IN THE WORKSHOP

by "Duplex"

No. 70-A Small Power-driven Hacksaw Machine

FOR some time past, the construction of a small power-driven hacksaw has been under consideration. It was thought that the ordinary commercial type of machine was unnecessarily large for use in the small workshop and would rarely if ever, be used to its full capacity. What was armed at was a small machine of, say, 1 1/2 in. capacity that would do all the ordinary sawing and cutting-up work, leaving the very large work occasionally required, to be dealt with, as in the past, with the hand hacksaw. Moreover, it was decided to fit the accurately made, standard Myford machine vice, and this in part determined the nominal capacity of the machine.

Rapidity of action 'was not considered an important factor, for the machine could be left, while some other work was undertaken and would stop automatically on completion of the cut.

The design of the components was made as simple as possible by using standard sizes of flat mild-steel, and, in addition, a few plain castings were employed in the construction to form bearings or to serve as rigid mountings for the parts supporting the saw frame.

On the whole, the machine may be regarded as compactly designed, for the baseboard on which the machine and its driving motor are mounted measures 23 in. by 7 in., and the base-plate of the machine itself is 5 in. wide and 12 1/2 in. long.

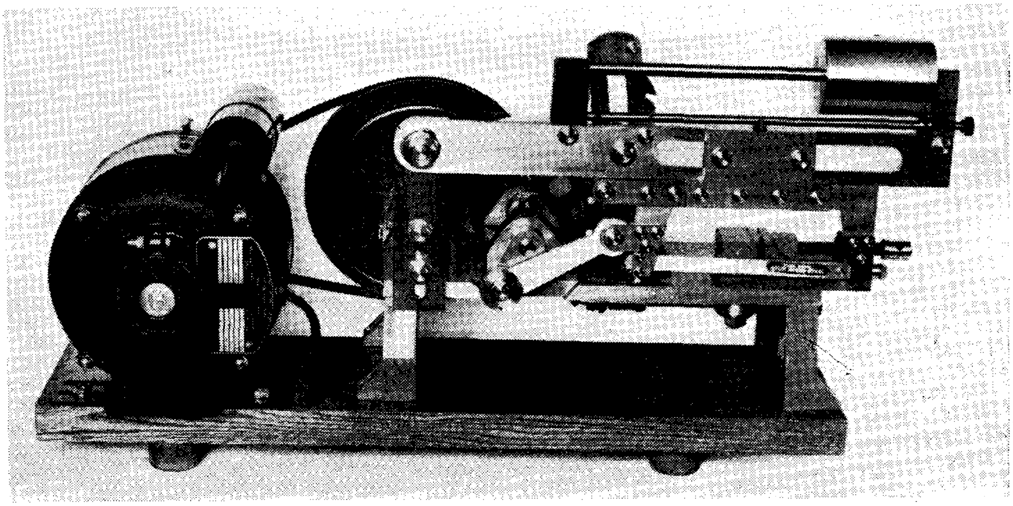


Fig. I. ***The complete machine in its final form***

Durability has also been taken into account, and the countershaft and crankshaft bearings of mild-steel to cast-iron are lapped to a close fit and are provided with an adequate lubrication system. On the score of durability, as well as to keep down the width of the connecting-rod bearings, both the small- and the big-end of the rod are fitted with standard ball-bearings, which will reauire onlv occasional lubrication.

To increase the scope of the machine, the height of the saw above the vice has been made adjust-able so that a parallel cut- can be taken when sawing components to shape ; in addition, the vice can be swivelled when angular cutting is required.

Although the driving motor and the machine itself can, if desired, be fixed permanently to the bench top, it was thought advisable to mount these two components on a baseboard, so that the complete machine could be moved from place to place-or have its position altered to accommo-date a niece of work of unusual length. To enable the machine to be left unattended while working, automatic switching-off at the end of the cut was effected by fitting a Burgess micro-switch controlled by an adjustable tripping gear.

Although the cutting action of the saw blade must necessarily give rise to some noise, there is no reason why extraneous noises should result from the working of the machine itself. With this in mind, the primary drive from the motor to the countershaft is by V-belt, and from this shaft the drive to the crankshaft is by means of a fabroil pinion meshing with a standard cast-iron lathe change wheel. With this arrangement, the complete drive not only runs almost silently, but it is also compact and normally gives a reduction ratio of 16 to I.

In addition to the bench model machine. the hacksaw has been designed for attachment to the lathe bed where it is driven from the lathe mandrel. In this form, the construction is much simplified for the components comprising the drive are omitted and, instead, the short crankshaft is gripped in the self-centring chuck. The machine itself is then secured to the lathe bed by giving a partial turn to a clamp lever situated on top of the baseplate ; at the same time, the baseplate is accurately located by means of an adjustable tenon fitting between the bed shears.

The bench machine in its final form is illustrated in Figs. I and 2 but, before it was possible to design and construct this machine, it was found necessary to make an experimental model in order to determine the value of several unknown factors. The first problem to be faced was the question of what type of saw blade to use. As the nominal capacity of the machine was little more than 1 1/2 in.,and the stroke was made 2 3/4 in. for the sake of compactness, a blade length of 6 in. seemed ample and a greater length would only mean loss of rigidity.

The only 6 in. blade obtainable was the Eclipse Junior blade which is 1/4 in. wide and has 32 teeth per inch. The wavy form of set given to the teeth slightly increases the breadth of the cutting edge and, although this is an excellent provision for all ordinary hand work, it means that the blade must be rather heavily .weighted when fitted 'to a machine in order to ensure that the teeth cut properly. If, however, this weight is excessive,-the blade will tend to be bowed in an upward direction and it will not then travel on a straight path when cutting the material. Nevertheless, this blade was found to cut really well on light work and, under the rather exacting conditions imposed, it retained its free-cutting qualities over a long period. When, however. the blade eventually became worn and in part lost its set, it was apt to wander and not cut the material squarely. The next trial was made with a 9 in. x 18 teeth high-speed steel blade ; this was, of course, found to be more rigid and it continued to cut squarely even when worn. It was felt, however, that the excess length of the blade merely reduced its rigidity and detracted from the compactness of the machine as a whole. The next step was to reduce a 9 in. blade to a length of 6 in. and to fit it in the frame previously used for the 6 in. Junior blade. This proved most successful and the blade not only cut well and looked right, but the shortening further increased its rigidity and made its proportions more nearly equivalent to those of a normal machine hacksaw blade. As the Eclipse Junior blade and the shortened high-speed steel blade both gave such good results under suitable working conditions, it was decided to make the saw frame to take either blade at will.

The purpose of testing the blades in this way was also to find out whether it was necessary to give relief to the blade by decreasing the pressure on the return or idle stroke.

A hydraulic gear was designed for this purpose, but, as the blades did not appear to suffer damage

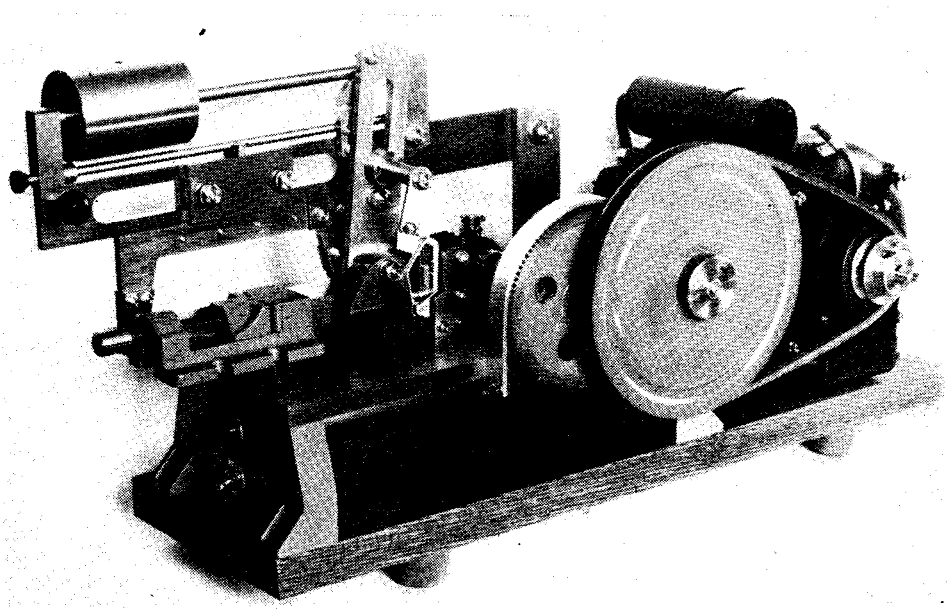


Fig. 2. The finished machine seen from behind

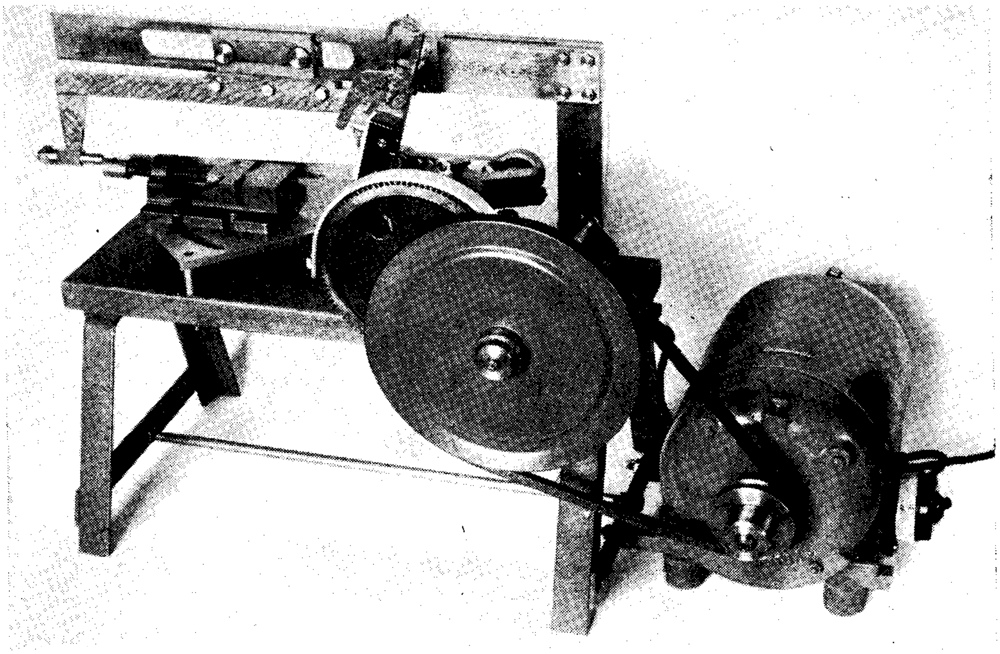


Fig. 3. The experimental machine

when used without this fitting, it was decided, on the score of simplicity to omit the device. This conviction was strengthed on visiting a small factory where the relief gear of the hacksaw machine had been disconnected, without apparently seriously affecting the life of the saw blades.

As will be described later. however. the construction of the machine does provide'for giving some relief to the blade on its backward stroke.

A series of trials were made with different weights loading the saw frame, and, as might be expected, the cutting rate was increased as weight was added. Nevertheless, it was taken into consideration that : bowing of the blade must be avoided : the absence of a relief gear might damage the teeth if overloaded : and, after all, accuracy and not a fast cutting rate was of first importance. Consequently, a moderately heavy weight was fitted which gave effective cutting, and, in addition, the weight was made to slide so that a suitable loading could be given to either type of blade fitted.

Although the gear ratio of the pinion drive is fixed, the rate at which the blade travels can be adjusted by altering the diameter of the motor belt pulley ; in practice, the machine should be set to make from 80 to 100 strokes a minute.

The next problem was to determine the size of electric motor required for driving the machine. The trial machine was, therefore, connected by belt to a d.c. motor furnished with an accurate ammeter, and on setting the machine to work at full capacity it was found to consume, at most 0.2 amps. at 220 volts

As a 1/6 h.p. a.c. motor fitted with a thermal overload' switch was available, this machine was employed for driving the hacksaw in its final form.

It may be noticed in the photographs that bolts and nuts have been fitted in many places in the machine where rivets would normally be used ; this was done purposely to enable the components to be readily dismantled and if necessary modified during the construction of the machine.

The experimental machine illustrated in Fig. 3 was intended to be used as a test bed for trying out components in course of construction. but as it proved so useful it was mainly employed for cutting up the material used to make the second machine.

No doubt, some workers, when building the machine, will want to introduce modifications, either to alter the general design or to adapt the machine for some particular kind of work, but this should present no great difficulty, as the machine is of simple, straightforward construction.

We would express our indebtedness to Mr. H. Haselgrove for making the patterns and supplying the castings where needed.

Constructing the Machine

When describing the construction of a machine it is not unusual to start with the bedplate or frame and give drawings indicating the positions of all bolt holes and slots, so that this part can be finished ready to receive all the machine components. It has, however, been thought better to mark-out and drill the baseplate as the work goes along ; that is to say, each component as it is finished is mounted in place. This allows the builder, if he wishes, to introduce modifications in the design, and, at the same time, this method ensures that the work is checked at every stage, so that errors, which might add greatly to the difficulty of construction, are thus avoided. Furthermore, the castings are located from datum surfaces and so can be clamped to the baseplate in their correct positions to enable the holes for the attachment screws to be drilled right through.

This method of assembly by stages, also, perhaps, makes the work more interesting and gives better opportunities for hand fitting.

Although there are patient individuals who are content to work by first making all the small parts of a machine, the majority, perhaps, like to get something working at an early stage and leave the detail work until later. Accordingly, the driving mechanism of the machine will be first described, and this will be followed by instructions for making the actual sawing mechanism, together with its mechanical and electrical controls.

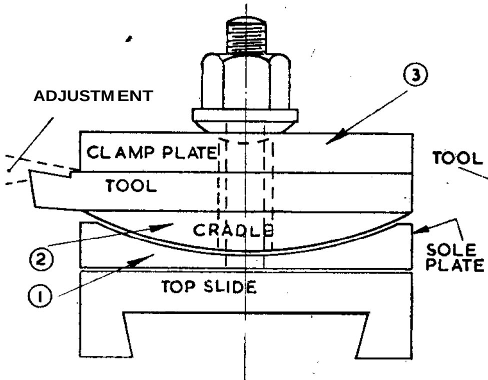
(To be continued)

An Adjustable Tool Holder

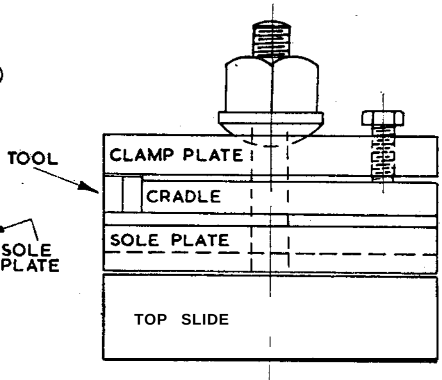
by W. V. Pagett

HERE is a useful little gadget that can be made in the home workshop to eliminate the necessity of packing-pieces frequently used for adjusting lathe tools to centre height.

Probably most model engineers buy standard size steel from which to grind their tools, and the " cradle " to be described should be made to accommodate this, as no specially-formed shanks are necessary. My plates are 2 1/2 in. square but can be made to suit individual requirements ; wood patterns will be needed for the two lower parts, and a casting taken from each in aluminium alloy. This material will be found quite satisfactory.



VIEW FROM HEAD STOCK



END VIEW FROM APRON SIDE

The main dimension to be noted is vertically from machined face of top slide to centre height, which in mv case is 13/16 in. The combined thickness of the-two lower parts should approximate this measure, as on this the normal position of the tool will depend. The soleplate (I), is flat on the underside and concave on top to a radius of 2 3/4 in. has a drilled clearance hole in the centre for the toolpost bolt. The middle or " cradle "-piece (2) is convex on the underside and flat ***on*** top with a square recess on one side to accommodate the tool. The depth is slightly less than the latter in thickness to provide for clamping, and this plate has an elongated hole in the centre.

The top or clamp plate (3) is of steel and necessitates an elongated dished hole in the centre, followed by a half-moon washer and tightening nut ; a jack-bolt should also be provided. Both elongated holes should allow about 1/8 in. clearance either side of the toolpost bolt, and also be in line with the tool recess. It will thus be seen that movement of the " cradle " and clamp plate will adjust the centre height of the tool as necessity requires.

It may be mentioned that the curved faces require accurately fitting together, and may with advantage be left slightly apart in the centre, as this will greatly improve stability and grip on the tool. My set-up has given entire satisfaction and proved well worth the time spent in ma king.