CHAPTER XI

TEST INDICATORS AND THEIR USE

THERE are many kinds of test indicators for lathe work, some of which are quite elaborate and some quite simple. the indicator shown in Fig. 108 is extremely simple and yet will show any variation in the truth of the work.

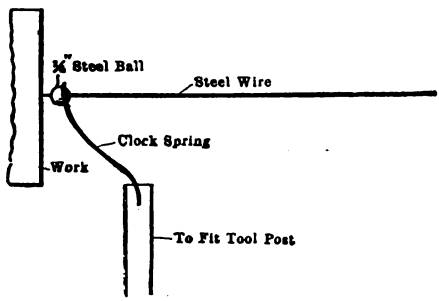

FIG. 108. A Simple Indicator

The only material required is a $\frac{1}{4}$-inch steel ball, a piece of wire 5 inches long, a piece of clock spring and a piece of bar steel to put in the tool-post. Anneal the steel ball and drill a hole through the center, a drive fit for the wire; then drill a $\frac{3}{16}$-inch hole in the end of the clock spring; slot one end of the steel bar and solder the end of the spring in the slot and the indicator is ready for use.

Use of the Lathe Indicator

Perhaps the simplest example of using an indicator in a lathe is for locating a piece of work on the face plate or in a chuck. For ordinary work, where the limit of accuracy may not be closer than a thirty-second of an inch, the indicator is hardly necessary as you can locate the prick-punch mark or the hole, either by the eye or with the point of a lathe tool. But for really nice work the indicator is a fine tool, even in its cruder forms as shown in Fig. 109, which is one of many types in general use.

This is simply a piece of steel, *A*, pointed at both ends and having the steel wire *B* instead in a crosswise hole, with the long end bent down so as to be in line with the centers of *A*. It will be readily seen that as the arm *B* is much longer than the piece *A* the end of the pointer will multiply the distance the point *C* is out of center when the work is revolved.

When the point *C* is exactly central, the point *E* will remain stationary; but if the point *C* is out of center one-hundredth of an inch the point *E* will travel in a circle having a radius as many times this as the distance from *D* to *E* is longer than from *C* to *D*.

To use this, a punch mark is made on the side of a lathe-tool shank and this fastened in the tool-post so that the punch mark comes as near the center of the lathe as possible. Then the point *D* is placed in the punch mark, the point *C* on the work and the work revolved, usually by hand. Watching the point *E*, tells the story whether it is sighted by the dead-lathe center or not. When the end of the pointer stands perfectly still while the work is being turned,

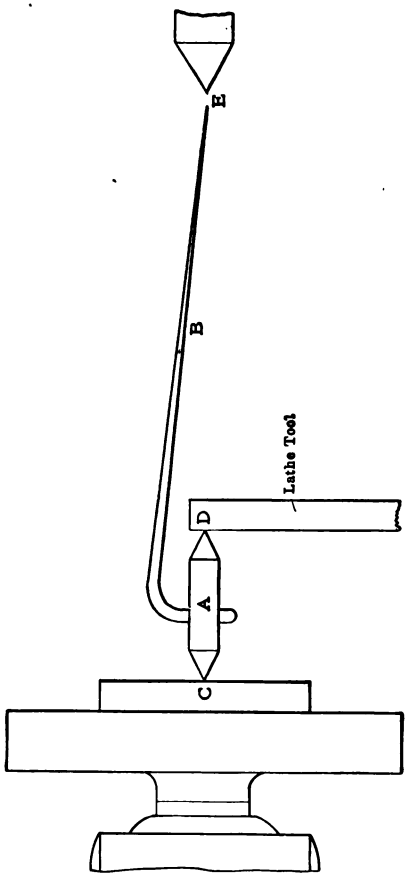

FIG. 109. Another Simple Lathe Indicator

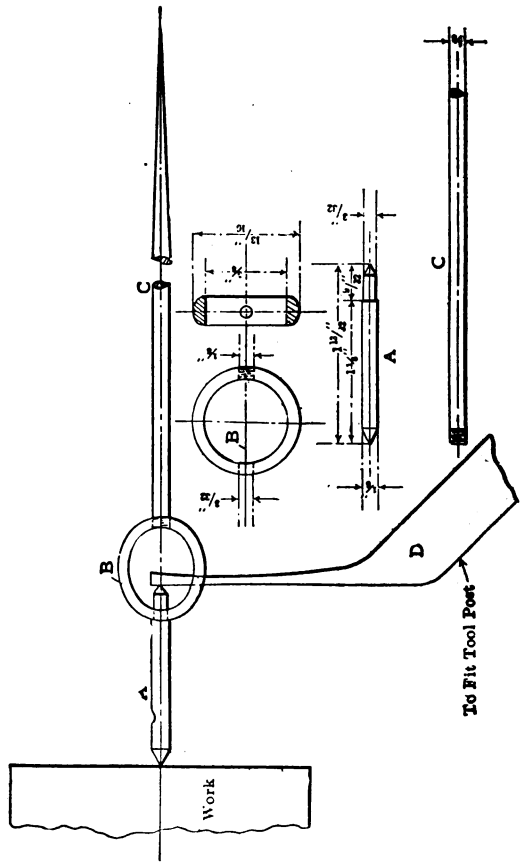

FIG. 110. A more Complete Indicator

the center of the work is located at the exact center of the lathe.

Another kind is shown at Fig. 110 which is also easily made. It consists of piece *A* which is stubs' steel, hardened and made a tight fit in steel ring *B*, and piece *C* which is threaded on one end to fit *B*. *A* and *B* are dimensioned clearly in the sketch. Pointer *C* can be made any length desired, the one shown being 12 inches long. The sketch shows the tool in use, the large end of *A* being held in posi-

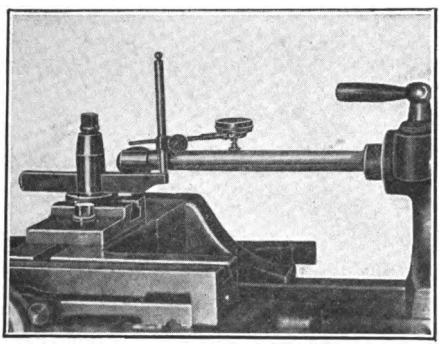

FIG. 111. Testing Alinement of Tail Spindle

tion by shank *D* which has a flexible end hardened, spring-tempered, and centered to receive the small end of *A*. One side of ring *B* rests on *D* to keep it from turning.

More Sensitive Indicators

The refinements of modern tool making have brought out many very sensitive indicators which show variations of a thousandth of an inch or less. Some of these are made with multiplying levers which increase the movement a

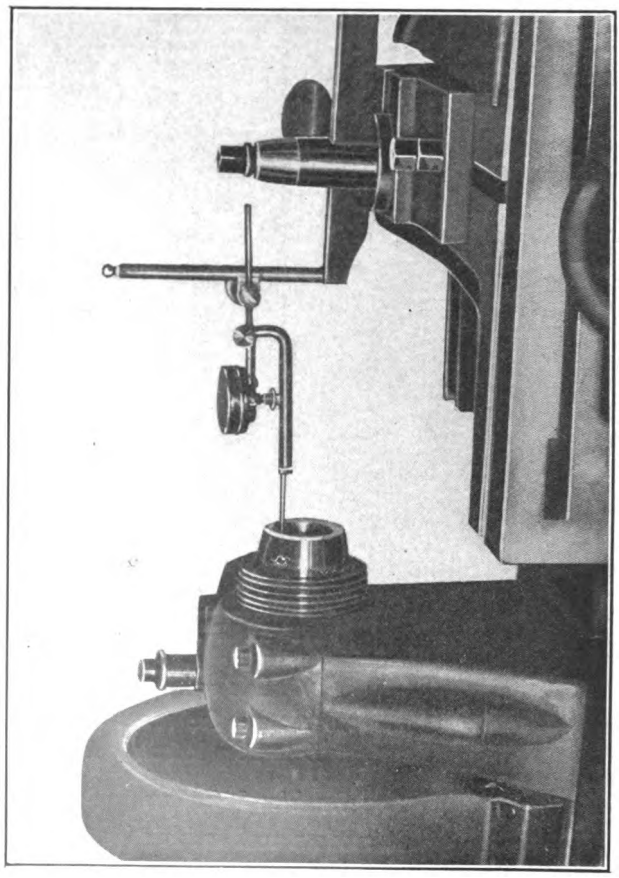

FIG. 112. Testing the Nose of the Spindle

hundred times. Others add dials to them and read the variations directly in that way.

Three applications of such an indicator are shown in Figs. 111 to 113 which are made from photographs furnished by the L. S. Starrett Company.

Fig. 111 shows the instrument fastened in the tool-post to test the accuracy of the tail spindle of a lathe by means

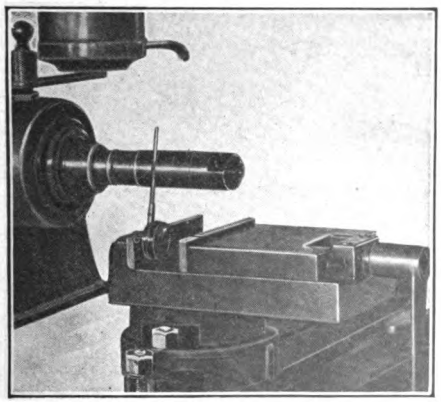

FIG. 113. Squaring Work with the Spindle

of the test bar shown. This bar is carefully turned up to fit the taper of the tail spindle and then the whole bar turned true with the taper. Putting this in the tail spindle and testing it at different points shows how the tail spindle lines up with the ways of the lathe.

Fig. 112 shows the testing of the truth of a lathe-spindle nose in much the same way, except that a multiplying arm has been put on in addition to the indicator itself. This

also shows a form of spindle nose that is better for getting chucks and face plates on true than the usual design. Here the thread draws it on the taper in front; in some, the taper is at the back and the threaded portion is smaller in diameter than the taper.

Fig. 113 shows the indicator in use on a milling machine,

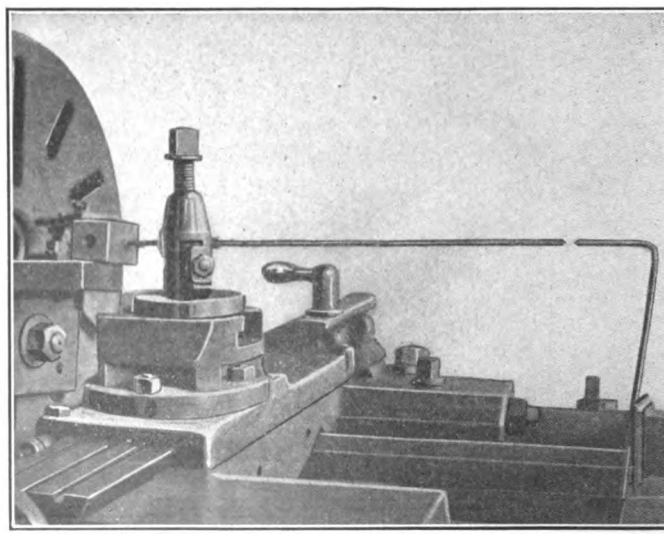

FIG. 114. A

although a similar use on a lathe would be to square a bar or casting across the lathe or to test whether the cross-slide was at exact right angles to the lathe spindle. If it is not it will not face exactly square. The piece to be tested, the vise jaw in this case, is adjusted till the indicator points

to zero when set to one end of the jaw. Then the spindle is turned until the indicator comes to the other end of the jaw, and the difference, if any, will be noted on the dial. By carefully adjusting the vise or whatever the work may be, until the reading is the same at both ends, we know the work is square with the spindle.

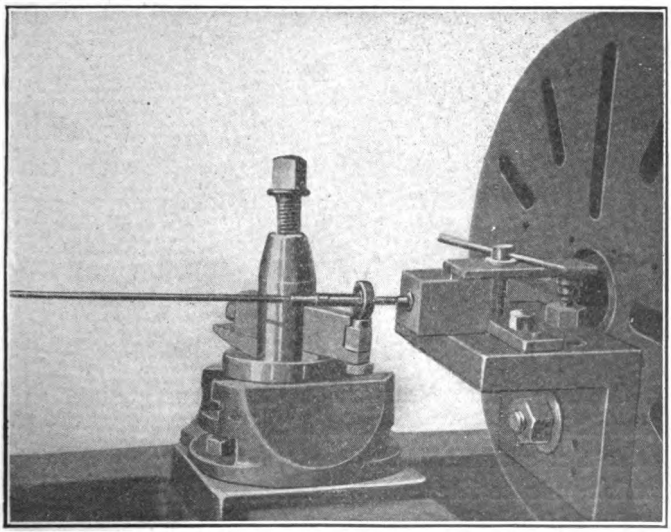

FIG. 114. B

The Indicator on a Nice Face Plate Job

The boring of two holes that cross each other at right angles and exactly central with each other is a nice job. The first thing is to square up the block on all sides and then use a stiff angle plate clamped to face plate as shown.

Having done this it is clamped to the angle plate, as shown in *A*, Fig. 114, and centrally adjusted. After this has been done the angle plate must be bolted to the face plate in such a manner as to insure it from not moving during the operation of boring both holes. Holding in this way also makes it free from all clamping strains.

In turning the block to position shown for boring second hole, care must be taken not to turn the block over; that is to say, the same side must be placed on the angle plate as was used in boring the first hole.

At *B* is shown how the two points should line up when the block has been centrally adjusted. The use of a surface gage in this way gives about the closest alinement of the lathe indicator that can be had. It will be noted that a point is fastened to the lathe as a guide for the indicator point as this makes any movement of the pointer readily visible.

Finishing Up Work

In the various operations of machining, fitting, and assembling of machinery and tools, too often little details in method and finish are overlooked; resulting in a finished article which is defective in operation, and unsightly to the truly mechanical trained eye. Had there been any care, forethought, or possibly knowledge of proper methods on the part of the workman, a neater and superior machine or tool at less cost would have been the result.

Were the little omissions referred to confined to the novice, it would be hardly worth while to mention them, but past experience has proved that the middle-aged journeyman is often as great a sinner in this respect as the appren-

tice. It sometimes happens that those placed in charge, through lack of shop training, are not able to see small defects or judge their importance.

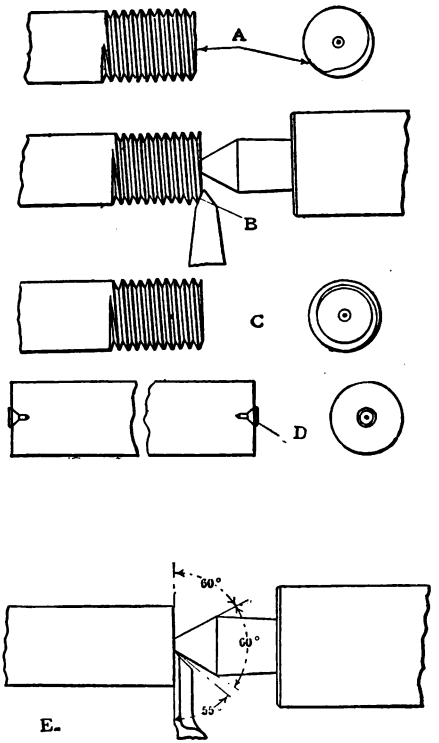

FIG. 115. Finishing the Ends of Work

Notice the first thread on the screw shown at *A*, Fig. 115. This is the way many so-called lathe hands turn the job over to the bench hand to finish with a file.

After the thread has been cut to size, before removing the tool or work from the lathe, open the lead-screw nut, move the carriage by hand and chamfer as shown at *B*, leaving it finished as shown at *C*. This not only looks better but is better, and takes less time. The same method applies to the threading of a nut on the lathe. The above does not apply to harvesting machinery, but to tool work where accuracy usually is economy.

To have the lathe boss bring you a shaft like this, with the centers as shown at *D*, is exasperating. And on protesting at his not having them faced off, to have him tell the bench hand to file "em" off, because "Bill hasn't any cutaway centers for his lathe and can't face them out!" This can be done by backing the tailstock center a little, and they can then be faced off the end clear into the countersink without a cutaway center.

Obviously great-grandfather was aware of those little kinks, and no doubt some who have actually learned their trade will smile when reading things so elementary; but the fact remains that there are plenty of men running lathes that have not learned them yet.

By looking at Fig. *E* it must be apparent to most any one that 55 degrees is about the proper angle to grind a facing tool. This gives ample strength and permits facing close to the center without interfering. But take a look around the shop and see how many facing tools you will find on the tool-boards, ground this way.

A Drilling Kink

Any one who has ever drilled a hole in a lathe by holding the drill with a dog, and feeding it in to the work with

the tail spindle, has probably had the drill catch just as it broke through the work, draw off the center, and raise more of a disturbance than is pleasant for any of the parties concerned.

To prevent this, especially in brass work, it is customary to grind the lips of the drill so that they have no top rake, or what corresponds to that in a lathe tool, but there is a

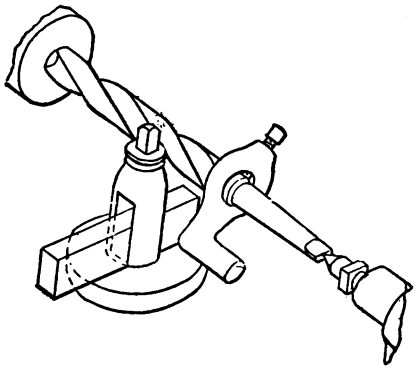

FIG. 116. A Good Drilling Kink

better way, even without the use of a drill chuck of any kind.

Just put a piece of steel or a lathe tool into the tail post, backward, as is often done, but, instead of letting the dog rest on the top of the tool have it rest on the tool-holder and back up against the tool, as shown in Fig. 116. This pulls the carriage along as the drill is fed into the work, and it effectually prevents any dragging of the drill into the work with the damage that often goes along with it.

Grinding Lathe Centers

If there is no center grinder in the shop, a man can, with very little skill, grind a lathe center perfectly true on a common emery wheel in less time than he can set up the ordinary grinding rig on his lathe. Fig. 117 shows the

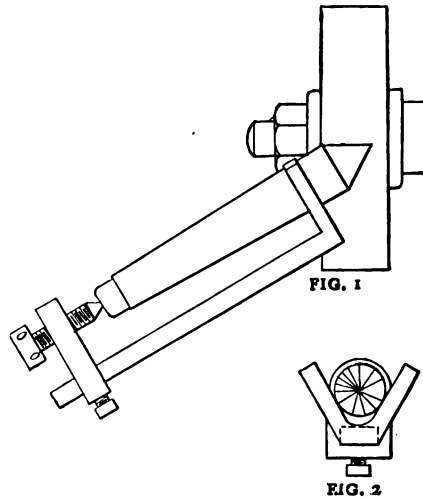

FIG. 117. Grinding Lathe Centers

position of holding the center to the wheel when giving the center the last finish. If the center is in bad shape, by lowering the left hand the operator can make the wheel cut very fast. It does not make any difference how much the center is out of true, the high speed at which it will run generates a true center and makes a good enough job for any except the nicest work.

ENGINE LATHE WORK

PRACTICAL SUGGESTIONS WHICH WILL GIVE THE YOUNG MACHINIST OR APPRENTICE THE FOUNDATION PRINCIPLES OF ENGINE LATHE WORK

BY

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