How to Test the Accuracy of Your Lathe Machine

THERE is an old saying that a bad workman blames his tools; the converse of this is that a good workman is one who knows how to put his tools right. We don't propose to explain how to correct an inaccurate lathe, but only to show how it should be tested for faults, which, after all, is the essential preliminary to making up your mind to do something about it. Now it might be thought that the quickest way to test a lathe machine for truth would be to check the work produced, but anyone who has tried this way will agree that it is slow and unreliable. It is seldom realized how much spring there is in the work itself, even with the lightest of cuts. For example, if the headstock is adjusted so as to turn parallel a piece of bar held in the chuck, a cylinder bored immediately afterwards will be found to be most unaccountably large at the back end. The error may not be great if the mandrel is a stiff one, and the work rigid, but it will be there all the same, and repeated attempts to get things just right by this method generally end in the unfortunate owner wishing he had left well alone.

To get the best performance from your lathe machine you need to check the accuracy of its working parts. Modern lathes have accuracy built into them, but there may be some parts that are not accuracy or properly aligned. Some of these problems can be easily fixed, and some require more work, but as we describe each of these problems we sill state how much deviations is acceptable (tolerance), and what operations would be ill affected by these errors. That way you can decide if you need to fix the problem. Fox example, if you never drill from the tailstock, or use the tailstock to steady work held in a chuck, then the alignment of the head and tail centers is not very important.

Before getting into the fun of working with a Lathe Machine, a few words on the subject of workshop safety may be in order. In an industrial environment, many activities involving machine tools are governed by legislation aimed at improving health and safety. One of the delightful aspects of the workshop lies in "escaping" from the worldly cares outside and as such, in our leisure pursuits, much of such legislation does not apply, and responsibility for safety of both ourselves and our visitors, lies very much in our own hands. A sensible approach to safe working practices involves first an appreciation of factors which can give rise to injury (and those parts of the body at risk), and second, a common sense attitude to working around these factors.

Fingers and hands

While a small machine such as the Bench Lathe Machine has much less power than a heavy-duty production engine lathe machine. But the inertia of chuck and work spinning at maximum speed would certainly be sufficient to cause severe damage to a misplaced finger. Another of the regular injuries is laceration due to sharp edges, which may be the tool, the work, or the swarf. Ribbons of swarf may look like bits of Xmas decoration, but think of then as long thin ragged razor blades. So when clearing swarf do not use fingers.

Eyes

Some materials, notably brass, produce swarf, which comes away in small needles at high velocity. If you

have the misfortune to get some of this in an eye, then it is almost certainly a trip to hospital, where (being non-magnetic) it will be removed manually. Safety glasses are cheap and will prevent this. They should also be worn when grinding tools on the bench grinder.

Feet

In an engineering factory you might wear safety boot or shoes rated so that you could drive a car over your foot without damage to toes. In our amateur workshop, most of what we handle will weigh perhaps not too much heavy. But a pound or half kilo dropped from bench height would cause a fair amount of bruising, so trainers or open toe style sandals may not be the ideal footwear. Our version of Murphy's Law also states that if you drop a sharp edged object on to your foot, it will land sharp side down.

Hair

Long hair can be caught by a rotating shaft and wound in, leading to probable head or facial injury. Tie hair back or use a net.

General clothing

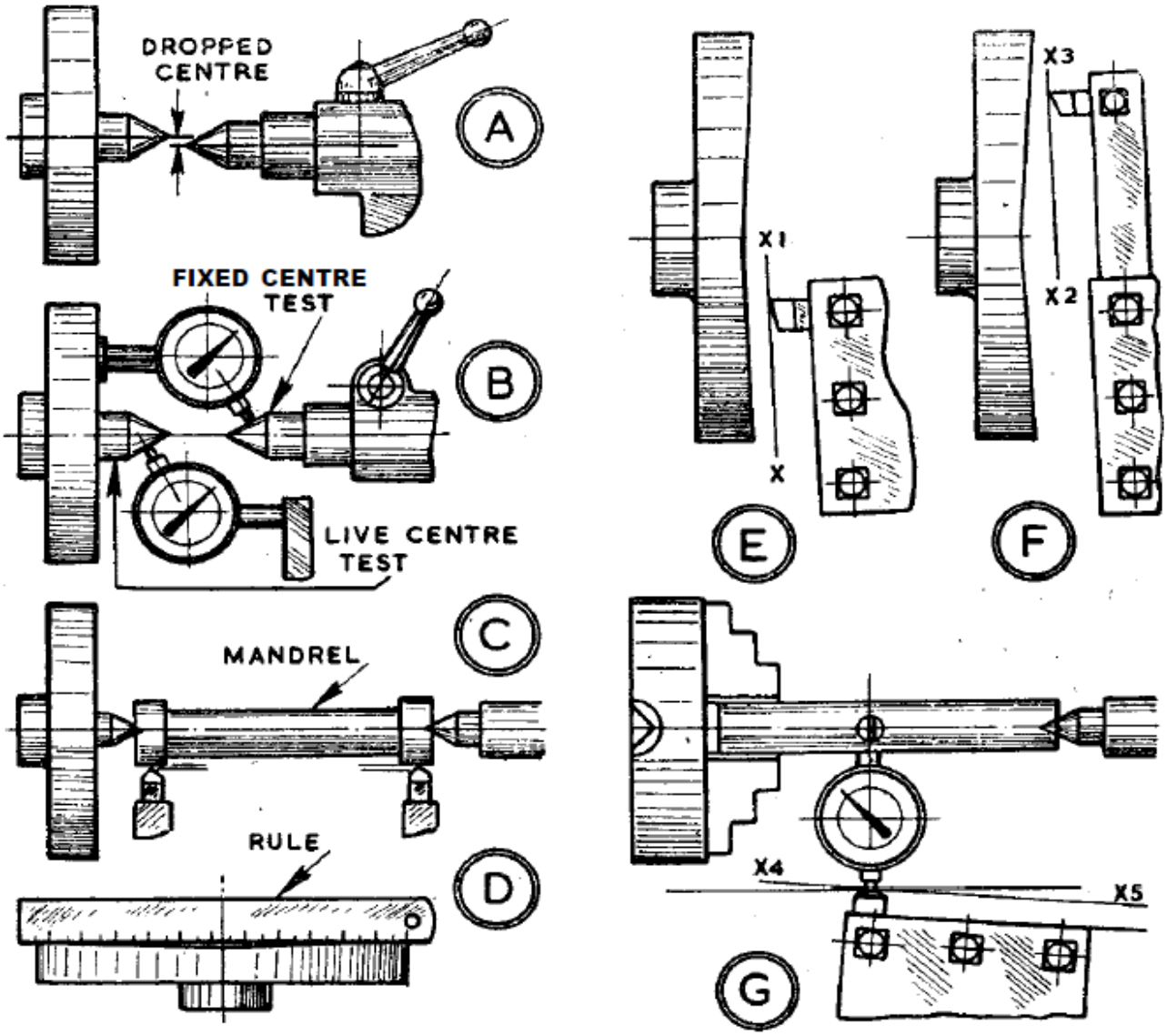
A tie presents the same form of risk as long hair. Preferably remove it or at least ensure that it is tucked in under a sweater. Loose fitting sleeves are similarly not recommended. Open collars can present a problem when machining at high speed. Hot swarf dropping down inside the neck can be painful and can cause involuntary movement leading to a secondary risk.

Electrical safety

If you have purchased a new Lathe Machine, then all should be well. If second hand, then it may be worth checking that the plug, cable and connections are in good order. If you are using an extension cable, route it in such a way that you won't trip over it. Connecting via an earth leakage or residual current circuit breaker is a sensible precaution.

Industrial machining processes often make extensive use of water based coolant to speed up the cutting. Clearly, water and electricity (especially at mains voltage) are not happy bedfellows. Using of the proprietary cutting compounds will be a safer option.

The most important test of a lathe machine lies, no doubt, in the accuracy of the work and the manner in which it is produced a skilled operator being able to overcome considerable basic inaccuracy. Even if the work is of a relatively simple character, ample scope for error exists-provided there is sufficient variation to test all aspects of alignment. This is to say, a lathe machine may be accurate for one type of work but not for another, and experience of it can indicate where to expect errors, though the reason why may not always be immediately apparent. However, there are various simple tests which are largely a substitute for "work experience" and which can be useful for discovering errors, for truing the machine (if possible), or on occasion for setting up.



A simple but important test, *photo A* , is the meeting of headstock and tailstock centres. When the fixed centre has noticeably dropped, wear of the underside of the tailstock and possibly of the bed itself is indicated. The effect on between-centre turning may be small or non-existent, but care will be necessary when using centre drills or boring cutters from the tailstock-a degree of "lift" then being necessary for the tools to centre. The same effect also obtains when supporting chucked work from the tailstock. This test should be made with the barrel both close in and well extended. A sideways error of the same kind can often be corrected by adjusting the tailstock.

A more severe test of the same sort, *photo B*, can be made with an indicator, which can be a dial type or one of the small inexpensive varieties. The indicator is mounted in a chuck or on a driving plate with its plunger bearing on the fixed centre. Then the lathe machine spindle is turned, when a steady reading shows perfect alignment, using a small mirror to see the instrument upside down and from behind. Where

there are variations in readings, as is virtually always the case, it can be seen in which direction (vertically or sideways) they occur, and the tailstock adjusted to correct sideways error.

A live centre test for running truth, *photo B*, can be made of the one normally in the spindle and of others of the same taper with the indicator mounted on the slide-rest. This can sometimes reveal that the centres themselves have not been ground true; and in use it may be advisable to keep them to one position-spindle or tailstock-marking for fitting in a certain manner.

General alignment

A test for general alignment of headstock and tailstock for between-centre turning can be made employing a mandrel, *photo C*. Any suitable piece of rod can be used, carefully centred, reduced in its length, and with the ends turned the same size. A tool mounted on the slide-rest can be brought close to one diameter, leaving a small gap, then the gap checked on the other diameter, a piece of white paper on the bed providing a light background against which to see the gaps. Finally, the tool may be set to touch the diameters lightly when traversing the saddle. This aids reasonable setting of a lathe before work begins, and as an alternative to a tool an indicator can be used.

A faceplate may be checked with a rule, *photo D*, and when mounted on the spindle and rotated is tested for face wobble. If chuck work is machined true, a test can be made on the faceplate of cross-slide alignment in two stages, *photo E* and *F*, using a tool or an indicator. Testing along the near side along line X-X1 in the above *photo*, no error may be shown if the faceplate was machined on the lathe, for alignment corresponds to the cross-slide. Testing on the far side, however, on line X2-X3, any error is doubled and can be easily seen.

Topslide setting can be tested as *photo G*, an indicator on a mandrel and a rounded rod on the slide-rest. With the slide out of alignment, movement is along such as X4-X5, and checking with saddle traverse, variations are shown, whereas with a true setting readings will be all the same.