MECCANO ®

GEARS SET
INSTRUCTIONS

MECCANO GEARS SET

This Gears Set, used in conjunction with your standard Meccano Set, will enable you to build a wide range of interesting mechanisms, and to drive your models through gears just as real engineers do. The gears in the Set have been selected as having the widest possible uses and the 4″ Rod with Keyway, together with the special Key Bolts, Collars and Compression Spring included in the Set, simplify the construction of many attractive and useful mechanisms illustrated and described in the following pages. You will find it quite easy to build these mechanisms and to fit them into suitable Meccano models.

WHAT ARE GEARS AND WHY ARE THEY NECESSARY?

Gearing may be defined simply as a mechanical arrangement used to transmit power from its source to the point where it is applied. For the Meccano model-builder this means the mechanism used to connect a Clockwork or Electric Motor to a model in such a way as to drive the moving part or parts at a suitable speed.

To transmit a drive from one shaft to another shaft that is parallel to it, we use **"Spur"** gears. Parts Nos. 25, 26, 26c, 27, 27a, 27b, 27c, 27d and 31 in the Meccano range are spur gears.

If the shafts to be driven are not parallel, but at right angles to each other, we may use **"Bevel"** gears or **"Contrate"** gears. Parts Nos. 28 and 29 are contrate gears. These are generally used with Pinions.

Another form of gear, used to connect shafts at an angle to each other, is the **"Worm"**. Part No. 32 is a worm gear and is used for this purpose in Fig. A.

We come now to another and extremely important function of gearing, namely, to drive a shaft or shafts at a different rate of speed from that of the driving shaft.

Suppose we place a 19-teeth $\frac{1}{2}″$ diameter Pinion on one shaft and mesh it to drive a 57-teeth Gear on another as shown in Fig. C. The shaft 2 carrying the 57-teeth Gear will revolve at one-third the speed of the shaft 1 carrying the $\frac{1}{2}″$ Pinion. This process is known as "stepping down" the shaft speed.

The great value of a speed reduction of this kind is that a drive of greater torque (power) is obtained, the increase in torque being directly proportional to the relative number of teeth on the two gears.

In the case mentioned the increase is one to three. The drive from shaft 2 therefore has three times the effective power that can be obtained from the shaft 1 carrying the $\frac{1}{2}″$ Pinion.

If instead of a speed reduction we require a speed increase, we carry out a similar process in the opposite direction. For instance, if we place our 57-teeth Gear on

one shaft and mesh it to drive a 19-teeth ½″ diameter Pinion on another, the shaft carrying the Pinion will revolve at three times the speed of the shaft carrying the 57-teeth Gear, but the effective power will be reduced to one-third. We have thus "stepped up" our shaft speed, but with a loss of torque. This "stepping up" process is seldom used in Meccano model-building, in which the object of gearing is almost always to obtain increased torque by "stepping down."
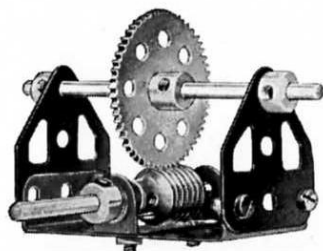

Fig. A

In order to make the best use of the gears in this Set it is advisable to know the various ratios that result from using them in any given combination. Fortunately it is easy to find these ratios, and for any two spur, bevel or contrate gears, it is always found in the same way.

The ratio or relative speeds of any two shafts carrying meshing spur, bevel or contrate gears is found by dividing the number of teeth in the smaller gear into the number of teeth in the larger gear. Fig. B shows a simple reduction gear using a ¾″ Pinion, which has 25 teeth, and a 50-teeth Gear. The ratio resulting from this arrangement is therefore 2 : 1. If the arrangement is reversed, so that the 50-teeth Gear drives the Pinion, the ratio also is reversed and is therefore 1 : 2.

Worms can be designed to be either reversible or non-reversible. A reversible worm can be used either as the driving or the driven gear, but a non-reversible worm can be used only as the driving member. **The Meccano Worm is of the non-reversing type, and therefore must always be used as the driver when meshed with other gears.**

Whenever a Meccano Worm is meshed with a Pinion, or other Spur gear, the resulting ratio is always determined by the number of teeth in the meshing gear, the Worm being rated as 1. For example, a Worm meshed with a ½″ Pinion, which has 19 teeth, gives a ratio of 19 : 1. This means that the Worm has to rotate 19 times to drive the Pinion through one complete revolution. A Worm meshed with a 1″ Gear, which has 38 teeth, gives a ratio of 38 : 1, and so on.

HOW TO USE GEARING.

The best type of gearing for use in a particular model will depend on the kind of model and the power required to drive it, bearing in mind the type of motor to be used. To operate a slow-moving model demanding great power, such as a traction engine, from a fast-running Clockwork or Electric Motor, gearing that will provide a large reduction ratio must be used, and a Worm meshed with a 57-teeth Gear in one stage of the gearing is nearly always necessary.

Sometimes the amount of reduction required may be greater than it is possible to get in a single stage

3

using only two gears. This difficulty is overcome by the use of several gears suitably meshed together in pairs to form two or even three stages of reduction. Such an arrangement is known as a "compound gear train".
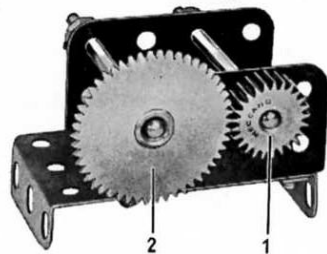

Fig. B

A good example of a two-stage compound reduction gear of this kind, making use of four different gears, a Worm, a 57-teeth Gear, a $\frac{3}{4}$" Pinion and a 50-teeth Gear, would be as follows: The Worm is fixed on the shaft of the Motor and meshed with the 57-teeth Gear on a shaft suitably mounted. This forms the first stage of the reduction, and the ratio it provides is 57 : 1. The second stage is formed by a $\frac{3}{4}$" Pinion also fixed on the Rod carrying the 57-teeth Gear, meshed with a 50-teeth Gear on another shaft. As the $\frac{3}{4}$" Pinion has 25 teeth, the ratio provided by the second stage is 2 : 1. The total resulting ratio of the train is found by multiplying together the ratio given by each stage, that is 57 : 1 multiplied by 2 : 1, giving a total ratio of 114 : 1.

Now let us see exactly what happens when the combined gears are set in motion. Let us assume that the speed of the motor shaft carrying the Worm is 570 revolutions per minute. Shaft 4, carrying the 57-teeth Gear, will rotate at a speed of 570 divided by

57, that is at 10 revolutions per minute. The Pinion on shaft 4 therefore rotates at 10 revolutions per minute and as the ratio between this Pinion and the 50-teeth Gear on shaft 3 is 2 : 1, the 50-teeth Gear revolves at 10 divided by 2 revolutions, that is 5 revolutions per minute.

The speed of the Motor drive has therefore been reduced from 570 to 5 revolutions per minute, a total reduction ratio of 114 : 1. **The result is that the torque that can be exerted by shaft 3 is 114 times greater than is obtainable direct from the Motor shaft.**

A 3 : 1 ratio of reduction is very suitable for use with a Clockwork Motor such as the Meccano No. 1 type, and will give a sufficiently powerful drive for most light models. It is easily arranged as shown in Fig. D. In the illustration $\frac{1}{2}$" Pinion 1 is fixed to the Motor driving shaft and meshed with a 57-teeth Gear 2 fixed on a short Rod 3 mounted in holes in the Motor sideplates. The drive to the model then is taken from Rod 3.

This form of reduction gear is one of the most useful in model-building and is nearly always used when a simple reduction is required.
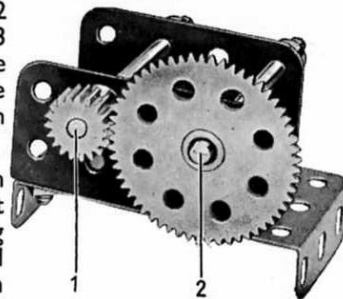
Fig. C

HOW TO USE MECCANO SPROCKET AND CHAIN.

Sometimes it is necessary for one shaft to drive another placed in some other part of a model. In such cases the best method of drive is the Meccano Sprocket and Chain system, an example of which is seen in Fig. F.
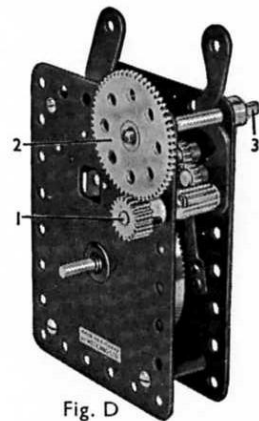
An advantage of this type of drive over ordinary pulley-and-belt drive is that the Chain drive is positive in action; that is, there is no slip between the Chain and the Sprockets, as may occur between a Cord belt and a Pulley. This positive drive therefore makes it possible for one Sprocket to drive another at a definite rate, just as with meshing gears.

Fig. D

Meccano Sprocket Chain is supplied in lengths of 40", and comprises six links to the inch. It can easily be separated and joined again when the requisite length has been measured off. To separate, the ends of one of the links are gently prised up with the blade of a screwdriver so that the adjacent link can be slipped out. After rejoining, the ends are bent back again carefully so that they do not grip the next link too tightly. The Chain should be passed round the wheels so that the
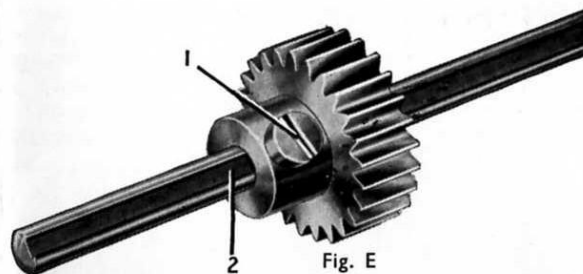

Fig. E

turned-over ends of the link face outward or away from the wheel, as this will result in smoother running.

ROD WITH KEYWAY, AND KEY BOLT.

These parts, which are shown in Fig. E, are intended to be used in mechanisms where it is necessary to arrange a Gear or Pinion so that it turns with the Rod, but is able to slide along it. The Key Bolt I should be screwed into one of the threaded holes in the Gear or Pinion so that the spigot at the end of the Key Bolt enters the keyway in the Rod with Keyway 2. When parts are **fixed** to the Rod with Keyway they must be arranged so that their Grub Screws or Set Screws are tightened on the part of the Rod **opposite** to the keyway.
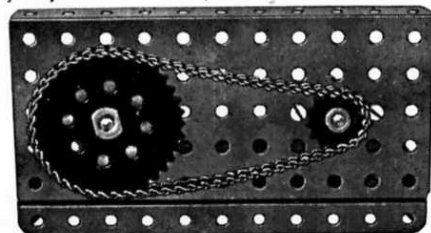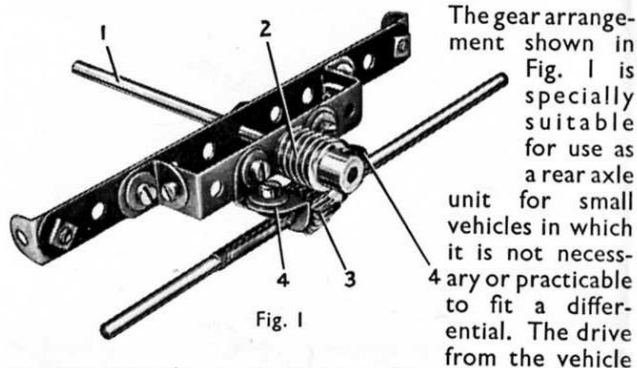

Fig. F

5

B.1 WORM REDUCTION GEARING

Fig. 1

The gear arrangement shown in Fig. 1 is specially suitable for use as a rear axle unit for small vehicles in which it is not necessary or practicable to fit a differential. The drive from the vehicle power unit is taken to Rod 1, if possible through a flexible drive to allow for changes in the angle of the drive caused by movement of the axle under the action of its springs. Rod 1 is mounted in a Strip as shown, and in a $2\frac{1}{2}'' \times \frac{1}{2}''$ Double Angle Strip attached to Angle Brackets bolted to the Strip. The Rod is fitted with a Worm 2 that meshes with a $\frac{1}{2}''$ Pinion 3 on the rear axle. The axle is carried in built-up corner angle brackets 4 fixed to the $2\frac{1}{2}'' \times \frac{1}{2}''$ Double Angle Strip. Each corner angle bracket is assembled from two $\frac{1}{2}'' \times \frac{1}{2}''$ Angle Brackets arranged as shown.

The mechanism is shown fitted with a $5\frac{1}{2}''$ Strip and an axle formed by short Rods joined by a Rod Connector, and of course the length of both the Strip and axle can be varied to suit any particular model.

B.2 REVERSING MOVEMENT FOR NON-REVERSIBLE MOTORS.

The drive to a model is taken from the output shaft 1 which carries a 57-teeth Gear and a 1″ fixed Pulley and is mounted in two Trunnions spaced from the base-plate by Washers. A $1\frac{1}{2}''$ equilateral triangular structure is built up from two $1\frac{1}{2}''$ Strips and a $2\frac{1}{2}''$ Strip, at the same time bolting a Double Bent Strip and a Reversed Angle Bracket 2 in position. One of the Bolts used is $\frac{3}{4}''$ long and this carries a $\frac{1}{2}''$ Pinion 3 loosely on its shank. The bolt is lock-nutted in place so that the Pinion will revolve freely and a further $\frac{1}{2}''$ Pinion on the 2″ input Rod 4 is meshed with this Pinion. A 1″ Pulley is also fixed on Rod 4 and the whole structure is pivoted on a Rod 5, which passes through the centre hole of the $2\frac{1}{2}''$ Strip and the free lug of Reversed Angle Bracket 2. Rod 5 is carried in two 1″ × 1″ Angle Brackets.

A lever is formed by bolting a $2\frac{1}{2}''$ Strip 6 through its second hole to the rear end of the other $2\frac{1}{2}''$ Strip. The drive from the Motor is taken by a Driving Band to the Pulley on Rod 4.

Fig. 2
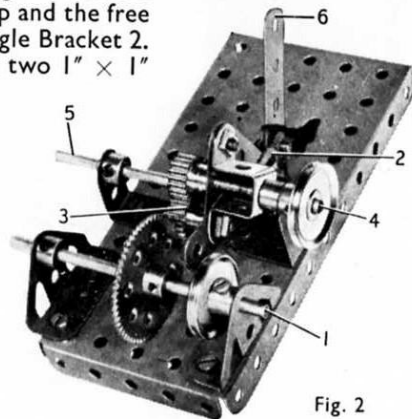
When lever 6 is moved, one or the other of the ½″ Pinions meshes with the 57-teeth Gear causing the output shaft to revolve, the direction of rotation depending on which Pinion is engaged. The lower ½″ Pinion is held in constant mesh with the 57-teeth Gear by a Driving Band passed over lever 6 and anchored to the baseplate.

B.3 REVERSING GEAR.

The input shaft 1 is a 4″ Rod with Keyway supported in two Flat Trunnions bolted to a 5½″ × 2½″ Flanged plate that forms a base for the mechanism. The shaft carries two ½″ Pinions 2, each of which is fitted with a Key Bolt that engages the keyway in the shaft 1. Two ½″ Reversed Angle Brackets 3 are placed on the shaft 1, using the slotted holes in the parts, so that the Pinions 2 are located
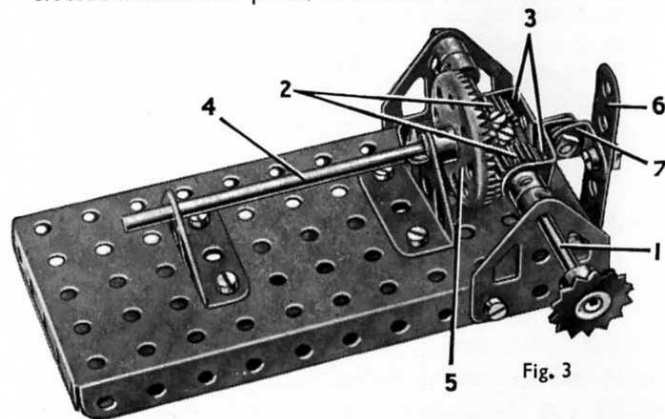
Fig. 3

between the two Reversed Angle Brackets. The shaft is held in place by Collars, and further Collars limit the sliding movement of the parts on it.

The output shaft 4 is a Rod supported in Trunnions bolted to the base, and it carries a 1½″ Contrate 5.

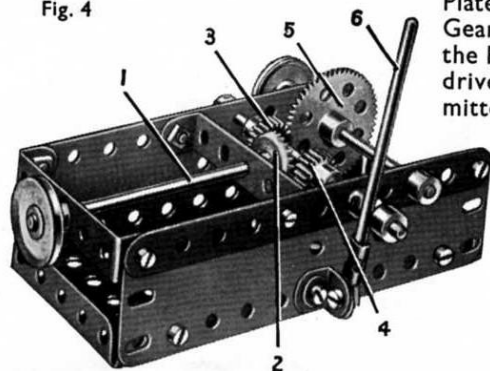The control lever 6 is a 2½″ Strip lock-nutted to the end of the base. It carries an Angle Bracket 7 and this also is pivoted on a lock-nutted Bolt. A ⅜″ Bolt is passed through the Reversed Angle Brackets 3, three Washers are placed on it and then it is passed through the Angle Bracket 7. A Nut screwed on the ⅜″ Bolt holds the parts tightly in place.

When the lever 6 is moved in one direction, the two ½″ Reversed Angle Brackets slide the Pinions 2 along the shaft 1 until one of the Pinions engages the Contrate 5 and transmits the drive between shafts 1 and 4. When the lever is moved the opposite way, the Pinions are slid in the opposite direction until the second Pinion engages the Contrate. This again transmits the drive between shafts 1 and 4 but in the opposite direction to when the first-mentioned Pinion is engaged.

B.4 REVERSING AND REDUCTION GEAR.

The input shaft 1, Fig. 4, is mounted in 2½″ × ½″ Double Angle Strips and carries a ¾″ Contrate 2. The position of the Contrate is adjusted so that it can be meshed with either of the ½″ Pinions 3 and 4, which are fixed on a Rod free to slide in Flexible Plates bolted to the base. A 57-teeth Gear 5 is fixed on a Rod also mounted in the Flexible

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Fig. 4

The sliding movement of the Rod is controlled by a lever 6, consisting of a Rod in a Rod and Strip Connector lock-nutted to an Angle Bracket. The lever engages between Collars on the sliding Rod.

B.5 DOG CLUTCH MECHANISM.

In motor-driven models it is necessary on many occasions to have some method of disconnecting the drive without stopping the Motor. The usual arrangement is to make use of a clutch, and Fig. 5 illustrates a simple but efficient dog clutch mechanism that can be used in models of many kinds.

The driving or input shaft I is a 4″ Rod with Keyway mounted in Trunnions bolted to a $5\frac{1}{2}″ \times 2\frac{1}{2}″$ Flanged Plate and held in place by Collars. A $\frac{3}{4}″$ Contrate 2 is

Plates, and the Gear meshes with the Pinion 3. The drive can be transmitted to either of the Pinions 3 and 4 by sliding the Rod on which they are fixed, but Pinion 3 remains in constant mesh with the Gear 5.

free to slide on the shaft but is made to turn with it by a Key Bolt screwed into the boss of the Contrate until its spigot engages the keyway. The output shaft 3 is a Rod supported in a Flat Trunnion and a $\frac{1}{2}″$ Reversed Angle Bracket, with a $\frac{3}{4}″$ Contrate 4 fixed to its inner end. The Contrate should be spaced from the Reversed Angle Bracket by Washers. A Compression Spring is placed on the shaft I between the two Contrates.

The Clutch is operated by a lever 5, formed by a $2\frac{1}{2}″$ Strip lock-nutted to an Angle Bracket bolted to the base. A $\frac{3}{8}″$ Bolt 6 fixed in the lever by a Nut can be used to slide the Contrate 2 along the shaft I. The Compression Spring normally holds the two Contrates apart, but by operating the lever 5 Contrate 2 can be slid along the shaft until its teeth engage those of the Contrate 4.
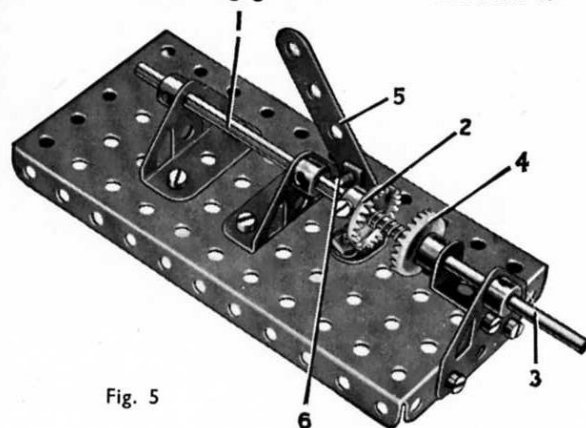

Fig. 5

B.6 AUTOMATIC REVERSING MECHANISM.

The mechanism is assembled on a $5\frac{1}{2}'' \times 2\frac{1}{2}''$ Flanged Plate, fitted with two Trunnions 1. The input shaft is a Rod 2 mounted in a $2\frac{1}{2}'' \times \frac{1}{2}''$ Double Angle Strip 3 attached to the base by $\frac{1}{2}''$ Bolts. These Bolts are passed through holes in the Double Angle Strip and are fixed in place by Nuts. A second Nut is then screwed on each Bolt and their shanks are passed through the Flanged Plate and locked by further Nuts. The height of the Double Angle Strip above the Flanged Plate is adjusted so that a $\frac{1}{2}''$ Pinion 4 on Rod 2 meshes accurately with a $1\frac{1}{2}''$ Contrate 5. Contrate 5 is fixed on a $1\frac{1}{2}''$ Rod held by a Collar in the base and in a $\frac{1}{2}''$ Reversed Angle Bracket bolted underneath the Flanged Plate. The output shaft is a $5''$ Rod 6 free to slide in Trunnions 1. It is fitted with $\frac{3}{4}''$ Pinions 7 and 8, positioned so that either can be moved into mesh with Contrate 5 by sliding Rod 6.

The reversing device is operated by a $\frac{1}{2}''$ Pinion 9 fixed on a Rod 13 mounted in the Flanged Plate and in a Double Bent Strip bolted to it. The Pinion is in constant mesh with a Worm on Rod 2. Rod 13 carries also a Bush Wheel fitted with a Fishplate 10, and a $2\frac{1}{2}''$ Strip 11 is linked to the Fishplate by a lock-nutted Bolt. The free end of Strip 11 is then attached by another lock-nutted Bolt to a $2\frac{1}{2}''$ Strip 12 that is fixed tightly to a Double

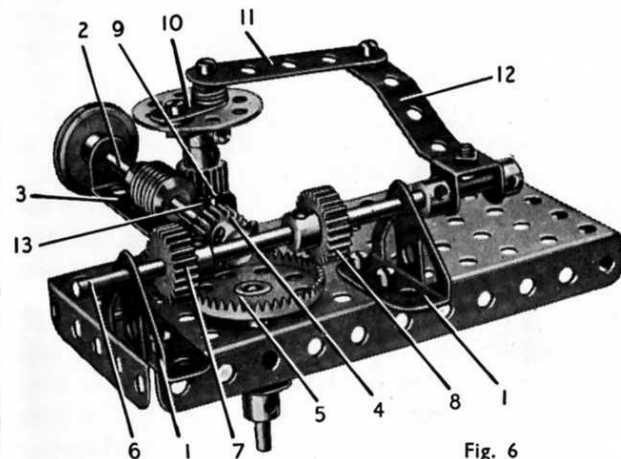Bracket. The Double Bracket is clamped between Collars on Rod 6.

Fig. 6

B.7 TWO-SPEED GEAR-BOX.

The framework for the gear-box consists of two $2\frac{1}{2}''$ Strips connected at their ends by two $2\frac{1}{2}'' \times \frac{1}{2}''$ Double Angle Strips fitted with Flat Trunnions 1. The input or driving shaft is a $4''$ Rod with Keyway 2, mounted in the Double Angle Strips and the Flat Trunnions. A $\frac{1}{2}''$

Fig. 7

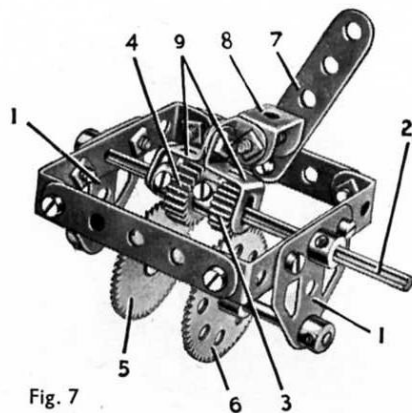of the housing. A $\frac{3}{8}''$ Bolt fixed by a Nut in the lever engages a hole in a Double Bracket 8. An Angle Bracket bolted to the Double Bracket is fixed between two $\frac{1}{2}''$ Reversed Angle Brackets 9. The slotted holes of the Reversed Angle Brackets are passed over the input shaft 2 so that the Pinions are located between the two Reversed Angle Brackets. A Washer should be placed between Pinion 3 and the Reversed Angle Bracket.

With the lever 7 in the position shown Pinion 3 is in mesh with Gear 6 and the ratio between the input and output shafts is 3 : 1. If the lever is moved to the left this Pinion and the Gear disengage, and Pinion 4 slides into mesh with Gear 5 to provide a 2 : 1 ratio between the shafts.

B.8 STEERING MECHANISM FOR MODEL CARS.

The construction of vehicles of one kind or another forms a large part of the average model-builder's activities, and in almost all of these some kind of steering system is required.

The contents of this Gears Set, in conjunction with a standard Meccano Set, permit many different steering arrangements to be built up, and one of the most useful of

Pinion 3 and a $\frac{3}{4}''$ Pinion 4 are free to slide on the input shaft, but are made to turn with the shaft by Key Bolts screwed into the bosses of the Pinions so that their spigots engage the keyway in the shaft. The output or driven shaft is a $3\frac{1}{2}''$ Rod mounted in the Flat Trunnions 1 and fitted with a 50-teeth Gear 5 and a 57-teeth Gear 6.

The sliding movement of Pinions 3 and 4 is controlled by a lever 7. This is a $2\frac{1}{2}''$ Strip lock-nutted to one side

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these is shown in Fig. 8. This mechanism is suitable for many kinds of motor cars and lorries.

The front axle is a $3\frac{1}{2}$" Strip bolted to a $1\frac{1}{2}$" × $\frac{1}{2}$" Double Angle Strip that is fixed to the chassis. On each side a $\frac{3}{8}$" Bolt is passed through a Double Bracket 1 and a $1\frac{1}{2}$" Strip 2, and these parts are held tightly on the Bolt by a Nut.
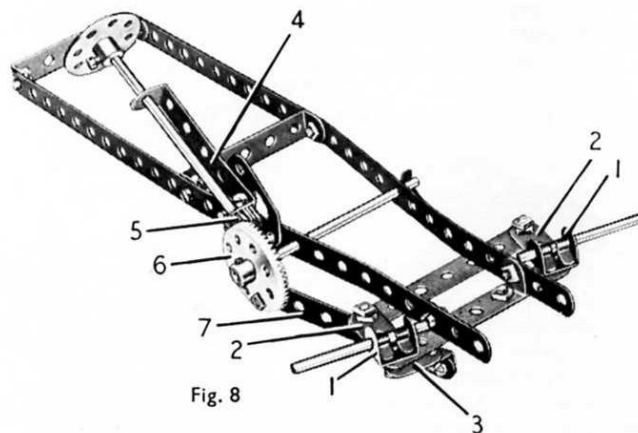

Fig. 8

The right-hand $\frac{3}{8}$" Bolt is passed through the $3\frac{1}{2}$" Strip and is fitted with lock-nuts, so that the assembly swivels freely in the Strip. The left-hand Bolt is passed through the Strip also, and a Nut is screwed on it but is not tightened against the Strip. A Fishplate 3 is now placed on the Bolt, and a second Nut is screwed tightly in place so that the Fishplate is fixed on the Bolt between the two Nuts. This arrangement fixes the Double Bracket, the $1\frac{1}{2}$" Strip and the Fishplate on the Bolt, but the Bolt itself is free to turn in the end hole of the $3\frac{1}{2}$" Strip. The Strips 2 are connected across by another $3\frac{1}{2}$" Strip, which is attached by lock-nutted Bolts.

The steering column is mounted in a $2\frac{1}{2}$" × $\frac{1}{2}$" Double Angle Strip 4, which is bolted to a Flat Trunnion fixed to the chassis. At its lower end the steering column carries a $\frac{1}{2}$" Pinion 5 that engages a $1\frac{1}{2}$" Contrate 6. This Contrate is fixed on a Rod mounted across the chassis as shown. A $3\frac{1}{2}$" Strip 7 is pivoted on a $\frac{3}{8}$" Bolt, which is fixed in a hole in the Contrate 6 by two Nuts. An Angle Bracket is lock-nutted to the front end of Strip 7 and also to the Fishplate 3.

The road wheels of the model are mounted freely on 2" Rods held in the Double Brackets 1 by Spring Clips. The wheels should be retained on the Rods by Spring Clips or Collars.
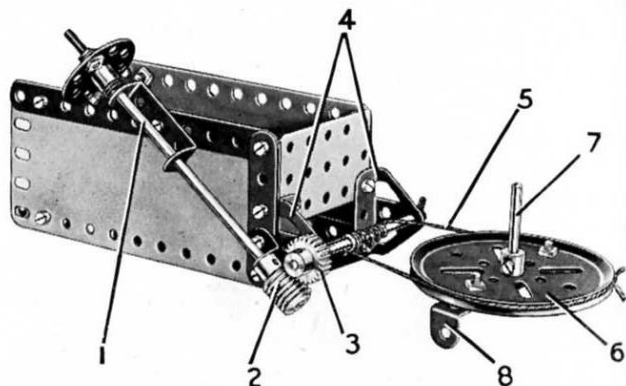
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B.9 STEERING SYSTEM FOR HEAVY TRACTION ENGINES AND TRACTORS.

Fig. 9

Another very useful and simple steering device is shown in Fig. 9. This is specially designed for large traction engines and similar models. The steering wheel is secured to the upper end of the Rod 1, which is mounted freely in a Double Angle Strip and an Angle Bracket fixed to the side of the model. At its lower end it carries a Worm 2 and this drives a $\frac{3}{4}''$ Pinion 3 fixed on a Rod mounted freely in Trunnions 4 or other suitable parts bolted to the framework of the model.

A length of Cord 5 is passed several times round this Rod so that it has a good grip, and the ends of the Cord are then tied together to make an endless belt.

The Cord passes round a 3" Pulley 6, which is fixed on a Rod 7. This Rod when mounted in the model is free to pivot. A road roller, or the axle of the front wheels of a tractor, is carried in a Double Angle Strip 8 bolted to the Pulley 6.

B.10 CASTOR STEERING.

A different type of steering mechanism is shown in Fig. 10. This is known as castor steering, and is intended for use in steering the driving wheels of a small vehicle such as a mobile crane or a delivery van, so as to give the maximum manœuvring ability. It is easy to assemble and it operates very smoothly. The steering wheel of the vehicle is connected in any suitable manner, according to
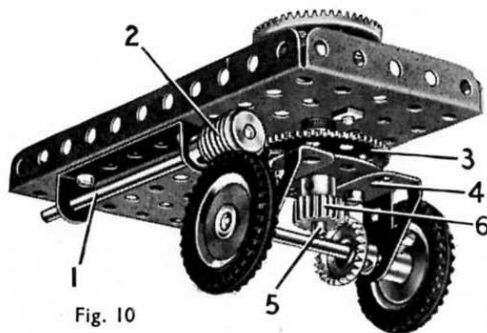
Fig. 10

the type of model under construction, to a Rod 1, which carries a Worm 2. This Worm engages and actuates a 57-teeth Gear 3. The framework 4 supporting the road wheels is attached to the 57-teeth Gear, and the entire unit pivots on a Rod 5.

This Rod 5 is connected at its upper end through gearing to the motor used to drive the vehicle, and at its lower end it carries a $\frac{1}{2}$" Pinion 6 that engages a $\frac{3}{4}$" Contrate mounted on the axle of the road wheels.

When the Rod 5 is set in motion by the driving motor, it actuates the road wheels through the Pinion 6 and Contrate, and this drive is not interrupted when the steering wheel is moved. All that happens is that the Worm 2 then causes the 57-teeth Gear 3 and the frame carrying the road wheels to rotate about the Rod 5.

B.11 SIMPLE SPROCKET-DRIVEN DIFFERENTIAL GEAR.

When a car turns a corner the inner wheels travel only a short distance compared with the outer wheels, which have to describe a much greater arc. This means that the inner wheels have to mark time, or turn slowly, while the outer wheels cover the larger sweep. For the driving wheels, therefore, means must be provided to drive the inner wheel more slowly than the outer wheel, the moment the car begins to turn. The mechanism used for this purpose is known as a differential, and it is a very interesting one as it is entirely automatic in action. Many different forms of differential can be made from Meccano
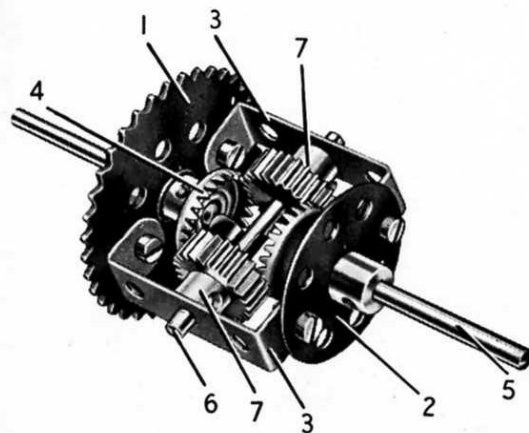
Fig. 11

Gears, and two that can be built from the Gears in this Outfit are shown in Figs. 11 and 12.

The device shown in Fig. 11 is a very simple form of differential and is compact enough to be built into a small model. It is designed for use with a Sprocket Chain drive instead of the more usual gear drive. A 2" Sprocket Wheel 1 is connected to a Bush Wheel 2 by means of two $1\frac{1}{2}$" × $\frac{1}{2}$" Double Angle Strips 3, each of the four Bolts holding the parts carrying a Washer for spacing purposes. A Rod to carry one of the road wheels is now passed through the boss of the Sprocket Wheel and fitted with a $\frac{3}{4}$" Contrate 4. A second Rod 5 passing through the Bush

Wheel carries the other road wheel, and is fitted with a Contrate in the same way as the first.

A 2″ Rod 6 is passed through the centre holes of the Double Angle Strips 3 and on it are mounted two $\frac{3}{4}$″ Pinions 7. One of these Pinions is fixed by its grub screw on the Rod, but the other is mounted freely and is held in position by a Spring Clip. A Washer is placed on the Rod between the Spring Clip and the Pinion. When the mechanism is fitted in a model car the drive from the motor is taken by Sprocket Chain to the Sprocket 1.

B.12 GEAR DRIVE DIFFERENTIAL.

The housing for this mechanism is formed by two $3\frac{1}{2}$″ Strips bolted to $2\frac{1}{2}$″ × $\frac{1}{2}$″ Double Angle Strips 1 and 2.

The 2″ Rod 3 is rotated by the motor, and a $\frac{3}{4}$″ × $\frac{1}{4}$″ Pinion fixed on the Rod meshes with a $1\frac{1}{2}$″ Contrate 4,
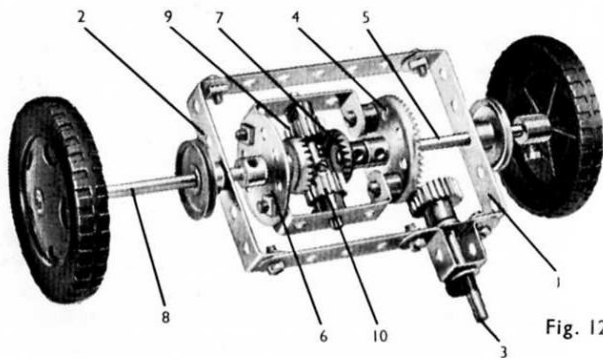
which is free to turn on a Rod 5. Two $1\frac{1}{2}$″ × $\frac{1}{2}$″ Double Angle Strips are attached to the Contrate by $\frac{1}{2}$″ Bolts, and a Collar on each Bolt is used for spacing purposes. The $1\frac{1}{2}$″ × $\frac{1}{2}$″ Double Angle Strips are connected at their free ends by a Bush Wheel 6.

A $\frac{3}{4}$″ Contrate 7 is fixed at the inner end of Rod 5, and a similar Contrate is fixed on a Rod 8, which is mounted in Double Angle Strip 2 and the Bush Wheel 6. Two $\frac{1}{2}$″ Pinions 9 and 10 are carried on a 2″ Rod mounted in the $1\frac{1}{2}$″ × $\frac{1}{2}$″ Double Angle Strips, so that the Pinions mesh with the $\frac{3}{4}$″ Contrates. Pinion 9 is fixed on the Rod, and Pinion 10 is free to turn but is held in position by a Collar.

B.13 TWIN DRIVE UNIT.

The input shaft 1 is a 4″ Rod with Keyway mounted in two Trunnions bolted to the sides of a $5\frac{1}{2}$″ × $2\frac{1}{2}$″ Flanged Plate that forms a base for the mechanism. The input shaft is fitted with two $\frac{3}{4}$″ Pinions 2 and two $\frac{1}{2}$″ Reversed Angle Brackets 3, arranged so that the Pinions are between the lugs of the Reversed Angle Brackets. The Pinions are free to slide on the shaft, but are made to turn with it by Key Bolts screwed into their bosses to engage the keyway in the shaft.

The output shafts 4 and 5 are mounted in $2\frac{1}{2}$″ × $\frac{1}{2}$″ Double Angle Strips and are held in place by Collars. The Double Angle Strips are bolted between $2\frac{1}{2}$″ × $1\frac{1}{2}$″ Flexible Plates fixed to the sides of the base. Each output shaft carries a $\frac{3}{4}$″ Contrate arranged so that it will mesh with the Pinions 2.

Fig. 12

The drive to the Contrate 2 is from a Rod 4 fitted with a ½" Pinion 5 that meshes with the Contrate. Rod 4 is supported in Fishplates attached to Double Brackets, which are bolted between the sides of the column.

The control lever 6 to lower the shaft 1 when necessary is made from two 2½" Strips overlapped three holes. This lever is lock-nutted at one end to the column and it carries a Bolt held in place by two Nuts. The head of the Bolt engages between two Collars 7 fixed to the shaft 1. It will be seen that as the lever 6 is depressed, the shaft 1 is pushed downwards against the pressure of the Compression Spring. As soon as the lever is released the Compression Spring extends and returns the shaft to its normal position.
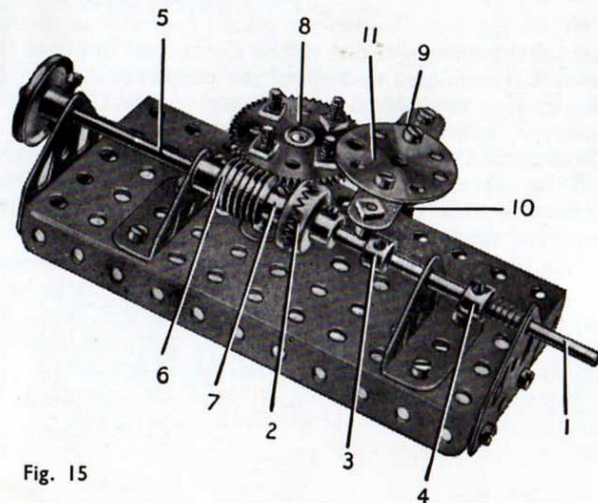
B.15 INTERMITTENT DRIVE.

The mechanism shown in Fig. 15 is designed to provide an intermittent output drive to a Rod, although the input shaft is driven continuously by a Motor. The output shaft is a Rod 1 supported in a Trunnion and a Flat Trunnion bolted to a 5½" × 2½" Flanged Plate. The Rod is fitted with a ¾" Contrate 2, and two Collars 3 and 4. A Compression Spring is placed between Collar 4 and the Flat Trunnion.

The input shaft is a Rod 5 and this also is mounted in a Trunnion and a Flat Trunnion bolted to the base. A Worm 6 and a ¾" Contrate 7 are fixed on this Rod. The Worm drives a 57-teeth Gear 8 mounted on a 1½" Rod, which is supported in the base and in a Double Bent Strip bolted to it. The Rod is held in place by a Collar and the Gear is fitted with four ⅜" Bolts fixed by Nuts. A 2½" Strip 9 is lock-nutted to the upper lug of a 1½" × ½" Double Angle Strip 10 bolted to one side of the base. A Wheel Disc 11 is bolted to Strip 9, which is fitted also with a Bolt

held in place by two Nuts. The head of this Bolt bears against the Collar 3 on the output shaft.

Normally the Compression Spring forces Rod 1 to the left and brings the Contrates 2 and 7 together, to form a dog clutch that transmits the drive from Rod 5 to Rod 1. As Rod 5 turns however, the Gear 8 rotates and the Bolts in it press against the Wheel Disc 11 and move the Strip 9 to the right. This movement slides Rod 1 to the right also, and separates the two Contrates to disconnect the drive. The drive between Rods 5 and 1 is thus disconnected at intervals as each of the ⅜" Bolts in turn engages the Wheel Disc. The number of times the drive is disconnected and the length of time it is disengaged for each revolution of Gear 8 can be varied by altering the number and the positions of the Bolts in the Gear.

16   Fig. 15