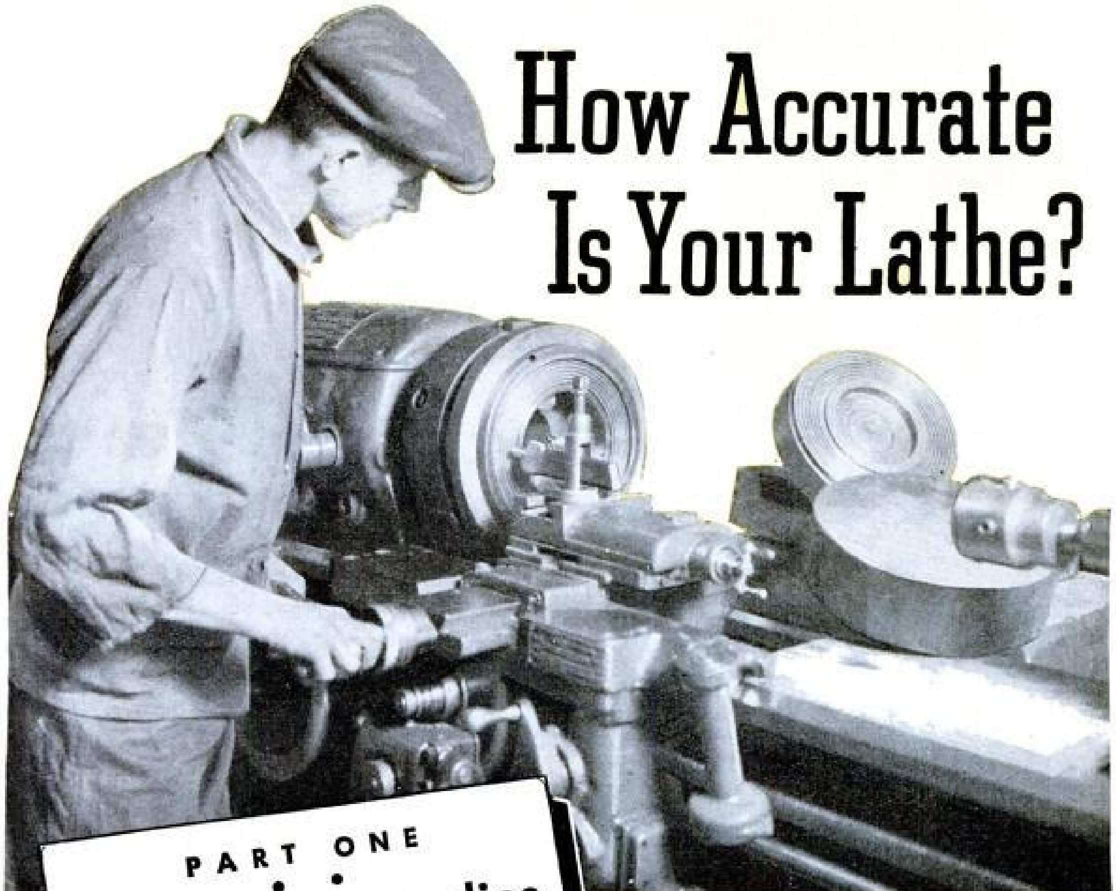
NEW SHOP IDEAS

How Accurate Is Your Lathe?



No matter how well trained and attentive a lathe operator may be, he can do good work only if his machine is accurately adjusted

PART ONE

Tests and Remedies for Spindle Wear and Misalignment

THE error of regarding a metal-cutting lathe too much as if it were a roughing tool is often made. The fact that a certain piece has to be finished by grinding does not relieve the lathe operator of any responsibility in respect to his drawing or dimensions. Allowing either an excessive or an insufficient amount of stock may prove costly at times.

Obviously, the condition of the machine and its accessories has much to do with production results as a whole. A two-year apprentice can do better work with a good lathe than a full-fledged graduate with one that's "all shot." Even an artist in his line

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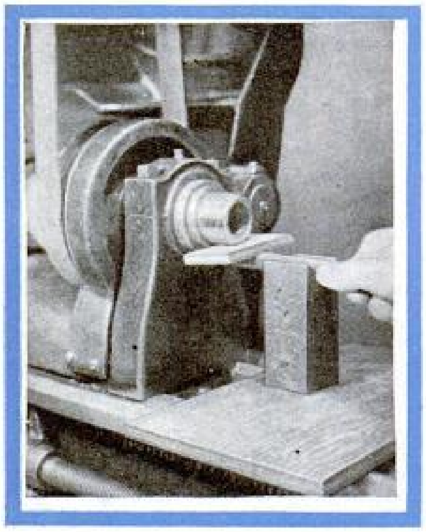
can accomplish little if he works with hay-wire equipment.

A true lathe hand keeps his machine well lubricated and well brushed up at all times, and this has much to do with his output. He is particularly attentive to the components of the cross-feed mechanism where chips accumulate rapidly.

Of course, the headstock bearings take the severest punishment, particularly the front bearing. The latter has to resist the bulk of the thrust due to pressure from drills feeding into the work and also the thrust due to pressure from the turning tools feeding against the work. The latter pressure is the more serious and is the cause of much chattering and also tapered work.



The lathe spindle is pried up gently to test for possible wear. Note the small block used to protect the threads

If your lathe is causing trouble, you can usually restore its accuracy by the following methods:

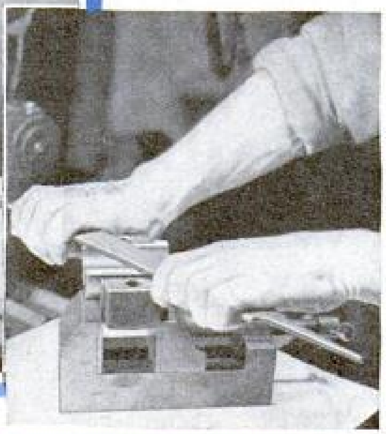
Brush the lathe thoroughly from top to bottom, dig all chips out from hard-to-reach places, give it a kerosene bath, and wipe thoroughly. If you make a practice of using an air jet, don't do it in this particular case and you will save time in the long run.

With no chuck or faceplate on the spindle, take an easy pry on the end of the spindle by using a board across the ways, a block, a bar, and another small piece of wood to protect the spindle threads, as shown in one of the photographs. If you find no play with this test, fill the bearing oil cup and repeat the test. A minimum amount of wear will be indicated by the oil's rising and falling in the cup. The same procedure is followed for both bearings.

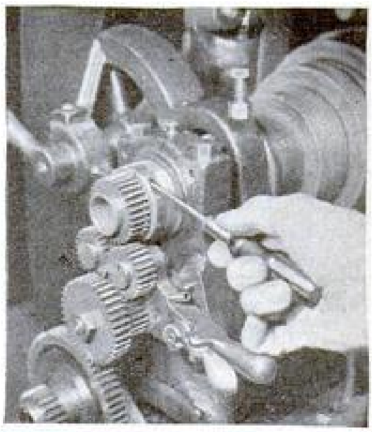
If adjustments have to be made, start with the front bearing by removing the cap and marking so that it may be replaced in its original position. Do not be alarmed at slight ridges on the journal and extending the full length of the bearing; these result from the fact that a lathe spindle has to operate without end play. The next move is to hold the bearing cap in a vise and evenly file off a slight amount to bring the required fit. If shims have previously been used as frequently happens, they will, of course, have to be stepped down.

You can now replace the

The front bearing cap and the headstock are marked with chalk so the cap can be replaced without difficulty in the proper position



The bearing cap is placed in the vise and filed evenly and cautiously to compensate for wear. The fit is then tested

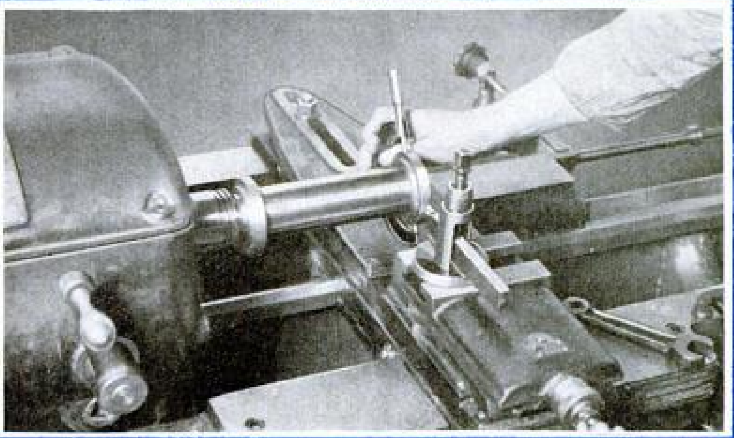


To compensate for end play, the lock screw of the take-up collar is loosened and the collar turned until the spindle drags slightly cap and repeat the original test. When you are satisfied with these results, take up the rear bearing in the same way if it needs it. Whatever you do, never remove the bushings from their housings or shim under or along the sides. All bearing components must fit tightly together. Don't attempt to make adjustments with tension on the cap screws.

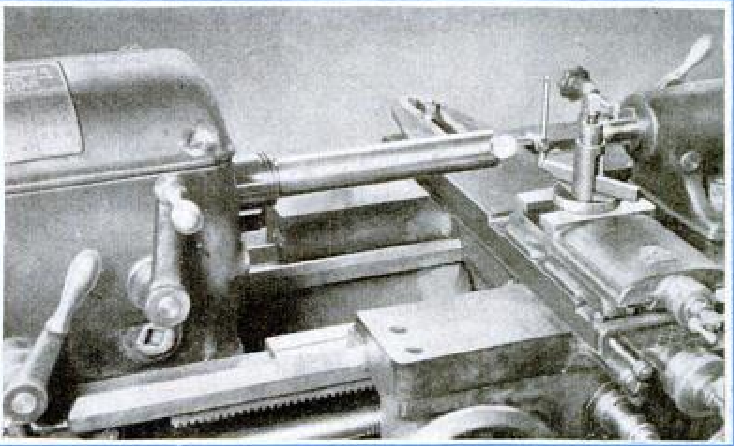
The next step is to remove all end play from the spindle. The conventional construction of a lathe allows for a take-up collar, which is threaded to the spindle. Loosen the lock screw and turn the collar slightly against the bearing until a light drag is felt when revolving the spindle, as shown in one of the photographs. Then lock the collar. The question is now to determine if the work already done has really restored the lathe's accuracy from that angle.

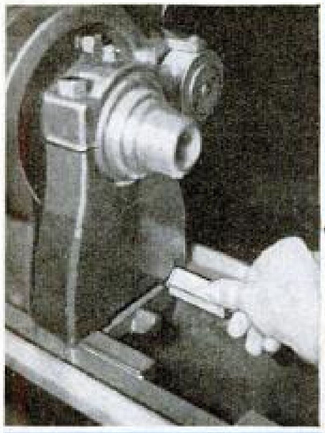
The first test is that of spindle alignment for turning and boring. The bar should have a testing length of 8″; the diameter should be from 2″ to 2½″; and it should be recessed as shown. The shank should be a perfect fit in the spindle bore and preferably be ground. The test consists of taking a light finishing cut at both ends of the bar with the same tool-depth setting. A variation not exceeding 0.001″ indicates satisfactory accuracy.

The second test is for spindle alignment in

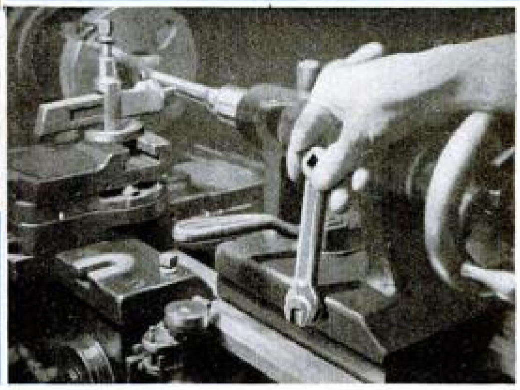


Spindle alignment is tested with a recessed bar. Identical finishing cuts are made at each end, and the variation should not exceed 0.001″



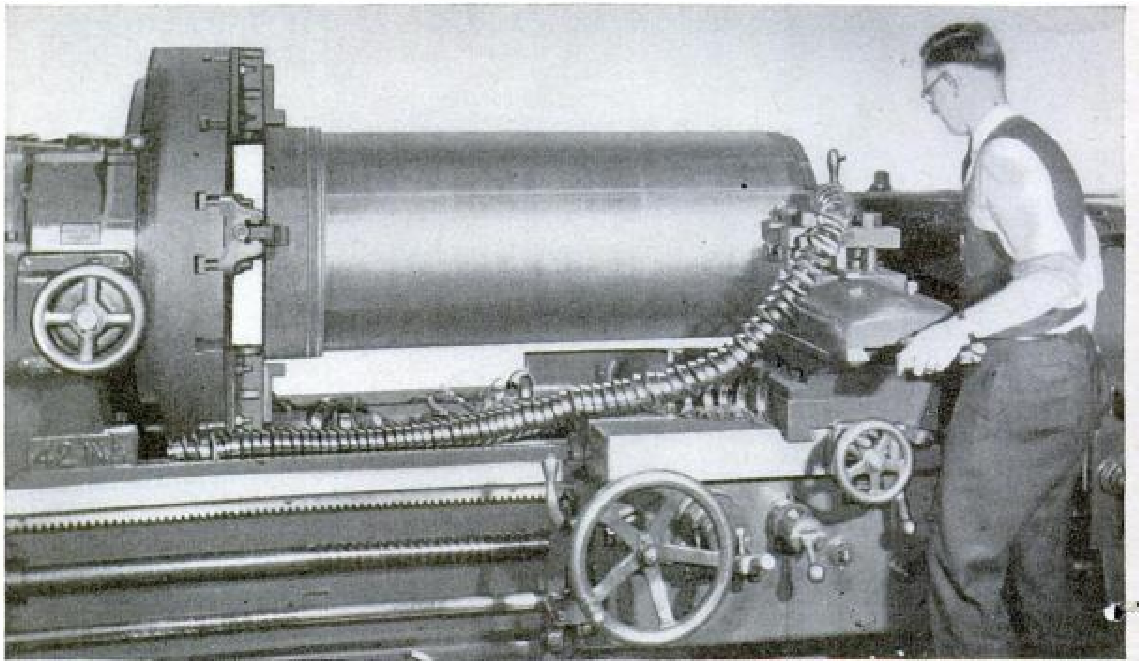


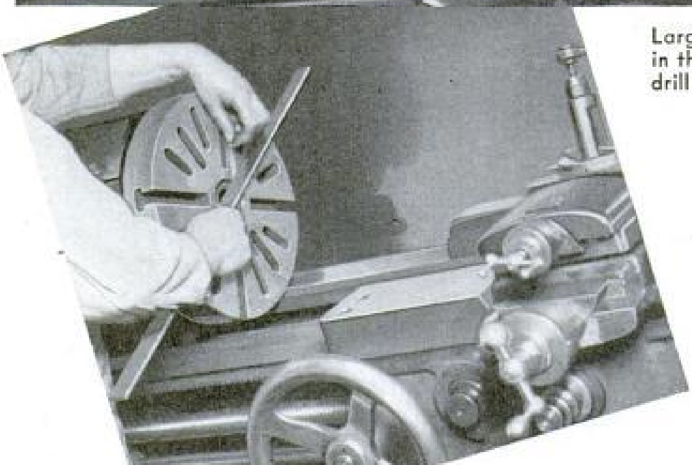
Shimming the vee of the lathe bed to compensate for wear at the rear of the front bearing resulting from tool pressure



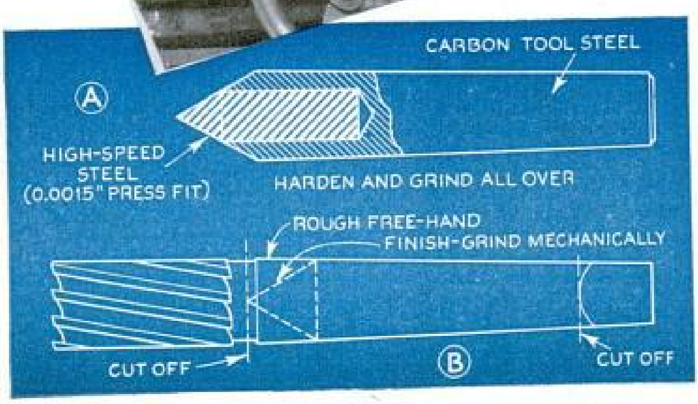
In addition to making the turning test, it is necessary to check the horizontal alignment of the spindle with a dial indicator as illustrated above. A similar test is then required for vertical alignment. At left, making transverse adjustments to tailstock until a centered piece turns straight

PART TWO Lathe Accuracy





Large or small, a lathe must be accurate, as in this case where the column of a big radial drill is being turned. Left, testing faceplate



AFTER a lathe has been checked up from the point of view of alignment, it is necessary to test the cross-feed mechanism. Work already done will avail nothing unless this part of the lathe is also in good order.

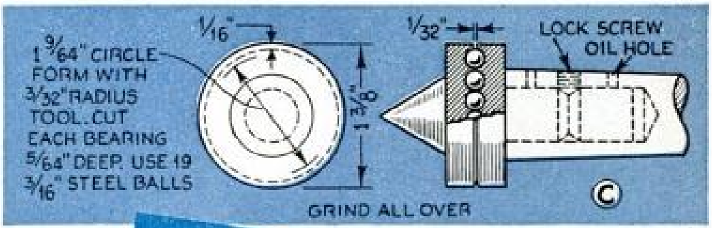
The major test, which is quite simple, relates to the faceplate. Mount the faceplate on the spindle, but make sure that contacting surfaces are clean. Now take two light cuts over the plate. Use a straightedge and a small piece of 0.001" thick paper, as shown, to see what the results are. If the surface is concave to this amount or less, it is considered quite satisfactory. On the other hand, even a minute amount of convexity is out of the picture and indicates wear in either of the dovetailed slides. Check the cross-feed slide and screw first, then the tool post and swivel slides. Gibs and adjusting screws are provided so that it is easy to compensate for wear.

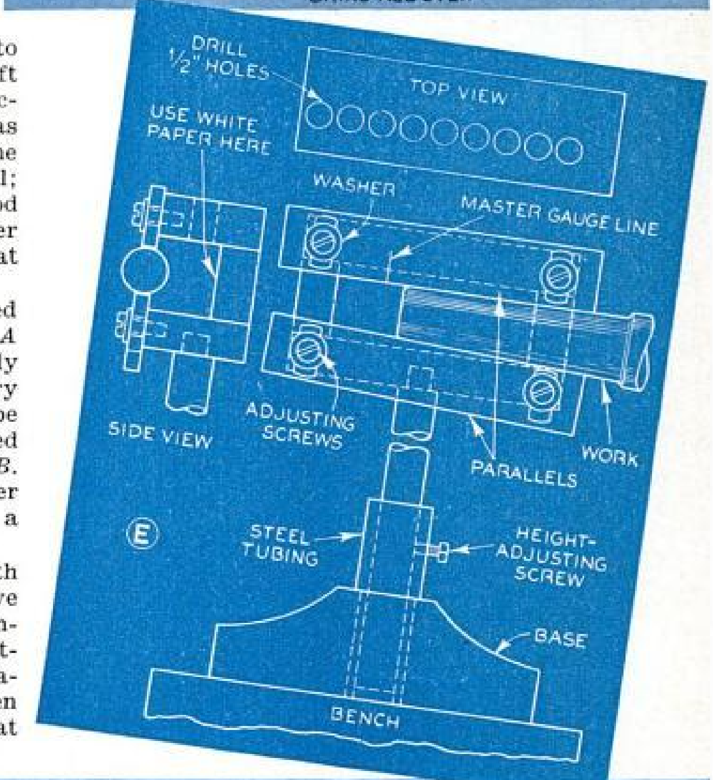
CHECKING UP ON THE CROSS-FEED . . . CENTERS CHUCKS . . . SPECIAL THROW PLATES . . . TAPERS

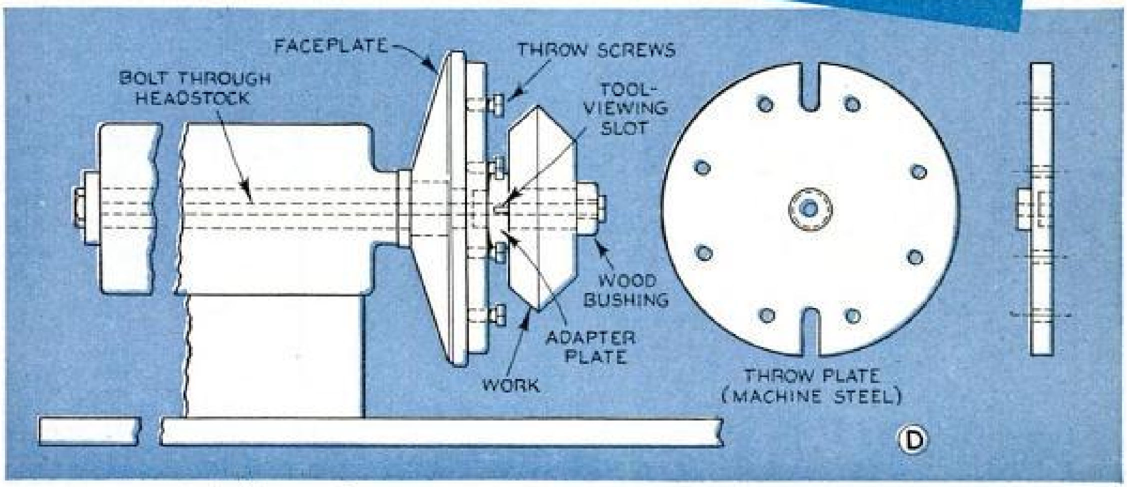
NOW let's consider the various accessories used with any lathe. It is logical to start with the centers because considerable unsatisfactory work is regularly traced to defective ones. Lathe centers should preferably be ground all over, although accurately turned and hardened centers are safe to use. Many lathe operators use soft headstock centers so they can occasionally true them by turning as shown. This idea is all right if the point is turned precisely radial; however, the conventional method is to prickpunch mark the center and spindle so as to align them at will.

Tailstock centers with high-speed steel inserts, made as shown at *A* in the drawings, are particularly recommended for long life. Very serviceable centers can also be economically made from discarded high-speed steel end mills, as at *B*. Grind the shank to a Morse taper before cutting off, or use with a combination taper collet.

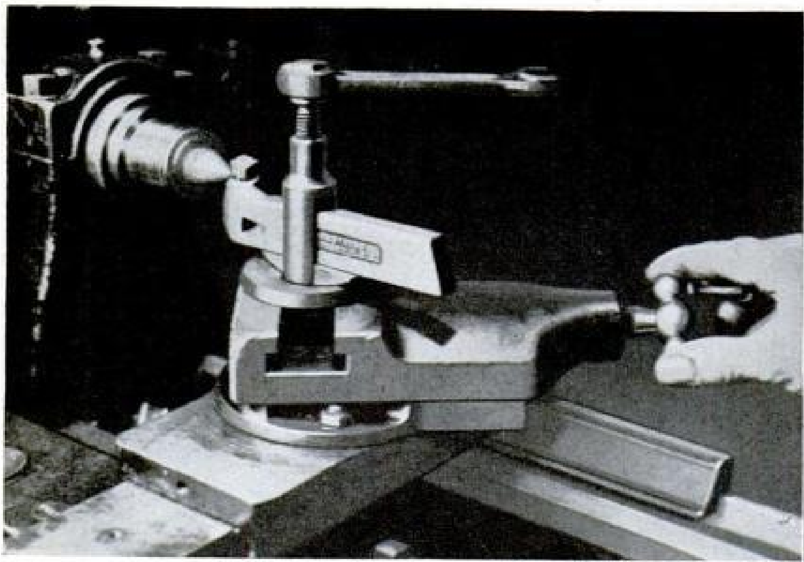
Some heavy work or work with large center holes requires live centers. These need not be expensive unless they are used constantly. Ball-bearing live centers machined from good carbon steel, then hardened and ground all over, as at





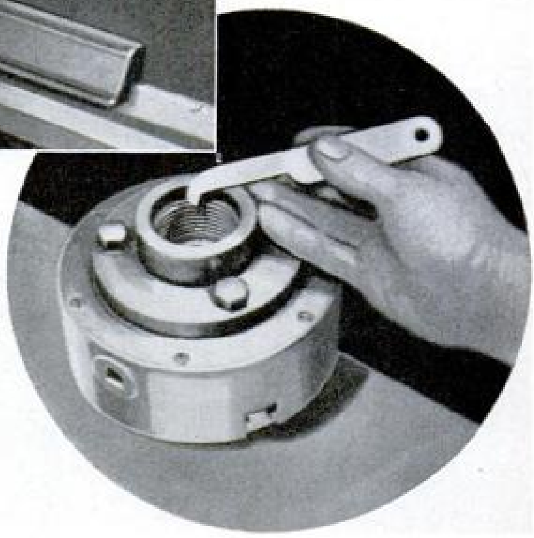


Suggestions for ball-bearing live centers, a parallel-gauge fixture, and a so-called "throw plate." On the facing page is shown a tail center with high-speed steel insert and one made from a discarded end mill



If you prefer to use soft centers in the headstock, it is a good idea to check up by means of an indicator after they have been trued up by turning as at the left

Before a chuck is mounted, it is important to see that the threads are clean. An easy way to do this is to use a small tool having a point shaped to match the threads as illustrated below



C, will handle a substantial weight. In fact, centers like the one shown have been used to turn 250-lb. crankshafts.

Good chucks play their part in accurate lathe production. Keep them right by dismantling them often and cleaning all parts in a gasoline or kerosene bath. Three-jaw universal scroll chucks should carefully be trued with a plug gauge after reassembling, but at times the jaws have to be ground to establish the desired concentricity. Always clean the threads of a chuck before using it. For this purpose an improvised tool may be used as shown in one of the photographs.

Work of irregular shape occasionally comes along and is of such a nature as to require extra truing facilities. In other words, some parts have to be accurately bored or rebored and trued to lateral as well as radial accuracy. The addition of a so-called "throw plate," shown at *D* in the drawings, will solve such problems. This plate is set against the regular faceplate and may be made slightly smaller than the latter. Small adapter plates of various diameters are made to suit the run of the work and set between the throw plate and the piece being trued. A variety of wood bushings are required to fill the gap between the bore of the work and the long bolt that holds the assembly together. These bushings also afford convenience in truing.

The procedure is first to true radially, then correct lateral errors with the throw screws. A slight movement of one or two screws against the faceplate—that is, those so located as to throw over the low spot—will quickly give the desired results. The piece is then securely held with a bored strap and two bolts, and the job is ready for boring or grinding after removing the long bolt and wood bushing. This outfit is, of course, suitable to use in any internal or universal grinder.

The turning and boring of tapers demand that the tool cut precisely radial as no taper can be accurately generated otherwise. All internal tapers should be finished with reamers unless intended to be ground. When finished by boring, final results can, however, be had by a lapping operation. External tapers predominate by far because such work includes shanks of all descriptions. Female taper gauges are expensive and require Prussian blue for testing, and the whole procedure is slow and inconvenient. A parallel-gauge fixture as shown at *E* is advantageous since it eliminates the female gauge and expedites work to a marked degree. The tool can usually be made from odds and ends except for the two parallels. These must be hardened and ground all over.

After all, the old saying, "A stitch in time saves nine," applies to a lathe or any other machine tool. Keep your lathe clean and well lubricated at all times. Watch for that first 0.001" play because it soon multiplies itself disastrously.