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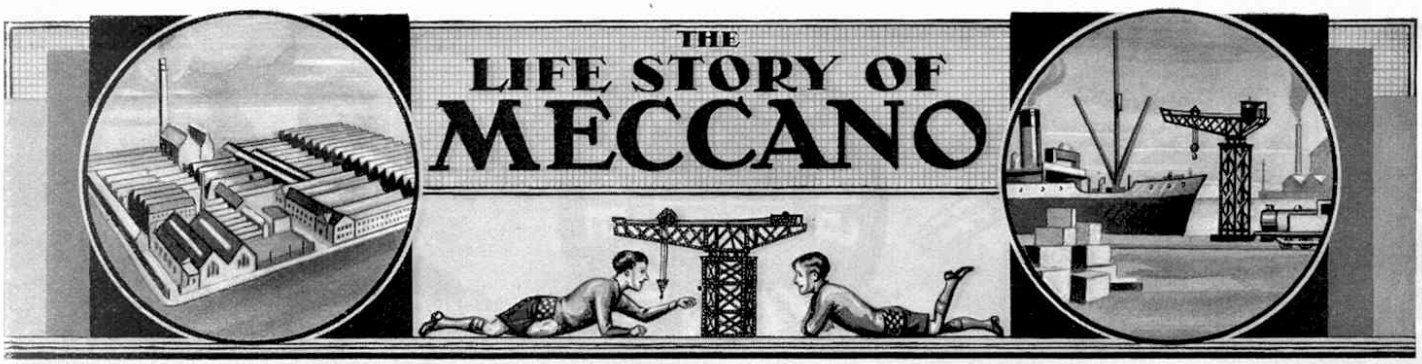
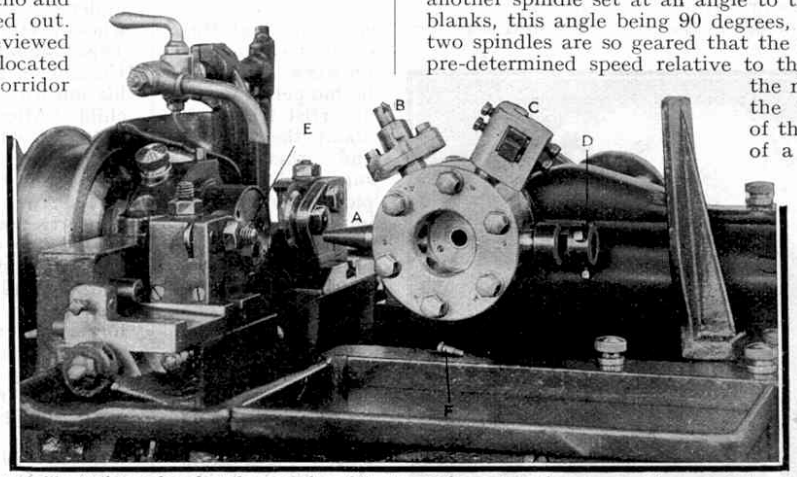
MECCANO MAGAZINE

MOBILE CRANE AT WORK
(see page 828)



X.—A Tour of the Factory. By Frank Hornby

LAST month we described the making of the tools for use in the Press and Machine Departments and dealt with the work of the Press Department where the blanking, piercing and forming of parts for Meccano and Hornby accessories are carried out. The next department to be reviewed is the Machine Department, located at the end of the main corridor shown in the plan of the Meccano factory reproduced in the October "*M.M.*" This department has many machines of outstanding interest specially designed for particular types of work. Pride of place is taken by a large battery of various sized automatic screw machines and automatic screw threading machines used for turning all such parts as pinion blanks, pummels, solid pulleys, grub screws, etc. To watch pummels turned at the rate of 30 per minute on an automatic screw threading machine that feeds itself with rods from a magazine holding 20 rods, each 10 ft. in length, is a revelation.



This illustration makes clear the operation of the turret of an automatic screw machine. A, B, C and D are tools in the turret ; E is the point of feed of the rod, and F a finished part. The illustrations on this page are reproduced from the Editor's "Book of Remarkable Machinery," by permission of the publishers, Harrap & Co. Ltd.

The brass rod is automatically fed into the machine up to a swinging stop. It is then gripped by the collet in the spindle, which is revolving at a speed of 5,000 r.p.m. A front cross slide carrying a tool shaped to the desired form of the part to be produced is moved forward by cams and proceeds to turn the rod on the periphery. Simultaneously the drilling spindle, which is revolving at a speed of 2,500 r.p.m. in the reverse direction to the main spindle, moves forward to drill the axis hole of the pummel. It will thus be seen that the drill cuts at a speed of 7,500 r.p.m. On the completion of these operations the tools withdraw and the rear cross slide carrying the part-off tool moves forward and separates the pummel from the rod. The rod is now automatically fed forward again and the whole cycle of operations repeated once in every two seconds.

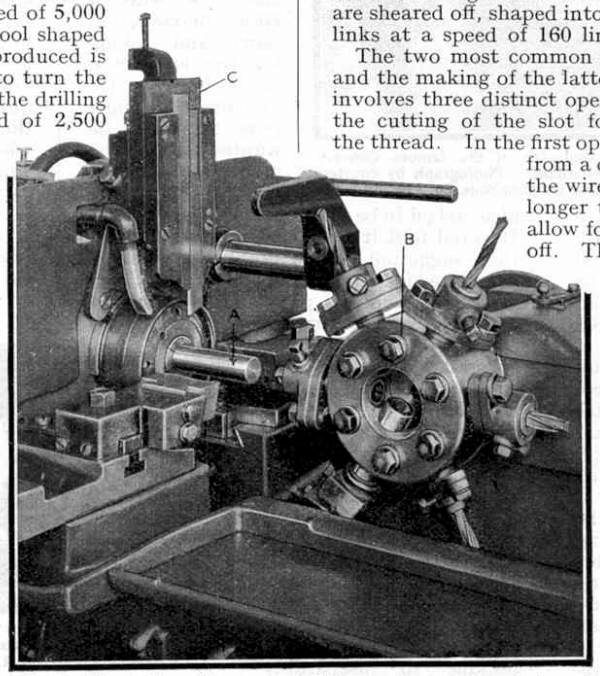
For more complicated work, the automatic screw machines are used. These machines are fitted with a turret at the rear end instead of a drill spindle, and have main spindles that can be reversed during operation. As many as six tools can be fitted into the turret, such as drills, reamers, taps, dies and box tools. Once the machine is set in operation it works fully automatically, every motion being controlled by cams.

Another battery of machines calling for particular attention are the gear cutting machines. These are of various types, but the most interesting are the gear hobbing machines. The blanks on which teeth are to be cut are placed between the centres of the machine and clamped in position. The cutting tool, known as the "hob," is carried on another spindle set at an angle to the work spindle carrying the blanks, this angle being 90 degrees, less the angle of helix. The two spindles are so geared that the cutting spindle revolves at a pre-determined speed relative to the work spindle according to the number of teeth to be cut on the blanks. The cutting teeth of the hob are placed in the form of a worm, that is, at an angle to its axis.

In the case of parts such as gear wheels for clockwork motors, the circular blanks —previously stamped from strips of brass or steel in the Press Department—are clamped together on the spindle until they resemble a short bar of solid metal. The cutting operation is carried out as already described, the length of time required for cutting the teeth on a batch of seventeen 57-toothed gear wheels being nine minutes.

Another most interesting operation in this department is the making of sprocket chain. The chain-making machine works with a coil of fine steel wire that is rolled straight as it enters the machine. Short lengths of wire are sheared off, shaped into links, and linked up with the preceding links at a speed of 160 links per minute.

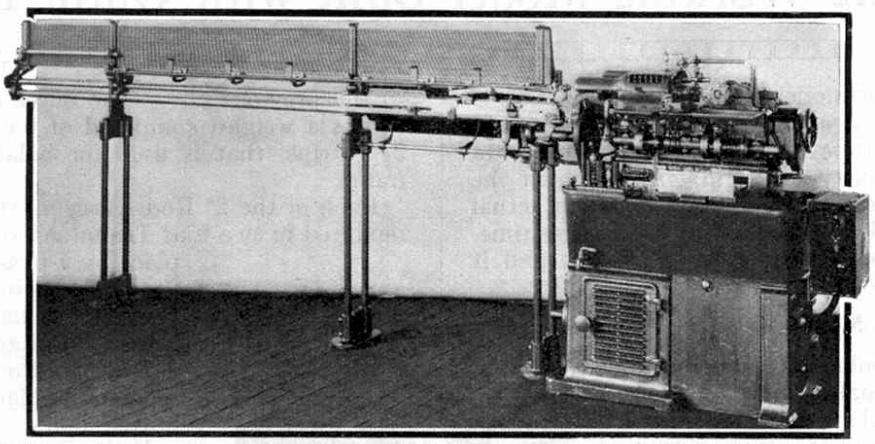
The two most common Meccano parts are the nuts and bolts, and the making of the latter is carried out in this department. It involves three distinct operations, the heading of the bolt blanks, the cutting of the slot for the screwdriver, and the rolling of the thread. In the first operation steel wire is fed into the machine from a coil, passed through rolls that straighten the wire, and the correct length of wire—rather longer than the length of the finished bolt, to allow for the heading up of the bolt—is sheared off. This length of wire is held in a die while the first operation heading tool gathers the material for the head, the second heading tool smashing it to the correct form. The bolt blank is then ejected out of the die and falls into a receptacle at the base of the machine.



A further illustration of the working of the turret. A is the rod of metal ready for working ; B the turret, holding centring, drilling, reaming and box tools, about to advance on the rod ; C a vertical slide holding the part-off tool. The swinging stop can be seen in the illustration immediately behind the first drilling tool.

The bolt blanks are taken to a second machine and placed in a hopper in which an arm moves up and down automatically, throwing the bolts on to a grooved chute in the front of the hopper. The shank of the bolt must lie inside the groove with the bolt head resting on the upper surface of the chute, so that the bolts travel down the chute and feed one by one into V-shaped notches on the edge of a wheel rotating at the bottom of the chute. This wheel passes under a circular saw that automatically feeds down and cuts the slots for the screwdriver. For

the threading operation the bolts are placed in a similar hopper to that employed in the slotting process, and at the bottom of the chute they are forced into the space between the faces of the thread rolling dies. These are circular in form consisting of a centre drum and outer segments, both of which have the thread form on their faces, the outer segments being stationary, while the centre drum rotates rapidly. The bolt travels with the rotation of the drum, and the threading on the die cuts into the surface of the bolt as it rotates with the drum. The thread rolling machines that we employ now actually thread 240 bolts per minute.



A high-speed screw machine complete with automatic feeding magazine, similar to that described in our article.

In an annexe to the Machine Department we have a section where the casting of Hornby miniature figures, locomotive buffers, chimneys, wheels, signal finials, etc., is carried out. The casting machine on which the locomotive wheels are made consists essentially of a gas-fired cupola or "pot" in which the metal is melted, fitted with a cylinder and plunger. The cylinder and plunger form a pump that forces the molten metal through a nozzle into a mould or die, the latter carrying the form of the part to be cast. Some machines have manually operated pumps, these being used for the heavier classes of work, while other machines have mechanically operated pumps and are automatic. The dies on the heavy machines are water cooled, those on the others being cooled by air.

In the case of driving wheels for the larger classes of locomotives the casting consists of one complete set of four wheels; but other types of wheels are cast in sets of six, eight and sometimes twelve.

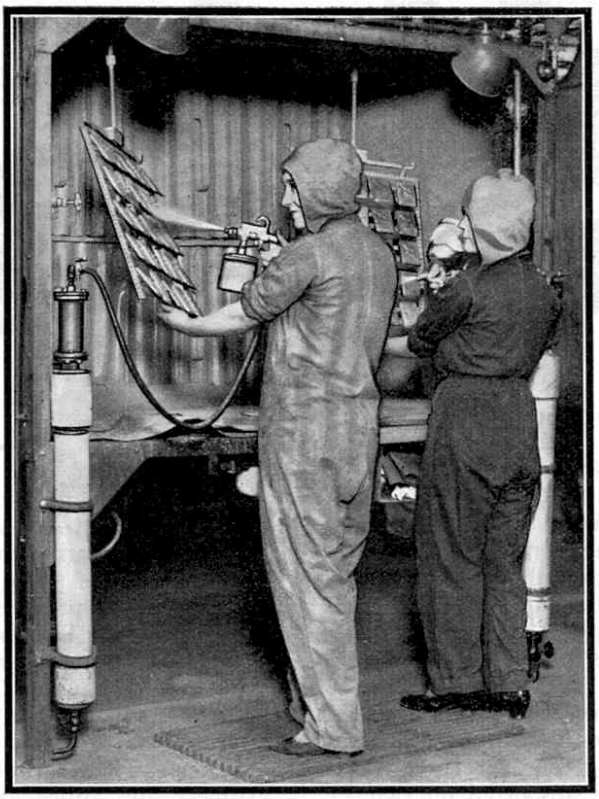
The miniature figures and farm stock recently introduced into the Hornby series are cast in hand moulds. After the parts of the mould have been clamped together, the lead is poured in from a small ladle filled from a cupola. The metal cools as it touches the side of the mould, and a rapid inversion of the mould syphons the surplus metal from inside the chilled skin back into the cupola. The mould is then separated and the hollow miniature figure removed.

Before the enamelling, plating or finishing processes can be undertaken, the parts must be freed from the oil and grease with which they have been in contact in the machine or press departments, and must be polished to remove any trace of roughness on the edges or surfaces. The polishing and cleaning work may be done in a variety of ways, according to the nature of the particular part.

The Barrelling Department is devoted particularly to preparing the parts for enamelling and plating, and must next be considered. I have heard this department colloquially described as the "Meccano Laundry," and indeed a casual glance suggests that the department is equipped with a series of washing machines! These are the barrels into which the parts are placed for the cleaning and smoothing process. The smaller types of barrel use sawdust, and the larger ones scrap leather, as polishing media. The parts are dumped into these barrels and rotated for periods varying from 30 minutes to three hours, and in some cases even longer, according to the nature of the parts. As the barrels rotate the parts tumble one over another, the rubbing having the effect of burnishing them.

In the case of strips, flat plates, girders and similar parts, the bumping about in the barrels has the effect of bending the parts, and subsequently they must be straightened. This is achieved by passing the parts through rolling mills comprising a set of seven rollers mounted three upon four, the clearance between the rollers being adjustable, so that after the strip has passed through it comes out perfectly straight.

Although the primary purpose of the barrelling process is to smooth the parts, it does also remove oil and grease, although not to a degree sufficient to permit immediate plating or enamelling. Before either of these processes can be carried out the last traces of grease must be removed. This is done in a variety of ways. In the case of Meccano Strips that are to be enamelled, the parts are laid in mesh-bottomed trays in a vat employing trichlorethylene as the solvent. At the bottom of this vat there is a sump containing the chemical, which is vaporised by heating with steam passed through a pipe in the sump. Immediately above the sump is a coil of steel tube through which cold water is circulated. Above this coil is a rack on which the mesh-bottomed trays are laid, and at the top of the tank is a further coil of steel tubing for the circulation of cold water. After the trays of parts are placed in the tank, it is closed, steam passed into the pipe in the sump, and cold water set in circulation through the coil at the top of the tank. As the vapour rises it acts upon the grease on the parts, loosening it. When the vapour reaches the top of the tank, contact with the cold water coil condenses it into vapour rain which, descending, washes the grease down into the sump. At the end of approximately ten minutes the steam is shut off and the cold water diverted from the upper to the lower coil. Condensation then takes place below the level of the frames containing the parts, and at the end of a further two minutes the tank is sufficiently clear of fumes to permit of its being opened and the trays removed. The parts are then clean and dry.



Spraying operations in progress in the No. 2 Enamelling Department, which will be described in the next article in this series. The enamel is contained in the reservoirs mounted below the spraying pistols, which are operated by compressed air.

Certain types of parts to be enamelled, such as locomotive housings and speedboat hulls, are not suitable for cleansing in this manner, for they contain various corners that prevent the free circulation of the solvent. These parts are de-greased in sweating stoves, the working temperature of which is 280°F., the grease being evaporated away. Since the temperature to be encountered in the enamelling stoves, to which I shall refer later, does not attain a higher level than 220°F., there is no risk of free grease showing itself in any subsequent operation in the finishing processes.

The de-greasing process employed for parts that are to be plated is carried out in the Plating Department itself. In this case the parts are clipped on to frames or strung on copper wires and placed in a chemical bath containing a solution of caustic soda and cyanide of potassium. A current of electricity is passed through the bath from an iron anode, the frame of parts constituting the cathode, and this causes the chemicals to give off hydrogen gas at the cathode. The gas penetrates the film of grease on the parts and forces it off. The

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