IMPROVEMENTS TO THE MECCANO CLOCK KIT NO 2

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This article presents improvements which can be made to the clock with hourly striking mechanism as marketed in the form of "Clock Kit No 2" by MECCANO Ltd. of Liverpool, England, from 1973 up to its discontinuation.
The advantages which can be obtained are:-

a) To exceed 24 hours running time with a free fall of 145 cm (57") for a driving weight of 2,450 Kg (5,4 lbs), compared to almost 9 hours running time for a driving weight of 2,041 Kg (4,5 lbs) in the original. I.e., for the same free fall, an increase of 167% in running time is obtained for an increase of only 20% in the driving power.

b) The Pendulum Rods (252) made specially for this kit are not required to be used.

c) It is possible to make the clock strike on the hours with an error of less than 2 minutes (depending on the functioning of the minute hand), something that was almost impossible with the original.

d) The restraint on the striking mechanism is relieved in such a manner that it is not necessary to use the specially strengthened Angle Brackets (266) made specially for this kit.

e) A mechanism is added to cause striking on the half hours, and also one to temporarily disconnect the striking mechanism without stopping the clock.

In order to assemble the clock start by using the MECCANO leaflet "Chiming Clock Assembly Kit 2" which is supplied with the kit referred to in the following as MECCANO leaflet (ML), and carry out the modifications which follow.

Finally to obtain better clarity in the description which follows, and even at the risk of being repetitive, the following conventions are used:

NOMENCLATURE

1. The names of the MECCANO parts are always written with capital letters and are the English names as defined by MECCANO Liverpool.

2. The part number is given in brackets.

3. When a special part is mentioned, the MECCANO part number is used followed by a suffix consisting of the last letters of the alphabet.

4. The reference numbers referring to sections of the construction in the figures, are given without brackets.

5. Both in the figures and in the text, the quantity is indicated before the part number, spearated by the sign "x".

6. Taking 1/2" as a unit it is defined e.g. that part number (1) is a Perforated Strip of length 25u (corresponding to the number of holes). Furthermore the Metric Decimal system is used, with the equivalent British system units added in brackets.

7. After the figure number given underneath each figure, the reference numbers used in that figure are listed between brackets for better correlation.

8. The principal axles are identified by the same reference numbers enclosed in a square, as used in the MECCANO leaflet (ML).

9. The adverbs "forward", "front", "above", "right hand", etc., all refer to an observer looking at the clock face as is seen in Fig. 2.

A. IMPROVEMENTS TO THE CLOCK MECHANISM

A1) Correction of the Escapement Wheel (P83)

If you wish the clockwork mechanism to function with an even beat you should correct the escapement wheel supplied with the kit which is a Sprocket Wheel with 20 teeth (P83) from the Plastic MECCANO range. This part has the disadvantage of having some irregularities which makes it unsuitable for the purpose for which it was intended.

In order to make the correction you will have to build the device shown in Fig. 4, made up of a Flanged Plate (52) 12 to which are firmly bolted two Flat Plates 2 x (70) 4 and 10, which are in turn connected by two Double Angle Strips (48a) 6 and 14.

As shown in Fig. 4, two Double Arm Cranks (62b) 9 and 15 are bolted to the third and fifth holes of the upper row of each of the Flat Plates (70).

If it is decided to use the Pivot Axle Rod as described in paragraph A2, then the following modifications must be made to accommodate a special 45mm (1.75") long Pivot Rod (549y). Replace the Double Arm Crank (62b) 15 by a Double Bent Strip (45) and remove the other Double Arm Crank (62b) 9, in order to fit the Pivot Bolts 2 x (545).

Now the Sprocket Wheel (P83) 13 is fastened to the boss of the Pinion (26) 16 by means of the plastic Collet Nut (P78) (Refer to the corresponding figure in the ML). If a tight fit cannot be obtained, then wind Cellotape around the boss of the Pinion. On the other side of the Sprocket (P83) instead of the Collar (59) shown in the ML, a Short Coupling (63d) 11 is used, fitted with 2 Bolts 2x(37b) which are wedged in the slots of the Sprocket (P83). The part of the Short Coupling (63d) which is pushed into the boss of the Sprocket (P83) should also have Cellotape wound around it until a perfect fit has been obtained.

A 9cm (3-1/2") Axle Rod (16) is now selected which has been verified as being perfectly straight by rolling it on a piece of good quality glass. The rod is passed through the boss of one of the Double Arm Cranks (62b), and the following parts are mounted on it:

- a Washer (38);
- a Collar (59)
- the Sprocket Wheel (P83) 13, together with parts (63d) 11 and (26) 16;
- a Collar (59)
- a Washer (38)

The Grub Screws of both the Collars (59) and the Short Coupling (63d) are tightened onto the Axle Road (16).

Finally two Perforated Slotted Strips (55a) 1 and 7 are connected to the Flat Plates by means of two 2u Angle Girders (9g) 3. A 7u Angle Girder (9b) is held by 2 Bolts, Nuts and Threaded Bosses 2 and 8 in the slotted holes of the strips so that it can be easily adjusted.

The correction of the Sprocket Wheel (P83) must be done with great care so as not to make it useless. By adjusting the position of the Angle Girder (9b) 5 with the necessary precision, the longer teeth can be filed down until each tooth fulfills the following conditions:-

1) passes without touching the Angle Girder (9b) 5 and
2) does not pass if a piece of paper is interposed (approximately 0,05 to 0,1 mm thickness). If Pivot Axle Rods are used, the Pivot Bolts (545) must be tightened so that the axle stays firmly gripped although it does not turn with complete freedom. When assembled as before with the Sprocket Wheel (P83) the Pinion (26) and the Short Coupling (63d), only the extreme point of the axle projects past the Coupling, leaving 5mm (3/16") clear past the Pinion (26) at the other extreme.

Having fulfilled the two conditions mentioned above for all the teeth of the Sprocket Wheel (P83), the axle is withdrawn completely from the device, taking care henceforth not to vary the relative positions of the 3 parts mounted on it, as this system of parts will form a definitive and fundamental part of the clock.

A2) <u>The use of Pivot Axle Rods</u>

Finally, to enable the clock mechanism to run more freely, and without being prejudiced against the advice given as much in the (ML) as in the published literature on this subject, it is very convenient to substitute the fastest rotating axle rods for Pivot Rods (548), (549), etc. from the MECCANO Elektrikit. The main inconvenience is that one will have to leave out the Discs (254), (264) and (265), with the optical effect that they produce, since the Pivot Rods will not be able to project from the framework of the clock, having to be supported in their corresponding Pivot Bolts (545).

The axle rods to be substituted in the clockwork mechanism, are those indicated as [5] (escapement) and [6] (anchor) in the (ML).

For the axle [5] a special Pivot Rod (549y) of 45mm (1 3/4") length (already described in A1 above) is used; and for the axle [6] another special Pivot rod (549x) of length 38mm (1 1/2") is used.

Fig. 5 shows the front Pivot Bolts 2x(545) 41 and 40 (the lowest one behind the clock dial) of both axles, the back Pivot Bolts being positioned in a similar manner. Every time changes or modifications are made to the clock, these Pivot Bolts must be finely adjusted for free running.

The manufacture of the special Pivot Rods is relatively simple, starting from a 4mm diameter bronze rod of adequate length, the ends of which are then made conical by means of a file while holding the road in a lathe or electric drill. The lengths mentioned are taken between points, as for the Pivot Rods from the MECCANO Elektrikit.

A3) Use of the Pendulum Connection (172)

In order to further diminish the friction of the axle [6] of the anchor, from which the pendulum hangs in the original model, the pendulum weight can be supported independently by means of a Pendulum Connection (172), the pendulum being actuated by means of a forked rod which can be made much lighter. Instead of the obsolete Pendulum Connection (172) one can substitute a small section of thin razor blade cut along the middle and held at each end by a Strip Coupling (63b).

The forked rod is a 20cm (8") Screwed Rod (79) that holds the pendulum by means of 2x(212a) Right Angle Rod and Strip Connectors, as can be seen in Fig. 3. Also in Fig. 5 one can see the forked rod 39 and the Strip Coupling (63b) 37 from which the pendulum is suspended by the Pendulum Connection (172) 38.

It is now not necessary to use the special Pendulum Rods (252), which can be substituted by:

- a 29cm (11 1/2") Axle Rod (13)
- a 20 cm (8") Axle Road (13a) and
- a 29 cm (11 1/2") Screwed Rod (78),

on which a 75mm (3") Pulley is fixed by means of a Threaded Boss (64) and a Bolt (37b). The height of the pulley (which determines whether the clock loses or gains) can be regulated with total precision by rotating it around the Screwed Rod (78). After adjustment the Pulley (19b) is fixed firmly to the Screwed Rod (78) by mounting 2 Rod Connectors 2x(213) and a nut on the Screwed Rod below the Pulley, as can be seen in Fig. 2 and 3.

A4) Use of Weights with Chains

The use of the Nylon Cord (267) provided by MECCANO and the system of traction described in the (ML), have various disadvantages such as the destruction of the cord due to the strong friction to which it is subjected, and the deterioration of the Rubber Band (186) that is arranged in the groove of the 5cm (2") Pulley without boss (20c). All these problems are overcome by using Sprocket Chains and Sprocket Wheels. Moreover with the more freely running clock mechanism as described in the above procedures, one can more than double the running time by arranging the weight cylinders next to each other and doubling the Sprocket Chain lengths according to the scheme shown in Fig. 7 and in Fig. 1 and 3.

Axle [1] shown in the (ML) will have to be made identical to axle [9] as described in Fig. 8, the one exception being that Sprocket Wheel 54 must be replaced by a 38mm (1 1/2") Sprocket Wheel (95a).

The Rod Connector (213) and the Compression Spring (120b) that joins both parts of axle [1] (one rod in the "front" compartment and the other rod in the "rear" compartment) must be moved to the "front" compartment, thus displacing the Pinion (26c) to the front, as shown in Fig. 5. In the same figure one can also see the changed position of Gear Wheel (27c) 30 on axle [3], which is required to be moved to the "front" compartment of the framework to make room in the "rear" compartment for the Axle rod containing the 38mm (1 1/2") Sprocket Wheel (95a) 29.

The Sprocket Chain arrangement shown in Fig. 7, and also Figs. 5, 13, 20 and 21, illustrate the method of actuating the clockwork mechanism by chains. The Sprocket Chain 31 is deflected by the Sprocket Wheels (95a) 29 and (96) 32. The Sprocket Wheel 29 forces the chain to pass round Sprocket Wheel 28 over a greater length, in order to transmit the drive and avoid slipping. The Sprocket Wheel 32 serves to separate the driving weights so that they do not interfere with the arrangement of the counterweight. In order to gain some 11cm (4 1/2") in the required effective height for the functioning of the clock (which means approximately one extra hour), the Boilers (162) of the driving weights are placed side by side as can be seen in Fig. 2.

Fig. 9 shows the units required for the chain drive. The Boilers 2x(162) 60 and 64 are filled completely with steel washers of 46mm (1 3/4") exterior diameter in order to give a total weight (including the MECCANO parts that make up the unit) of 2,450 Kg. (5,4 lbs). The Boilers are closed by means of two 15cm (6") Screwed Rods 2x(79a) 63 passing through the centre. The Boilers are joined at the

lower end by a 6u Perforated Strip (4), and at the upper end by a 6u Angle Girder (9c) 61, to which a Triangular Plate (77) 62 is attached. The Triangular plate must be separated from the Angle Girder 61 by means of washers such that its plane passes through the centre of gravity of the assembly so that on suspending the unit by the upper hole of the Triangular plate 62, the unit hangs vertically.

The unit to suspend the driving weight is constructed of 2 Semi-circular Plates 2x(214) 65 which are connected by 3 30mm (1 1/8") Bolts 3x(111d) 67, on the lowest of which is attached a simple Hook (57) 68 between 2 Collars 2x(59). In the central upper hole a 25 mm (1") Axle Rod is inserted, on which is mounted a 19mm (3/4") Sprocket Wheel (96a) 65 and a Collar (59). The position on the Hook 68 from which the Triangular Plate 62 will suspend the driving weight, must be positioned within the plane of rotation of Sprocket Wheel 65, so that the mechanism is totaly vertical, otherwise the chain will leave the Sprocket Wheel and the clock will stop working.

The counterweight consists of a Sleeve Piece (163) 69 with 2 Chimney Adaptors (164) and 2 x 19 mm (3/4") washers (38d) at either end, held in place by a 5cm (2") Screwed Rod (81) that supports a Double Bracket (11) at the upper end. Two Fishplates 2x(10) 70 are bolted on each lug of the Double Bracket (by their elongated holes), between which are positioned a 19mm (3/4") Sprocket Wheel (96a) 71 and a Collar (59).

The length of Sprocket Chain (94) provided must be 3,10m (122").

It is not necessary to lubricate the chain or Sprocket Wheels to avoid dangerous slipping, if the chain slips over the Sprocket Wheel (95a) 28 while driving it. If the chain does slip, the counterweight can be loaded with some bolts or nuts, taking into account that this load will reduce the force of the driving weight.

B. IMPROVEMENTS TO THE STRIKING MECHANISM

B1) Correction of the chime wheel unit [8]

When the wheel rotates as indicated on the (ML) drawing with the Angle Brackets 12x(266) positioned as shown, it is impossible for the correct number of chimes to be struck for each hour. If one studies Fig. 10, which does not coincide with the figure in the (ML), it is clear that the positions of the Angle Brackets must be as calculated here.

As stated before, if the amendments in B3) are carried out, then the Reinforced Angle Brackets 12x(266) need not be used, and can be replaced by normal Angle Brackets 12x(12). The assembly of the wheel unit [8] can be done as described in Fig. 11, positioning all the Angle Brackets 12x(12) before adjusting, although one will have to experiment. It is convenient to commence by positioning the Angle Bracket (12) corresponding to the 12 hour strike in a round non-elongated hole on [8b] in the position as shown in Fig. 10, and continue placing further Angle Brackets relative to this one as indicated.

B2) The use of Pivot Axle Rods

For the same reasons as given in A2) it is useful to implement this modification. The Figures 12 and 13 show the Pivot Bolts 4x(545) 72, 73, 75 and 78 which support the 2 axles [13] and [14] of the striking mechanism. Both Pivot Rods are 64mm (2 $^{1}/_{2}$") long, and their position as well as that of mounted gears are as shown in the (ML).

B3) Regulation of the Striking Mechanism

When the axle [16] which supports the strike check levers (which are activated by the cam bolts on axle [2] to release the chime wheel [8] for striking to commence) is positioned on the left of the framework as is shown in the (ML), the strike check levers move too slowly as the cam bolts on axle [2] turn in the opposite direction to the hands of the clock, and striking can take place with an error of up to 7 minutes before or after the minute hand reaches the hour.

When the strike check levers are reversed and axle [16] is positioned on the right of the framework as shown (one lever for the even hours, and the other for the odd hours), the regulation is much easier to yield an error in striking of less than 2 minutes, depending on the position of the minute hands.

To produce a more rythmic functioning of the strike clock levers, axle [2] should be modified as shown in Fig. 15, by mounting the following on a 6mm (2 1/2") Axle Rod (16a) 83: a Gear Wheel (27d) 82, an 8 hole Wheel Disc (24a) 85 and an 8 hole Bush Wheel (24) 86, all joined together by four 30mm (1 1/8") bolts 4x(111d) 88 fixed rigidly and spaced by nuts, and also by another four 15mm (1/2") bolts 4x(111a) 84 and 87, arranged alternately on 82 and 86. The more accurately the bolts are centred in their corresponding holes the more accurately the hours will strike.

B4) Modification of the Braking System for the Chime Wheel Unit

The biggest disadvantage of the striking mechanism as described in the (ML) is the large braking force required to stop it on completion of the striking phase. This is due to the braking being applied on the chime wheel [8], which is the unit which turns the slowest and therefore exerts the most force. The following modification works precisely the other way round and brakes the mechanism by means of light friction on the wheel which turns the fastest, namely the one that holds the air brake on the axle [14] (82 in Fig. 13). The axle is mounted as described in the (ML) with the only difference being that the Three Way Rod Connector with Boss (213b) is replaced by a 5cm (2") Pulley (20a) 82 (Fig. 14), on which is mounted a suitable rubber ring, against which the braking will take place.

The mechanism functions as follows: the cam wheel on axle [2] activates the two strike check levers on which spring buffers are installed which in turn are compressed by the action of the Angle Brackets (12) on the chime wheel [8].

At one end these spring buffers move the rocker arm 22 (Fig. 5 and 13), on the other end of which is mounted a Screwed Rod 81 (Fig. 13) that presses against the Pulley 82, and immediately brakes the mechanism without resistance.

The combination of strike check lever and spring buffer is separately constructed and shown in Fig. 17 seen from above with the two tension ties separated; and in Fig. 16 seen from underneath.

Each spring buffer is constructed partially of a 5u Perforated Strip (5)93, at one end of which a Collar (59) 95 is attached, spaced by 3 Washers 3x(38) 94 from the strip, taking care that the bolt does not obstruct the free movement of an Axle Rod inside the Collar. An Angle Bracket (12) 90 is bolted on the opposite end of the strip 93. A Collar (59) 101 is fixed by means of a Key Bolt (231) at a distance of 11mm (7/16") from the one end of a Rod with Keyway (230) 98. Note that the sole purpose of

using the Key bolt here is to attach the Double Bracket (11) 106 to the Collar so that the Key Bolt head does not obstruct the sliding of the Strip (5) 93 after the Axle Rod (17) 92 is placed in positon. The Key Bolt (231) must also fix the Collar (59) 101 in the groove of the Rod with Keyway (230) 98.

The same Key Bolt (231) mentioned in the previous paragraph fixes the Double Bracket (11) 106 which must be fixed to the Rod with Keyway (230) by tightening a Grub Screw (69a) in the opposite hole of the Collar (59). A second Collar (59) 100 is fixed 30mm (1 1/8") from the end of the Rod with Keyway (230) to restrain a Compression Spring (120b) 99. The Rod with Keyway (230) passes freely through the Collar (59) 95, 3 Washers 3x(38) 96, and a Slide Piece (50) 97 fitted with a Key bolt (231) which permits sliding but not rotation about the Rod with Keyway (230). The whole spring buffer must function in such a way that, assuming the Rod with Keyway (230) and the Double Bracket (11) to be fixed in space, when the Slide Piece (50) is pushed, it displaces the Strip (5), overcoming the resistance of the Compression Spring (120b), thus moving the Angle Brackets (12), while the Slide Piece (50) is prevented from rotating on the Rod with Keyway (230).

A U-support is built up of a 3u Perforated Strip (6a) 89 and 2u x 1u Angle Brackets 2x(12b) 91 and 102, fastened together by two 5cm (2") Screwed Rods (81) 76 and 77 and locknuts. A 54cm (2") Axle Rod (17) 92 passes through the elongated holes of the Angle Brackets (12b), through both holes of the Double Brackets 2x(11) 106, through a Collar (59) 107, and through two Washers 2x(38). Fixing the Collar (59) 107 to the Rod 92 effectively fixes the rod in position.

At 19 (Fig. 5) can be seen the Washers 3x(38) separating the 11u Angle Girder (9) 21 from the framework. This enables the 3u Flat Girder (103h) 20, of which only the two edges can be seen on Fig. 5 (see also 20 on Fig. 2), to be fastened to the Angle Girder by its elongated holes, and moved well to the right (so that it does not interfere with the Angle Brackets 17, 18, etc. on the Chime Wheel [8] as it rotates).

The whole spring buffer assembly is fastened to the Flat Girder 20 (by means of locknuts on the Screwed Rods 77) having previously inserted the strike check levers through the end loops of 2 Tension Springs 2x(43) 105 which are fastened by their opposite loops to 2 End Bearings 2x(166) 104. The End Bearings are held by 7,5 cm (3") Screwed Rods 2x(80c) 35 and 36, which pass through the End Bearings (166) and are fastened by nuts and locknuts.

Finally the Screwed Rods 35 and 36 are held by nuts on a support consisting of a Double Angle Strip (48) and a 19mm ($^3/_4$") Bolt (111) 34. To accomodate this support the front righthand Angle Girder (8b) of the framework must be replaced by a 15u Perforated Strip (1b).

By adjusting the nuts and locknuts on the Screwed Rods 76, 77, 35 and 36, the mechanism must be regulated in such a way that rotation of the Axle [2] (which turns the minute hand), will cause the strike check levers to alternatively release the Angle Brackets 17, 18, etc. on the Chime Wheel [8]. On rotation of the Chime Wheel the following Angle Bracket presses against the Slide Piece (50) 97 and displaces the spring buffer, having to overcome only the resistance of the Compression Spring (120b) 99.

The balance beam is now constructed (see Fig. 18, 19 and 29) starting with a 11u Perforated Strip (2) 22 on one end of which is bolted a 2u x 1u Double Bracket (11a) 112 by means of two bolts 2x(37). On the same side and in the fourth hole from the same end is bolted an Angle Bracket (12) 115 on which is mounted an additional bolt to hold the Tension Spring (43) 23. Also on the same side in the fifth hole is bolted a Double Bracket (11) 110, and in the ninth and tenth holes is bolted a 2u Triangular Plate (77) 109. A 5cm (2") Screwed Rod (81) 108 is fastened by locknuts in the free hole of the Triangular Plate, and on the extreme end of the Screwed Rod a Collar (59) 114 is held between two nuts. A 7,5 cm (3") Axle Rod (16b) 24 is passed through the holes of the Double Bracket 110 and a 3u Double Angle Strip (48) 26 and is held position by 2 Collars 2x(59) 111 and 113.

The complete balance beam assembly is bolted to the 15u Angle Girder (8b) which forms the central part of the right hand side of the framework (see Fig. 5 and 12). The balance beam must be regulated so that as the spring buffers 90 (Fig. 17) advance and push against the Double Bracket 112, the balance beam rotates such that the Collar (59) 114 touches the rubber ring 74 (Fig. 12). At the point of the spring buffers being released (at the start of striking) the balance beam releases the wheel 74. This is activated by the Tension Spring 23, whose other end is held by a bolt fastened on the inside part of the framework.

B5) Use of Weight with Chains

The same considerations apply as stated in the first two paragraphs of A4). In these the duration of the movement is referred to, the calculation of which is carried out very clearly in Fig. 10. Even by doubling the length of the Sprocket Chain the clock will not be able to strike throughout the 24 hours with a free fall of 145cm (57").

In Fig. 8 the construction of the driving wheel assembly on axle [9] is described. The Sprocket Chain arrangements is shown in Fig. 7 and positions of the various Sprocket Wheels are clear from Fig. 6, 20, 21 and 22. In order to adequately separate the driving weight from the counterweight, the lower lefthand girder of the framwork has to be modified by replacing the 11u Angle Girder (9) with a compound girder made up of an 11u Perforated Slotted Strip (55) 44 bolted from one end to a 7u Angle Girder (9b) 127. Also the 11u Perforated Strip which is bolted obliquely on the left hand side to strengthen the framework, is replaced by an 11u Angle Girder (9) 48, bolted through its elongated holes. A pair of left and right Flanged Brackets (139) and (139a) 121 and 123 are connected by a Double Bracket (11) 122 and bolted to the framework. The Sprocket Chain (94) 120 hangs from this construction and is directly connected by an open link onto the Double Bracket (11) as indicated at 45 (Fig. 7).

A Corner Gussetr (108) 126 is added to the lower left corner of the central part of the framework, in order to support a 9cm (3 $^{1}/_{2}$") Axle Road (16) 142 on which the 25mm (1") Sprocket Wheel is mounted.

The driving weight and the counterweight are constructed according to the instructions in A4) and as shown in Fig. 9, the only difference being that the driving weight is filled with washers to yield a gross weight (including MECCANO parts) of 2,210 Kg. (4,87 lbs). The length of Sprocket Chain required is 3,10 m (122").

B6) Striking on the half hour

This is handled by a simple mechanism 129 which is operated by a Cam (131) 79 fixed on the rear part of axle [1] and which strikes a Boiler End (162a) 121 (Fig. 21, 23 and 28.). This mechanism suffers from the grave defect that, as it is attached to the rear part of axle [1] and not to the front part, the cam does not turn when the minute hand is turned manually to set the clock to the correct time, and the strike will no longer be on the half hour. The difficulty is overcome by loosening the cam and re-aligning it each time the clock is set to the correct time, or by stopping the clock if it is necessary to lose time, or disconnecting the pendulum bar (which will make the escapement rocker oscillate faster by being shorter) if it is necessary to gain time.

The mechanims (Fig. 24) is mounted on a 5u Angle Girder (9d) 132 on the end slotted holes of which are bolted 2 Handrail Supports 2x(136) 130 and 133 spaced from the girder by 2 Washers 2x(38) 134. They are adjusted so that a 7 $^{1}/_{2}$cm (3") Axle Rod (16b) 130 can slide freely in them both. On the Axle Rod 130 the following are mounted from bottom to top: a Compression Spring (120b) 135; a Collar (59) 137 (which is fitted with two Bolts 2x(37b) 131 and 136 the heads of which prevent the Rod from turning by bearing on the edges of the Angle Girder 132); and a Short Coupling (63d) 140. In the bore of the Short Coupling a Flexible Coupling Unit (175) 138 is held, on the other end of which is mounted another Short Coupling (63d) 139 which strikes the Boiler End (162a) 121 when the Cam (131) 79 revolves and releases the Axle 130.

The Boiler End (162a) is bolted by its central hole to a 3u Perforated Strip which is attached to the middle part of the framework. The hammer 130 strikes on the inside of the Boiler End.

B7) Supressing the Striking Mechanism

This is handled simply by means of a 5cm (2") Screwed Rod (81) 144 (Fig. 25 and 26) which restrains the hammer 143 which strikes the bell. This Screwed Rod is locknutted to the Curved Strip (89a) 145. This device suppresses only the striking of the bell, and the striking mechanism continues to function normally so that when striking is re-connected by removing the Screwed Rod, adjustment of the striking mechanism is not necessary.

C. FINAL CONSIDERATIONS

C1) Lubrication

DO NOT lubricate the Sprocket Chain (94) nor the teeth of the Sprocket Wheels which make contact with it. It is sufficient to lubricate the bearings of the Axle Rods which carry these Sprocket Wheels.

The conical ends of the Pivot Rods carried by Pivot Bolts may be lubricated with very light oil, provided that the clock is not situated in an atmosphere containing a lot of dust. Otherwise the dust will become "stuck" in the oil and impede rather than facilitate the movement. Where necessary, the bearings will be able to function without lubrication.

Also light oil must be placed in all bearings between the framework and Axle Rods which turn at high speed, and also between the teeth of the gear wheels.

A slightly heavier oil can be used for the Axles [1], [3], [9] and [10] and their associated gear wheels.

The use of a small brush with soft bristles and a long handle for putting the oil in place, is advisable.

C2) Other Modifications

In addition to the modifications described, the improvements which can be made to this magnificent MECCANO model are innumerable.
Among others, the following improvements can be considered:

- The electrification of the clock (MECCANO MAGAZINE October 1973 pages 60 and 61, and March 1975 Pages 140 and 141). The interesting ideas given therein will make it possible to design a rapid switch which decreases the spark which is produced in cutting off the current to the motor.

- The possibility of duplicating or even triplicating the Strips of the framework which support Axles [1] and [9] which carry the driving weights, and also the insertion of washers between these Strips which will improve the lubricating conditions.

- The desirability of strengthening the Strips which support the Pivot Bolts, or even replacing them with Angle Girders, so that the Pivot Bolts can be adjusted with greater precision.

- The positioning of the mechanism for striking on the half hour so that it does not suffer from the defect mentioned in B6).

- The possibility of mounting a mechanism which supresses the striking of the bell during a specified period, without manual operation.

- The decoration of the framework, forming a box covered with Flexible Plates, so as not to risk spoiling the effect which the sight of the mechanism causes.

It is certain that the "Clock Kit No. 2" can already be considered to be one of the MECCANO classics, and that with or without these modifications, it will offer many hours of sound amusement to he who assembles it and sets it in motion.

Buenos Aires, April 1980.

COMPLETE LIST OF PARTS REQUIRED FOR BUILDING THE CLOCK WITH THE MODIFICATIONS

2x1	1x15b	140x37b	4x77	10x111v	1x179
6x1a	8x16	2x37c	1x78	1x116	3x194
6x1b	3x16a	227x38	1x79	2x118	7x212a
4x2	2x16b	4x38d	4x79a	4x120b	3x213
3x3	1x17	4x43	2x80c	1x125	1x213a
2x4	1x18a	2x43x	6x81	1x131	4x214
2x5	7x18b	2x48	6x89a	2x136	2x230
1x6	1x19b	1x48d	2x89b	2x136a	4x231
3x6a	1x20a	2x50	6,40mx94	1x139	1x235b
1x8	4x24	1x55	3x95a	1x139a	1x235d
8x8b	5x24a	4x57	3x96	1x155x	1x251
4x9	8x26	42x59	5x96a	4x162	1x253
1x9b	1x26a	1x63	1x103h	1x162a	1x263
3x9c	2x26c	2x63b	3x108	2x163	1x532
1x9d	1x27a	2x63c	7x111	4x164	8x545
1x9g	1x27b	3x63d	19x111a	2x166	1x549x
4x10	7x27c	1x64	2x111c	2x171	1x549y
8x11	2x27d	10x69	29x111t	2x172	2x549z
1x11a	328x37a	3x69x	4x111u	1x175	1x562
19x12					1xP78
1x12a					1xP83
3x12b					138xIron
1x13					Washers
1x13a					46mm dia.
2x15a					external.

Figures 1, 2 and 3

Complete view of the finished clock. Consider the 4 Boilers (162) which form the 2 driving weights: the weight on the right hand side drives the timing mechanism; the weight on the left hand side drives the chiming mechanism. Between these two are the two counterweights which maintain the tension of the chains.

The connection can also be seen which makes the escapement anchor independent of the weight of the pendulum, and in Fig. 3 the manner in which the anchor is driven by the pendulum clasped between 2 Right Angle Rod and Strip Connectors (212a) is seen.

The handrail Couplings (136a) that crown the framework are the only effective decoration.

Figure 4

The device for the correction of the Escapement Sprocket Wheel (P83). If it is decided to use the Pivot Axle Rod as described in paragraph A2), then the Sprocket Wheel (P83) should be permanently mounted on the corresponding Axle Rod before proceeding with the correction. See text.

Figure 5 (17/41)

Close-up view of the entire mechanism. One can clearly see: the balance beam 22, which stops the striking mechanism; the ends of the spring buffers 25 and 27 which activates it when striking is completed; and the recovery spring (43) 23 that frees it to begin striking.

The reinforced Angle Brackets (266) 17, 18 etc. can be substituted by normal Angle Brackets (12) if the improvements mentioned in B3) are carried out.

The hook 33, which can be substituted for a Plain Hook (57), supports the closed end of the Sprocket Chain driving the clockwork mechanism, the other open end of which is hooked directly over the edge of the 11u Angle Girder (9) (116 in Fig. 20 and 32).

Figure 6 (42/50)

Part of the modifications to the lower left hand side of the framework can be seen to allow passage of the chain (94) 50 which drives the striking mechanism, deviated to the left and supported at its extreme end by the Double Bracket (11) 45 bolted between the ends of the Flanged Brackets (139) and (139a) 46 and 47. A simple Hook (57) 43 supports the other extreme (closed) end of the chain.

The 11u Angle Girder (9a) 48 replaces the original 11u Perforated Strip (2); and part of the Perforated Slotted Strip (55) 44 which replaces the original Angle Girder (9).

Figure 7 Sprocket Chain Arrangement.

Figure 8 (51/59)

Driving wheel assembly for the Striking mechanism on Axle [9], similar to that of the clockwork mechanism. The "ratchet" on the Gear Wheel (27c) 51 is constructed as shown in the (ML) but in place of the rubber band (186) using a Tension Spring (43x) or a piece of Spring Cord (58) 59, deviated by means of a Bolt (37b) 58. Next follows a Collar (59) 56 fixed on the 10cm (4") Axle Rod (15b) 52; a Bush Wheel (24) 57 fitted with 8 Bolts and Nuts 8x(37), whose boss, free on the Axle Rod 52, is held by a Socket Coupling (171) 53, in the other end of which is held the boss of a 25mm (1") Sprocket Wheel (96) 54 also free on the Axle rod 52; and finally a Collar (59) 55 fixed on the Axle Rod 52. The unit formed by 57, 53 and 54 must turn freely between the Collars 55 and 56 in one direction through the "ratchet" mechanism on the Gear Wheel 51.

Figure 9 (60/72)

The Driving Weights, the device to suspend the weight and the counterweight.

Figure 10

In 12 hours the clock gives 1 + 2 + 3 + 4 + ...+ 11 + 12 = 78 strikes and the wheel [8] turns through 1 revolution.

On each strike it will turn through $360^{o}/78 = 4,6154^{o}$.

The Angle Brackets (12) will have to be located at the angles indicated in Table 1, starting from the line representing the hour 12.

The large fork piece (116) on the Axle [12] that activates the hammer gives 78 revolutions in 24 hours (2 strikes per revolution). Therefore the Axle [9] activated by the driving weight will turn:

$$78 \times \frac{133}{19} \times \frac{19}{95} \times \frac{19}{95} = 21{,}84 \text{ revolutions in 24 hours.}$$

With the Sprocket Wheel (96) 54 of 1" = 2,54 cm the driving weight will fall:

3,14 x 2,54 x 21,84 = 174 cm in 24 hours.
And by doubling the chain the fall is reduced to 87cm.

Figure 11

In the centre of a Flanged Plate (52) two Bush Wheels (24) are bolted (one on each side) holding on Axle Rod (17). On this a small square of plywood or similar about 15cm x 15cm with a hole at its centre is bolted to the Flanged Plate (52). This page is placed on the plywood and then the two Hub Discs 2x(118) [8] are positioned on the Axle Rod (17) so as to be able to exactly locate the Angle Brackets (12) that regulate the number of strikes.

Once the Angle Brackets (12) are positioned, fine adjustments can be made to them as well as to the grub screws of each of the 4 gear wheels that are mounted on the chime wheel [8].

ADDENDUM July 1981

EXTRA PARTS REQUIRED FOR "CLOCK KIT NO. 2"

MODIFICATIONS BY OSCAR E. FONTAN

1x1b, 2x4, 2x5, 3x6a, 1x9b, 2x9c, 1x9d, 1x9g,(2 hole angle girder), 4x10, 6x11, 1x11a, 7x12, 2x12b, 1x13a, 1x17, 4x18b, 1x19b, 1x20a, 2x24, 1x26a, 142x37a, 4x37b, 2x37c, 137x38, 1x43, 1x43x(non-Meccano light tension spring), 2x48, 1x55, 4x57, 24x59, 2x63b, 2x63c, 3x63d, 1x64, 8x69, 3x69x(shortened set screw), 4x77, 1x78, 1x79, 4x79a, 2x80c, 6x81, 6,4mx94, 2x95a, 3x96, 4x96a, 1x103h, 1x108, 1x111, 1x111a, 29x111t, (special bolt), 4x111u(special bolt), 10x111v(special bolt), 3x120b, 1x131, 2x136, 2x136a, 1x139, 1x139a, 1x155x(non-Meccano rubber ring for 2" Pulley), 2x162, 1x162a, 2x171, 1x172, 1x175, 2x212a, 4x214, 2x230, 4x231, 8x545, 1x549x(1½" Pivot rod), 1x549y(1 3/4" Pivot rod), 2x549z(2½" Pivot rod)

ERRATA

Section B5, first paragraph, last sentence should read as follows :-

By doubling the length of the Sprocket Chain and the weight, the clock will be able to strike throughout the 24 hours with a free fall of 145cm(57").