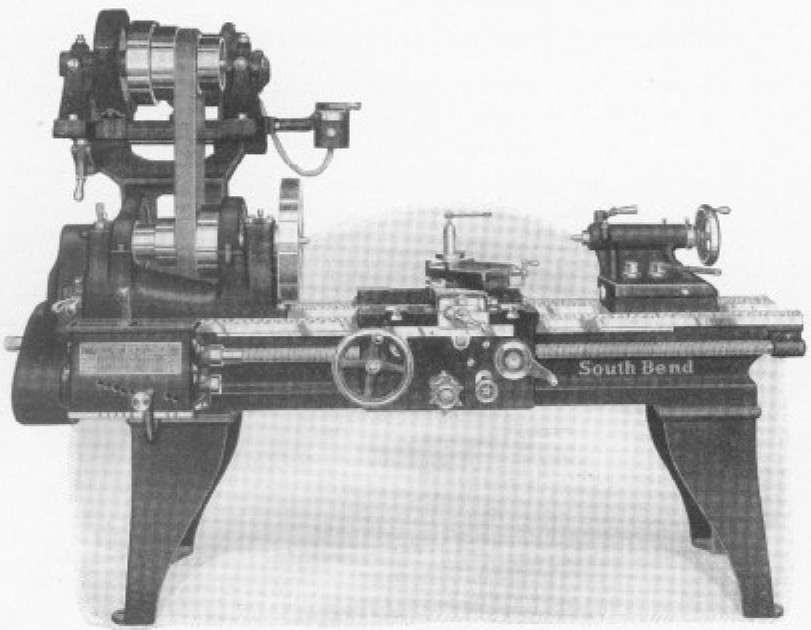
The New Compound Rest is graduated to 180 degrees on the base and can be operated at any angle. The compound rest has an angular travel. The compound rest screw has Acme threads, and is fitted with a micrometer graduated collar that reads in thousandths of an inch.

The New Lead Screw of special steel has Acme standard threads cut on a special machine having a Pratt and Whitney master lead screw which insures the utmost precision and accuracy in the cutting of finest precision thread gauges, master taps, etc.

The New Quick Change Gear Box provides forty-eight changes for cutting right and left hand standard screw threads from 2 to 112 per inch. It also provides for various adjustments for the automatic cross feeds and automatic longitudinal feeds. The index plate shows the arrangement of levers, for cutting threads and feeds.

Sixty-four Major Accuracy Tests are made during the process of manufacture of the lathe. After being assembled the lathe is operated under its own power and a record of each test is filed in our office.

The Life of the New Model Lathe we estimate is at least twenty-five years if given the proper care and attention. We are still using in our own shop one of the first South Bend Lathes that we built twenty-two years ago. It is still in operation and is giving good satisfaction on production work.



New Model Silent Chain Motor Driven Lathe

The New Model Silent Chain Motor Driven Back Geared Screw Cutting Lathe is a practical, powerful and efficient tool. The motor drive unit, with its silent chain, eliminating vibration and noise, is the ideal electric drive for the screw cutting lathe.

The spindle is driven by belt from an overhead cone, which receives its power from the motor through the silent chain. The absence of vibration means the cutting tool will always leave a smooth even surface, so necessary on precision tool work.

The Constant Speed Reversing Motor is necessary on account of the numerous start, stop and reverse operations in cutting screw threads. The motor is mounted above the lathe, away from all dirt and chips. A lever tilts table forward for easy, quick belt shifting. Stretch of the belt is taken up by an independent adjustment.

The Reversing Control Switch (drum type) has proved the most practical type for lathe work. Located in front of the lathe in an easy working position for the operator, it has a rotary motion of three positions—left, for forward speeds; center, for neutral, and right, for reverse.

The Motor Driven Lathe is widely used in shops where space is limited because no overhead installation equipment is required—a hook-up with the electric current makes it ready for operation. A 9-inch lathe of this type can be safely operated from any ordinary light socket. General Electric and Westinghouse use silent chain motor driven lathes extensively.

The features illustrated and described on pages 78 and 79 apply to all sizes of Silent Chain Motor Driven Lathes.

96 Popular Sizes and Types of New Model South Bend Lathes

Net Factory Prices F. O. B. Cars, South Bend Indiana; Crated for Domestic Shipment

Brief Specifications				Countershaft Drive Lathes				Silent Chain Motor Drive Lathes							
Size of Lathes				Quick Change Gear Lathes		Standard Change Gear Lathes		Quick Change Gear Lathes				Standard Change Gear Lathes			
Swing Over Bed Inches	Length of Bed Feet	Between Centers Inches	Power Required H.P	Catalog No of Lathe	Price	Catalog No. of Lathe	Price	Catalog No. of Lathe	3-Phase 60-Cycle A.C. Motor	1-Phase 60-Cycle A.C. Motor	Direct Current Motor	Catalog No. of Lathe	3-Phase 60-Cycle A.C. Motor	1-Phase 60-Cycle A.C. Motor	Direct Current Motor
*9-inch Junior New Model South Bend Screw Cutting Lathes															
9¼	2½	11	¼	Not Made in Quick Change Gear Type		22-XB	$150.00	Not Made in Quick Change Gear Type				322-X	$246.00	$262.00	$258.00
9¼	3	18	¼			22-YB	155.00					322-Y	251.00	267.00	263.00
9¼	3½	23	¼			22-ZB	160.00					322-Z	256.00	272.00	268.00
9¼	4	29	¼			22-AB	165.00					322-A	261.00	277.00	273.00
9¼	4½	38	¼			22-RB	170.00					322-R	266.00	282.00	278.00
9-inch New Model South Bend Quick Change and Standard Change Gear Screw Cutting Lathes															
9¼	2½	11	¼	82-X	$265.00	31-X	$230.00	382-X	$366.00	$381.00	$369.00	331-X	$331.00	$346.00	$334.00
9¼	3	18	¼	82-Y	270.00	31-Y	235.00	382-Y	371.00	386.00	374.00	331-Y	336.00	351.00	339.00
9¼	3½	23	¼	82-Z	275.00	31-Z	240.00	382-Z	376.00	391.00	379.00	331-Z	341.00	356.00	344.00
9¼	4	29	¼	82-A	280.00	31-A	245.00	382-A	381.00	396.00	384.00	331-A	346.00	361.00	349.00
9¼	4½	36	¼	82-R	285.00	31-R	250.00	382-R	386.00	401.00	389.00	331-R	351.00	366.00	354.00
11-inch New Model South Bend Quick Change and Standard Change Gear Screw Cutting Lathes															
11¼	3	12	½	84-Y	$325.00	33-Y	$290.00	384-Y	$445.00	$471.00	$454.00	333-Y	$410.00	$436.00	$419.00
11¼	3½	18	½	84-Z	330.00	33-Z	295.00	384-Z	450.00	476.00	459.00	333-Z	415.00	441.00	424.00
11¼	4	24	½	84-A	335.00	33-A	300.00	384-A	455.00	481.00	464.00	333-A	420.00	446.00	429.00
11¼	5	36	½	84-B	345.00	33-B	310.00	384-B	465.00	491.00	474.00	333-B	430.00	456.00	439.00
13-inch New Model South Bend Quick Change and Standard Change Gear Screw Cutting Lathes															
13¼	4	16	¾	86-A	$390.00	35-A	$340.00	386-A	$525.00	$565.00	$534.00	335-A	$475.00	$515.00	$484.00
13¼	5	28	¾	86-B	402.00	35-B	352.00	386-B	537.00	577.00	546.00	335-B	487.00	527.00	496.00
13¼	6	40	¾	86-C	414.00	35-C	364.00	386-C	549.00	589.00	558.00	335-C	499.00	539.00	508.00
13¼	7	52	¾	86-D	426.00	35-D	376.00	386-D	561.00	601.00	570.00	335-D	511.00	551.00	520.00
15-inch New Model South Bend Quick Change and Standard Change Gear Screw Cutting Lathes															
15¼	5	24½	1	88-B	$475.00	39-B	$415.00	388-B	$628.00	$655.00	$701.00	339-B	$568.00	$595.00	$641.00
15¼	6	36½	1	88-C	490.00	39-C	430.00	388-C	643.00	670.00	716.00	339-C	583.00	610.00	656.00
15¼	7	48½	1	88-D	505.00	39-D	445.00	388-D	658.00	685.00	731.00	339-D	598.00	625.00	671.00
15¼	8	60½	1	88-E	520.00	39-E	460.00	388-E	673.00	700.00	746.00	339-E	613.00	640.00	686.00
16-inch New Model South Bend Quick Change and Standard Change Gear Screw Cutting Lathes															
16¼	6	34	1	92-C	$540.00	41-C	$480.00	392-C	$695.00	$722.00	$768.00	341-C	$635.00	$662.00	$708.00
16¼	7	46	1	92-D	555.00	41-D	495.00	392-D	710.00	737.00	783.00	341-D	650.00	677.00	723.00
16¼	8	58	1	92-E	570.00	41-E	510.00	392-E	725.00	752.00	798.00	341-E	665.00	692.00	738.00
16¼	10	82	1	92-G	600.00	41-G	540.00	392-G	755.00	782.00	828.00	341-G	695.00	722.00	768.00
18-inch New Model South Bend Quick Change and Standard Change Gear Screw Cutting Lathes															
18¼	7	41½	2	94-D	$675.00	43-D	$610.00	394-D	$883.00	$932.00	$973.00	343-D	$818.00	$867.00	$908.00
18¼	8	53½	2	94-E	700.00	43-E	635.00	394-E	908.00	957.00	998.00	343-E	843.00	892.00	933.00
18¼	10	77½	2	94-G	750.00	43-G	685.00	394-G	958.00	1007.00	1048.00	343-G	893.00	942.00	983.00
18¼	12	101½	2	94-H	815.00	43-H	750.00	394-H	1023.00	1072.00	1113.00	343-H	958.00	1007.00	1048.00
New Model South Bend Brake Drum Screw Cutting and General Purpose Lathes															
32¼	6	36	¾	Prices Upon Request		1-BC	$488.00	Prices Upon Request				301-BC	$523.00	$663.00	$632.00
36¼	6	27	1			2-BC	650.00					302-BC	805.00	832.00	878.00
36¼	8	51	1			2-BE	682.00					302-BE	837.00	864.00	910.00
42¼	8	38	3			3-BE	1400.00					303-BE	1754.00	1820.00	1880.00

*9-inch Junior Countershaft Drive Lathes have Bench Legs. All others have Floor Legs.

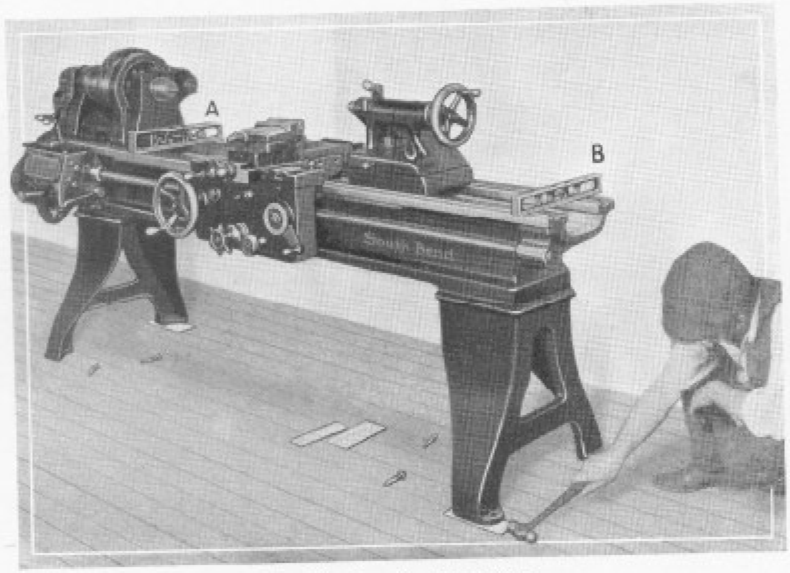


Fig. 175. Leveling the Lathe

How to Level a Lathe

It is important that the lathe be perfectly level, otherwise true and accurate machine work can not be produced on the lathe. If at any time the lathe is not doing accurate work, one of the first tests should be to see if it is level.

It is also necessary that the lathe be placed on a firm foundation so as to eliminate vibration.

Instructions for Leveling the Lathe

Level the Lathe Lengthwise and Crosswise.—Place the level lengthwise on top of the bed at the headstock end, on both front and back ways, then place the level on the ways at tailstock end of bed. Then place level crosswise at headstock end and at tailstock end of bed. The level should be at least 12" long so that it will reach across the entire width of the bed.

When the lathe is perfectly level and the floor properly braced, fasten the lathe securely to the floor with lag screws and again test to see if it is level because if the lathe is screwed to the floor and it is not perfectly level it will cause the bed to twist and the result will be that accurate work cannot be done on the lathe.

The Location of the Lathe has much to do with its satisfactory operation. The lathe should be located so that the light will shine over the operator's right shoulder or so that his back will be toward the window. Leave enough space to permit a person to pass back of the operator without interfering with his work. For information on erecting and setting up countershaft see book "How to Run a Lathe."

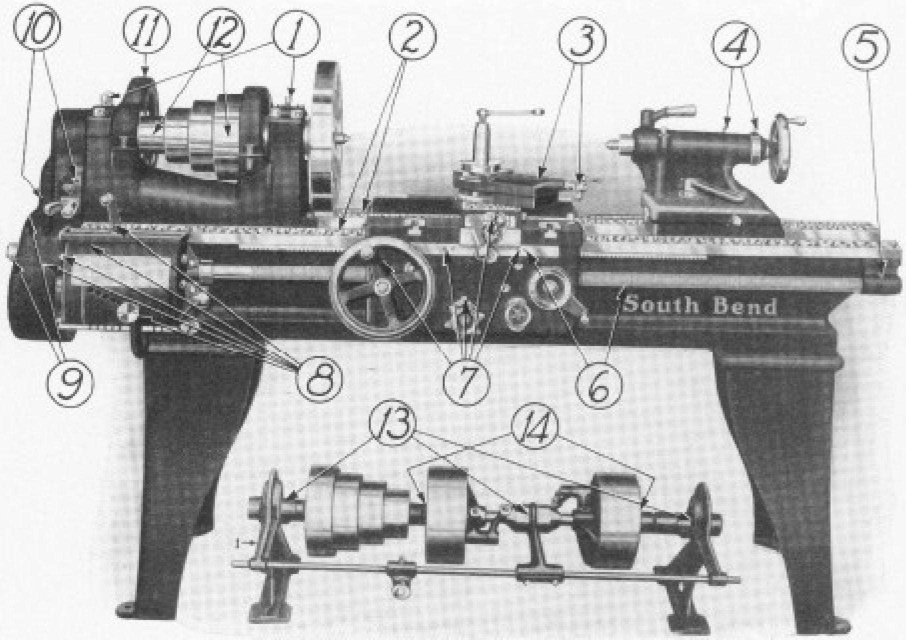


Fig. 176. Location of Oil Holes

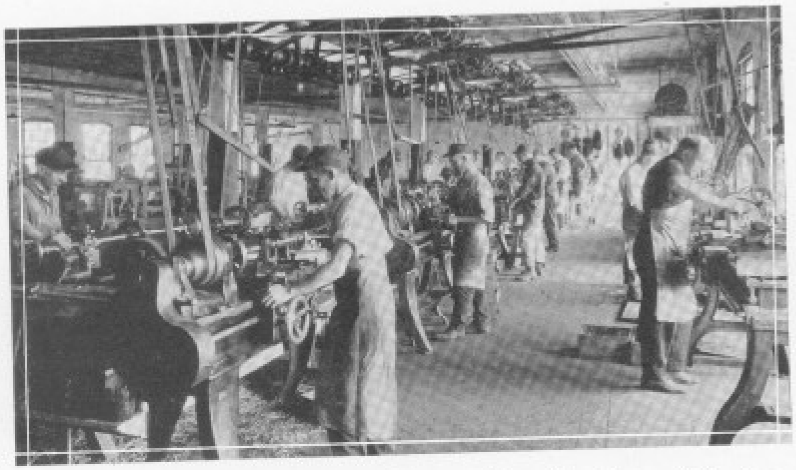
Oiling the Lathe and Countershaft

Regular Oiling of the Lathe, or any other machine in the shop, should never be neglected, not even for a day. If the lathe is operated without having the bearings and principal revolving parts oiled regularly, it may ruin the lathe in a very short time. Keep the lathe well oiled according to the instructions as shown below.

Never attempt to oil the lathe or countershaft while machine is in motion.

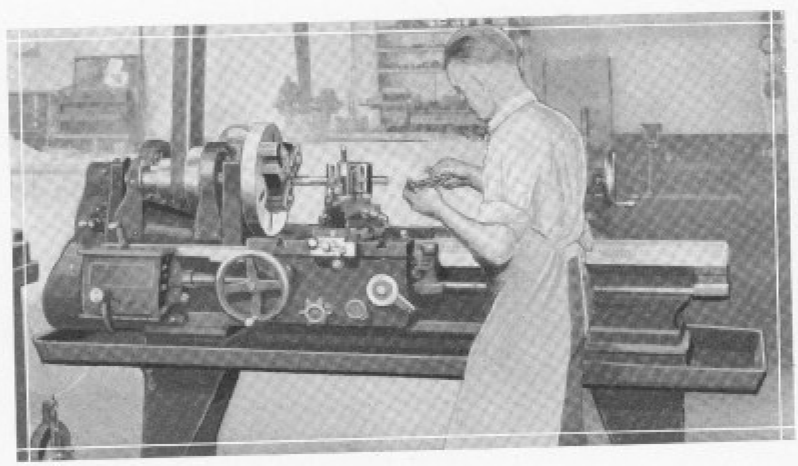
Instructions for Oiling Lathe Units

1. . Spindle	Oil every hour first 100 hours, twice a day thereafter
2. . Carriage "V" Ways	Keep well oiled and wipe clean frequently.
3. . Compound Rest	Oil all bearings every week.
4. . Tailstock	Oil all bearings every week.
5. . Lead Screw Bearing	Oil every day.
6. . Lead Screw and Half Nuts	Oil every hour when in use. Keep lead screw clean.
7. . Apron	Oil all bearings every day.
8. . Gear Box	Oil all bearings every day.
9. . Primary Gears	Oil all bearings every day.
10. . Reverse	Oil all bearings every day.
11. . Back Gears	Oil all bearings every day.
12. . Cone Pulley	Oil every day.
13. . Countershaft Bearings	Oil all bearings every day.
14. . Friction Clutch Pulleys	Fill oil cups every day.



The Screw Cutting Lathe on Production Work

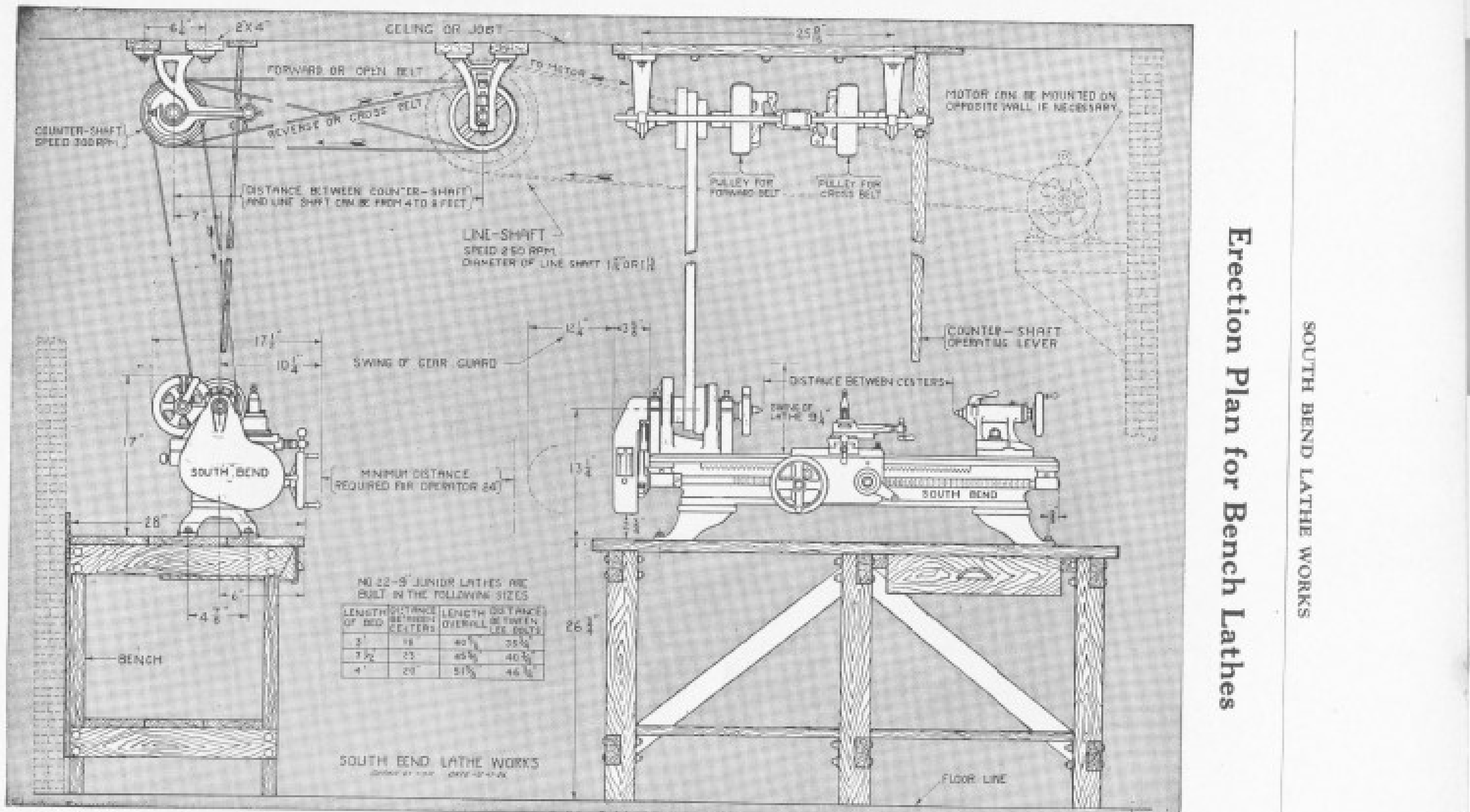
The illustration above shows sixteen South Bend Lathes in operation in a manufacturing plant on production work. The New Model South Bend Lathe is especially recommended for production because it has special features for this work. These lathes are producing remarkable results in some of the largest and best manufacturing plants in the country.



The Tool Room Lathe on Precision Tool Work

The illustration above shows a 16″ x 6′ New Model South Bend Tool Room Lathe in operation in a large plant. This lathe is equipped with countershaft drive and is fitted with draw-in collet chuck attachment, taper attachment, thread dial, oil pan and is capable of taking care of the finest tool, jig and fixture work that comes up in any manufacturing plant. Send for a list of industries that are using this lathe in tool room work.

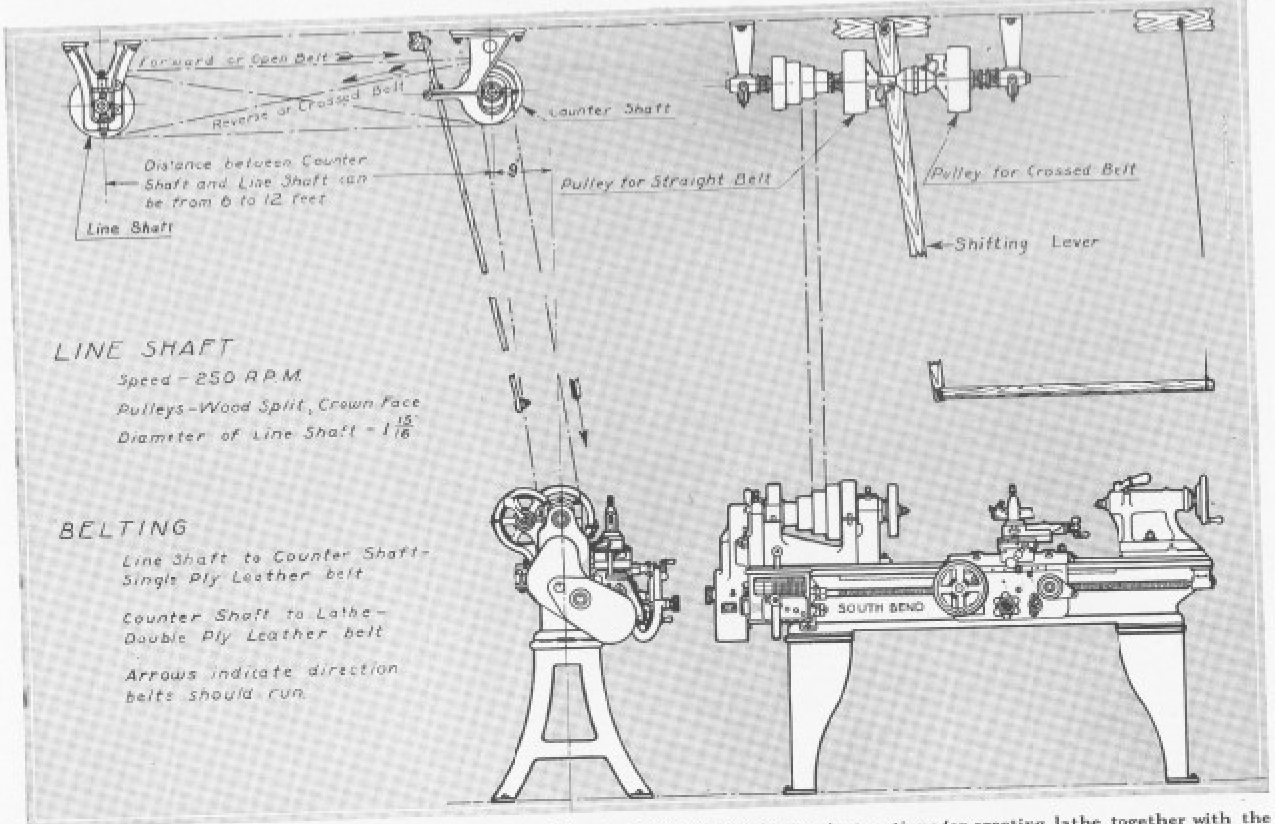
Erection Plan for Bench Lathes



The illustration shows the front and end views of the 9" Junior New Model Bench Lathe arranged for Overhead Countershaft drive, the motor is fastened on a shelf on the side wall and drives the lineshaft and countershaft which in turn drives the lathe.

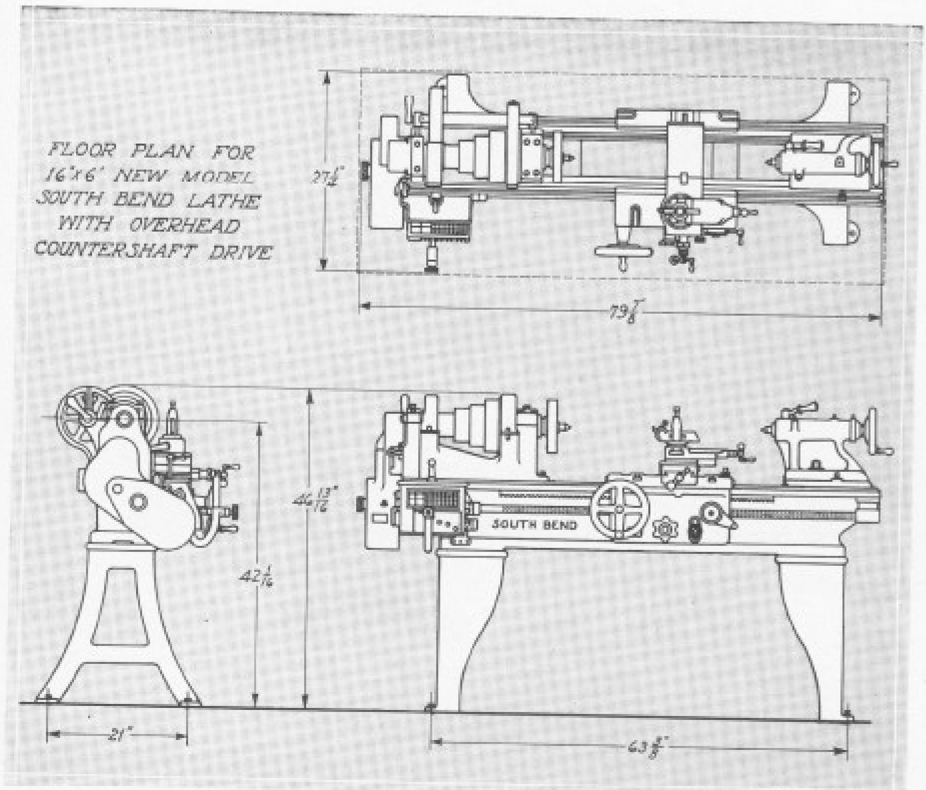
The lineshaft is $1\frac{7}{16}$" in diameter and has a speed of 250 R.P.M. It is attached to ceiling or joists of the room. The height of the bench is $26\frac{3}{4}$ inches. The size of the original drawing is 12"x18", a blue print of which is furnished with the lathe.

Lathe With Countershaft Drive



The illustration above is a reduction from an original drawing 12" x 18" which gives instructions for erecting lathe together with the size and speed of pulleys and lineshaft. This drawing is for a 16" lathe. Similar blueprints are furnished with each size lathe.

The overhead countershaft drive is the most popular type of drive used in industry. The countershaft is driven from the lineshaft. The advantage is that a number of other machines can also be driven from the same lineshaft.



Floor Plan for the New Model South Bend Lathe

The above drawing shows the floor plan of the 16″ x 6′ New Model South Bend Lathe with overhead countershaft drive. The view shown at the upper right of drawing indicates the amount of the floor space that this lathe will occupy when installed in your shop.

The drawing is a reduction of a blue print that gives the entire length and width of the lathe. It shows the distance from the floor to the center line of the lathe and the height over all. It also shows the distance between bolt holes for the floor legs for fastening the lathe to the floor.

Floor plans can be furnished for any size and type of New Model South Bend Lathe. If you are interested in purchasing a lathe, give the size of lathe wanted, that is, the swing, length of bed and type of drive, and we will be pleased to send you a floor plan of the lathe in which you are interested.

In addition to these floor plans, we also furnish erection plans of each size lathe, and when necessary foundation plans for the larger size lathes, especially where a cement foundation is desired.

The book entitled "How to Run a Lathe" illustrated and described on page 94 of this book, contains additional information on the installation and care of the Back Geared Screw Cutting Lathe.

Rules Relative to the Circle and Sphere

To find the circumference of a circle, multiply the diameter by 3.1416.

To find the diameter of a circle, multiply the circumference by .31831.

To find the area of a circle, multiply the square of the diameter by .7854.

To find the surface of a ball (sphere), multiply the square of the diameter by 3.1416.

To find the side of an equal square, multiply the diameter by .8862.

To find the cubical content (volume) in a ball, multiply the cube of the diameter by .5236.

The radius of a circle × 6.283185 = circumference.

The square of the diameter of a circle × .7854 = the area.

The square of the circumference of a circle × .07958 = the area.

Circumference of a circle × one-fourth its diameter = the area.

The circumference of a circle × .159155 = the radius.

The square root of the area of a circle × .56419 = the radius.

The square root of the area of a circle × 1.12838 = the diameter.

A gallon of water (U. S. Standard) weighs 8⅓ pounds and contains 231 cubic inches. A cubic foot of water contains 7½ gallons, 1728 cubic inches, and weighs 62½ pounds at a temperature of about 39 degrees Fahrenheit. The weight changes slightly above and below this temperature.

To find the pressure in pounds per square inch of a column of water, multiply the height of the column in feet by .433.

Steam rising from water at its boiling point (212 degrees F.) has a pressure equal to that of the atmosphere at sea level (14.7 pounds per square inch.)

Doubling the diameter of a pipe increases its capacity four times.

For other tables see book "How to Run a Lathe".

MISTAKES!

We all make mistakes. When you make a mistake on a piece of work correct and report it as soon as possible. Do not let it get by. People who shrink from letting mistakes be known for fear it will react on them only make matters worse by so doing.

Gear Information

Diameter, when applied to gears, is always understood to mean the pitch diameter.

Diametral Pitch is the number of teeth to each inch of the pitch diameter.

Example: If a gear has 40 teeth and the pitch diameter is 4 inches, there are 10 teeth to each inch of the pitch diameter and the diametral pitch is 10, or in other words, the gear is 10 diametral pitch.

Number of Teeth required, pitch diameter and diametral pitch given. Multiply the pitch diameter by the diametral pitch.

Example: If the diameter of the pitch circle is 10 inches and the diametral pitch is 4, multiply 10 by 4 and the product, 40, will be the number of teeth in the gear.

Number of Teeth required, outside diameter and diametral pitch given. Multiply the outside diameter by the diametral pitch and subtract 2.

Example: If the whole diameter is 10½ and the diametral pitch is 4, multiply 10½ by 4 and the product, 42, less 2, or 40, is the number of teeth.

Pitch Diameter required, number of teeth and diametral pitch given. Divide the number of teeth by the diametral pitch.

Example: If the number of teeth is 40 and the diametral pitch is 4, divide 40 by 4, and the quotient, 10, is the pitch diameter.

Outside Diameter or size of gear blank required, number of teeth and diametral pitch given. Add 2 to the number of teeth and divide by the diametral pitch.

Example: If the number of teeth is 40 and the diametral pitch is 4, add 2 to the 40, making 42, and divide by 4; the quotient, 10½, is the whole diameter of gear or blank.

Distance Between Centers of two gears required. Add the number of teeth together and divide one-half the sum by the diametral pitch.

Example: If the two gears have 50 and 30 teeth respectively, and are 5 pitch, add 50 and 30, making 80, divide by 2, and then divide the quotient, 40, by the diametral pitch, 5, and the result, 8 inches, is the center distance.

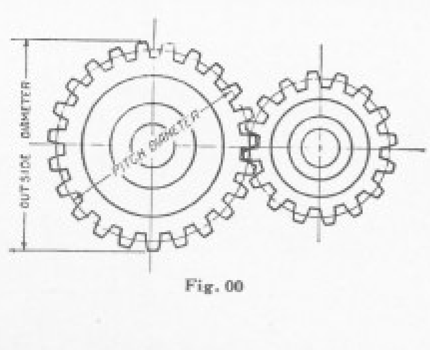


Fig. 00

Sizes of Tap Drills for Standard and Special Screw Threads

U. S. Standard Threads marked with *—S. A. E. Standard Threads marked with ‡

All Threads in Table that are not marked are Special Threads

Size of Screw	Threads per Inch	Tap Drill Size	Decimal Equivalent of Drill
1/4	20*	7	0.2010
	24	4	0.2090
	27	3	0.2130
	28‡	3	0.2130
	32	7/32	0.2187
5/16	18*	F	0.2570
	20	17/64	0.2656
	24‡	I	0.2720
	27	J	0.2770
	32	9/32	0.2812
3/8	16*	5/16	0.3125
	20	21/64	0.3281
	24‡	Q	0.3320
	27	R	0.3390
7/16	14*	U	0.3680
	20‡	25/64	0.3906
	24	X	0.3970
	27	Y	0.4040
1/2	12	27/64	0.4219
	13*	27/64	0.4219
	20‡	29/64	0.4531
	24	29/64	0.4531
	27	15/32	0.4687
9/16	12*	31/64	0.4844
	18‡	33/64	0.5156
	27	17/32	0.5312

Size of Screw	Threads per Inch	Tap Drill Size	Decimal Equivalent of Drill
5/8	11*	17/32	0.5312
	12	35/64	0.5469
	18‡	37/64	0.5781
	27	19/32	0.5937
11/16	11*	19/32	0.5937
	16‡	5/8	0.6250
3/4	10*	21/32	0.6562
	12	43/64	0.6719
	16‡	11/16	0.6875
	27	23/32	0.7187
13/16	10*	23/32	0.7187
7/8	9*	49/64	0.7656
	12	51/64	0.7969
	14‡	13/16	0.8125
	18	53/64	0.8281
	27	27/32	0.8437
15/16	9*	53/64	0.8281
1	8*	7/8	0.8750
	12	59/64	0.9219
	14‡	15/16	0.9375
	27	31/32	0.9687
1-1/8	7*	63/64	0.9844
	12‡	1-3/64	1.0469

Sizes of Tap Drills for Machine Screw Threads

The American (National) Standard Coarse-and-Fine-Thread Series

Coarse Thread Series

Size of Screw	Threads per Inch	Tap Drill Size	Decimal Equivalent of Drill
1	64	53	0.0595
2	56	50	0.0700
3	48	47	0.0785
4	40	43	0.0890
5	40	38	0.1015
6	32	36	0.1065
8	32	29	0.1360
10	24	25	0.1495
12	24	16	0.1770
1/4	20	7	0.2010
5/16	18	F	0.2570
3/8	16	5/16	0.3125
7/16	14	U	0.3680
1/2	13	27/64	0.4219

Fine Thread Series

Size of Screw	Threads per Inch	Tap Drill Size	Decimal Equivalent of Drill
0	80	3/64	0.0469
1	72	53	0.0595
2	64	50	0.0700
3	56	45	0.0820
4	48	42	0.0935
5	44	37	0.1040
6	40	33	0.1130
8	36	29	0.1360
10	32	21	0.1590
12	28	14	0.1820
1/4	28	3	0.2130
5/16	24	I	0.2720
3/8	24	Q	0.3320
7/16	20	25/64	0.3906
1/2	20	29/64	0.4531

Weights and Measures

Troy Weight

24 grains = 1 dwt.
20 dwts. = 1 ounce.
12 ounces = 1 pound
Used for weighing gold, silver, and jewels

Apothecaries' Weight

20 grains = 1 scruple
3 scruples = 1 drachm
8 drachms = 1 ounce
12 ounces = 1 pound
The ounce and pound in this are the same as in troy weight

Avoirdupois Weight

$27^{11}/_{32}$ grains = 1 drachm
16 drachms = 1 ounce
16 ounces = 1 pound
25 pounds = 1 quarter
4 quarters = 1 cwt.
2,000 pounds = 1 short ton
2,240 pounds = 1 long ton

Dry Measure

2 pints = 1 quart
8 quarts = 1 peck
4 pecks = 1 bushel
36 bushels = 1 chaldron

Liquid Measure

4 gills = 1 pint
2 pints = 1 quart
4 quarts = 1 gallon
31½ gallons = 1 barrel
2 barrels = 1 hogshead

Measure of Solidity

1,728 cubic inches = 1 cubic foot
27 cubic feet = 1 cubic yard

Time Measure

60 seconds = 1 minute
60 minutes = 1 hour
28, 29, 30, or 31 days = 1 calendar month (30 days = 1 month in computing interest)
365 days = 1 year
24 hours = 1 day
7 days = 1 week
366 days = 1 leap year

Circular Measure

60 seconds = 1 minute
60 minutes = 1 degree
30 degrees = 1 sign
90 degrees = 1 quadrant
4 quadrants = 12 signs, or 360 degrees = 1 circle

Long Measure

12 inches = 1 foot
3 feet = 1 yard
5½ yards = 1 rod
40 rods = 1 furlong
8 furlongs = 1 statute mile
5,280 feet = 1 statute mile

Cloth Measure

2¼ inches = 1 nail
4 nails = 1 quarter
4 quarters = 1 yard

Mariner's Measure

6 feet = 1 fathom
100 fathoms = 1 cable length
6,080 feet = 1 nautical mile
3 nautical miles = 1 league
10 cable lengths = 1 mile

Square Measure

144 sq. inches = 1 sq. foot
9 sq. feet = 1 sq. yd.
30¼ sq. yards = 1 sq. rod
40 sq. rods = 1 rood
4 roods = 1 acre
640 acres = 1 sq. mile

Metric System of Weights

The gram is the primary unit of weights, in the metric system, and is the weight in a vacuum of a cubic centimeter of distilled water at the temperature of 39.2°F.

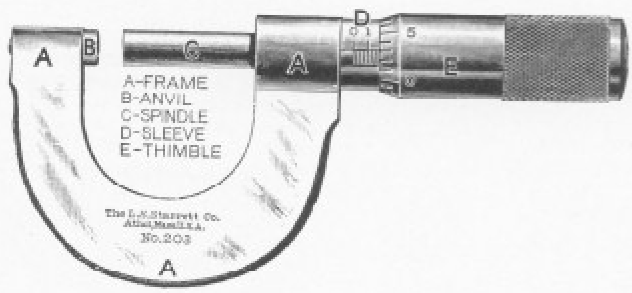
10 milligrams (mg.)	= 1 centigram (cg.)	= 0.1543 troy grain
10 centigrams	= 1 decigram (dg.)	= 1.543 troy grains
10 decigrams	= 1 gram (g.)	= 15.432 troy grains
10 grams	= 1 decagram	= 0.3527 avoirdupois ounce
10 decagrams	= 1 hectogram	= 3.5274 avoirdupois ounces
10 hectograms	= 1 kilogram (kg.)	= 2.2046 avoirdupois pounds
10 kilograms	= 1 myriagram	= 22.046 avoirdupois pounds
10 myriagrams	= 1 quintal (q.)	= 220.46 avoirdupois pounds
10 quintals	= 1 tonne (t.)	= 2204.6 avoirdupois pounds

1 kilogram per kilometer	= 0.67195 pound per thousand feet
1 pound per thousand feet	= 1.4882 kilograms per kilometer
1 kilogram per square millimeter	= 1.423 pounds per square inch
1 pound per square inch	= 0.000743 kilogram per square millimeter

Different Standards for Wire Gauges in use in the United States

Dimensions of Sizes in Decimal Parts of an Inch

Number of Wire Gauge	American, or Brown & Sharpe	Birmingham, or Stubs' Iron Wire	Washburn & Moen, Worcester, Mass.	W. & M. Steel Music Wire	New American S & W Co.'s Music Wire Gauge	Imperial Wire Gauge	Stubs Steel Wire	U. S. Standard Gauge for Sheet and Plate Iron and Steel	Number of Wire Gauge
00000000	......	......	......	.0083	......	......	......	......	00000000
0000000	......	......	......	.0087	......	......	......	......	0000000
000000	......	......	......	.0095	.004	.464	......	.46875	000000
00000	......	......	......	.010	.005	.432	......	.4375	00000
0000	.460	.454	.3938	.011	.006	.400	......	.40625	0000
000	.40964	.425	.3625	.012	.007	.372	......	.375	000
00	.3648	.380	.3310	.0133	.008	.348	......	.34375	00
0	.32486	.340	.3065	.0144	.009	.324	......	.3125	0
1	.2893	.300	.2830	.0156	.010	.300	.227	.28125	1
2	.25763	.284	.2625	.0166	.011	.276	.219	.265625	2
3	.22942	.259	.2437	.0178	.012	.252	.212	.250	3
4	.20431	.238	.2253	.0188	.013	.232	.207	.234375	4
5	.18194	.220	.2070	.0202	.014	.212	.204	.21875	5
6	.16202	.203	.1920	.0215	.016	.192	.201	.203125	6
7	.14428	.180	.1770	.023	.018	.176	.199	.1875	7
8	.12849	.165	.1620	.0243	.020	.160	.197	.171875	8
9	.11443	.148	.1483	.0256	.022	.144	.194	.15625	9
10	.10189	.134	.1350	.027	.024	.128	.191	.140625	10
11	.090742	.120	.1205	.0284	.026	.116	.188	.125	11
12	.080808	.109	.1055	.0296	.029	.104	.185	.109375	12
13	.071961	.095	.0915	.0314	.031	.092	.182	.09375	13
14	.064084	.083	.0800	.0326	.033	.080	.180	.078125	14
15	.057068	.072	.0720	.0345	.035	.072	.178	.0703125	15
16	.05082	.065	.0625	.036	.037	.064	.175	.0625	16
17	.045257	.058	.0540	.0377	.039	.056	.172	.05625	17
18	.040303	.049	.0475	.0395	.041	.048	.168	.050	18
19	.03589	.042	.0410	.0414	.043	.040	.164	.04375	19
20	.031961	.035	.0348	.0434	.045	.036	.161	.0375	20
21	.028462	.032	.03175	.046	.047	.032	.157	.034375	21
22	.025347	.028	.0286	.0483	.049	.028	.155	.03125	22
23	.022571	.025	.0258	.051	.051	.024	.153	.028125	23
24	.0201	.022	.0230	.055	.055	.022	.151	.025	24
25	.0179	.020	.0204	.0586	.059	.020	.148	.021875	25
26	.01594	.018	.0181	.0626	.063	.018	.146	.01875	26
27	.014195	.016	.0173	.0658	.067	.0164	.143	.0171875	27
28	.012641	.014	.0162	.072	.071	.0149	.139	.015625	28
29	.011257	.013	.0150	.076	.075	.0136	.134	.0140625	29
30	.010025	.012	.0140	.080	.080	.0124	.127	.0125	30
31	.008928	.010	.0132	......	.085	.0116	.120	.0109375	31
32	.00795	.009	.0128	......	.090	.0108	.115	.01015625	32
33	.00708	.008	.0118	......	.095	.0100	.112	.009375	33
34	.006304	.007	.0104	......	......	.0092	.110	.00859375	34
35	.005614	.005	.0095	......	......	.0084	.108	.0078125	35
36	.005	.004	.0090	......	......	.0076	.106	.00703125	36
37	.004453	......	......	......	......	.0068	.103	.006640625	37
38	.003965	......	......	......	......	.0060	.101	.00625	38
39	.003531	......	......	......	......	.0052	.099	......	39
40	.003144	......	......	......	......	.0048	.097	......	40



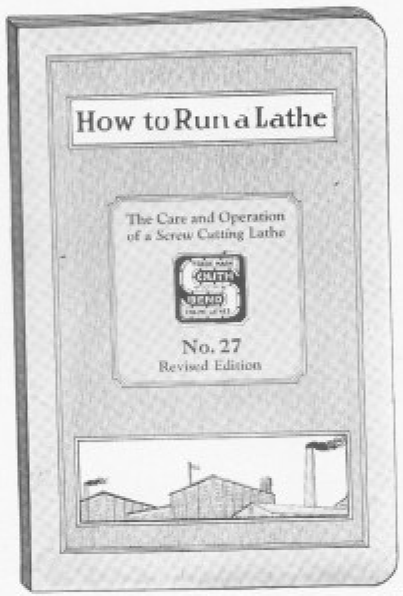
How to Read a Micrometer

The pitch of the screw threads on the concealed part of the spindle is forty to an inch. One complete revolution of the spindle, therefore, moves it lengthwise one fortieth (or twenty-five thousandths) of an inch. The sleeve D is marked with forty lines to the inch, corresponding to the number of threads on the spindle.

Each vertical line indicates a distance of one-fortieth of an inch. Every fourth line is made longer than the others, and is numbered 0, 1, 2, 3, etc. Each numbered line indicates a distance of four times one-fortieth of an inch, or one tenth.

The beveled edge of the thimble is marked in twenty-five divisions, and every fifth line is numbered, from 0 to 25. Rotating the thimble from one of these marks to the next moves the spindle longitudinally one twenty-fifth of twenty-five thousandths, or one thousandth of an inch. Rotating it two divisions indicates two thousandths, etc. Twenty-five divisions will indicate a complete revolution, .025 or one-fortieth of an inch.

To read the micrometer, therefore, multiply the number of vertical divisions visible on the sleeve by twenty-five and add the number of divisions on the bevel of the thimble, from 0 to the line which coincides with the horizontal line on the sleeve. For example, in the engraving, there are seven divisions visible on the sleeve. Multiply this number by twenty-five, and add the number of divisions shown on the bevel of the thimble, 3. The micrometer is open one hundred and seventy-eight thousandths. ($7 \times 25 = 175 + 3 = 178$.)



"How to Run a Lathe"

Authoritative Manual on Lathe Work

"How to Run a Lathe" is an authoritative manual covering the fundamental operations of the modern back geared screw cutting lathe. This 144-page book contains more than 300 practical views illustrating and describing the care and operation of the lathe and the use of various attachments. It is a valuable reference book for the mechanic.

It contains complete instructions on setting up the lathe, how to grind and set tools, the proper cutting feeds and speeds for machining metals, the cutting of screw threads, the various sizes and types of lathe dogs and their application, also the mounting of work on the different types of mandrels and numerous other important subjects that the mechanic has occasion to refer to. A copy of this book is included with the equipment of each New Model South Bend Lathe.

Price, each, 25 cents. Mailed postpaid anywhere in the world. Coin or stamps of any country accepted.

Partial List of Contents

Care of the Lathe—
Cleaning, Oiling, Adjusting, Leveling, etc.

Application of Lathe Tools—
Turning, Facing, Threading, Forming, etc.

Grinding Lathe Tools—
Clearance, Rake and Angle for Cast Iron, Soft Steel, Tool Steel, Brass, etc.

Setting Lathe Tools—
Height, Angle, etc., for various metals.

Cutting Speed of Metals—
Cast Iron, Steel, Brass, etc.

Centering—
Locating and Countersinking Centers, Center Drills, Countersinks, etc.

Care of Lathe Centers—
Hard and Soft Centers, Alignment of Centers, Truing Centers.

Machining on Centers—
Turning and Facing, Rough and Finish Turning, Use of Follower Rest and Center Rest.

Drilling in the Lathe—
3-Jaw Universal Lathe Chuck, Drill Chuck in Head Stock Spindle, in Tail Stock Spindle. Drill held on Tail Stock Center.

Grinding of Drills—Proper Angle, etc.

Thread Cutting—
U. S. Standard Threads, Acme Standard, Square Threads, External and Internal Threads, Multiple Threads, Right and Left Hand Threads, etc.

Taper Turning and Taper Boring—
Using Tail Stock Set-over, Taper Attachment, Compound Rest.

Chucking—
Showing application of Independent Chucks, Universal Chucks, Combination Chucks and Drill Chucks. Truing work in Chuck. Holding work for turning, boring and threading in the Chuck.

Face Plate Work—
Face Plate used as a Driver. Centering work on Face Plate. Face Plate used as a Chuck. Angle Iron on Face Plate.

Draw-in Collet Chuck Attachment—
Use in production on small accurate work.

Tool-Room Lathes—
Showing application of the Taper Attachment, Thread Dial, Draw-in Chuck, Oil Pan, Oil Pump.

The Lathe as a Screw Machine—
Showing the use of the Tool Post Turret, Saddle Turret, Turnstile Turret, Hand Lever Turret, Hand closing Lever for Draw-in Chuck.

Milling Operations in the Lathe—
Keyseating, Facing, Squaring a Shaft, etc.

Grinding in the Lathe—
Internal and External Grinder, Electric Grinder, Belt Driven Grinder.

Miscellaneous Lathe Operations—
Illustrated and described.

A Valuable Reference Book

South Bend Catalog No. 89-A

Complete Information on South Bend Lathes

Our new General Catalog, No. 89-A, illustrates, describes and prices the entire line of New Model South Bend Back Geared Screw Cutting Lathes from 9-inch swing to 24-inch swing, Countershaft and Motor Drive. Each size is described with its features and specifications.

A full line of Attachments, Chucks, Tools and Accessories for use on South Bend Lathes are also shown.

This catalog has 72 pages with more than 300 illustrations. It is a reference book of considerable value to anyone who is interested in mechanical equipment.

Mailed Anywhere in the World, Postpaid, No Charge

PARTIAL LIST OF CONTENTS

Quick Change Gear Lathes
Standard Change Gear Lathes
Tool Room Precision Lathes
Gap Bed Lathes
Brake Drum Lathes
Taper Attachment
Grinding Attachment
Silent Chain Motor Driven Lathes
Self-Contained Motor Driven Lathes
Simplex Motor Driven Lathes
Junior Bench and Floor Leg Lathes
Draw-in Collet Chuck Attachment
Milling and Keyway Cutting Attachment
Chucks, Tools and Accessories

9-inch Junior Lathe Catalog No. 23

A Popular Lathe for Small Work

The 9-inch Junior Lathe Catalog is a 20-page booklet, illustrating and describing the 9-inch Junior New Model Lathe. Each type of 9-inch Junior Lathe is shown and explained in detail. An interesting booklet for the shop owner who needs a small back geared screw cutting lathe. The illustrations tell the story a hundred times better than words.

The Attachments, Chucks, Tools and Accessories practical for use on the 9-inch Junior Lathe are also shown with descriptions and prices.

The use of the small screw cutting lathe is explained and illustrated; special equipment for production work is shown; also a variety of operations that come up in every shop. Many other interesting items are given.

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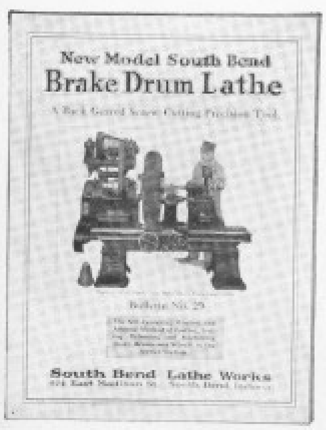

Brake Drum Bulletin No. 29

Revolutionizes Old Methods of Truing Brake Drums

Here is a booklet that every automobile mechanic will be interested in. It shows the New Model South Bend Brake Drum Lathe in three sizes and two types of drive, with features, specifications and prices of each.

Self-Centering Mandrels and Universal Bearing Adapters for mounting wheels, are illustrated and described in detail. Automobiles, trucks and buses are listed with the correct sizes of mandrels and adapters to use.

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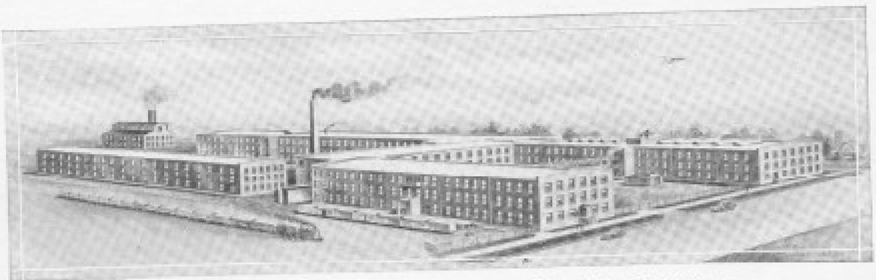
PARTIAL LIST OF CONTENTS

Brake Drum Lathe in Three Sizes
Self-Centering Mandrels
Universal Bearing Adapters
List of Mandrel and Adapter Sizes for Automobiles, Trucks and Buses
Balancing Wheels
Chuck and Tool Assortment
Machining Flywheels
Fitting Ring Gears
Brake Drum Lathe Utility Jobs
Blue Prints of Jobs
Taper Mandrels for Rear Wheels
Brake Drum Machining Time
General Brake Drum Information



Plant of the South Bend Lathe Works, at South Bend, Indiana

Facts About the South Bend Lathe Works

The South Bend Lathe Works was established at South Bend, Indiana, in 1906. For twenty-two years the entire plant has been devoted exclusively to the manufacture of South Bend Back Geared Screw Cutting Lathes. There are now over 43,000 South Bend Lathes in use in shops and various industries throughout the United States and 78 other countries.

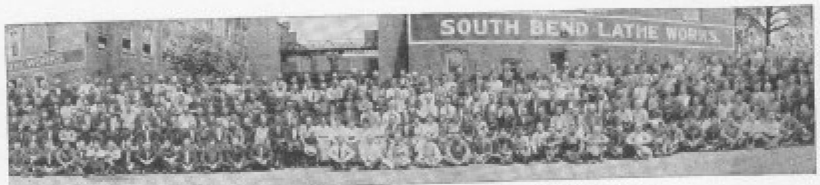
The Factory of the South Bend Lathe Works represents an investment of more than one million dollars. The plant facilities include the best modern machine and tool equipment to insure accuracy and interchangeability of parts. We build 96 sizes, types and drives of New Model South Bend Lathes. The annual production capacity is 4,800 lathes.

Lathes on Production Work in Our Factory

The above illustration shows a group of sixteen South Bend Lathes operating in our factory. These and other special manufacturing machines built in our shop insure accuracy and precision in all New Model South Bend Lathes.

Lathes in Assembly Line Ready for Testing

This illustration shows the assembly room where the lathes are assembled from the units in lots of twenty-five. They are afterward tested for accuracy and records of these tests are kept in our office for future reference.



A Group of Employees of the South Bend Lathe Works

For The Apprentice

1. Learn to use precision gauges. Use your micrometers frequently.
2. Use machine methods, not hand methods, when on accurate work.
3. Take an interest in your job—don't feel that you are forced to work.
4. Be sure your machine is set up right before starting the work.
5. Keep the belts tight, smoothly laced, and free from oil.
6. Hold yourself responsible for the job you are working on.
7. Have a place for everything and keep everything in its place.
8. If you have spoiled a job, report to your foreman, and don't offer excuses.
9. Keep your tools sharp, your machines clean and neat, and your shop tidy.
10. Don't borrow tools—have your own kit and take pride in it.
11. Do your work in such a manner that you will become known as a skilled mechanic.
12. Learn the "why" of the internal combustion or gasoline engine—it will be of practical help in servicing its parts.
13. Read the best technical magazines relating to automotive construction and repair service.
14. The automobile and airplane motors are precision machines and their efficient operation demands precision service. If you learn to become a skilled workman you have a future.
15. Henry Ford, Westinghouse, the Wright Brothers, and thousands of others all started out as mechanics—they forged ahead because they excelled in their chosen work.

SOUTH BEND LATHE WORKS
666 E. Madison Street
SOUTH BEND, INDIANA, U. S. A.

TRADE MARK
SOUTH
TWINS
BEND
ENGINE LATHES

Printed in U. S. A.