Light vertical MILLING MACHINE

Gmtinued from June I

BY

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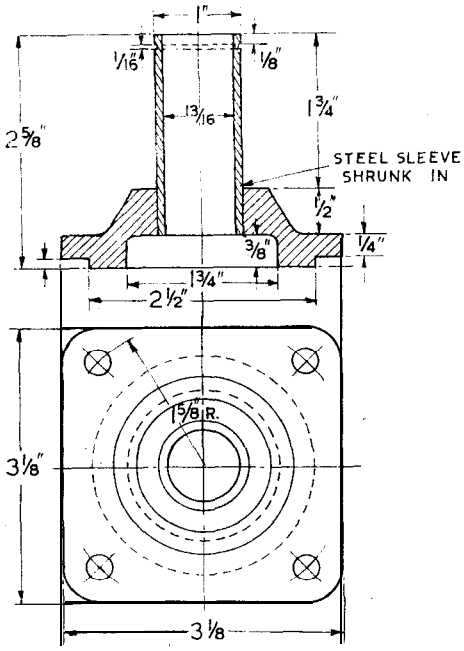
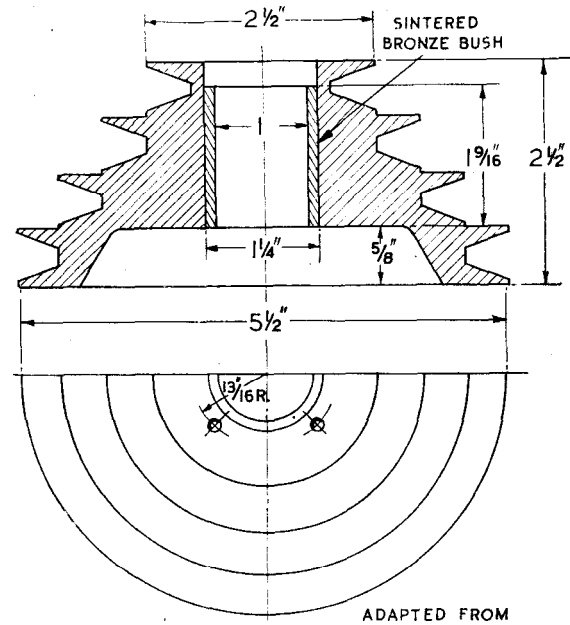


LEY BEARING 1 OFF C.I. OR L. 4.



DRIVING PULLEY 1 OFF ADAPTED FROM STANDARD PULLEY

AFTER the quill has been mounted securely in position, the end cap should be centre-drilled for supporting it by the back centre. The rack teeth may now be machined, with a tool mounted normally in the lathe toolpost. You obtain the linear spacing of the teeth to the correct pitch by traversing the saddle a definite distance for each cut. With the 8 t.p.i. leadscrew, exactly one turn each time is required. If the leadscrew handwheel is not indexed, it must be marked so that its position can be assured. Make certain that the threads of the leadscrew and clasp nut are clean and in good condition, and that the slides of the nut, together with the saddle, are closely adjusted. The depth of cut can be measured by the cross-slide index; and if a limit stop can be fitted, so much the better.

Gash all the teeth in first with a parallel tool, not more than 0.040 in. wide, as this greatly relieves the load on the forming tool, which is of Acme thread form, with flanks at an included angle of 29 degrees, and 0.045 in. wide at the tip. The depth specified on the detail drawing is slightly greater than the normal standard, to give ample tip clearance for the pinion teeth. You will not find it difiicult to grind the tooth to the correct form on a bench grinder fitted with an adjustable tool rest, checking the angle by a protractor with the aid of a lens, and grinding the tip last to adjust the width.

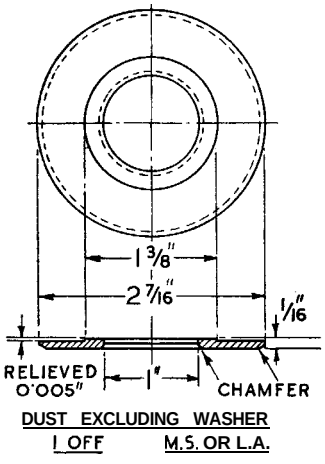
In use, the tool should be securely mounted in the toolpost, with minimum overhang, and the topslide should be gibbed tightly or otherwise prevented from moving inadvertently. Though the drawing shows the rack cut right to the bottom end of the quill, I have not found this necessary; it need not extend nearer than 3/4 in. from each end, giving a rack length of 4 in.

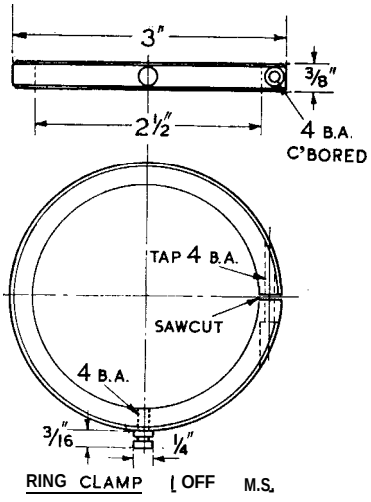
To complete the machining of the quill, we mill a closed keyway in the centre part of its length, at right angles to the centre line of the rack. The object is to prevent any tendency of the quill to rotate; it does not have to withstand any appreciable torque so long as the bearings are in normal working order. To engage with it, the stud which forms the pivot for the fine feed wormshaft is turned down to 1/4 in. dia. and projects through the inside wall of the housing for a distance of 1/8 in. You may therefore check the location of the keyway in the quill by marking through the stud hole with the rack teeth in their working position. I end milled the keyway by using the milling spindle on the vertical slide.

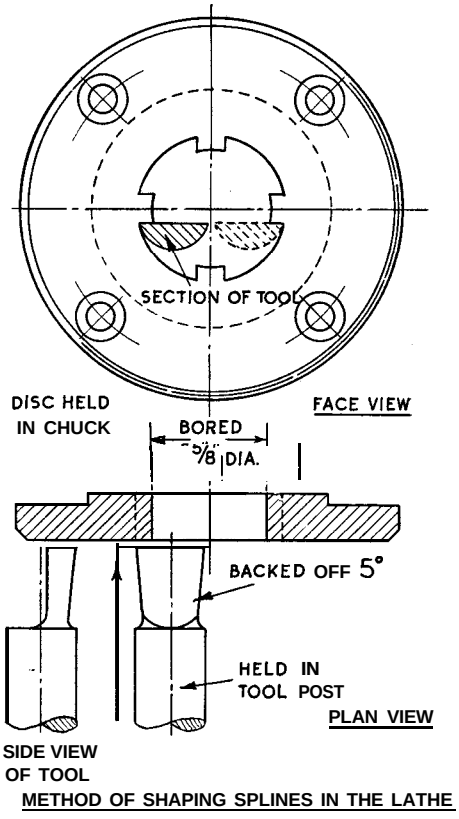
This is the spindle drive

In assembling the spindle in its bearings, a dust excluding washer is first pressed on, against the collar of the spindle, before the lower ball race is fitted. This washer is shown in place in the assembly drawing on page 3 19 of the May 1 issue. It may be made in steel or light alloy sheet, bored to fit closely on the spindle, with a radius or chamfer on the underside to clear the fillet on the shoulder of the spindle, and relieved on the upper face to prevent rubbing on the outer race. After assembling both ball races, adjust them endwise by the spindle nuts, so that all end play is eliminated and slight friction can be felt. Overloading must be avoided. The nuts are then locked tightly against each other; it is worth while to make a pair of C-spanners in 1/4 in. mild steel.

The pulley bearing is in the form of a steel sleeve mounted on a square-flanged end cap, which fits on the top face of the quill housing, registered truly by a spigot on the underside. If preferred, the sleeve may be screwed into the cap instead of being shrunk in; the important thing is that it must be in true concentric alignment with the spindle when the cap is bolted down. For this reason, you may do the final machin-





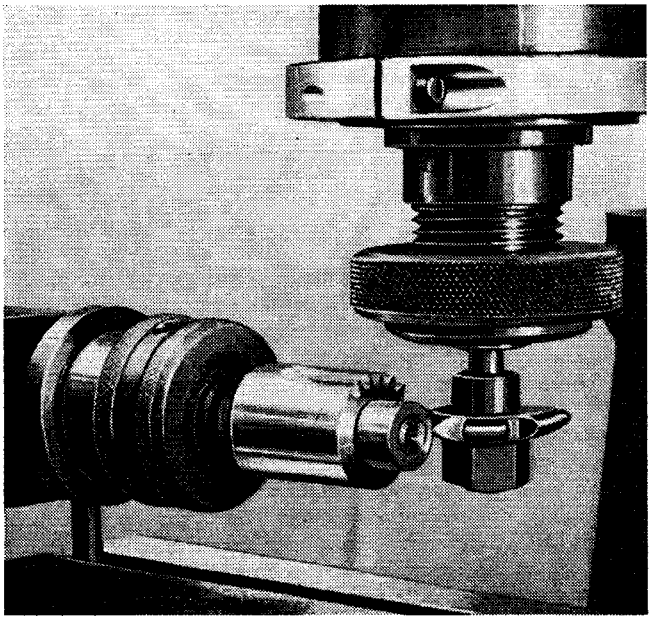


METHOD OF SHAPING SPLINES IN THE LATHE

i.ng after fitting the sleeve permanently to the cap by locating from the bore on a mandrel, and skimming the outer surface, and also the register spigot, at the same setting.

A ready-made four-step pulley casting in light alloy can easily be adapted as the spindle drive; it will bore out to take the bush which forms the actual bearing surface. The bush is of sintered bronze, which is porous and when impregnated with oil will furnish all the necessary lubrication for a long period. It should not be drilled for oil feed, but the hole originally drilled in the pulley for the grubscrew may be used to replenish the oil supply to the ***outside*** of the bush only. Standard pulleys carmot be relied upon to be true all over; they should be carefully checked and given a light skim over the grooves and other surfaces to correct any errors. Their balance may also be capable of improvement; this applies also to the motor pulley, which is a replica of the pulley on the spindle except that the bore is not opened out or bushed. Both pulleys may be statically balanced by being mounted on true mandrels and rolled on knife-edges or carefully levelled steel rails.

The groove in the top end of the sleeve is intended to take a spring circlip, with the object of preventing endwise movement of the pulley when it is fitted. This may not be considered absolutely necessary, as the pulley seats itself by gravity and the belt also tends to maintain correct alignment. Upward movement of the pulley can take place only if the splines of the driving disc (shown on page 319) tend to bind in the keyways. But if the circlip is fitted, some means of removing it, to allow the pulley to be removed, must also be provided. The simplest way is to drill a 3/16 in. hole in the top of the pulley to permit a chisel-pointed rod to be inserted in the joint of the circlip so that the circlip can be expanded enough to be extracted from the groove.



Cutting the feed pinion on the finished machine

Shaping the splines

It will be seen that the driving disc is spigoted to register in the top end of the pulley bore, and is held in place thereon by four socket-head 4 BA screws. Its internally-splined bore may present some difficulty, as it cannot be produced by simple machining methods unless we have a slotting machine or a suitable broach. Careful filing, to witness circles on both faces of the disc, can be employed; the circular parts should have clearance on the spindle, and only the splines need to fit in the keyways. I did the work in the lathe, using a half-round slotting tool with its flat face upwards, and set 1/16 in. below lathe centre. The lathe mandrel was indexed in four positions, and by rocking the saddle backwards and forwards I shaped the sides of the splines back and front, at one setting. To remove the rest of the surplus metal, I inched the mandrel round and carried on the shaping with a round-nose slotting tool.

This form of drive may tend to be somewhat noisy when the splines on the keyways of the spindle become slightly worn. I have considered making the disc out of laminated composition such as Tufnol, increased to about twice the stated thickness to give greater strength and bearing surface on the splines. Note that any extra space taken up here reduces the maximum feed movement of the spindle, unless the length of its extension is increased to correspond. This applies also to the fitting of a stop collar (page **319)** on the end of the spindle, but the collar can easily be removed when full movement is required. It is useful for many operations in drilling and milling to a specified limit of depth.

The ring clamp, for the lower end of the quill, is used for anchoring the tension spring when this method of carrying the weight and returning the quill is employed. It is bored to a push fit on the quill, and before splitting it through you should drill and tap the hole for the clamping screw. To start the drill, an end mill is fed in sideways to form a flat seating, as indicated by dotted lines in the plan views. The spring, which is like that used in muscle developers, is anchored between a grooved screw in the ring, and another in the top flange of the quill housing. Its position is really immaterial, but it may well be placed close behind the projecting strip on the side of the housing, as seen in the pictures of the complete assembly. If you object to the appearance of the exposed spring, you can enclose it in a light sheet metal casing attached to the side of the housing. But the vertical strip on the casting which is finished parallel to the spindle axis, should be left exposed to help the checking of spindle alignment.

To be continued

BOXHILL.. .

Continued from page 443

down, but three push-fit pins with dummy hexagon heads are provided at each end, so that the hand pump can be brought into action very quickly.

Elbows are also fitted to the bottom rear comers of the tanks to carry the balance pipes, which are bent up from thin-wall copper tube 5/16 in. dia. For easy filling, air vents must be fitted to both side tanks, as well as to the bunker tank. Separate air vents are not shown; a small air hole could be drilled through each of the " condenser " pipes on the top front end of the tanks.

By-pass valve

The right-hand tank has an extension ₁in. long, protruding into the cab at the side of the firebox. To this the water by-nass valve is fitted. It is arranged far enough awav from the inside of the cab side to allow its handle to clear it and is screwed into the rear plate of the side tank, which is thickened up locally to take more threads. The water filler on this tank contains a filter made from fine copper petrol gauze and soft-soldered to a ring, a loose fit in the filler recess. Thus you can remove it quickly for cleaning by inserting one finger and lifting it straight out.

At the front of each tank, a short length of 1/4 in. brass angle is attached. About five 8 BA screws can be put through it, into the running board, the screws passing through into the footplate bracket beneath. A strap (not shown in the drawings) should be put right across the boiler and the two side tanks, to keep the tanks quite rigid. It can be of hard brass or nickel-silver strip 3/16 in. X 1/32 in., and its best position is just ahead of the dome. Hexagon-head screws should be used, about 8 BA, and once again the top sheets should be thickened locally to receive them. The strap must, of course, end short of the removable panel on the top of the left-hand tank. Even so, there should be plenty of room for three screws in each tank.

To be continued