Expert's Workshop

Machining spindle locking devices

Duplex details a selection of robust fittings with a wide variety of uses and applications in the home workshop

A FAMILIAR EXAMPLE Of a spindle-lock is the arrangement used for locking the barrel of the lathe tailstock, and similar devices of several different types are also employed in connection with various parts of machine tools and other mechanisms. For instance, locking bolts of the kind described here, were fitted to the spindles of a pair of dividing heads that were made in the workshop as attachments for a recently constructed vertical milling machine.

The essentials of these fittings are that a secure lock should be obtained with only light operating pressure and without the danger of damaging moving parts. The locking mechanism in its usual form is illustrated in Fig. 1 and the series of appropriate machining operations is set' out in Fig. 2. It is essential that the work is carried out correctly to ensure that the parts are properly fitted and grip securely.

Before the main component is bored to receive the spindle, the locking bolt must be fitted at the correct distance from the axis of the bore and for this purpose, the work is marked-out to show the centre lines of both the bore and the locking bolt.

Close tolerances

As shown in Fig. 2A the distance between the two centre lines should allow for the bolt to engage for rather less than its half-diameter where it bears on the spindle-if this distance is exceeded, the bolt itself may be unduly weakened.

After the hole to receive the bolt has been drilled, it is reamed to the finished size. To make the bolt, a length of mild-steel rod is turned down to a light press-fit in its housing and the end is threaded to take the clamping nut or lever.

Alternative methods

The bolt is then firmly nutted in place (Fig. 2B) and the shouldered end is left to project, as it will be cut off to the finished length at a later stage. An alternative method of securing the bolt during machining is, as shown in Fig. 2D, to use a length of well-fitting, parallel rod and to clamp it in place with a nut at either end. Several washers should be fitted at the lower end to ensure that all the threaded portion is removed from the finished bolt.

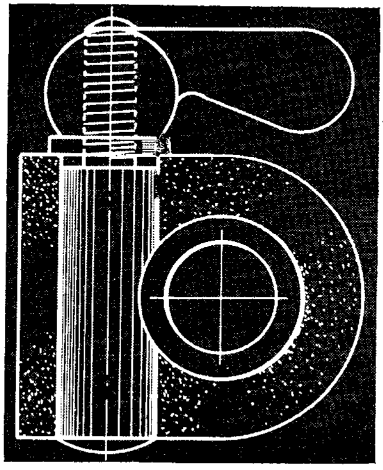
After the bore for the machine spindle has been machined and lapped to the finished size, with the bolt still in place, the bolt is removed so that it can be made a close sliding fit by rotating it in the lathe and applying a smooth file to clean off the surface pressure-marks. The bolt is now cut off to the finished length (Fig. 2C) and the shouldered end is turned down to allow the bolt to slide endwise in its housing.

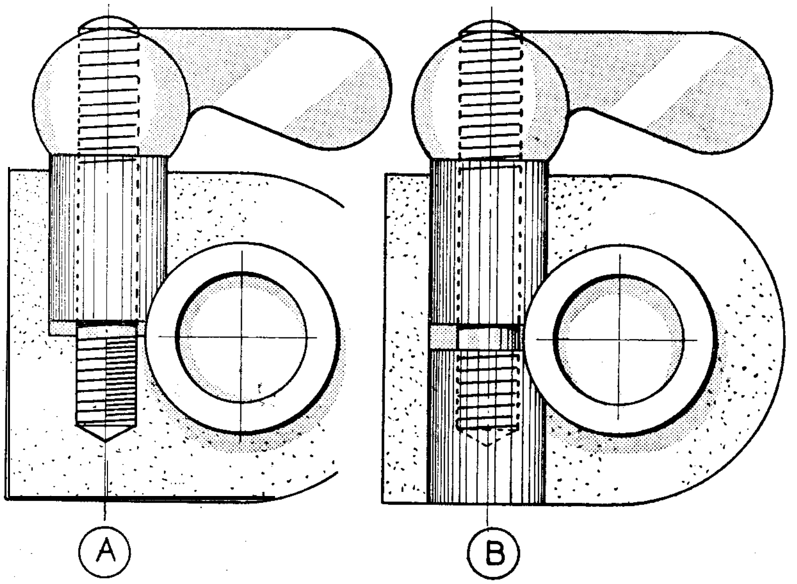
Lathe application

When a clamping bolt of this kind is fitted to a lathe tailstock, the drill hole forming the housing is often blind and does not go right through the casting, as in the previous instances. In this case, the bolt, pre-

Fig. 3, Right: A-a *machine spindle fitted with a single locking sleeve; B- the double jam-nut spindle lock*

Fig. 1, Below: A machine spindle-lock





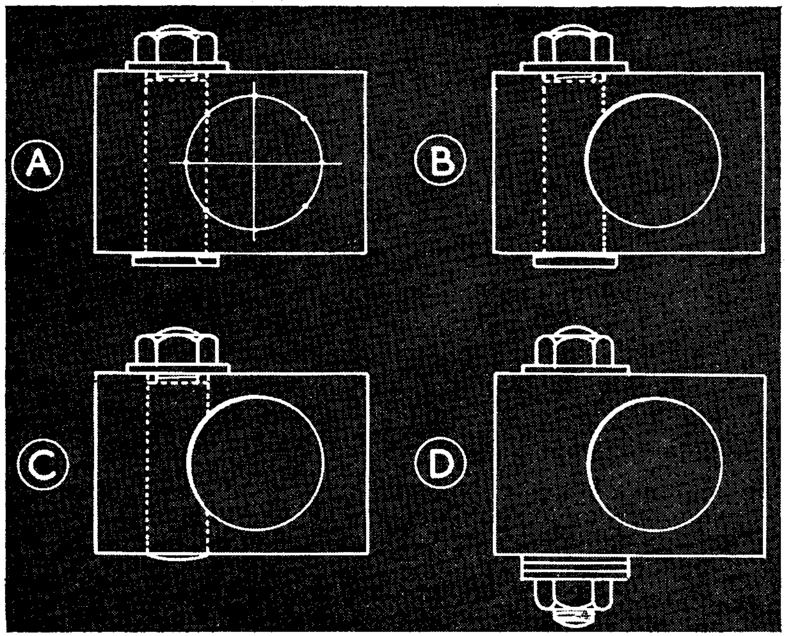


Fig. 2: The series of machining operations in fitting a locking bolt

paratory to the machining operation, is made a force fit and is afterwards removed by using a draw-nut and collar,

A secure fit is, here, essential, otherwise the bolt will tend to turn under the pressure of the cut and will then be incorrectly machined.

Good method

When a clamping bolt of this type is tightened, the tailstock barrel or other machine spindle will be forced to one side, for a distance depending on the amount of working clearance between the moving parts. It seems therefore, somewhat difficult to ex-. plain why the old-fashioned method of locking the tailstock barrel has been generally abandoned, for this consisted in slitting the forward end of the casting and contracting the bore evenly on the barrel by means of an ordinary clamp-bolt.

Another way of fitting a clamping bolt is illustrated in Fig. 3A. Here, a stud is screwed into the casting and carries a sliding collar which is forced against the spindle when the clamping lever is tightened. To increase the area of contact between the parts, a curved contour is filed or machined on the lower end of the collar.

One drawback

In an alternative design, the stud is reolaced by a bolt. to which the clam&handle- is attached,. and this bolt screws into the castmg. One objection to this is that wear takes place in the casting itself and a difficult repair might be called for if, in the course of time, the thread became stripped.

A better arrangement is that illustrated in Fig. 3B, where what is termed a double jam-nut is used. The lower half-nut is fixed, to the clamping bolt and the upper is made free to slide. When the spmdle is secured by tightening the clamp-handle, the two half-nuts each exert equal pressure and the area of contact. is correspondingly increased.

Manufacturing details

As a heavy-duty locking device, this form is ureferable to that illustrated in Fig. l, and it serves well for securing the table of a drilling-machine to the column.

This form of locking device is machined in the same way as the first example cited, with the assembled parts securely bolted in place. To enable the two half-nuts to close and grip the spindle, they must be separated during machining for some 1/16 in. by means of a distance washer, or they can afterwards be slightly reduced in length at their inner ends.

It sometimes happens that solid or double-nut clamping bolts have to be made after the spindle bore has been machined. In this event, the rod or assembly from which the part is made is set up in the lathe, and a fly-cutter, attached to the faceplate, is accurately adjusted to cut to the exact radius and depth required. ❑

RAILWAY FACTS AND FIGURES

THOSE READERS who take a keen interest in railway matters are recommended to a publication called " Facts and Figures about British Railways." This 40-page booklet covers in comprehensive form all the major details of British Railways' expenditure, income, engineering plans and other branches of the system.

The last few pages are possibly the most interesting. Recorded in tabular form is a complete record of the railways stock, equipment, staff and stores. Another section includes details of station sizes? main-line gradients, tunnels and bridges.

The total number of locomotives in 1954 (excluding service engines) was l8,816-out of this total all were steam-powered except for 71 electric and 320 diesel, petrol and gas-turbine types. There are 63,100 bridges; 1,049 tunnels and 25,816 level crossings.

The largest passenger station is the 21-3/4 acre Clapham Junction while Waterloo has the largest number of platforms-21 in all. Clapham Junction is the busiest railway junction and handles 2,500 trains every 24 hours !

In 1954 the railways used 14 million tons of coal-all but just over one million of which in the locomotives mentioned. This amazing figure is justified by the fact that 24,000 passenger trains and 16,000 freight trains are run every weekday. Freight trains moved 283,498,000 tons of goods in 1954 over 51,482 miles of track and to keep an eye on all this, 577,183 railway men (and women) were needed !

Although train crashes have figured in the news recently, the overall safety of the system revealed by figures which show that,.in 1954, was nil in over 20 million passenger miles. A further breakdown figure shows one fatality in 759 million passenger miles.

This brief sample of fascinating statistics gives some idea of the appeal of this booklet. Copies are obtainable free, from the British Transport Commission, 222, Marylebone Road, London, N.W. 1. Readers should mention the MODEL ENGINEER and, as supplies are limited, application should be made immediately. ❑