Machining lengths accurately

BY GEOMETER

ON most components, diameters are more important than lengths as their accuracy controls the working fit of parts. A piston must be a nice running fit in its cylinder, to retain pressure but not to seize. A housing must be a precise interference fit for a ball race, to avoid excessive force for fitting-or to prevent the ball race from working loose.

Accuracy is implicit for these diameters, and for many others; and so we exercise the greatest care in machining them, and check the sizes frequently with micrometers and gauges as they approach the finished dimensions.

On the other hand, we may take most of our length dimensions from a rule-which is quite satisfactory if we are careful; but when our attention relaxes? or our judgment varies, we fall into error, or find that we have an accumulation of mistakes.

I was reminded of this recently when I turned up an old letter. The correspondent had made a small engine, which I had designed. He said that there must be an error in the length dimensions on the drawing, because he had made all the parts to size but the piston was not in its correct position at top dead centre. In fact, he had made an accumulation of small errors, as was proved by adding and subtracting relevant dimensions on the drawing. They cancelled correctly, and so it was suggested that the solution to his problem was to alter the dimension to the crown of the piston.

This method is quite acceptable for "one-off" jobs, all parts of which which can be made to suit each other,. providing that the errors are kept within bounds. To rely on it as a principle is not advisable, as it does not help to improve our standards of workmanship. On the contrary, we should aim at precision -which is not difficult to achieve on length dimensions.

On a lathe which has a micrometer collar to its topslide screw, facing tools can be fed from one face to another, and so short lengths can be machined within two or three thou of dimensions. On a lathe without this collar, and lacking one for its leadscrew as well, other methods must be adopted, as shown at diagrams A, B and C.

For a small step to a deep shoulder, as at Al, you can often use the shank of a twist drill to set the tool for the final facing-cut from the end of the work. Alternatively, standard silver steel or mild steel rod can be used. A lathe tool will serve as well, or a piece of flat mild steel.

By another method, as at A2, end-gauges are placed to a jaw of the chuck. You make the gauges by facing a steel rod to a micrometer.

For an inside step or recess, as at B, a gauge consisting of a piece of suitable material can be placed to the inside face to locate the tool for the final cut from the end. When a lathe has a stop on the bed, standard material can be used between it and the saddle to provide settings for both inside and outside steps.

Sometimes, for a short repetition run on a centre lathe, it pays to make a setting gauge. I made one for machining a number of unions, from a large steel washer and three screws and nuts setting the dimensions by micrometer and depth gauge. Diagram C shows the principle of the device. A short screw 1 set the facing rool from the flange to the end of the union. Another short screw 2 set the parting tool for the thickness of the flange; length.

By a similar principle, you can employ a stop and a gauge to set a tool for facing work to length on a mandrel, as at ***D.*** Use faced angle iron with a piece of rectangular material bolted to it. Tighten the bolt with the two held down on a flat surface.

If you make the clamped work carrier which I described last week, you can use it with an end gauge, as at E, to locate a tool for facing the shoulders of a shaft between centres.

To locate a long shaft in the chuck, make a reference line on it and set this to the chuck jaws with a flexible rule, as at ***F.*** Then you can use gauges, as at A2, to the end of the shaft. ❑