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MECCANO®

MECHANISMS SET

INSTRUCTIONS

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THE MECCANO MECHANISMS SET

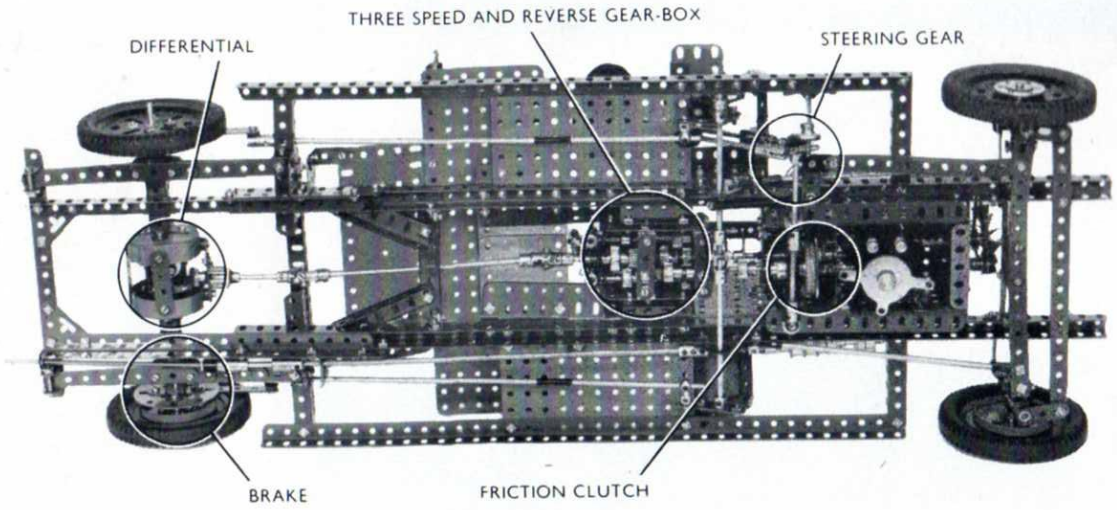
FASCINATING MECHANICAL DEVICES REPRODUCED IN MODEL FORM

The Meccano Mechanisms Set contains a special selection of parts with which it is possible to assemble a wide range of fascinating and useful engineering mechanisms. These mechanisms have been selected to demonstrate various mechanical principles and show how different basic mechanical movements, often required in Meccano model-building, can be obtained. It is quite easy to modify the actual constructional details of the mechanisms so that they can be incorporated in complete models such as cranes, machine tools, etc., and so make them work just like the real thing. These mechanisms therefore provide the model-builder with wide scope for exercising his ingenuity in model designing.

On the other hand the mechanisms illustrated are interesting in themselves, and in constructing them the builder will learn a lot about engineering principles and the way in which machines are made to carry out their various tasks.

WHAT A MECHANISM IS

Both in actual engineering and in Meccano model-building a mechanism can be best described perhaps as a collection of mechanical parts, which may or may not include gears, assembled together in such a manner that when set in motion by a motor or other means, the complete assembly carries out a particular functional purpose. One example that will be familiar to most modellers is the gear-box of a motor car. Essentially this is a collection of gear-wheels of various sizes, levers and shafts, arranged in such a manner that, when in motion, it is capable of transmitting different speeds of drive to the road wheels of the car and so enabling the power of the engine to be applied to best advantage.



FROM MECHANISMS TO MACHINES

If we assemble several complete and suitable mechanisms together so that their separate functions are co-ordinated and applied to a specific end, we have got a complete machine.

The modern motor car chassis is an excellent example of the way in which a large number of separate mechanisms are associated together to produce a complete machine. Chief of these mechanisms, excluding the engine, which is itself a complete assembly of various mechanisms, are the clutch, gear-box, differential, brakes and steering gear. The location of these is shown in the accompanying illustration of a fine Meccano model chassis.

It will be seen, therefore, that if one has a clear idea of the functions of each of the various mechanisms, and there is no better way to obtain this knowledge than by building them up for oneself with a Meccano Mechanisms Outfit, the manner in which the complete machine or car operates is readily understandable.

There are literally hundreds of mechanisms that can be built up in Meccano, and the few elementary examples shown in this book are intended merely to 'whet' the builder's appetite and encourage him to experiment on his own. It is in this way that the greatest pleasure and satisfaction from Meccano is obtained, for with it comes the thrill of being a real inventor.

Numerous large engineering firms and industrial experimental and research laboratories employ Meccano parts for designing mechanical movements and mechanisms, which, when fully developed, can be put into practical production for use in real engineering or other structures.

Famous inventors also have used Meccano for working out their ideas. Your possession of the Meccano Mechanisms Set gives YOU the opportunity to join their ranks and experience for yourself the joys of inventing.

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GEARS AND GEAR TRAINS: *Captains of the Mechanical World*

WHAT GEARS ARE AND HOW THEY ARE USED

When a draughtsman sets out to design a new machine or other working engineering construction, in nine cases out of ten, he has to employ gears of one type or another. Gears, indeed, play such a great part in engineering constructions of all kinds, that it is perhaps appropriate to describe them as 'the captains of the mechanical world'. Gears play an equally important rôle in Meccano model-building, so it is therefore of great importance to the model-builder to have some knowledge of this subject so that he can apply the usefulness of gearing to the best advantage in his models.

WHY ARE GEARS NECESSARY?

Simply, gearing may be defined 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 most generally to connect the drive of a Clockwork or Electric Motor to a model in such a way as to drive the moving part or parts at a suitable speed. There are many different types of gears and the best type for use in a particular case depends largely on the power to be transmitted, the final drive speed required and the angle at which the driving shaft, that is the motor shaft, is situated in relation to the shaft of the model or machine it has to drive.

If we wish to transmit a drive from one shaft to another shaft that is parallel to it, we use what are known as *Spur* gears. Four different examples of Spur gears, Parts Nos. 25, 26, 27 and 27a, are included in the Mechanisms Set, and there are others listed in the complete range of Meccano Parts.

The situation often arises where the shafts to be driven are not parallel, but are at right angles to each other. In such cases we can use *Bevel* or *Contrate* Gears. Two different sizes of Contrate Gears are included in the Mechanisms Set. These are Parts No. 28 and 29 and they are generally used in conjunction with *Pinions*. A pinion is a form of spur gear that has a wide tooth face in relation to its diameter. Five Pinions, Parts Nos. 25 and 26, are included in the Mechanisms Set.

Another form of gear that is used to connect shafts at right angles to each other is the *Worm*. In the Mechanisms Outfit this gear is represented by Part No. 32, and an example of its use for this purpose is seen in Model No. 19.

USING GEARS TO INCREASE OR REDUCE DRIVING SPEEDS

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. Many arrangements of gears can be used to achieve this object and, in addition to altering the driving speed in this way, gearing provides another very important advantage, which we shall refer to later on.

If we place a 19-teeth ½" diameter Pinion, Part No. 26, on one shaft and arrange it so that its teeth engage those of a 57-teeth Gear, Part No. 27a, the shaft carrying the 57-teeth Gear will rotate at one-third the speed of the shaft carrying the ½" Pinion. This process is known as 'stepping down' the shaft speed, and the arrangement of the two gears in this way is often referred to as a 'reduction gear'. *The advantage of a speed reduction of this kind is that it makes it possible to obtain a drive of greater power. The increase in power is directly related to the number of teeth in each of the two gears.* In the case we have given as an example, the power would be increased threefold, because the 57-teeth Gear has three times the number of teeth of the ½" Pinion that drives it, so that the ratio between the two gears is 3:1. The drive from the shaft carrying the 57-teeth Gear therefore will have three times the effective power that could be obtained from the shaft carrying the ½" Pinion.

If instead of a speed reduction we wish to arrange a *speed increase*, all we have to do is to carry out the above process *in the opposite direction*. We fix a 57-teeth Gear to one shaft and mesh it with the ½" Pinion on another shaft, and in this case the ½" Pinion will revolve at three times the speed of the shaft carrying the 57-teeth Gear, *but the effective power or torque will be reduced to one-third.* We have thus 'stepped up' our driving speed, but with a loss of driving power. This 'stepping up' process is seldom used in Meccano model-building, as the object of gearing so far as model-building is concerned is almost always to obtain increased torque by 'stepping down'.

In order to make the best use of Meccano gears the model-builder should make himself acquainted with the various ratios that result from using them in any given combination. Fortunately it is very 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 small gear into the number of teeth in the larger gear.* If we take, for example, a simple reduction gear using a ¾" Pinion, which has 25 teeth, and mesh it with a 50-teeth Gear, the ratio resulting from the arrangement will be 2:1. If the arrangement were reversed, so that the 50-teeth Gear drives the Pinion, the ratio also would be reversed, i.e. 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, 50-teeth Gear, Contrate or other 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.

Gear types in the Meccano Mechanisms Outfit

Spur Gear

Pinion

Worm

Contrate Wheel

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GEAR AND PULLEY DRIVES FOR MECCANO MOTORS

HOW TO INCREASE THE EFFECTIVE POWER OF YOUR MOTOR

If you have read carefully the information given on page 1 you will now have a good knowledge of the purpose of gearing and of the various types of gears and the functions for which each type is designed.

Now we come to a matter that affects all Meccano model-builders sooner or later and that is the way in which gearing or pulleys should be used to get the best results from their Clockwork or Electric Motors.

The best type and arrangement of gears for use in a particular case will depend on the kind of model and the power required to drive it, and the type of Motor to be used. To operate a heavy, 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.

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 drive sufficiently powerful for most light models. It is easily arranged by fixing a ½" Pinion to the Motor driving shaft and meshing it with a 57-teeth Gear fixed on a short Rod mounted in holes in the Motor sideplates. The drive to the model is then taken from this Rod.

Sometimes the amount of reduction required may be greater than it is possible to obtain in a single stage using only two gears. This difficulty is overcome by the use of several gears suitably meshed together in pairs to form two or three stages of reduction. Such an arrangement is known as a *compound gear train* and an example of such a train fitted to a No. 1 Clockwork Motor is shown in Fig. 2 on this page. This arrangement of gears will be found quite suitable for driving many models and it provides a total reduction of 6:1. It will be seen that the train makes use of four gears, a ½" Pinion, a 57-teeth Gear, a ¾" Pinion and a 50-teeth Gear. The ½" Pinion is fixed on the shaft of the Motor and meshed with the 57-teeth Gear on a shaft mounted in the Motor sideplates. This forms the first stage of the reduction, and the ratio it provides is 3:1. The second stage is formed by the ¾" Pinion fixed on the same shaft as the 57-teeth Gear and meshed with the 50-teeth Gear. As the ¾" 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 3:1 multiplied by 2:1, giving a total ratio of 6:1. In Fig. 1 the same gearing is used with an E15R Electric Motor.

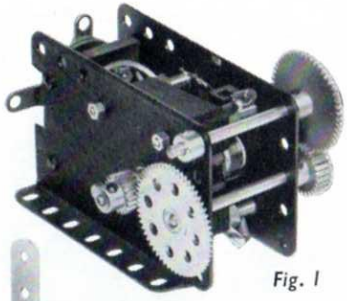

Fig. 1

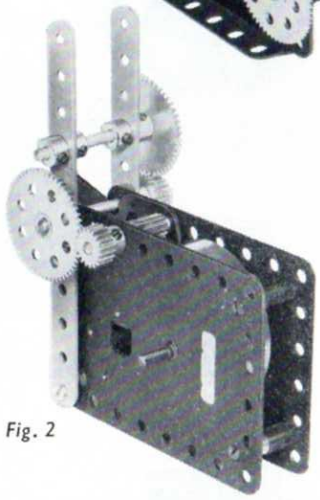

Fig. 2

Now let us see exactly what happens when the Motor is set in motion. Let us assume that the speed of the Motor shaft carrying the ½" Pinion is 570 revolutions per minute. Then the shaft that carries the 57-teeth Gear will rotate at a speed of 570 divided by 3, that is at 190 revolutions per minute. The ¾" Pinion therefore rotates at 190 revolutions per minute and as the ratio between this Pinion and the 50-teeth Gear is 2:1, the 50-teeth Gear revolves at 190 divided by 2 revs., that is 95 r.p.m.

The speed of the Motor drive has therefore been reduced from 570 to 95 revolutions per minute, a total reduction ratio of 6:1. The result is that the power or torque exerted by the shaft carrying the 50-teeth Gear is 6 times greater than is obtainable direct from the Motor shaft.

In Fig. 3 is seen an example of a powerful reduction ratio suitable for use with an E15R Electric Motor. It consists of a Worm fixed on the Motor shaft and meshed with a 57-teeth Gear fixed on a Rod mounted in the arms of a 2½" × 1½" Double Angle Strip. The drive to a model would be taken from the Rod carrying the 57-teeth Gear. The reduction ratio provided by the arrangement is 57:1.

The Meccano *Magic* Motor is not designed for use with gearing, but is provided with a pulley fixed to the Motor shaft, and a separate ½" Pulley for fixing to the shaft of the model it is desired to drive. This arrangement gives a driving ratio of approximately 2:1, but, if desired, a greater reduction ratio can be obtained by fixing a 1" Pulley on the driving shaft of the model. This gives a ratio of approximately 4:1, while, if a 2" Pulley were used, the ratio would be approximately 8:1. Pulley arrangements of this kind can also be used with any Meccano motors.

The *Magic* Motor can be fixed in models either horizontally or vertically, as shown in Figs. 4 and 5.

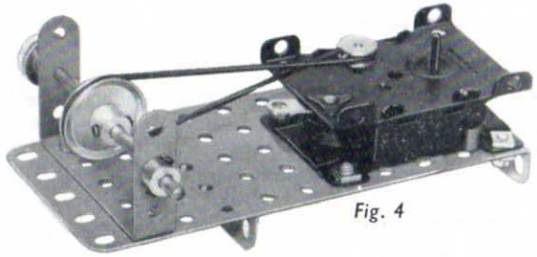

Fig. 4

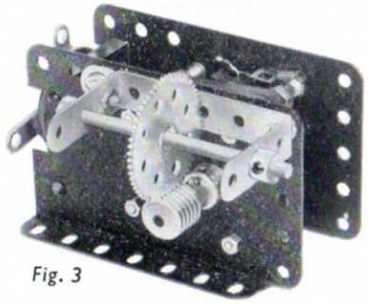

Fig. 3

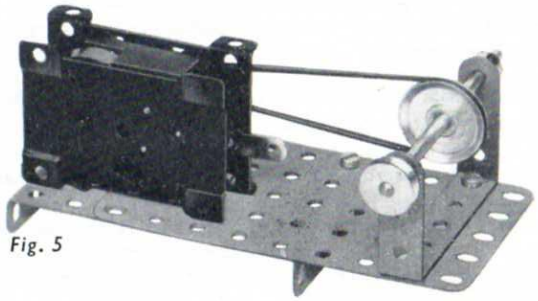

Fig. 5

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PULLEY SYSTEMS FOR CRANES: *The Engineer's Power Savers*

One of the most generally useful machines in engineering is the crane, and in its many different forms it is found in shipyards, docks, engineering workshops and factories of all kinds. It is only natural, therefore, that cranes are one of the most popular subjects with Meccano model-builders.

The lifting of great weights by cranes is made possible largely by the use of pulleys, which are incorporated between the winding drum and the load. These pulley systems may be composed of two pulley blocks having any number of pulleys, but there are seldom more than six.

Pulleys, when properly used, make possible a great saving in power and energy, thus enabling great weights to be lifted with comparatively little expenditure of engine power. This increase in effective power is due to a mechanical advantage produced by passing the hoisting rope around a system of pulleys, one set of which is fixed while the other set is moveable. In a crane, the fixed set is mounted at the jib head, and the load hook is attached to the moveable set. Either set may consist of one or more pulleys. These two sets of pulleys are shown at A and B in Fig. 9, which represents the jib head of a simple model crane. Each set in this case consists of two Pulleys. Fig. 10 shows single pulley sets.

The quantity of work, or 'energy', of which any engine or machine is capable is measured by 'foot-pounds'. A 'foot-pound' is the quantity of energy that is needed to lift a 1 lb. weight through a height of 1 ft. If, for example, a weight of 2 lb. has to be raised through a height of 1 ft., the energy needed to do it would be exactly equal to that necessary to raise a weight of 1 lb. through a height of 2 ft., namely, 2 ft.-lb. If 10 lb. has to be lifted 100 ft., 10 ft.-lb. will be required for the first foot of lift, the same for the second, third, and so on up to 100 ft., making a total of 1,000 ft.-lb. of energy.

In Fig. 8 we illustrate a demonstration set-up of a pulley system using a single fixed pulley A and a single moveable pulley B. The rope is passed (or 'rove') over the fixed pulley A and around the moveable pulley B, and is then tied to the framework as shown.

A load of, say, 1 lb. attached to the 'running' end 'C' of the rope will raise a weight of approximately 2 lb. suspended from the moveable pulley B. The explanation of the increased power, or mechanical advantage as it is called, obtained, is as follows. In our model we would find that to raise a load attached to the moveable Pulley 1 in. the power load applied to the rope at C would have to descend 2 in. — for it is clear that if B is to rise 1 in. the lengths of rope 'D' and 'E' must each be shortened by 1 in. — therefore 'C' must move through a distance of 2 in.

From this it will be seen that a moveable pulley enables a force to move through a greater distance than that moved by the load it lifts. As the energy exerted by a force is increased proportionally to the distance through which it moves, by using a single moveable pulley we can almost halve the force that would be necessary without it, for it enables us to move the force through a distance twice as great. But it should be noted that the force is increased always at the expense of speed, since it must move through a greater distance than the load it lifts. In actual practice the increase in effective power is reduced slightly owing to friction.

Another and more elaborate pulley system of special interest to model-builders is shown in Fig. 7. The principle is the same here as in the system shown in Fig. 8, but two further pulleys have been added. The rope C is rove over one of the pulleys, or 'sheaves' as they are termed, situated in the fixed pulley block A, then under one of the sheaves in the lower moveable block B, over the second pulley A, and down to the second moveable pulley B. From here it is led up and secured to the framework of the fixed pulley block.

It will be seen that the load is thus supported by four lengths or 'falls' of rope, and to raise the load through a distance of 1 in. for example, each of the four 'falls' of the rope from the upper block to the lower block must be shortened 1 in. This means that the running end 'C' of the rope must be lengthened by 4 in. From this it may be calculated that, disregarding friction, a load of say 4 lb. attached to the load hook of the moveable block, could be raised by a load of 1 lb. on the running end 'C' of the rope, for as we have already seen, the energy exerted by a force is increased proportionally to the distance through which it travels. In actual practice a little more than a quarter of the load would be required to raise it, due to friction.

In Figs. 9 and 10 are shown the jib heads of two small cranes fitted with pulley systems assembled from parts in The Meccano Mechanisms Outfit. In one case two pulleys are used, while, in the other, four pulleys are employed. Systems of these types are the most generally useful so far as the Meccano model-builder is concerned.

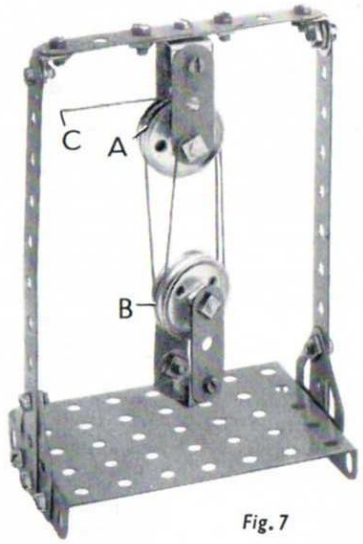

Fig. 7

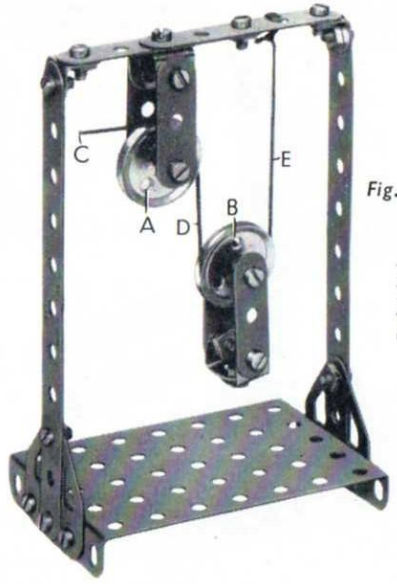

Fig. 8

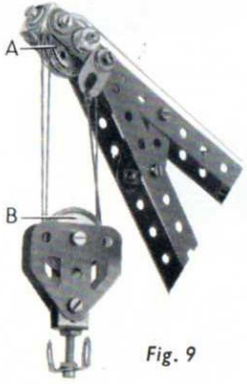

Fig. 9

Jib Head: Double Pulley Arrangement (*Fig. 9*)

4 of No.	2	4 of No.	22a	1 of No.	40
2 " "	6a	19 " "	37a	2 " "	59
1 " "	10	14 " "	37b	2 " "	111
8 " "	12	18 " "	38	2 " "	126a
1 " "	18a				

Simple Pulley Arrangement (*Fig. 8*)

2 of No.	2	19 of No.	37b
2 " "	5	4 " "	38
4 " "	6a	1 " "	40
6 " "	12	1 " "	53
2 " "	22a	2 " "	111
24 " "	37a	2 " "	126a

Two-fold Pulley System (*Fig. 7*)

2 of No.	2	4 of No.	22a	1 of No.	40
2 " "	5	26 " "	37a	1 " "	53
4 " "	6a	20 " "	37b	2 " "	111
6 " "	12	3 " "	38	2 " "	126a

Jib Head: Single Pulley (*Fig. 10*)

2 of No.	2	5 of No.	37b
1 " "	10	16 " "	38
6 " "	12	1 " "	40
1 " "	18a	2 " "	59
2 " "	22a	2 " "	111
1 " "	37a	2 " "	126a

Fig. 10

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THE LEVER: *The Simplest Form of Mechanical Power*

WHAT IS A LEVER?

The most simple form of mechanical appliance is the lever, the use of which has been known from the earliest days of civilization. In its most elementary form a lever is simply a rod or bar of wood or metal used to increase the effect of a force or to change its direction. A commonly used example of a lever in everyday use, is given when a workman uses a crowbar to move or lift a heavy load, such as a packing case or a large lump of rock. He pushes one end of the crowbar under the load he wishes to move and then places a small block of wood or stone under the crowbar and as near as possible to the object to be moved. Then he applies power by pressing downward on the free end of the crowbar and the load is raised so that it can be manipulated as required. The small block of wood or stone that he places under the crowbar, acts as a pivot and forms what is known as the *fulcrum* of the lever formed by the crowbar.

There are three different types of levers, but they differ only in the position of the fulcrum in relation to the power and the load. These three types are known as levers of the First, Second and Third Orders.

THE THREE ORDERS OF LEVERS

A lever is said to belong to the First Order if the fulcrum, or pivot point, is between the power and the load. In the Second Order of levers, the fulcrum is at one end and the power is applied at the other, the load being between the two. In the Third Order of levers the load is placed at one end and the fulcrum at the other. The power is applied between the two and is always *greater* than the load. The treadle of a lathe or grindstone is a simple practical application of a lever of this Order.

A demonstration model of a Lever of the First Order is shown in Fig. 13, the fulcrum being at A. If we carry out an experiment it will be found that a power load of say 1 oz. applied at B is sufficient to balance a load of 2 oz. suspended from the short arm of the lever at C. This *mechanical advantage* as it is termed is due to the fact that the radius of the point B from the fulcrum A is twice as great as that between points A and C. Therefore the point B must move through a distance twice as great as that through which point C moves, and it is a basic mechanical law that power is increased proportionately to the distance through which it moves. The rule may be expressed more generally by stating that the power is to the load as the distance of the load from the fulcrum is to the distance of the power from the fulcrum. By applying this rule we may ascertain the power required to balance or raise any given load, provided we know the lengths of the two arms of the lever.

A Lever of the Second Order is shown in Fig. 12. In this the fulcrum A is at one end of the lever, the power C at the other, and the load D is applied at the point B. Therefore the distance A–C is twice as great as the distance A–B and by applying the rule set out above we know that if the load at D is 1 oz. the power required at C to counterbalance it will be ½ oz. It must be mentioned however, that in actual practice a slight addition would have to be made in order actually to raise the load owing to the force lost by friction in the apparatus. Further experiments can be carried out with this apparatus by moving the positions of points B and C along the lever. In each case the rule set out will be found equally applicable.

Fig. 11 shows a Lever of the Third Order. Here the fulcrum B is at one end, the load A is at the other end and the power C lies between the two. This type of lever is never used when it is required to increase power; whenever it is used the power must always exceed the load. The advantage gained by its use is the fact that the power moves through a smaller space than the load. For this reason levers of the Third Order are usually employed as foot treadles in various machines, where the power is applied by the foot between the fulcrum at one end of the lever and the load, or effort required to move the crankshaft, at the other end.

In the example illustrated it will be seen that the distance of the load from the fulcrum is twice as great as the distance of the power from the fulcrum. Therefore, according to the rule, the power must be twice as great as the load.

The position and weight of the load and the point of application of the power in relation to the lever, can of course be varied as desired, and will provide scope for interesting experiments.

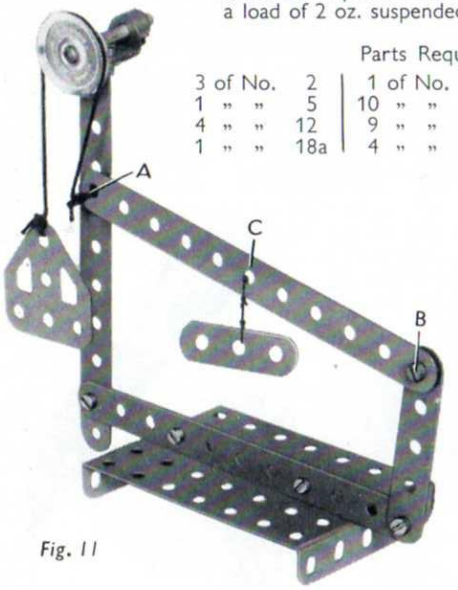

Fig. 11

Parts Required

3 of No.	2	1 of No.	22	1 of No.	40
1 " "	5	10 " "	37a	1 " "	53
4 " "	12	9 " "	37b	1 " "	59
1 " "	18a	4 " "	38	1 " "	126a

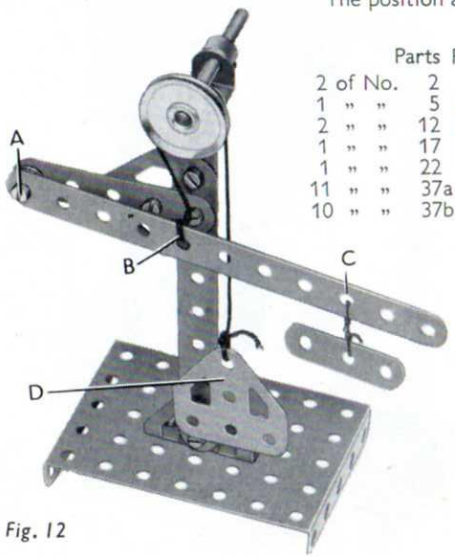

Fig. 12

Parts Required

2 of No.	2	2 of No.	38
1 " "	5	1 " "	40
2 " "	12	1 " "	53
1 " "	17	1 " "	59
1 " "	22	1 " "	111c
11 " "	37a	1 " "	126
10 " "	37b	2 " "	126a

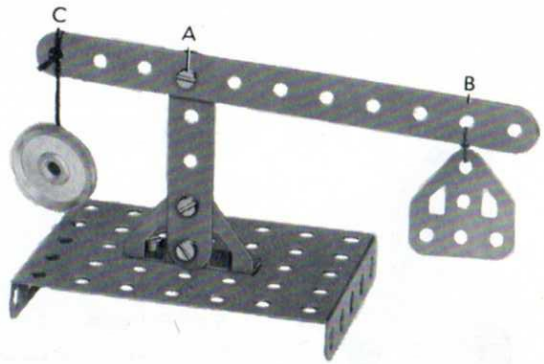

Fig. 13

Parts Required

1 of No.	2	6 of No.	37a	1 of No.	53
1 " "	5	5 " "	37b	1 " "	126
1 " "	22	1 " "	40		

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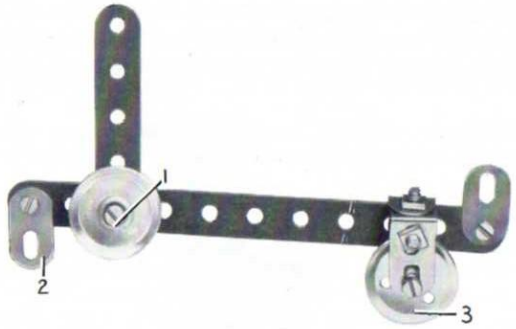
EXAMPLES OF LEVERS USED IN MODEL-BUILDING



No. 1

No. 1 ROMAN BALANCE OR STEELYARD

(Application of Lever of First Order)

The Roman Balance or Steelyard is an example of a Lever of the First Order. It consists of a straight bar pivoted on a Bolt 1 near one end. In use the article to be weighed would be hung on the Fishplate 2 on the short arm of the bar and would be measured by moving the Pulley 3 along the long arm, which would be graduated, until a balance was attained. This simple contrivance has been employed throughout the ages, and at the present time forms the basis of many modern weighing machines.

No. 1 Roman Balance or Steelyard

Parts Required

1 of No. 2	4 of No. 10	1 of No. 22	9 of No. 37a	2 of No. 38
1 " " 5	2 " " 12	1 " " 22a	5 " " 37b	2 " " 111

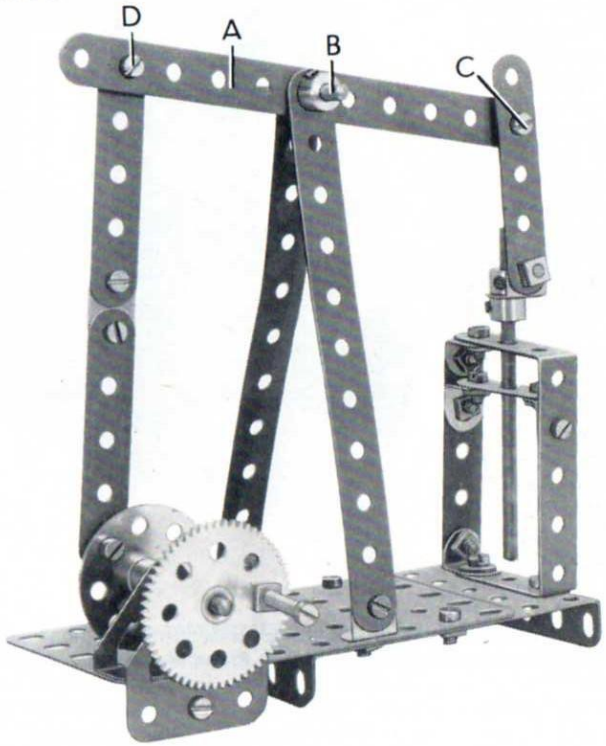
Complete building instructions for several new Meccano models and/or mechanisms appear each month in the Meccano Magazine

No. 2 BEAM ENGINE

(Application of Lever of First Order)

A lever of the First Order, in which the fulcrum is between the load and the power, forms the operating beam in this simple model of a Beam Engine. The lever is the 5½" Strip A pivoted on the Rod B that forms the fulcrum. In a real engine the power would be applied by the engine piston connecting rod at the point C, and the load at point D.

In our model, however, which is hand driven, the points C and D are reversed, the power being applied at D by turning the handwheel formed by the 57-tooth Gear fitted with a ¾" Bolt, while the load is at point C.



No. 2

No. 2 Beam Engine

Parts Required

3 of No. 2	8 of No. 12	1 of No. 27a	1 of No. 47	1 of No. 111
4 " " 5	1 " " 16	29 " " 37a	1 " " 53	1 " " 126
1 " " 6a	2 " " 18a	23 " " 37b	1 " " 53a	1 " " 126a
1 " " 10	1 " " 24	5 " " 38	4 " " 59	

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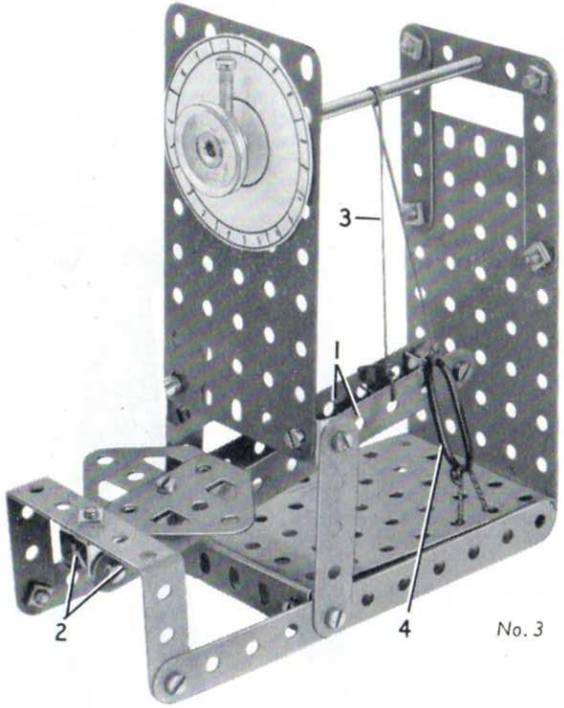
No. 3 PLATFORM WEIGHING MACHINE MECHANISM

(Application of Lever of Third Order)



No. 3

An application of a Lever of the Third Order is seen in the weighing mechanism for the Platform Weighing Machine illustrated. The lever consists of the two 5½" Strips 1, which are coupled together, and pivoted at one end on Bolts 2 lock-nutted in Angle Brackets and which form the fulcrum. A Cord 3, tied near the other end of the Strips as shown, is passed a few times around the Rod on which the weight indicator pointer is mounted, and then its free end is tied to a Driving Band 4 held to the base by Cord as shown. When a person (the 'power') steps on to the weighing platform formed by the two Flat Trunnions, the lever is pressed downwards pulling the Cord and so rotating the Rod carrying the pointer, the amount of movement depending on the power applied on the Flat Trunnions. The load is represented by the Driving Band, which returns the lever to its normal position when the weight is removed from the platform, and its effect is applied to the lever at the point where the cord is tied.

No. 3 Platform Weighing Machine

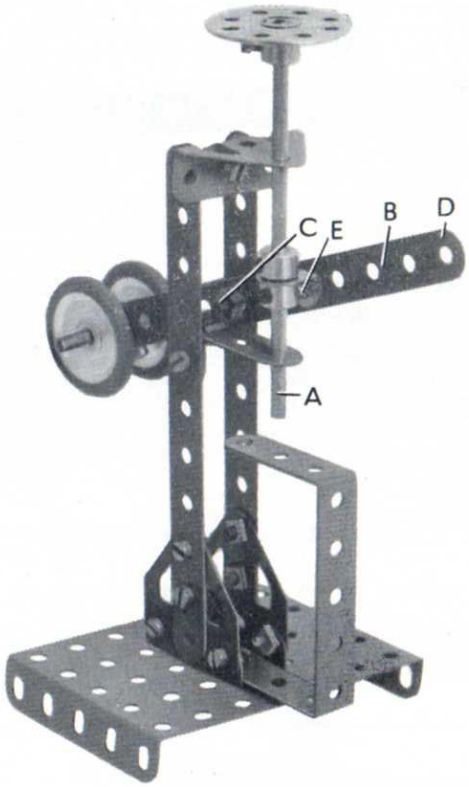
Parts Required

4 of No.	2	1 of No.	22	1 of No.	40	2 of No.	53a	1 of No.	126
5 " "	5	27 " "	37a	1 " "	47	1 " "	59	2 " "	126a
8 " "	12	25 " "	37b	1 " "	53	1 " "	111	1 " "	186
1 " "	15b								

No. 4 PUNCHING MACHINE

(Application of Lever of Second Order)

In this simple model pressure on the punching tool A is applied through a lever of the Second Order, represented by the 5½" Strip B pivoted on the ⅜" Bolt C that forms the fulcrum. The power (that is, hand pressure) is applied at D, and the load is transmitted to the punching tool at point E.



No. 4

No. 4 Punching Machine

Parts Required

3 of No.	2	1 of No.	18a	16 of No.	37b	1 of No.	53	1 of No.	126
1 " "	6a	2 " "	22	2 " "	38	2 " "	59	2 " "	126a
8 " "	12	1 " "	24	1 " "	47	1 " "	111c	2 " "	155
1 " "	15b	19 " "	37a						

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INTERMITTENT DRIVE OR START AND STOP MECHANISMS

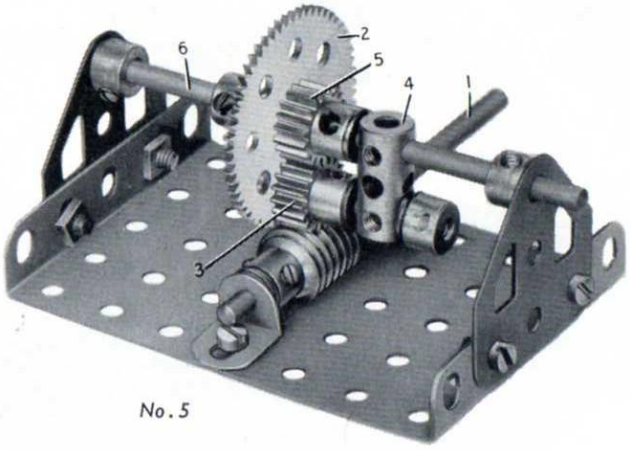
In many models it is necessary to incorporate a mechanism that will give an intermittent drive to certain parts of the model, or perhaps to actually 'start and stop' the working of the model automatically at definite intervals, without interfering with the running of the driving Motor itself.

Two requirements for such mechanisms that come readily to mind are the movement of the film in a ciné projector and the feeding of the tools in machines such as planers.

No. 5 INTERMITTENT MOTION MECHANISM

The driving power is applied to the shaft 1 on which the Worm is fixed. The 57-teeth Gear 2 is *free* on the shaft 6 and the ½" Pinion 3 is *free* on a Rod, supported in the Coupling 4 *and in a hole in Gear* 2. The Pinion 5 is *fixed* to Rod 6, from which the intermittent drive can be taken by any suitable means to the part of a model it is desired to actuate.

The mechanism operates as follows: As the Worm rotates the Gear 2 the latter carries round with it the Coupling and Pinion 3. As this assembly turns, the Pinion 3 is brought into mesh with the Worm for a short period during each revolution of the assembly, and thus drives the Pinion 5 fixed on the output shaft.



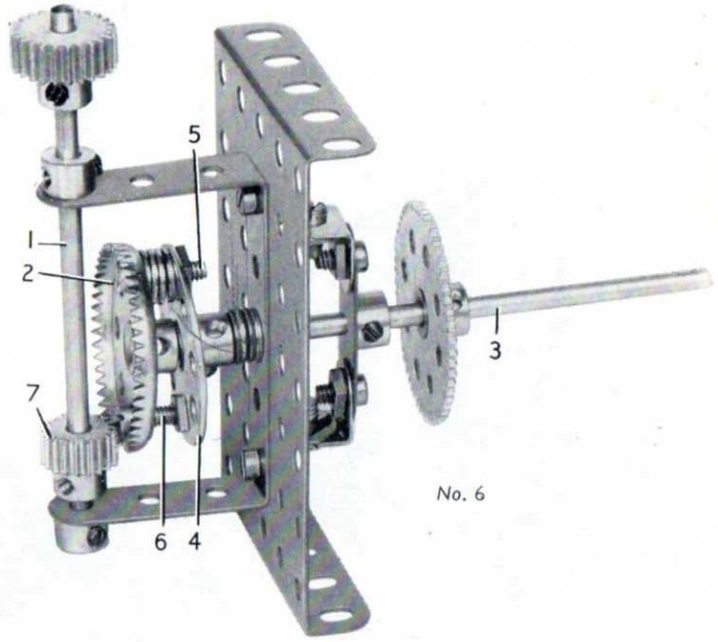
No. 5

No. 5 Intermittent Motion Mechanism

Parts Required

2 of No. 12	1 of No. 18a	1 of No. 32	7 of No. 38	1 of No. 63
1 " " 15b	2 " " 26	6 " " 37a	1 " " 53	2 " " 126a
1 " " 16	1 " " 27a	6 " " 37b	6 " " 59	

Two examples of intermittent motion mechanisms, both of which are designed to transmit timed impulses to a shaft, are shown on this page. These are only two of many different intermittent motion devices that can be assembled from parts in the full Meccano range.



No. 6

No. 6 NOVEL INTERMITTENT MOTION MECHANISM

In this mechanism the output shaft 1 is driven intermittently by the Contrate Wheel 2 mounted on the continuously driven input shaft 3, which takes its drive from the operating motor. It should be noted that the Contrate Wheel is spaced from the Bush Wheel 4 by four Washers on a ½" Bolt 5 and by Nuts on a ½" Bolt 6, so that it is set at an angle to the output shaft 1, and therefore engages with the Pinion 7 on the output shaft during only part of each revolution.

No. 6 Novel Intermittent Motion Mechanism

Parts Required

1 of No. 6a	1 of No. 24	1 of No. 27a	6 of No. 37b	1 of No. 53
4 " " 12	1 " " 25	1 " " 28	8 " " 38	3 " " 59
2 " " 15b	1 " " 26	10 " " 37a	1 " " 47	2 " " 111a

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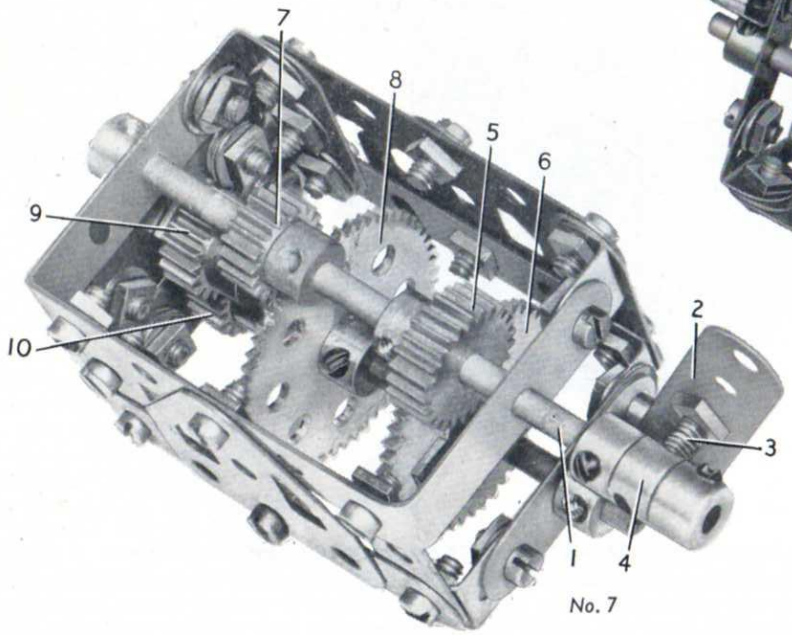
GEAR DRIVE AND REVERSING MECHANISMS

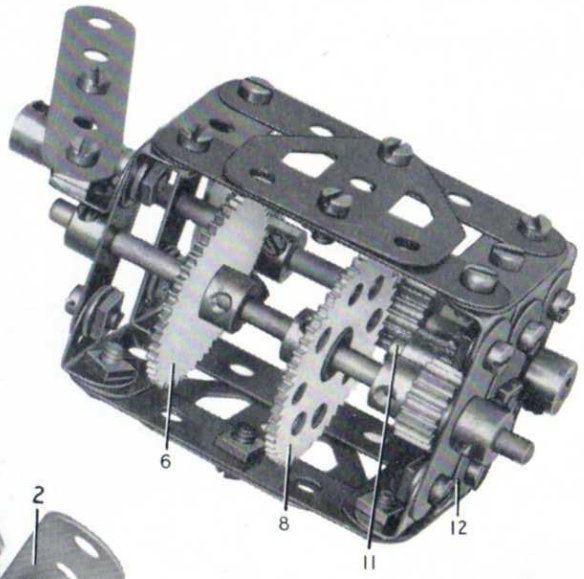
No. 7 TWO-SPEED AND REVERSE GEAR-BOX

In this two-speed and reverse gear-box the shaft 1 is slidable and is operated by the pivoted lever 2 through a ⅜" Bolt 3 that is fixed in the lever and screwed into the threaded hole of Collar 4.

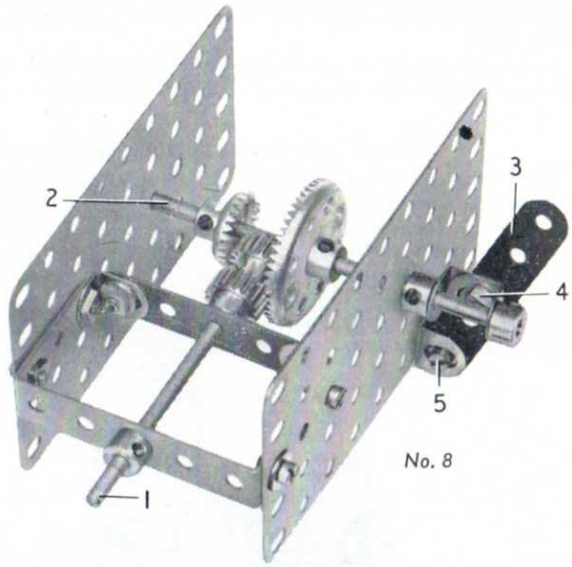
One speed is provided when the shaft 1 is slid to bring ¾" Pinion 5 into mesh with 50-teeth Gear 6, and a second speed when it is moved so as to engage ½" Pinion 7 with 57-teeth Gear 8. A reverse drive is provided through the ½" Pinion 7 and two further ½" Pinions 9 and 10. Pinion 9 runs freely on a ¾" Bolt 11 fixed by two Nuts in a 1½" Strip 12 attached to the sides of the gear-box casing by Angle Brackets.



No. 7



No. 7(a)



No. 8

No. 8 TWO-SPEED REVERSE GEAR

This mechanism gives a slow forward speed and a rapid reverse, or vice versa, and the driving power can be connected to either of the Rods 1 and 2.

The Rod 2 can be slid endways in its bearings by means of lever 3, which is pivotally attached by a Bolt with lock-nuts 4 to two Angle Brackets mounted on the Rod between Collars as shown. The lower end of the lever is attached by lock-nutted Bolt 5 to an Angle Bracket.

No. 7 Two-speed and Reverse Gear Box

Parts Required

4 of No. 5	1 of No. 16	1 of No. 27a	10 of No. 38	1 of No. 111
7 " " 6a	1 " " 25	27 " " 37a	1 " " 47	1 " " 111c
9 " " 12	3 " " 26	23 " " 37b	6 " " 59	2 " " 126a
1 " " 15b	1 " " 27			

No. 8 Two-speed Reverse Gear

Parts Required

2 of No. 5	1 of No. 16	1 of No. 29	7 of No. 38	4 of No. 59
5 " " 12	2 " " 26	12 " " 37a	1 " " 47	1 " " 111c
1 " " 15b	1 " " 28	8 " " 37b	2 " " 53a	

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GEAR DRIVE AND REVERSING MECHANISMS *(continued)*

No. 9 FORWARD AND REVERSE DRIVE

(2 : 1 Reduction in Reverse)

In some models it is desirable to have the forward drive faster than the drive in reverse and this mechanism might be useful in such circumstances.

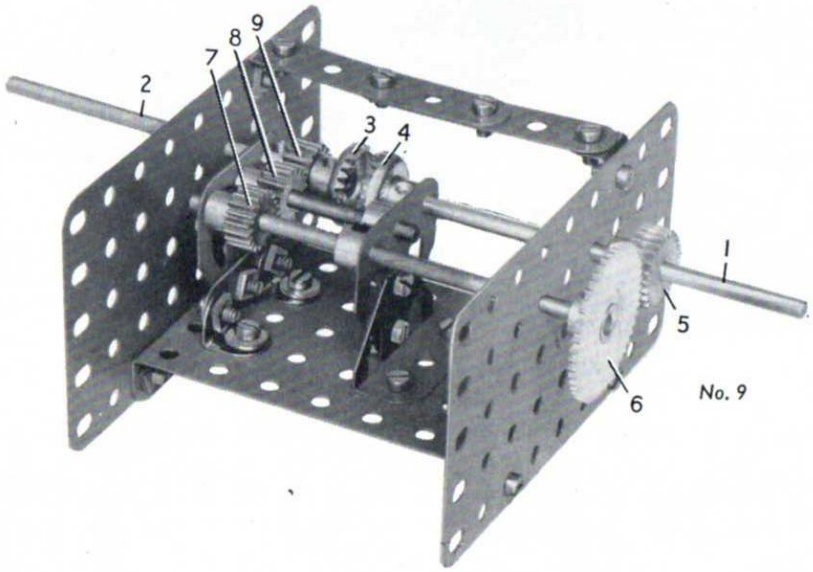
The input drive from the operating Motor is taken to shaft 1, which can be slid endways about $\frac{3}{16}$" in its bearings. A suitable lever arrangement for sliding this shaft might be built up similar to that used in the Two-speed Reverse Gear No. 8. The output drive is taken from shaft 2.

When shaft 1 is pushed right in, the two $\frac{3}{4}$" Contrates 3 and 4 are engaged and so provide a straight-through drive. When the shaft 1 is pulled outward, however, the $\frac{3}{4}$" Pinion 5 engages 50-teeth Gear 6 and the Contrates are disengaged. A reverse drive is thus transmitted through the $\frac{3}{4}$" Pinion, 50-teeth Gear and the three $\frac{1}{2}$" Pinions, 7, 8 and 9, the $\frac{3}{4}$" Pinion and the 50-teeth Gear providing a 2:1 reduction ratio.

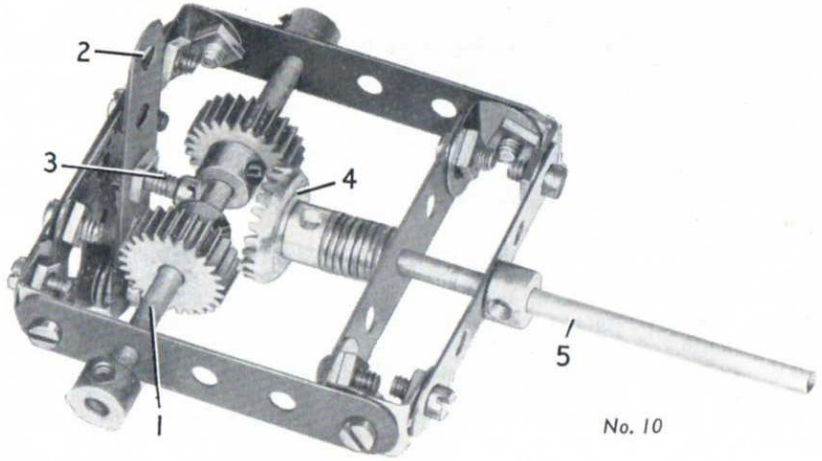
No. 9 Forward and Reverse Drive

Parts Required

2 of No. 5	1 of No. 16	1 of No. 27	2 of No. 38	3 of No. 59
1 " " 6a	1 " " 17	2 " " 29	1 " " 53	1 " " 126
4 " " 12	1 " " 25	19 " " 37a	2 " " 53a	2 " " 126a
2 " " 15b	3 " " 26	19 " " 37b		



No. 9



No. 10

No. 10 REVERSING MECHANISM

(1 : 1 Ratio)

The Motor drive is taken to shaft 1, which is slidable by means of the pivoted lever 2 and carries two $\frac{3}{4}$" Pinions. A $\frac{1}{2}$" Bolt 3 fixed to the lever engages between the bosses of the Pinions. By moving the lever to right or left either of the Pinions can be engaged with the $\frac{3}{4}$" Contrate 4 on the output shaft 5.

No. 10 Reversing Mechanism *(1 : 1 Ratio)*

Parts Required

6 of No. 5	1 of No. 16	16 of No. 37a	10 of No. 38	2 of No. 111c
6 " " 12	2 " " 25	12 " " 37b	3 " " 59	1 " " 126a
1 " " 15b	1 " " 29			

For new models and mechanisms to build see the
MECCANO MAGAZINE
which is published monthly

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GEAR DRIVE AND REVERSING MECHANISMS *(continued)*

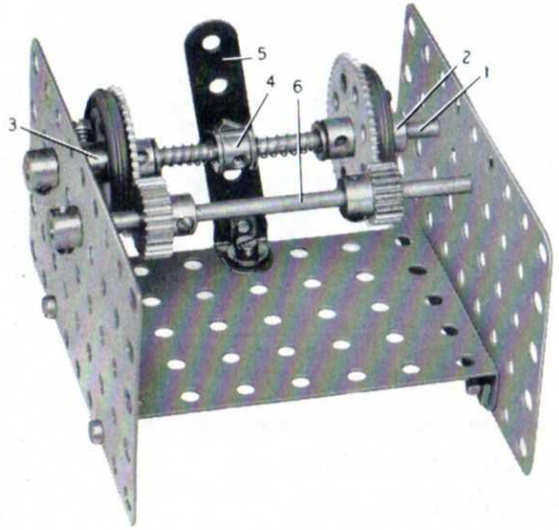
No. 11 CLUTCH-CONTROLLED GEAR-BOX WITH TWO-SPEED DRIVE

This is an efficient gear-box of the constant-mesh type in which it is not necessary to slide the shafts in order to change gear. Hence the driving connections are simplified and wear on gears is minimised.

The Motor power is taken to shaft 1 on which are *fixed* two 1" fast Pulleys 2 and 3 each fitted with a Rubber Ring. Placed against the Pulleys are a 50-teeth Gear and a 57-teeth Gear respectively, which are free on the shaft. Between the Collar 4, *which is loose on the shaft*, and each Gear, is a Compression Spring and two Washers.

The control lever formed by 2½" Strip 5, is pivotally attached at its lower end to an Angle Bracket, and a Bolt is held in its centre hole by a Nut. The shank of the Bolt is screwed into a threaded hole of the Collar 4 *but not sufficiently to lock the Collar to the shaft.*

When the lever is in its central position no drive is transmitted to the output shaft 6 carrying a ¾" and a ½" Pinion, but when the lever is moved either to right or left one of the Compression Springs is made to press its respective Gear against the Rubber Ring on its Pulley. Consequently the Gear commences to rotate solid with the shaft, while the other Gear continues to ride idly on it. In this way the drive can be transmitted to either of the Pinions on shaft 6 as required.

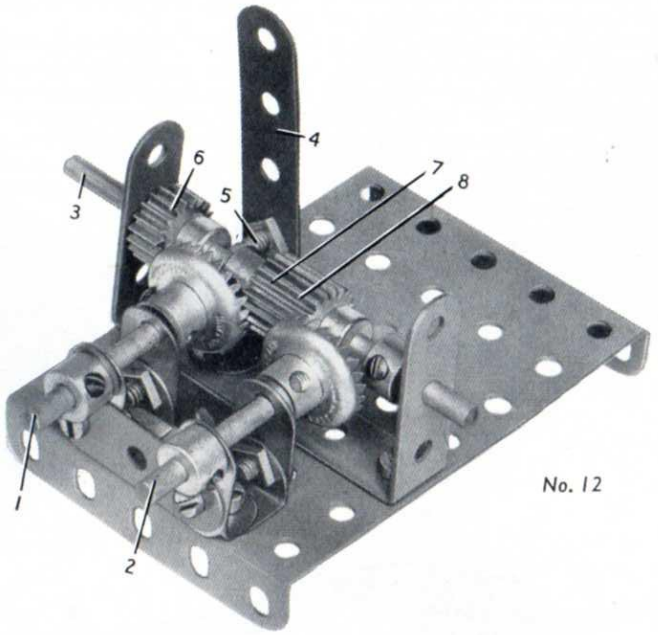


No. 11

No. 11 Clutch Controlled Gear-Box

Parts Required

1	of No.	5
1	" "	12
2	" "	15b
2	" "	22
1	" "	25
1	" "	26
1	" "	27
1	" "	27a
8	" "	37a
7	" "	37b
5	" "	38
1	" "	53
2	" "	53a
5	" "	59
2	" "	120b
2	" "	155



No. 12

No. 12 REVERSING GEAR *(1:1 Ratio)*

This mechanism gives a ratio of 1:1 in both forward and reverse positions so that the driving shaft 1 and driven shaft 2 always rotate at the same speed. The Rod 3 carries three ½" Pinions 6, 7 and 8, and is slidable by means of lever 4, which carries a ⅜" Bolt 5, the shank of which engages between the bosses of Pinions 6 and 7.

No. 12 Reversing Gear *(1:1 Ratio)*

Parts Required

1	of No.	5	5	of No.	12	3	of No.	26	10	of No.	37b	1	of No.	53
2	" "	6a	1	" "	16	2	" "	29	4	" "	38	3	" "	59
4	" "	10	2	" "	18a	12	" "	37a	1	" "	47	1	" "	111c

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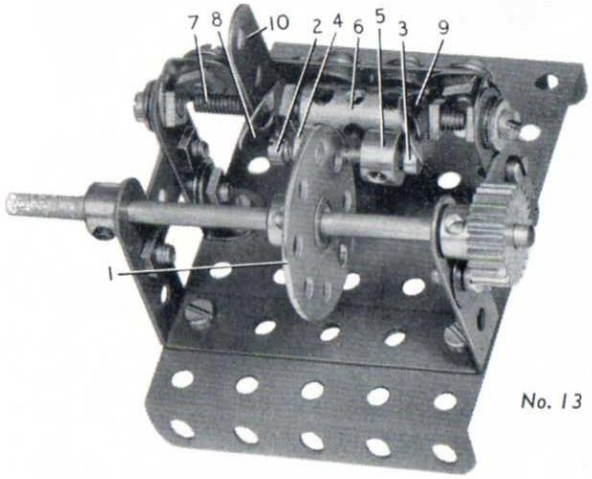
BRAKES

Friction brakes of many different types are in wide use in all branches of general engineering and transport and they range in size from a few inches to 20 ft. or more in diameter. Cranes, motor cars, aeroplanes, excavators, lifts, and in fact every machine that has motion to be arrested or controlled, makes use of some kind of braking apparatus, which may be operated manually or by some other form of power such as hydraulic or electric.

Many types of brakes can be faithfully reproduced in Meccano but so far as the model-builder is concerned those in which a strap or band can be tightened around the rim of a rotating wheel or drum are the most generally useful. Another very adaptable and widely used type of brake, particularly for motor vehicles, is that in which two or more pads or 'shoes' faced with friction material are arranged to contract externally, or expand internally, on to the surface of the brake drum.

Another type of brake now used on some fast sports and racing cars is the disc brake. In these the braking effect is achieved by mounting a metal disc or flange on an axle and positioning pads or brake shoes on either side of the rim, directly opposite to each other. Pressure can then be applied to the pads to bring the rotating disc and shaft to rest. Heat generated by the friction is quickly transferred from the point of contact to the complete metal surface of the disc, and the large surface area available is adequately cooled by the oncoming air stream when the brake is released and the car commences to build up speed again.

Three examples from the many different types of brakes that can be built with Meccano parts are included here.



No. 13

No. 13 FRICTION DISC BRAKE

The brake disc is represented by Bush Wheel 1 and the pressure pads by two ⅜" Bolts 2 and 3 held in Collars 4 and 5. The Collars are fixed by Grub Screws to the Coupling 6, which in turn is fixed by Bolts to the framework. A Screwed Rod 7 is carried freely in the bore of the Coupling and two Fishplates 8 and 9, slightly curved as shown, are locked on it between Nuts. The operating lever is a 1½" Strip 10 also locked to the Screwed Rod by Nuts.

The Fishplates 8 and 9 must be shaped by bending slightly so that when the lever 10 is pushed forward the Fishplates contact the heads of the Bolts 2 and 3 and so force them against the faces of the Bush Wheel.

No. 13 Friction Disc Brake

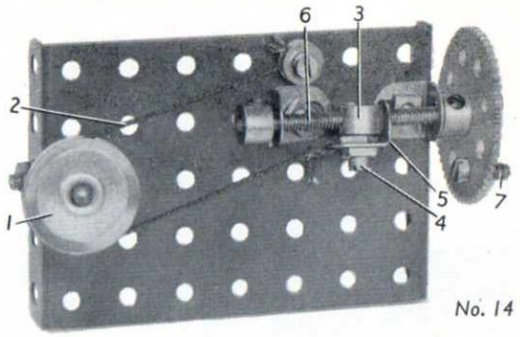
Parts Required

1 of No.	5	1 of No.	15b	19 of No.	37a	1 of No.	47	1 of No.	63
5 " "	6a	1 " "	24	16 " "	37b	1 " "	53	1 " "	81
2 " "	10	1 " "	25	14 " "	38	3 " "	59	2 " "	111c
4 " "	12								

No. 14 Powerful Screw-operated Brake

Parts Required

4 of No.	12	5 of No.	38
1 " "	18a	1 " "	40
1 " "	22	1 " "	53
1 " "	27a	3 " "	59
10 " "	37a	1 " "	81
4 " "	37b	2 " "	111c



No. 14

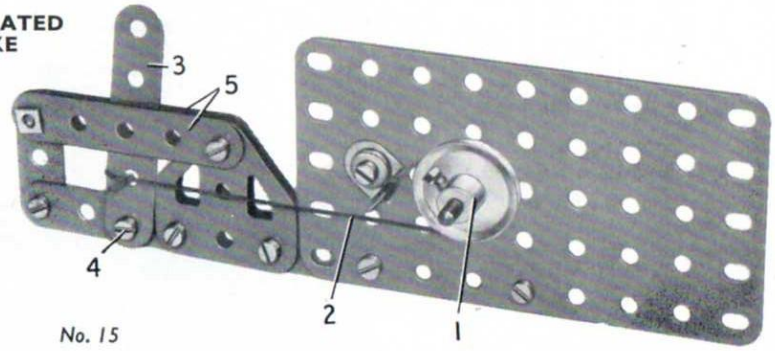
No. 14 POWERFUL SCREW-OPERATED BRAKE

This powerful type of brake is excellent for controlling crane winding and jib hoisting drums, but it has also many other useful applications.

Pulley 1 forms the brake drum, and the strap, represented by the Cord 2, is tightened or slackened around the Pulley by the screw-operated unit 3, which is a Collar placed on the protruding shank of a Bolt 4 fixed by two Nuts in Angle Bracket 5. The Collar is free to move in a horizontal direction when the Screwed Rod 6, which passes through its threaded holes, is turned by the hand-wheel 7.

When the Collar is moved outward the strap tightens around the brake drum, and slackens off when the Collar is moved inward.

No. 15 LEVER-OPERATED STRAP BRAKE



No. 15

Pulley 1 is fixed on the shaft it is desired to brake, such as the shaft of a crane winding drum. The brake strap is a length of Cord 2 anchored at one end to a suitable part of the frame of the model, then passed around the Pulley and finally tied near the lower end of a lever 3. The lever pivots on a lock-nutted Bolt 4 and moves between guides formed by two 2½" Strips 5 that exert just sufficient pressure on the lever to prevent it moving too freely.

No. 15 Lever-operated Strap Brake

Parts Required

1 of No.	2	3 of No.	12	12 of No.	37a	1 of No.	40	1 of No.	111a
3 " "	5	2 " "	17	8 " "	37b	1 " "	53a	2 " "	111c
1 " "	6a	1 " "	22	11 " "	38	1 " "	59	2 " "	126a

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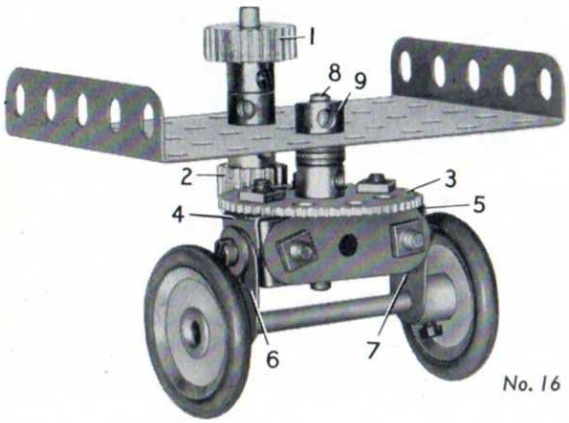
STEERING MECHANISMS



No. 16

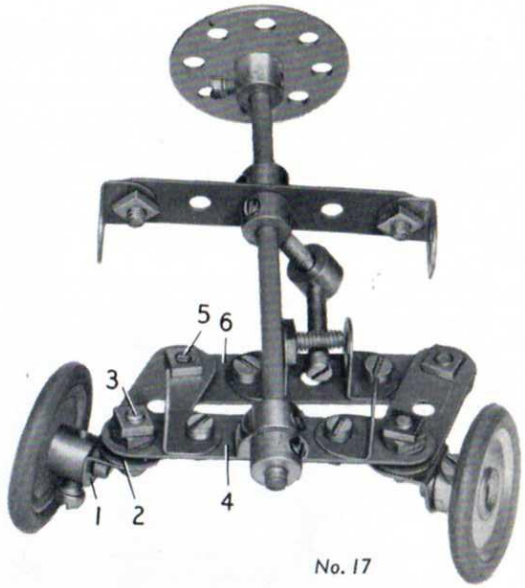
No. 16 CASTOR STEERING GEAR FOR MANOEUVREABILITY

Pinion 1 is actuated from the steering wheel of the vehicle, and Pinion 2 fixed on the same Rod, actuates Gear 3. The frame carrying the road wheels consists of two 1½" Strips joined together at each end by Angle Brackets. This frame is attached to the Gear 3 by Angle Brackets 4 and 5 at each end. The wheel axle is mounted in Fishplates 6 and 7. The Gear 3 is fixed to Rod 8, which is held in place by Collar 9.

No. 17 SIMPLE STEERING GEAR FOR SMALL VEHICLES

This is one of the more simple types of steering gear and is adaptable for use in various small model vehicles.

On each wheel assembly the Angle Bracket 1 and the 1½" Strip 2 are fixed by a Nut on ⅜" Bolt 3. The Bolt then passes through the 2½" Strip 4 and is held in place by two Nuts locked together. The other end of each 1½" Strip is fixed between two Nuts on a Bolt 5, which is *free to pivot* in the 2½" Strip 6.



No. 17

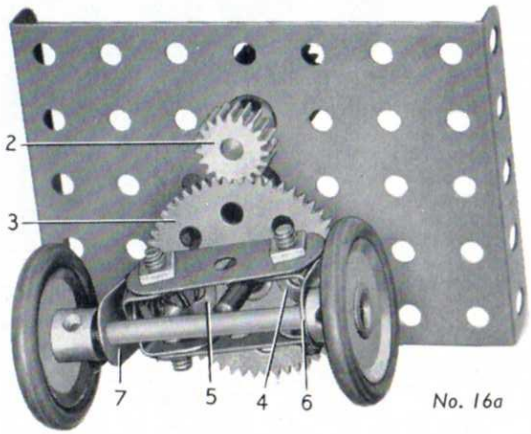
PRIZES FOR NEW MODELS

Model-building Competitions, in which fine Cash Prizes are offered for new and original Meccano models, are announced periodically in the *Meccano Magazine*.

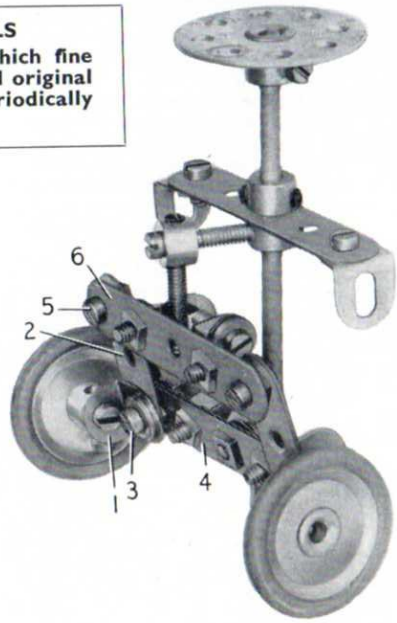
No. 16 Castor Steering

Parts Required

2	of No.	6a
2	„ „	10
6	„ „	12
1	„ „	17
2	„ „	18a
2	„ „	22
1	„ „	25
1	„ „	26
1	„ „	27a
8	„ „	37a
8	„ „	37b
7	„ „	38
1	„ „	53
2	„ „	59
2	„ „	155



No. 16a



No. 17a

No. 17 Simple Steering Gear

Parts Required

3	of No.	5	11	of No.	37b
2	„ „	6a	4	„ „	38
9	„ „	12	5	„ „	59
1	„ „	15b	2	„ „	111
2	„ „	22	1	„ „	111a
1	„ „	24	2	„ „	111c
18	„ „	37a	2	„ „	155

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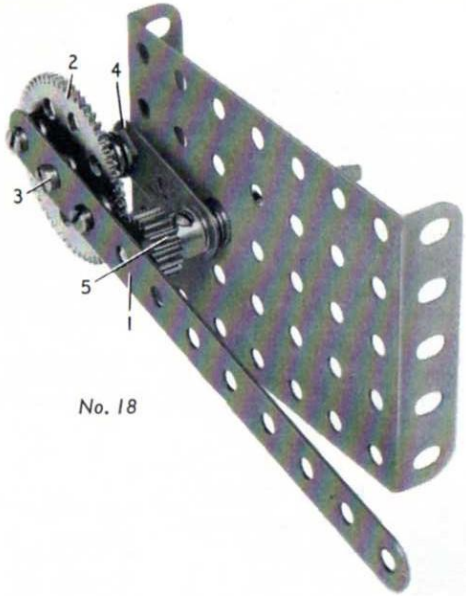
MISCELLANEOUS MECHANISMS



No. 18

No. 18 'SUN AND PLANET' MECHANISM

'Sun and Planet' gear was designed to convert reciprocating motion, such as that of a piston, into rotary motion like a crankshaft, and was used for this purpose in some early steam engines. In our example Strip 1 represents the engine connecting rod and is bolted to Gear Wheel 2, which is free to turn on a ¾" Bolt 3 fixed to a 1½" Strip 4. Washers on the ¾" Bolt space the Gear from the Strip. Strip 1 is also spaced from the Gear Wheel by Washers on each of the two securing Bolts so that the Strip may clear the Pinion 5 when in motion. The rotary drive is taken from the Rod carrying Pinion 5.

No. 18 'Sun and Planet' Mechanism

Parts Required

1 of No. 2	1 of No. 26	4 of No. 37a	14 of No. 38
1 " " 6a	1 " " 27a	2 " " 37b	1 " " 53
1 " " 17			1 of No. 59
			1 " " 111

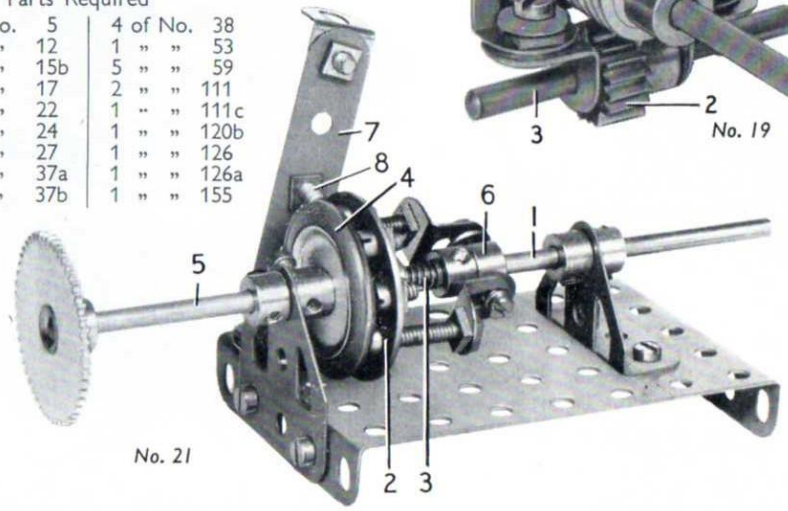
No. 21 FRICTION CLUTCH FOR MOTOR VEHICLES

The transmission shaft 1 carries a *free* Bush Wheel 2 and a Compression Spring 3. The Spring forces the heads of Bolts fixed in the Bush Wheel against a Rubber Ring 4 fitted to a 1" Pulley on the engine shaft 5. Two ¾" Bolts pass through two opposite holes of the Bush Wheel and are connected by Nuts to Angle Brackets that are free to slide on Bolts passed through their slotted holes into Collar 6. The pedal lever 7 is fitted with a ⅜" Bolt 8 that projects between the Rubber Ring and the Bush Wheel and forces the Bolts in the Bush Wheel out of contact with the Rubber Ring when the lever is depressed.

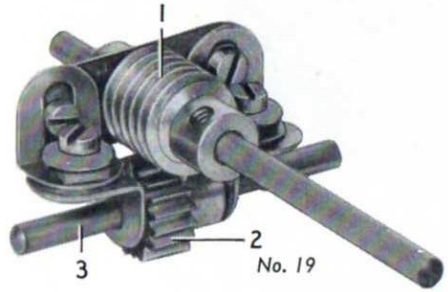
No. 21 Friction Clutch

Parts Required

1 of No. 5	4 of No. 38
4 " " 12	1 " " 53
1 " " 15b	5 " " 59
1 " " 17	2 " " 111
1 " " 22	1 " " 111c
1 " " 24	1 " " 120b
1 " " 27	1 " " 126
19 " " 37a	1 " " 126a
15 " " 37b	1 " " 155



No. 21

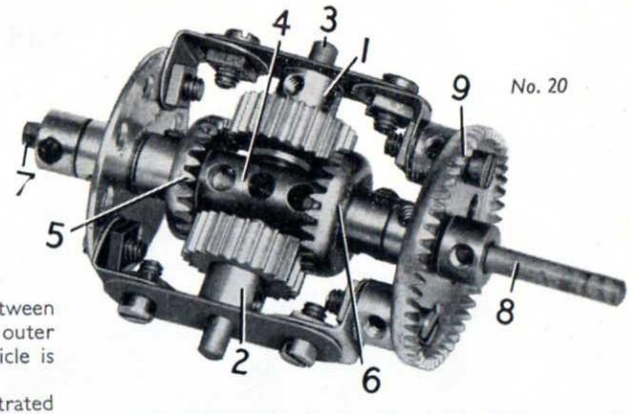


No. 19

No. 20 DIFFERENTIAL MECHANISM FOR MOTOR VEHICLES

The most general use of differential gearing is in the transmission system of a motor vehicle. Its object is to allow for the difference between the speeds of the inner and outer road wheels when the vehicle is turning a corner.

In the simple example illustrated the ¾" Pinions 1 and 2 are *free to turn* on a 2" Rod 3 *fixed* in the Coupling 4. The ¾" Contrates 5 and 6 are *fixed* on the Rods 7 and 8 respectively and engage the Pinions. Rods 7 and 8, which are the road wheel axles, protrude ¼" into the longitudinal bore of the Coupling. In a model car the differential would be driven from the gear-box transmission shaft through the 1½" Contrate 9.



No. 20

No. 20 Differential Mechanism

Parts Required

2 of No. 6a	2 of No. 29
4 " " 12	8 " " 37a
2 " " 17	6 " " 37b
1 " " 18a	2 " " 38
1 " " 24	4 " " 59
2 " " 25	1 " " 63
1 " " 28	2 " " 111a

No. 19 SIMPLE REAR AXLE DRIVE FOR CARS

This simple rear axle drive mechanism can be adapted for use in small model cars. The Worm 1 is fixed on the transmission shaft from the Motor, or gear-box if one is used, and the ½" Pinion 2 on the axle 3 of the rear road wheels. The axle 3 is mounted in the *round* holes of the two Angle Brackets that form its bearings.

No. 19 Simple Rear Axle Drive

Parts Required

1 of No. 6a	1 of No. 32
4 " " 12	6 " " 37a
1 " " 16	4 " " 37b
1 " " 17	2 " " 38
1 " " 26	1 " " 59

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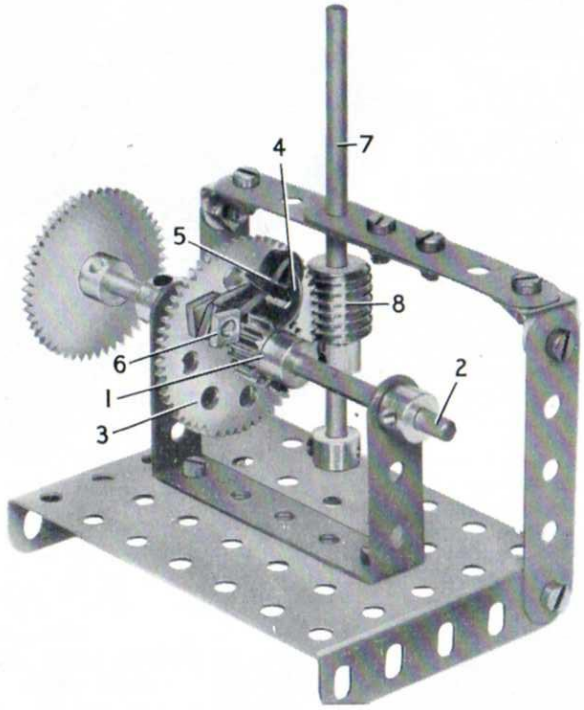
MISCELLANEOUS MECHANISMS *(continued)*



No. 22

No. 22 FREE WHEEL MECHANISM

The ½″ Pinion 1 is *fixed* to the Rod 2 but the 57-teeth Gear 3 is *free* on it. An Angle Bracket 4, loose on a Bolt in the 57-tooth Gear, is held against the teeth of the Pinion by the Rubber Band 5, which is looped through it and anchored at one end to the Bolt 6. In use the mechanism would be driven from Rod 7 through the Worm 8.

No. 22 Free Wheel Mechanism

Parts Required

4 of No. 5	1 of No. 26	1 of No. 32	7 of No. 38	5 of No. 59
3 " " 12	1 " " 27	15 " " 37a	1 " " 47	2 " " 111c
2 " " 15b	1 " " 27a	10 " " 37b	1 " " 53	1 " " 186

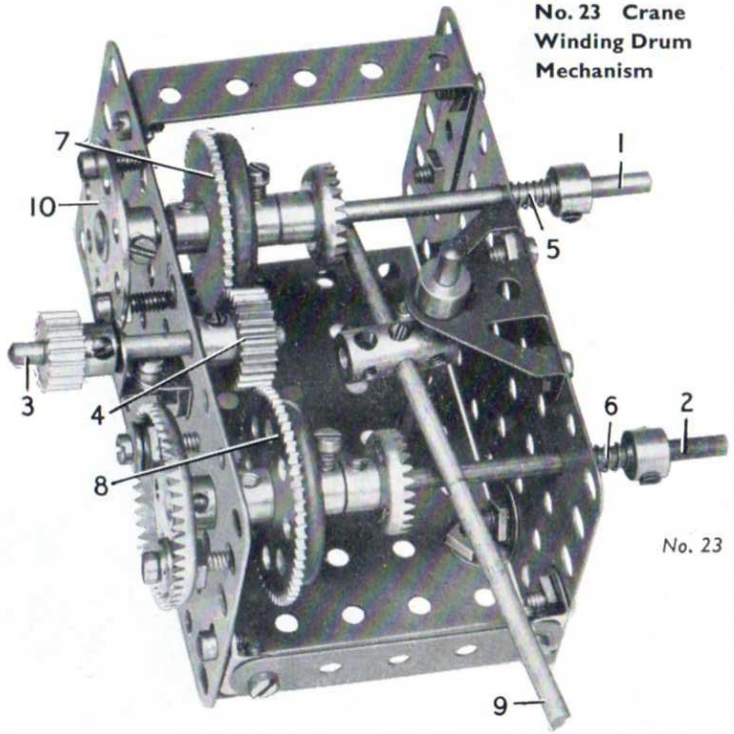
No. 23 CRANE WINDING DRUM MECHANISM

In this mechanism a single lever is used to control the jib-luffing and load hoisting and lowering drums, and a brake is automatically applied to each drum when not actually in use.

When the mechanism is used in a model the winding drums are fixed on Rods 1 and 2, and the Motor drive to each of these Rods is taken through Rod 3 and Pinion 4 and thence through a friction clutch. Each clutch consists of a 1″ Pulley with Rubber Ring fixed to shafts 1 and 2. These shafts are slidable in their bearings and are fitted with Compression Springs 5 and 6. Also on these Rods, *but not fixed to them*, are a 50-teeth Gear 7 and a 57-teeth Gear 8, which mesh with ¾″ Pinion 4, and a ¾″ Contrate Wheel. Normally the Gears rotate freely on the Rods but by moving lever 9 sideways, either of the 1″ Pulleys and its Rubber Ring can be pressed against Gears 7 or 8, when friction between the Rubber Ring and the Gear causes the Rod to rotate solidly with the Gear.

Rod 1 is fitted with a Bush Wheel 10 carrying two ⅜″ Bolts in opposite holes, and a similar arrangement is fitted to Rod 2, except that a 1½″ Contrate and ½″ Bolts are used. The Bolts engage in holes in the housing sideplates when the appropriate clutch is disengaged and so form an effective brake to prevent the winding drum from rotating.

No. 23 Crane Winding Drum Mechanism



No. 23

Parts Required

1 of No.	5
8 " "	12
1 " "	14
2 " "	15b
1 " "	16
1 " "	17
2 " "	22
1 " "	24
1 " "	25
1 " "	26
1 " "	27
1 " "	27a
1 " "	28
2 " "	29
26 " "	37a
20 " "	37b
6 " "	38
1 " "	47
1 " "	53
2 " "	53a
4 " "	59
1 " "	63
2 " "	111a
2 " "	111c
2 " "	120b
1 " "	126
2 " "	155

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MISCELLANEOUS MECHANISMS *(continued)*

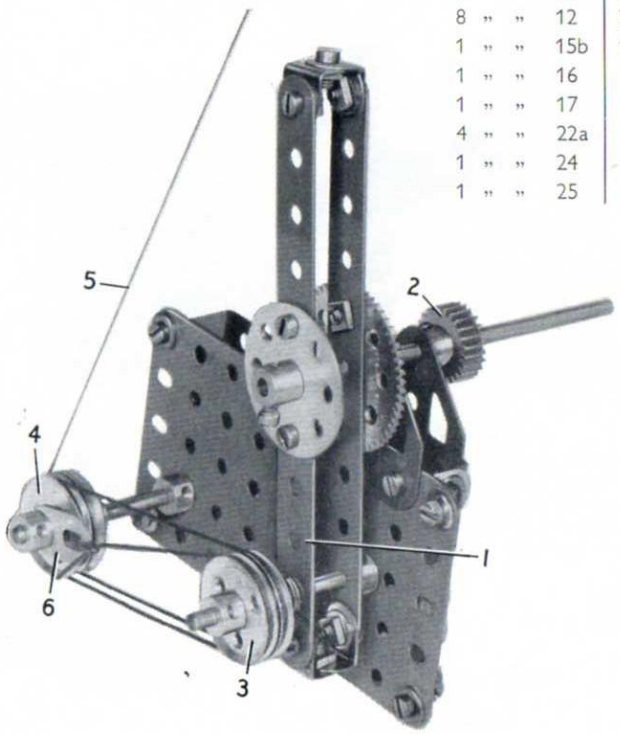
No. 24 AUTOMATIC REVERSING HOIST

This mechanism is suitable for operating a lift and making the cage rise and descend automatically. The arm 1 is driven from the Motor through the ¾" Pinion 2. The Pulleys 3 are loose on their Rod. Two other Pulleys 4 are also free on their Rod. The hoisting Cord 5 is connected to the lift cage and passes around both pairs of Pulleys and finally is tied to the Fishplate 6. When the arm is rotated the Cord 5 is drawn in and paid out automatically.

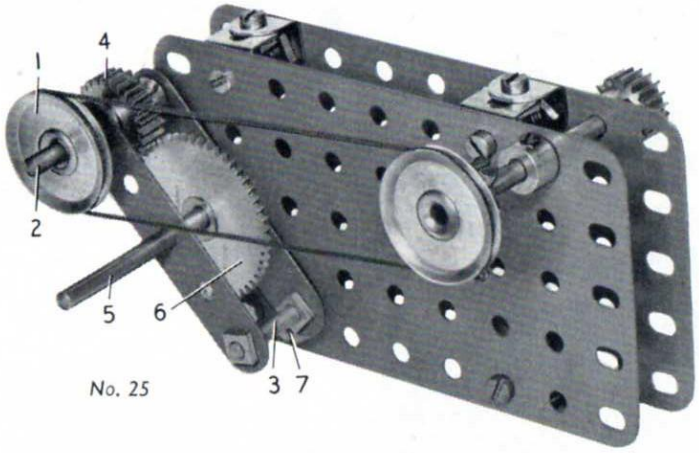
No. 24
Automatic Reversing Hoist

Parts Required

3 of No.	2	1 of No.	27a
1 " "	10	23 " "	37a
8 " "	12	23 " "	37b
1 " "	15b	18 " "	38
1 " "	16	1 " "	40
1 " "	17	1 " "	53
4 " "	22a	1 " "	53a
1 " "	24	6 " "	59
1 " "	25	2 " "	126a



No. 24



No. 25

No. 25 BELT TENSIONING DEVICE

The drive from the power unit is taken to the 1" Pulley 1 on Rod 2. This Rod is mounted in two 2½" Strips connected together by ¾" Bolt 3 and it carries ¾" Pinion 4. The 2½" Strips are *free to pivot* about the final drive shaft 5, which is fitted with Gear 6 that meshes with Pinion 4. Movement of the 2½" Strips is limited by Bolt 7.

When the mechanism is in motion the drive from Rod 2 is transmitted to the output shaft 5 through Pinion 4 and Gear 6, but at the same time the Pinion tends to climb round the teeth of the Gear carrying with it the 2½" Strips and Pulley 1 and so tightening the belt. This tendency increases as the load increases.

No. 25 Belt Tensioning Device

Parts Required

2 of No.	5	1 of No.	18a	1 of No.	26	13 of No.	37b	2 of No.	53a
8 " "	12	2 " "	22	1 " "	27a	10 " "	38	2 " "	59
1 " "	15b	1 " "	25	16 " "	37a	1 " "	40	1 " "	111
1 " "	17								

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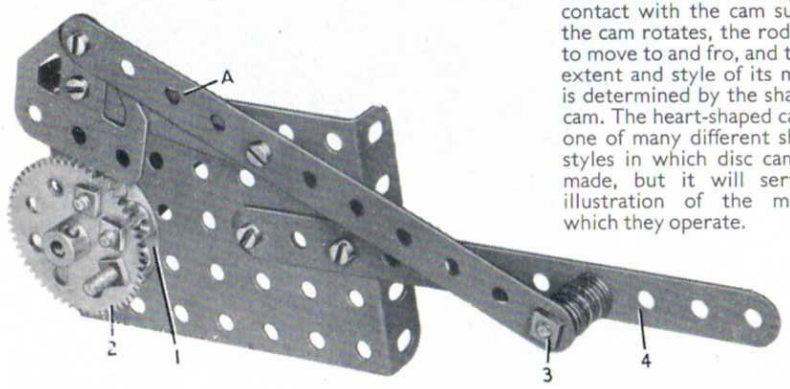
CAMS: *The Engineer's 'Maids of All Work'*

CAMS AND THEIR USES

Cams used in engineering are of many different kinds, shapes and sizes, and there are hundreds of ways in which they are used. The cam mechanism therefore, may truthfully be described as the 'engineer's maid of all work'.

The most simple form of cam is the disc cam and a representative of this type that will be familiar to the majority of model-builders is the eccentric used for operating the valve rod of a steam engine and causing it to move to and fro. An eccentric is simply a circular disc of metal mounted on a shaft 'off centre' — that is, the shaft does not pass through the centre of the disc, but at a point more or less 'off centre' as desired. The amount by which the disc is set 'off centre' is known as the 'throw' of the eccentric.

One of the most generally used cams is a machined piece of metal shaped roughly like a heart. This is mounted on a rotating shaft, and bearing against its perimeter is a roller or 'follower' as it is termed. The 'follower' is linked by some suitable means, such as a pivoted lever, to the mechanism the cam has to actuate. In other cases the roller is mounted at the end of a spring-loaded rod so that the roller is always kept in contact with the cam surface. As the cam rotates, the rod is caused to move to and fro, and the speed, extent and style of its movement is determined by the shape of the cam. The heart-shaped cam is only one of many different shapes and styles in which disc cams can be made, but it will serve as an illustration of the manner in which they operate.



No. 26

No. 26 ADJUSTABLE THROW CAM

No. 26 is an Adjustable Throw Cam, in which the extent of the movement imparted by the cam to the 'follower' or lever arm A can be varied. This is done by varying the number of Collars fixed on Bolts between the Bush Wheel 1 and the 57-tooth Gear 2. The lever arm A is fixed between Nuts on the Bolt 3, which is free to turn in its supporting Strip 4.

No. 26 Adjustable Throw Cam

Parts Required

2 of No. 2	1 of No. 24	7 of No. 37b	4 of No. 59
1 „ „ 5	1 „ „ 27a	12 „ „ 38	2 „ „ 111
1 „ „ 17	12 „ „ 37a	1 „ „ 53	2 „ „ 111a

1 of No. 126a
1 „ „ 126a

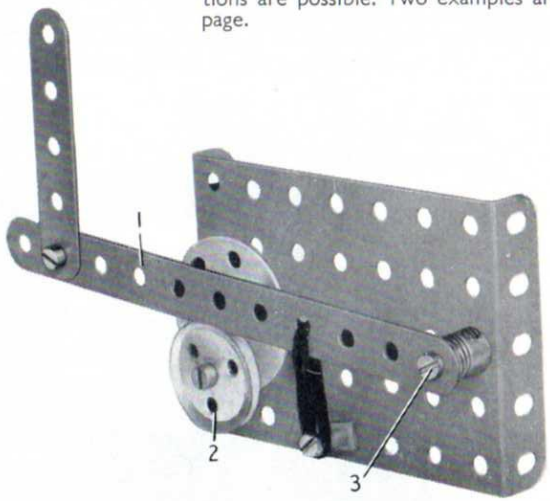
Other types of cams consist of a cylinder or a disc, in the surface of which a specially shaped spiral groove is cut. The 'follower' roller works in the groove and follows its path as the cylinder rotates.

Some cams are designed so that they will impart a uniform motion to the 'follower' roller, while others give a gradually accelerating motion until the peak of the movement is reached and then a sharp return to zero.

One of the most prolific fields in which cams are used is in the operation of the tools and tool-heads on automatic screw-cutting and similar high-production machine tools.

Another common application is found in motor car engines, where they are often used to provide the short sharp lift to the valves of the engine. In this case several cams are located on a single shaft, their positions differing radially. This assembly is known as a camshaft.

Cams are used for a large number of purposes in Meccano model-building, and many different constructions are possible. Two examples are shown on this page.



No. 27

No. 27 SMOOTH ACTION CAM

With a cam of this kind a smooth steady rise and fall is imparted to a 5½" Strip 1 riding in the groove of a 1" Pulley 2. The Pulley is mounted on a ⅜" Bolt fixed in a hole of the Bush Wheel and is spaced from the Bush Wheel by a Washer. The 5½" Strip is held in contact with the Pulley by a Driving Band and is free to pivot on a ¾" Bolt 3. The Driving Band is looped through the 5½" Strip and anchored to a Bolt fixed to the framework.

No. 27 Smooth Action Cam

Parts Required

1 of No. 2	1 of No. 22a	8 of No. 37a	1 of No. 53	1 of No. 111a
1 „ „ 5	1 „ „ 24	1 „ „ 37b	2 „ „ 59	1 „ „ 111c
1 „ „ 17	1 „ „ 25	7 „ „ 38	1 „ „ 111	1 „ „ 186

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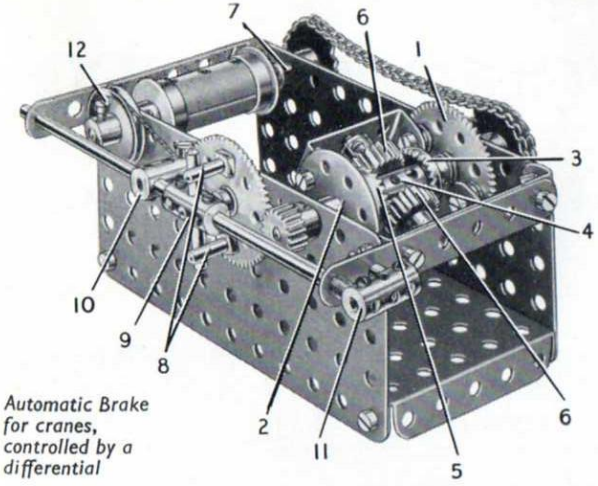
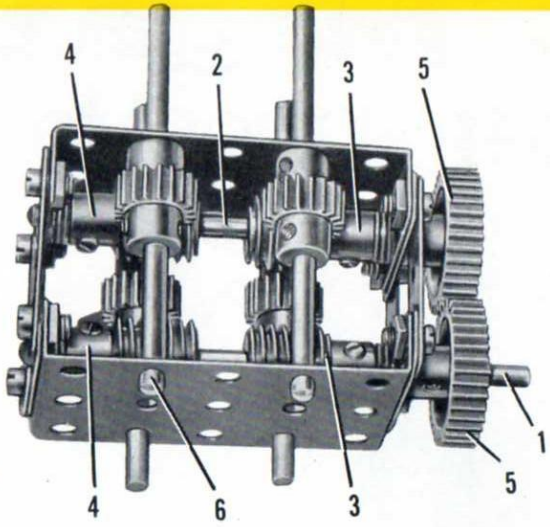
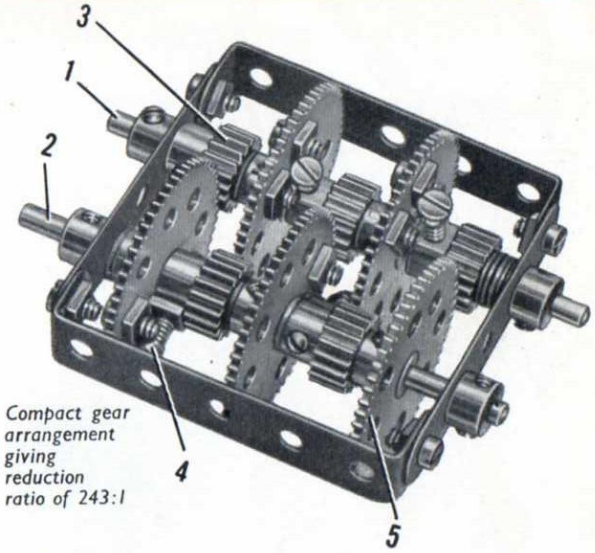
MORE FASCINATING MECHANISMS BUILT WITH MECCANO



Automatic Brake for cranes, controlled by a differential

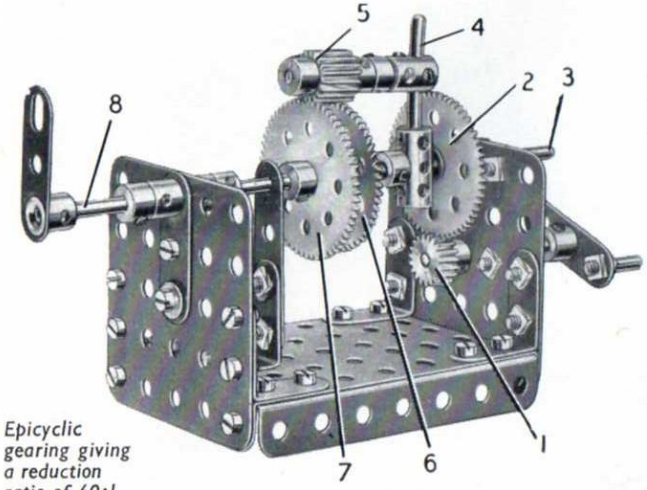


Neat 4-movement gear-box suitable for model cranes



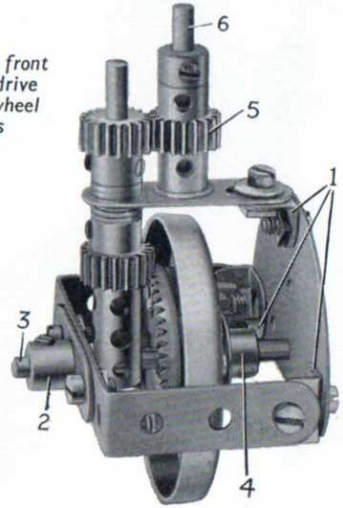
Compact gear arrangement giving reduction ratio of 243:1

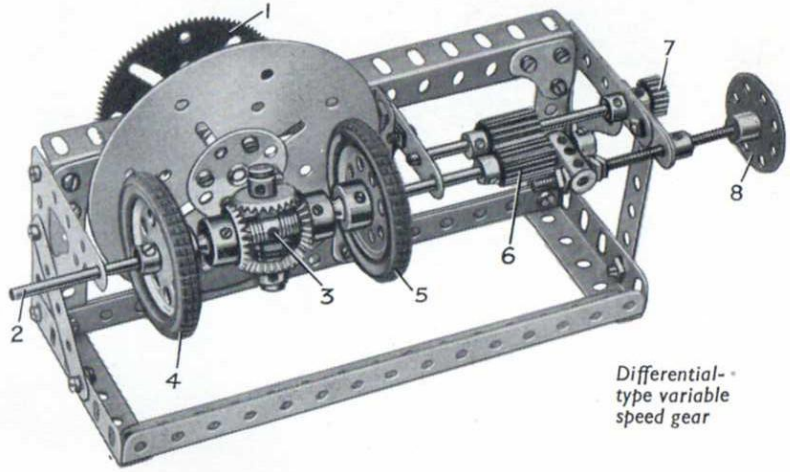
Almost any kind of mechanical movement can be reproduced with the aid of Meccano parts and the examples of advanced mechanisms shown on this page indicate the scope available to the keen experimenter. All Meccano parts are available for separate sale, and by adding further gears and other parts to the contents of your Mechanisms Outfit all the devices illustrated here, and hundreds more, will come within your scope.



Epicyclic gearing giving a reduction ratio of 60:1

Pivoted front wheel drive for 3-wheel vehicles





Differential-type variable speed gear

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MECCANO Magazine – QUARTERLY

Helps you make the most from your Meccano

"Meccano Magazine Quarterly" (MMQ) is THE magazine for Meccano modellers. It gives a regular supply of new models to build – big and small; built from particular Meccano Sets, and "special" non-set models. It gives hints on ways of overcoming problems and improving model building and it features useful mechanisms to bring added movement to your models.

MMQ is very much the Meccano modellers' OWN magazine. It features models built by readers and brings ideas and news from readers to readers. It includes regular reports from Meccano Clubs around the world and generally keeps everybody in touch with current Meccano activity.

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