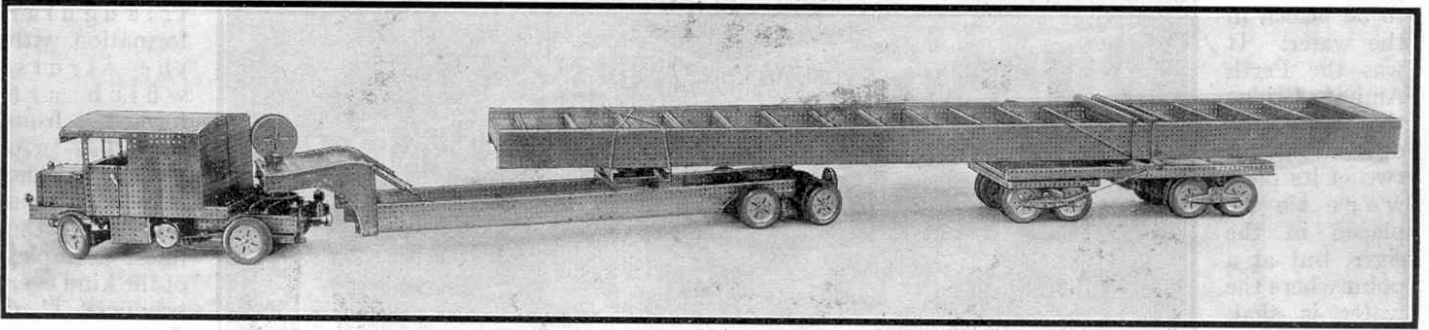


Giant Meccano Lorry with Trailer

Model that Carries Load of Nearly Six Cwt.



ON page 184 of the "M.M." for March, 1932, a brief description was given of a remarkable Meccano model of the M.R.S. 100-ton lorry, and 16-wheeled trailer that recently was employed for the transport of a girder 68 ft. in length and weighing practically 100 tons from Marylebone goods station to the site of a hotel now being erected near the Marble Arch, London. The model is illustrated on this page and is an exact reproduction in miniature of its original, including the load. Although built to the scale of $1\frac{1}{4}$ in. to 1 ft., it is 11 ft. 6 in. in length from the head lamps to the rear of the girder, which overhangs the trailer, and weighs $1\frac{1}{2}$ cwt. The girder itself accounts for nearly half of this great weight, to which the 5,000 nuts and bolts used in constructing the model make a substantial contribution!

This remarkable model is fitted with a Meccano E.1 Electric Motor and easily carries not only the heavy girder, but also a weight of five cwt. placed on top of the load. It faithfully reproduces every movement of its prototype and is an outstanding example of the capabilities of the Meccano system.

The features of the construction of this magnificent model will be full of interest to Meccano enthusiasts, many of whom will desire to reproduce it, or to make use in models of their own design of the special mechanisms incorporated in it. In the present article, therefore, we describe the building of the more important parts, such as the differentials, the rear wheel assemblies and the gear box, in order to show how the movements required may be effected.

The differentials included in the model are of special interest, for three of these mechanisms are provided in order to enable the drive of the lorry to be transmitted to four double wheels that act independently when turning corners. The main differential, Fig. 2, is exceptionally neat and compact and is built up as follows. The crown wheel, a $1\frac{1}{2}$ " Bevel Gear, carries two Pole

Pieces 1, which form a rigid connection between the crown wheel and the frame 2. This frame is constructed from four 1" Corner Brackets bolted together at their outside corners and carrying at two of the opposite corners two $1" \times \frac{1}{2}"$ Angle Brackets. Each of the slotted holes of the Brackets is fitted with a $\frac{1}{2}"$ Bolt on which a $\frac{3}{4}"$ Contrate is free to rotate. These Contrates mesh with two $\frac{1}{2}"$ Pinions 3 and 4 mounted on $6\frac{1}{2}"$ Rods that are journaled at their inner ends in the Collar 5.

The differential casing consists of two Face Plates, passed over the $6\frac{1}{2}"$ Rods of the differential, and connected together by 2" Strips. Each side of the front of the casing is fitted with a Crank 12 (Fig. 3), and a $1\frac{1}{2}"$ Strip 13. The Crank shown in Fig. 3 carries a $1\frac{1}{2}"$ Rod, to the inner end of which is secured a Coupling. This Coupling, that is also secured to the Crank opposite 13 by a 1" Rod, supports, in its centre tapped hole, a $1\frac{1}{2}"$ Rod. The Bush Wheel 14 is mounted on the outer end of this

Rod and the inner end carries a $\frac{1}{2}"$ Bevel Gear

that meshes with the crown wheel of the differential. The 2" Strips mentioned earlier are attached to the Face Plates by $\frac{1}{2}" \times \frac{1}{2}"$ Angle Brackets and the space between every two Strips is filled by a further 2" Strip secured to its neighbour by means of two Flat Brackets. The inspection cover 6 (Fig. 2) is constructed from two $2\frac{1}{2}"$ and five 2" Strips and the complete cover is secured to the differential casing by means of two Hinges. The casing is also fitted with two $\frac{3}{4}"$ Bolts 10, the use of which will be described later.

Each secondary differential casing is constructed from $1\frac{1}{2}"$ Angle Girders and $1\frac{1}{2}"$ Flat Girders and Strips and is attached to the main differential casing by means of four $1\frac{1}{2}" \times \frac{1}{2}"$ Double Angle Strips. The top edges of these casings are fitted with Flat Trunnions and at the outer ends of each are four Double Brackets, arranged in a similar manner to the Double Angle Strips forming the connection between each differential casing. The upper and lower Double Brackets carry a $1\frac{1}{2}"$ Strip 7 and the

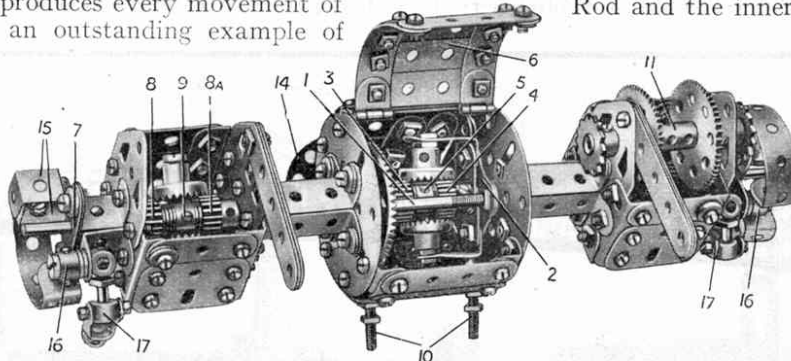


Fig. 1. The complete Lorry and Trailer, with the load in position, is seen in the upper illustration on this page. Fig. 2. The lower illustration shows the three differentials that enable the four driving wheels to operate independently when turning a corner.

two $1\frac{1}{2}$ " Strips at the outer ends of the assembly carry the ends of the $6\frac{1}{2}$ " Rods of the main differential.

Each secondary differential consists of two idle $\frac{1}{2}$ " Pinions 8 and 8a, which are spaced apart from a central "spider" Collar 9 by the requisite number of Washers. On its inner face the Pinion 8a bears against a Flat Bracket and the Pinion 8 bears against a Collar on its outer face. The "spider" 9 is secured by two Grub Screws to its Rod, the Grub Screws being in opposite holes, and each of the two remaining holes carries a Pivot Bolt on which a $\frac{3}{4}$ " Contrate is free to rotate. The Bolts are locked in the threaded holes of the "spider" by means of Nuts. The Pinions 8 and 8a mesh with 57-teeth Gears that are secured on 1" Rods journaled at their outer ends in the centre

$\frac{3}{4}$ " Bolts 10. The two $4\frac{1}{2}$ " Angle Girders are then bolted to two further $4\frac{1}{2}$ " Angle Girders 20 overlapping five holes, and these are secured to the main frames of the lorry. Each of the main frames consists of a $24\frac{1}{2}$ " Angle Girder 21, the front portion of which is strengthened by a $12\frac{1}{2}$ " Flat Girder and Angle Girder. The rear portion, a section of which is shown in Figs. 1 and 3, is strengthened by means of three $3" \times 1\frac{1}{2}"$ Flat Plates and a $9\frac{1}{2}"$ Angle Girder. The spaces between the ends of the $12\frac{1}{2}"$ Angle Girders and the inner edges of the $3" \times 1\frac{1}{2}"$ Flat Plates accommodate the differential unit, and this may be fitted immediately the two sides of the lorry frames are completed. The two $4\frac{1}{2}"$ Angle Girders 20 are bolted in place thirteen holes from the rear of the $4\frac{1}{2}"$ Girders 21.

Two sets of stays 22 and 38 are provided in order to strengthen the fitting of the differential unit. The front portions of the lorry frames are connected together by a $5\frac{1}{2}"$ Angle Girder and the rear portions by two $7\frac{1}{2}"$ Angle Girders, bolted together to form a channel section girder.

An E1 Electric Motor provides the motive power for the model and the drive is transmitted from this through a compact single plate clutch to the gear-box, which provides four forward speeds and one reverse, the gear ratios being 9:1, 6:1, 4:1, and 2:1 forward and 3:1 reverse. The construction of the gear box framework and the position of the gears will be seen clearly from Fig. 3. It should be noted, however, that only half of the boss of the 1" Gear

Wheel, situated immediately behind the 57-teeth Gear 23, is occupied by the end of the Rod 24, the remaining space being taken up by the Rod 25. Thus the Gear Wheel supports both lay-shafts and the space taken up by an extra bearing is saved. The connection between the gear-box and the differential unit is formed from two Bush Wheels one of which is seen at 14. Four Bolts are secured in the holes of one Bush Wheel and the shanks of these engage opposite holes in the Wheel 14.

The construction of the front axle and springs is shown clearly in Fig. 3. The steering is operated on the worm and nut principle, and is an excellent example of the heavier type of Ackermann's Steering Gear. The steering column, a $6\frac{1}{2}"$ Rod, is fitted at its lower end with a 2" Screwed Rod, the necessary connection being made by means of a Threaded Coupling. The Screwed Rod operates a Threaded Boss that is pivotally attached to one end of a built-up bell crank. Four Simple Bell Cranks clamped together form this crank and it is pivotally attached by a Pivot Bolt to a $1\frac{1}{2}"$ Angle Girder on the frame of the lorry. The lower end of the crank carries a Swivel Bearing and this is fitted with a $1\frac{1}{2}"$ Rod 26. The free end of this Rod is secured by a second Swivel Bearing 27 to a Crank 28 that is fixed on a vertical $1\frac{1}{2}"$ Rod, a portion of which is shown at 29. This Rod carries a Coupling which in turn supports a $1\frac{1}{2}"$ Rod carrying a Threaded Coupling 30. The lower end of this Coupling carries the track rod 31 and this operates the inside wheel of the lorry. Each front wheel is carried on a 1" Rod supported in the longitudinal bore of a Coupling which, as described earlier, carries the Rod and Threaded Coupling 30.

holes of the Flat Trunnions, previously mentioned. The inner ends of these Rods are carried in Couplings, one of which is shown at 11, and the extreme outer ends are fitted with $\frac{3}{4}"$ Sprocket Wheels.

The outer ends of the $6\frac{1}{2}"$ Rods of the main differential are fitted with internal expanding brakes, one of which is shown partly dismantled to the left-hand side of Fig. 2. Each brake shoe consists of a $2\frac{1}{2}" \times \frac{1}{2}"$ Double Angle Strip, the long side of which is curved to the inside diameter of a Boiler End. One end of these shoes is bolted securely to two Double Brackets 15 that are pivotally attached to one of the Double Brackets on the end of the secondary differential casing. The operating cam 16, a Collar fitted with two Grub Screws, is gripped on the shank of a Pivot Bolt. This Bolt passes through the Double Bracket, shown in the illustration, and carries a "spider" collar on its threaded portion. This Collar carries a Threaded Pin, as shown, which in turn carries a Swivel Bearing 17 and this will be used later for connection to the brake pedal. It will be seen that on operating the Swivel Bearing the Grub Screws of the Collar 16 force the brake shoes outward to press against the inner face of the Boiler End 18, Fig. 3. When the pressure on the brake is released the shoes contract under the influence of a short length of Spring Cord stretched between the two brake shoes.

When the differential and brake unit is completed it is secured to two $4\frac{1}{2}"$ Angle Girders 19 by means of the two

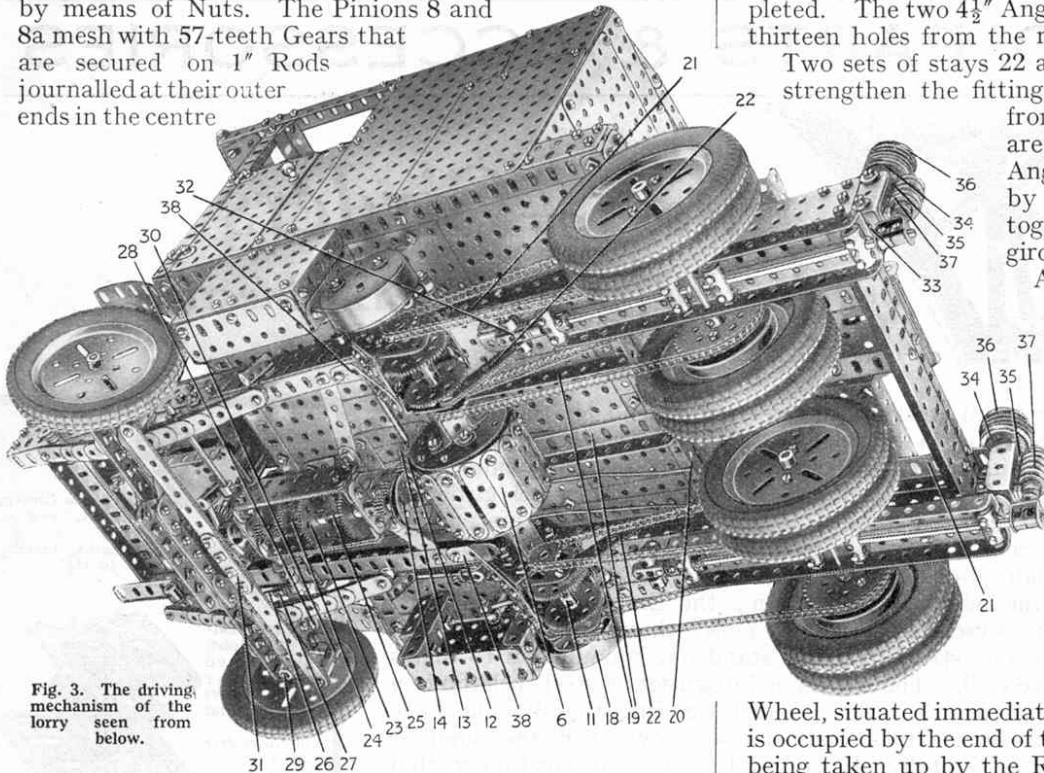


Fig. 3. The driving mechanism of the lorry seen from below.

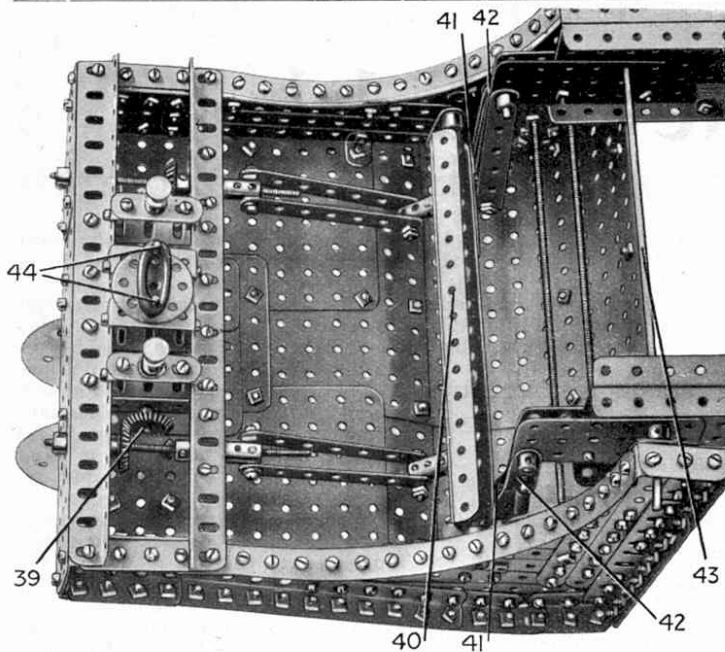


Fig. 4. Close-up view of the mechanism by means of which the height of the rear section of the lorry may be adjusted.

The method of mounting and driving the rear wheels is seen clearly from the illustration, the shock absorbers being the only parts needing description. Each rear axle beam, swivelling about the pivot 32, operates a 1" Rod 33 that passes through the end hole of the 9½" Girder of the lorry frame. The inner end of the 1" Rod carries a Collar and this is in contact with a Single Bent Strip that in turn presses against a 1" fast Pulley 34. The Single Bent Strip is held in a position in which it is free to slide, by a ½" × ½" Angle Bracket and the two ends of the Bent Strip pass one each side of a Handrail Support. The securing nut of the Handrail Support is shown at 35. This Handrail Support also carries a Screwed Rod over which is passed four 1" Rubber Rings. These are held firmly against the Pulley 34 by means of a second similar Pulley 36, locked on the Threaded Rod by Grub Screws. Thus when the rear wheels of the lorry come into contact with uneven surfaces on the road the 1" Rod 33 compresses the Rubber Rings and in this way a great percentage of the shock is absorbed. The ½" Loose Pulleys 37 represent Compression Springs but in the model their only useful purpose is to prevent side-play in the lorry axle beams.

The construction of the radiator and cab of the lorry is carried out with Flat Plates of varying sizes and the pivot for the load-carrying portion of the lorry (a Flanged Ball Race and Bush Wheel) is mounted directly over the driving wheels on a platform of Angle Girders.

The swan neck may now be built. This is the structure that pivots on the rear of the power unit and connects the two parts of the lorry. Its general construction is shown clearly in Figs. 1 and 4 and needs no further description. The raising and lowering of the swan neck in actual practice is carried out hydraulically, but in the model a mechanical movement has been substituted. The movement is operated from the two large wheels mounted on top of the swan neck and the drive from these is transmitted by Sprocket Chain to a ¾" Sprocket Wheel on the Rod 39. This Rod is fitted at each end with a 1" Bevel Gear and these mesh with further 1" Bevel Gears mounted on 5" Screwed Rods. It will be noticed that the Bevel Gears mounted on the Screwed Rods engage different sides of their respective gears. The 5" Screwed Rods are journalled as shown in the illustration and carry Threaded Couplings, and each of these carries, pivotally, two 3½" Strips. The free ends of these Strips are attached by means of ¾" Bolts to Couplings that are secured by Pivot Bolts to the rolling beam 40. This beam is mounted by means of four Handrail Supports on two 4½" Rods, the outer ends of which are secured in Cranks bolted to the sides of the swan neck. Threaded Pins are now fitted in the second holes from the ends of the rolling beam, and each of these carries a Coupling 41 that is coupled to the ends of the load-carrying girders by means of 3½" Strips. In order to relieve the mechanism of some of the strain, two Springs are attached to each side of the swan neck and also to the last-mentioned 3½" Strips at the points 42.

The swan neck is coupled to the load-carrying Girders, at their front ends, by an 11½" Rod 43, the space between the swan neck and Girders being filled in by Couplings. The two Threaded Pins 44 fit the holes of a Bush Wheel mounted on the rear of the motive portion of the lorry. The 1" Rubber Ring passed round these

Threaded Pins, and the two Spring Buffers mounted on either side of the pivot form shock absorbers for the swan neck.

The rear wheel unit consists of two sets of four double wheels. Its general form is shown in Fig. 5, two of the Double Wheels having been removed in order to show the construction of the brakes and wheel mountings. The rearmost wheel mounting consists of a square tube built up from four 1½" Angle Girders and fitted at each end with a Coupling. Each Coupling carries a 1½" Rod and on this is mounted its respective double wheel. Two ½" × ½" Angle Brackets are fitted to each end of the tube and the slotted holes of these carry Bolts that support the brakes. A Flat Girder 45 also is fitted to carry a 1½" Strip and the brake spring. The tube is carried on a vertical 3½" Screwed Rod supported in a loosely mounted Coupling 46 and is prevented from moving vertically by a Socket Coupling fitted with a Coupling and a Threaded Boss, both of which are shown clearly in the illustration. A locknut 47 is also provided and this prevents the back-axle mounting from slipping. Each set of rear wheels of the unit is able to rock about the Coupling 46 and on the pivot 48, and steer about the vertical 3½" Screwed Rod. The steering is controlled from a 3" Pulley Wheel 49 that through a built-up shaft of Socket Couplings and Couplings rotates a ½" Double Width Pinion 50. This Pinion meshes with a 1½" Contrate mounted on a vertical 2½" Rod journalled in a Coupling. The lower end of the Rod carries a Collar to which is bolted a 1½" Strip, by its centre hole. Each end of this Strip carries a Hinge that is connected by a 4½" Strip to a Hinge on the inside end of its respective rear axle. These two Hinges on the rear axles are held in place by Collars. It will be seen that on turning the Wheel 49 both rear sets of wheels turn in similar directions, thus assisting the lorry when manœuvring round a corner.

The fore set of wheels do not steer and only rock about the points 51 and 48, but the construction of their mountings is similar to that of the rear sets except for the addition of Flat Trunnions, as shown in the illustration. The brakes of all wheels are operated by Bowden wire constructed from Spring Cord and Meccano Bare Iron Wire. The control ends of the separate lengths of Bare Iron Wire are secured to a Collar carried on an 8" Rod that passes down the centre of the steering column, and is controlled from the 2" Pulley Wheel 52. The complete rear axle unit is connected to the load-carrying Girders by four ¾" Bolts 53.

The platform of the trailer is built from Angle Girders and is 29" long and 13" wide. Its front end is mounted on a turntable that in turn is carried on two strongly-constructed oscillating beams, each of which carries four double wheels. The rear of the trailer is mounted directly on two oscillating beams of similar construction to those mentioned. The platform itself carries a 4" Ball Bearing and on this is placed the Girder forming the load of the lorry. This is a scale reproduction of the 99½-ton girder carried by the 100-ton lorry and its trailer from Marylebone goods station to Cumberland Place, as explained on page 184 of the "M.M." for March. It weighs ¾ cwt. and is constructed from 24½" Angle Girders and 5½" × 3½" Flat Plates built in the form of an "H." Eighteen 12½" lateral "T" girders are fitted for strengthening purposes, a number of which are shown in Fig. 1. The two turntables on which this huge Girder is carried are built up from Circular Plates and Hub Discs, the Girder itself resting on built-up 12½" transverse girders which are bolted to the Hub Discs of the turntables.

The trailer turntable carrying the road wheels, and also that supporting the Girder, are fitted on each side with extensions coupled together by means of flexible wire, as shown in Fig. 1. The effect of this is to keep the trailer bogie parallel to the load and thus to enable the unit to be efficiently steered.

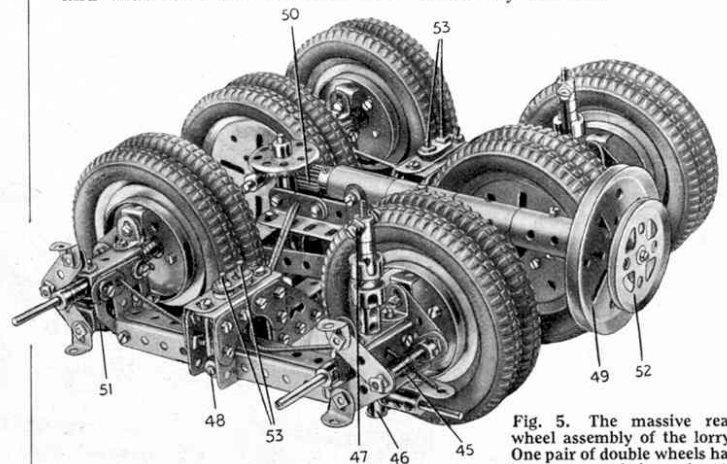


Fig. 5. The massive rear wheel assembly of the lorry. One pair of double wheels has been removed in order to illustrate the construction of the mountings and the brakes.

Transporting a Girder Weighing $99\frac{1}{4}$ Tons

Meccano Model Solves Difficult Steering Problem

ONE of the most remarkable Meccano models ever built is a representation of the 100-ton lorry described on page 104 of our issue for February, 1931, together with a 16-wheeled trailer that was attached to this lorry when a girder 68 ft. in length and weighing practically 100 tons had to be carried on it. The model illustrated on page 185 will be seen to be an exact reproduction in miniature of the original, including the load. It is built to a scale of $1\frac{1}{4}$ in. to 1 ft., and is 11 ft. 6 in. in length from the head lamps to the rear of the girder, which overhangs the rear trailer. Its total weight is $1\frac{1}{2}$ cwt., the girder itself accounting for half of this enormous weight. The number of wheels is 58, however, and thus each of the Meccano 3 in. Dunlop Tyres fitted carries a load of less than 3 lb.

The model was exhibited on the stand at the Birmingham section of the recent British Industries Fair of M.R.S. Ltd., Liverpool, the owners of the 100-ton lorry. There it attracted the interested attention of visitors, practically all of whom were engineering experts, and they were greatly impressed by the faithfulness with which every feature of the great lorry and its trailer were reproduced. The unanimous opinion was that the model is a great achievement, and supplies proof, if indeed proof is still needed, that Meccano model-building is true engineering in miniature.

The performance of this wonderful model is as remarkable as its appearance. It is fitted with a Meccano E.1 Electric Motor and pulls its heavy load with remarkable ease. Even the addition of a weight of five cwt. failed to reduce the speed during its trials, and it is doubtful if so small a motor has ever surpassed the feat accomplished by that employed in the model. The motor was a standard production, taken from stock, and this achievement is a wonderful testimonial to the powers of Meccano motors, while the model is a splendid proof of the adaptability of the Meccano system.

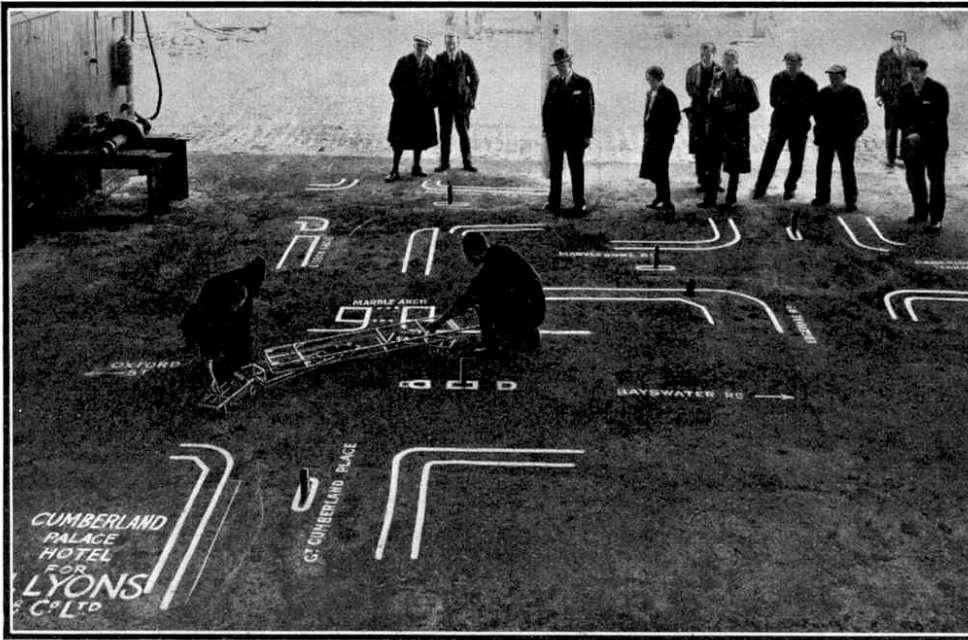
The original of the model has been employed in transporting girders required in the erection of the Cumberland Palace Hotel now being built near the Marble Arch, London. The girders were built by Dorman Long & Co. Ltd., Middlesbrough, and among them is one that is believed to be the largest and heaviest ever made. It is 68 ft. in length, 10 ft. 4 in. in depth, and 2 ft. 4 in. in thickness, while its weight is $99\frac{1}{4}$ tons and it contains no less than $2\frac{1}{2}$ tons of rivets. A second girder is only slightly smaller and weighs 82 tons. Both were brought by rail from Middlesbrough to the L.N.E.R. goods yard at Marylebone.

The task of conveying these huge girders to the site of the hotel was undertaken by M.R.S. Ltd., Liverpool, and the giant 100-ton lorry already referred to was employed. The larger of the two girders was moved first. The only route available included a number of awkward right-angled turns, and it was necessary to exercise great care and forethought both in planning the route and in deciding upon the means to be employed, for if a breakdown had

occurred during the journey, or if the calculations, which only gave a clearance of a fraction of an inch at each corner, had been incorrect, the girder could only have been removed from the streets by cutting it into sections. This would have taken a considerable time and the girder itself would have had to be scrapped. It was too long to be carried on the lorry alone. One end therefore was supported on the lorry and the other carried on a 16-wheeled trailer, the girder actually resting on turntables, 8 ft. in diameter, made of steel plate an inch in thickness. The necessity for using a second vehicle added to the difficulty of dealing with the girder, for a trailer at a distance of nearly 60 ft. from the driver of a lorry is not easy to control, and efficient means of steering such a vehicle have been sought for years. The problem was solved after experiments with models built from Meccano parts, however, which led to the discovery of a new and reliable principle. This is to

couple side extensions from the load-carrying turntable to the steering gear of the trailer. In this manner the movements of the rear end of the girder itself control the steering of the trailer and keep it under control by causing it to track perfectly behind the forward vehicle.

Even when the design of the combined vehicle was settled, there still remained the difficulty of negotiating the corners between Marylebone goods yard and the site of the hotel. There were three that threatened difficulties. These were the turnings from Lisson Grove

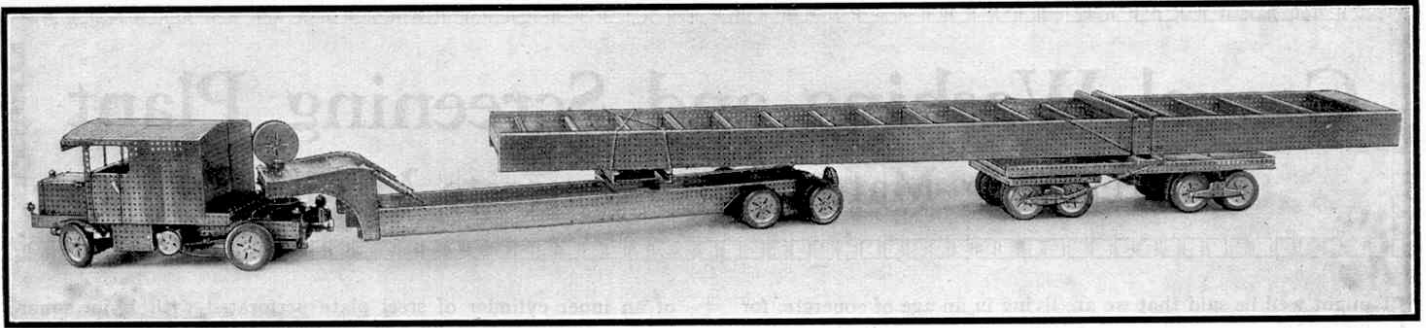


Planning the route to be followed when transporting the giant girder through London. Scale plans of the turnings were marked out in chalk and a Meccano model of the lorry and its load was used to find the best course to follow.

into Marylebone Road, from Marylebone Road into Edgware Road, and finally from the junction of Bayswater Road and Oxford St. into Great Cumberland Place, where the hotel is being erected. Refuges in the middle of the roadway and electric main fuse boxes on the pavements at each of these turnings added to the difficulties because they reduced the width of available roads at corners to 15 ft. It was necessary to survey the route very closely before the actual journey was attempted, therefore, and trial runs were made with an exact scale model of the lorry and trailer on reproductions of the turnings marked out in white paint on a large concrete floor. The model was constructed of Meccano parts and reproduced exactly the pivoting and steering arrangements of the giant vehicle on which the girder was to be transported.

After a number of trials, the exact courses to be steered at the turnings were discovered, and these were marked out in chalk on the roads at the actual corners to be negotiated. The manhole covers and gully grates that were likely to be crossed by the wheels were then covered with steel plates, and everything was made ready for the actual journey.

The morning of Sunday, 25th October, was the time chosen for the transport of the first girder. Special permission had to be obtained from the London County Council authorities and the police, for during the slow passage of the girder it was necessary to close certain streets entirely to traffic. To add to the difficulties, it was learned that the Horse Guards were to be on parade at the



time when it was expected that the lorry would be passing from Bayswater Road to the Marble Arch. A friendly warning was issued that the march of the Horse Guards could not be held up in any circumstances, for the Royal Standard would be carried because the King was in residence in London.

The whole of the day before the actual journey was spent in transferring the girder to the lorry and trailer, and in so placing it that the load was distributed evenly over the 30 wheels of the two vehicles. The weight of the girder and the lorry was 164 tons, but owing to the number of wheels and the width of the rubber treads this gigantic total imposed no more strain per square inch of road surface in contact with the tyres than is caused by an ordinary omnibus.

All was ready at 11 a.m. on Sunday, and a crowd of interested sightseers estimated at between 15,000 and 20,000 then saw the 60 h.p. tractor-trailer haul the girder out of Marylebone goods yard into Lisson Grove. Unfortunately the people walked over the guiding chalk marks, completely obliterating them, and they also made matters more difficult by preventing the driver of the lorry from obtaining a clear view of the edges of the pavement,

which were expected to give useful help in steering. Excellent progress was made at a speed of about $1\frac{1}{2}$ m.p.h. however, and the first turning, that from Lisson Grove into Marylebone Road, was made entirely according to plan. When the outfit was straightened out, however, it was found that the girder had slipped about a foot towards the near side of the rear trailer. It was returned to its correct position by adjusting the levels of the girders at the front of the combined lorry and trailer, and progress was resumed.

The turning from Marylebone Road into Edgware Road was only made after considerable delay, for a projection from the turntable on the trailer threatened to destroy an electric main fuse box at the corner. The rear end of the girder was slightly out of its expected position, probably owing to the lack of exact guidance that followed the obliteration of the chalk marks. A few inches extra clearance would have allowed the passage of the load, but for lack of this it was necessary to make no fewer than six reversals of the entire outfit.

Even then the trouble was not at an end. In order to negotiate the fuse box it was necessary to disconnect the steel wire connecting the girder to the turntable of the trailer. The lorry and its trailer then assumed the shape of a capital letter Z, and destruction threatened a lamp post on a refuge in the middle of Edgware Road. In order to overcome the new difficulty, a steam tractor was connected by cable to the front of the trailer, and this was forcibly hauled sideways while the lorry itself pulled forward. The obstacle was satisfactorily negotiated in this manner. The special steering arrangement then was re-connected, and as a result the whole load straightened

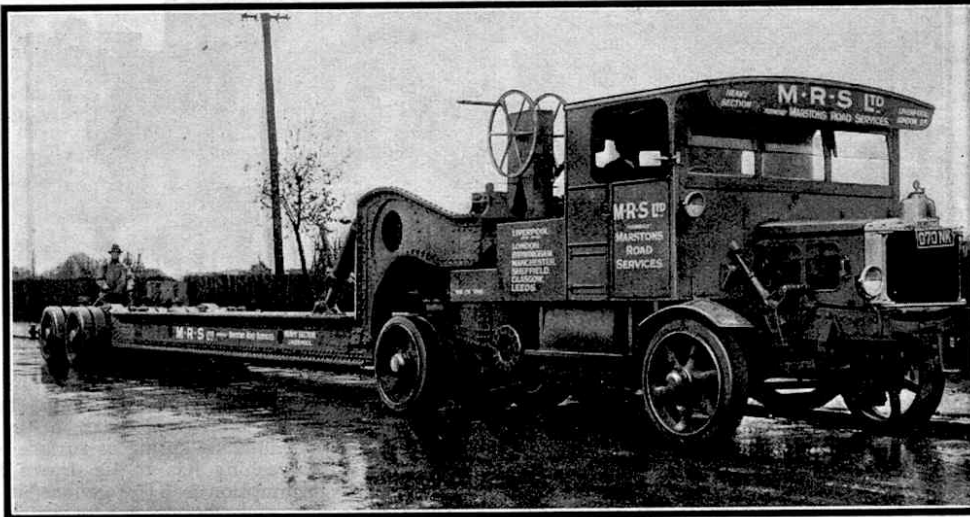
out when the lorry proceeded forward.

The trouble at the corner of Marylebone Road and Edgware Road caused a delay of nearly three hours, but after that no difficulty was experienced. The turning from Marble Arch into Great Cumberland Place was made in a few minutes, the pivoting and steering arrangements working perfectly; and after its long and slow journey the girder was drawn up alongside the site of the hotel in readiness for lifting into position.

The whole of this enormous weight was drawn by a 4-cylinder petrol engine of standard design. This is normally of 60 h.p. and actually used less than a gallon of petrol during the journey. On the following Sunday the second girder was dealt with in a similar manner. It was moved early in the morning, and as few people were present the route chalked on the road could be followed without difficulty. The result was that the girder was taken to its destination in 40 minutes without a hitch.

The whole story of the movement of the giant girders from the goods yard to the site on which they were to be erected illustrates the adaptability of Meccano and justifies the claim that it is engineering in miniature. The discovery of the new

principle of steering a trailer was made during experiments with miniature vehicles built of Meccano parts and in actual practice the idea worked as well as in trials with the models. In addition, the use of a reproduction in Meccano of the girder mounted on the lorry and trailer not only enabled the route to be planned beforehand, but actually was necessary in order to make certain that the gigantic loads could be moved safely by road.



The illustration at the head of the page shows the Meccano model of the giant girder mounted on the 100-ton lorry and its trailer. The lower photograph gives an excellent idea of the 100-ton lorry itself. For this photograph, and that on the opposite page, we are indebted to M.R.S. Ltd., Liverpool.

The contract for the removal of girders from the L.N.E.R. goods yard at Marylebone to the site of the Cumberland Palace Hotel was an extensive one, and in addition to the two already dealt with, girders weighing from 40 tons to 75 tons were included. These were not as long as the giant girders weighing 99½ tons and 82 tons respectively, and it was not necessary to make use of the trailer.

Until a few years ago the transport of these giant girders by road would have been regarded as impossible, but as the article, already referred to, in the "M.M." for February, 1931 shows, it is quite easy to move locomotives, boilers, parts of electrical machines and large castings in this manner. The giant lorry has 14 wheels, four of which are removed when loads of less than 65 tons are to be carried, and it is claimed that the distribution over these of the enormous weight carried means the imposition of only slight strains on road surfaces. In addition, the maximum speed of the lorry is restricted to five or six miles per hour, while the rear axles are of the oscillating type and the wheels remain in close contact with the ground. All these features are faithfully reproduced in the Meccano model illustrated on this page, and this will be fully described in an early issue of the "M.M." The model itself, exhibited on the stand of M.R.S. Ltd. at the Birmingham section of the British Industries Fair, has aroused widespread interest.

The World's Largest Lorry

Road Vehicle Carries Locomotive 100 Tons in Weight

ONE of the most striking developments of recent years has been the transference of heavy traffic from the railways to the roads. This is part of the general tendency to return to the roads that has followed the introduction of the internal combustion engine and the motor car. During the past few years larger and more powerful vehicles of all kinds have been introduced, but it is a little startling to find that to-day loads up to 100 tons may readily and easily be transported by this means. This is the limit of the weight that may be carried by the world's largest lorry, by means of which locomotives, cranes, excavating machinery, heavy castings and boilers may be moved with even greater efficiency than is possible on railways.

The lorry referred to was constructed by Scammell Lorries Ltd. for M.R.S. Ltd., the well-known firm of road transport contractors. It is 70 ft. in length, and in order to enable it to negotiate corners, steering gear is provided for the back wheels as well as for those at the front. The man in charge at the rear of the vehicle is in communication by telephone with the driver, and the arrangement works so efficiently that the lorry can make an ordinary right angle turn from a roadway measuring 15 ft. in width into one that has a width of 24 ft.

The lorry is really built up in two parts. First comes what may be described as a lorry of the ordinary type. This has a two-wheeled front axle, steered by Ackermann gear, and two rear axles in line, each of which has two wheels mounted on it. The drive is by chain and sprocket wheel. The load itself is

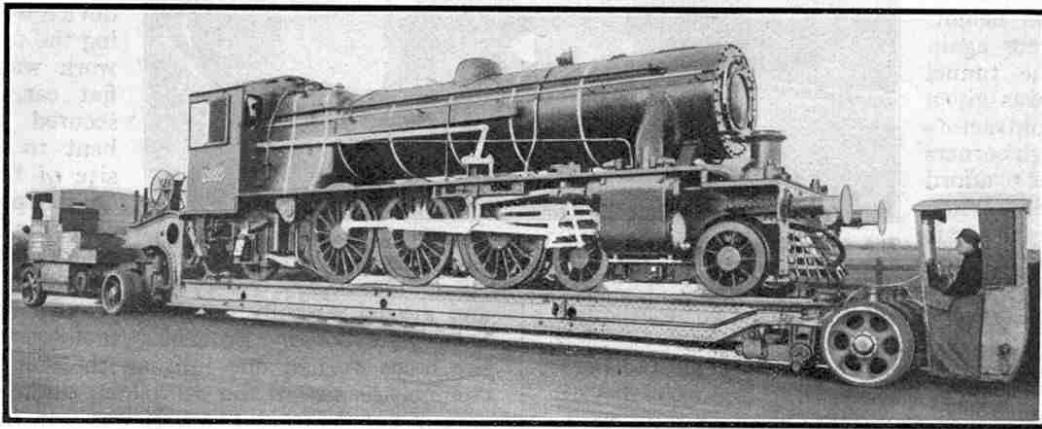
carried on the second part which consists of huge girders that are connected to the rear of the front section by means of a swan-necked structure. This rests on a turntable above the rear wheels and may readily be seen in the upper illustration on the next page.

It is this gigantic articulated joint that enables the whole vehicle to turn in such a short space. The swan-neck is connected with the girders of the carrier by means of two hydraulic rams that are operated by a pump behind the cab. When the rams are extended the girders are lowered to the ground, thus enabling a

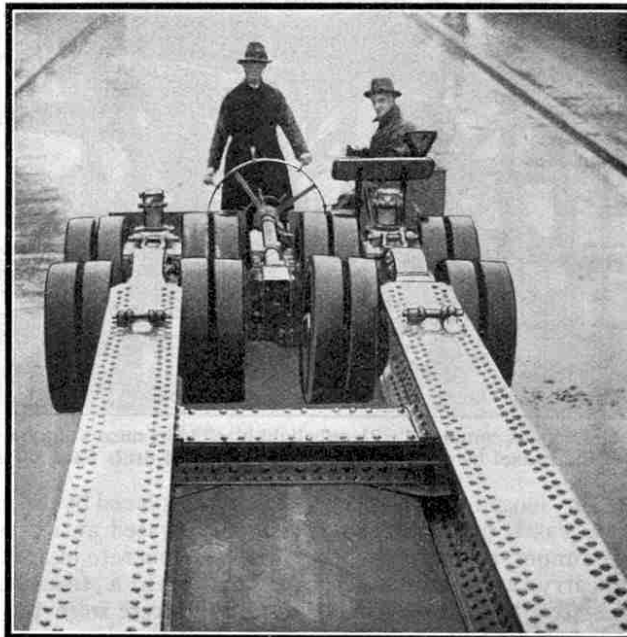
bulky load to be lowered when necessary to enable it to be taken under an overhead bridge. Similarly the girders may be raised by contracting the arms. This is often useful when the crown of a hump-backed bridge is to be cleared.

The rear wheels of the carrier also are mounted on separate axles in line. There are eight of them and thus the total weight of the vehicle and its load is distributed over no fewer than fourteen wheels. In order that the road surface may not suffer any ill effects from the passage of such a gigantic lorry, it is very important that every wheel should remain in steady contact with the ground in addition to bearing its proper share of the total weight. It is for this reason that rear axles of the oscillating type are employed. They do not pass across the full width of the vehicle, and thus its movements are not greatly affected by inequalities of the ground.

The manner in which the weight is spread out over a large number of wheels is largely responsible for the success of the world's largest



A locomotive weighing 82 tons on the world's largest lorry. The locomotive was one of 22, built for the Indian State Railways, and was conveyed by road to Liverpool for shipment abroad.



Steering the back wheels of the 100-ton lorry. After this photograph was taken, the cab shown in the upper illustration on this page was provided for the steersman in the rear.

lorry. At first glance it would be thought that a leviathan of this kind, when carrying a giant locomotive or a similar load would pound to pieces the surface of any road over which it travelled. But the lorry moves slowly, its speed with maximum load being from five to six miles per hour, and actually it is said that its destructive effect is less than that of a large saloon car. Naturally, springing is of great importance and rubber is largely used to give the necessary resilience, the springs under the swan-neck, for instance, consisting of rubber rings under compression.

The lorry has eight forward speeds and one reverse, and is driven by means of a four-cylinder petrol engine. At the back of the cab a sleeping cabinet has been erected. In this there is a cooking stove and other equipment necessary to enable the lorry to carry relief men and thus to travel throughout the full 24 hours of every day.

The task of transporting huge and unusual pieces of machinery is by no means an easy one. In many instances it is necessary to plan a route very carefully in order to avoid narrow places in which there is no room to pass, or bridges that are unable to bear the weight of the vehicle and its contents. Even this precaution is not always effective, and when particularly large loads have been carried it has occasionally been necessary to take the drastic course of excavating the roadway under bridges in order to lower it sufficiently to give head room to a particularly tall load. Of course, in such cases the road has afterwards been restored to its original state.

With certain loads of large dimensions it is not neces-

sary to dig up the roadway. For instance, when huge boilers are being carried they may sometimes be removed from the lorry and rolled under bridges that otherwise would be impassable.

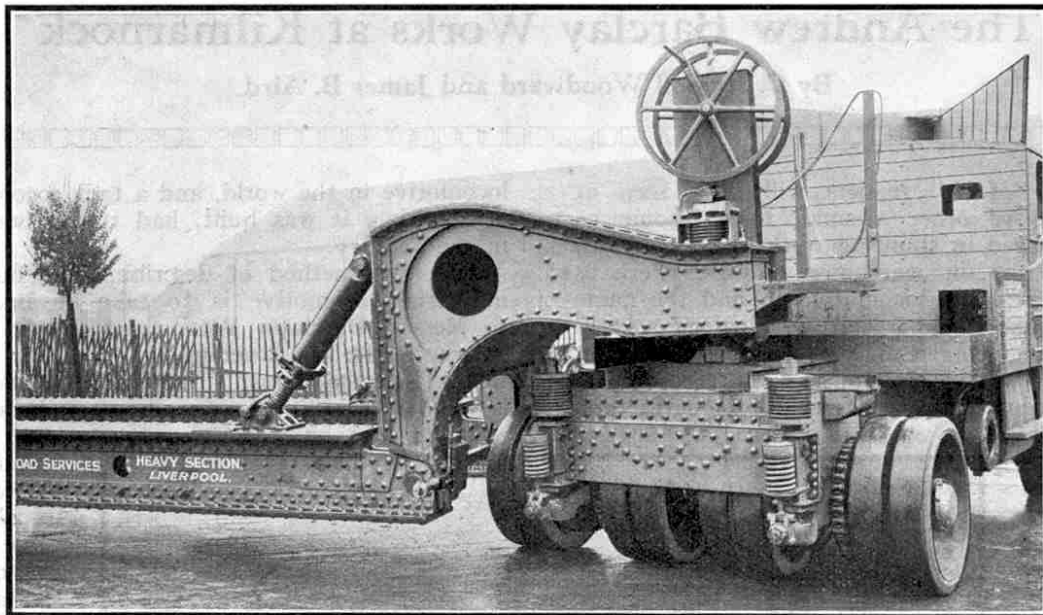
When making way for passing traffic the lorry has sometimes been pulled too far to the left. In certain instances the wheels then have sunk in soft ground, and the lorry has come to a standstill. The rams connecting the swan neck with the girders of the carrier have then been of great value. These are extended until the girders rest on the ground, and by means of ratchets on the rams fluid is then driven back into them, with the result that

the whole of the motive unit, including the driving wheels, is elevated clear of the ground. Sleepers and plates may then be placed on the ground beneath the wheels in order that they may take a grip and allow the lorry to move onward once more.

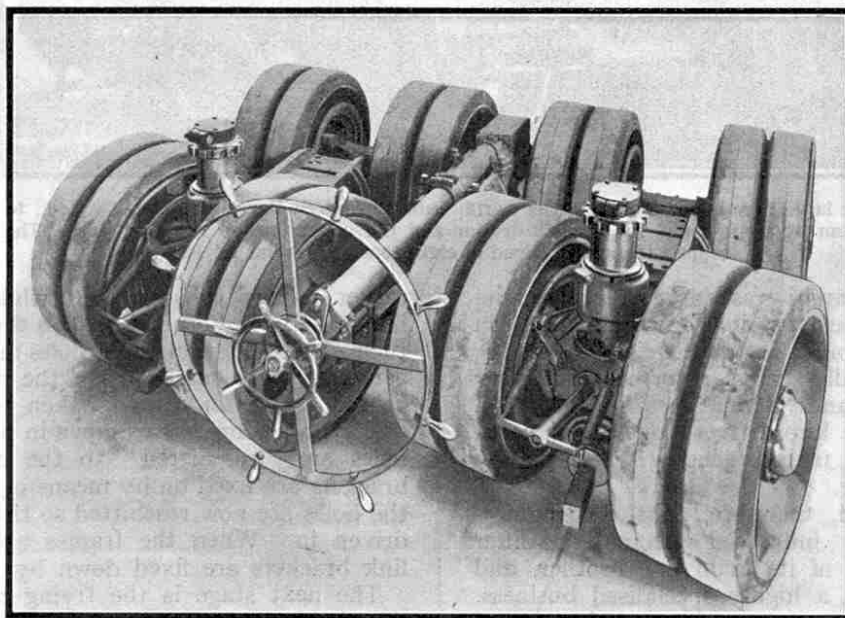
One of the most interesting uses to which the huge lorry is put is the transport of locomotives intended for export. From the works in which they are built these must be taken to the docks. As a rule, they are unable to run on existing railway lines because of the difference in gauge, and to load them directly on trolleys for transport by rail also is often impossible because of the loading gauge restrictions. For carriage by rail, therefore, it is usually necessary to remove various parts in order to reduce

the size of the load, and in most cases locomotives are almost entirely dismantled for transport, and re-erected on arrival at their destinations.

The introduction of the M.R.S. lorry makes these steps unnecessary, for by its use (Continued on page 161)



The swan-neck structure that connects the two parts of the 100-ton lorry. This is pivoted on a turntable above the rear wheels of the front portion.



The back wheel assembly of the M.R.S. 100-ton lorry. Four wheels may easily be removed when loads of less than 65 tons are to be carried.

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Meccano is ideal for carrying out experiments in practical mechanics, and we are able to offer (at the special price of 1/7½ post free) a limited number of spring dynamometers, which will be found invaluable for experimental work of this kind. These dynamometers are made from brass and, as shown in the accompanying illustration, are graduated to register a maximum tensional force of 250 grammes. Each instrument is fitted with two hooks so that it may be attached easily at the required point in a model. With the aid of these dynamometers it is possible to carry out many interesting experiments, dealing with Force, Friction, Momentum, Inclined Planes, Gravity, etc., and many additional uses will at once suggest themselves to constructors.

Although these meters are being offered at such a remarkably low price, it should be borne in mind that only a limited number are available and once present stocks are exhausted it will be impossible to repeat. Orders, each accompanied by a remittance of 1/7½, should be forwarded to Meccano Ltd., Binns Road, Old Swan, Liverpool, as early as possible.

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World's Largest Lorry—(Continued from page 105)

locomotives may be moved bodily from the works to the docks. In order to do this a short length of rail of correct gauge is laid down on the carrying portion of the lorry and the locomotive run on to it. It is then carefully chocked in position and the road journey begins. This is slow, for great care must be taken when negotiating corners, and, of course, other traffic must not be interfered with.

On arrival at the dockside the girders of the carrier are lowered to the ground, the pin in the articulated joint is knocked out and the whole of the motive unit, including the swan neck, and the hydraulic rams, drawn bodily away. A sloping ramp is then placed against the two ends of the girders. On these there are rails of the same gauge as those on the lorry, and the locomotive is simply rolled off by means of a pinch bar. The entire operation of unloading a heavy engine occupies only 20 minutes and there is no necessity to employ heavy and expensive cranes.

It is interesting to note that M.R.S. Ltd. recently employed their lorry to transport six heavy locomotives from Leeds over the Pennines and the Yorkshire moors to Manchester. These were for the Sudan Government, and one of the conditions imposed was that the engines should be delivered complete. If it had been necessary to dismantle the locomotives for transport, the order probably would have gone abroad.

Complicated cranes and electrical machinery also are readily transported by means of the M.R.S. lorry, and the practice is becoming popular because often it makes dismantling unnecessary. Machines must always be erected in the works in which they are made in order that they may undergo the necessary tests. For transport in the ordinary manner they are then taken to pieces and the parts re-erected on arrival. This takes time and is costly, and many manufacturers now prefer to use the large road vehicles that make it unnecessary. The only restriction on the size of a machine or casting to be transported by road is that imposed by the width of the roadway under bridges, or the strength of the structures over railways and canals that have to be crossed. As a rule several alternative routes are available, and the best of these may be chosen. As already explained, roadways may be lowered in order to give head room, and bridges may be strengthened in order to allow the passage of a particularly heavy load if further steps of this kind are necessary.

For the conveyance of these loads it is not always necessary to make use of the world's largest lorry, and a number of smaller vehicles are employed by M.R.S. Ltd., in moving boilers, electrical transformers, rotors of alternators, stern frames and rudders of large vessels and similar cumbersome loads.

The 100-ton lorry may be used for loads of less than 65 tons on removing four wheels at the rear of the machine, these being easily replaced when machinery weighing more than this is to be carried. Another type of lorry carries loads not exceeding 40 tons. This has permanent jacks fixed to the chassis members. When the back end of the lorry is lowered to rest on these the rear axle may be removed, and boilers and similar loads may then simply be rolled off the lorry, no crane being necessary to remove them.

OUR MAIL BAG



In this column the Editor replies to letters from his readers, from whom he is always pleased to hear. He receives hundreds of letters each day, but only those that deal with matters of general interest can be dealt with here. Correspondents will help the Editor if they will write neatly in ink and on one side of the paper only.

P. Mills (Bristol).—Technical words describing the nature of chemical compounds do not comply with the conditions of our Long Words Competition. It hardly seems fair to attack an unsuspecting malaria microbe with "Diethylaminoisopentylaminomethoxyquinine!"

H. W. Sharland (Frome).—The "M.M." "not only interests me, but also my father, who is a keen engineer, and who takes the liberty of using my Meccano when I am away!" This surreptitious use of Meccano is becoming quite common among fathers, although many of them refuse to confess it.

H. Sebel (Westcliff-on-Sea).—Although your father was surprised at the quantity of information we sent you, this is not uncommon, for we are always glad to hear from readers and to do our best to help them. That's what we are here for! We are pleased to learn that your Meccano Club is now well established.

D. N. Fisher (Melrose, Massachusetts, U.S.A.).—You have certainly created a new record by losing only two hooks in four years, and we congratulate you on the excellent manner in which you look after your Outfit. Meccano parts are too precious to lose, but fortunately most mothers understand that they are sacred.

Mr. F. E. R. Nunn (Colchester).—It is interesting to hear that you received your first Meccano Outfit 21 years ago, and that you have been a reader of the "M.M." since it was given away in the form of a double sheet. This is a splendid record. We hope you will still be a Meccano "boy" in 21 years from now!

Mr. C. D. Stampados (Athens).—Many engineers and inventors in this country use Meccano in working out their ideas, and we feel sure Meccano will prove useful to you in your career. We should be glad to have details of interesting engineering works in Greece.

N. B. Scott (Winnipeg, Canada).—We agree that the mass production of motor cars is extremely interesting. We should like you to see Meccano and Hornby locomotives and trains being manufactured here; the making of such small engineering parts is very fascinating to watch.

R. Styles (Loscove).—The articles are just my sort, so you've fixed up at least one person! Goodness knows how you can compose such good stuff, but it's there! We are glad to hear your good opinion of the "M.M." Let us know more about your Hornby Railway when you have time.

Mr. K. E. Haines (Punxsutawney, Pa., U.S.A.).—If we were to adopt your suggestion to produce a series of trains at much higher prices we could of course produce models more perfectly to scale; but the demand for costly scale models is very limited. Our aim is to manufacture good railway models at a price within the reach of the average boy.

George Watson (Birmingham).—Our larger locomotives and rolling stock would certainly run more perfectly on curves with a radius of 3 ft. or 4 ft., but a layout constructed with such curves would take up far more room than is available in the average house.

T. Thomson (Dewsbury).—There is no reason why you should not join the H.R.C. as well as the Guild, in fact thousands of boys are members of both. It is a good idea to have one correspondent interested in Meccano and the other in model railways.

H. Tomlinson (Shrewsbury).—We very rarely receive a complaint that the "M.M." articles are too advanced for younger readers. Perhaps some of the subjects dealt with may be of interest mainly to older boys, but we have to try to cater for all readers. Let us know with which particular articles you refer.

C. Watkinson (Dunedin, N.Z.).—We are interested to hear that your exhibition of quaint models from "Adventures in Meccanoland" proved such a success. These tiny models seem to fascinate everybody. We shall be glad to have details of the new ones you have "created."

H. Elliot (Wolverhampton).—There is no doubt that a large proportion of "M.M." readers are interested in music, but we doubt whether a monthly article on this subject would be of general interest. You will be pleased to hear, however, that, in response to continued requests, we intend to commence a series of notes on the gramophone and the best records issued during each month.

W. Wright (Southampton).—It is certainly true that the continued introduction of new and improved locomotives is apt to make one dissatisfied with the old types. This is one of the penalties of progress!