Meccano Constructors' Guide Part 3 *(continued)*

by B. N. Love

Basic Crane Structures

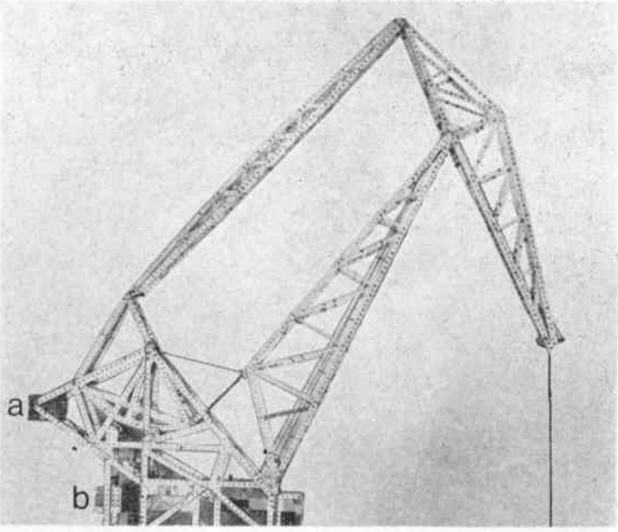
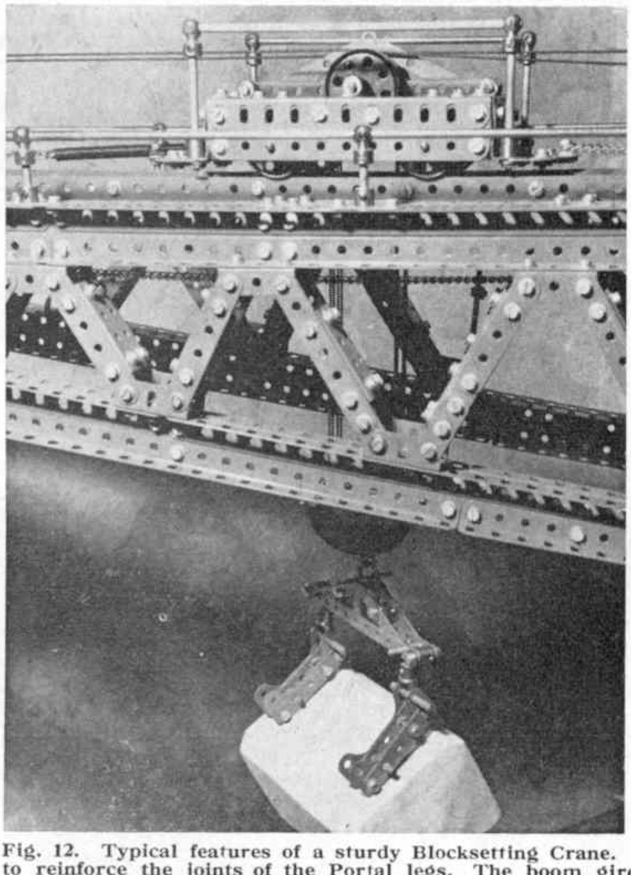


Fig. 8. The jib system of a level-luffing crane in which the linked jib method is employed. Note the parallelogram form of the geometry and the sliding counterweight at (b) which keeps the entire luffing system balanced.

Crane safety is a most important aspect in crane construction whether a simple pulley block or giant Hammerhead Crane is in use. Safe working loads and the inspection of all running gear, brake drums, etc., is vital, of course, but the basic design of the crane must always ensure stability and strength. However, as economy of materials and weight must always be considered, the combination of sound engineering principles must be applied to finding the compromise. The accompanying illustrations give some idea of the way in which Meccano cranes can be constructed to follow sound lines in accordance with their prototypes.



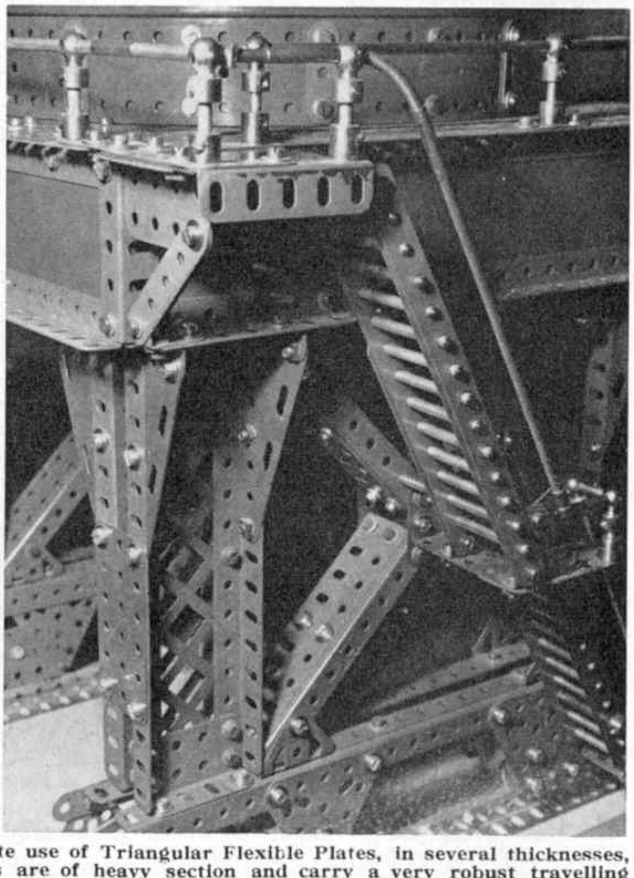


Fig. 12. Typical features of a sturdy Blocksetting Crane. Note use of Triangular Flexible Plates, in several thicknesses, to reinforce the joints of the Portal legs. The boom girders are of heavy section and carry a very robust travelling "crab" capable of supporting the weight of the stone block, etc.

Fig. 9 show a simple but very strong crane tower in which the rigidity of the corner Girders is reinforced by the bracing qualities of Perforated Strips and the use of triangulation is well exploited.

Fig. 10 shows the base of a free-standing structure for a Monotower crane in which compound girders, similar to those discussed in Chapter 1, are used to reinforce the base of the tower and to support the heel of the crane pivot post which runs down through the centre of the tower and takes the entire downward thrust of the whole crane revolving structure. As can be seen in Fig. 10, the central 'H' girder taking the thrust at the base is fitted with a pad of small Flat Plates on which a Bush Wheel is mounted and to which a Socket Coupling is attached. The heel of the pivot post carries a Bush Wheel or similar component, the boss of which enters the upper socket of the Socket Coupling for a short distance where it meets a Meccano Steel Ball resting in the upper socket. The result is a highly efficient rotary thrust bearing which permits the superstructure of the crane to be rotated with ease and a minimum of power.

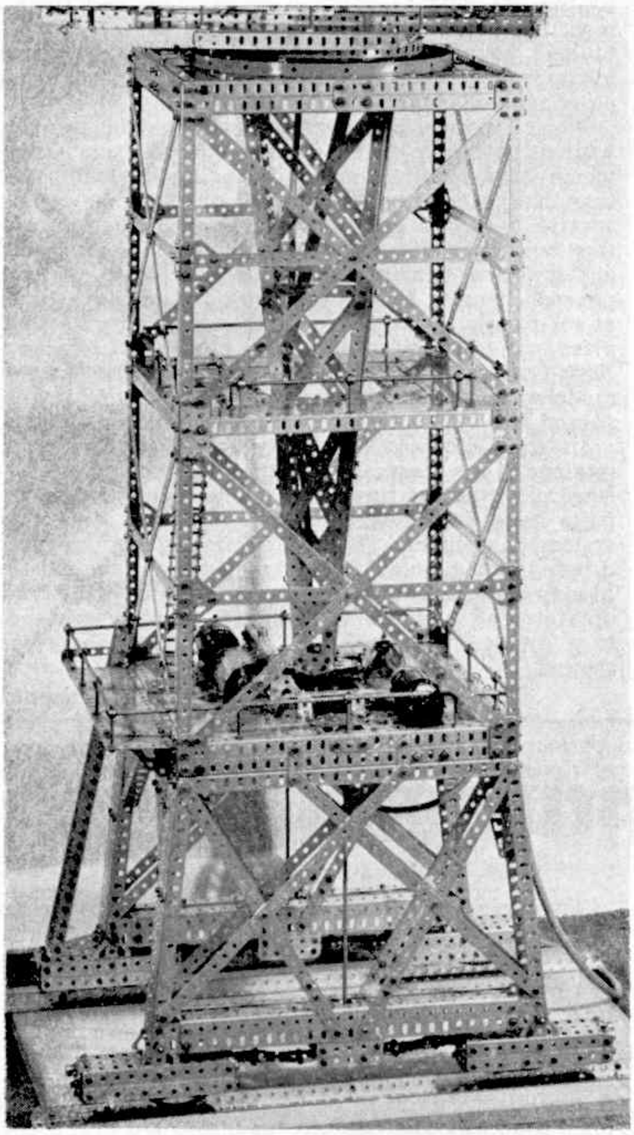


Fig. 9. A good example of an elegant, but strong tower construction for a high-reach dockside crane. Triangular bracing is well exploited as also are the rigid properties of Angle Girders.

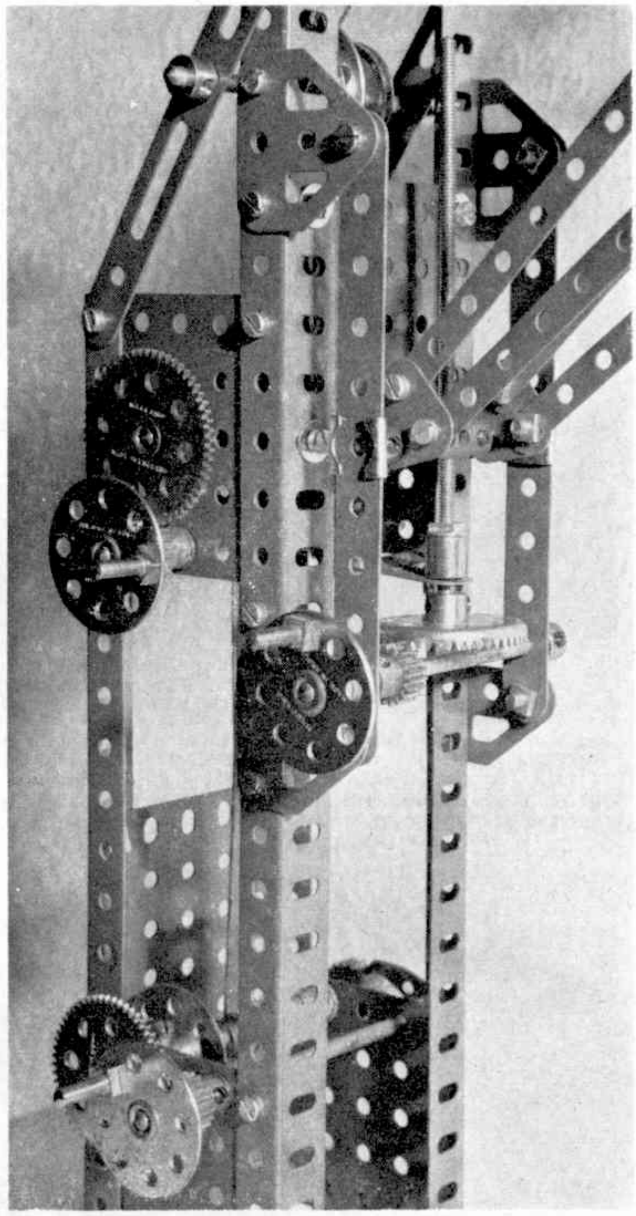


Fig. 7a. Close up of the operating mechanisms of the Toplis Crane. The top handwheel is for luffing the jib, by a simple cord and pulley system. The handwheel at front centre drives a screw mechanism for adjusting the pivot point at the lower end of the jib.

Having secured adequate strength with due regard for overall weight, stability of the crane is of importance. This means that when the crane is hoisting its heaviest safe working load at the extremity of its reach it must never be in danger of toppling over. This safety factor is achieved by making sure that the crane is adequately counterbalanced by placing ballast weights in an appropriate position. Referring back to Fig. 8, a sliding counter-weight is arranged at position (b), its sole purpose being to balance the parallelogram jib system for power economy in jib luffing. The fixed counter-weight at (a), however, is a ballast box (loaded with scrap lead in the model) to balance the working load of the crane proper.

Fig. 11 shows another method of counter-balancing commonly used on Tower cranes where the ballast box is fitted to a cantilever beam supported by long stays from the top of the crane's central mast. For

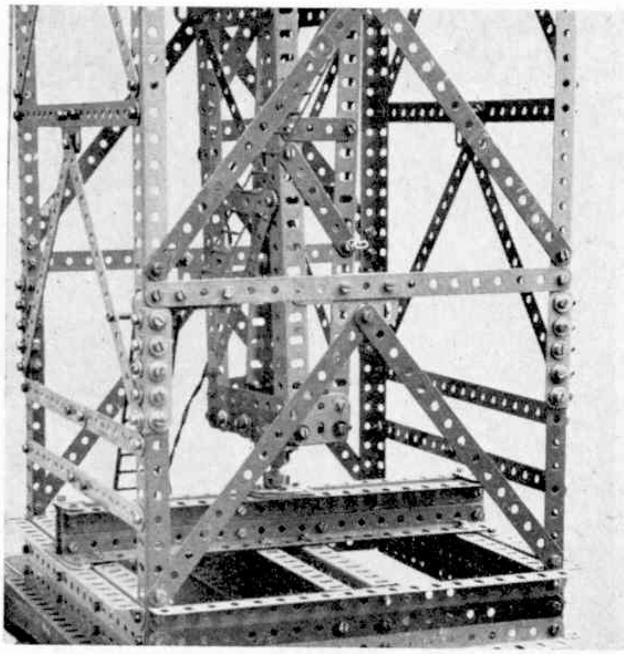
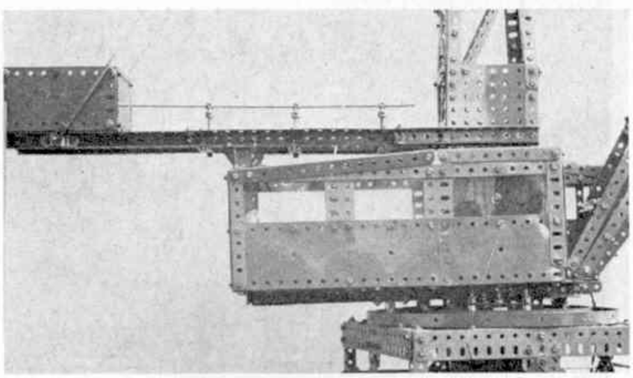


Fig. 10. Above: Base of a free-standing Monotower Crane heavily reinforced with compound girders to take the entire downward thrust of the crane's superstructure on a simple ball bearing.

Fig. 11. Below: Counter balance ballast box typical of that employed on Monotower Cranes. Note that side thrust rollers only are employed in the turntable.



model makers, in the absence of suitable scrap lead, the ballast may be provided by spare Meccano Strips, Plates, Washers and Nuts & Bolts, the use of which makes the ballast adjustment very simple. In calculating safety factors of the nature outlined, the crane engineer must also take wind speeds into consideration and stresses on the hoisting gear and crane stability which could arise through operator errors.

In the last two types of crane mentioned, the revolving superstructure has been carried on a strong centre post made of Angle Girders cross braced with strips which pivots inside the crane tower and is an ideal method of slewing such cranes as no heavy turntable is required at the upper level, a light-duty side thrust roller race being all that is required.

The types of crane which the Meccano enthusiast can model are legion and hundreds of examples of them are to be seen all over the country whether inland or at seaports. Mobile cranes form a class of their own although the principles outlined are as important for these as for any other class of crane. The gantry crane is another very popular type which is very well covered by the Meccano Manuals of Instructions and since it is virtually a travelling bridge its inherent stability is a built-in feature allowing it to cope with the greatest loads, weight for weight, by comparison with any other type of crane.

No mention of crane structures would be complete without reference to the Giant Block-Setting Cranes which have featured in Meccano literature for more than half a century. Very few of these juggernauts survive to-day as the breakwaters and harbours which they built over the past century are now well established and modern construction utilises pre-cast, or site-poured concrete by contrast with the fifty-ton blocks of solid masonry which these veteran ' Titans ' set into place with precision of a trained eye and a steady nerve. Such cranes are fascinating challenges for the Meccano modeller and Fig. 12 shows some aspects of their rugged structure which may be reproduced in Meccano.

In the following chapter we shall be considering motions of the crane, in particular the hoisting mechanisms and types of turntables. The range of Meccano parts is so vast by comparison with any competitive system that highly efficient turntables and powerful drives to them may be constructed from the existing Meccano range without resort to purpose-made parts or ' foreign ' bodies and diameters varying from 1 in. to a couple of feet are well within the scope of the system.

Part 4—Winding Gear

NO MATTER to what size a model crane is made, the greatest satisfaction to the modeller comes when it springs to life with the first movement of its winding drum. The simplest form of ready-made winder in the Meccano system is the Crank Handle which is found in all Meccano Outfits from the smallest to the largest and with the simple set-up shown in Fig. 1. it is perfectly efficient. At one time, younger modellers had some difficulty in securing the hoisting cord to the Crank Handle, as simple hitches and knots gave no real grip, but with the introduction of the Cord Anchoring Spring, Part No. 176, a positive grip was assured.

Two points are worth noting with regard to the use of this part as a cord anchor. It is important that, when the winding handle is turned, tension come on to the small loop arm of the Anchoring Spring in such a way as to tend to wrap the Spring more tightly round the shaft as the load is hoisted. Fig. 1 shows the Cord Anchoring Spring correctly set for hoisting with a clockwise motion. Before attaching the hoisting cord to the Spring, the cord should first be tied with a half-hitch round the shaft and its ' tail ' secured to the small loop on the Spring. This prevents ' snatch ' when the hoisting cord has run out to its fullest extent.

For younger model-builders, the process of fitting a

Cord Anchoring Spring to a Meccano Axle Rod or Crank Handle can present something of a difficulty, as a twisting motion on the Spring is required to make it open its coils very slightly to accommodate the shaft diameter. This is made very simple by first locking a Bush Wheel or Pulley on to the shaft and trapping the loop of the Anchoring Spring with the thumb. The shaft may then be twisted into the Spring, using the Bush Wheel to apply the twist in such a direction that the Spring tends to unwind (very slightly) as it is pushed on to the shaft. The moment that the Spring loop is released, the whole Spring will grip the shaft very tightly. The greater the pull of the winding cord on the loop, the stronger will be its grip on the shaft. Fig. 2 shows the method of adjusting the position of the Cord Anchoring Spring on an Axle Rod.

With just a few parts, a rugged and realistic winch can be constructed such as the typical two-handed donkey winch shown in Fig. 3. This may be incorporated in hand-operated derrick cranes or mounted on low-loader trailers for winching heavy loads aboard and is very simple to make. A novel feature of this winch is the use of the slotted holes in the two Triangular Plates forming the frames. As can be seen from the illustration, a 15-teeth Pinion is meshed with a 38-teeth Gear Wheel giving a gear ratio of approximately $2\frac{1}{2} : 1$ which is very useful and gives a nice scale speed of wind-in. End checks for the winding barrel are provided by an electrical Bush Wheel (Part No. 518) at one end, and at the other end two $\frac{3}{4}$ in. Washers which are free to ride against the 38-teeth Gear Wheel and thus prevent chafing of the cord by the gear teeth. The small Bush Wheel provides splendid anchorage for the cord. The two side frames are braced apart by 3 in. Threaded Rods, lock-nutted as shown. Further realism may be added to the winch by providing a Pawl and Ratchet, Parts Nos. 147 and 148, fitted to the side frames.

Despite the simplicity of the Axle Rod as a winding drum, it has advantages even in advanced models. Its narrow diameter gives a very fine control of hoisting so that critical adjustments for such things as the tripping rings for a single-suspension bucket grab can be made with precision, while auxiliary hoists in large models can be nicely scaled with small winding drums. In engineering practice, wire ropes are used extremely extensively in all kinds of cranes, excavators draglines, etc., and are often of a very generous size to take strains of hoisting, luffing, winching, etc. Such ropes run more efficiently, with less wear and internal friction, if they are not bent to a sharp radius round a narrow diameter winding drum.

The Meccano system lends itself well to the construction of larger winding drums by making use of the standard cylinders available. These are illustrated in Fig. 4 and figure quite frequently in published models. The standard shaft fitted with electrical Bush Wheels, by the way, may be augmented by mounting one or two Couplings on the shaft to give a small increase in diameter, and a variety of end cheeks for these parts is available in the shape of Bush Wheels, Flanged Wheels, Face Plates, Sprocket Wheels, large Gear Wheels and the Circular Plates. Such end cheeks have the advantage of perforations through which a heavy hoisting cord can be threaded to be secured on the outside, as shown in Fig. 5. In this illustration a Rod and Strip Connector forms a ' Thimble,' in the throat of which a spliced or whipped loop at the inner end of the hoisting rope is seized. A Washer ensures a sure grip for the actual loop. In simple models, however, the cord can be passed through two holes of the end cheek and knotted internally, as shown in Fig. 3.

Winding capacity for two of the drums illustrated in

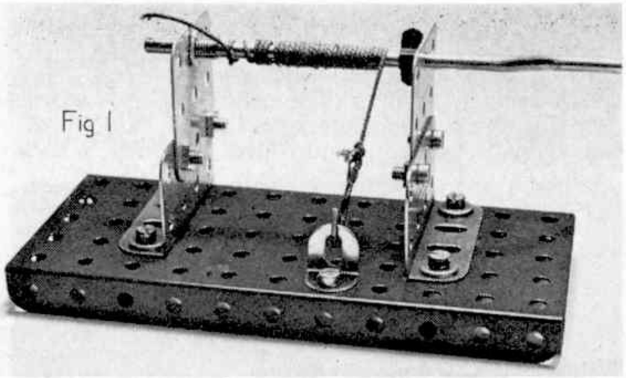


Fig. 1. The most simple of all Meccano winding equipment, the Crank Handle, seen here fitted with a Cord Anchoring Spring.

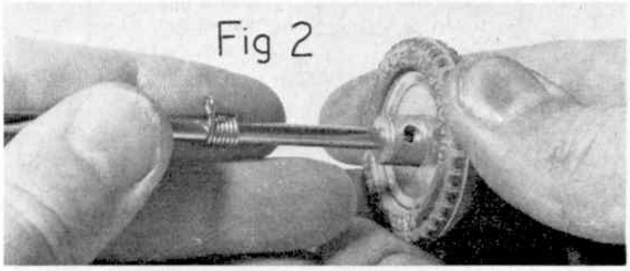


Fig. 2. A simple method of positioning the Cord Anchoring Spring on an Axle Rod with the aid of a Pulley and Tyre.

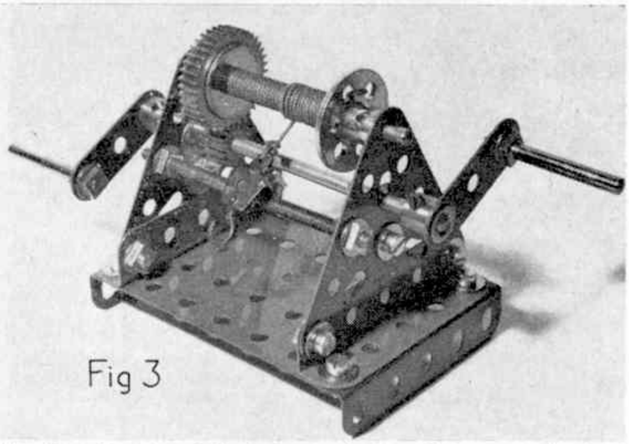


Fig. 3. Two-handed donkey winch. Note non-standard spacing of gears making use of the slotted holes in the triangular side plates.

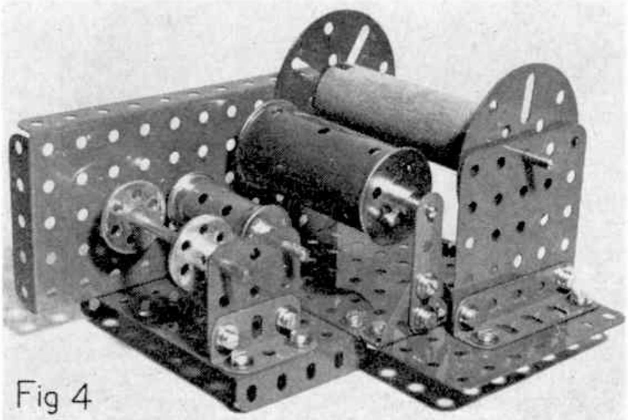


Fig. 4. A selection of Meccano winding drums made from standard cylindrical-shaped parts.

Fig. 4 can be improved by adding end cheecks as shown in Fig. 6. Normally the Sleeve Piece seen here is centralised by small Flanged Wheels fitted externally, while the 2½ in. Cylinder is centralised by large Flange wheels fitted internally. The Sleeve Piece is carried on internally-mounted Chimney Adaptors, Part No. 164, and the end cheeks are provided by Bush Wheels.

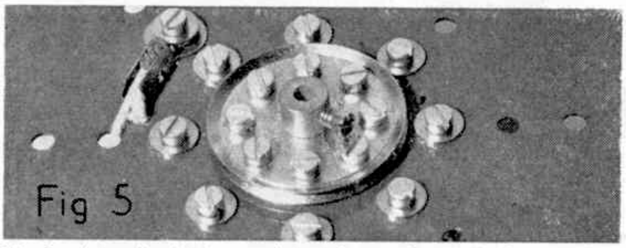


Fig. 5. A method of securing a heavy-duty winding cord to the outside of a winding drum. Note the use of a Rod and Strip Connector as a "thimble".

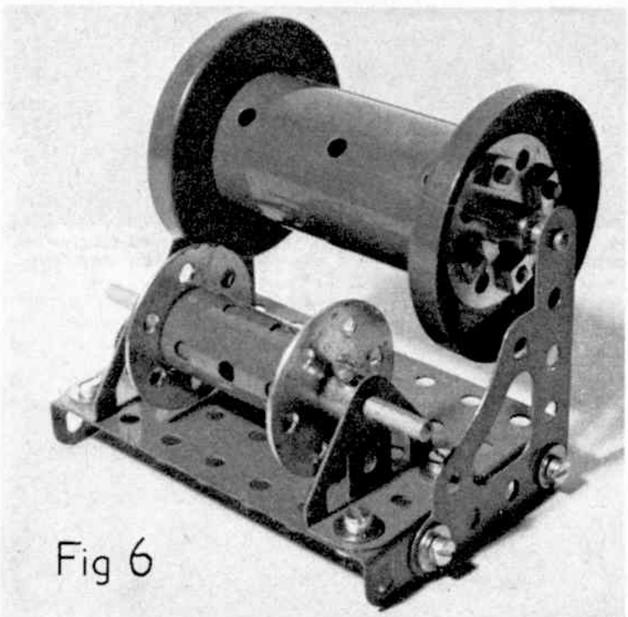


Fig. 6. Improved versions of winding drums, the smaller made from a Sleeve Piece and the larger from a 2½ in. Cylinder fitted with bigger end cheeks.

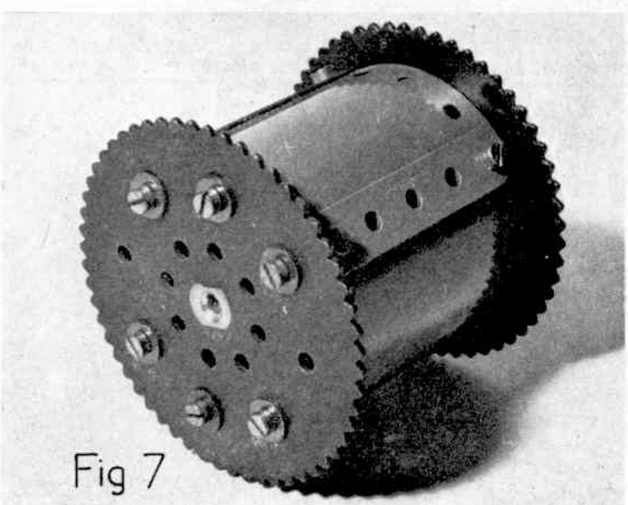


Fig. 7. Large-diameter winding barrels can easily be built-up from curved Flexible Plates. Note the use of heavy-duty end cheeks, supplied by Sprocket Wheels in this case.

Construction of end cheeks for the 2½ in. Cylinder is a little more involved. Four 3 in. Threaded Rods are each fitted with a Nut and Washer, then are pushed through four alternate holes of an 8-hole Bush Wheel to bring them into register with the four holes punched in the Wheel Flange, Part No. 137, illustrated. Each Threaded Rod is then fitted with two Anchoring Springs for Cord, which will slide over the threads of the Rods quite easily, these Springs simply acting as spacers to take up the 'slack' in the circumference of the 2½ in. Cylinder, which is next passed over the four Threaded Rods. When the second Wheel Flange and 8-hole Bush Wheel are lock-nutted into place, the Cylinder is tightly held concentrically between the end cheeks. If necessary, the hoisting cord to be wound on this reel can be secured by a Washer and Bolt through one of the perforations in the Cylinder.

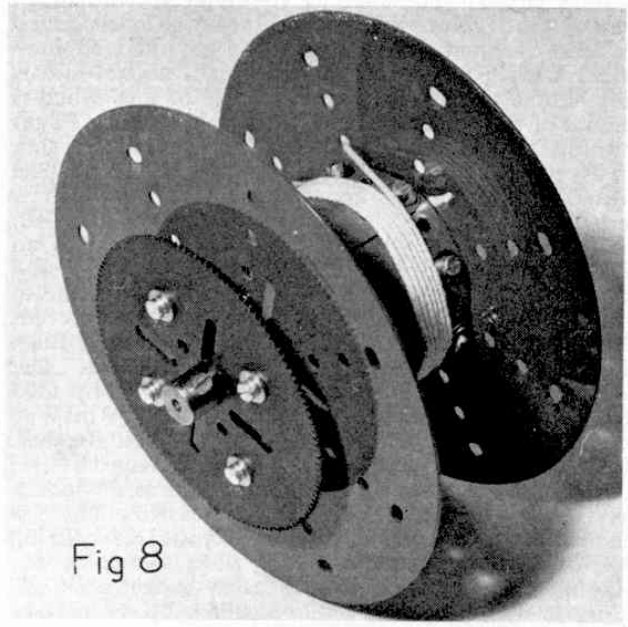


Fig. 8. A "deep-throated" winding drum for a colliery winding engine or large model dragline. The driving gear is bolted directly to the drum for rugged drive.

If longer Threaded Rods are used in the construction of the latter drum they may, with advantage, be passed through the holes of one of the larger Sprocket Wheels or Gear Wheels to provide a very positive drive.

Some drum drive arrangements require a slow-moving, large-diameter barrel, and this is readily achieved in standard Meccano parts by using 2½ in. × 2½ in. Flexible Plates, Part No. 200, which are already curved to the form required. Fig. 7 shows a drum built up from these plates and mounted between two 3 in. Sprocket Wheels internally fitted with four, six or eight Threaded bosses, Part No. 64. The transverse tapped bores of the Threaded Bosses are used for securing the four Curved Plates required at four points spaced at 90° round the drum. The remaining two or four Bosses in each end cheek act as bearers to accommodate the curvature of the Plates. The slotted holes in the Curved Plates lend themselves very well to cylindrical adjustment of the drum, but, for strength and appearance, these are overlaid with 2½ in. Perforated Strips.

The "Plate technique" can be applied in making specially-large drums for colliery winding engines or large models of heavy draglines, as shown in Fig. 8. Again, a driving gear is attached directly to the 6 in.

diameter Circular Plate acting as the end cheek so that a very rugged drive can be applied to the drum. If the far cheek is fitted externally with a Circular Girder, Part No. 143, a large-diameter brake ring is available for a heavy-duty contracting brake. Such a drum would accommodate several hundred yards of heavy-duty cord such as that used for off-shore sea fishing lines. A medium-size drum can be made on similar lines using the 4 in. diameter Circular Plate. Although Fig. 8 shows securing Bolts fitted to each anchoring point supplied by the Threaded Bosses beneath the Plates, alternate Bolts may be removed after the joins in the Curved Plates have been secured.

Just to give some idea of the versatility of Meccano parts in coping with any model from the humble to the mighty, Fig. 9 shows a winding drum of no less than 9½ in. diameter ! Although a rather unusual requirement for a model, the method of rotating the drum will be of particular interest to advanced model-builders since it employs one of the oldest systems of gear drives, i.e. peg teeth. The 167b Flanged Ring is fitted with eight sections of 4 in. Curved Strips, each fitted with ⅜ in. Bolts and Nuts. The drive comes from a 6-hole Bush Wheel fitted with short Threaded Pins which impart a surprisingly smooth motion to the large drum.

Brake systems for model cranes are featured frequently in Meccano Manuals and literature and many of them have been quite ingenious. Fig. 10 shows two simple, but very effective brakes which are the essence of simplicity. The left-hand section shows a slip brake comprising a weighted lever arm fitted to a Double Arm Crank mounted on a Pivot Bolt, about which it is free to move. One arm of the Crank engages in the " V " slot of the 1 in. Pulley which would be fitted to the winding drum or gearing. A 2½ in. Driving Band applies tension to the brake lever which may be adjusted by shortening the rubber band with short loops over the two Bolts between which it is stretched. Such a brake is normally in the " on " position so that it is necessary to raise the lever to allow the 1 in. Pulley to 'slip.'

The right-hand arrangement in Fig. 10 shows a very simple but versatile brake capable of immediate adjustment both for tensioning and for application. The brake lever is a 4 in. Axle Rod fitted with a Handrail Coupling for a handle and it is pivoted on a Short Coupling half-way up the side plate of the crane gearbox. The lower end of the brake lever carries a Slide Piece, Part No. 50 which rubs against a Tension Spring, Part No. 43 and is thus held in any desired position. A Threaded Pin attached to the side plate acts as a simple stop for rearward movement of the brake lever. The brake 'shoe' is another Slide Piece which embraces the tread of a 1 in. Motor Tyre, Part No. 142c when the brake lever is set to the " on " position. As shown, the position of the Slide Piece ensures absolute locking of the Motor Tyre in the clockwise direction and will hold a winding barrel, to which the brake is fitted, against any normal load. Adjustment of the Slide Piece up the brake lever will give finer degrees of braking. Additional tension may be applied to the movement of the brake lever simply by stretching the Tension Spring to a wider anchorage or by lowering the bottom Slide Piece. Other sizes of Motor Tyre and Pulley can be worked satisfactorily with this design which, despite its simplicity, is very efficient.

Fig. 11 shows a specimen crane gearbox in which simple brakes are fitted in the form of loops of cord passed round Pulleys and held in tension by counter-weighted brake levers. This method is quite effective as a simple brake and may be applied satisfactorily in

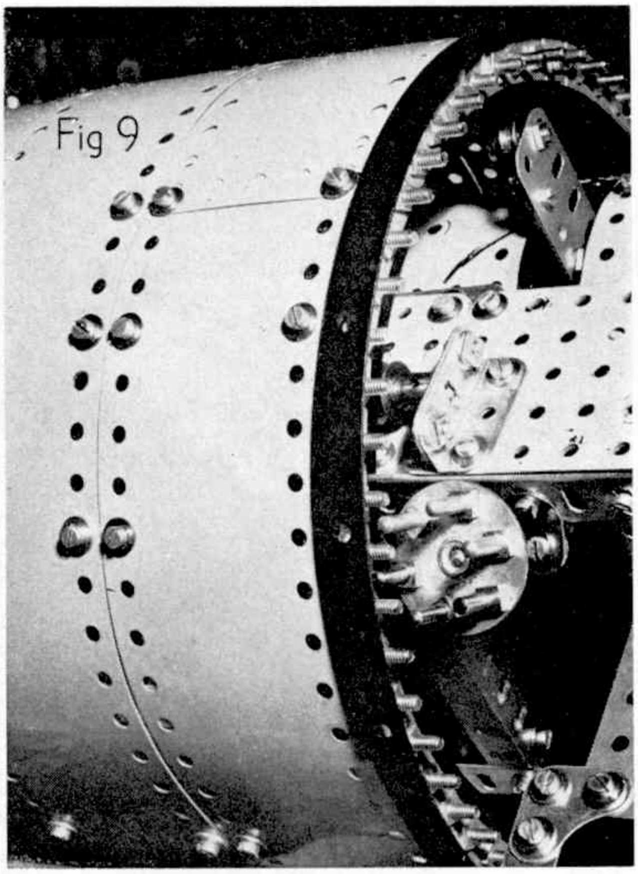


Fig. 9. This giant winding drum is driven by one of the oldest gear principles known—peg gears. In this case the pegs are supplied by Bolts and Threaded Pins.

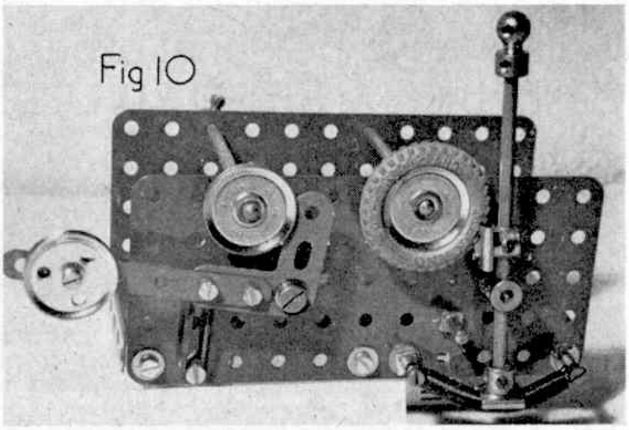
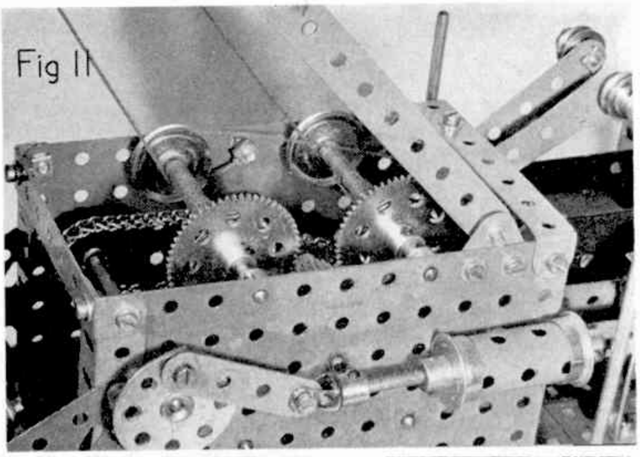
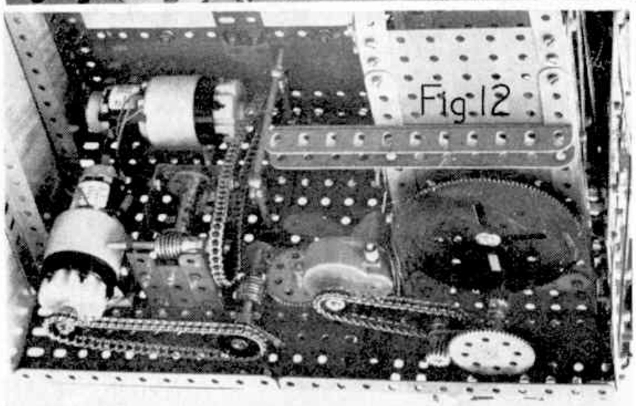


Fig. 10. Two simple but effective brake systems for winding drums. On the left is a " slip " brake. On the right a versatile positive-lock brake capable of fine adjustment.

smaller models. However, it has the disadvantage that cord tends to stretch rather easily and a vigorous release of the brake lever can throw the cord loops off the pulleys.

In contrast to Fig. 11, which shows a gearbox feeding four different movements from one shaft, Fig. 12 shows the neat control cabin lay-out of a model Monotower Crane. The use of individual power units is quite striking and is well in accordance with modern crane-building practice, although at one time it was customary to install a very heavy power plant in large cranes which





drove all of the movements by means of lengthy shafts, masses of gearing and flexible couplings. Power losses were considerable under these circumstances, but, in the days of cheap coal and lack of smaller high-power units, this was no great problem. Many veteran Meccano modellers enjoy reproducing the earlier models of such cranes, but the modern Meccano D.C. Motor with 6-ratio gearbox gives the enthusiast tremendous scope for placing his drive exactly where he wants it. This means that each unit is supplying the correct power for its individual job, with minimum power-loss, through extended shafting, and, of course, with worm drives to the movements, as shown in the illustration, braking problems do not arise to the same extent as would be in the case of winding drums and other movements being dependent upon clutch linkages. Individual electric power units have the advantage of small size, internal gearboxes and remote-control, thus reducing operator fatigue and making the crane available from ground control. The Meccano Constructors' Guide is not intended to give comprehensive coverage to the topics outlined in this Chapter, but the enthusiast will find a rich source of material on crane gearboxes and movements both in pre-war and post-war Meccano Magazines, due to the tremendous popularity of cranes as models throughout the history of Meccano.

Chapter V will be dealing with swivels and turntables for cranes and other similar machines and will include a complete built-up roller bearing making use of the new Meccano Large-toothed Quadrants and special Pinion.

Fig. 11. Cord brakes fitted to an early Meccano Breakdown Crane. Fig. 12. Individual electric power units in a model of a modern Monotower Crane. Note the small winding drums made from Couplings, and the Worm drives to the movements.

"STARDUST FORTUNES"

An amusing personal experience described by RICHARD LEE

IN THIS COUNTRY, seeing what the stars hold for us in the horoscope columns provides a form of amusement or light escapism. In the East, however, the telling of fortunes by Astrology is not only big business—it is a very serious business also. In India, where even today most marriages are arranged by the parents of the prospective brides and grooms—who often see each other for the very first time at the actual wedding ceremony—the most important part of the arrangements concerns obtaining horoscopes of the intended couple in order to see whether these horoscopes forecast similar futures for the pair. Sometimes the horoscopes will differ, perhaps forecasting that the groom is destined to go overseas, and the bride may be forecast never to leave her native shores. In circumstances such as these the marriage is invariably 'off' —for what would be the use of such a union if it has to be spent apart?

Eleven years ago, when I was in India as a single man, I scoffed at the idea that Astrology could accurately foretell the future. I was warned by an Indian colleague not to be damning in my attitude without first giving it a trial. I agreed to this and he undertook to get me a 'pukka' horoscope. I had to pay 25 Rupees (about £2.0.0) for it and also to wait about three months for its arrival. When it came in the post from the Indian Astrological Research Institute, from Kodakara in Travancore State, I was impressed at once by the trouble that they had taken over it. It was in the form of a bound book with 46 typewritten