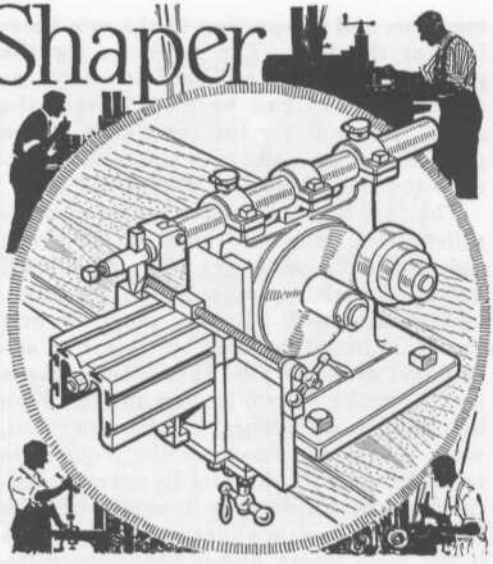
A 6-in Bench Shaper

by J. V. Romig



THE VALUE of the shaper as a machine tool is appreciated by every mechanic, but the man in the small shop, much as he may appreciate the advantage of such a tool, is not always in a position to purchase it. Here, however, is a shaper that can be made in any small shop at a reasonable cost, and which, on work within its capacity, will rapidly pay for the labor and slight expense of building.

There are two types of shaper in general use, the push-cut and the draw-cut. Each has its advantages; the draw-cut shaper, for example, is the better for tool work, where profiling to a layout line is to be done, since the layout line faces the operator, and the tool, cutting on the back or draw stroke, cuts clean to the line. On work of this kind the push-cut shaper, cutting on the forward stroke, breaks off the edge of the work, and makes it much more difficult to work close to the line. In addition to this, the draw-cut type takes heavier cuts with less vibration, as the pressure on the slides and the work is toward the main frame. On the other hand, the push-cut type is better for work in which the tool must be carried at an angle, and it permits the use of gooseneck tools. The advantages of both types are combined in this shaper, by the simple expedient of employing two clapper boxes, one of the push-cut and the other of the draw-cut type, either of which can be used to suit the work in hand.

In addition, and by eliminating a few of the usual components of shaper construction, such as the slide on the ram, a more powerful and rigid tool is obtained. Vertical feed is secured by raising the cross-rail assembly, and angular work is machined by tilting the table. Horizontal movements are obtained in the usual manner, by sliding the table saddle on the cross rail by means of the feed screw.

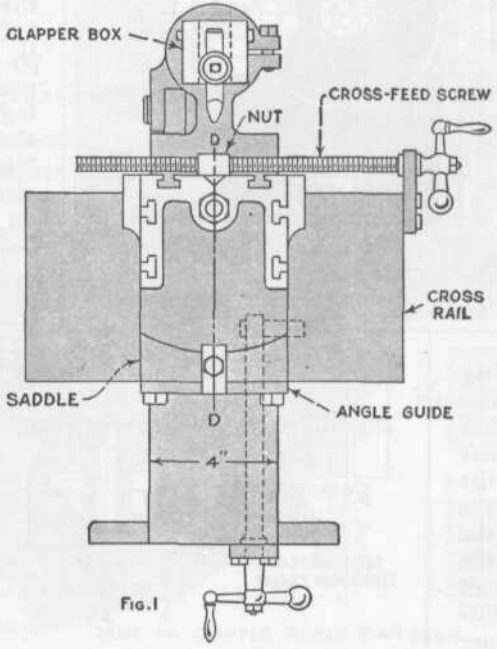


Fig. 1

The main frame of this little shaper is a gray-iron casting, machined to the sizes given in the accompanying drawings. The pattern for the casting is made of white pine, and is quite easy to fashion, even for the amateur patternmaker. All the parts to the right of the frame are cast integral with it, while the parts to the left are separate, and positioned with pins. These portions are the part of the front slide and the base that overhang the center web of the

machine, and the portion of the ram bearings at the top. The housings for the gear mechanism do not need any cores, as the shaft holes can be drilled from the solid. Patterns for the remainder of the parts should be made with sufficient allowance for the machining operations.

The ram is made from a length of cold-rolled steel, machined only on its front end for the clapper boxes. The bar should be tested with an indicator, in the lathe, and straightened. It may seem, at first glance, to be rather long, but this is an advantage, as many jobs that would take a longer stroke than 6 in. can still be done by taking two "hitches" of the ram; also, work that is too far from the front slide to be reached by the tool in normal position can be finished by moving the ram forward. The ram slides in two bearings in the main frame, and is kept from turning by the clamping member, which is also connected to the rocker arm below. On angular work, clearance for the tool on the return stroke *is* effected by turning the ram in the clamp the requisite amount. For all straight shaping or slotting work, the clapper box is, of course, kept in a vertical position.

The clapper boxes are made of machine steel, to the drawings, and fastened to the ram with taper pins. The draw-cut box is held with two pins, and has an auxiliary toolholder swiveling on a taper pin. The setscrew that holds the tool tight is reached through the hole in the front of the box. The toolholder for the push-cut box is turned from a length of steel, and is held in the box by its lower flange, which fits in the counterbore in the rear of the box. A serrated tool-steel washer is used between the tool and the front. The tools are 1/2 in. square, or 1/2 by 3/4 in.

When machining the main frame, care must be taken to get the ram-bearing holes square with the front slide, both vertically and horizontally. It is therefore best to machine the front slides first, to get a working surface for the subsequent operations. The ram bearings can be fitted with bronze bushings, although this is not essential. Compensation for wear is secured by splitting the bearings and adjusting with the clamping screws. Use oil cups or sight-feed lubricators on the bearings.

The ram is reciprocated by a crankpin on the main gear, the pin carrying a slide which fits the slot in the rocker arm. The crank may be clamped in any position on the gear, permitting

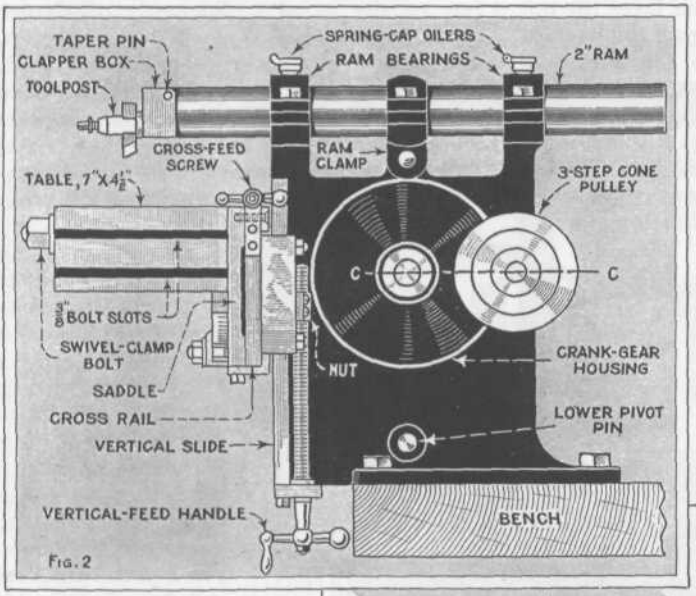


Fig. 2

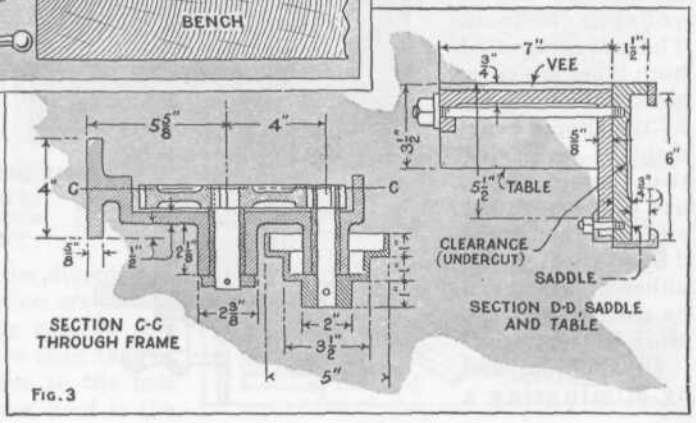
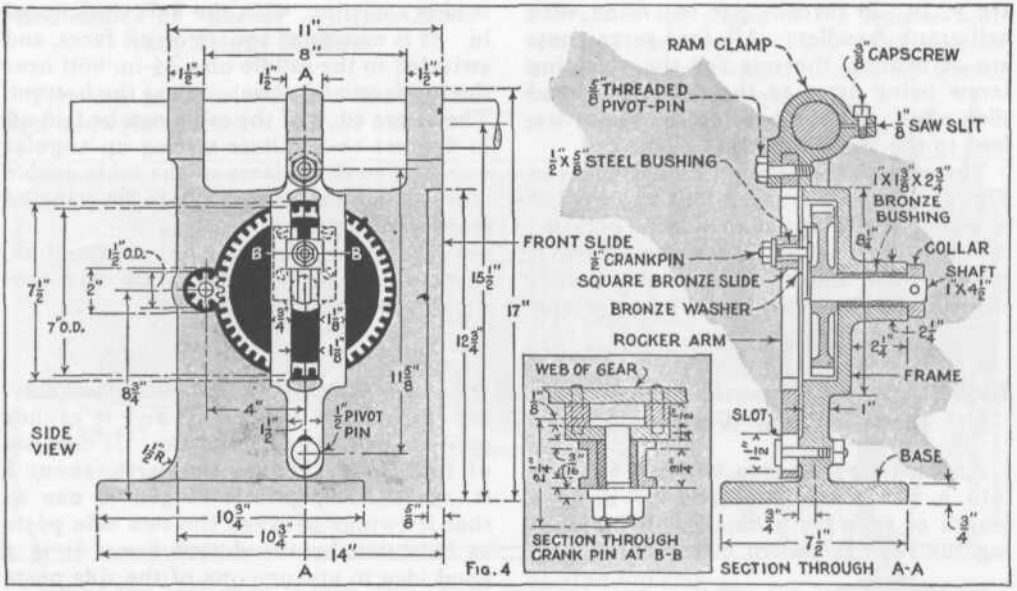


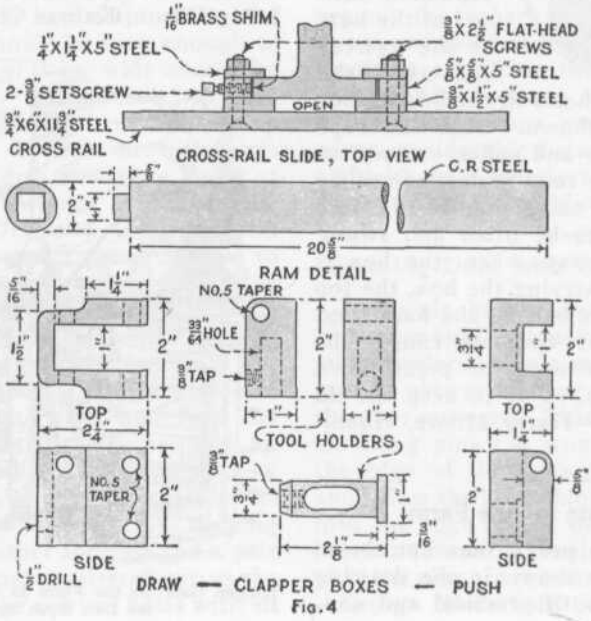
Fig. 3



any variation of stroke from zero to 6 in., the range of the machine. The rocker arm is fastened to the ram clamp with a screwed pin, and is pivoted on a pin at its lower end. The fit in the ram clamp should be snug, so as to eliminate play. Oil holes must be drilled and oil grooves cut to provide for the lubrication of all moving surfaces.

The gears are of No. 12 pitch, the smaller having 15 teeth and the larger 82, with a 1-in. face. The maker, of course, can use other ratios if he desires, but he must be careful to figure the center-to-center distance correctly. The large gear should have a solid-web center, so that it can be slotted for the crank-pin adjustment. Both gears are keyed to their shafts, and should be a light press fit. The shafts run in bronze bushings. A collar is fitted and pinned to the large shaft, and a three-step cone pulley to the smaller one, as detailed.

The cross-rail assembly is built up of flat cold-rolled steel, as in the drawing. Four 3/8-in. flat-head screws connect the cross-rail proper to the guide pieces, and the holes for these screws are drilled 3/8 in. in all the parts except the 5/8-in. square spacing pieces, which are tapped to secure clamping action. The thin outer plates are fastened with nuts and should be fitted so as to allow free vertical movement, without any play, when they are drawn up tight. Brass shims, 1/16 in. thick, adjusted by 3/8-in. set-screws, regulate the side fit of the slide. All feed screws



are 1/2 in., 20 threads per in., fitted with ball-crank handles. All feed-screw nuts are of bronze, the one for the elevating screw being fitted to the rear right-hand slide plate, and the bearing for the cross-feed to the right-hand side of the rail.

The saddle is a casting, machined as in Fig. 3. It will be noted that the casting is wider at the top than at the bottom; this provision is made because there is greater wear and strain on the top slide than on the bottom one. The worktable is also a casting, with the bolt slots cored in. It is machined square on all faces, and swiveled to the saddle on a 1/2-in. bolt near the top face, and clamped near the bottom. The lower edge of the table can be laid off in degrees to facilitate setting up angular work. The three faces of the table enable work of almost any shape to be handled from any angle.

When using the draw-cut clapper box, reverse the belt, so as to obtain slow motion on the return stroke.