the form shown in the diagram Fig. 7 and is held in place by the set screw seen at the right-hand end of the bar. The lock nut at the opposite end permits the bar to be turned so that the cutter may approach the work at any angle desired. In the illustration the cutter is seen facing forwards. In use this is not so since the device needs to be *pulled* through the work on the back stroke of the shaping machine. This action requires the clapper box to be locked in order to prevent the tool from lifting in the normal manner on the return stroke.

Tools for Sawing

Many years ago, in the course of making certain components, a sawing operation was required. At the time, and with the equipment then available, the shaping machine was considered to be the best medium for carrying out the work in a simple manner. Accordingly, the simple small tool depicted in Fig. 14 was evolved. The body of the device is the holder for boring tools used in the lathe. This holder is split axially by a saw cut and is fitted with a pair of pinch screws which normally serve to make the holder grip the boring tool. The sawcut, however, can be used to grip a short length of hacksaw blade that may be applied to the work once the holder has been set in the clapper box and the machine set in motion. This device was found to be quite successful in practice. So much so, in fact, that the enlarged version illustrated in Fig. 15 was developed to deal with work needing a tool with rather greater capacity.

Fig. 13 Small Sawing Tool with work

CHAPTER 5

Additions to the Machine

AS A RESULT of keeping a machine tool specifically designed for the amateur to an acceptable price level, there are often a few, perhaps minor, shortcomings that are usually within the capabilities of its owner to put right. The shaping machine is no exception. Here some of the improvements that can be carried out concern the tool slide itself.

In Fig. 1 the tool slide of the Acorn Tools shaper in the author's workshop is illustrated. Three modifications have been made to it, and these will serve as examples that may be applied to other makes of machine.

Fig. 1 Acorn Tools Shaper Tool Slide

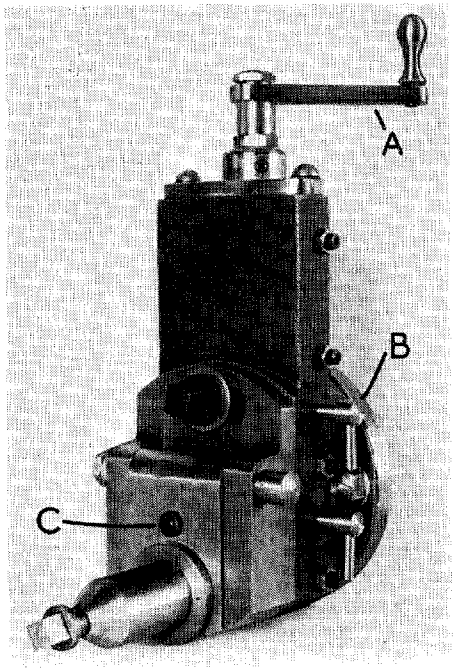
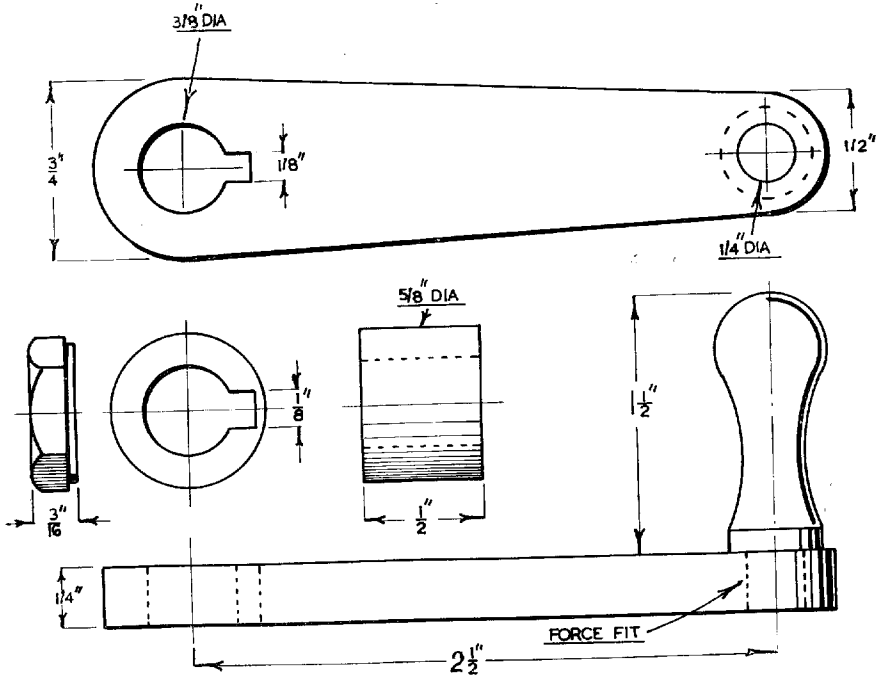


Fig. 2
Original Feed Screw Handle

The Feed Screw Handle

The handle for the feed screw which came with the shaper is illustrated in Fig. 2. A 3-in. rule has been set alongside the component in order that the reader may the more readily assess its size. From

Fig. 3 Modified Feed Screw Handle



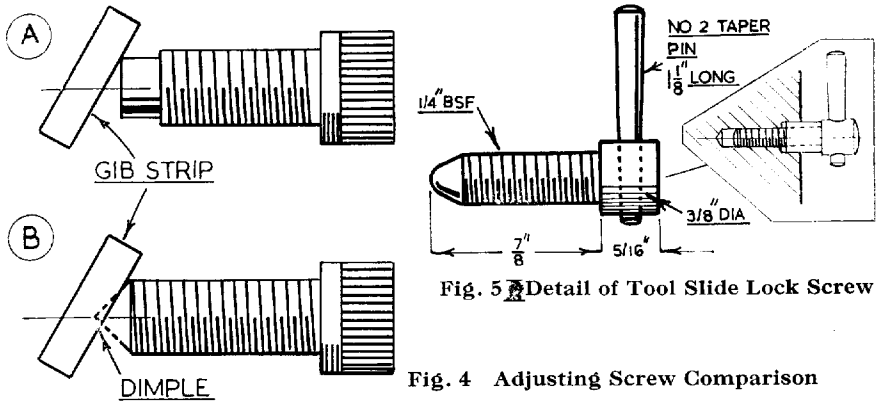


Fig. 5 Detail of Tool Slide Lock Screw

Fig. 4 Adjusting Screw Comparison

this estimation it will readily appear that the effective leverage is very small since the centre line of the handle is not much more than 1½ in. from the centre of the feed screw. Such a figure is really insufficient for comfortable working so the modified handle, illustrated at "A" in Fig. 1 and detailed in Fig. 3, was made and fitted to the feed screw itself. The new handle has a much increased leverage, as may be seen from the drawing, thus giving the operator greater comfort. The few parts needed are readily made. The keyway in both the lever and distance piece can be formed either by filing or by a machining operation using the lathe itself as a shaper.

Gib Strip Lock Screws

As will be seen the tool slide is provided with a number of adjusting screws that bear on the gib strip and remove any shake in the slide that may arise. A word or two here, on the subject of these adjusting screws may not be out of place. Fig. 4 depicts diagrammatically a pair of adjusting screws making contact with a gib strip. At "A" is a condition sometimes encountered, fortunately only rarely, where a dog-ended set screw has been used. Now the adjusting screws have a dual role to play; not only must they be capable of taking up slack but they must also restrain the gib itself so the strip is dimpled and the point of the screw pointed so that it can enter the dimple as depicted at "B".

It is a good practice to provide one or more lock screws independent of those used for adjusting purposes. This avoids disturbing the gib strip adjustment and ensures that once the depth of cut has been set it will "stay put". A pair of lock screws may be seen in Fig. 1 at "B" with details of a suitable design in the illustration

Fig. 5, where, it will be noted the distance pieces have not been shown. They do not have any real technical significance, but do, perhaps, make a contribution in the course of tidiness, particularly if (as it should be) the slide is counterbored slightly to receive them.

Earlier in the book various methods of locking the clapper box have been described. One of these concerned a clapper fitted with an American type of tool post. It may be of interest to refer to Fig. 1 where the cap screw locking the clapper may be seen at "C".

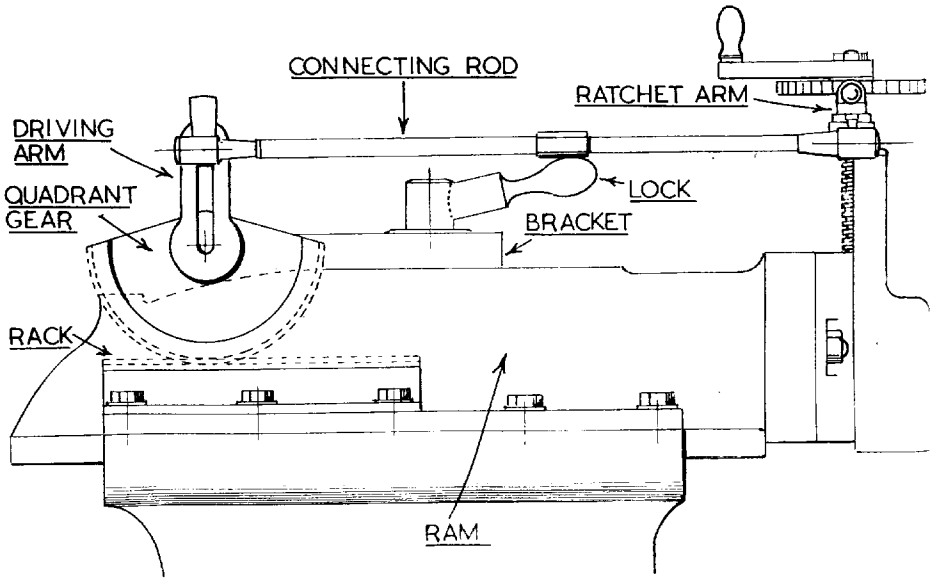
Automatic Down Feed for the Tool Slide

Very few small power-driven shaping machines are fitted with an automatic feed to the tool slide. Whilst automatic traverse to the work table, or in some makes of machine the ram slide, may suffice for much of the work undertaken, there is little doubt that much gain is to be had from a tool slide having automatic feed.

The 7-in. Acorn Tools machine in the author's workshop has now been fitted with such a device which has much increased the general capability of a single-handed shop where two different machines are often in work at the same time.

As modified the tool slide feed screw is turned by a pawl-and-ratchet system driven by the mechanism depicted in Fig. 6. This

Fig. 6 General Arrangement of the automatic down feed for the shaping machine



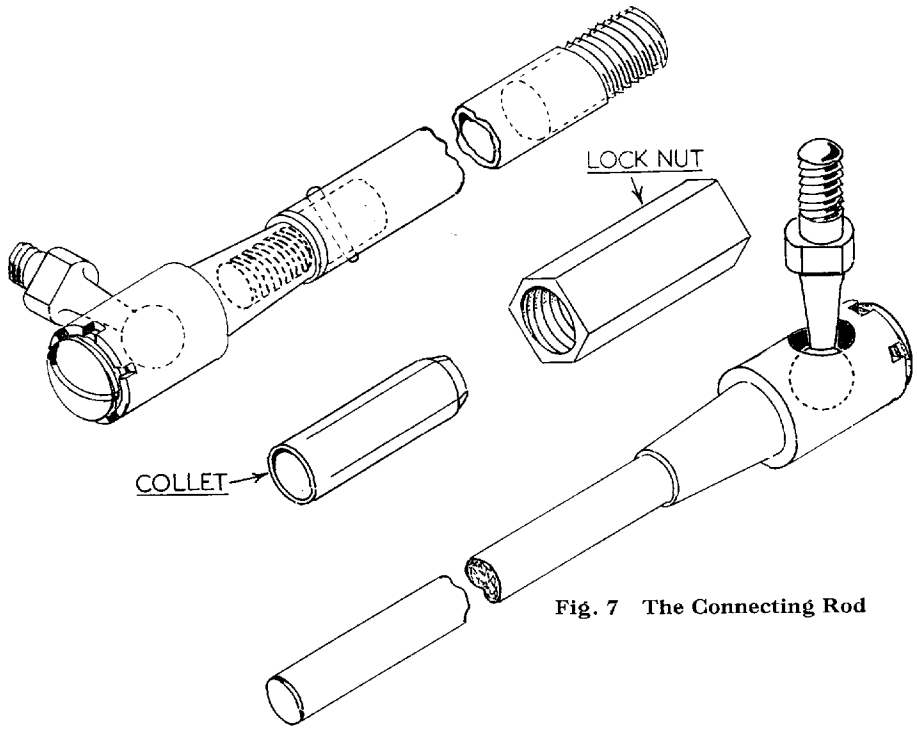


Fig. 7 The Connecting Rod

consists of a length of rack, 20 diametral pitch, fixed to a bracket mounted on top of the ram slide gib strip, three of the original gib strip set screws being used for the purpose of securing the bracket. The rack engages a quadrant gear cut from a 100 tooth change wheel and on this gear is mounted a driving arm slotted so that a ball joint fixed to the end of the connecting rod can be adjusted radially in the arm. In this way a fine or coarse feed can be selected at will, varying from 0.003 in. to 0.012 in. according to the number of teeth on the ratchet wheel that are gathered by the pawl. The quadrant gear itself is mounted on a stud carried by a bracket clamped to the ram position lock plate.

The Connecting Rod

The rod fitted with ball joints at each end, and has a clamping device at the centre, similar to that of a collet chuck. The reason for this provision is that when adjusting the position of the ram it may often be necessary to vary the length of the connecting rod. The assembly is depicted in Fig. 7.

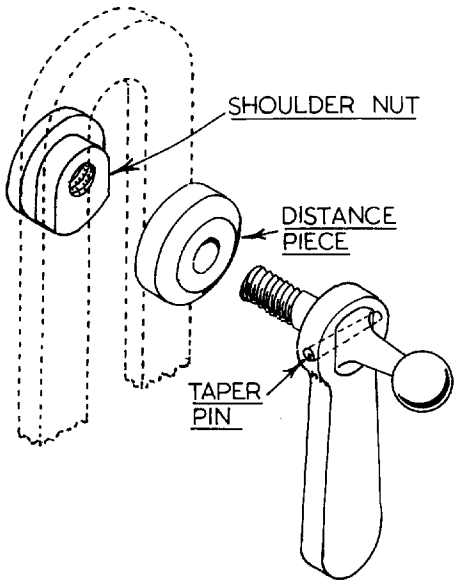


Fig. 7A The Connecting Rod Stroke Adjustment Lock

The ball joints at each end of the rod are of a type sometimes fitted to carburetter controls on motor cars. That at the feedscrew end of the rod is fixed to the ratchet-and-pawl mechanism whilst the other is provided with the adjustment lock illustrated in Fig. 7A. This consists of the parts depicted, the shoulder nut and distance piece forming a clamp for the driving arm that is operated by the ball itself. The ball has two flats machined upon its shank, so that a spanner can be used to turn it when the ball joint needs adjustment on the driving arm. For convenience sake a small ring spanner has been made and permanently attached to the ball and secured by the taper pin seen in the illustration.

The Driving Arm

This part is attached to the quadrant gear and mounted on an axial extension to that gear, so designed as to enable the ball joint to be set on either side of the arm and clamped there. Changing the position of the ball from one side to the other is an important provision when the tool slide needs to be set over steeply in relation to its normal upright position.

The Quadrant Gear

The gear is cut from a standard 100T change wheel of 20 diametral pitch a wheel obtainable from Myford Ltd. in fact. As a maximum

ram movement of 7 in. has to be catered for, half the wheel has to be used in order to engage the 8-in. long rack. For those who may be contemplating applying the modification being described to another make of shaping machine, it may be as well to indicate the manner in which the number of gear teeth required is calculated The number of teeth is arrived at in this way.

The circular pitch (that is the centre of one tooth to the centre of the next) of a gear of X diametral pitch is given when the diametral pitch is divided by 3.1416 so, in this case, the pitch is:

$$\frac{20}{3.1416} = 0.157$$

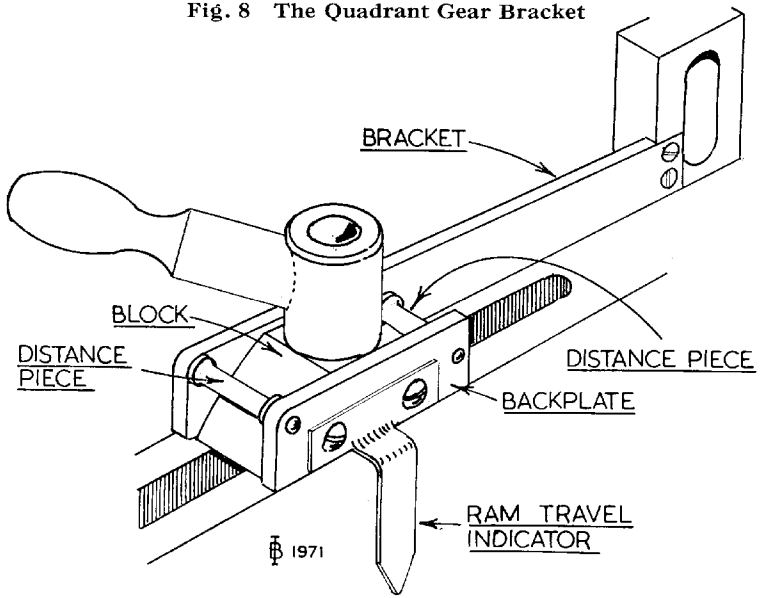
Therefore, in order to obtain the maximum engagement for a 20 D.P. rack 8 in. long the number of teeth in the quadrant gear will be:

$$\frac{8}{0.157} = 50 \text{ teeth approximately}$$

The Quadrant Gear Bracket

When designing the automatic down feed for the Acorn Tools shaping machine it was deemed unwise to drill any new holes in the

Fig. 8 The Quadrant Gear Bracket



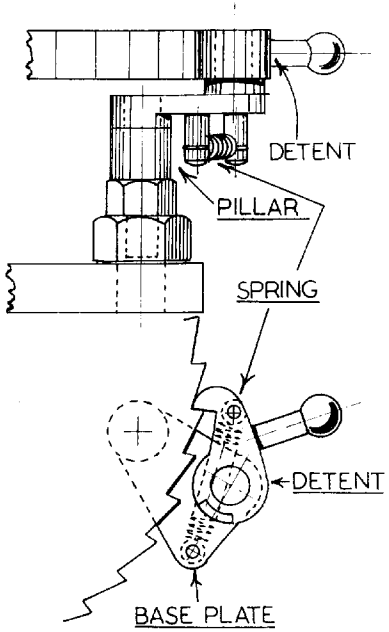
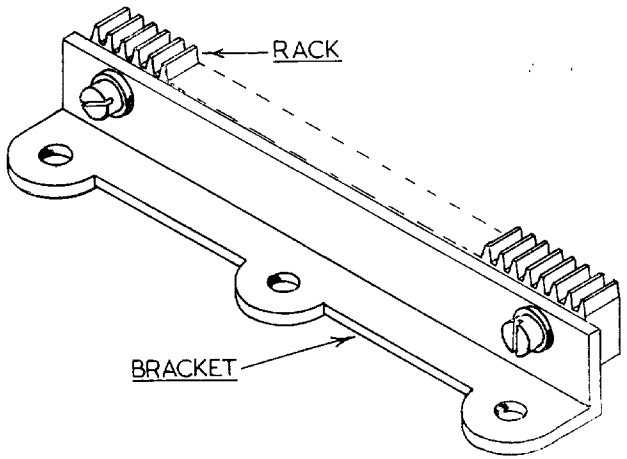


Fig. 11 Detent Assembly

castings or parts of the shaper itself. For this reason the bracket carrying the quadrant gear is clamped to the block forming part of the positional adjustment for the ram itself. Fortunately, the block

Fig. 9 Bracket for the Rack



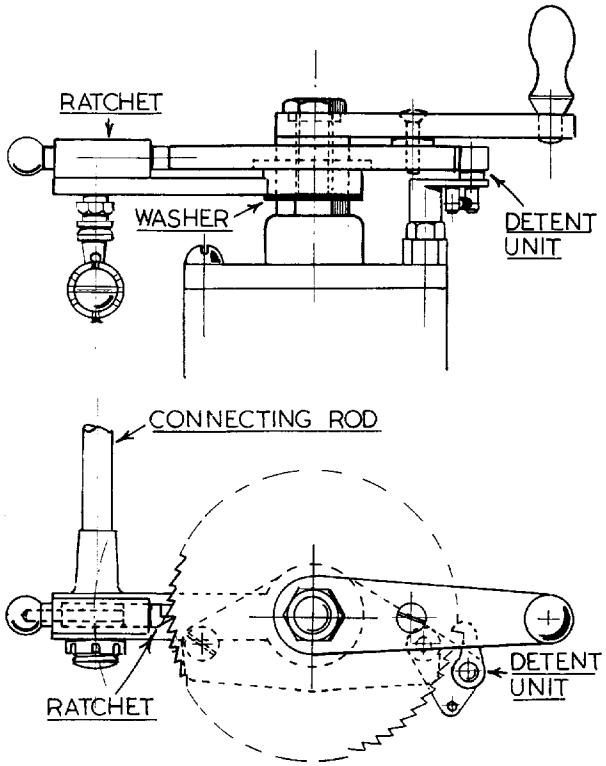


Fig. 10 Assembly of Ratchet & Detent Unit

already has two holes 2BA. Normally these are used to house screws provided for securing the indicator pointer that shows the length of stroke that the ram has been set to make. However, in this instance these holes serve well for the attachment of the back plate of the quadrant gear bracket as seen in the illustration Fig. 8.

The two screws only secure the bracket plate and these are restrained by a pair of tubular distance pieces seen in the sketch. In this way, the bracket and backplate are kept from tipping inwards. The distance pieces are made a few thousandths-of-an-inch less than the width of the block itself, thus providing a positive grip on the block by the two plates forming the main components of the quadrant gear bracket.

Rack Bracket

The bracket carrying the rack illustrated in Fig. 9, is cut from a length of 1-in. angle iron. As has already been shown, it is mounted

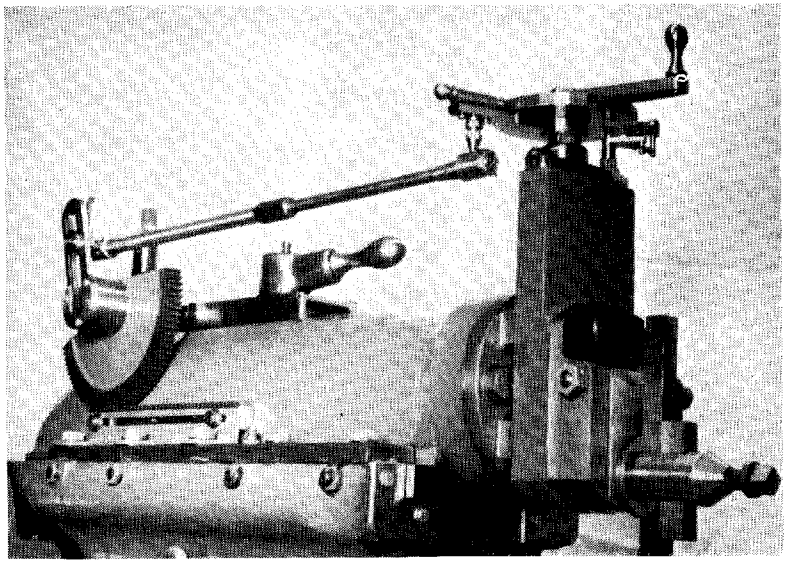
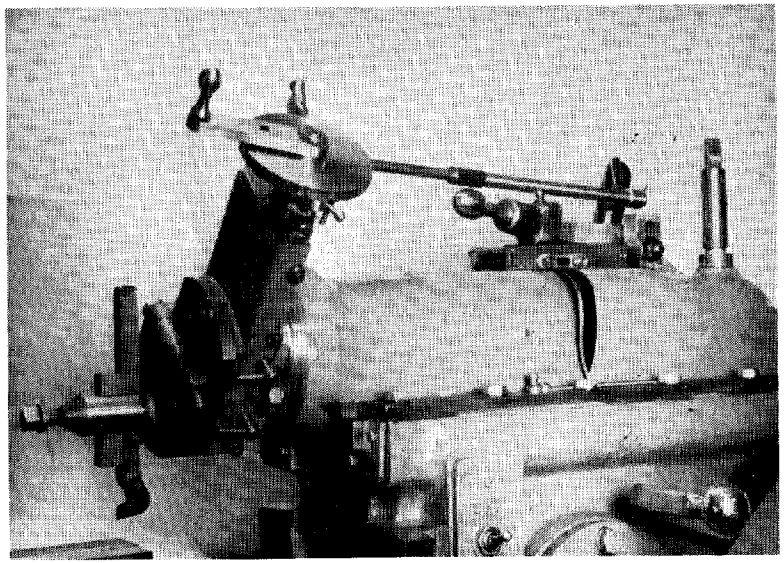


Fig. 12 The Down Feed Mechanism assembled on the Shaping Machine

Fig. 13 The Down Feed Mechanism assembled on the Shaping Machine



on the ram gib strip and is secured by three of the screws that secure the gib strip itself.

The Ratchet Wheels and Accompanying Details

The wheel has 30 teeth or notches, each notch moving the tool 0.003 in. The ratchet arm is sited below this wheel and is retained in place by a washer set above the nut controlling the end-float of the feed screw. The ratchet itself is mounted on the arm and is a self-contained unit consisting of a plunger and spring carried in a housing. In service, the plunger is withdrawn from contact with the ratchet wheel by turning the ball screwed to the end of the plunger spindle. An assembly of the ratchet and ratchet wheel may be seen in the illustration Fig. 10.

The Detent

The feed screw of the tool slide on the Acorn Tools shaper works very easily, so it has been found necessary to provide a spring-controlled detent whose purpose is to prevent the ratchet wheel from reversing direction each time the ratchet itself moves back to collect another tooth on the wheel. The arrangement of this detent are depicted in the assembly drawing Fig. 11, where the components of the fitment may be seen. The detent arm is pivoted and is supported by a stud attached to a small base plate. This plate also forms an anchorage point for one end of the control spring, the other being attached to the detent itself. In order to clear the ratchet wheel, the spring needs to be carried below the plate; extended anchorages are therefore attached to the detent as well as to the plate itself. The detent unit as a whole is attached to a pillar forming an extension of the hexagon screw holding the tool slide bearing plate in place. A small ball-ended lever is screwed to the detent itself to enable it to be swung quickly in or out of contact with the ratchet wheel as required. The complete equipment is seen mounted on the shaping machine in Figs. 12 and 13.