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.