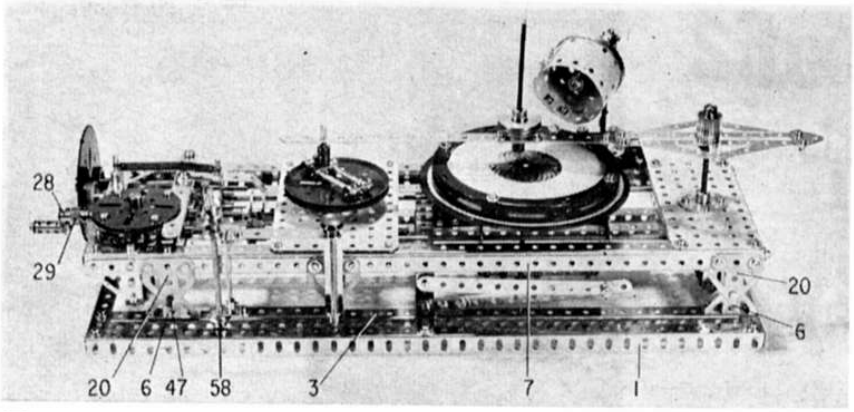
Mecca

Hungarian reade



This outstanding Meccanograph is the brainchild of Hungarian reader Andreas Konkoly of Budapest—probably the world's leading exponent of Meccano-built designing machines. Mr. Konkoly has entitled the model "the Meccano Guilloche Machine"

PERHAPS the most captivating of all Meccano models ever built are those fascinating mechanical pattern-drawing machines we have long-since nicknamed "Meccanographs". Every Meccano modeller worth his salt has at some time built —or plans to build—a Meccanograph and I doubt if a single one of us has ever been, or will be, disappointed with the results. Our attempts aside, though, the world's leading exponent of this type of model is almost certainly Mr. Andreas Konkoly of Budapest, Hungary. Andreas is a true Meccanograph expert. He has designed and built various examples over the years and each one of them has been outstanding for its effective operation and amazing compactness. We have featured at least two of his machines in the M.M. in the past, the first being a straight-forward Meccanograph drawing traditional patterns and the second being a "Spiralograph" which drew a fine pattern that gradually spiralled in to the centre of the paper. Now we feature Andreas' latest and most intricate model—his Meccano Guilloche Machine, the end result of two years' continued experimenting.

I must admit that the title meant nothing to me when I first received the constructional details. I had never heard the word "Guilloche" before! However, thanks to the dictionary, I discovered that a Guilloche was a pattern made by interlacing curved lines and Andreas himself amplified this description by explaining that it was a complicated rosette, or similar type of pattern often used on banknotes and other bond-print to provide a safeguard against forgery because of the difficulty involved in copying. It was, in other words, an excellent description for the model, which does produce complicated interwoven designs, symmetrically ordered on both the outside and inside edges.

As with all Andreas' models, the Guilloche Machine is a fine example of careful design work. Compact mechanisms are housed in a strong framework which hinges open to allow easy access to the internal gearing. It will produce hundreds of different patterns and it even incorporates a small lamp for illuminating the revolving table. It is, beyond doubt, a magnificent piece of Meccano equipment.

The model illustrated is reproduced from Andreas' original instructions which we have tried to follow as closely as possible. We have, of necessity, slightly altered the method of securing the arms which hold the frame open, but any other slight differences which might be included are unintentional. I can say that our model worked successfully and this, after all, is the main requirement.

Framework

Construction begins with the framework which must be very rigidly assembled. Two 18½ in. Angle Girders 1 are joined at the ends by two 7½ in. Angle Girders 2, another two 18½ in. Girders 3 being secured between Girders 2, three holes from each end. The round holes of the Girders are used in all cases. Girders 1 and 3 are then connected together through their centre holes by a 7½ in. Strip 4, centrally overlaid by a 5½ × ½ in. Double Angle Strip 5, spaced from the Strip by a Washer on each securing bolt. Four Trunnions 6 are bolted, two to each Girder 3, in the positions shown, a spacing Washer on the inner securing Bolts in the end Trunnions and on both securing Bolts of the other Trunnions.

Two 18½ in. U-section Girders 7, each built up from two 18½ in. Angle Girders, are next connected together at the ends by two 5½ in. U-section Girders 8, the securing Bolts at one end helping to hold two 1½ in. Corner Brackets in position and, at the other end, a 5½ × 2½ in. Flat Plate 9. The inner Bolts securing this Plate also fix a 5½ in. Angle Girder 10 between girders 7, while a similar Girder 11 is bolted between girders 7 five holes in from their other ends. Note that the inner corner of one of the above Corner Brackets is fixed to its girder 8, not by a Nut and Bolt, but by a Bolt screwed into an Adaptor for Screwed Rod 12. U-section girders 7 are further connected through their eleventh and seventeenth holes by two more 5½ in. Angle Girders 13 and 14, the securing Bolts also fixing a 5½ × 3½ in. Flat Plate 15 in place, this being spaced from girders 7 by a Washer on each bolt. An 8-hole Bush Wheel is bolted to the centre top of this Plate, a similar Bush Wheel being bolted to the centre of Flat Plate 9.

Two 1 × ½ in. Reversed Angle Brackets, their lower lugs joined by a 4½ in. strip, are now bolted through the third holes in the lower flanges of girders 7 in such a position that the centre hole of the Strip lines up with the centre hole of Plate 9. Similarly the centre hole of Plate 15 lines up with the centre hole of a 5½ in. Strip 16 attached by 1 × ½ in. Angle Brackets to two Flat Trunnions 17 bolted to the sides of girders 7. Girders 7 are further connected by a 5½ × ½ in. Double Angle Strip 18 and a 5½ in. Strip 19, Strip 18 being bolted direct to the centre of the lower flanges of the girders and Strip 19 being attached by Angle Brackets to the lower corners of two 1½ in. Corner Brackets bolted to the sides of the girders in the position shown. Also bolted, two to the side of each girder, are four Flat Trunnions 20 which will later be connected to Trunnions 6 in the lower frame. A Double Bent Strip 21 is bolted to the underside of Strip 19, its centre hole coinciding with the fourth hole in the Double Angle Strip, while a 2½ in. Strip 22 is bolted between the fourth holes of Angle Girder 11 and nearby U-section girder 8.

no Guilloche Machine

's intricate designing machine described by 'Spanner'

Table-Support

We come next to the sliding table-support which consists of a 3½ × 2½ in. Flanged Plate 23, to each flange of which a 3½ in. Strip overlaid by a 2½ in. Triangular Plate 24 is bolted. The lower corners of Plates 24 are joined by a 3½ in. Strip, attached by Angle Brackets, a Double Arm Crank 25 being bolted to the underside of this Strip with its boss coinciding with the third hole of the Strip. An 8-hole Bush Wheel is also bolted to the top of the Flanged Plate, its boss coinciding with the corresponding hole in the Plate. The boss of this Bush Wheel and that of the Double Arm Crank serve as the bearings for a 3½ in. Rod on which the revolving table will be fixed. A 57-teeth Gear 26 is mounted on the Rod.

The table slides on two 8 in. Rods 27, passed through the end holes in the 3½ in. Strips bolted to Plate 23 and held by Collars in the third holes from each end of the Angle Girders 10 and 13.

Driving Systems

As drive not only for that table-support, but also for all movements originates from one point, it is advisable to complete the drive systems at this stage. A handle is supplied by a Washer and a Coupling mounted, free, on a 1½ in. Bolt locked by Nuts to the arm of a Crank 28 fixed on the end of a 6½ in. Rod held by Collars in the centre holes of Girders 8, 11 and 14. Also mounted on the Rod is a ½ in. Pinion 29, outside girder 8, a Worm 30, between Girders 8 and 11, and in order between Girders 11 and 14, a Collar, a 50-teeth Gear 31, another Collar and a 57-teeth Gear 32. Only one of these two Gears will be secured on the Rod at any one time and the Collars are therefore needed to hold them in place when unsecured.

In constant mesh with Gears 31 and 32 are, respectively, a ¾ in. Pinion 33 and a ½ in. Pinion 34, both fixed on a 6½ in. Rod held by Collars in the fourth holes of Girders 11, 13 and 14. Also fixed on the Rod midway between Girders 13 and 14 is a ½in. Helical Gear which meshes with a 1½ in. Helical Gear 35 on a vertical 3 in. Rod journalled in the centre hole of Strip 16 and in the boss of the Bush Wheel bolted to the centre of Flat Plate 15. Fixed on the upper end of this Rod is the pen arm actuator which is built up from a 3 in. Pulley 36, to the face or which two Couplings 37 are secured by a ⅜ in. Bolt passed through the centre transverse smooth bore of the Coupling, fitted with a Washer, passed through an outer round hole in the Pulley and secured in place with a Nut. Fixed in the end transverse bores of the Couplings are two 2½ in. Rods on which a third Coupling is mounted, a vertical 1½ in Rod 38 being tightly held in the central transverse bore of this Coupling. A loose Collar is carried on this Rod, as also is the pen arm when fitted.

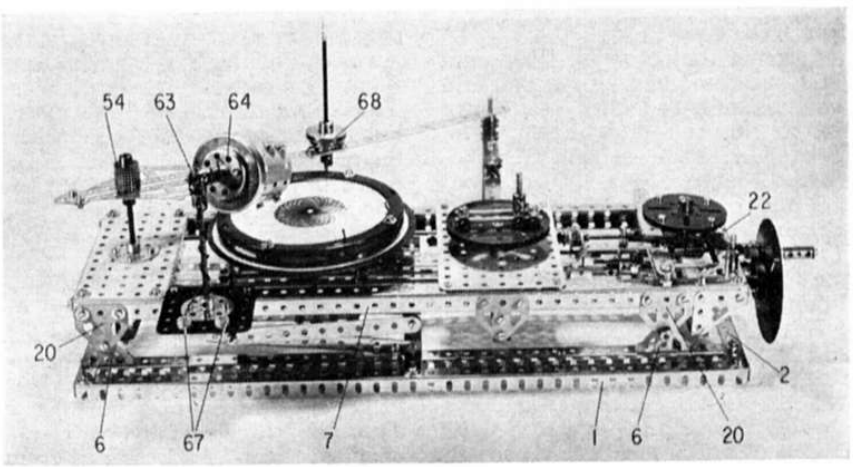
Worm 30 meshes with a 57-teeth Gear 39 on a vertical 3½ in. Rod journalled in Strips 22 and 19 and Double Bent Strip 21. Mounted on the upper end of the Rod is the table-support slide-motion cam 40, built up from a ½ in. Pulley without boss sandwiched between two Face Plates in the faces of which four ⅜ in. Bolts are carried. Varying the positions of these Bolts will of course alter the shape of the pattern.

The cam acts on a 5½ in. strip 41, pivotally attached to the fifth hole of appropriate U-section girder 7 by a Pivot Bolt, but spaced from the Girder by a free Collar. Lock-nutted through the fourth hole of the Strip is a 12½ in. Strip 42 which is cranked as shown, inserted through the space between Flat Plate 15 and Girders 13 and 14, and then bolted to the edge of Flanged Plate 23 in the table-support. Fixed through the third hole (cranked end) of this Strip is a Threaded Pin, a Tension Spring 43 being stretched between this Pin and Adaptor for Screwed Rod 12.

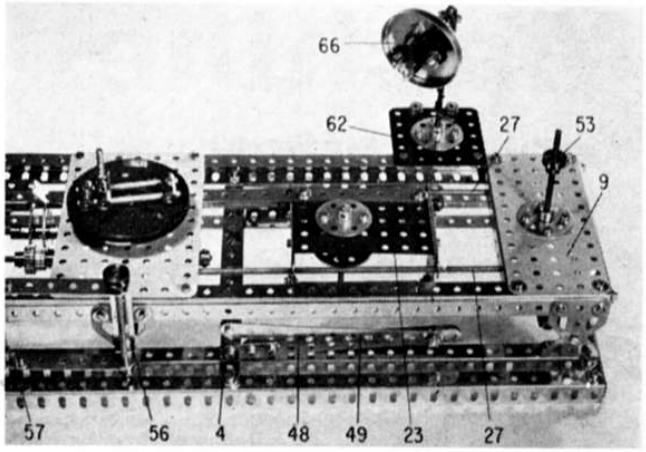
Pinion 29 is now meshed with a 3½ in. Gear Wheel fixed on a 4 in. Rod held by a Collar in the second holes of Girders 8 and 11. Also secured on this Rod outside girder 8 is a 1 in. Gear 44 which meshes with a second 1 in. Gear on a 3½ in. Rod journalled in the fourth holes of Girders 8 and 11 and held in place by the Gear and a 1 in. electrical Bush Wheel 45. Two Long Threaded Pins are locked in opposite holes in the face of this Bush Wheel, the shanks of the Pins engaging in corresponding holes in the face of a second 1 in. Bush Wheel 46 on an 11½ in. Rod journalled in the fourth holes of Girders 13 and 14. The Rod also passes through the end holes in the flanges of Plate 23 in the table support, where it is held by two Collars, one each side of the Plate. A Worm on the Rod meshes with Gear Wheel 26.

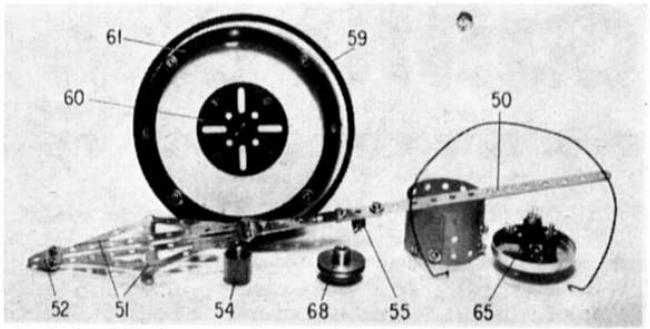
Frame Connection

At this stage, the two sections of the framework can be mated. As already mentioned, Mr. Konkoly designed the framework to open and this is achieved by lock-nutting the apexes of the end pair of Flat



A general view of the Guilloche Machine with the pen arm located on its "holding" support.





Left, in this close-up view of the model, the design table has been removed to show the sliding table-support. Above, a collective view, removed from the model, showing the revolving design table, the pen arm, the pressure weights (54 and 68), the lamp and lampshade and the wire circlip. The circlip has been bent into shallow waves to provide increased grip on the drawing paper.

Trunnions 20 to the apexes of corresponding Trunnions 6. The remaining Trunnions 6 and 20 are not bolted, but are connected by a 6½ in. Rod 47, passed through their apex holes and held in place by Collars. This Rod can of course be removed when desired.

Two collapsible supports are each provided by a 5½ in. Angle Girder 48, extended one hole at one end by a 1½ in. Strip. Lock-nutted to the Girder through its second hole from the outer end is a 5½ in. Strip 49, the other end of this Strip being in turn lock-nutted to the lug of Double Angle Strip 18. The 1½ in. Strip is lock-nutted to the lug of Double Angle Strip 5. When the frame is hinged open, the Girder and Strip 49 straighten, at which point Rod 47 (removed from Trunnions 6 and 20), or a Bolt or Threaded Pin is simply inserted through the appropriate hole in the Strip and the end hole in the Girder to lock them in place. (In his original model, Mr Konkoly actually had Strip 49 positioned inside the flange of the Girder which prevented the Strip from hingeing past the straight point, but none of our Strips would fit inside the Girder flange in our model.)

Pen Arm

Leaving the revolving table until later, we come next to the pen arm which is built up from a 9½ in. Strip 50, to the end of which a 1 in. Triangular Plate is bolted. Two Girder Frames 51 are in turn bolted to the remaining holes in this Triangular Plate, a second similar Triangular Plate 52 being secured to the opposite ends of the Girder Frames. A space of approximately ⅜ in. remains between the Frames and located in this space is a 5 in. Rod held in the boss of the Bush Wheel bolted to Flat Plate 9 and in a Double Arm Crank bolted to the underside of the 4½ in. Strip beneath it. A ½ in. Pulley 53 is fixed on the Rod, its face forming a platform on which the Girder Frames can slide, while a loose ¾ × ¾ in. Pinion 54 is added above the Frames to serve as a weight to prevent the pen arm from rising. A Double Arm Crank 55 is secured to the underside of Strip 50, its boss coinciding with the sixth hole of the Strip and acting as the pen-holder. In operation, Rod 38 is located in one of the holes towards the other end of the Strip.

A novel "extra" built onto the model is a movable support for the pen arm when not located for drive. A 2½ × ½ in. Double Angle Strip 56 is bolted to right-hand Flat Trunnion 17, then pivotally attached to the lugs of this Double Angle Strip by a 3½ in. Rod are two 3 in. Strips, connected at their outer ends by a second 2½ × ½ in. Double Angle Strip 57. The Rod is held in place by a ½ in. Pulley and a Collar. A third 2½ × ½ in. Double Angle Strip is bolted back-to-back to Double-Angle-Strip 57 and in its lugs is journalled a 4½ in. Rod held in place by two Collars, each Collar being spaced from its lug by a ½ in. Pulley without boss 58. A ½ in. Pulley with boss is fixed towards the upper end of the Rod. The pen arm is slipped over the Rod when not engaged on Rod 38. Note that the lower end of the Rod projects very slightly beneath the securing Collar. Thus, when the support is not in use, it is hinged back to the frame, where the projecting end of the Rod is engaged in the space between Girders 1 to hold the support in place.

Revolving Table

We now come to the revolving table, with which care should be taken if good results are desired. The simplest table would of course be a wooden disc fixed to a Face Plate or Bush Wheel, but it is doubtful if this would give the results obtained from Andreas' carefully designed unit. This consists of a 6 in. Circular Plate 59 (covered with a paper disc), to each side of which a Face Plate 60 is bolted. A 2 mm. (approx. $\frac{1}{12}$ in.) thick glass disc of 121 mm. (approx. $4\frac{23}{32}$ in.) diameter is obtained and positioned inside a 5½ in. Circular Girder 61, then the Girder, with the glass disc is secured to the Circular Plate, using four ¾ in. Bolts. Each Bolt is first fitted with a Washer, then is inserted into the Circular Girder and secured with a Nut. The glass disc is added, followed by a second Nut which is screwed up until the glass is tightly held between the two Nuts, care being taken not to break the glass by over-tightening the Nuts. (Although Andreas does not call for it, it might be an advantage to fit Washers between the glass and Nuts, here.) The four Bolts are then passed through the Circular Plate and finally secured by further Nuts.

It will be seen that a space equal to one Nut thickness remains between the glass disc and the lip of the Circular Girders. Into this goes the paper discs on which the patterns are drawn. These discs are ingeniously held in place by a "circlip" in the form of a length of steel wire curved round to an open and incomplete circle, with the ends of the wire bent up at right-angles. The length of the wire should be such that, when the open ends are closed to form a complete circle, the circle will fit inside the Circular Girder. Then, when the ends of the wire are released, the "spring" in the wire should cause the circle to open against the Girder and thus effectively clamp the paper disc. Andreas recommends wire with a diameter of about 2.2 mm. and we found 13½ in. to be a suitable length. Using Face Plates 60, the completed table is fixed on the upper end of the 3½ in. Rod carrying Gear 26 in the table support.

Lamp

Although not an essential component the lamp illuminating the design table makes a novel luxury feature. This is built up from a $2\frac{1}{2} \times 2\frac{1}{2}$ in. Insulating Flat Plate 62, to the centre of which an 8-hole Bush Wheel is fixed. Secured in the boss of the Bush Wheel is a $3\frac{1}{2}$ in. Rod carrying a universal Coupling 63 on its upper end, this Coupling in turn carrying a 1 in. Rod, to which a $1\frac{1}{2}$ in. Contrate Wheel 64 is secured.

A Lamp Holder 65 with clear Lamp is now fixed *by one lug only* to the inside of a Wheel Flange 66, but is spaced from the Wheel Flange by a Collar on the securing $\frac{1}{2}$ in. Bolt. Using its two opposite free holes, the Wheel Flange is then bolted to Contrate Wheel 64. A length of insulated wire is threaded through the Contrate and Wheel Flange and is connected to the free lug of the Lamp Holder, care being taken to ensure that the connection remains isolated from any other metal part of the construction. The other end of the wire is connected to one of two Contact Studs 67 secured to Insulating Flat Plate 62. The remaining Stud is connected to one of the Bolts fixing the Bush Wheel to the Insulating Plate, then the Plate itself is bolted to left-hand U-section Girder 7. A suitable power source is connected to Studs 67. A shade for the lamp is supplied by a $5\frac{1}{2} \times 1\frac{1}{2}$ in. and a $2\frac{1}{2} \times 1\frac{1}{2}$ in. Flexible Plate bolted together in a thirteen hole circle and wedged inside the flange of Wheel Flange 66.

Operation

To set up for operation, a suitable drawing instrument, or pen, such as a free-running ball-point pen refill, is fixed in Crank 55 on the pen arm. A Cone Pulley 68 is slipped over the pen to serve as a weight to keep it in reasonably firm contact with the drawing paper disc, then the pen arm is located by one of its holes on Rod 38. Either Gear 31 or Gear 32 (never both) is tightened on its Rod and the machine is then ready to go. Pattern variations can be achieved in a number of ways, the most obvious being changing Rod 30 to a different hole in the pen arm. Also, however, the position on its supporting Rods of the Coupling carrying Rod 38 can be altered; the number and layout of the Bolts in slide-motion cam 40 can be changed; 57-teeth Gear 26 can be replaced by a 60-teeth Gear as also can be Gear Wheel 39, and, the pattern will differ between Gear Wheels 31 and 32, depending on which is fixed in place. The permutations of all these variables are almost countless.

"Photographic Plate"

Before finishing, I must mention a very interesting experiment successfully performed by Andreas with his original model. He de-greased the glass design plate with weak hydrochloric acid and then sprayed the plate with a thin coat of drawing ink dissolved in spirit. He mounted a gramophone stylus in the pen arm and then, in effect, engraved a pattern onto the glass plate which he subsequently used as a photographic plate from which he could produce perfect photographic prints, greatly enlarged if desired. An excellent idea!

PARTS REQUIRED

1—1	1—16b	1—45	1—123
1—1a	1—18a	3—48a	2—124
1—1b	1—19b	2—48d	4—126
5—2	3—23a	1—52a	6—126a
1—2a	3—23b	1—53	4—133
7—3	3—24	21—59	1—143
2—4	2—25	1—62	1—146
3—5	1—25b	1—62a	1—147b
4—6a	5—26	2—62b	1—173a
8—7a	2—27	4—63	1—211a
2—8b	2—27a	1—70	1—211b
10—9	1—27b	2—76	2—518
2—12	1—27c	2—77	1 flat
4—12b	2—27d	4—109	glass
1—13	2—31	6—111	disc,
2—13a	2—32	9—111a	121 mm
4—14	163—37a	1—111c	dia.
2—15a	127—37b	1—111d	1 length
1—15b	77—38	2—113	Piano
4—16	9—38d	1—115	Wire,
2—16a	1—43	2—115a	13½ in.

ADDITIONAL PARTS FOR LAMP

1—16	1—59	1—188	4—542
1—24	2—111	1—189	2—544
1—28	2—111c	1—511	Con-
13—37a	1—137	1—539	necting
9—37b	1—140	1—540c	Wire.

Right, the Guilloche Machine hinged open to show the general layout of the upper frame and drives. Note Rod 47 inserted in the hinge to lock it in place. Below, another close-up view of the model showing the pen arm movement actuator and the table-support movement cam.