

Precision Tools in the Meccano Factory

A Remarkable Milling Machine

EVERY year many hundreds of people from all over the world come to Liverpool to make a tour of the great factory where Meccano and Hornby products are manufactured. Before these visitors leave the factory they are asked what has made the greatest impression on them; and almost invariably they express amazement at the precision machine tools. It comes as a revelation to them to find in a toy factory machines working to limits as fine as one two-thousandth of an inch (.0005 in.).

One of the most interesting of these precision machines is illustrated on the cover of this issue. It is known as a Universal Pantograph and Milling Machine, and it is one of the most ingenious machine tools yet produced. It is designed for producing rapidly in steel or other suitable materials all kinds of parts having irregular and intricate surfaces, such as die-casting moulds and embossing dies. When the photograph from which our cover was prepared was taken the machine was at work on the production of a die-casting mould for the Dinky Toys Empire Flying Boat.

Each mould or die is produced from a master copy made by pouring special plastic material over a hand-made wood pattern, and allowing it to set and harden. Some kinds of parts, however, can be copied direct from models made in hardwood. The machine consists of two horizontal tables, the positions of which can be adjusted as desired by means of handwheels. On one of the tables is mounted the master copy and on the other is placed a blank piece of steel or other suitable material in which the mould is to be cut. Each table is provided with T-slots and clamps to hold the copy and work in position. The copy holder can be adjusted vertically by means of a handwheel, and for carrying out certain kinds of work can be rotated about its axis. The work table also is movable vertically and crosswise and lengthwise to the machine base, and the handwheels by which the adjustments are controlled are engraved with .001 in. divisions so that adjustments can be effected to a very high degree of accuracy.

The essential part of the reproducing mechanism is the pantograph arrangement shown in the accompanying illustration. This is very similar to the pantograph used by draughtsmen for copying, enlarging, or reducing

drawings. It is mounted above the two tables and consists of four steel bars or arms pivotally connected to each other in parallelogram formation. The entire pantograph structure is mounted in ball bearings in such a manner that it is free to move up and down and swing in any direction. The parallelogram is anchored at one corner, and at the opposite corner it carries a tracer point known as a style, which is used to trace over the surfaces of the master copy. The rotary cutter is mounted at any desired point on one of the sides of the parallelogram, so that it

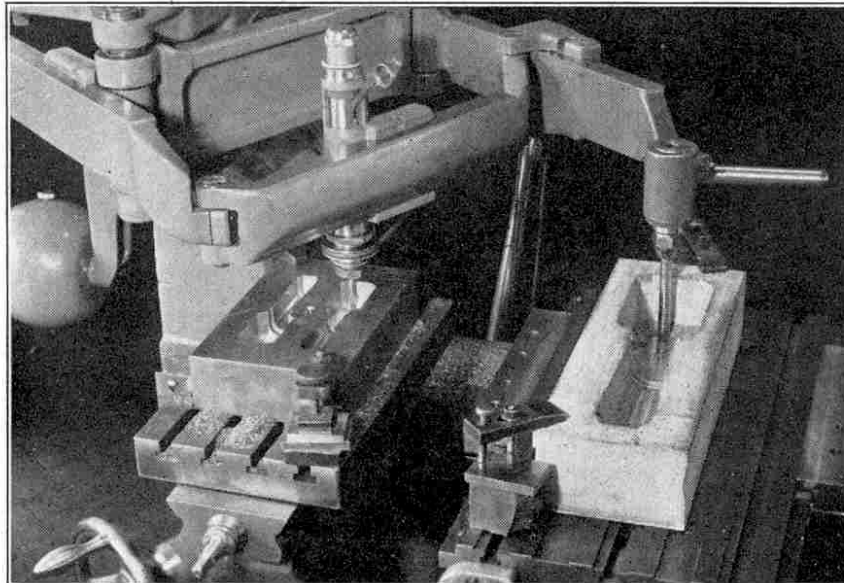
moves in exact accordance with the movements of the style. The position in which the cutter is fixed determines the ratio in size between the work and the master copy. This ratio can be varied between limits of 1 : 1.5 and 1 : 10. In order to simplify the operation of preparing the machine for work, the settings of the bars and tool holder for the most frequently used ratios are engraved on the pantograph bars.

When the machine is in action the operator grips the handle on the pantograph

and guides the style carefully over the outlines and contours of the master copy. To make it easier to carry out this operation with the necessary delicacy the weight of the pantograph is counterbalanced by a heavy ball that can be moved along a balancing bar attached to the pantograph. Every movement of the style is transmitted by the pantograph to the cutting tool, which gradually cuts an exact reproduction on a reduced scale of the master copy.

The cutting tool is driven by an electric motor, mounted on a platform at the rear of the machine, the drive being transmitted to a pulley on the cutter spindle by means of an endless cord belt. The belt passes around idler pulleys carried on a spring-tensioned rod, and thus is kept always at the correct tension irrespective of the position of the cutter holder on the pantograph bar.

Various extra attachments are provided for use with the machine to facilitate the carrying out of special kinds of work. One of these is an automatic regulator for controlling the depth of cut when the machine is used for engraving. In this case the pantograph is locked so that it can be moved only in a horizontal plane, the necessary depth of cut being obtained by feeding the cutter downward. The cutting speeds vary from 1,500 to 9,500 r.p.m.



A remarkable Deckel pantograph milling machine of the type described in this article. Photographs by courtesy of George H. Alexander Machinery Ltd., Birmingham.