MECCANO CONSTRUCTORS GUIDE by B. N. Love

PART 6: MOVEMENT ON RAILS

Engineers are frequently concerned with the question of moving equipment over rails and the rail systems used may be considered either as permanent or temporary roadways of a special kind. Readers are familiar with the 'permanent way' consisting of thousands of miles of railway lines all over the country, but other permanent rail systems are to be found elsewhere—principally in dockyards, where giant cranes move from one end of the dockyard to the other on very strong rails which are usually permanently set in concrete. Tram tracks, unlike the railways, have to be sunk below road level, where normal traffic is flowing, so the rail section has to be grooved rather than flat topped or "bullnosed" as permanent railway track usually is. In the same way, if it is necessary to have movement of other vehicles in a dockyard, sunken rails for the cranes are again essential and the type of wheel for the different tracks has to be designed for the purpose.

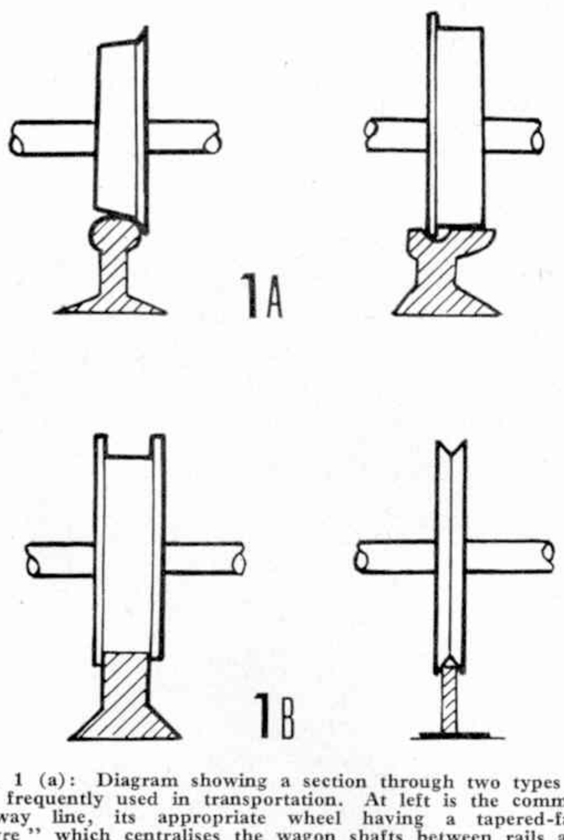


Fig. 1 (a): Diagram showing a section through two types of rail frequently used in transportation. At left is the common railway line, its appropriate wheel having a tapered-face "tyre" which centralises the wagon shafts between rails and allows for different rail radii when "banking" on a curve. At right is a typical tramway rail secton, but a bevelled face wheel is often required where sharp radii curves are met with. Fig. 1 (b): Two further rail sections. The rail, left, has an almost square top, the double flange of the wheel maintaining its location. The simple rail, right, is useful in simple models and for some internal running gear in larger models.

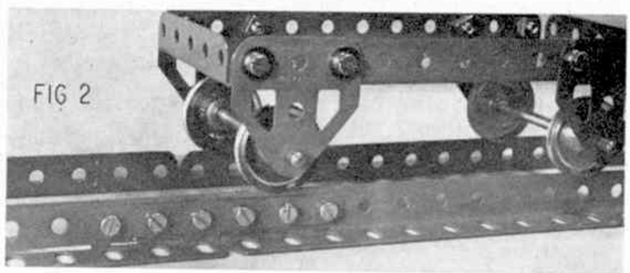


Fig. 2: A simple method of making a none-bulge joint in strip rails for pulley wheel running gear.

The Meccano system lends itself very well to the building of models which run on tracks and its wide range of wheels and wheel discs gives tremendous scope to the modeller. Fig. 1(a) shows, basically, the two types of rail section found in engineering practice, while Fig. 1(b) shows two further types suitable for models as well as some aspects of other machinery. All four types are readily made with Meccano parts and the simple rail, illustrated in Fig. 1(b) can be made from Perforated Strips mounted on edge, or from Angle Girders, as shown in Fig. 2.

The equally-simple rail truck in Fig. 2 runs very well on the track shown, so long as continuity of rail joint can be maintained. This can prove difficult when using pulleys as rail wheels but the solution is shown in the illustration. A non-bulging rail joint is achieved by butting the two ends of the strips or Girders forming the rail and overlaying the joint on each side with electrical 2 in. Brass Strips, Part No. 530 and then adding two Narrow Strips, Part No. 235a, as reinforcement. When bolted up tightly, the join is very strong and pulley wheels will run over it quite smoothly. Note the "bump" spot on the far side caused by the curved ends of the Girders.

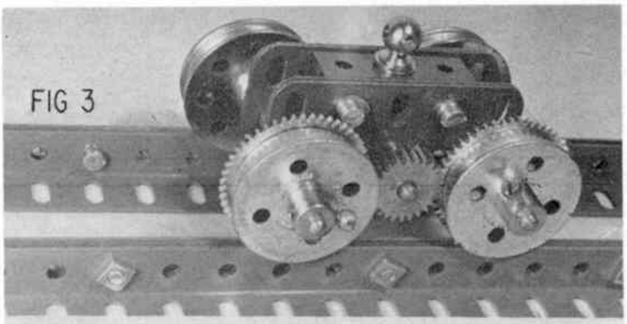
There are occasions when the engineer is faced with having a very heavy machine, like a Dragline, working on a soil face or even sand. In such cases, the terrain has to be levelled as far as possible and temporary tracks laid out. Care will be taken to maintain uniformity, but means is provided in heavy machines to compensate for vertical movement of temporary tracks on soft or shifting ground. Fig. 3 shows two views of a Dragline bogey, which would be one of four, mounted at each corner of a dragline. This would distribute the weight over a total of 16 wheels and the bogies would run on two sets of twin tracks, one length of which is shown in Fig. 3. This particular design of bogey truck utilises the double flanged wheels and flat-topped rail shown in Fig. 1(b), normal Meccano 1⅛ in. Flanged Wheels being used and fitted with 6 or 8-hole Wheel Discs on one side of the bogey and 50-teeth Gear Wheels on the other. The flat topped rail is made from three thicknesses of Perforated Strips sandwiched between Angle Girders.

If such a track is used for a model dragline, the twin rails should be spaced accurately by the use of Perforated Strips and then cross-connected to the other twin rails at the other side of the model to suit its width. Spacing strips can be avoided if the whole set of rails is screwed to a base-board.

It will be noticed from the illustration that the bogey truck has a Handrail Support, Part No. 136, screwed into the top of a Channel Bearing, to which double thicknesses of 2½ in. Flat Girders are attached with Nuts and Bolts, reinforced with Washers for a secure grip. The Flat Girders give adequate strength and serve as bearings for the Axle Rods carrying the double-sided flanged wheels, while the Handrail Support acts as part of a " Ball and Socket " joint.

Since the temporary rails over which a heavy dragline would work are subject to displacement, the bogey trucks must be able to " ride " up and down a little, the two rear ones being mounted at either end of a heavy compensating beam, pivoted at its centre to the rear of the dragline platform. The beam and the forward part of the superstructure would carry four Socket Couplings, Part No. 171, pointing downwards to take the heads of the Handrail Supports. A short length of Spring Cord, Part No. 58, gripped in the cross bore of the Handrail Support by double Grub Screws, will also pass into the tapped holes at the bottom of the Socket Coupling. This will give a flexible joint which can stand considerable downward pressure but will not fall apart if the model is lifted bodily. The Socket Couplings would, of course, have to be securely attached to the superstructure of the dragline.

Fig. 3a shows the under view of the bogey trucks, where the Sprocket Chain drive and 25-teeth reduction Pinion can clearly be seen. In operation, the chain lies in a slightly sagging loop to accommodate any rise or fall in the bogey trucks, this being as acceptable as in the prototype because of the slow speed of operation of such gear.



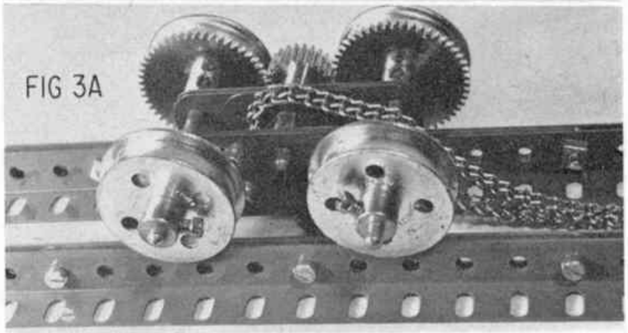
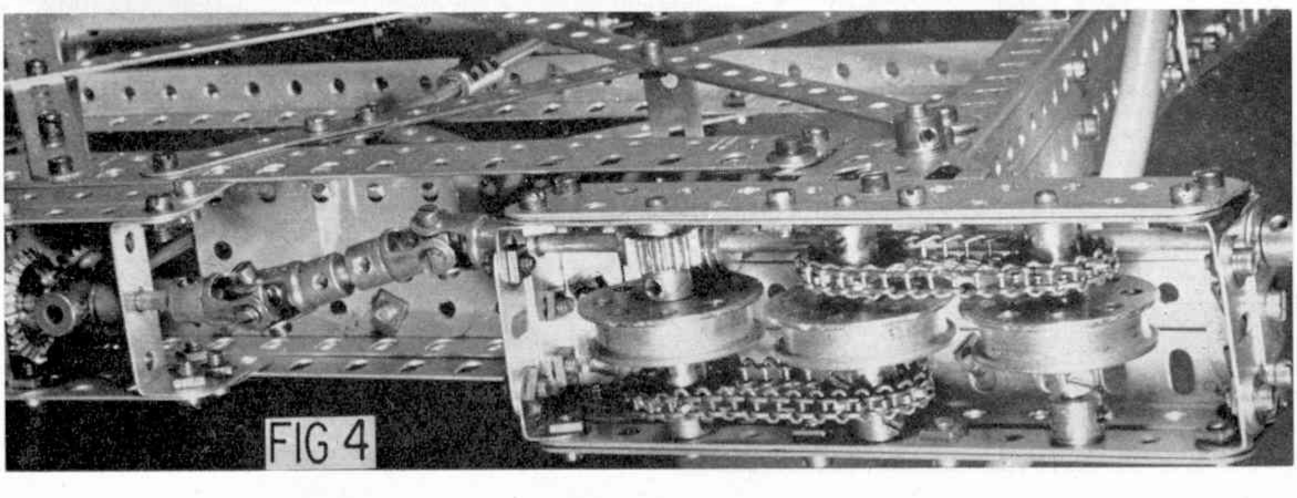


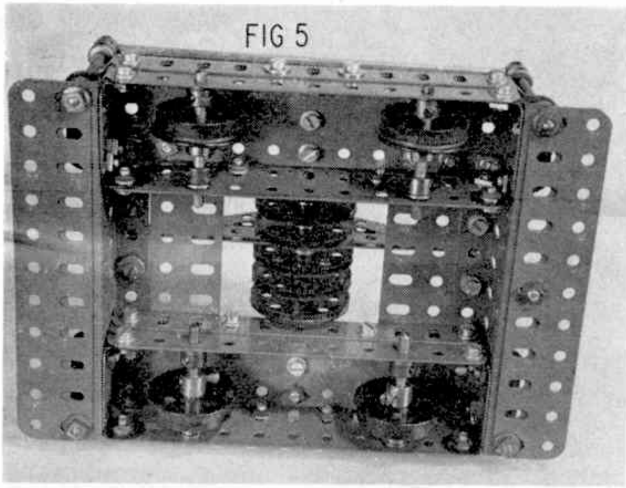
Fig. 3: Dragline bogey truck with double flanged wheels and flat-topped rail. Handrail Support at top forms lower part of " Ball and Socket " joint with Socket Couplings attached to superstructure.

Fig. 3 (a): Lower view of dragline bogey showing spur gear drive to travelling wheels via Sprocket Chain. Chain drive runs in a slack loop at low speed and accommodates rise and fall of bogey over uneven rail sections.

For the locomotive building enthusiast, Meccano Flanged Wheels provide a ready-made item for track working and Fig. 10 shows how they are put to good use in the construction of a self-contained locomotive bogey. The perforations in the Flanged Wheels take standard Meccano Bolts or Pivot Bolts so that connecting rods, made from 2½ in. Narrow Strips, can be attached as shown. Cylinders are provided by Couplings, Part No. 63, housed in a pair of Chimney Adaptors on either side of the truck and a drive is imparted to the wheels via 1 in. Gear Wheels meshed

Fig. 4: Travelling arrangements, for the advanced modeller, having a number of advantages over simpler designs. Note Worm drive and compact positive drive to all axles.





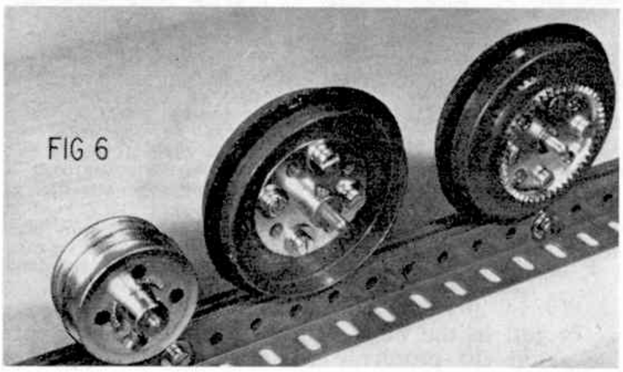


Fig. 5: Heavy duty "crab" trolley for giant Block-Setting Crane making use of independently-mounted Flanged Wheels for maximum axle strength.

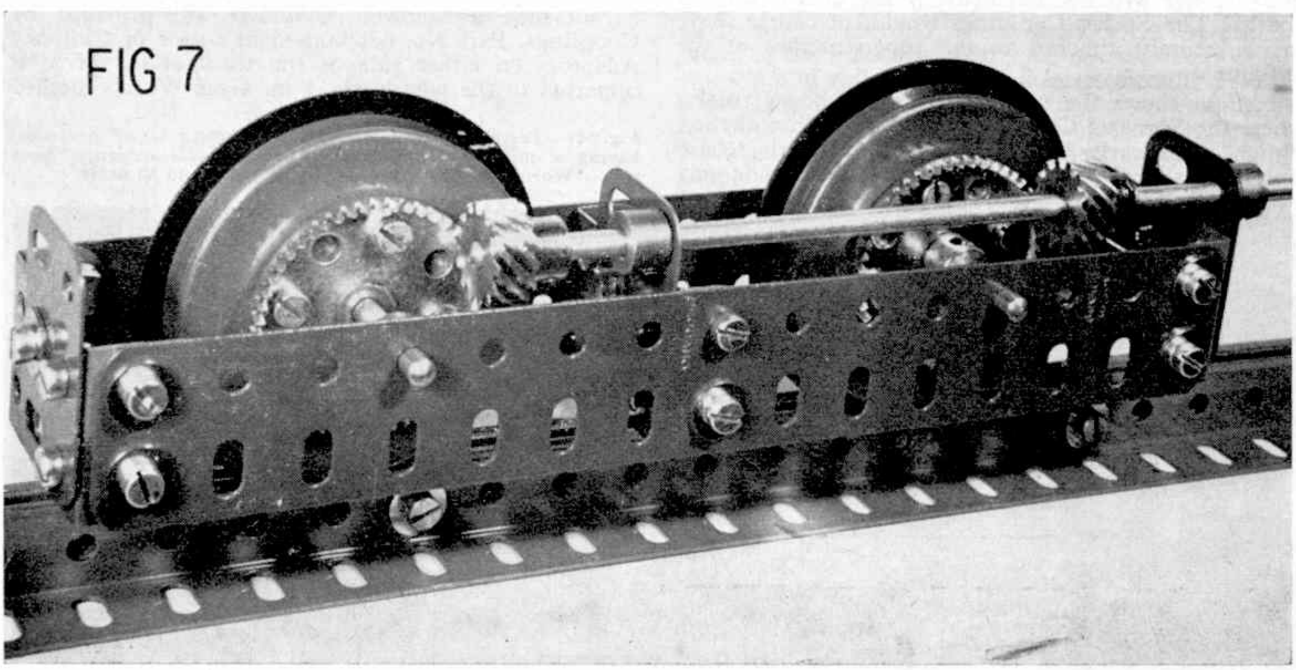
Fig. 6: Built-up travelling wheels with centre flange and wide surface contact suitable for heavy machinery. Note recess in centre of flat-topped rail. The extra thickness of strips is divided in the centre and spaced by a Washer, nut or twist of Meccano Cord to accommodate depth of centre flange.

together, the centre shaft receiving its drive via a $\frac{3}{4}$ in. Pinion and Contrate Wheel. The shaft carrying the $\frac{3}{4}$ in. Pinion also forms the pivot for the bogey truck when it passes up through the boiler platform of the locomotive. Although the front axle carries a Coupling, this is simply to join two short axles, to make use of available parts at the time of building, but a $2\frac{1}{2}$ in. Axle Rod may be used instead.

A further application of the standard Flanged Wheel is shown in Fig. 5 which illustrates a heavy duty "crab" truck used on a model of a Giant Block-Setting Crane. As this crab takes a considerable load of genuine stone, it is built to rugged proportions with adequate strengthening from Flat and Angle Girders. All four rail wheels are mounted on independent short axles to relieve bending strains and to keep the centre section of the crab clear for the fall of the hoisting ropes. This is a case where the engineer is concerned with internal rail running which is a feature of many items in the engineering field. The crab illustrated runs on a set of rails mounted rigidly to the boom of a crane, but in many other machines—particularly interesting textile machines—integral portions of the machinery oscillate on rails, sometimes over considerable distances, and quite often the running wheels are of simple grooved or pulley form.

As machinery gets heavier, to handle greater loads, the wheels on which such machines are carried must be proportionately increased in size and strength. A Gantry crane capable of straddling 200,000 ton oil tankers in shipyards has now been installed in a British shipyard and, as might be expected, its travelling wheels run on flush or sunken rails and make use of centre flanged wheels which present a wide surface to the rail contact point. Samples of such wheels are illustrated in Fig. 6 where three types are shown. The smaller compound wheel is made from two $1\frac{1}{8}$ in. Flanged Wheels sandwiching a 6-hole or 8-hole Wheel Disc between them. The two larger

Fig. 7: Heavy-duty travelling gear employing wide-face centre-flange wheels. Note unorthodox use of small Helical Gears meshing with large Contrate Wheels to give a smooth and compact gear drive.



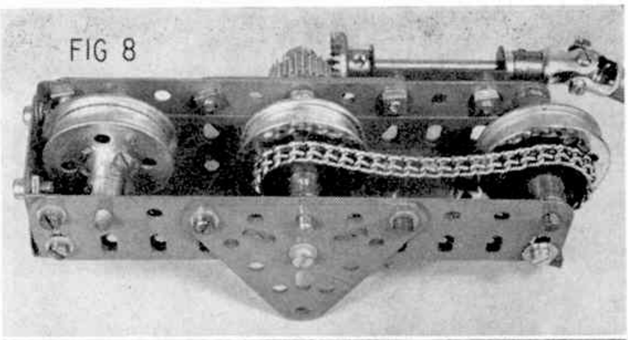
wheels are made from Wheel Flanges bolted to a Face Plate and the illustration shows how they may be constructed with shallow or wide hubs. The shallow version, in which the flanges are mounted rim outwards, gives a centre flanged wheel of minimum width, but when the flanges are mounted on the Face Plate with rim inwards, a more stable wheel is produced and a large Contrate wheel can then be bolted directly into the assembly, forming an extra boss with that of the Face Plate for additional rigidity with very little overhang from the Contrate. Being mounted integrally with the wheel, the Contrate gives an absolute positive drive. By using Bush Wheels or Wheel Discs bolted to the Wheel Flanges, additional hub support can be achieved. For the narrower of the two centre flange wheels illustrated, standard length Bolts are adequate but $\frac{3}{4}$ in. Bolts are required for the broader version where they secure the Contrate Wheel, two Wheel Flanges and the Face Plate in one go.

When applying a geared drive to travelling wheels, some thought should be given to proportionate sizes of the gears employed. In the case of the large centre-flange wheels mentioned, the Contrate Wheel shown is nicely scaled and can be driven by $\frac{1}{2}$ in. or $\frac{3}{4}$ in. Pinions. In this case, additional width of the truck carrying the wheels must be provided. An elegant solution to the problem of keeping down overall width of the wheel trucks (an important consideration in a crowded dockyard) is supplied by the use of gears which can run at right-angles to the wheel axles and over the top of them. This is achieved, as shown in Fig. 7, by the unorthodox use of the small Helical Gear which will mesh perfectly with the large Contrate Wheel at the "2 o'clock" position. Adjustment and careful packing with Washers to find the correct meshing point is essential, but once found, the drive is very smooth and quiet.

The use of the large travelling wheels outlined requires a structure of proportionate dimensions and so the use of the standard Flanged Wheels is far more popular for the smaller or medium-sized models. Fig. 8 shows a typical travelling bogey truck, suitable for a dockside crane, where linkage beetween travelling wheels is by Sprocket Chain drive, this being quite adequate. Again, Flat Girders provide adequate wall strength and the double thickness of $2\frac{1}{2}$ in. Triangular Plates provide both heavy journals for the central driven axle an strong trunnion supports for attachment of the bogey truck to the crane tower. In this case, the small Contrate drive, which gives pleasing proportions, is mounted externally on the truck.

In Fig. 9, the truck is shown mounted at the foot of one of the crane portals, and it will be noted that the triangular supports pivot in a parallel bearing. This gives alignment in the forward direction but allows the bogey some "float" to negotiate uneven levels on the dockside rails. If such a crane were required to move on a curved path of wide radius round a dock-yard basin, a universal pivot would be required to allow the bogies to "steer", i.e. be steered by the rails over which they would run. The $1\frac{1}{2} \times \frac{1}{2}$ in. Double Angle Strip carrying the small contrate spindle provides an adequate bearing when packed out by Washers and bolted tightly to the truck wall. The Universal Couplings leading off from it may then be connected to a suitable power take-off point by appropriate shafting and gearing.

Fig. 4 shows a very neat arrangement of bogey truck for the advanced modeller, based on sound engineering principles. With four similar bogies a crane or other heavy machine would receive a twelve-



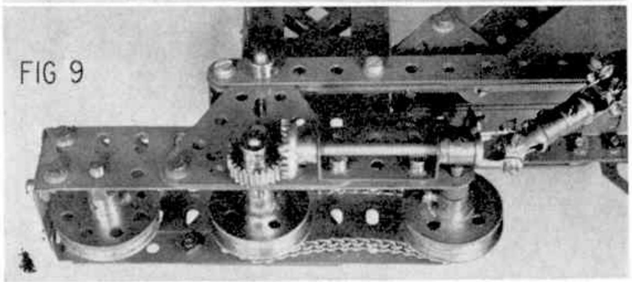


Fig. 8: Simple powered bogey truck for dockside crane. Note strong trunnion arrangement of Triangular Plates to give adequate vertical support for pivotting arrangements.
Fig. 9: Drive arrangements for simple powered bogey. Universal Couplings to Contrate drive should be maintained at a shallow angle for efficient drive.

wheel drive since every load-carrying axle is directly driven. A Worm and Pinion drive to the trailing axle in each bogey maintains the overall slimline appearance of construction without sacrificing efficient wheel drive at scale speed. Additional bearing surfaces for each axle are provided by Perforated Strips, bolted to the Flat Girders at each side of the bogey trucks, while the careful use of paired Universal Couplings enables the central vertical drive from the crane portal to be transmitted to the off-centre Worm drive shaft. A further advantage of this drive system is that the Worm shafts in each set of bogies on one side of the model rotate in the same direction, so that no split reversing gears are required from the drive shaft in the portals. It is true that, as a result, the model is "locked" when drive to the wheels is switched off, due to the "non-reverse" configuration of Meccano Worm drives, but this is of no disadvantage in the working model.

Fig. 10: Typical use of standard Meccano Flanged Wheels in construction of powered bogey for model locomotive.