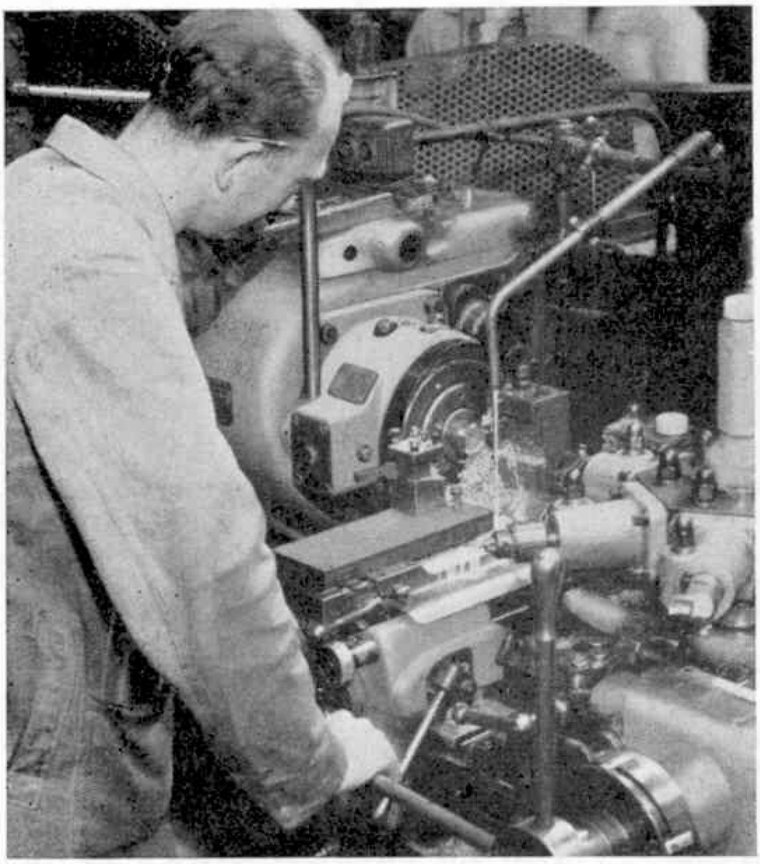
Making Meccano Bevel Gears

By the Editor



The 1½ in. Bevel Gears are blanked from brass rod on a capstan lathe. Part of the turret that carries the tools required is seen on the right of the picture. The operator has his left hand on the lever with which he opens or closes the collet on the headstock that keeps the brass rod rigid during turning.

I DO not need to tell you that every Meccano part and component is made in true engineering style. That is why Meccano is truly engineering in miniature. To make sure that it is, and that each part will stand up to continuous use in the construction of an indefinite number of models, followed by their dismantling, the most reliable and up-to-date engineering methods are used in its making.

Parts that particularly illustrate the care and skill used in making Meccano products are gear wheels, all of which are blanked and cut in exactly the same way as similar gear wheels used in full-size engineering production. As an excellent example of this I have chosen the production of the 1½" Bevel Gear, Part No. 30c. One of my reasons for doing this is that it gives me an opportunity of introducing to you the capstan lathe, one of the most valued tools of the engineer.

The part is made in stages. In the first of these the "blank" seen on the left in the picture at the foot of the page is made, in the second the teeth on the bevelled edge are cut and then follow finishing operations. Let us see first how the blank is made. It is in this stage of production that a capstan lathe is used.

The idea of a capstan lathe is quite simple. It is an engineer's lathe, designed for carrying out a series of operations to form a component, such as a blank for a bevel gear. This requires a succession of tools. What is called the turret on a capstan lathe is mounted on a slide which can move forward or backward when the capstan wheel is turned. Appropriate tools are mounted in holes equidistant round the turret head and on the centre line of the headstock, which holds the workpiece. The turret head moves round one station each time the turret slide is moved to the extreme backward position, so bringing into position the next tool for use in the correct sequence of operations.

Now let us follow the making of the blanks for the Meccano Bevel Gear on a lathe of this kind. The metal used is brass, and the stock, as the engineer calls it, from which the blank is made takes the form of a round bar 1 $\frac{9}{16}$ in. in diameter. This is fed into the lathe through the headstock, which by means of a collet in

The blank and finished Bevel Gear are shown here, and between them is the milling tool that cuts the teeth of the gear.

the nose end of the headstock holds the metal bar rigid when it is in the closed position. This you can see in the centre of the upper picture on the opposite page, which shows the blanks for $1\frac{1}{2}''$ Bevel Gears actually in production, and part of the turret head, with some of the tools mounted on it, can be seen on the right of the illustration.

The first step is to open the collet and then feed a sufficient length of the brass bar through the headstock. To limit the amount of metal fed forward to the correct amount, a stop consisting of a rod of metal with a flat end is used. This is the first tool mounted on the turret.

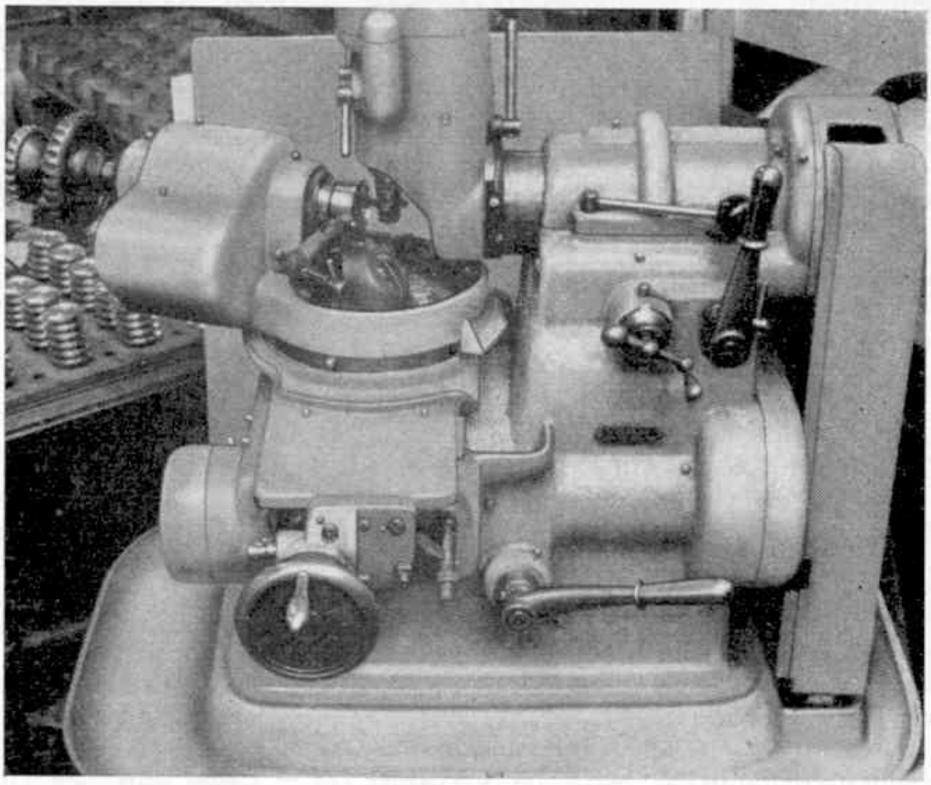
When the bar has been positioned in this way the collet is closed, the turret slide is then moved back to turn, or index as the engineer calls it, the turret head one station; this moves the stop round and presents the next tool to be used. This tool makes a small indentation in the exact centre of the end of the brass bar, which of course is rotating throughout these operations. The purpose of the indentation is to provide a guide for the drill that makes the central hole in the bevel gear.

This drill is the next tool to be brought into position by the rotation of the turret. When it is in position it is fed into the brass bar, drilling a hole to a depth exactly sufficient for the making of one bevel gear. This is to ensure that when the metal is fed forward for the next gear blank, no portion of the previous drilled hole is left in the bar stock that might interfere with the correct centring of the blank to be made.

This operation is an example of the precision with which all work of this kind is carried on.

Now take a look at your bevel gear, or at the illustration of the blank to which I have already referred. You will see that the face, inside the ring of teeth, is recessed, and that the teeth themselves, since it is a bevel gear, are at an angle to the face, with a reverse angle behind them. The cutting of the recess and the forming of the angled faces are the next tasks undertaken, the turret rotating to bring the necessary tools into position. The next operation is to cut away metal behind the bevel gear itself, so as to form its boss, and for this a tool, carried on a cross slide mounted in a tool holder, moves in from the front of the machine.

This completes the forming of the blank, and a further tool, mounted at the rear of the cross slide, now advances at a controlled rate to cut, or part it off, from the bar. The blank falls away and the whole process begins anew. The bar again advances up to the stop that is the first tool used, the new end is centred and the central hole drilled, and so on. The process is continuous and all the time a stream of coolant flows down over the workpiece to ease the task of the tools. The metal turned off of course accumulates as swarf, and is removed from time to time as required.



The machine on which the teeth of the Bevel Gears are cut.

From the capstan lathe on which they are produced the blanks next pass to the gear-cutting machine, which is illustrated on this page. The unwanted metal is removed by a milling cutter, which you can see in the middle of the lower illustration on the opposite page. This is a carefully (Continued on page 458)

Testing an Aircraft Undercarriage—(*Continued from page 405*)

is retracted, a horn sounds, the electro-magnetic release is operated and down drops the undercarriage complete with weights. As it approaches the side load table it automatically fires the table mechanism and the whole assembly arrives at the ground with all the appropriate loads reproduced and recorded. This part of the test takes approximately 2/10th of a second. By this time, of course, there is quite a lot of noise, some smoke from the tyres and a not unpleasant slight smell of rubber.

It is at this stage that the technicians develop their records and get down to the important task of analysing results and writing up reports, providing valuable records which are to guide and assist them in their experiments and in keeping pace with the requirements of future aircraft design.

Making Meccano Bevel Gears—(*Cont. from page 417*)

designed tool with four cutting edges, which you can easily recognise in the illustration on page 416. Each blank in turn is placed in position on the machine and the milling cutter is mounted in such a position that when it is rotated, and brought up to the blank, its cutting edges act on the angled face where the teeth are to be formed.

Both workpiece and milling cutter rotate. The latter runs at high speed, and it is fascinating to watch metal being cut away and the teeth being formed as the blank rotates more slowly until, when the blank has made a complete revolution, the ring of teeth is complete.

As you will no doubt realise, the bevel gear as you know it is not yet complete. The eight holes that you use for such purposes as fixing the bevel gear in position in some models are next pierced on a press and then the holes in the boss for set screws are drilled. These holes are tapped to form in them threads matching those of the Meccano Bolts used to fix the gears on the Axle Rods used as shafts in working Meccano models.

It will perhaps come as a surprise to many of you to learn how many different operations are necessary in the production of this single part. There are six on the capstan lathe, where the blank is formed. Then follow the cutting of the teeth, the piercing of the holes in the face of the gear, and the drilling and tapping of the boss. The fitting of the set screw follows, and so we have as many as 11 operations. The result is a bevel gear that is sound and solid in construction, with its teeth accurately cut, and the set screw holes in the boss accurately threaded, to ensure that in use the set screw will hold the part firmly on its shaft, with the Bevel Gear teeth meshing perfectly with those of the ½" Bevel Gear, Part No. 30a, with which Part No. 30c is used by model-builders.

From Manchester to Sheffield—(*Cont. from page 420*)

the opposite direction. Instead of taking current from the overhead line they acted as generators and returned current to the line, the effect being to check the speed. With the air and vacuum brakes completely off, the train ran freely down the slopes, held to the speed required by the regenerative action of the motors.

A stop was made at Penistone, about six miles below Dunford Bridge, and for this the normal brakes of the train were brought into operation. They were replaced by the regenerative braking on re-starting past Barnsley Junction, where the branch from Wath, also electrified, joins the main line. Down we went through the short Thurgoland Tunnel, a plunge into darkness of the traditional kind, but now without smoke or dirt, and on at a steady controlled pace past the lovely woods at Wharncliffe. We rounded the sharp curve at Oughty Bridge without changing speed, for there the outer rail is canted to a height of about 6 in., which must be one of the highest cants in the country, and soon we were in the outskirts of Sheffield and slowing down for Victoria Station. There we came smoothly to rest dead on time.

Stamp Collectors' Corner—(*Continued from page 455*)

will be easily come by. And then there are the commemorative sets, which are mostly a joy as far as the colourful designs are concerned. The set which I like the best is the one issued in 1940 to commemorate the Centenary of British Sovereignty. The designs are wonderful. The Peace issue of 1946 is another fine set. Then we have the Otago Centenary, Canterbury Centenary issues, etc., and the "Health" stamps that come out every year. Yes, either on simplified or specialized lines New Zealand is a grand country to collect, and this latest commemorative set includes some wonderful stamps. Better still, the buying of a set will only knock us back about a shilling. Isn't that the best part of it?

A final word, if you feel you cannot go back to the 1936 set, why not start from the Queen's set of 1953–54. But be sure that you only have fine copies. Take no heavily cancelled copies or your collection will never look nice.

Easy Model-Building—(*Continued from page 433*)

the ½" Pulley rotates clockwise also. In Picture No. 4 the arrow shows that the ½" Pulley turns anti-clockwise, or in the opposite direction to the Pulley in Picture No. 3. This change in direction is brought about by twisting the Driving Band half a turn before it is placed round the Motor pulley. So you see that by making this simple change in the arrangement of the Driving Band the ½" Pulley can be made to turn in the direction required, no matter what type of model it is arranged to drive.

JOHNSON PRINT-A-SNAP PACK

Everyone starts practical photography at home by trying their hand at making contact prints, as neither experience nor complicated equipment are required for this interesting job. For the beginner, or for the experienced amateur photographer who occasionally wishes to make some extra prints, the ***Print-a-Snap Pack*** introduced recently by Johnsons of Hendon Ltd., the well-known manufacturers of photographic chemicals and apparatus, is a most economical proposition, as it contains everything required.

The Pack is in the form of a strong wallet that can be used afterwards to hold the finished prints, and contains a simple cardboard printing frame, a packet of the new JOHNSON CONTACT PAPER, and packets of developer and fixer, together with very full instructions. Packs containing either 24 sheets of paper 2½ × 2½ in., or 16 sheets 2½ × 3½ in., are available, each with the appropriate printing frame. The price for either size is 3/– including Purchase Tax.

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