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ABC

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FRONT COVER

All shone up for a rally is this Aveling tractor which looks as though it started life as a steam tractor and has been converted to represent a showman's engine. Fascinating machines; more about them on page 114-117. *Photo A. C. Muttitt.*

NEXT MONTH

A simple semi-scale sailing model of an eighteenth century revenue cutter will be a full-size plan feature in our next issue.

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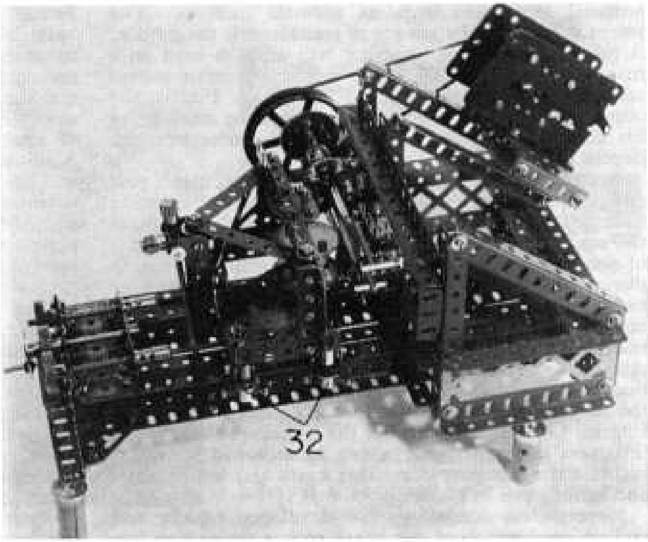
A Meccano Gear-Cutting Machine

By MM reader
T. V. Vollenhoven
of Eindhoven, Holland



FEATURED here is a Meccano Gear-cutting Machine which not only demonstrates how gear-cutting is done in real practice, but which is capable of cutting real gear wheels in all standard Meccano sizes, using as a "cutting tool" a $\frac{9}{16}$ in. Whitworth Tap, obtainable in every toolshop. The gears can be cut from many different materials such as brass, aluminium, PVC, nylon, etc. and the plastic gear wheels thus made are especially recommended in places where "silent" transmissions are required. In any case, it gives the model-builder—after completing the model—a lot of fun in making an extra supply of gear wheels!

The machine demonstrates the great possibilities of standard Meccano parts for the building of really good working "production machines", provided the builder takes care to make the unit strong enough, in the sense of rigidity against bending. Meccano parts practically never break, but at some loads, they occasionally bend, owing to their flexibility.

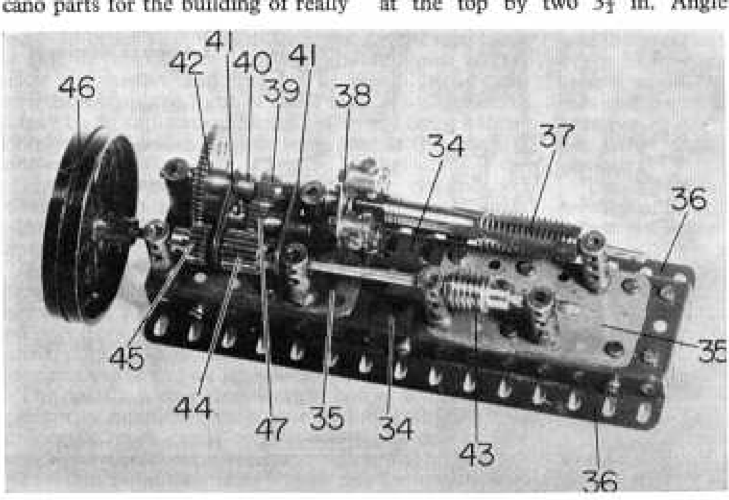
In the relevant accompanying photographs, the machine is shown at work, cutting a 60-teeth gear wheel from a nylon disc, thus proving its success in operation.

Building the Model

THE FRAME consists of two I-section beams 1, each made from four 12½ in. Angle Girders and one 12½ in. Flat Girder bolted together at regular intervals. At the forward end, the beams are joined together, at the top by two 3½ in. Angle Girders 2 overlaying a 3 × 1½ in. Flat Plate 3, and at the bottom, by a 5½ in. Angle Girder 4, the joins being strengthened by four 1½ in. Corner Brackets. Another 5½ in. Angle Girder 5 is bolted to the spare flange of Girder 4, the securing Bolts helping to fix four diagonal bracing 2½ in. Strips 6 in place between this Girder and nearby Girder 2.

Journalled in Girders 2 are two Axle Rods extended, via Threaded Couplings, by Screwed Rods, as shown, a 1 in. Gear 7 being mounted on the end of each Axle Rod. In mesh with these Gears is a third 1 in. Gear on a centre Rod, an 8-hole Bush Wheel 8, fitted with Threaded Pin, being fixed on the end of the Rod to serve as a hand-wheel. This whole arrangement acts as the horizontal feed for the carriage.

The rear end of the frame consists of five 7½ in. Angle Girders 9, all bolted between beams 1 in the positions shown and extending two holes at one side and six holes at the other. Four 3 in. Strips 10 are also bolted diagonally between the beams to provide further support, while three vertical 5½ in. Angle Girders 11, braced by three diagonal 5½ in.



Top, a "working" Meccano model in the true sense of the word is this Gear-cutting Machine, designed and built by the author. It will produce real gears from a variety of materials.

Left, a close-up view of the main bearing assembly, removed from the model. The cutting tool (37) is a $\frac{9}{16}$ in. Whitworth Tap.

Angle Girders 12, give support for the main bearing assembly. The ends of upper and lower rear Girders 9 are connected by two vertical 2½ in. Angle Girders, each of these being connected to nearby Girder 11 by a 4½ in. Braced Girder overlaid by two 4½ in. Angle Girders 13. The frame is then completed by a 7½ in. Braced Girder at the rear and a 2½ in. Braced Girder 14 at the front.

Note that the completed frame must be as perfectly "square" and rigid as possible. The I-section beams must be arranged neatly parallel and all Nuts and Bolts well tightened up for heavy-duty work. Legs for the frame are provided by Sleeve Pieces attached to ¾ in. Flanged Wheels.

The model is powered by an E15R Electric Motor, secured to a 3½ × 2½ in. Flanged Plate 15 which, in turn, is bolted to the flanges of another similar Plate fixed between two Girders 12.

The Carriage

Pictured in one of the accompanying illustrations is the carriage as it appears removed from the model. It consists of two U-section girders 16, each supplied by two 4½ in. Angle Girders, the U-section girders being connected by a 3 × 1½ in. Flat Plate 17, a 2½ × 1½ in. Flexible Plate and two 2½ in. Flat Girders, arranged on top of each other as shown, but with the Flat Girders separated by a distance of one hole. Flat Plate 17 must slide with the minimum clearance between beams 1 of the frame, the Flexible Plate giving the carriage a little clearance in the vertical direction.

The cutting carriage as it appears removed from the Machine. In the right foreground is a P.V.C. disc prepared ready for cutting and a completed gear cut from brass.

Spindle 18, vertical when the carriage is mounted in the frame, carries the "leading" Gear Wheel and the disc to be cut. It is journalled in two bearings supplied by Double Arm Cranks, the top bearing being bolted to a 1½ in. Flat Girder which, in turn, is bolted to a 4½ in. Angle Girder 19. Girder 19 is attached to the carriage by ½ in. Bolts and extra Nuts, thus allowing for easy dismantling when setting up for cutting a new gear wheel.

Vertical feed of spindle 18 is controlled by a lever system attached to the underside of the carriage. On the spindle, a Coupling 20 is freely mounted, being held in place by two Collars, one each side of the Coupling, with the spindle passing through the centre transverse bore of the Coupling. Two 3½ in. Strips 21, free to pivot, are held by Collars on two 1 in. Rods fixed in the ends of the Coupling. Bolted to the Flat Girders and Plates underneath the Carriage are two Handrail Supports 22 in the heads of which is fixed another 1 in. Rod, this carrying a Crank 23, five Washers and a Double Arm Crank 24, all free on the Rod. The Rod passes through the boss of the Crank and the circular hole in the arm of the Double Arm Crank.

The swivel for the lever is a short Rod 25, passed through the second holes of the Strips 21, the boss of Double Arm Crank 24 and the circular hole in the arm of Crank 23. The Rod is free to rotate, being held in place by Collars.

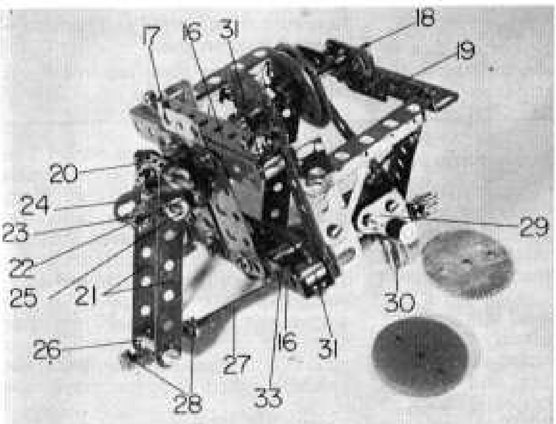
Loosely mounted on two Bolts between the opposite ends of Strips 21 is a Coupling 26, the centre tapped bore of which carries a 6 in. Screwed Rod 27. This Rod actuates the lever, but excessive movement is prevented by two "stops" 28, each provided by two Nuts locked against a Washer between them. The upper end of the Screwed Rod passes through the centre *smooth* bore of another Coupling, held in the carriage by two short Rods in two 1 in. Corner Brackets 29 bolted to a 2½ in. U-section girder secured, along with a Flat Trunnion, to one girder 16. Fixed on the end of the Rod is a $\frac{7}{16}$ in. Pinion and vertical feed is accomplished by turning this Pinion by hand. However, as vibrations during cutting tend to cause the Screwed Rod to revolve involuntarily, the Rod can be secured for two or three cutting revs. at a time by a second $\frac{7}{16}$ in. Pinion 30, fixed on a Pivot Bolt screwed into one tapped centre bore of Coupling 26.

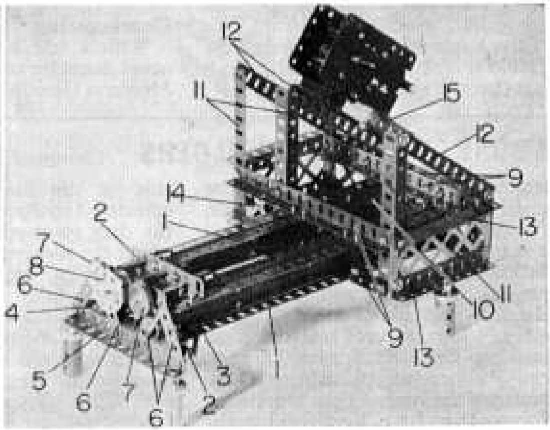
Fixed between the flanges of U-section girders 16 by short Bolts, each fitted with two Washers, are four Threaded Bosses 31. Screwed into these Bosses under operating conditions are four swing-bolts 32, each made up of a Threaded Boss in which a short Screwed Rod is locked by a Nut. A ¾ in. Washer is mounted on the Rod, the "wings" of the bolt being provided by two ½ in. Bolts. These swing-bolts must be firmly tightened during the final vertical cutting so as to obtain the best results. Construction of the remaining carriage framework is clear from the illustrations, but it should be mentioned that the two Screwed Rods providing horizontal feed for the carriage locate in the transverse bores of two further Threaded Bosses 33 secured between the flanges of lower girder 16.

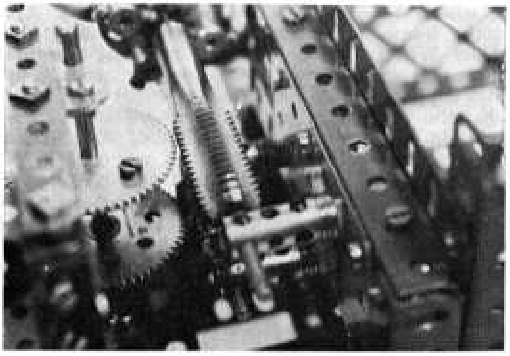
Main Bearing Assembly

Moving to the main bearing assembly, two 7½ in. Angle Girders

A view of the main frame without the cutting carriage and main bearing assembly. The horizontal feed for the carriage appears at the near end of the frame.







A detailed view of gear-cutting in operation. As the lower Meccano Gear Wheel makes contact with the Worm, when fed in horizontally (from left to right), the Tap begins cutting the upper disc. The Worm and Tap drive are coupled in a 1 :(1) : 1 ratio.

34 are connected together by four 1½ in. Angle Girders and two 3½ × 1½ in. Flat Plates 35, then two further 7½ in. Angle Girders 36 are bolted, one to each Girder 34 to form reversed angle girders. Seven Threaded Pins are mounted in the positions shown, four in one Plate 35 and three in the other Plate, each Pin carrying three Washers and a Coupling. The upper transverse bores in the Couplings provide fine and easily lubricated bearings for Rods carrying the cutting equipment and relevant gearing.

The cutting tool itself is a 5/16 in. Whitworth Tap 37, centred between short and long pointed Rods, the long Rod carrying an 8-hole Bush Wheel 38, to the face of which four Threaded Bosses are fixed by their longitudinal bores. Screwed through their transverse bores are four ½ in. Bolts which hold the squared end of the Tap. The same Rod also holds a ½ in. Pinion 39, a Collar 40, two pairs of two 1½ in. Strips 41 and two 57-teeth Gear Wheels 42, the last face to face for heavy-duty driving.

Running parallel to the cutting tool and shaft is a 5 in. Rod carrying the "leading" Worm 43 and the other end of one pair of Strips 41, being fixed part way in the bore of a ½ × ½ in. Pinion 44. Running free in the other half of the bore of the Pinion is a shorter input-drive Rod, carrying the other pair of Strips 41, a ½ in. Pinion 45 and, on my model, a Meccano Flywheel 46. This last very fine, but long-since obsolete, Meccano part can be replaced by two 3 in. Pulleys with Tyres, if desired. Pinion 45 meshes with Gear Wheels 42.

In mesh with Pinions 44 and 39 is an "idler" ½ in. Pinion 47 on a 1½ in. Rod, held by a Collar in the centre holes of Strips 41. Here, and at all other points double Grub Screws should be used.

When completed the main bearing assembly is bolted to the frame at a somewhat inclined angle, as shown, this being necessary as the tangent to the Worm (and the cutting tool) must be exactly vertical. With Girders 36 bolted to outside vertical Girders 11, there must be *one* hole clear in left-hand Girder 11 and two holes clear in right-hand Girder 11, counting from the top. In other words, upper Girder 36 must be bolted through the second hole of left-hand Girder 11 (furthest in photographs) and the third hole of right-hand Girder 11 (nearest in photographs). With the unit in place, Flywheel 46, or its substitute, is connected by a suitable Driving Band to a ½ in. Pully fixed on the Motor output shaft.

Gear-cutting

With a fine hack-saw, a disc of equal diameter to the corresponding Meccano Gear Wheel is sawn out of the chosen sheet material. A centre-hole of standard shaft diameter is drilled in this and also two holes at ⅜ in., or ½ in. distance from the centre in order to Bolt the disc to a 1 in., or 1½ in. Bush Wheel. For cutting in brass, *two* Bush Wheels are recommended, one each side of the disc, and, when cutting a 133-teeth Gear Wheel (the largest possible in the carriage), the largest Sprocket Wheel should be used as a bush wheel.

The leading Meccano Gear Wheel should be located at the centre of Worm 43, but the disc to be cut must be positioned somewhat below the middle of the Tap to allow the Worm and leading Gear to make contact first when feeding horizontally. The horizontal feed must be stopped when the leading Gear cannot be moved further into the Worm, then the swing-bolts are tightened and the vertical feed is begun, moving the spindle in an upwards direction.

Cutting in thick materials would also require "thick" leading Gear Wheels, but it can also be done by repositioning the leading Gear Wheel after reaching half of the vertical feed!

Further developments

By some modifications to the model, it must be possible not only to cut gear wheels of standard Meccano tooth numbers, but also gear wheels of special tooth numbers—say 75-teeth, for example. In this case, a 60-teeth Meccano Gear could still act as the leading gear wheel on the spindle, as before, but the cutting tool (the Tap) must be placed somewhat behind, i.e. not in the same vertical plane as the Worm. The gear-ratio between the shaft carrying Worm 43 and the Tap must be changed from 1 : 1 to 60 : 75 (4 : 5). Whatever is done, however, the model will give good service—provided every care is taken to ensure strong, rigid and correctly-aligned construction.

We regret no parts required list is available for this model.

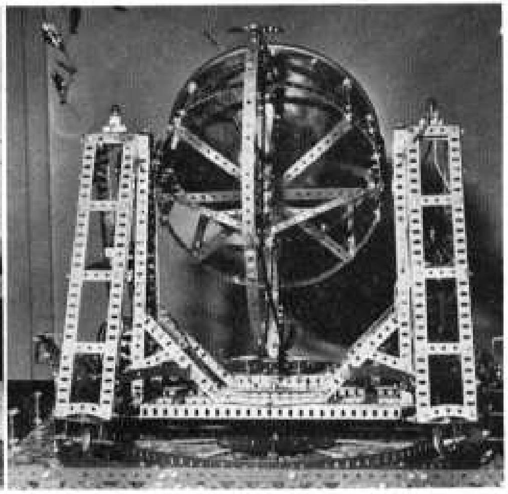
AMONG THE MODEL BUILDERS

(Continued from opposite page)

reasons I shall explain later, the aerial dish is provided by a Bialaddin Paraffin Pressure Stove reflector and it is mounted on a carefully-formed lattice-work of Strips, one of which runs in the vertical plane in a wide arc from one side of the dish to the other. This is used as a vertical tracking guide, and runs between two Rubber-Ringed rollers in the centre of the base. Dish movement is controlled by a handwheel at the side of the main superstructure, connected by Sprockets and chain to the dish pivot-point. Mounted on top of the superstructure are two red lamp bulbs, representing aircraft warning lights.

Although the model was built by the Cubs themselves, the basic design work was carried out by Pack Committee Member and Helper, Mr. Wilfrid Burrows of Whitley, to whom we are indebted for our chance to see the model. The Cubs involved in its construction were Spencer Cobley, Terry Platt, Andrew Barber, Andrew Leicester, Michael Houghton, Kevin Partington, Jonathan Alms, Robin Clarke, Eric Monaghan and Andrew Laithwaite (all of whom appear in the accompanying photograph), together with Ian Scragg, Stephen Simpson and Philip Heesom who were not available when the photograph was

(Please turn to page 150)



AMONG THE MODEL BUILDERS with 'Spanner'

Top left, members of the 1st Whitley Cub Scout Pack proudly display their intriguing model, structurally based on the Jodrell Bank Radio Telescope. Also in the picture are several Scouts who, as Cubs at the time the model was built, helped with its construction. Committee Member and model-designer, Mr. Wilfrid Burrows, and Akela, Mrs. Laithwaite, appear standing at the rear. Above, a rear view of the model showing the lattice-work of Strips supporting the aerial dish. Below left, a general view of the Jodrell Bank model with the aerial dish pointing vertically upwards. Note the strong superstructure construction. Below, in this general side view of the Cubs' model, the batteries and control switch for the aircraft warning lights can be clearly seen.

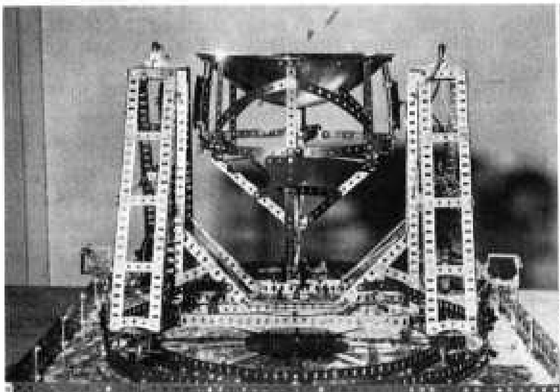
Cubs' Fine Achievement

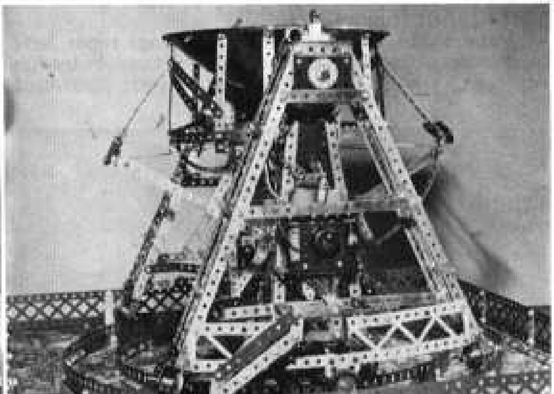
Last December, I and a photographer were privileged to visit the headquarters of the 1st Whitley Cub Scout Pack near Warrington, Lancs, having been invited along to see a Meccano model built by members of the pack and inspired by Britain's famous radio telescope at Jodrell Bank, Cheshire. I must say that the visit was very worthwhile. Not only were we kindly and hospitably received by the young Cubs and their leaders, but also the model itself was most impressive, making the evening both enjoyable from a personal point of view and successful from a business point of view. In consequence, I am particularly delighted to reproduce here a few of the photographs we took during the visit.

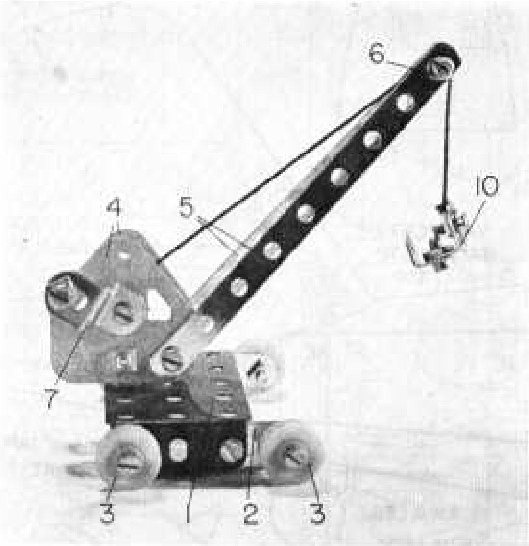
Obviously the star attraction was the model and this is worthy of the highest praise—especially in view of the age of the builders, who were all less than 11 years old when it was built! Although not an exact reproduction, it is structurally based on the Mark I Telescope at Jodrell Bank and it also performs the major movements of the original. The whole superstructure, with the aerial "dish", revolves through a full 360 degree circle in the horizontal plane, while the dish itself moves through more than a full 180 degree semi-circle in the vertical plane. In other words, the dish can "explore" the whole visible hemisphere from horizon to horizon in every direction!

The revolving superstructure is centrally-mounted on a simple but effective free-moving roller bearing, with positive tracking being achieved by four built-up flanged wheels, mounted one at each corner of the structure and running on a circular rail secured to the baseboard of the model. The structure itself is very strongly built from Angle Girders braced by Strips and Plates. For

(*Continued opposite*)







Entered in Section 2 of the recent Pocket Meccano Competition, this Mobile Crane was built by 12-year-old Philip Clarke of Braunston, Nr. Rugby.

MORE FROM POCKET MECCANO

BY 'SPANNER'

CONTINUING, as promised, our series of interesting models entered in last year's Pocket Meccano "Build-a-Model" Competition, I am pleased to feature here three more constructions, chosen at random from the hundreds of entries received. These actually make up the third batch of models to be described, but they differ somewhat from the two previous groups in that none of them is a prize-winner. All the models so far described have won a prize of some sort, yet those illustrated here have not. Why feature them then?

To answer this question, I would like to refer back to the article in January's M.M. announcing the winners of the Pocket Meccano Competition. At the time I remarked on the high quality of entries in the Competition and mentioned the fact that very many unsuccessful models were well up to prize-winning standard. I do not hesitate to say now that these three offerings are, in my opinion, three of those up-to-standard models and I am quite sure that, if there had been more prizes to go round, all three would have stood excellent chances of netting something for their builders.

As it was, of course, the number of prizes was naturally limited and, as a result, many possible winners were just beaten into the "losing" category. When prizes are limited, there *must* be losers, but there is nothing to suggest that some of those losers should not be featured in these pages. Many unsuccessful entries were worthy of mention and so, by way of a change, we have chosen the three models for this month from among those entries. They are, as a glance at the pictures will show, a Mobile Crane, a Helicopter and a Dodgem Car and I think you will agree that, although losers, they are all interesting models in their own right.

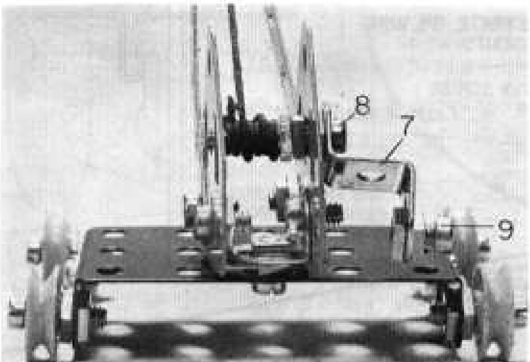
Mobile Crane

Beginning with the Crane, this is a delightful working model designed by 12 year-old Philip Clarke of Braunston, Nr. Rugby, Warks. Fitted with four wheels, it is fully mobile and it also has a rotating jib allowing even greater versatility. Its most interesting feature, however, is a working winch—quite a noteworthy feat on such a small model!

The mobile chassis consists quite simply of a $2\frac{1}{2} \times 1\frac{1}{2}$ in. Flanged Plate 1, each flange of which is extended one hole forward by a Fishplate 2. Firmly held by Nuts in the forward end holes of the Fishplates and in the opposite end holes of the Plate flanges are four $\frac{1}{2}$ in. Bolts, on each of which a $\frac{1}{2}$ in. Pulley 3 is mounted to serve as a wheel. Lock-nutted to the top of the Flanged Plate through its rear row centre hole is a compound double bracket built up from two Angle Brackets. This built-up double bracket should revolve freely, but not sloppily, on the Plate.

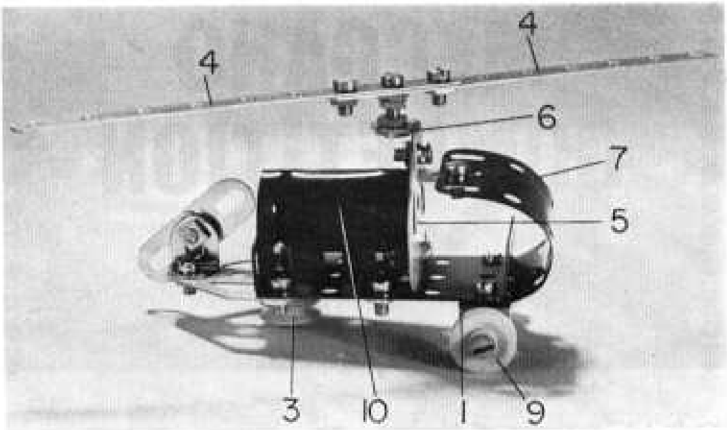
Tightly fixed to the vertical lugs of the double bracket are two Flat Trunnions 4 secured through their centre base holes. These Trunnions serve as the Crane body, the Crane jib being supplied by two $4\frac{1}{2}$ in. Narrow Strips 5, bolted to one set of base corner holes of the Trunnions. The top ends of Strips 5 are connected together by an ordinary Bolt 6 passed through the end hole in one Strip and fixed by two Nuts in the end hole of the other Strip. This leaves a short length of Bolt Shank clear between the inner Nut and the opposite Strip, and it is over this exposed shank that the winch Cord will later be passed.

The winch itself is supplied by a $\frac{1}{2}$ in. Reversed Angle Bracket 7 which is secured by a Nut on a $1\frac{1}{2}$ in. Bolt 8. The shank of the Bolt is then passed through the centre hole of right-hand Flat Trunnion 4, where it is lock-nutted in place with the end of the Bolt just protruding through the centre hole of the left-hand Flat Trunnion. The Bolt

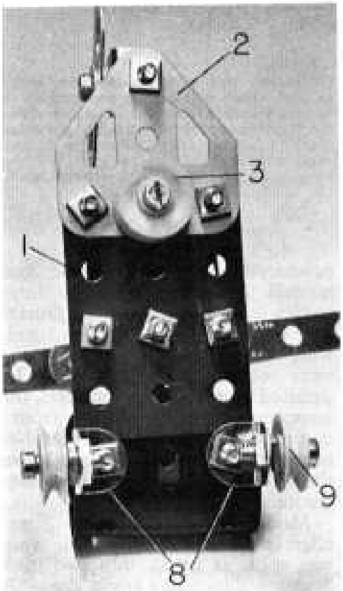


A close-up rear view of the Crane body showing the hoisting winch.

Also entered in Section 2 of the Competition was this little Helicopter, designed by S. R. H. Gregory of South Nutfield, Surrey.



must be free to turn in the Trunnions, controlled by the crank formed by Reversed Angle Bracket 7. A handle for the crank is supplied by a Bolt 9, locked by Nuts in the spare lug of the Reversed Angle Bracket. The shank of Bolt 8 serves as the Crane winding drum, the hoisting Cord passing from this, over Bolt 6 to be finally tied to a "hook" 10 supplied, in our case, by a compound double bracket built-up from two Angle Brackets, bolted together. The finished model is a neat example of a fine little working production.



PARTS REQUIRED			
2—10	25—37a	1—51	1—125
4—12	11—37b	1—111	2—126a
4—23	1—40	4—111a	2—235d

Helicopter

Moving onto our second model, we come to the Helicopter—the pleasing work of 12 year-old S. R. H. Gregory of South Nutfield, Surrey.

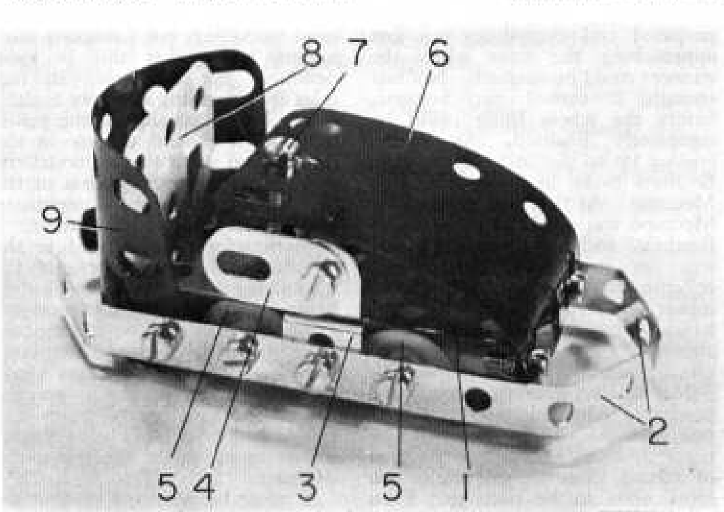
Helicopters have long been popular subjects for Meccano modellers and, in fact, a large number of different versions were entered in the Pocket Meccano Competition. Master Gregory's version, illustrated, is just one of many and I have chosen it, not because it is necessarily better or worse than the others, but because it was the first to really appeal to me when I was looking for models to feature.

As regards construction, the main body section is supplied by a 2½ × 1½ in. Flanged Plate 1, the tail section being represented by a Flat Trunnion 2, bolted to the underside of the Flanged Plate. Passing through the centre base-hole of the Trunnion and Plate 1, is a ¾ in. Bolt which carries two ½ in. Pulleys 3 to act as the tail skid. The rotor blades are constructed from two 4½ in. Narrow Strips 4, overlapped three holes. A Flat Trunnion 5, separating the tail section from the rest of the fuselage, is attached to the centre of Flanged Plate 1, by an Angle Bracket. A ½ in. Reversed Angle Bracket 6 is then secured by its centre lug to the apex of Trunnion 5, thus forming an upper and lower flange. The rotor blade is lock-nutted to the upper lug of Bracket 6 by a ½ in. Bolt which passes through the centre hole.

The front of the cockpit is made from a 2½ × 1½ in. Plastic Plate 7 which is bolted to Flanged Plate 1, along with two Angle Brackets 8 at the corners. Two ½ in. Pulleys 9 are secured to these Brackets by ½ in. Bolts, completing the wheel assembly. The Plastic Plate is then bent round and bolted to the lower flange of Reversed Angle Bracket 6. Finally, a second 2½ × 1½ in. Plastic Plate 10 is curved to shape and the ends located in the slots in the heads of Bolts secured in the top of Flanged Plate 1 to hold it in place. This completes the model and, at the same time illustrates an excellent way of saving parts!

(continued on page 151)

Above, an underside view of the Helicopter showing the simple undercarriage.



Right, this delightful Dodgem Car was entered in Section 3 of the Competition by J. Spriggs of Spalding, Lincs. A very appealing model!

MECCANO COMPETITION NEWS

By 'Spanner'

REGULAR readers of Meccano Magazine may vaguely remember that, in the January 1971 issue, we launched a Meccano model-building competition in which entrants were required to build a model from a specific current Meccano Set. Readers who actually entered the contest will, I am sure, be wondering what on earth became of it, as no announcements have been made since the contest closed! An explanation is called for and I am at last able to offer the explanation, although this will not appear until the March issue. (As I write, it is the beginning of December, 1971!).

The competition was run by Meccano in Liverpool and, as already mentioned, it closed at the end of last April. In due course, judging took place, although this was a little later than planned, and then the judging itself took quite some time to complete which resulted in a further delay. Eventually, however, the winners were chosen, the necessary lists and paperwork prepared and everything was fast approaching the time when the winners could be notified. Not fast enough, it turned out, because, before the whole thing could be completely finalised, the events leading up to the collapse of Lines Brothers broke in a storm around Meccano. At that time, of course, Meccano was a subsidiary of Lines Brothers and, although Meccano was not itself in difficulty, the collapse of the parent Company meant that certain Meccano matters had to be temporarily held in abeyance. The competition was one of those matters.

Meccano was, and is, a strong and profitable company. By the time you read this, its future should be perfectly clear, although at the time of writing, there are still one or two loose ends to be tied up. Even now, however, prospects are so bright for an extremely successful future that the competition has been given the green light to proceed. I am therefore delighted to report that the winners have now been notified and, indeed, when you read this they will have long since received their prizes! A list of the winners is given below, but, before coming to it, some comments on the competition itself are in order.

To begin with, the number of entries received in the contest was disappointing. I do not have an exact figure to quote, but I have no hesitation in saying that it was almost certainly the lowest entry ever received for a Meccano competition. Indeed, some of the sub-sections into which the competition was divided did not attract a single entrant, while, in others, there were not sufficient models of prize-winning standard to warrant the presentation of all the allocated prizes.

I did wonder if all this indicated a decline in the popularity of Meccano modelling, but Company sales figures prove that this is most definitely not the case. In fact sales are increasing at a very healthy rate! I then considered the possibility of a general decline in the competition spirit among modellers, but the tremendous success of the recent Pocket Meccano Competition proves this idea to be untrue. I have therefore been forced to the conclusion that the course of the trouble lay in the particular Contest being somewhat different from past Contests by calling for outfit models, as opposed to "unlimited parts" models. Past competitions have generally laid no limits on the quantity or variety of parts that could be used, and this makes things much easier for the model designer.

It must be admitted that, at the time the contest was planned, we did feel an "outfits-only" rule might cause problems. I remember saying in the Magazine announcement last January (1971) that it is a lot harder to produce a model from a specified number of parts than from an unlimited stock. I also said that this increased the challenge and it most certainly did—so much so that the challenge appeared to be too great for a lot of would-be competitors who didn't even enter!

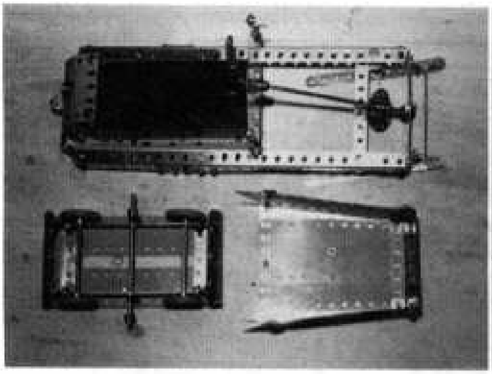
Having said all this, I should now like to congratulate those competitors who did meet the challenge by entering the contest and I must say that, considering the problems imposed by being limited to a particular Set, some very good models were produced. Nor were these good models exclusive to the larger outfits. A number of very presentable constructions from Sets 3 and 4 were entered and, although these were obviously considerably less detailed than the larger models, they compared very favourably from a quality and design point of view. A number of prize-winning models are shown in the accompanying illustrations.

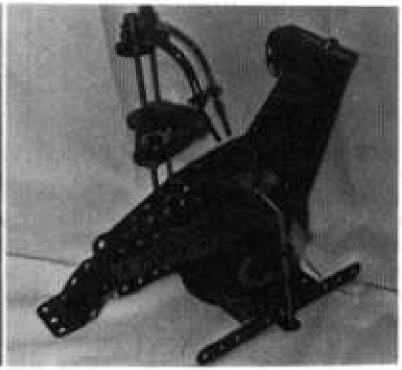
Models from outfits 1 to 7 were eligible for the competition, which was split, as usual, into two major Sections depending upon age—"A" for competitors under 14 and "B" for competitors aged 14 and over. Each Section was in turn split into seven Sub-sections, numbered from 1 to 7 and determined by the outfit from which the model was built. Three prizes were offered in *each* Sub-section: cash for 1st place, a Meccano Set for 2nd place and Meccano Parts for 3rd place, with Sub-sections 3, 4 and 5 receiving the largest prizes. The winners were as follows:

Opposite, not a prize-winner, but a model which was highly praised by the judges was this Dumper Truck, designed by B. Comley of Northfield, Birmingham 31 and entered in Section A, Sub-section 7 of the Competition. We hope to publish full building instructions for the model in a future M.M.

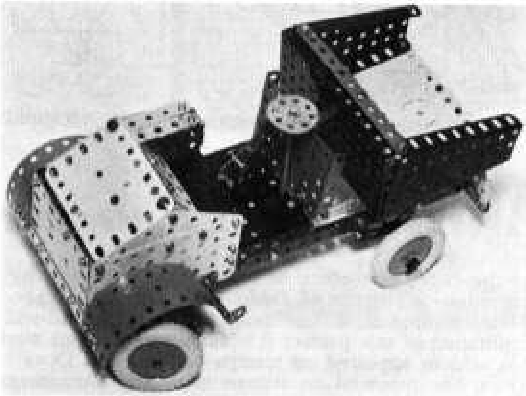
Opposite page, built with Meccano Set No. 5, this well-proportioned Dragster netted 1st Prize in Section 1, Sub-section 5 of the Competition. It was designed and built by Martin McCrorie of Hailsham, Sussex. Far right, Second Prize in Sub-section 7 of Section B was won by Mr. Colin Hoare of Beaconsfield, Quebec, Canada with this Snowmobile which incorporates working skid steering.

For the picture on the right, Mr. Hoare's Snowmobile (see photo below) has been broken down into sections to show its simple yet sturdy construction.





Far right, as always, originality of subject was a factor ever in the minds of the judges. The originality of this Dentist's Chair was enough to win 1st Prize in Sub-section 5 of Section B for Mr. Bob Boundy of Christchurch, New Zealand.



Section A

Sub-section 1:
No entrants

Sub-section 2:
No entrants

Sub-section 3:
1st – Miss L. Robinson, Wilmslow, Cheshire.
2nd – S. L. Houghton, Kendal, Westmorland.
3rd – M. Park, Dorchester, Dorset.

Sub-section 4:
1st – A. Atkin, Rotherham, Yorks.
2nd – P. Mead, Bridgewater, Somerset.
3rd – M. Fairman, Trowbridge, Wiltshire.

Sub-section 5:
1st – M. McCrorie, Hailsham, Sussex.
2nd – S. Cummings, Horsham, Sussex.
3rd – None.

Sub-section 6:
1st – A. Saul, Handsworth Wood, Birmingham.
2nd – R. Hamlin, Basildon, Essex.
3rd – None.

Sub-section 7:
1st – S. Ashford, Cookham, Berks.
2nd – P. Garfield, Bournemouth, Hants.
3rd – N. Pluck, Christchurch 2, New Zealand.

Section B

Sub-section 1:
1st – P. D. Hancock, Edinburgh.
2nd – J. E. Smith, Southall, Middlesex.
3rd – None.

Sub-section 2:
No entrants

Sub-section 3:
No entrants

Sub-section 4:
1st – P. Owens, Seven Kings, Essex.
2nd – A. C. Dexter, Horley, Surrey.
3rd – None.

Sub-section 5:
1st – R. Boundy, Christchurch, New Zealand.
2nd – J. R. Crocker, St. Ives, N.S.Wales, Australia.
3rd – H. Kronberg, Odense, Denmark.

Sub-section 6:
1st – J. G. Burke, Cardiff, Glam.
2nd – C. Warrell, Eltham, London, S.E.9.
3rd – A. Bentley, Newcastle, Staffs.

Sub-section 7:
1st – E. Amirault, Sask., Canada.
2nd – C. G. D. Hoare, Beaconsfield, Canada.
3rd – J. C. Palmer, Droitwich Spa, Worcs.

My sincere congratulations go to all the winners for a job well done!

MECCANO PARTS AND HOW TO USE THEM—PART 3

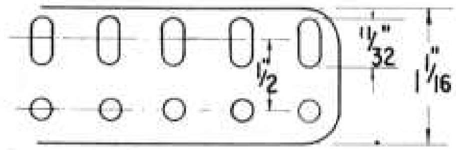
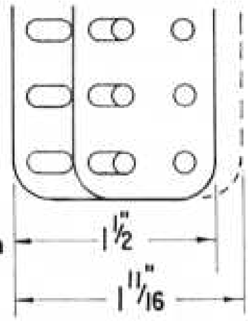


FIG.1

FIG.1a



GIRDERS

BY B. N. LOVE

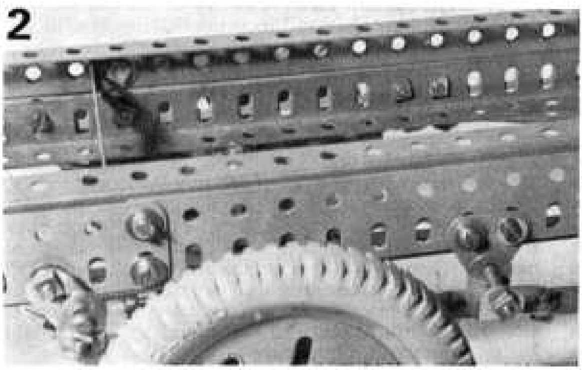
Strength is a prime consideration for any structural engineer, but so is lightness and economy. Frank Hornby was fully aware of these principles and since he started off with tinplate, design of his basic parts was critical if they were to prove durable. Fortunately the simple process of putting a right-angled bend into a strip of metal alters its characteristics to suit the engineer admirably. Take any strip of notepaper, for instance, which is quite unrigid and floppy and then put a fold down the centre of its length. The strip is still flexible but not so floppy as before. Now open out the fold to a Vee shape and you have instant rigidity along the length of the strip. You have, in fact, formed an elementary girder! It really is as simple as that.

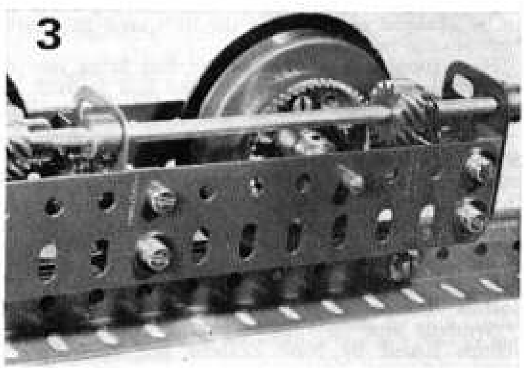
Angle Girders came into the system very early on in its history when the name "Meccano" was rapidly being established as an international household word and its design, being so fundamentally simple and satisfactory, has hardly been altered since. This is certainly true of the Angle Girder which forms the rigid framework of so many Meccano models. Most readers are familiar with its properties but the manufacture of the Angle Girder is a story of its own. Strip steel, $1\frac{1}{16}$ in. wide and $\frac{1}{32}$ in. thick, is passed into a piercing press from which it emerges in a continuous length punched with the familiar pattern of holes shown in Fig. 1. A second machine 'crops' the continuous lengths into standards as required for the full range of Angle Girders and a further machine puts the right-angled fold into the finished parts before the cleaning and plating process.

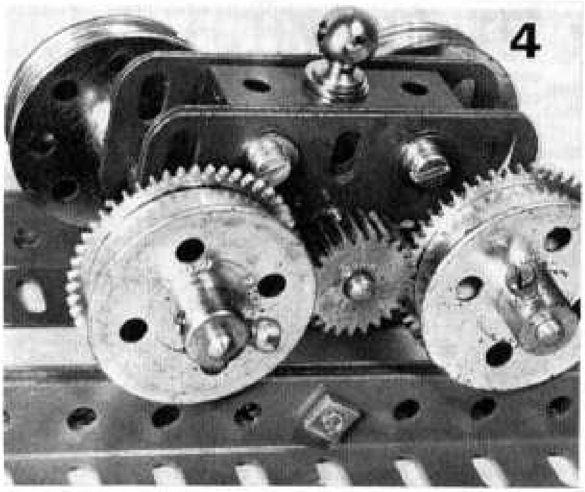
In its unfolded form, the Angle Girder is known as the Flat Girder (which is really a contradiction in terms.) It should be more properly named the "Wide Perforated Strip" as it possesses no rigid properties of its own. However, when it is combined with the standard Angle Girders as shown in Fig. 2, it provides a strong web for the compound channel girder thus formed. Flat Girders came on to the Meccano scene as a standard part at about the time of the First World War. They were listed as a part number in $5\frac{1}{2}$ in. length only but were not even included in the top set of the day, Outfit No. 6. Consequently, they seldom featured in the manuals of instructions but they did appear in the first advanced model of the famous Meccano Loom, (beyond the scope of the No. 6 Outfit) in 1919, if not earlier. Since that time they steadily became a popular choice for the model-builder as their versatility was disclosed and exploited. The basic dimensions of the Flat Girder are shown in Fig. 1.

Elongated slots are the key to the versatility of the Flat Girder although 'centre line' dimensions of the holes still conform to the half-inch standard. Fig. 1a shows the 'spread' available when a pair of Flat Girders are lapped over each other and this can be extended by lapping slot to slot. Since Flat Girders are available in ten sizes from $12\frac{1}{2}$ in. downwards, the Meccano constructor has a whole range of adaptable plates at his disposal.

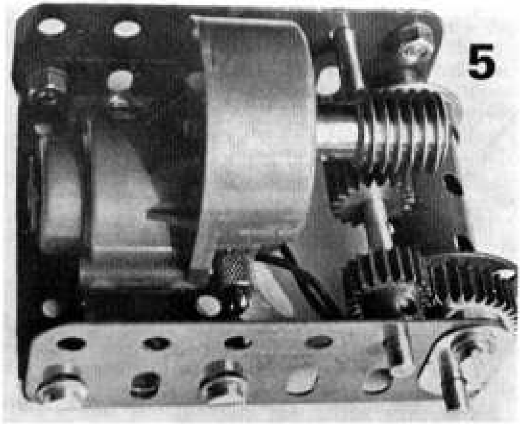
The chassis members of Fig. 2 show one aspect of the Flat Girder







The versatility of Flat Girders is demonstrated especially well in Figs. 4 and 5; both use the elongated slots to maximum advantage.



in its use as a web joining standard Angle Girders to form channel girders, but Fig. 3 shows that the Flat Girder can also act as a framework with simple bracings of short Double Angle Strips. Its latitude of adjustment allows an unorthodox meshing of a small helical Gear with a Contrate Wheel in a power-driven crane bogey, short Flat Girders mounted vertically forming the off-set bearings required.

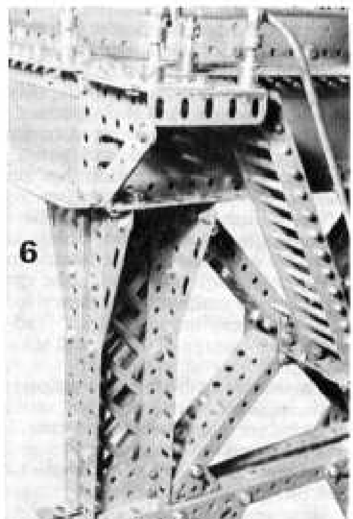
Fig. 5 shows a further example of the Flat Girder's adaptability. In this case a pair of Flat Girders act as the side frames for the lower portion of a light trolley hoist in which the winding drum gear is a 1 in. Gear Wheel. This will not mesh with the ½ in. 19-teeth Pinion shown at standard spacing, but when the Pinion is off-set in the upper row of holes in the Flat Girder, ½ in. inwards from the end, the 1 in. Gear Wheel may be lifted into mesh by securing its shaft in the round holes of a pair of Fishplates mounted at each side of the trolley frame. The resulting drive is a very satisfactory and rugged one, nicely scaled. Bracing of the Flat Plates is done by a 2½ × 1½ in. Flanged Plate which forms an admirable base (adjustable in height by virtue of the slotted holes in the Flat Girders) for the electric motor and its Worm drive to the central 19-teeth Pinion shown.

Quite compact forms of travelling bogies can be made from Flat Girders, as illustrated in Fig. 4 where the principle of double-layer Strips for axle bearings, mentioned in Part 2, is clearly shown. This time a Channel Bearing, Part No. 160, provides full rigidity for the bogey and additional grip for the Bolts is provided by Washers as mentioned in Part 1 of this series.

If a fully compensating bogey is required, one pair of the driven flange wheels shown should be capable of independent movement to accommodate irregularities in rail surfaces or heights. In this case the Flat Girders should be turned with the slotted holes at the bottom and the forward axle should be stabilised by a pair of Fishplates as was done in Fig. 5. The rear axle should then be located in a central swivel bearing to allow the axle to 'ride' in the slots of the Flat Girder. Note, once again, the happy complement of Flat and standard Girders, this time the Angle Girders forming substantial rails for the bogey. Long Angle Girders, sandwiching the heavier-gauge Perforated Strips (7½ in. and upwards in overlapping staggered sections) provide a really strong flat-topped rail suitable for the heaviest of model drag-lines or excavators.

The standard Angle Girder of course, has a hallowed place in the outfit (if not the heart!) of the Meccano enthusiast. He is somewhat prone to classify his Meccano status by the number of Angle Girders he has; the longer and more numerous the better, rather like the chieftain who bases his status on the number of goats he possesses! There is no doubt about it though, the Angle Girder is the 'corner post' (in more senses than one) of the Meccano system, although no lad must ever be discouraged by not having them in his outfit. Thousands of excellent and advanced models have been made which do not use a solitary Angle Girder. However, they certainly look an impressive sight on the old familiar shipyard cranes, etc.

Finally we can see the result of combining those elements of the Meccano system form to the rigid tower structure of a recent model Giant Block-setting Crane as shown in Fig. 6. The upper portion of the tower is surrounded by massive deep webbed girders formed from 12½ in. Strip Plates and Angle Girders. Sturdy 'legs' run to the base of the model where Braced Girders form double webs for compound girders, but utilise the lightweight technique. Channel girders appear again as the combination of Flat and Angle Girders forming rugged tower bracings and bottom rails. Note, also, the use of Washers wherever slotted holes are encountered to ensure a good grip for Nuts & Bolts.



young Bidder perform and all urged upon his father the need for the young genius to be formally educated. At last, after a plea by the great astronomer Herschel in 1817, the boy was belatedly sent to begin his lessons. After a time he had progressed so far that the services of a private tutor were needed. He proved to be a truly brilliant pupil.

Within five years of beginning his academic education he had carried off the mathematical prize of Edinburgh University. At first he was employed by the Ordnance Survey, and later worked for the Institution of Civil Engineers.

In his adult life Bidder's early fame as an arithmetical prodigy was largely forgotten. He became one of the greatest engineers of the nineteenth century. As we have seen above his most enduring monument is perhaps the vast Royal Victoria Dock on the Thames, at that time the world's largest, but he was also a great railway builder.

Bidder became a highly educated man and his powers, (unlike those of some boy geniuses) increased with his age. It is interesting to compare two problems set for him, one at the age of twelve, and the other sixty years later, only two days before his death.

In 1817 Sir William Herchel asked him the following question:—

> Light travels from sun to earth in eight minutes. Assuming the sun to be 98 million miles away, if light took 6 years and 4 months to travel from the nearest star, how far away is that star?

Bidder answered correctly 40,633,740,000,000 miles.

Almost at the end of his life he was asked by a friend:—

> If light travels at 190,000 miles per second, and the wave length of red rays is 36,918 to the inch, how many of its waves strike the eye in one second?

He replied at once 444,433,651,200,000.

It would seem that Bidder though an excellent all-round mathematician showed exceptional skill mainly in questions involving multiplication and division. He himself left an interesting account of his own mental development, and the accounts of his boyhood genius are well authenticated. He died at Dartmouth in 1878, aged 72.

George Parker Bidder Junior (the 'Younger Bidder') the son of the engineer, was born in 1837, and inherited his father's genius for figures. He too could quite easily multiply 387,201,969,513,825 by 199,631,057, 265,413. He could play two games of chess at once, blindfold! At Cambridge he was a brilliant mathematician, but he was never really interested in the subject! He took up law and had a distinguished career at the Bar, becoming a well known Q.C. Had he been really interested in the world of numbers he would quite possibly have excelled even his famous father.

Both however remain marvellous examples of the incredible capacity of the human mind. Even the electronic brain would be hard put to it to beat them for speed and accuracy.

MODEL BUILDERS

(Continued from page 122)

taken. Since the model was built, some of the boys have entered the Whitley Scout Troop, as is evident from the different uniform worn by several of those in the photograph, but they were all Cubs at the time of construction.

I have been asked to stress that, while the model was inspired by the Jodrell Bank Telescope, it is *not* itself a Radio Telescope. It looks like the original and reproduces the original's movements, but it does *not* perform the radio-telescopic work of the original. Nonetheless, it is still much more than a purely mechanical model; it actually serves as a receiving aerial for household radio and television broadcasts!

It is, of course, to achieve this unique result that the special "dish" is required. The metal bowl collects and concentrates the radio or T.V. waves, which are then picked up by an aerial "feeler" projecting through the centre of the bowl. This feeler is connected by screened aerial cable to a radio or T.V. set in the normal manner to complete the chain.

In operation, with everything connected and the set switched on, the model is manipulated, the dish searching the air until the clearest and loudest results are achieved. Obviously the best results will come when the dish is aimed directly into the path of the broadcast waves and this fact also enables the model to be used as a direction-finder as well as an aerial. At peak reception, the dish will point in the direction of the broadcasting transmitter when receiving direct waves and will also indicate the general direction of the transmitter when receiving waves reflected off the "Heavyside Layer" of ions surrounding the Earth. In the latter case, the dish would point skywards to pick up the reflected waves, but in most cases it would be angled skywards, rather than point vertically upwards, and this angle would still indicate a ground direction.

It is clear from all this that the model has many fascinating possibilities. I was certainly impressed by it when I visited the Pack at Whitley and I should now like to take this opportunity of congratulating the Cubs on their achievement. I should also like to thank the Cubs and all who made us welcome during our visit, especially Mr. Burrows and "Akela", Mrs. Laithwaite, who was also the Pack Founder. Thank you all—and we did find our way back safely!

Self-searching Model

Quite coincidentally, I am able to report—briefly—on another model inspired by Jodrell Bank Radio Telescope, this one built by Mr. A. Lindsay Greer, of Ballymena, Co. Antrim, Northern Ireland. As with the Cubs' version, however, it must be stressed that Mr. Greer's model is purely a model and is *not* a radio telescope. In fact, as I understand it, the model reproduces only the shape and movements of the original. It does not serve as a radio or T.V. aerial, as does the Whitley-produced version, but it does incorporate a highly-commendable self-searching feature which makes it worthy of special note.

Unfortunately, I do not have a photograph of the model to reproduce here, but Mr. Greer kindly gave me a clear description of the model's principles which, I think, explains the situation admirably.

"For a birthday present", he wrote, "I received the Meccano Electronic Control Set. To utilise this, I built a model which was inspired by both the Jodrell Bank Radio Telescope and a French solar power station, of which I had an illustration. When switched on, a reflecting dish revolves, at the same time tilting up and down, both movements being automatic.

"On the end of the 'needle' inside the dish is the L.D.R. (Photo Cell) of the Electronic Set, this being wired in the appropriate circuit with the Relay, Motor and power source. By covering the Photo Cell with a filter, it can be made to switch the motor off when it is pointing at the sun or at a light bulb. In this way, the machine searches the sky until it finds the sun, at which point the Motor switches off, leaving the

Photo Cell pointing at the sun. When the sunlight moves away from the Photo Cell, the Relay switches the Motor on again, driving the model until the Photo Cell again points at the sun. Thus the dish follows the sun across the sky".

I think all readers will agree that both the models described here offer something really different from a Meccano point of view. They certainly illustrate the versatility of the system!

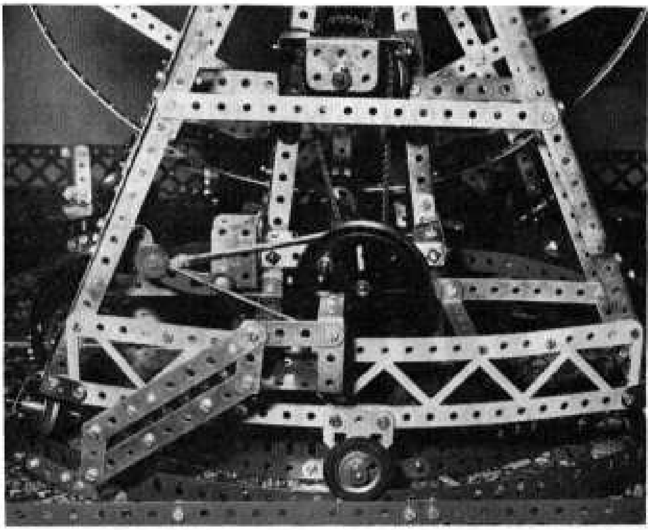
T.V. Appearance

Before finishing this month, I would like to draw attention to the remaining photograph, reproduced here, which we have included to let enthusiasts know that Meccano is still receiving plenty of good publicity. It won't take modellers long to recognise the Meccano Blackpool Tower in the picture—and it won't take T.V. viewers long to recognise the two men either! They are, of course, popular British comedians Mike and Bernie Winters, and the scene is taken from the London Weekend Television show "Mike and Bernie's Christmas Cavalcade" which was broadcast during the Christmas period.

I should say, I *hope* the show was broadcast and I *hope* the scene was included, because, at this moment as I write, I do not know—Christmas is still a couple of days away! The show, however, has just been recorded in advance and London Weekend have kindly sent me the photograph, so I am assuming everything went as planned. If it did, no doubt many readers saw the programme, therefore the photograph will, I trust, bring back some happy festive memories.

Incidentally, the model trains in the picture look like old Hornby O-gauge Clockwork Trains, once made by Meccano. I wonder if any member of the Hornby Railway Collector's Association can confirm this . . . ?

Below A close-up view of the control handle and Sprocket drive providing vertical dish movement on the Jodrell Bank model. Note the band brake which locks the dish at the chosen altitude. Right. Meccano Blackpool Tower meets Mike and Bernie Winters! See text.



POCKET MECCANO (*Continued from page* 133)

PARTS REQUIRED

2—10	24—37a	1—111	2—126a
4—12	14—37b	1—111a	1—194
4—23	1—51	1—125	2—235d

Dodgem

Lastly, we have the Dodgem Car which is a nicely-proportioned and realistic little model designed by 13 year-old J. Spriggs of Spalding, Lincs. The chassis is built up from a 2½ × 1½ in. Flanged Plate 1, to the sides of which two 4½ in. Narrow Strips 2, bent to the shape shown, are attached by Angle Brackets 3 to represent the bumpers. The flanges of the Plate project downward and note that the Angle Brackets are fixed to the underside of the Plate, the securing Bolts in each case also fixing a further Angle Bracket to the top of the Plate. A Fishplate 4 is bolted to the spare lug of each of these additional Angle Brackets.

For mobility, the Dodgem is provided with four wheels, each supplied by a ½ in. Pulley 5 on a ½ in. Bolt, tightly fixed in one or other Narrow Strip 2. The Pulleys are free to turn on the Bolts, but are held in place by two Nuts locked together on the end of each Bolt.

The main body fairing is represented by a 2½ × 1½ in. Plastic Plate 6. When fitting this Plate, however, it is best to first fix a 1½ in. Bolt 7 by a Nut in one centre end hole of the Plate, the lower end of the Bolt shank then being locked by two Nuts in the second row centre hole from the rear end of Plate 1. The other end of Plate 6 is curved round and bolted to the forward flange of Plate 1. Bolted to the rear flange of the Plate, by its apex hole is a Flat Trunnion 8, serving as the seat-back, the model finally being completed by a second 2½ × 1½ in. Plastic Plate 9, curved as shown and bolted between the third holes of Narrow Strips 2. This adds the final touch to a very pleasing little model!

PARTS REQUIRED

2—10	25—37a	1—111	2—194
4—12	11—37b	4—111a	2—235d
4—23	1—51	1—126a	