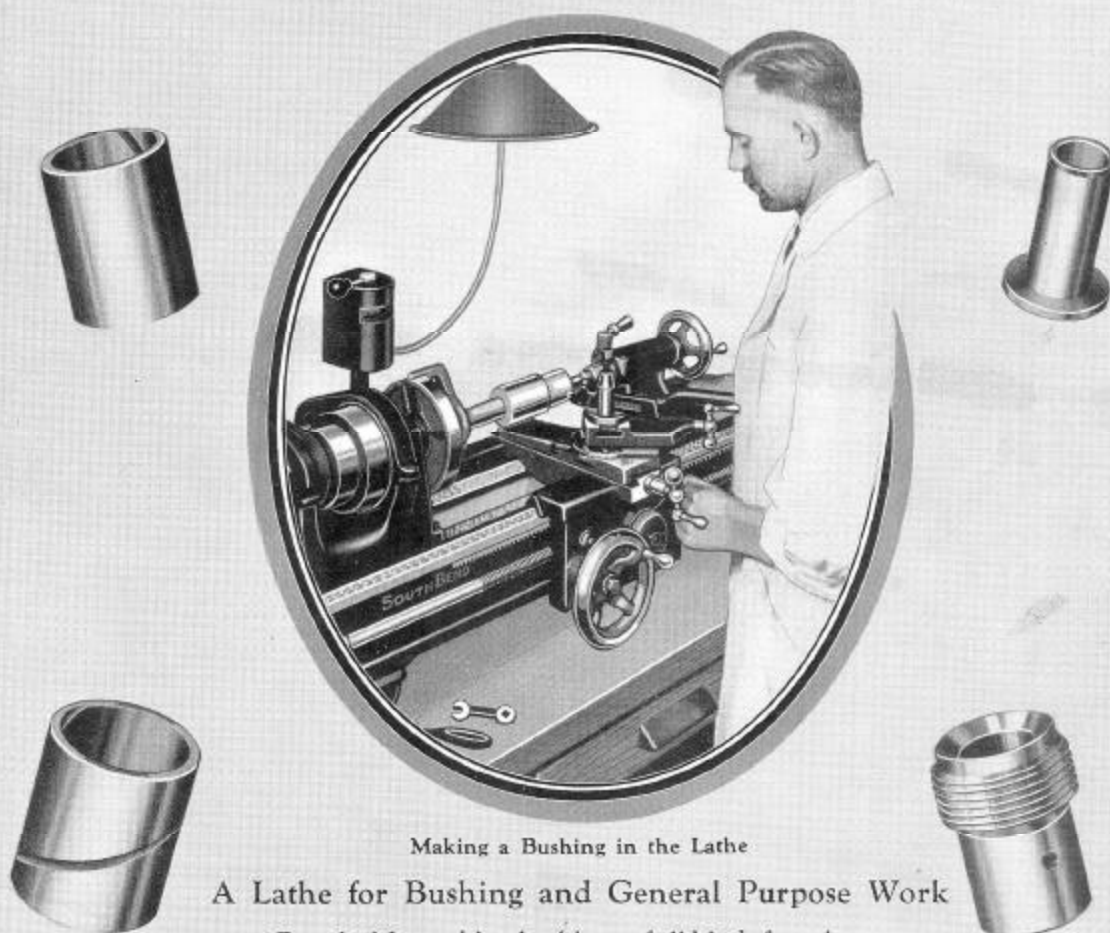


Bulletin No. 7
How to Make Bushings
IN THE
Auto Repair and Electrical Shop



Making a Bushing in the Lathe

A Lathe for Bushing and General Purpose Work

Practical for making bushings of all kinds from bronze, brass, steel, cast iron, fibre, aluminum, bakelite, etc., and of any size or shape required.

In addition to outlining the latest shop practice and equipment used in modern auto repair shops for making replacement bushings, this bulletin also shows the application of the lathe for servicing armatures, valves, pistons, connecting rods and for tool and machine work.

South Bend Lathe Works

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

Lathe Builders for 26 Years . . . More than 55,000 Users

-- 1937

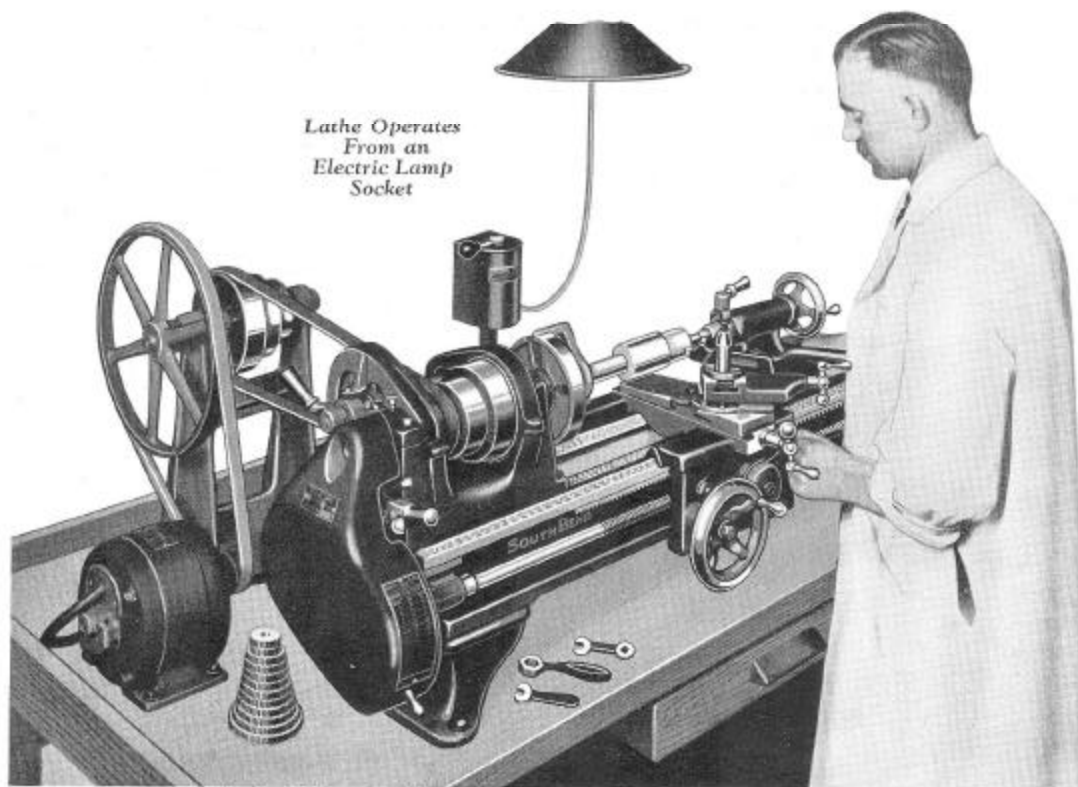


Fig. 1. Making a Bushing in the New 9-inch Junior South Bend Lathe

How to Make Bushings in the Auto Repair Shop

On the New 9-inch Junior South Bend Lathe



Fig. 2. King Pin Bushing.

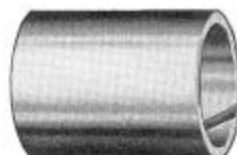


Fig. 3. Wrist Pin Bushing.



Fig. 4. Starter Switch Bushing.



Fig. 5. Water Pump Bushing.

The illustration above shows the New 9-inch Junior South Bend Lathe set up and in operation making a bushing for an automobile generator. This lathe is practical for making all sizes and types of bushings and sleeve bearings for automobiles, buses, trucks, tractors, motors, generators, stationary engines, aircraft and machinery equipment of all kinds.

All materials from which bushings are made can be machined successfully in the lathe, for example, bronze, brass, steel, cast iron, fibre, bakelite etc. Hardened bushings can be ground in the lathe by using an electric grinding attachment as shown in illustration Fig. 13 on page 3.

The methods of bushing servicing described in this bulletin assure accuracy in the finished bushing, as the inner bearing surface will be perfectly concentric with the outer bearing surface. This produces an accurate smooth running fit when the bushing is re-assembled in the engine, machine, motor, or generator.

Making bushings is more economical than carrying stocks of finished bushings. An enormous investment would be required in any shop to maintain an adequate stock of purchased bushings. However, with a few dollars worth of brass, bronze and steel, the shop that is equipped with a lathe is prepared for any emergency.

Important Bushings that Can Be Made On the Lathe

Starter Motor Bushings
Wrist Pin Bushings
Valve Stem Guide Bushings
Valve Rocker Arm Bushings
Fan Shaft Bushings
Packing Glands

Brake Control Lever Bushings
Cam Shaft Bushings
Valve Tappet Guide Bushings
Steering Arm Bushings
Pump Bushings
Brake Shoe Cam Roller

Spring Shackle Bushings
King Pin Bushings
Drive Shaft Bushings
Steering Gear Eccentric Adjusting Bushings
Miscellaneous Bushings, all types



Fig. 6. Making a Bushing Complete in One Set-up in the Lathe Without Removing from the Chuck.



Fig. 7. Center Drilling Bushing to Start Large Drill Straight when Drilling Hole.

Making New and Replacement Bushings and Bearings

Using the New 9-inch Junior South Bend Lathe

Bushing stock for making bushings is mounted in the lathe by three different methods: (1) In a 4-Jaw Independent Chuck. (2) In a 3-Jaw Universal Chuck. (3) On a mandrel between the lathe centers. The lathe is arranged so that chucks of various kinds can be mounted for holding bar stock, tubing, etc.

The material from which bushings are made may be purchased in the form of solid bars, tubing, cored bars, castings, or moulded forms of brass, bronze, steel, iron, fibre and bakelite. Salvaged parts may also be used and cut down to the proper size. Listed below are several popular size bars and tubes we can supply to the shop doing its own bushing servicing.

The operations of making a bushing are essentially the same regardless of the size or kind of material used. Dimensions and specifications of the length, bore, diameter, threads, etc., will vary for each bushing, but the method remains the same. No special equipment for doing the work is needed as the lathe with chuck and tools are all that is required.

Complete instructions for performing the operations required on bushings are contained in Manual No. 7, "How to Make Bushings," described on page 5.

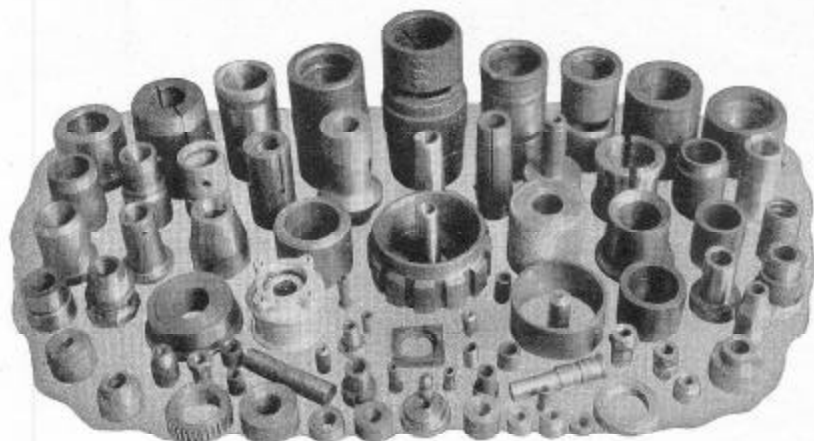


Fig. 8. Various Types of Bushings That Can Be Made in the Lathe.

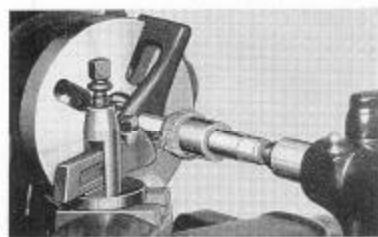


Fig. 12. Cutting a Screw Thread on a Replacement Water Pump Bushing.



Fig. 13. Grinding a Hardened Steel Bushing Mounted on a Mandrel.

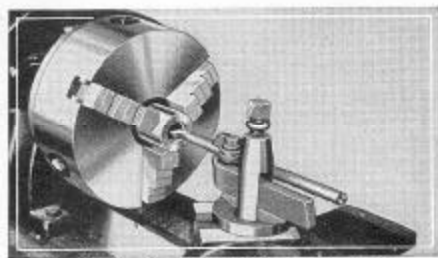


Fig. 9. Boring the Hole in the Bushing.

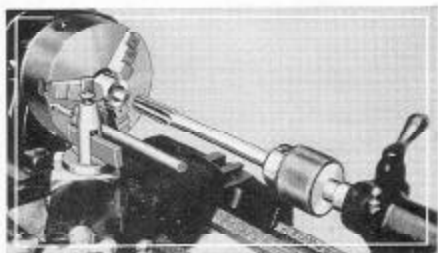


Fig. 10. Reaming the Hole to Size.



Fig. 11. Facing the End of the Bushing.

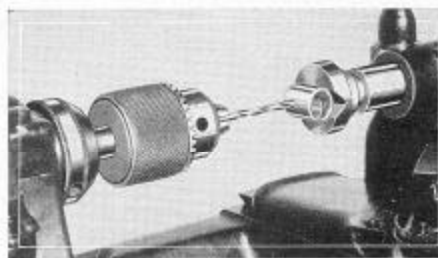


Fig. 14. Drilling Oil Hole in Bushing. Using Crotch Center in Tailstock.



Fig. 15. Hardened Steel Mandrels

These mandrels are slightly tapered and may be pressed or driven into any work with a standard diameter hole. Made of good quality steel, properly hardened and ground true to centers. Center holes are large size and are countersunk to prevent damage.

Prices of Hardened and Ground Steel Mandrels

Diameter Inches	Length Inches	Cat. No.	Price Each	Diameter Inches	Length Inches	Cat. No.	Price Each
3/4	3 1/4	519-A	\$0.80	1 1/2	6 1/2	519-K	\$1.85
3/8	4	519-B	.90	1 3/8	6 3/4	519-L	2.00
3/8	4 1/2	519-C	1.00	1	7	519-M	2.15
3/8	4 3/4	519-D	1.10	1 1/8	7 1/4	519-N	2.30
3/8	5	519-E	1.20	1 1/4	7 1/2	519-O	2.45
3/8	5 1/4	519-F	1.30	1 1/2	7 3/4	519-P	2.60
3/8	5 1/2	519-G	1.40	1 3/4	8	519-Q	2.80
3/8	5 3/4	519-H	1.50	1 7/8	8 1/2	519-R	3.00
3/8	6	519-I	1.60	2	8 3/4	519-S	3.25
3/8	6 1/4	519-J	1.70	2 1/8	9	519-T	3.75

Bronze Bushing Stock

For the convenience of our customers we supply the best quality bronze bushing stock. Bars come either solid or with a cored hole according to specifications given in the tabulation below at the right.

The market price of bronze varies from time to time, and the price quoted below is subject to change without notice.

The standard length for bronze bushing stock is 12-inches. An extra charge of 25 cents is made for sawing each piece, if shorter lengths are ordered.

Bronze Bushing Stock. Price per lb., f. o. b. South Bend, Indiana. \$0.40



Fig. 16. Bronze Bushing Stock in 12-inch Bars.

Average Weight of Bronze Bushing Stock

Size Bar, Inches	1x12	1 1/4x12	1 1/2x12	2x12	2 1/2x12
Weight Solid, Pounds	3	4 3/4	6 3/4	11 3/4	18 3/4
Size Cored Hole, Inches	3/4	3/8	3/4	1	1 1/4
Weight Cored, Pounds	2 3/4	3 1/2	5	8 3/4	13 3/4

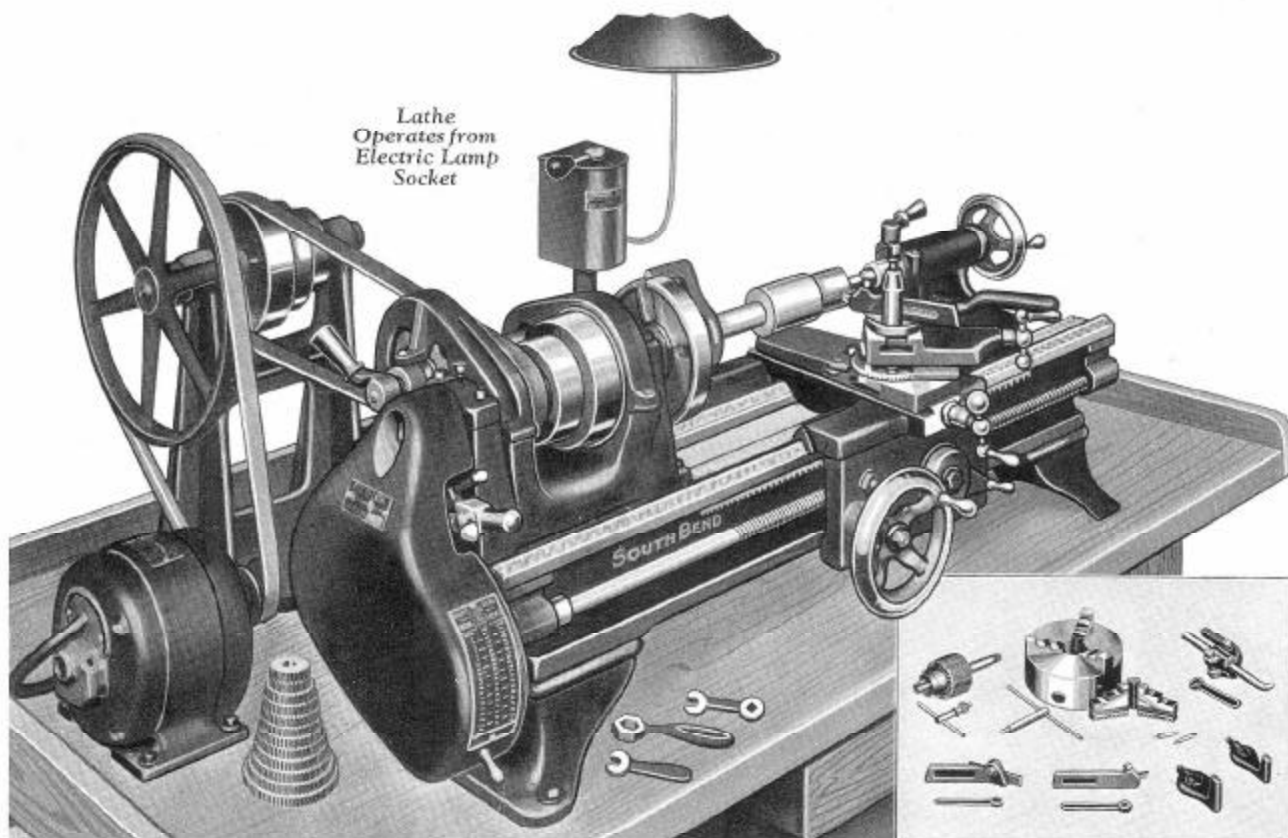


Fig. 17. The New 9-in. x 3-ft. Junior South Bend Lathe in Operation Making a Replacement Bushing. Small Illustration Shows the Bushing Servicing Equipment for Lathe as Listed and Priced Below.

The New 9-inch Junior South Bend Motor Driven Lathe

A Universal Tool for the Automotive Repair Shop

The New 9-inch Junior South Bend Lathe illustrated above can be used for making replacement bushings of all sizes and types and of any material such as bronze, brass, steel, etc. This is the same lathe that is illustrated and described on page 2 and is used in handling all of the jobs shown throughout this bulletin. This lathe has the power to reduce the diameter of a steel shaft $\frac{1}{4}$ -inch in one cut.

Regular Lathe Equipment included in the price of the New 9-inch Junior South Bend Lathe consists of: V-belt countershaft as shown above (for use on bench, wall or ceiling); graduated compound rest; face plate; tool post; ring and wedge; two 60° lathe centers; spindle sleeve; change gears for screw thread cutting and automatic longitudinal screw feed to carriage; wrenches; lag screws; washers; installation plan; book, "How to Run a Lathe;" and Manual No. 7, "How to Make Bushings." Bench for lathe is extra.

Bushing Servicing Equipment priced in the tabulation at right includes the attachments and accessories required for doing the bushing servicing operations shown in this bulletin, such as chucking, turning, boring, threading, etc. Prices are itemized so that the equipment wanted can be selected and the accessories and tools not wanted may be eliminated.

Screw Thread Cutting. The 9-inch Junior Lathe is supplied with a set of independent change gears which provide for cutting standard screw threads from 4 to 40 per inch, right or left-hand, including 11½ pipe thread. A metal index chart as illustrated at right is attached to the lathe and shows the screw threads obtainable.

SCREW THREAD CUTTING CHART			
GEARS FOR NEW FEED LATHE			
THREAD PER INCH	STOCK DIA.	NEW DIA.	NEW DIA.
4	64	32	64
5	64	32	64
6	64	32	64
7	64	32	64
8	32	32	32
9	32	32	32
10	32	32	32
11	32	32	32
11½	32	32	32
12	32	32	32
13	32	32	32
14	32	32	32
15	32	32	32
16	32	32	32
18	32	32	32
20	32	32	32
22	16	44	44
24	16	40	40
26	16	52	52
28	16	56	56
30	16	60	60
32	16	64	64
36	16	72	72
40	16	80	80

Metal Index Chart on 9-inch Lathe.

Mechanical Features and Specifications of the New 9-inch Junior Lathe are described and listed at the bottom of the following page.

Price of 9-inch Lathe and Motor Drive Equipment

1—9-in. x 3-ft. Junior South Bend, Screw Cutting Bench Lathe complete with graduated compound rest, V-belt countershaft (for bench, wall or ceiling) and other regular lathe equipment as listed at left. No. 422-Y. Distance between centers, 16½". Shipping weight crated, 375 lbs. Price f.o.b. factory.....\$164.00*

Motor Drive Equipment for 9-inch Lathe

1—¼ H.P. Motor, Start-and-Stop split-phase reversing type, 1725 R.P.M. (1-phase, 60-cycle, A.C. 110-volt).....\$10.00
 1—V-Groove Pulley for ½-inch motor shaft......50
 1—V-Belt, motor to drive unit......75
 1—Reversing Switch (drum type).....5.00
 1—Stand for supporting reversing switch.....1.50
 1—Flat Leather Belt (1¼" x 53") countershaft to lathe...1.15 18.90
Total Price of 9-inch Lathe and Motor Drive Equipment...\$182.90

Price, Bushing Service Equipment for 9-inch Lathe

1—3-Jaw Universal Lathe Chuck, 5" capacity, fitted to lathe. No. 741.....\$26.50
 1—3-Jaw Drill Chuck, ½" capacity, with arbor fitted to lathe. No. 326.....5.85
 1—Right-hand Cutting-off Tool with cutter. No. 881-R...2.35
 1—Straight Shank Turning Tool with cutter. No. 849-S...2.20
 1—Boring Tool, Style "D," with ¼" bar. No. 505-A....2.50
 2—Lathe Dogs, ½", No. 2-M; and 1", No. 6-M.....1.20
 2—Comb. Center Drills and Countersinks. No. 898-B...40 \$41.00

*Prices of the 9-inch Junior Lathe with Longer Bed Lengths. For price of 9-inch lathe with 3½' bed add \$6.00 to above price of lathe; for lathe with 4' bed add \$13.00; for lathe with 4½' bed add \$21.00. Distance Between Centers: 9" x 3½' Lathe, 21½"; 9" x 4' lathe, 27½"; 9" x 4½' lathe, 34½". Shipping Weight of Lathe Crated: 9" x 3½' lathe, 400 lbs.; 9" x 4' lathe, 425 lbs.; 9" x 4½' lathe, 450 lbs.

For lathe with floor legs instead of bench legs, add \$10.00 to above price of lathe.

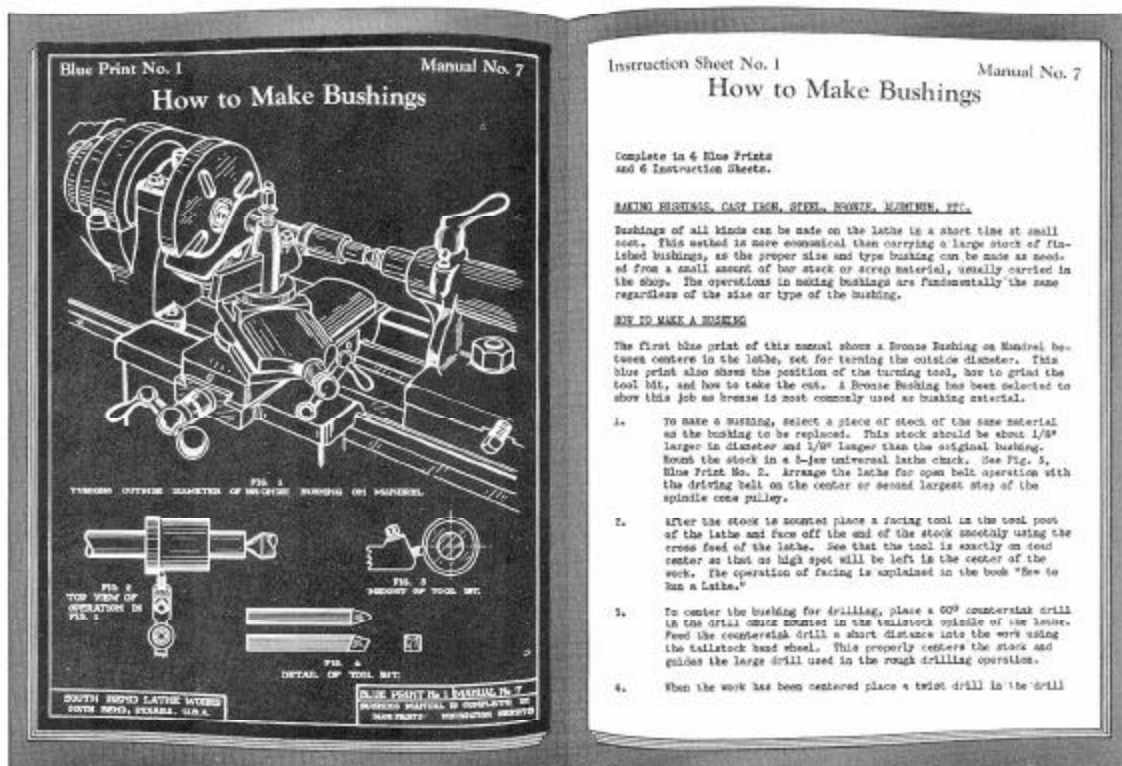


Fig. 18. The Illustration Shows Manual No. 7, "How to Make Bushings." This Manual Contains 4 Blue Prints, 8 1/2" x 11", and 6 Instruction Sheets, 8 1/2" x 11".

Instruction Manual Shows How to Make Bushings Of Various Sizes and Types from Bronze, Steel, Cast Iron, etc.

Job Instruction Manual No. 7, "How to Make Bushings," as illustrated above consists of 4 blue prints and 6 typewritten job instruction sheets, 8 1/2" x 11". The blue prints illustrate the various operations described in the job instruction sheets and show how to set up the lathe for doing all the various bushing jobs described in this bulletin.

In addition to this manual on bushing servicing, we publish ten additional manuals on other automotive service jobs which can be handled in the lathe. Write for list of manuals.

Instruction Manual No. 7, "How to Make Bushings," bound in a heavy serviceable cover is included free of charge with every South Bend Bushing Lathe. To non-users of these lathes, the price is \$1.00 per copy, mailed postpaid, to any address.

Reference Book, "How to Run a Lathe," as illustrated and described on page 8, and an instruction manual on "Grinding Lathe Tools" are also supplied free with the 9-inch Lathe.

Bushing Service Manual No. 7 Shows How to Do All the Following Jobs:

- How to make bushings of bronze, steel, cast iron, aluminum, etc., in the lathe.
- How to set up the lathe for machining bushings.
- How to drill, bore and ream bushings.
- How to finish the diameter and ends of bushing.
- How to make a short bushing complete in one set-up in a 4-Jaw Independent chuck.
- How to cut screw threads on bushings.
- How to make a bushing in a 3-Jaw chuck.
- How to make a bushing on a mandrel.
- How to file and polish a bushing.
- How to lap the hole in hardened bushings.
- How to chamfer a bushing.
- How to drill an oil hole in bushing.

Features and Specifications of the 9-inch Junior South Bend Lathe A Back-Geared, Screw Cutting Precision Lathe for the Auto Repair Shop

Back-Geared Headstock is hand-scraped to bed, has three-step cone and takes 1 1/4-inch belt. Six changes of spindle speeds are provided, three direct and three back-geared, ranging from 39 to 596 R.P.M. Headstock has quick acting wrenchless bull gear lock and spring latch reverse for feeds and threads.

Headstock Spindle is made of special alloy steel, finish ground, has 3/4" hole its entire length. Collet capacity 1/64" to 1/2". Size of spindle nose 1 1/2" diam., 8 threads. Lathe centers are No. 2 Morse Taper.

Headstock Bearings are phosphor bronze, line bored and lapped to a perfect bearing and are adjustable for wear. An improved oiling system lubricates bearings.

Saddle of carriage is strong and has a wide bridge. The carriage has long hand-scraped bearing surfaces on front and rear V-ways of bed and is provided with an adjustable gib. A locking device is provided for facing and cutting-off work. The cross feed screw has a micrometer collar graduated in thousandths of an inch.

Compound Rest is graduated to 180 degrees, swivels to any angle and has an angular travel of 1 3/4". The compound rest screw is fitted with a micrometer collar graduated in thousandths of an inch. The slide is hand-scraped and has an adjustable gib. A forged steel tool post is provided and takes tool holder shank 11/32" x 13/16" for cutters 1/4" x 1/4".

Tailstock is hand-scraped to bed; has set-over for taper turning; graduated spindle; improved spindle lock; self-ejecting center.

Precision Lead Screw, 3/4" diameter, eight Acme threads per inch, for cutting accurate screw threads and for automatic longitudinal geared screw feed to carriage.

Lathe Bed is 50% steel, heavily constructed and reinforced by box braces. Three V-ways and one flat way accurately planed and hand-scraped, align and support headstock, carriage and tailstock.

Automatic Feed. The 9-inch lathe has automatic longitudinal geared screw feed to carriage and provides a wide range of feeds from fine to coarse. Automatic feeds are obtained by clamping the half-nuts on the lead screw.

V-Belt Countershaft furnished with lathe can be supplied for mounting on bench, wall or ceiling. Bench mounting type is furnished unless otherwise specified.

Motor for the lathe is suitable for 1-phase, 60-cycle, A.C. If direct current motor is wanted, add \$13.00 to the price of the motor as quoted in Motor Drive Equipment on page 4.

When Ordering specify current, voltage, phase, cycle and number of wires. Do not specify 110-220-volt motor, as we cannot furnish motors with double voltage rating.

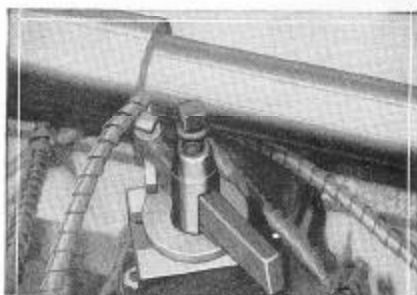


Fig. 19. Reducing the Diameter of a Steel Shaft $\frac{1}{2}$ in. in one cut.

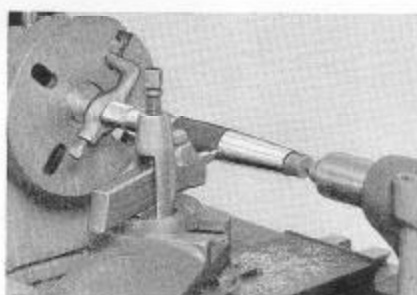


Fig. 20. Turning a Taper on an Axle Shaft with Tailstock Set Over.



Fig. 21. Testing and Straightening a Bent Armature Shaft in the Lathe.

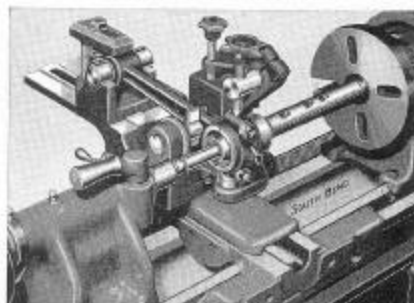


Fig. 25. Boring a Rebabitted Connecting Rod in the Lathe.

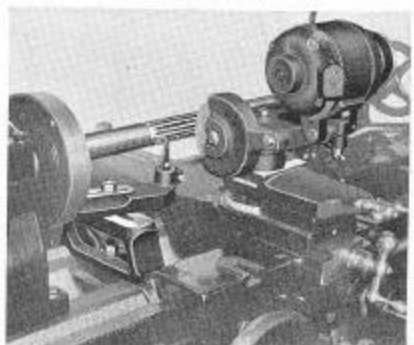


Fig. 27. Sharpening a Straight Reamer using a Grinding Attachment on the Lathe.



Fig. 29. Lathe used as Drill Press for Drilling Hole in Flat Piece of Work.



Fig. 31. Lathe is Practical for Filing, and Polishing Bushings, Shafts, Parts, etc.

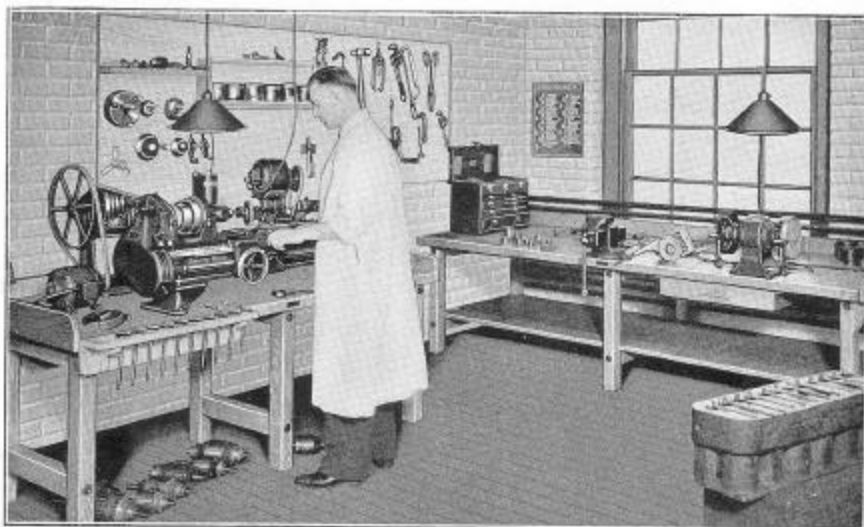


Fig. 37. The No. 9 Auto Service Shop Equipped with Lathe and Equipment for Servicing Bushings, Armatures, Valves, Pistons, Connecting Rods, etc.

The No. 9 Automotive Service Shop

For Small Service and Repair Jobs on the Automobile, Truck and Bus

The Completely Equipped Shop. The auto service shop illustrated above is completely equipped for small service and repair jobs on the automobile, truck and bus. The lathe shown is the 9-in. x 3-ft. Junior South Bend Lathe, as illustrated and described on pages 2 and 4 of this bulletin. In addition to the lathe, the shop has the equipment for making bushings as itemized on page 4, also the equipments for servicing armatures, valves, pistons and connecting rods, as itemized and priced on page 7.

Shop Handles All These Jobs. All the jobs shown throughout this bulletin were handled on the 9-inch Junior Lathe as shown in the above shop. This lathe, in addition to making bushings, is practical for grinding and servicing valves, truing armature commutators, undercutting insulation, finishing pistons, cutting screw threads, drilling, boring, tapping, sharpening reamers of all kinds, making tools, reaming, and hundreds of other jobs.

Attachments May Be Added Later. The shop that intends to install the 9-inch Lathe need not buy all of the attachments and equipments at the time of its purchase. At any time later, after the lathe has been installed, attachments, tools and accessories for handling various classes of work may be added, when required.

Over 5,000 Auto Service Shops Equipped. The 9-inch Junior South Bend Back-Geared, Screw Cutting Lathe, illustrated in this bulletin, is the lathe that has become so popular in auto repair shops, garages, electrical shops and truck service shops. More than 5,000 automotive shops in the United States are using this lathe on auto service work.



Fig. 32. Finishing a Semi-Machined Cast Iron Piston Mounted on the Piston Adapter.

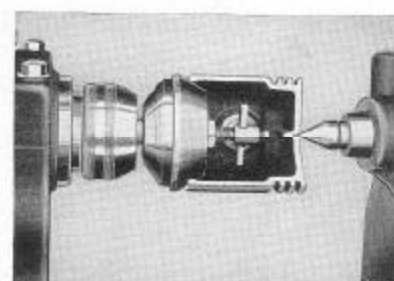


Fig. 33. Cross Section View showing Application of the Piston Adapter.

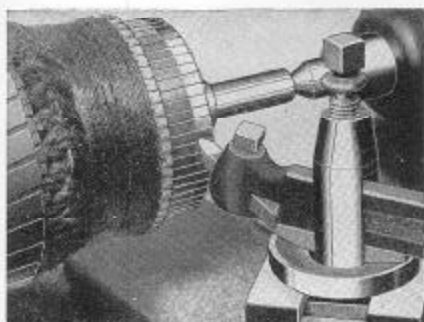


Fig. 22. Armature Commutators of Generators and Starting Motors are Accurately Trued.

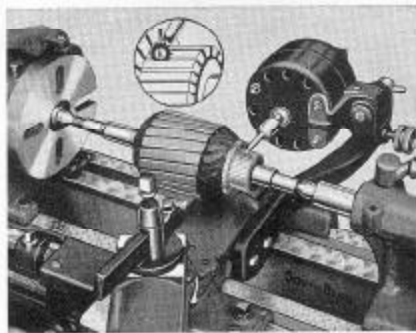


Fig. 23. Undercutting Insulation with Rotary Electric Undercutting Attachment.

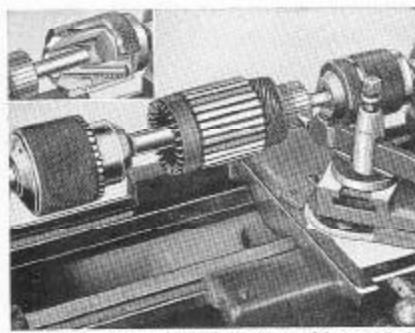


Fig. 24. Centerless Armature Mounted in Lathe using Tailstock Adjustable Bushing.

Equipments for Servicing Armatures, Valves, Pistons, and Connecting Rods in the 9-inch Lathe

Equipments for 9-inch Lathe. Below we list and price individual equipments consisting of chucks, tools and fixtures for servicing armatures, valves, pistons and connecting rods. These equipments may be fitted to the 9-inch Junior South Bend Lathe as illustrated and priced on page 4, and as shown in the No. 9 Automotive Service Shop on page 6.

Omit Items Not Wanted. All the equipments, attachments and accessories, or any combination of them may be ordered with the 9-inch Junior South Bend Lathe, also any item in the equipments can be eliminated if the shop has no use for them. The shop wishing to specialize in any one job can select the attachments and tools suitable for that work and eliminate the others.

Armature Commutator Truing Equipment for the 9" Lathe

1—Headstock Driving Chuck with Taper Arbor and Key for centerless armature shafts up to $\frac{3}{4}$ " diam., complete. No. 327.....	\$ 7.35	
1—Tailstock Adjustable Bushing for centerless armature shafts from $\frac{3}{8}$ " to $\frac{3}{4}$ " diam., with No. 2 Morse Taper Shank. No. 361-B.....	8.10	
1—Straight Shank Turning Tool with H. S. steel cutter. No. 849-S....	2.20*	
1—Electric Rotary Undercutter for 110-volt, 1-phase, A.C. current, complete with five cutters, assorted widths. No. 544-B.....	25.00	\$42.65

Valve Service Equipment for the 9" Lathe

1—Electric Grinder with $\frac{1}{4}$ H.P. Motor, 110-volt, A.C. 1725 R.P.M., switch, extension cord, Grinding Wheel $4" \times \frac{1}{2}"$, and V-belt. No. 14-B.....	\$50.00	
1—Precision Valve Chuck, $\frac{5}{8}"$ capacity, fitted to lathe. No. 907-A.....	9.00	
1—Diamond for truing grinding wheel. No. 406.....	4.50	
1—Diamond Holding Fixture. No. 91-B.....	2.25	
1—Holding Fixture and Spring Stop for reamer and cutter grinding. No. 19.....	8.00	
1—V-Block for holding valves when grinding end of stem. No. 545....	3.00	
1—Rocker Arm Grinding Fixture. No. 703.....	3.00	\$79.75

Piston Finishing Equipment for the 9" Lathe

1—Piston Adapter with driving Dog and No. 1-D Cone Ring for pistons $2\frac{1}{8}"$ to $3\frac{1}{8}"$ diam. No. 44-A.....	\$ 9.00	
1—Cone Ring for pistons $3\frac{1}{8}"$ to $3\frac{3}{4}"$ diam. No. 2-D.....	1.75	
1—Piston Skirt Reamer for pistons $2\frac{1}{8}"$ to $3\frac{1}{8}"$ diam. No. 1-R.....	6.00	
1—Piston Skirt Reamer for pistons $3\frac{1}{8}"$ to $3\frac{3}{4}"$ diam. No. 2-R.....	6.50	
1—Straight Shank Turning Tool with H.S. steel cutter. No. 849-S....	2.20*	\$25.45

Connecting Rod Boring Equipment for the 9" Lathe

1—Connecting Rod Boring Attachment consisting of holding jig, V-block and adjustable clamping device for connecting rods up to $11\frac{3}{4}"$ between centers and $4\frac{1}{8}"$ across bolt lugs. No. 1229.....	\$30.00	
1—Boring Bar with cutter bits for boring, facing, rounding, and turning outside of bearings from $1\frac{1}{4}"$ to $2\frac{1}{2}"$ diameter. No. 461-B; also Centering Cones and Driver for boring bar. No. 908.....	16.50	\$46.50

*These items appear in two or more equipment lists and need not be duplicated when ordering.

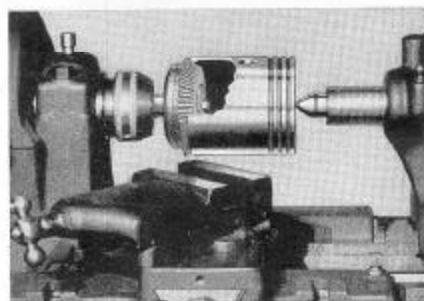


Fig. 34. Reaming the Skirt of a Piston, Reamer is held on Piston Adapter Shank.

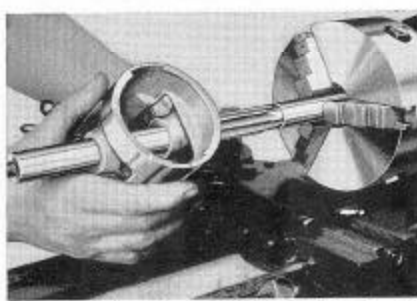


Fig. 35. Using Lathe as a Variable Speed Reamer Driver Reaming Wrist Pin Hole.

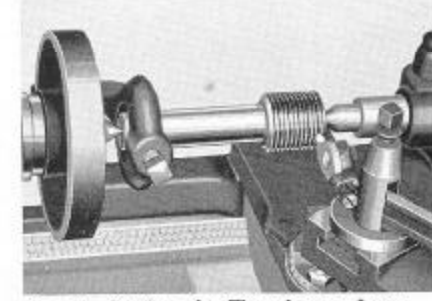


Fig. 36. Cutting the Thread on a Large Diameter Special Tap.

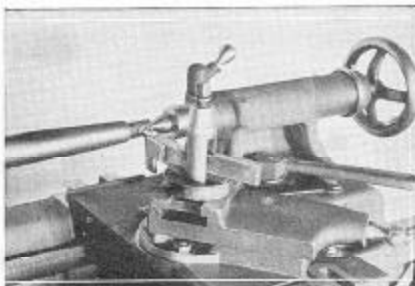


Fig. 26. Cutting a Screw Thread on an Axle, Screw Thread Range of Lathe, 4 to 40 per inch.

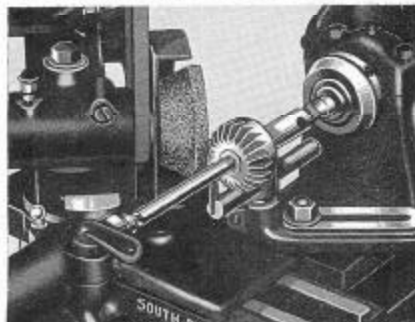


Fig. 28. Sharpening a Valve Seat Reamer using Holding Fixture with Spring Stop.



Fig. 30. Grinding a Valve Face in the Auto Shop Lathe, using Electric Valve Grinder.

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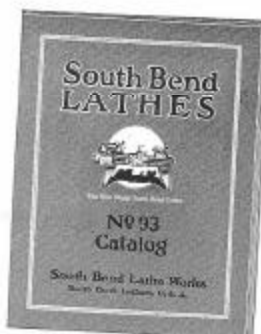
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If Total Price of Your Order Amounts to	Amount to Add for Financing	Amount of Down Payment	Payment Each Month	Approx. No. of Payments
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110.01 to 120.00	7.00	32.00	7.50	12
120.01 to 130.00	7.50	33.00	8.50	12
130.01 to 140.00	8.00	34.00	9.00	12
140.01 to 150.00	9.00	35.00	10.00	12
150.01 to 175.00	10.00	36.00	11.50	12
175.01 to 200.00	11.50	40.00	13.00	12
200.01 to 225.00	13.00	45.00	15.00	12
225.01 to 250.00	14.50	50.00	17.00	12
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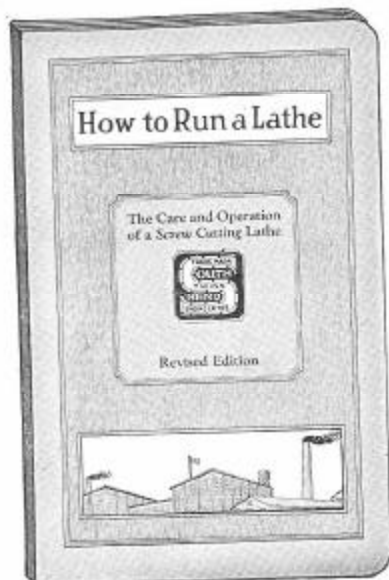
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