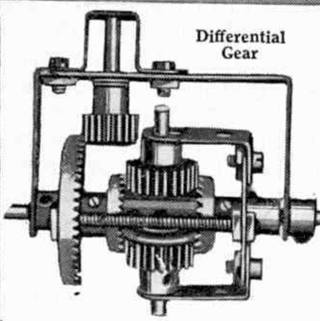


Suggestions Section

Edited by "Spanner"

(129)—Meccano Combination Safe Lock

No comparison can be made between the crude locks of primeval man, who sought by means of a wedge or piece of wood to bar the door of his hut against both human and animal foes, and the ingenious time lock of the modern safe. Yet it may be said that the one is the direct ancestor of the other, for both are locks, in a sense, although at the very extremes of their class.

Modern safes, or strong rooms, as the larger variety should more correctly be called, are certainly marvels of the engineer's art. For example, an improved type of strong room recently introduced by a well-known British firm of safe makers is claimed to be burglar-, fire-, and even earthquake-proof! It has a door 24″ thick that is secured in position by twenty-four bolts. The bolts are so controlled by a complicated system of time locks that they cannot be moved until a certain set time has elapsed. The time may be anything from a few hours to a few weeks, but it is practically impossible to open the door until the allotted period has elapsed.

All safes are not quite so big as this, of course, but the smallest and most innocent-looking safe may have unpleasant surprises in store for those who attempt a little amateur safe-breaking! For instance, some safes resent being touched and if so treated they promptly ring a gong and thus spread the alarm. Electric shocks, too, may come the way of those who attempt without authority to investigate the interior of a safe. On the whole, safe-breaking is not a profession we advise any of our readers to go in for!

The Meccano combination safe lock illustrated in Figs. 129 and 129a is intended to demonstrate the principles underlying the working of a typical combination lock.

The safe door consists of four 5½″ Angle Girders to which are bolted two 5½″ × 3½″ Flat Plates. Collars forming the movable portions of the hinges are secured to one of the 5½″ Angle Girders as indicated.

The two combination dials 1 and 2 (Fig. 129) consist of circular cardboard discs pasted to Bush Wheels. They are graduated round their peripheries by equally-spaced markings, which should be numbered or lettered. The 1½″ Rods on which the Bush Wheels are mounted are journalled in Double Arm Cranks bolted to the front of the 5½″ × 3½″ Flanged Plates and Worms 4 and 5 secured on their inner ends engage with ½″ Pinions on the 3½″ Rods 6 and 7. These Rods are free to slide in 1″ × 1″ Angle Brackets bolted to the Flat Plates, and Strip Couplings 8, 9 are secured on their ends.

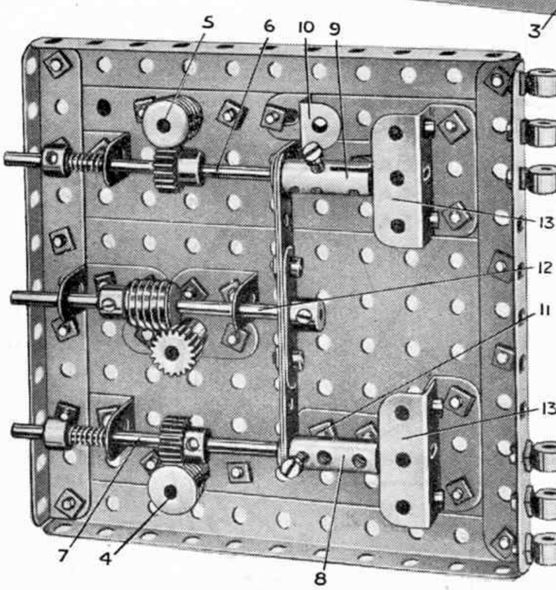


Fig. 129a. Reverse Side of Door

A connecting piece, consisting of two 3½″ Strips placed together face to face and bolted to a Double Arm Crank, is placed on the Rods 6 and 7 behind the Strip Couplings 8 and 9, and is secured to the end of the Rod 12 by the Double Arm Crank. A Worm secured to the latter Rod engages with a ½″ Pinion on the end of the short Rod to which the handle 3 (Fig. 129) is attached.

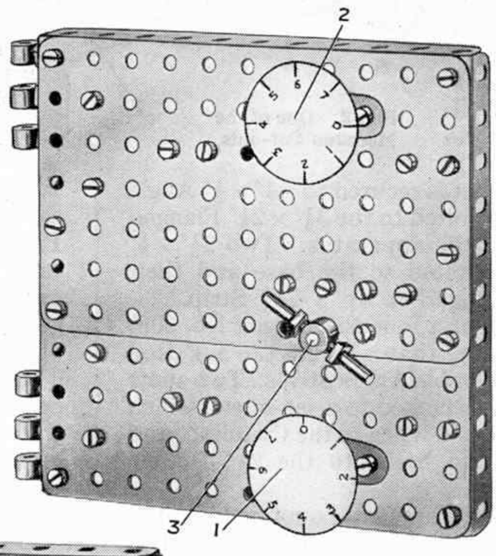


Fig. 129
Front of Safe Door

As will be seen, the handle consists of a new style Collar, or the "spider" from a Universal Coupling, with two Threaded Pins inserted in its set-screw holes. On turning the handle the Worm on the Rod 12 functions as a rack and Rods 6, 7 and 12, which represent the three bolts, will be moved to the right—provided, of course, that the slots in the ends of the Strip Couplings 8 and 9 coincide with the edges of the 1½″ Angle Girders 13.

The ⅜″ Bolts inserted in the Strip Couplings limit the amount the latter may turn by striking against the stops 10 and 11. The stop 10 takes the form of a ½″ Reversed Angle Bracket, while stop 11 is the shank of a Bolt. When the safe door is locked the ⅜″ Bolts should butt against their respective stops, but by turning each dial a pre-determined number of complete turns and fractions of a turn, as denoted by the numbers on the circumference of the dial, the slots in the ends of the Strip Couplings are brought opposite the edges of the Angle Girders 13. The bolts may then be shot back by means of the handle 3 and the door may be opened.

In order to bring the Strip Couplings to the required positions it might be necessary, for example, to revolve the dial 1 ten complete turns and a fraction of a turn, say to the third division, while the dial 2 might have to be rotated only a fraction of a turn.

When the door is closed again and the handle 3 released, the bolts 6, 7 and 12 are shot back into the bolt holes in the jamb of the safe by means of the Compression Springs placed on each of the bolts 6 and 7. The positions of these Compression Springs are indicated clearly in Fig. 129a.

It should be an easy matter to build a very interesting and efficient model safe incorporating this lock mechanism. The two sets of Collars shown attached to one side of the door form sections of the hinges, and corresponding sets of Collars should be secured to the safe. A built-up hinge of this type was illustrated and described under Suggestion No. 107 (see December, 1927, "*M.M.*").

The construction of Meccano lock mechanism provides endless opportunities for the exercise of one's inventive abilities, and we hope many Meccano boys will be prompted by this model to design a lock according to their own ideas. It should not be impossible to build a Meccano safe that would be practically burglar proof.

(270) Combination Padlock

(E. Heneage, Harrogate)

The device consists of two parts, which are shown separately in the illustration. Four $1\frac{1}{2}'' \times \frac{1}{2}''$ Double Angle Strips, bolted in the radial slots of a Face Plate, hold in position five Wheel Flanges. The bolt heads are on the outside of the Face Plate and a second nut is threaded on each Bolt, making it impossible for the Bolts to be undone when the lock is assembled. The Wheel Flanges are inserted by bending one of the Double Angle Strips outward and replacing it when they are in position. A 2″ Screwed Rod is fitted in the Boss of the Face Plate and carries the Coupling 3. Five Collars are fixed on the Rod 1 with a small space between each, and carry Set Screws arranged in line. Strips of paper are gummed round the edges of the Wheel Flanges, and numerals or letters marked on each strip.

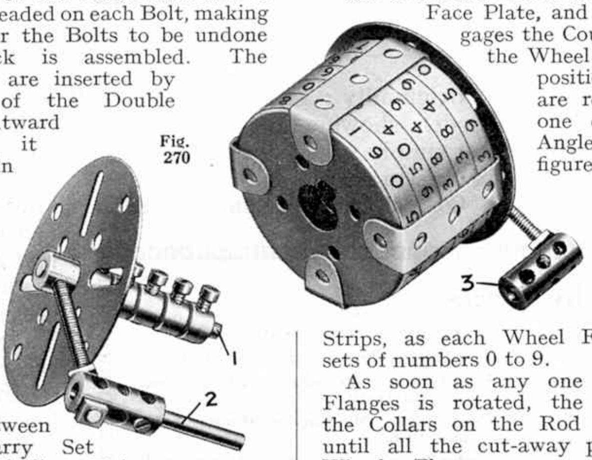


Fig. 270

The cut-away portions in the centres of the Wheel Flanges, when arranged in line, allow the Set Screws in the Collars on the Rod 1 to pass through unimpeded. The end of the Rod fits into the boss of the Face Plate, and the Rod 2 engages the Coupling 3. With the Wheel Flanges in this position the numbers are read off against one of the Double Angle Strips. If figures are employed it will be necessary to take the readings against two different Double Angle Strips, as each Wheel Flange has two sets of numbers 0 to 9.

As soon as any one of the Wheel Flanges is rotated, the withdrawal of the Collars on the Rod 1 is prevented until all the cut-away portions of the Wheel Flanges are again in line, so allowing a free passage for the Set Screws.

(271) Double-Acting Feed

(R. Beauchamp, Poitiers, France)

An ingenious double-acting ratchet feed device is shown in Fig. 271. This imparts rotary movement to the Sprocket Wheels on both the forward and return strokes, the Wheels being stationary only when the driving Crank passes the "dead centres." The mechanism can be used for driving a conveyor where a slight periodic pause is required, and it may be used in certain cases instead of the more usual form of Ratchet Gearing.

The Rod carrying the Crank 1 is journalled in Flat Brackets bolted across the elongated holes of two simple Bell Cranks, and carries in addition a $\frac{1}{2}''$ Pinion and a Collar. The Eye Piece 3 is securely held on a Threaded Pin and in it a $3\frac{1}{2}''$ Strip is free to slide. A Rack Strip is secured to the Strip, but spaced from it by Washers; and at each end a $1\frac{1}{2}'' \times \frac{1}{2}''$ Double Angle Strip is fixed. The Pawls 4 are mounted on Pivot Bolts passed through the Rack Strip, and the heads of the Bolts are placed between the $3\frac{1}{2}''$ Strips and Rack Strip so that they do not foul the Eye Piece 3. A length of Spring Cord is attached to the Pawls to hold them in position in the chain that passes round the Sprockets at each end of the frame.

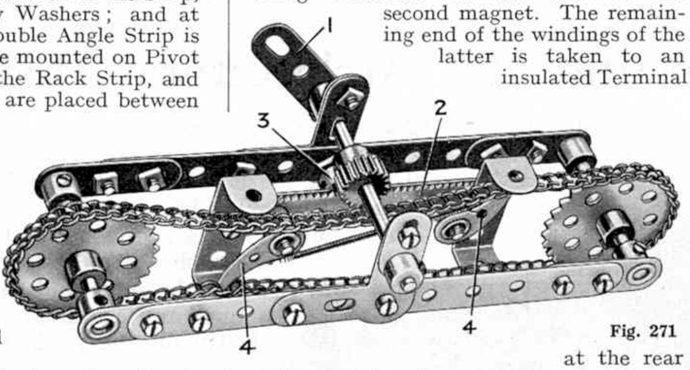


Fig. 271

To operate the device, the Crank 1 is pivotally attached to a connecting link that is pivoted at its other end to a crank, which rocks it to and fro. The movement is transmitted through the Rack and Pinion to the sliding frame, and as this moves to the left the leading Pawl engages the Chain and rotates the Sprocket Wheels. When the movement of the frame is reversed the other Pawl engages the Chain, which continues to move in the same direction, and on the return stroke the first Pawl trails idly over the links.

(272) Magnetic Engine

(G. Hugel, Mulhouse, France)

The novel form of electric engine illustrated in Fig. 272 can be operated successfully from a pocket lamp battery. A pair of electro-magnets form the motive power, and their energy is converted into rotary mechanical motion in an extremely interesting manner. The electro-magnets consist of Bobbins wound with No. 26 gauge cotton-covered Wire, and covered with paper to protect the windings. They are attached to the base plate by means of Pole Pieces, and one end of one magnet winding is attached to an insulated Silver-tipped Contact Screw 2, its other end being attached to one end of the second magnet. The remaining end of the windings of the latter is taken to an insulated Terminal at the rear of the model, and a second Terminal is provided that is in metallic contact with the plate.

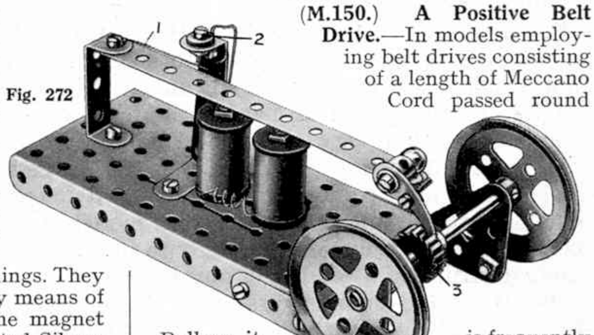


Fig. 272

The battery is connected to the Terminals at the back of the base Plate, and the current flows along the wire contact 1 to the bolt 2 and eventually to the magnets. These attract the $5\frac{1}{2}''$ Strip, which is drawn downward; and its movement causes the Pawl on its outer end to rotate the Ratchet Wheel 3 through a fraction of a revolution. As soon as the Strip is attracted to the magnets the contacts break apart so that the Strip keeps moving up and down.

Miscellaneous Suggestions

Under this heading "Spanner" replies to readers who submit interesting suggestions regarding new Meccano models or movements that he is unable to deal with more fully elsewhere. On occasion he offers comments and technical criticisms that, he trusts, will be accepted in the same spirit of mutual help in which they are advanced.

(M.149.) Winder for Aeroplanes.—To wind an elastic-driven aeroplane by hand is a very tedious operation, and there is always a possibility of the hand slipping, often with painful results, as many who have tried this method will know! The time-saving device suggested by D. Brobyn (Norbury, S.W.16), will be a boon to all those who favour the elastic motor for propelling their aircraft.

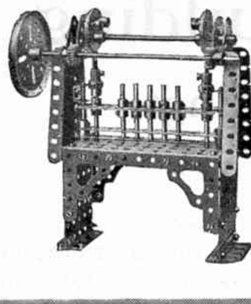
The essential part of the mechanism is a Clockwork Motor, the driving shaft of which is fitted with a large Fork Piece that engages the aeroplane propeller. The Motor is secured to a stand in such a manner that its height from the ground can be varied, so that it can be used for aeroplanes of different types and sizes. If the models for which it is intended require more power to wind them, a stage of reduction gearing is arranged between the Motor driving shaft and the rod carrying the Fork Piece.

By this means the propeller of the aeroplane can be given approximately the same number of turns for each wind. Thus a full length of run is ensured, and the possibilities of overwinding the elastic are greatly reduced.

(M.150.) A Positive Belt Drive.—In models employing belt drives consisting of a length of Meccano Cord passed round Pulleys, it is frequently difficult to get a positive drive. To ensure that the Pulleys grip the cord, J. Erdington (Manchester) places a small rubber band in the groove of each Pulley, so that the cord rests on the rubber. He claims that this method is more satisfactory than using a rubber band for the belt, as cord transmits a more powerful drive, and does not stretch, or break, like rubber if called upon to withstand a heavy load.

(M.151.) Differential for Small Models.—J. Whitley (Leeds) suggests a compact differential gear that is very suitable for use in small models, especially when the supply of gears is limited. The device is extremely simple, but not so efficient as a built-up unit using Bevels, or Contrates and Pinions. The rear driving axle is in two pieces, and on the inner end of each Rod is a 1″ Pulley Wheel fitted with a $\frac{5}{8}''$ Rubber Ring. The two Pulleys are placed close together so that there is sufficient friction between the two Rubber Rings to make the two halves of the rear axle rotate as one unit.

Only one Rod is driven, so that on taking a corner the tendency for one road wheel to rotate faster than the other overcomes the friction between the Rubber Rings, and the two sections of the back axle rotate independently so avoiding wheel slip.



Suggestions Section

Edited by "Spanner"

(287)—Combination Safe Door Lock (G. Whalley, Ottawa, Ont., Canada)

The safe door shown in Fig. 287 is fitted with a combination lock that is absolutely fool-proof. Only one dial is necessary for obtaining the combination, and a second knob 2 is used for withdrawing the bolts. The handle 3 is provided for opening the door, but this in no way controls the mechanism of the lock. The construction of the safe door and frame is clear from the illustrations (see Figs. 287 and 287b). The door is made of four 5½″ × 3½″ Flat Plates and two 5½″ × 2½″ Plates, secured to four 9½″ Angle Girders. The frame is constructed from Angle Girders and Flat Girders, and the safe should be built round this. If insufficient parts are available for the complete safe, this may be made of sheet metal bolted to a framework of Angle Girders, or may even consist of a wooden box.

The door and frame need not be of the same size as shown, and should be built to suit individual requirements. The hinges are of the type that have previously been described in this section. The Collars 4 are fixed to the door and the Collars 5 to the frame. They are secured by bolts inserted in their tapped holes and spaced from the Angle Girders by Washers. Each bolt also carries a Washer beneath its head. A 2½″ Rod is passed through the Collars and is firmly held by Grub Screws in the Collars 4, but is free to turn in the others.

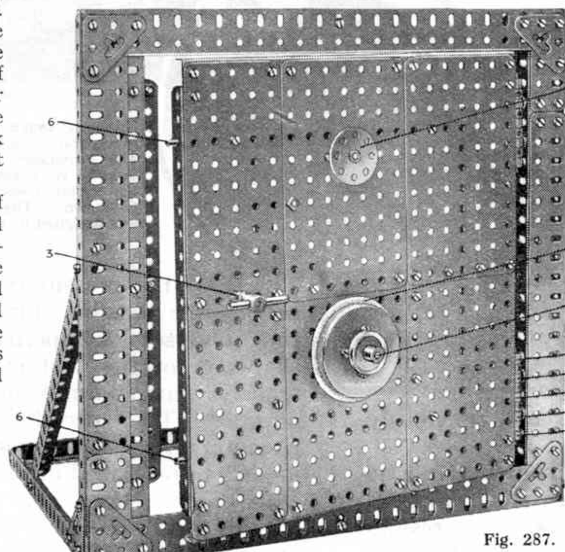


Fig. 287.

The bolts 6 can be seen projecting slightly in Fig. 287 and their arrangement is shown in Fig. 287b. Two 8″ Axle Rods form the bolts and are connected across their ends by a further 8″ Rod. The Rods 6 slide in Angle Brackets spaced from the door by Washers, and it is important that the Angle Brackets should be in line with the holes in the Angle Girders, so that the Rods slide freely. The Rod 7 is journalled in the boss of a Double Arm Crank and carries the Bush Wheel 2 (Fig. 287) and a ½″ Pinion that engages with a Worm on the upper bolt.

The housing for the tumblers is made from two 3½″ × 2½″ Flanged Plates and one 4½″ × 2½″ Flat Plate. Two 3½″ Angle Girders are bolted to the sides, and the structure is braced by 1½″ Corner Brackets. The tumblers are shown removed in Fig. 287a. Each consists of a Face Plate loose on the Rod and carrying four 2½″ Curved Strips fixed in place by Flat Brackets. A gap is left in each set of Strips as is shown in the illustration. The Bush Wheel 9 is fixed to the Rod and carries a Threaded Pin. Three Washers space the Bush Wheel from the first Face Plate and the remaining Plates are each spaced apart by one Collar and four Washers. A Collar placed behind the end Face Plate holds them all in position. Two of the Face Plates are provided with two Threaded Pins each placed as shown at 10 and 11, and the third Plate carries only one Threaded Pin 12. The Rod 8 passes through the safe door and carries a Face Plate 1 (Fig. 287) to which a piece of paper carrying the numbers is glued. A Wheel Flange is bolted to the Face Plate and a 1″ Pulley on the end of the Rod finishes off the knob.

The 4½″ Rod 13 is fixed in a Double Arm Crank bolted to the safe door and carries a Boss Bell Crank that is loose on the Rod but retained in position by a Collar. Six 2½″ Strips 14 are fixed between the arm of the Bell Crank and a Crank at the other end of the Rod, by means of 1″ × 1″ Angle Brackets. Two 2½″ Strips 15 are bolted to the Bell Crank and carry a Threaded Boss. When the Strips 14 are in the raised position the Threaded Boss prevents the bolts from being withdrawn on account of the Rod 16. As soon as the tumblers are arranged with all the gaps in the Curved Strips in line immediately beneath the Strips 14, the latter drop into place and the Threaded Boss on the Strips 15 no longer prevents the bolts from being shot back. A 1″ Screwed Rod prevents the Strips 15 from moving back too far, so that by turning the dial again the Strips 14 are raised. Pendulum Connections are arranged to bear on each set of Curved Strips and serve as brakes to prevent the tumblers from rotating too freely.

To find the combination the following procedure should be adopted: Turn the dial until all the Threaded Pins on the Face Plates are engaged, and note the reading when the gap in the third tumbler takes up its correct position. The reading should be taken against a certain hole in one of the Plates, the omission of a pointer making it more difficult for the safe to be opened in the event of the would-be safe-breaker finding out the combination. Having obtained the first reading, turn the dial in the reverse direction for two complete turns, and then note the reading when the second tumbler is correctly placed. Now turn the dial in the original direction for one complete turn and continue turning slowly until all three tumblers are correctly arranged for the Strips 14 to drop.

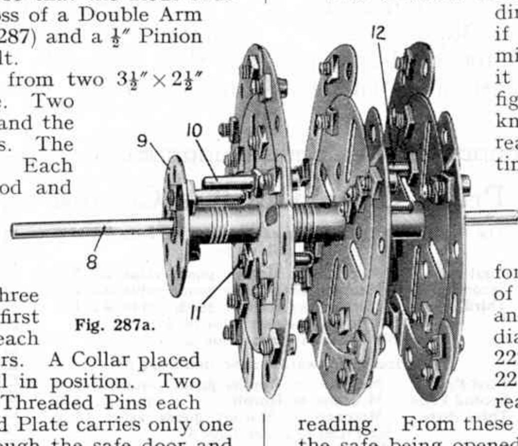


Fig. 287a.

Two different combinations may be taken, according to the direction of rotation of the dial. For instance, if turned clockwise first, the combination might be 3321515. By writing it this way it would be difficult for a person finding the figures to open the safe, but to the one who knows, they would mean that the first dial reading is 33 after turning the knob several times in a clockwise direction. It is then necessary to give two complete turns in the opposite direction and continue turning until a reading of 15 is obtained. Again reverse the direction of rotation for one complete turn, and the final reading of 5 is taken before the knob 2 can be turned and the safe opened. By first turning the dial anti-clockwise a combination such as 22222133 may be obtained. This means 22 first reading, two turns clockwise, 22 second reading, one turn anti-clockwise, and 33 third reading. From these figures it will be seen that the possibilities of the safe being opened by an uninitiated person are very remote.

A safe built on these lines can be put to many useful purposes. Meccano Clubs should find one useful for keeping articles of any value safe from unwanted intruders, and the lock may even be used for the Meccano cupboard.

Modern Locks and How They Work

Cipher Combination with 100 Million Changes

By Vincent J. M. Eras

IN common with many other articles in general use, locks are among the accepted facts of modern life. Few people give them a moment's thought until they go wrong, and still fewer take the trouble to investigate their mechanism and learn how they work. Nevertheless there is as much difference between a bad lock and a good one as there is between a flimsy toy boat and a battleship; and though a toy boat does give pleasure in its brief spell of life, a flimsy lock creates nothing but irritation. It is valuable therefore to have a knowledge of locks, and to be able to judge how far to trust one and thus avoid purchasing a lock that could make only a pretence of safeguarding one's property.

By far the most important thing about locks is the principle that governs their locking mechanism—in other words, their security against picking. All the well-known lock inventors, Bramah, Cotterill, Tonks, Chubb, to name only a few, had their distinct methods, but for all practical purposes there are now only two systems in really wide use. These are the pin tumbler locking device as applied to cylinder locks, and the lever lock. Each of these principles may be explained quite simply, and therefore it is an easy matter to acquire an understanding of locks generally.

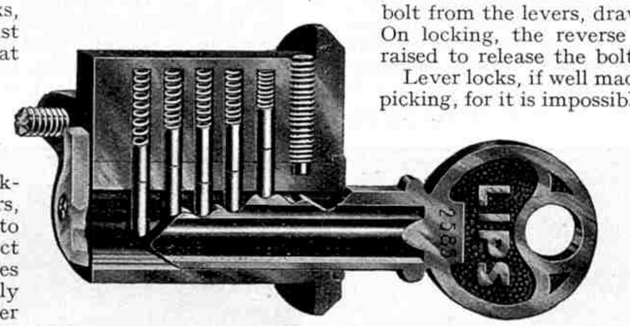


Fig. 1. A sectional view of a pin tumbler or cylinder lock. The manner of raising the pins to the "breaking line" is made clear in this illustration.

Let us first of all examine the principle of the pin tumbler or cylinder lock. Fig. 1 illustrates a lock of this type bisected lengthways, and with a key partially inserted. It will be noted that the cylinder contains a closely fitting revolving cylindrical bar that is pierced lengthways by a slot for the key. This bar is normally prevented from turning by a series of pins known as pin tumblers, each consisting of two parts, that are pressed downward by spiral springs into holes in the bar. It is only free to turn when the tops of all the lower pins are on an exact level with the outside of the bar, forming what is technically known as the "breaking line." This occurs only when the right key is inserted, the action of the key being to raise each of the pin tumblers to its "breaking" position.

The advantage of the pin tumbler locking device is that it permits of considerable variation in keys. Five is the usual number of pins for a good lock, and the slightest variation in the breaking point of one pin tumbler involves the use of a different key to operate the lock, a fact that makes for security. This principle is in general use for better-class entrance door locks, padlocks and even for cabinet locks. Not the least of its merits is that the locking mechanism, that is, the cylinder, need not be very large, and requires only a small, light key to operate it.

Chubb's invention of the lever lock has been developed into a system that, in its present perfected form, produces a secure, strong and serviceable lock. Fig. 2 illustrates one of these locks, and shows the bolt A; the locking stud, B, riveted on the bolt and resting in the forward notch of the levers; the levers, C, in this case six in number, pivoting on the centre pin D; a spring, E, formed by six separate springs, pressing on the ends of the six levers; the longitudinal slots or "gatings" of the levers, F, and the key, G.

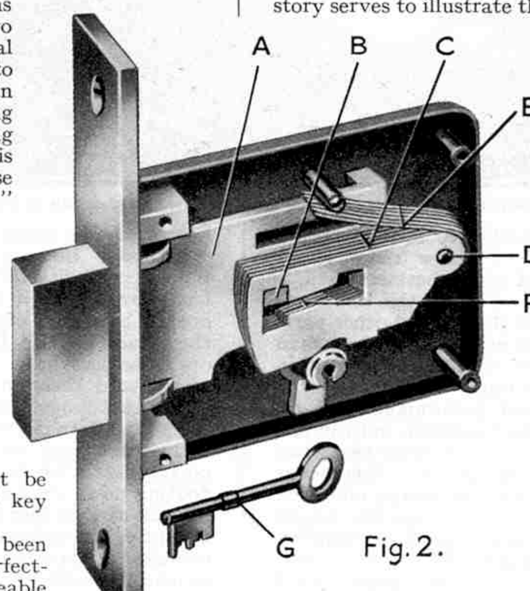


Fig. 2.

Fig. 2. A typical lever lock. As many as 2,500,000 different combinations can be effected with the lock and key illustrated.

The levers are metal discs—in good locks they are made of non-corrosive materials—that are raised by the key exactly to the different heights required to allow the locking stud to pass through the gatings so that the bolt may be withdrawn. The levers are situated one over the other, but quite separate and distinct, in order to allow each and all of them to be raised to different heights by the corresponding incisions on the bit of the key. When the key is turned in the lock it raises the levers to bring the gatings that connect the two notches in the levers into line. Simultaneously the lower or bolt step of the key catches into the tail end of the bolt and presses it backward. The pressure of the key on the bolt causes the locking stud to enter the "gatings," moving from one notch to the other. In this manner the key releases the bolt from the levers, drawing it in entirely, and the lock opens. On locking, the reverse action takes place, the levers being raised to release the bolt stud from the rear notch.

Lever locks, if well made, afford considerable security against picking, for it is impossible to tell when any one lever is lifted to its correct height; much less can the combination of the six be ascertained. Obviously the security of the lock is determined to a great extent by the degree of accuracy with which the gatings in the levers fit the locking stud. The greater the play allowed to the stud, the less secure is the lock; indeed, one may say that excessive play in the levers stamps a lock as inferior. A false key, provided it does not differ appreciably from the true key, may open the lock with equal ease.

The variations or changes that may be effected in a key of the type illustrated in Fig. 2, without altering the length of any of the steps, is $1 \times 2 \times 3 \times 4 \times 5 \times 6$, or a total of 720. Further changes may be obtained by altering the height of each step, including that of the bolt step; or by altering the pin on which the key fits, or the gauge of the pipe of the key. Variations to the number of over 2,592,000 can be effected by these means. The following little story serves to illustrate the amazing number of variations that can be achieved with just a simple lock. A party of seven friends were sitting down to dinner one night. As a joke, one of them persuaded his companions to agree to give him a free dinner each evening until such time that he was unable to arrange the members of the party in a different position at the table. It was a long time before his victims realised that they had committed themselves to providing him with free dinners for nearly 14 years!

The modern cipher combination lock that is employed extensively on safes is an even more interesting example of what can be achieved by ingenuity in arranging changes, for as many as 100 million changes are possible in this type of lock! The explanation of this staggering variety is that better-class locks of this kind contain four discs, each provided with a gating to receive the bar of the bolt tail; and each disc allows 100 changes in the position of the gating. The total number of possible changes, therefore, is $100 \times 100 \times 100 \times 100$, or the amazing total of 100 millions!

In this type of lock the underlying idea is the same as that of the breaking line of the cylinder lock. The gatings in the discs must be brought into line to allow the bar on the bolt tail to drop into the groove thus formed. The four discs then revolve by a turn of the knob, and the lock opens to permit the withdrawal of the bolt. The principle of these combination locks is a loose core in each disc by means of which it is possible to vary at will the position of each gating in relation to the others.

For the illustrations to this article we are indebted to Lips' Brandkasten- en Slotenfabrieken, Dordrecht, of which firm the author is Managing Director.

(330)—Combination Lock (S. C. Herbert, London, S.E.15)

The model shown in Fig. 330 is an interesting demonstration of the method of operation of a combination lock and can be put to practical use if required. The front of the lock is provided with a rotating dial and with a knob for withdrawing the bolt 8. The dial is mounted on the Rod 1 and consists of a Wheel Flange that is bolted to a Bush Wheel. A knob for rotating the dial is provided by a 1" Gear, and a strip of paper is gummed to the rim of the Wheel Flange and is marked with letters A to Z, and in addition with figures 1 to 10.

The Rod 1 carries a Collar fitted with the ⅜" Bolt 2, the Collar being gripped securely on the Rod. Two Bush Wheels are free on the Rod and carry ⅜" Bolts in their bosses, but the Bolts are prevented from gripping the Rod by means of nuts. When the dial is turned the Bolt 2 strikes the shank of the bolt 3 and thus rotates the Bush Wheel. Similarly the ⅜" Bolt on this Bush Wheel strikes the shank of a bolt on the second Bush Wheel and causes the second Bush Wheel to rotate.

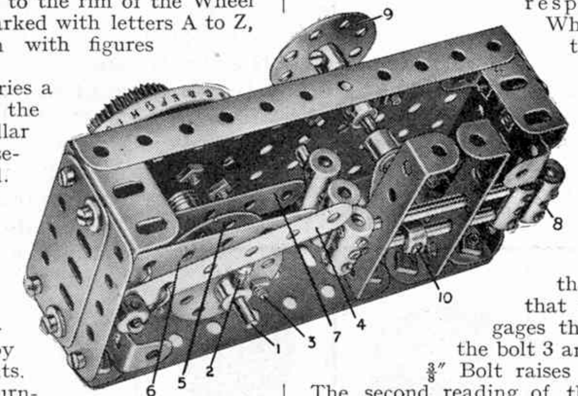


Fig. 330.

The 3" Strip 4 is pivoted on a Rod, and a short length of Spring Cord normally holds the Strip on the Collar of the Bolt 2. There are three of these Strips or tumblers, 4, 6 and 7, each being pivoted on the same Rod and being provided with short lengths of Spring Cord. When the tumblers are in the normal position the bolt 8 cannot be withdrawn. The bolt consists of two Couplings secured on 3" Rods that slide in two 2½" × ½" Double Angle Strips. Another Coupling at the inner ends of the Rods carries a 1½" Rod that is provided with two more Couplings. These three Couplings strike the ends of the tumblers to prevent the bolt 8 from being withdrawn. The bolt 3 and the corresponding bolt in the Bush Wheel 5 should be so arranged that when the dial is rotated the three tumblers are not raised simultaneously by the ⅜" Bolts.

To open the lock it is necessary to make three distinct movements of the dial. It is first turned in a clockwise direction until the ⅜" Bolts have engaged the bolts in their respective Bush Wheels. It is then turned until the ⅜" Bolt in the Bush Wheel 5 raises the tumbler 7 and the reading of the dial against a fixed point is noted. The direction of rotation is then reversed so that the bolt 2 engages the other side of the bolt 3 and so the second ⅜" Bolt raises the tumbler 6. The second reading of the dial is then noted. The dial is again turned in the clockwise direction so that the bolt 2 raises the tumbler 4, and a third reading is taken. With all the three tumblers in the raised position the bolt 8 can be withdrawn by turning the handle 9. The Collar 10 on the lower sliding Rod carries a Threaded Pin that engages the elongated hole of a Crank on the Rod of the Wheel 9.

If the dial is rotated first in an anti-clockwise direction a different set of readings will be obtained. By noting these readings the lock can be opened after the mechanism has been completely enclosed. It is important to ensure that the Collar of the Bolt 2 is securely attached to the Rod 1, and also that the dial is tightly gripped on the Rod. This precaution will prevent any slipping occurring and thus upsetting the combination.

(331)—Intermittent Motion (J. Sumner, Croydon)

An unusual movement is obtained from the device illustrated in Fig. 331. The mechanism is of utility for an automatic intermittent feed motion, and in practice is used in cinematograph apparatus for drawing the film through the camera.

Two 57-teeth Gears are meshed together, and one of them is driven from the power unit. A Pivot Bolt 1 is secured to one of the Gears by two nuts and the moving arm is free to pivot on this Bolt and is spaced from the Gear by a Collar. The arm consists of a 4" Curved Strip extended by means of a 2½" large radius Curved Strip. The end of the 4" Strip slides in the Eye Piece 2 that is pivotally attached to the second 57-teeth Gear. The position of the Eye Piece in relation to the Bolt 1 is very important. It should be arranged almost diametrically opposite, but the operation of the device will be improved if the Eye Piece is slightly in advance of the direct opposite position when its Gear is turning in a clockwise direction.

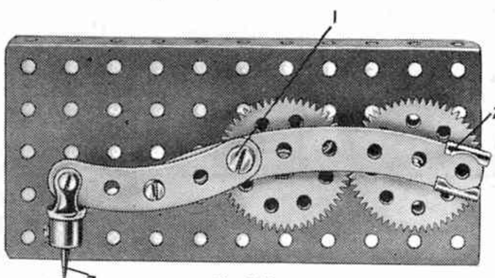


Fig. 331.

The outer end of the 2½" Curved Strip carries an End Bearing in which the Centre Fork 3 is fitted. In the actual device this part is shaped to engage the slots at the sides of the film, and in the model the Centre Fork may engage a Sprocket Chain or belt for providing the necessary feed. When the Gears rotate, movement is imparted to the Centre Fork 3, which follows a straight path for a short distance and then moves upward and backward, describing a semi-circle.

To serve its intended purpose the model should be arranged exactly as shown, but by varying the position of the Bolt 1 in relation to the Eye Piece 2 some very interesting movements are imparted to the Centre Fork 3.

Any suitable part may be fitted in place of the Centre Fork, according to the purpose for which it is intended to use the device.

Miscellaneous Suggestions

Under this heading "Spanner" replies to readers who submit interesting suggestions regarding new Meccano models or movements that he is unable to deal with more fully elsewhere. On occasion he offers comments and technical criticisms that, he trusts, will be accepted in the same spirit of mutual help in which they are advanced.

(M.179.) Rubber Tyred Flanged Wheel.—Recent experiments with rubber tyred wheels for rail cars have prompted a suggestion from G. R. Webb (Wimbledon, S.W.20). The suggestion concerns a rubber tyred wheel that our contributor claims gives very silent running on gauge O track. The wheel is made from a 1" Pulley Wheel fitted with a ⅝" Rubber Ring and placed face to face with a Bush Wheel that forms the flange. An advantage possessed by this type of wheel is the tendency to prevent wheel slip.

Another suggestion comes from R. Nuttall (Burley-in-Wharfedale, Yorks.), who uses a larger wheel. This is built up from a Face Plate and a 1½" Pulley that is fitted with a Dunlop Tyre.

(M.180.) Remote Control.—An interesting device suggested by R. Tydeman (Stowmarket, Suffolk) enables an Electric Motor to be controlled from a distance to provide two distinct movements. Instead of fitting solenoids or other devices for controlling the gear change mechanism, Tydeman uses a reversing type Electric Motor but removes the reversing switch. The studs behind the switch are connected up to a reversing switch that is mounted wherever required. Alternatively the reversing switch on the Motor can be controlled at a distance by means of cords or Bowden Wire.

The method of obtaining two movements is very ingenious and is achieved by means of two free wheels. They are arranged in such a manner that when the Motor is rotating in one direction one of the free wheels is idle while the other supplies a drive. In the reverse direction of the Motor the first free wheel drives and the second rotates idly, and thus the drive is transferred from one movement to another.

A Pinion on the Motor armature drives a Gear on a long Rod journalled in the Motor plates. A free wheel is mounted at each end of the Rod and the Ratchet Wheels are fixed with the bosses inward so that the teeth are in opposite positions in relation to each other. The Pawls engaging the Ratchets are mounted on the ends of 2" Strips that are attached to 57-teeth Gears but spaced away by Washers. The Gears are free on the Rod, and it will be apparent that when the Rod is rotating one way, one of the Gears is driven and the other is free, and when the Rod drives the other way the drive is changed from one Gear to the other. The Gears may be arranged to drive any required movement.

(M.181.) Front Wheel Springing for Motor Chassis.—Details of a new type of chassis spring have been submitted by H. Upton (St. Albans). The spring is of the semi-elliptic type and the interest centres in the method of mounting it. The front end of the spring is hinged to the front dumb iron and this can be carried out by means of a Meccano Hinge or by means of Double Brackets that are pivoted together. At the rear a ¾" Bolt is passed through the end hole of the spring and is secured to the chassis. Thus the rear of the spring is free to slide on the bolt but it is pressed downward by means of a Compression Spring on the shank of the bolt. The Compression Spring helps to smooth out the action of the semi-elliptic leaf spring.

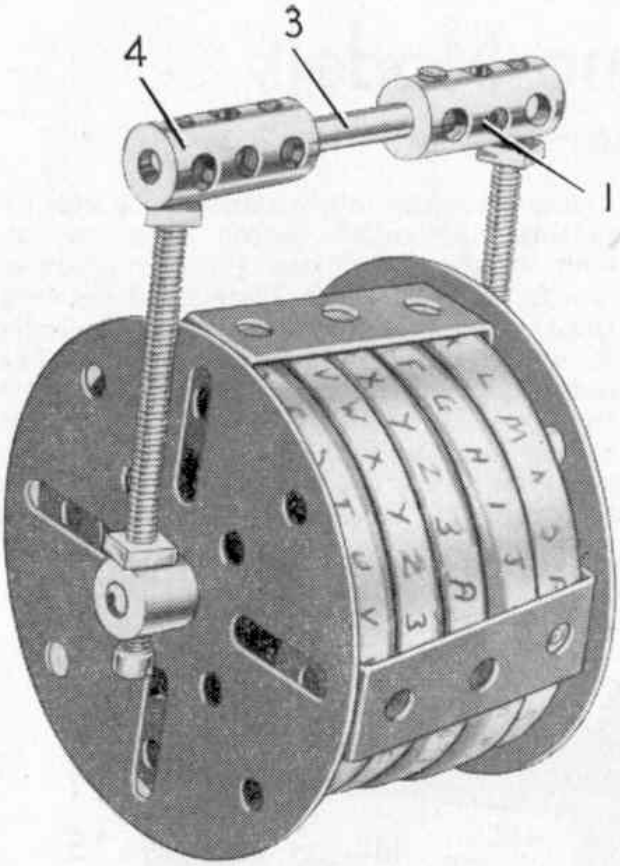


Fig. 3. A Meccano combination lock.

Hornby Train enthusiasts of Puckeridge, Herts, as it is mounted over the shop of their local Meccano dealers, Messrs. J. and K. Harris. Spinning merrily around in the slightest breeze, it readily attracts the attention of passers by.

The windmill was built by Mr. J. Harris from an odd collection of bits and pieces, in conjunction with Meccano parts. For the wind buckets he has used aluminium basins, mounted on arms consisting of Meccano Strips attached to a Circular Strip and a Circular Plate. The axle is a piece of gas pipe mounted in a seaside bucket, and the letters of the word "Meccano" are cut from sheet aluminium. The letters are suitably coloured, and as they rotate they show up clearly against the central white cone.

The windmill operates so freely that the slightest breeze is sufficient to keep it in motion. I congratulate Mr. Harris on his ingenuity and hope that the windmill will continue its merry career for a long time to come.

A Meccano Combination Padlock

If you are on the look-out for a novelty in model construction I can recommend the interesting combination lock shown in Figs. 3 and 4 for your attention. It takes very little time to assemble it, and the work will provide a very pleasant change from ordinary model-building.

The device consists of two parts, shown assembled in Fig. 3 and separately in Fig. 4. Four $1\frac{1}{2}'' \times \frac{1}{2}''$ Double Angle Strips, bolted in the radial slots of a Face Plate, form a cage for five Wheel Flanges. The bolt heads are on the outside of the Face Plate and a second nut is threaded on each bolt. The Wheel Flanges are inserted by bending one of the Double Angle Strips outward and replacing it when they are in position. A 2″ Screwed Rod is fitted in the boss of the Face Plate and carries a Coupling 1, which is locked by a nut. Five Collars are fixed on a 2″ Rod 2 with a small space between each, and carry Set Screws arranged in line. Strips of paper are gummed round the edges of the Wheel Flanges, and numerals or letters are marked on each strip.

The cut-away portions in the centres of the Wheel Flanges, when arranged in line, allow the Set Screws in the Collars on the Rod 2 to pass through unimpeded. The end of the Rod fits into the boss of the Face Plate, and the Rod 3 engages the Coupling 4. With the Wheel Flanges in this position the markings are read off against one of the Double Angle Strips. As soon as one of the Wheel Flanges is rotated, the withdrawal of the Collars on the Rod 2 is prevented until all the cut-away portions of the Wheel Flanges are again in line.

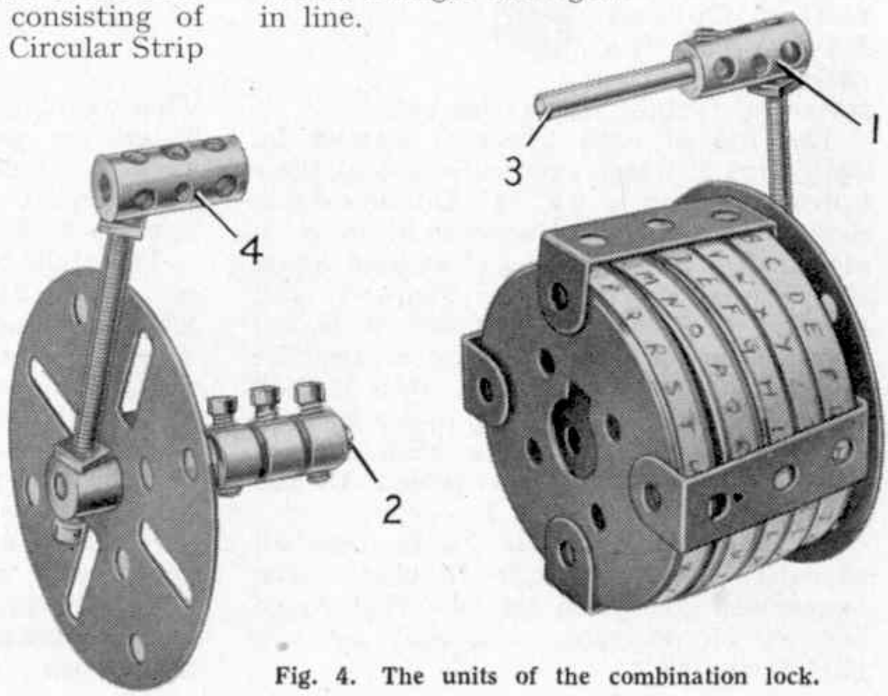


Fig. 4. The units of the combination lock.