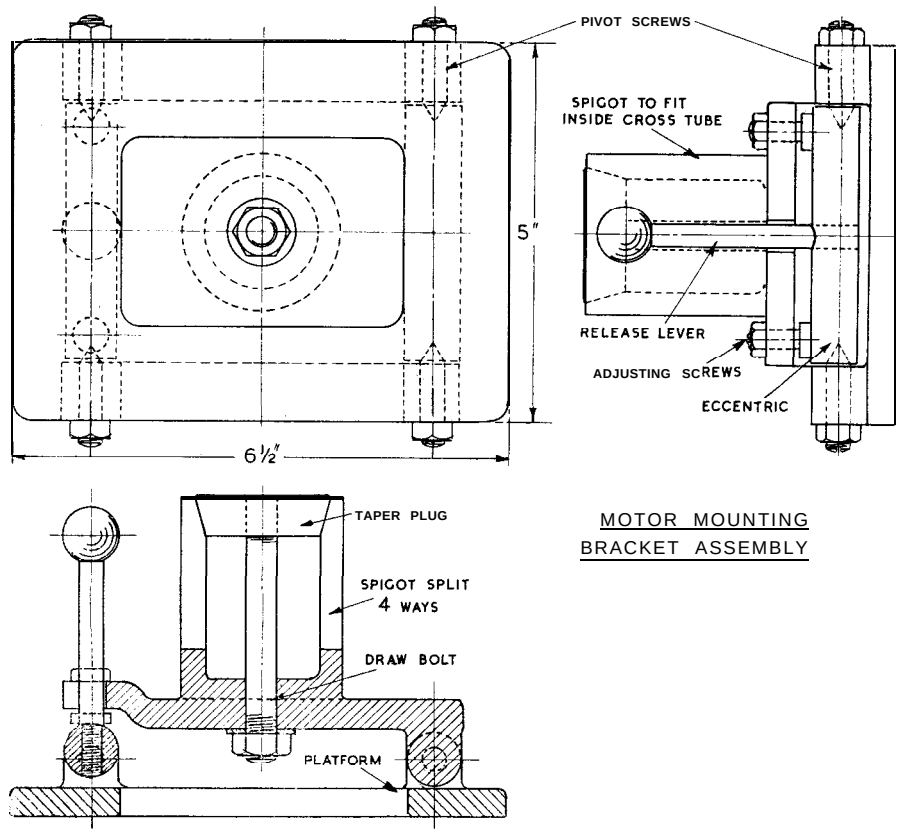
Light vertical MILLING MACHINE

Continued from July

By Edgar T. Westbury



MOTOR MOUNTING BRACKET ASSEMBLY

HERE ARE SOME

AN adjustable index bracket is clamped to the boss of the wormshaft bracket so that the graduations on the handwheel can be easily read from any working position, it is bored to a close fit on the boss, drilled and tapped for a 2 BA clamping screw, and split through the lug. It needs only to be filed on the edge of the arm, to the same radius as the rim of the wheel, and incised with a fme knife-edge file to form the index mark.

The entire wormshaft assembly swings on the pivot stud for engaging or disengaging the tine feed gear and is locked in either position by the hand lever. You might find it an improvement to provide pre-location in two positions for the bracket, possibly by using a spring-locking device, but it is important that the worm should engage fully, without backlash, to give accurate indexing.

My description would not be complete without some reference to the mounting of the driving motor, though this is not necessarily a component of the machine itself, and is subject to considerable modification. For operating on a.c. mains in Britain, I recommend a standard 1/4 h.p. split-phase induction motor, preferably a capacitor-start, of 220/240 v. 50-cycles, running at 1,425 to 1,450 r.p.m. But different makes of motors conforming to this specification vary widely in shape and size, including their diameter and length, the position of mounting feet and their longitudinal relation to the output shaft. To be adaptable for all types of motor, the mounting bracket would have to be larger and more cumbersome than it need be to fulfil its simple purpose.

The motor first fitted to the machine was of the flange mounting type, and the mount had to be in the form of an angle bracket. This was attached to a spigot turned to a push fit in the bore of the cross tube and secured by a bolt passing horizontally through its diameter. Slots in both sides of the cross tube gave some latitude for adjustment of belt length and tension. For the more usual foot-mounted motor, a flat plate attached to a spigot and fitted to the cross tube in the same way would fulfil the basic requirements, and would probably satisfy many. But it lacks any provision for quick release of belt tension when we change speed by shifting the belt from one position to another. While it is possible to spring the belt over the pulley rims, this is liable to stretch it permanently and shorten its life, apart from the extra effort required.

Motor attachment

A form of motor attachment which provides both for quick release and tension adjustment is shown in the drawing. The dimensions given for the motor platform, 6 1/2 in. X 5 in., will accommodate several types of standard motor, with some latitude for vertical location for pulley alignment. The two main parts are intended to be in the form of light

alloy castings, though they could be fabricated in steel by welding or brazing.

The bracket has a hollow spigot which should be turned to a close push-fit in the bore of the cross tube, and is bored at the mouth to a taper of 30 deg. inclusive. It is then split four ways for about half its length, and fitted with a taper plug and draw bolt so that it can be expanded to a secure fit inside the tube. The rectangular flange of the bracket has a projecting lug at one end, centre-drilled at top and bottom to fit the hinge pivots, and is set back at the other extremity to take the two adjusting screws. These have plain round flat heads and are fitted with locking nuts. The motor platform is simply a flat plate which has an aperture in the centre to economise metal and reduce weight (an optional feature) and is provided at the back with four lugs, each drilled and tapped for pointed screws, which are also fitted with lock nuts.

Tension is released by a short bar, centre-drilled eccentrically at each end to fit the points of the pivot screws, and cross-drilled and tapped at the middle to take the hand lever. In the plan view, the lever is at right angles to the motor platform, with the eccentric bearing against the heads of the adjusting screws to maintain normal belt tension. When the lever is turned outwards, to just over a right angle, the platform is free to move closer to the bracket and thus loosen the belt. No provision is made for preventing the platform from swinging away from the bracket, as this can happen only if the belt is completely removed. A simple limiting device can easily be added.

For working with normal right-handed cutters of any type, the top end of the machine spindle--and also, of course, the end of the motor spindl-must rotate in a clockwise direction. A reversible motor is not necessary, unless left-handed cutters are to be used, in which event you would be wise to make some provision to prevent the collet chuck cap and other screwed fittings from working loose. If the motor, as originally made, runs in the wrong direction and is not intended to be reversible, we must find the ends of the main and starting windings and reverse them in relation to each other.

The milling machine, in its basic form as described and illustrated, is of course capable of being improved and elaborated. One addition which many will consider worth while is a guard or enclosure for the driving belt; in a machine intended for industrial use this would be regarded as an essential safety precaution. I have not given details, but its design does not involve any great problems. It could easily be made from sheet metal by fabrication or panel-beating methods, and attached to the spindle head and the motor bracket at front and back. For easy removal while changing belt positions, these attachments may be in the form of bent steel angle brackets, to which the guard is fastened by knurled hand-screws.

For accuracy

The possibility of fitting an index to the cross member, to show the angular position of the spindle head, will undoubtedly occur to many, but it is not as easy as it looks to devise a practical fitting of this kind which will be effective at all extensions of the head. A ring, indexed radially in degrees, could be attached to the front end of the cross tube, and a straight line incised along the cross tube would indicate angular settings against it. But in view of the relatively small diameter of the tube, the accuracy of indications provided in this way, at the much greater radius of the spindle nose or cutter, would not be very great.

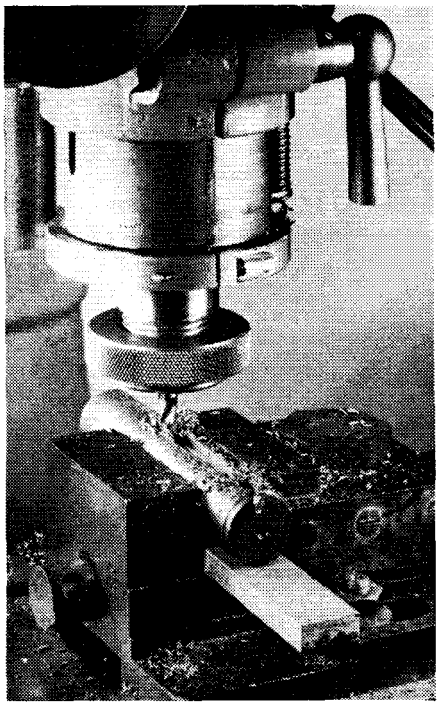
Undoubtedly most of the work done on this machine will call for vertical setting of the spindle, and the need will be evident for some way of providing accuracy. One of the simplest and most positive means is to make or adapt a try-square with specially long blade and stock, which will rest on the surface of the milling table and register against the vertical strip on the right-hand side of the spindle head. The same idea can be applied to adjusting angular settings, by making a protractor with similar long limbs, or adapting the protractor from a large combination rule set. The check should be made over as great a length of surface as possible, on both the table and the spindle head.

Angular settings

The difficulty of adjusting angular settings accurately is not as great as we may think. For instance, it has been put to me that if we need to alter either the height or the radial extension of the spindle head, we must make a complete re-check of the spindle angle and lateral alignment-a tedious business. But there are many simple aids which can be used to eliminate the need for re-checking. For instance, in moving the spindle head in any plane, we can maintain, or return to, the previous spindle location by fitting a true-running dummy mandrel in the collet chuck and registering it against a straight test strip bolted to the machine table or held in the chuck in a true lateral or cross plane.

In the milling of flat surfaces with a broad cutter, it is often an advantage to set the spindle head slightly out of the vertical plane-only a mere fraction of a degree--so that the

ACCESSORIES



Milling a keyway fin. wide X tin. deep with a slot drill in a single cut

cutter penetrates deeper on one side than the other. This relieves cutting load, and often makes it easier to produce a good finish on difficult material. The same principle is often employed in surface grinding on vertical spindle machines. Inspection of the surface of the work, after you have taken a light test cut with an end mill, will give you a good indication of the vertical accuracy of the spindle; if the cutter wipes out its own footmarks, so to speak, the error is very small indeed.

Machine vice

The most essential accessory fixture for a milling machine is a good machine vice which can be bolted securely to the table and will hold work with reasonable accuracy. There are several kinds which can be bought ready-made at reasonable prices. The lugs or bolt-holes for securing the vice should be located so that bolts can be fitted to the T-slots in the table, which are 4 in. apart. Separate clamps or straps are needed for holding many work-pieces, but when applied to holding down a vice they are an encumbrance and sometimes a nuisance. If the vice can be located by tongues or dowels in the T-slots, so that the jaws are lined up truly in the lateral or square position, it is all the better, though it should also be capable of being set at an angle on the table when required. Swivelling vices can be obtained which will hold work at almost any angle, but they are generally less secure than the plain type, and a good deal more expensive.

The size of vice required will obviously depend largely on the work to be carried out, but it is a mistake to suppose that because we have plenty of room on the table a vice of a size to take full advantage of it is the best possible choice. Small and inexpensive vices, such as those in the Myford range of accessories, are extremely useful within their limited capacity, and quite reasonably accurate. Hardened jaw inserts are not always an unqualified advantage, though they undoubtedly help to maintain accuracy over a longer working period than soft iron or steel jaws. Horizontal or vertical V-grooves in the jaws are a great aid to security and accuracy in holding round stock, and shallow steps in the jaws are useful for holding sheet or strip material.

The vice shown is one which I have had for many years; it was originally obtained at a club jumble sale (maker unknown, probably amateur), and improved in detail design and accuracy. Its jaw width and opening capacity are 2 1/4 in. X 1 in. depth, and it has been capable of holding most of the work which I have so far encountered. The rear (moving) jaw has been fitted with side cheeks which guide it in true parallel motion, and with a large stud and nut which can be used to clamp it down firmly after the jaws have been tightened on the work in the usual way. This counters the prevalent tendency of the jaw to lift, which often results in impairing the accuracy of work despite care in setting it truly. All four edges of the baseplate have been squared up so that it can readily be located on the machine table.

To be continued

NINE CORNISH MAIDENS . . .

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Suddenly a head appeared from above the organ pipes. A man gave me a grin and a nod as if expecting us. Then he vanished, to appear again.

" Ay, she's a beauty isn't she ? " he said in a Cornish accent. " Bought her for fire-wood I did, five years ago up in Hampstead at the Fair. Just a heap of junk she was then.

" The wagon she was in leaked like a basket. Look, I'll show 'ee the state of her." Mr Jonas led me across the yard to another workshop, littered with huge parts of traction engines, decorative parts of showman's engines, motor cycles of the early 1900s, organ pipes and all the paraphernalia of a workshop of half a century ago.

At one end was a pile of strips of wood from the old organ pipes. " We brought it in by the barrow-load, one wheelbarrow-full after another," he said in the matter-of-fact way that his Cornish forebears might have described their clearing of a wreck. " We dried it out and went around old furniture sales and brought up furniture to get the right kind of seasoned wood for new pipes. Some of the register boxes had to be rebuilt and I had to make up new brass valves for the key frames.

" Now she's got bass, trombone, baritone, cello, violin, bass drums, side drums, kettle drums, castanets and cymbals. There's a lot more to be added. We want to fit bells some time-for carols, y'know. They'll go up in front."

" Are there nine maidens ? " I asked.

" Them ? Oh yes, nine. Look, here's the other two." He led me to another shed, piled with parts of engines and organs. There they stood on their pedestals, even more voluptuous than the others. White-skinned, red-lipped and golden-haired, they gleamed in their fresh paint.

I asked Mr Jonas, farmer, repairer of agricultural machinery and haulage contractor, if he himself played an instrument. " Oh yes," he said, " I play most things. But I've never had a lesson, y'know. Just by ear."

He took two organ pipes and blew them together with his mouth. "These two are in G and one's exactly an octave above the other. You've got to get them tuned exactly and you can only do that by ear."

Spares ? " Oh, the best place is the Continent. Amsterdam I get some of the music from. There's a more lively cut to the Continental music-shorter notes and more life. France is the home of the steam organ. Mine was made in Paris for a dance hall."

The organ paused again and started on a new tune with its I,600 pipes.

A mile and a half later, across a boggy field, we found the Nine Maidens. As in Mr Jonas's workshop, only seven were standing in position. Sadly overgrown and neglected, they were mixed up with derelict farming machinery of the twentieth century. I felt that the Ministry of Works had a lesson in rehabiliation to learn from Bill Jonas. ❑