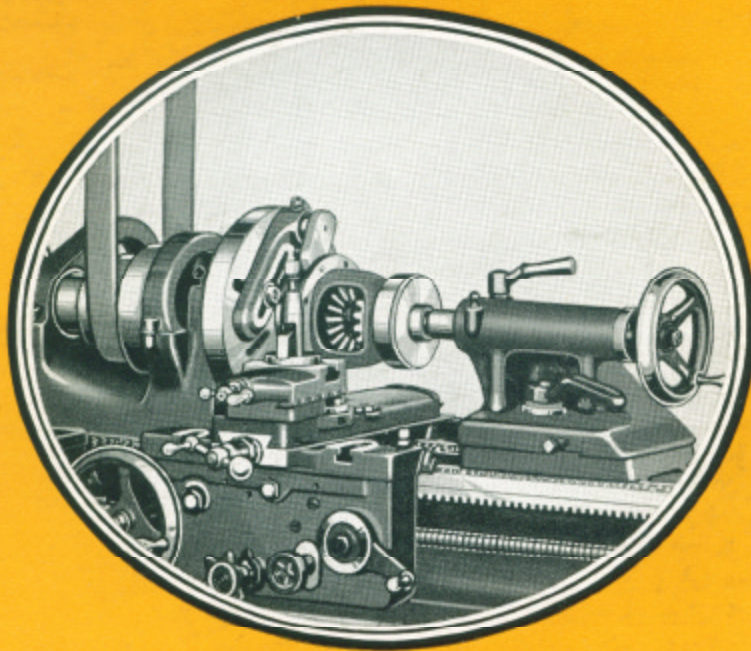


BULLETIN NO. 5-A

# How to Test and True Differentials



Price 10 Cents  
Postpaid to Any Address  
Coin or Stamps of Any Country Accepted

**SOUTH BEND LATHE WORKS**  
476 NILES AVE.      SOUTH BEND, INDIANA, U. S. A.

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## Differential Service

The most practical methods for testing and truing differential gear case flanges in the automotive service shop are outlined in this bulletin. Differential service not only requires precision machinery and equipment, but also correct methods and careful workmanship.

A back-geared screw cutting lathe is the most practical and convenient equipment for testing and truing the differential gear case flange. The lathe can also be used for testing the accuracy of the differential drive pinion and for checking the entire assembly after a new differential ring gear has been installed.

Differential service for popular models of automobiles can be handled on the 9-inch swing South Bend "Workshop" Lathe, which has sufficient capacity for testing and truing differential flanges up to 9 inches in diameter. The 11-inch and 13-inch South Bend Lathes have greater capacity and are recommended to shops specializing in heavy car, truck and bus service.

In addition to testing and truing differential gear case flanges, the lathe can be used for many other practical automotive service jobs, such as boring re-babbitted connecting rods, finishing semi-machined pistons, truing armature commutators, refacing valves, testing and straightening bent axle shafts, cutting right and left hand screw threads, etc.

Some auto mechanics believe they should have a special, single purpose machine for each important automotive service job, such as boring re-babbitted connecting rods, truing differential gear flanges, refacing valves, finishing pistons, truing differentials, etc. One lathe will take care of each of the various classes of automotive service work and will do the work better than it can be done on most single purpose machines. The cost of the lathe complete with necessary attachments and accessories is less than half the cost of single purpose machines for handling the same classes of work.

South Bend Lathe Works

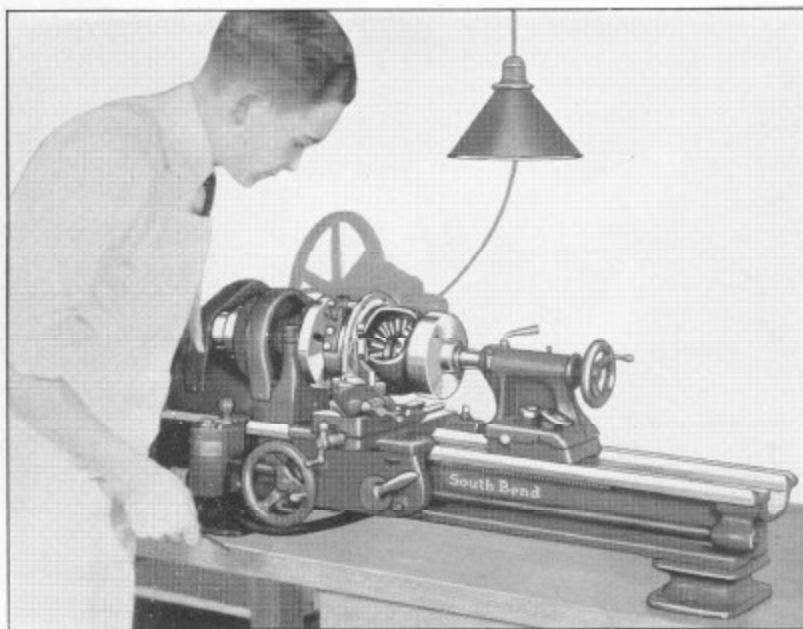


Fig. 1. Truing a differential gear case flange in a 9-inch South Bend Workshop Lathe.

## How to Test and True Differentials

### Precision Equipment Required for Satisfactory Service

The differential gear case flange should always be checked with precision equipment before replacing the differential ring gear and drive pinion because a variation of only a few thousandths in the alignment of the differential drive pinion and the differential ring gear is sufficient to cause an annoying noise, if not more serious trouble.

Differential replacement is usually the result of a broken tooth in the differential drive pinion or the differential ring gear, and the broken tooth often wedges between the two parts, springing the differential gear case flange out of square. For this reason, it is important that the differential gear case flange be tested for accuracy before the new gear is installed, and if found to be out-of-true, the flange must be machined.

Since the differential ring gear and pinion are always supplied in matched sets, it is necessary to replace both parts. If an old gear is used with a new pinion (or vice versa) quiet operation cannot be expected.

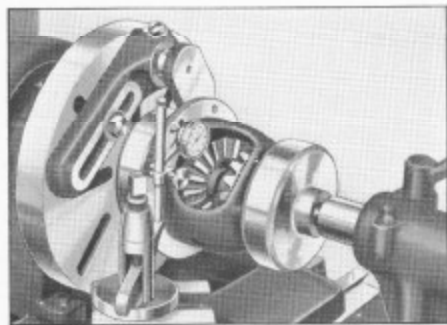


Fig. 2. Testing differential gear case flange with dial indicator.

### Dial Indicator Used to Test Flange

Fig. 2 at left shows how a dial indicator may be mounted in the tool post of the lathe for testing the accuracy of the differential gear case flange and determining whether or not the flange should be remachined.

The differential ring gear pilot should also be tested with the dial indicator to make sure that it runs true. Note that the differential gear case assembly is mounted on its own bearings.

The differential drive pinion may also be tested, as shown in Fig. 9, page 3.

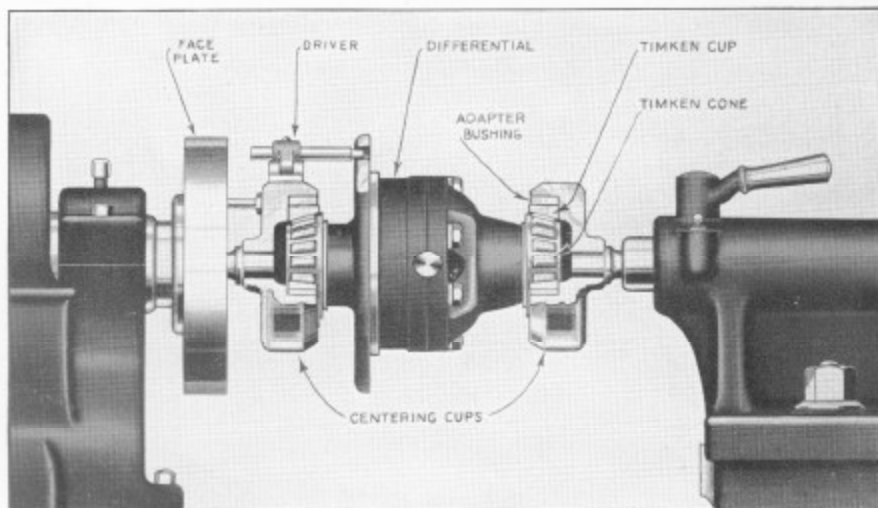


Fig. 3. Differential gear case mounted in lathe on its own bearings for testing and truing flange.

## How to Mount Differential Assembly in Lathe

### Special Adapters Locate Assembly from Bearings

Special adapters are fitted to the headstock spindle and the tailstock spindle of the lathe for mounting the differential assembly in the lathe, as shown in Fig. 3, above. These adapters are large cups with tapered shanks in which the bearings of the differential assembly are placed. Various sizes of adapter bushings placed inside of the centering cups are used for various sizes of bearings. Only four or five different sizes of bearings are used in various makes and models of automobiles, so only a few adapter bushings are required.

Since the differential assembly is mounted on its own bearings for testing and machining, the differential flange will run perfectly true when replaced in the axle. This will not be true if any other locating point is used for mounting the assembly in the lathe, and for this reason tapered cone or tapered cup centers should not be used in the lathe spindles for differential service.

When truing the differential gear case flange, it should be driven from one of the bolt holes, as shown in Fig. 3 above, and also in Fig. 4 below. The lathe tool cutter bit should be sharpened with a narrow point and set approximately on center, as shown in Fig. 4. Remove only a sufficient amount of metal to obtain a smooth, accurate surface.

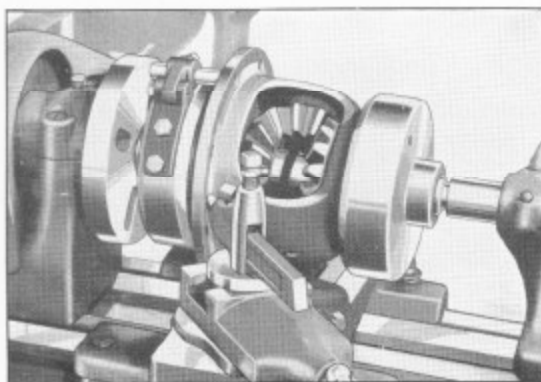


Fig. 4. Truing a differential gear case flange in the lathe.

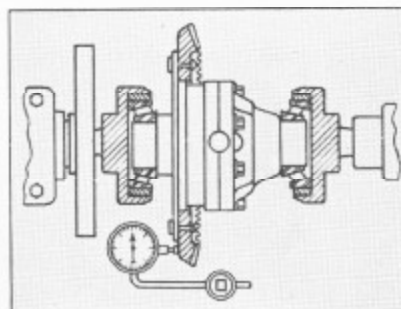


Fig. 5. Testing differential gear.

After the new differential ring gear has been installed, it should be tested with a dial test indicator, as shown.



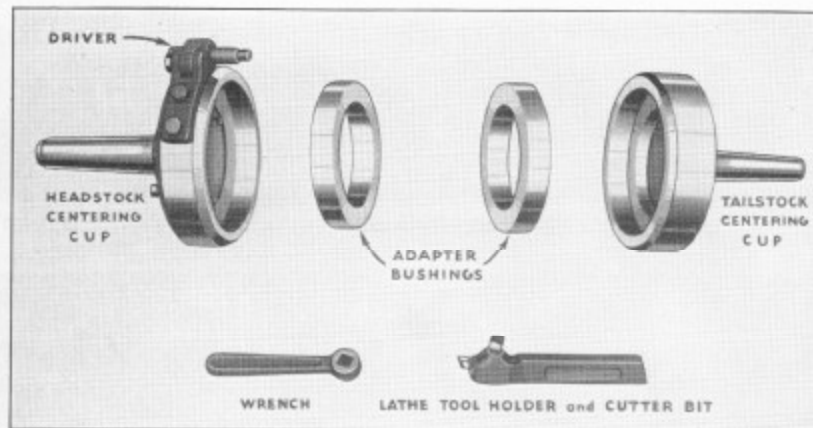


Fig. 6. Differential servicing equipment for 9-inch South Bend Lathe.

## Equipment for Testing and Truing Differentials

### Centering Cups and Adapter Bushings Used in Lathe Spindles

Differential testing and truing equipment, illustrated in Figs. 6 and 7, includes a set of differential centering cups for the headstock and tailstock spindles of the lathe and the necessary adapter bushings. Only a few sizes of adapter bushings are required, because only four or five different sizes of bearings are used in the differential assembly of the various makes of automobiles.

A driver for driving the differential gear case flange is also required. This driver may be attached to the headstock centering cup, as shown in Fig. 6 above, or it may be separate for attaching to the face plate of the lathe, as shown in Fig. 8 below.

A lathe tool holder and cutter bit are also required for truing the differential gear case flange. A dial test indicator, as shown in Fig. 7, is recommended for testing the accuracy of the flange, testing the differential drive pinion, testing the differential ring gear after assembling on differential case, etc.

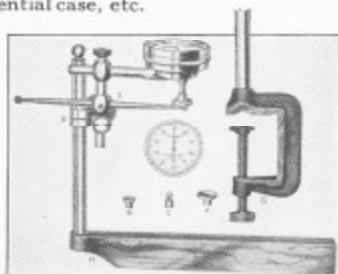


Fig. 7. Dial test indicator for lathe.

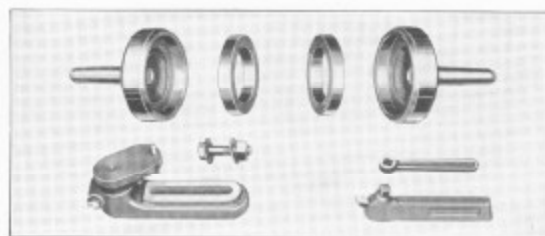


Fig. 8. Differential equipment for 13-inch South Bend Lathe.

## How to Test the Differential Drive Pinion

The differential drive pinion shaft is sometimes bent through accident, and if an old pinion is to be used it should always be tested. The pinion should be placed between the lathe centers, as shown in Fig. 9. A dial test indicator should be mounted in the tool post of the lathe and a reading taken on each of the bearing surfaces of the drive pinion shaft.

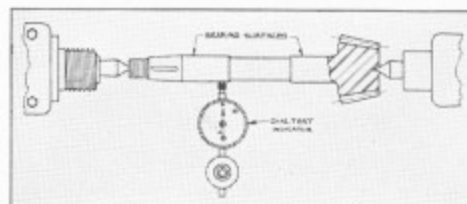


Fig. 9. Testing a differential drive pinion in the lathe.

## Other Auto Service Jobs Which Can Be Done On the 9-inch Back-Geared, Screw Cutting Lathe

The Back-Geared Screw Cutting Lathe is the most useful tool in the automotive service shop because it can be used for such a wide variety of work. The illustrations below show six important classes of work which may be handled on one lathe. The same lathe may be used for hundreds of other profitable automotive service jobs.



Fig. 10.—Making Bushings



Fig. 11.—Finishing Pistons

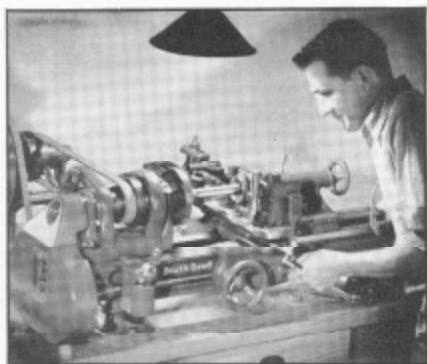


Fig. 12.—Boring Connecting Rods

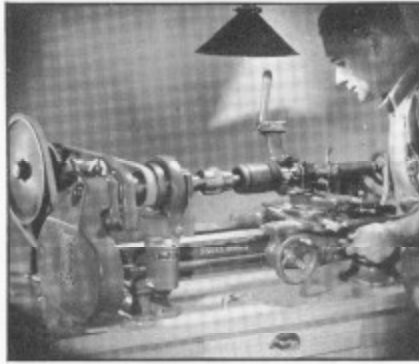


Fig. 13.—Truing Armature Commutators

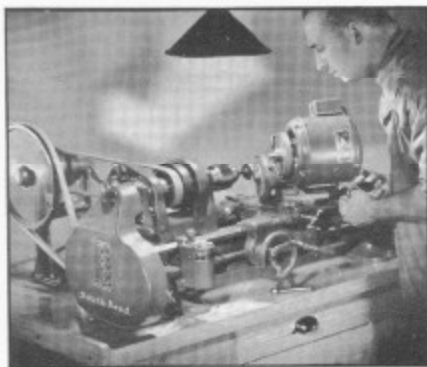


Fig. 14.—Refacing Valves



Fig. 15.—Cutting Screw Threads

## Valuable Books for the Mechanic

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



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

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

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

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

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

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

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

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

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

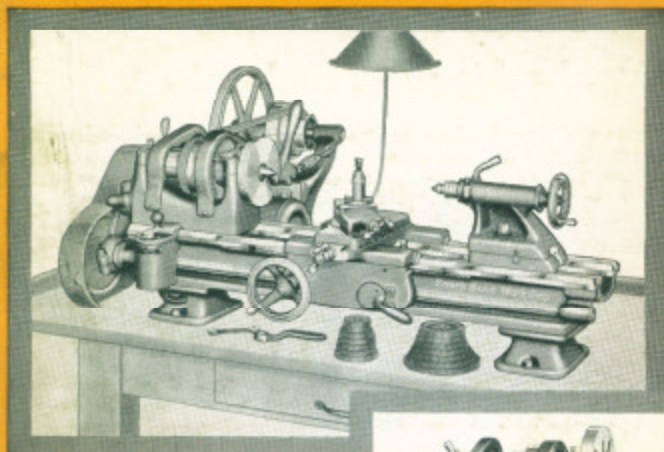
"How to True Brake Drums" Bulletin No. 4-A. (Automotive). Shows how to mount various types of brake drums in the lathe for truing the drum so that it will be concentric, round and true. 16 pages, size 6"x9", 40 illustrations. Price postpaid .....10c

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

"How to Run a Lathe" (32nd Edition). This is an authoritative and instructive manual on the care and operation of a back-gear, screw cutting lathe. It gives the fundamentals of lathe operation in detail with illustrations of various classes of work. Contains 160 pages, size 5 1/4"x8", and more than 300 illustrations.

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





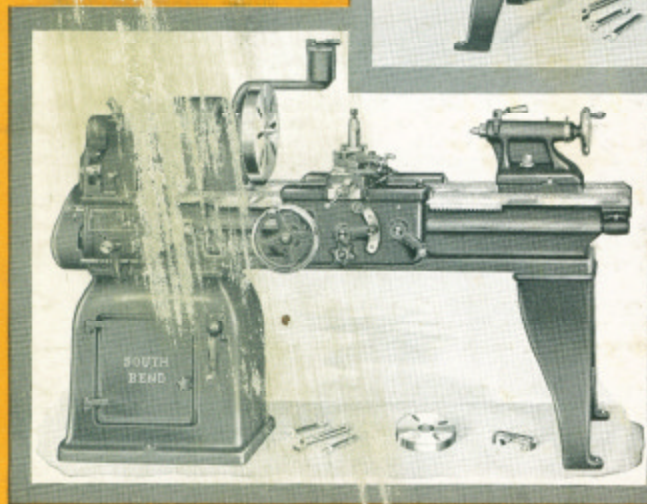
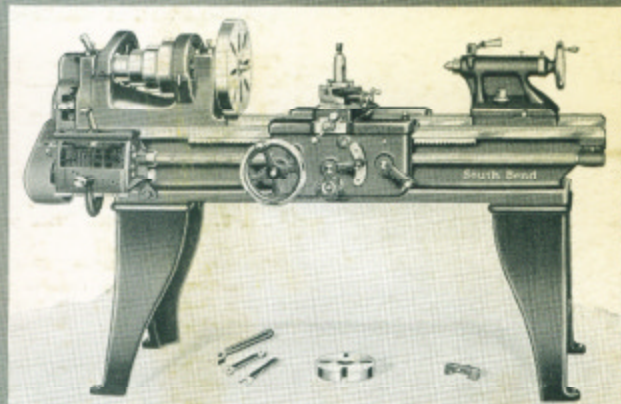
At Left—No. 415-YA 9" x 3' 1936 Model South Bend "Workshop" Adjustable Horizontal Motor Driven, Back-Geared Screw Cutting Precision Bench Lathe.

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At Left—No. 117-C 16" x 6' 1936 Model South Bend Underneath Belt Motor Driven, Quick Change Gear, Back-Geared Screw Cutting Precision Lathe.

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SOUTH BEND, INDIANA, U. S. A.



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