PENNY A TUNE

By Spanner

DEFINITELY not having a good singing voice, I never thought I'd see the day when a sweet musical refrain would be heard drifting melodiously from the cluttered confines of my office—but it's happened and for only a penny, at that! Nor did it come from a singing secretary out to make a bit of money. Instead it was produced by a rather magnificent Musical Box, described below, which is built up mainly from Meccano parts and powered by a Meccano E.15.R Electric Motor. When 'fed' with a penny, it plays the first few bars of 'The Bells of St. Mary's'. One of the beauties of the machine, however, is that it is not limited to a particular tune. In fact, it will play the first 40 notes of any tune that falls within one octave of a scale, as will become obvious as the building instructions progress.

Generally speaking, the model can be split into five basic sections: framework, drive unit and gearbox, keyboard, roller and start/stop unit. Dealing first with the framework, one side is built up from two 14 in. compound angle girders 1 joined by two 3½ in. Angle Girders 2, the intervening space being enclosed by a 14 in. by 2½ in. compound strip plate 3. Each compound girder 1 is obtained from a 12½ in. and a 4½ in. Angle Girder, while the compound strip plate is obtained from a 12½ in. by 2½ in. Strip Plate extended three holes by a 2½ in. by 2½ in. Flexible Plate.

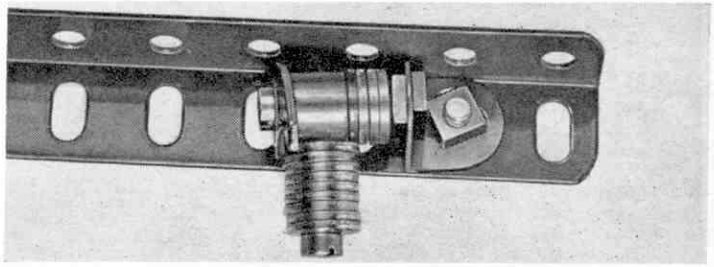
The other side of the framework is also built up from two 14 in. compound angle girders 4, joined by two 3½ in. Angle Girders and incorporates a compound strip plate. This last, however, is built up from a 9½ in. by 2½ in. Strip Plate and a 2½ in. by 2½ in. Flexible Plate, overlapped two holes, and is therefore only 11 in. long by 2½ in. wide. It is edged at one end by a 3½ in. Strip 5. Another two 3½ in. Strips 6 are then bolted between girders 4, a distance of three holes separating them, as shown, while a 1½ in. Flat Girder 7 is bolted to upper girder 4.

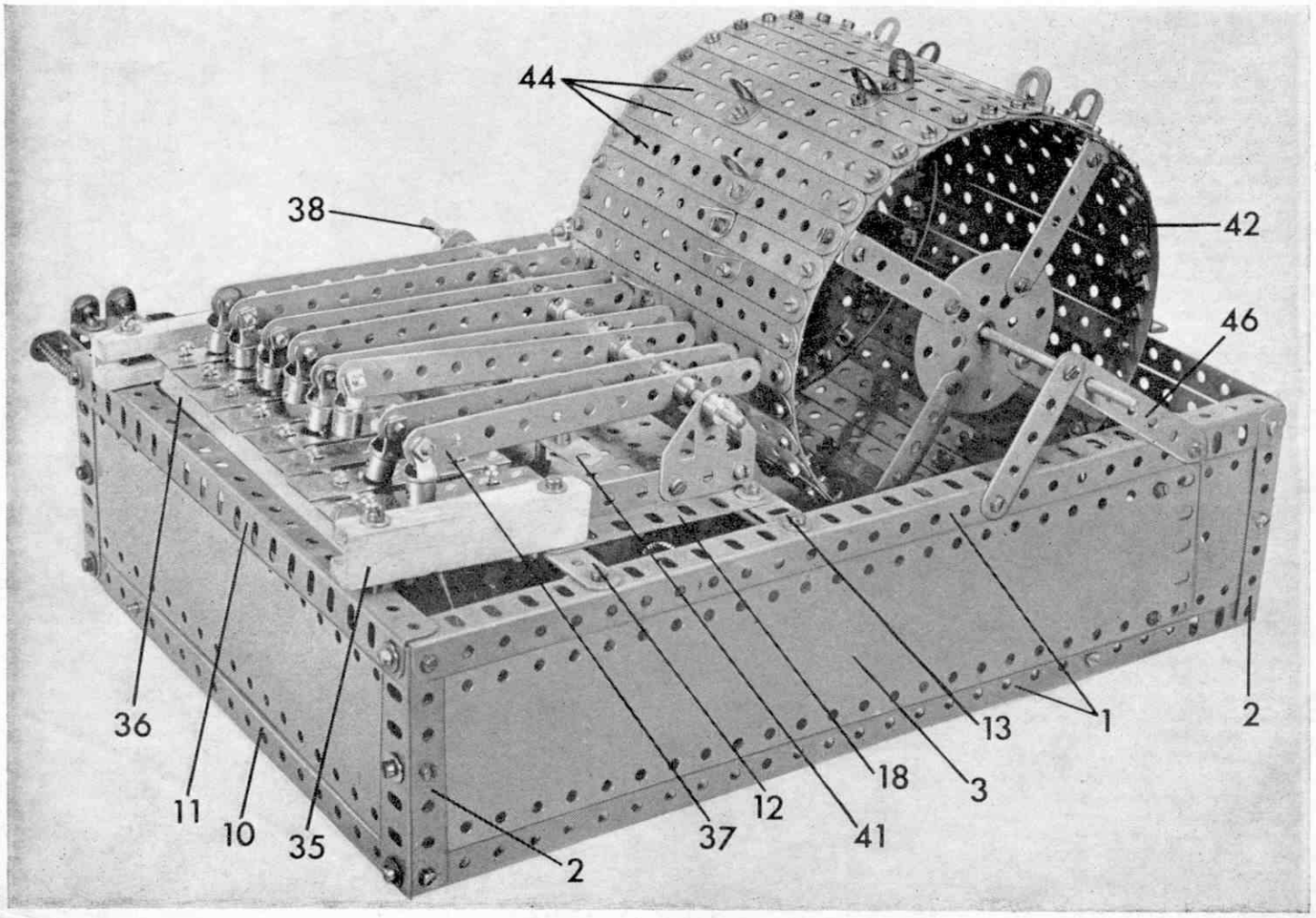
Both sides are now joined at one end by a 9½ in. Angle Girder 8, a 9½ in. by 2½ in. Strip Plate and a 9½ in. Strip 9, and at the other end by two 9½ in. Angle Girders 10 and 11, as well as a 9½ in. by 2½ in. Strip Plate. Another 9½ in. Strip 12 is bolted between upper girders 1 and 4 through their sixth holes, while a 9½ in. Angle Girder 13 is fixed between them through their twelfth holes. Lower girders 1 and 4 are connected through their eleventh holes by a 9½ in. Angle Girder 14, which is then joined to Girder 10 by two 5½ in. Angle Girders 15. One of these Girders is in turn connected to lower girder 4 by a 3½ in. by ½ in. Double Angle Strip 16, while the other Girder is connected to lower girder 1 by a 4 in. Strip 17. Bolted between Strip 12 and Girder 13 are two 3½ in. Angle Girders 18 and a 5½ in. by 3½ in. Flat Plate 19.

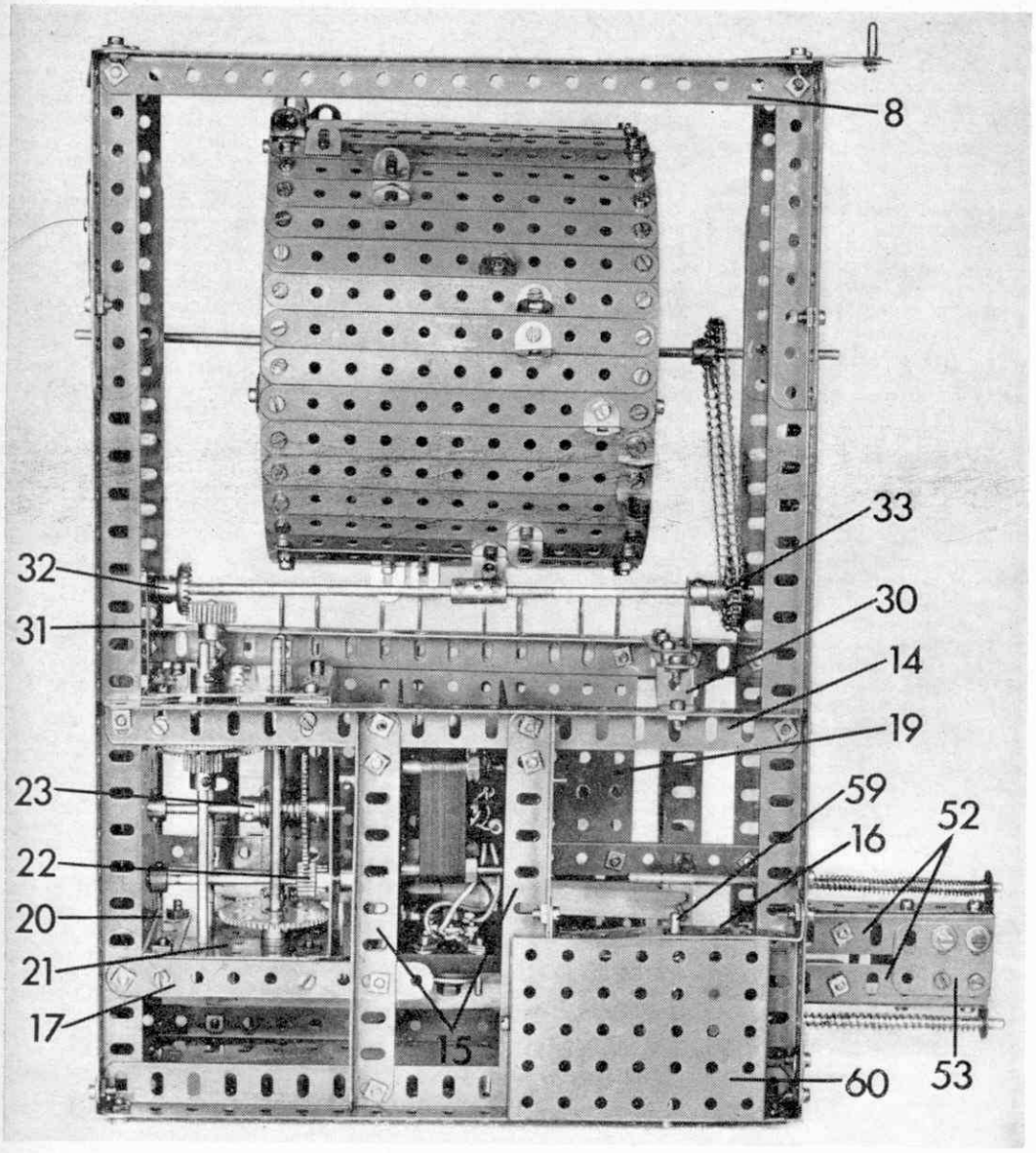
Drive unit and gearbox

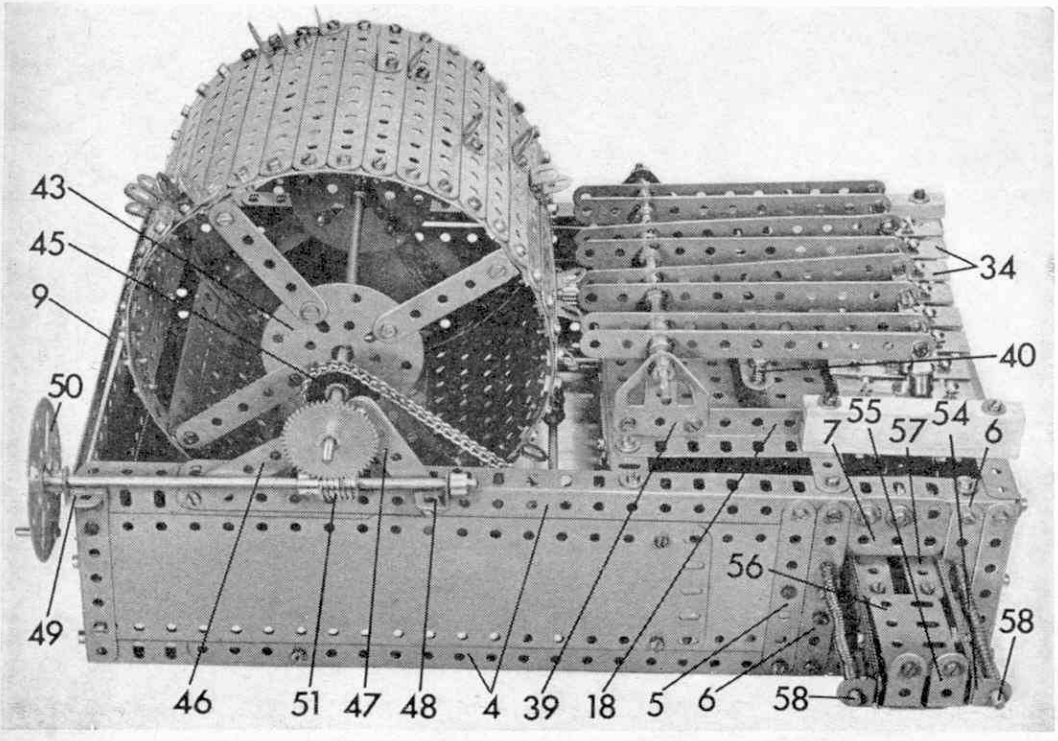
In this particular case the drive unit, as such, needs no description—it consists quite simply of a Meccano E.15.R Electric Motor bolted to Angle Girders 15—but the gearbox most certainly does. The casing is easily built up from two 3½ in. by 2½ in. Flanged Plates 20 joined by two 2½ in. by 2½ in. Flat Plates 21, the complete item then being attached to Angle Girder 14 and Strip 17 by Angle Brackets. A ½ in. Pulley on the Motor output shaft is connected by a 2½ in. Driving Band to a 1 in. Pulley on a 3½ in. Rod journalled in Flanged Plates 20, and held in place by a Collar and a ½ in. Pinion 22. In mesh with this Pinion is a 57-teeth Gear Wheel on a 3 in. Rod, also held in the Flanged Plates by a Collar and carrying a Worm 23. Engaging with this Worm is another ½ in. Pinion on a 4½ in. Rod 24, journalled in Flat Plates 21 and held in place by a Collar outside one of the Plates and a ½ in. Pinion inside the Plate. This Pinion meshes with a 57-teeth Gear 25 on another 4½ in. Rod journalled in the Flat Plates, which itself also carries a ½ in. Pinion. This Pinion engages with a third 57-teeth Gear 26 fixed along

The device ensuring that the penny drops from the sliding tray when the tray is returned to its normal position









with a ½ in. Pinion 27 on a third 4½ in. Rod held by Collars in the Flat Plates. Pinion 27 engages with a final 57-teeth Gear Wheel 28 on a 5 in. Rod, held in Flat Plates 21 by a Collar at one end and a Coupling 29 at the other end. The Rod is fixed in the longitudinal bore of the Coupling.

At this stage a 3½ in. Strip is bolted to Angle Girder 13 and is attached to Angle Girder 14 by a Double Bracket 30. Another 3½ in. Strip 31 is bolted to one Flanged Plate 20, so that it projects three holes beyond the Plate, as shown, then a 9 in. compound rod is journalled in the end hole of this Strip and in the apex hole of a Trunnion bolted to the Strip attached to Double Bracket 30. The compound rod is built up from a 5 in. and a 4 in. Rod, joined by a Coupling and carries a ¾ in. Contrate Wheel 32, spaced from Strip 31 by three Washers. This Contrate Wheel meshes with a ¾ in. Pinion mounted on the end of the Rod carrying Gear Wheel 28. On the other end of the compound rod is fixed a Collar and a 1 in. Sprocket Wheel 33.

Keyboard

Next we come to the keyboard which is actually the only non-Meccano section of the model. In a word, it consists simply of a xylophone and, in fact, a child's small 'toy' xylophone could be used. We, however, built up the unit from eight ready-made metal xylophone platens 34 (obtainable from most music shops), held by steel pins on a wooden frame, each platen being loose on its pins and resting on pieces of string running the length of the frame. All the platens were ⅝ in. wide and ranged in length from 3 in. to 2¼ in. Together they gave the complete scale of C in one octave.

For the xylophone framework four lengths of wood are required, two with approximate dimensions of 7 in. by ½ in. by ⅜ in., and two with dimensions of 3¼ in. by ¾ in. by ⅜ in., also approximate. Each short length 35 has a longitudinal slot cut in it which is about ¼ in. deep and 1/5 in. wide, while both ends of each long length 36 are sufficiently slotted to enable the short and long lengths of wood to be locked together, as shown. Before the framework is assembled, however, a small hole is drilled towards each end of each long length of wood. A piece of string is threaded through these holes, is pulled as tight as possible, then the short lengths are forced into position to hold the string in place.

If necessary, glue can be applied to complete the framework but, before doing so, remember to arrange the long lengths of wood so that they converge slightly to allow for the different lengths of xylophone platens which get progressively shorter as the note rises higher in the scale. The finished xylophone is fixed to Girder 11 and Strip 12 by 1¼ in. Bolts passed through holes drilled in the short lengths of wood.

Eight hammers are next each built up from a 5½ in. Strip 37, to one end of which an End Bearing is fixed. All these Strips are then mounted on an 8 in. Rod 38, each Strip being loosely held by two Collars placed one each side. The Rod, which

passes through the third holes in the Strips, is journalled in the apex holes of two Flat Trunnions 39, bolted to Angle Girders 18.

As you probably know, a xylophone will not produce a correct note if the hammer, after striking the platen, is allowed to remain in contact with it. A device has therefore been fitted to the model which lifts the hammers clear of their respective platens immediately they have struck them. It consists quite simply of eight Pivot Bolts 40, each carrying a Compression Spring on its shank, mounted loose in a 5½ in. Strip 41 which is fixed about 3/5 in. above Flat Plate 19 by Nuts on ¾ in. Bolts. Each Pivot Bolt/Compression Spring unit should be arranged so that it is not too strong to prevent the hammer from hitting the platen at the initial 'strike', but should have sufficient power to lift the hammer clear of the platen immediately it has made the 'strike', and to prevent it bouncing several times on the platen.

Moving on to the roller, this, of course, determines the tune to be played, or, at least, the quantity and position of Angle Brackets bolted to the roller does. The basic roller is built up from two 'wheels', each consisting of four 5½ in. Strips 42, bolted together and shaped to form a circle. Four 2½ in. Strips are fixed to Strips 42, in the positions shown by Angle Brackets, their other ends being bolted to a Face Plate 43. The 'wheels' are then joined by 40 5½ in. Strips 44 to complete the roller which is then mounted on an 11½ in. Rod that also carries a 1 in. Sprocket Wheel 45, connected by Chain to Sprocket Wheel 33.

The Rod is held by Collars in the second holes of two 3½ in. Strips 46 bolted, one each, to compound angle girders 1 and 4 and braced by 2½ in. Strips 47, also bolted to the compound angle girders. The Bolt fixing Strip 47 to compound girder 4 also holds a left-hand Corner Angle Bracket 48 in place and this, along with a right-hand Corner Angle Bracket 49 bolted to the corner 3½ in. Angle Girder, provides a bearing for a 6½ in. Rod held in place by a Collar and a Face Plate 50, in which a Threaded Pin is fixed. A Worm 51, on the Rod, engages with a 50-teeth Gear on the end of the 11½ in. Rod forming the axle of the drum.

This last arrangement, as you will probably have realised, is actually a hand-drive system which has been included for the benefit of readers who would like to build the model but who do not own a Motor. If used, it does, of course, do away with the need for the gearbox, but, at the same time, makes the model a far less impressive construction. If, on the other hand, the Motor and gearbox are included and the hand-drive is used, Sprocket Wheel 45 must be loosened so that it does not prevent the drum from turning. Alternatively, when the Motor is in operation, the 50-teeth Gear Wheel must be removed.

In operation, the hammers are actuated by Angle Brackets, bolted to the drum, which strike against Strips 37 and, as already mentioned, the quantity and positions of these Angle Brackets determine the tune to be played. Assuming you want the model, like our example, to ring out the charming notes of 'The Bells of St. Mary's', you will require 31 Angle Brackets bolted one to each of the required Strips 44 of the roller. The positions of these Angle Brackets I can best describe by simply listing the hole in the Strip in which the Angle Bracket is fixed.

Looking at the roller from the xylophone end of the model, counting the holes in the Strips from the right and working from Strip to Strip upwards, the holes are as follows: 1st, 1st, 2nd, 4th, 4th, 0, 7th, 8th, 8th, 0, 10th, 11th, 11th, 0, 8th, 7th, 7th, 0, 4th, 5th, 5th, 0, 7th, 0, 4th, 0, 1st, 2nd, 1st, 11th, 10th, 8th, 7th, 5th, 4th, 2nd, 1st, 0, 0. It is important to remember, incidentally, that all the Angle Brackets are fixed to the roller by their short lugs and that slight variations in the 'timing' of the notes can be obtained by bending the long lugs of the Brackets.

All that remains to be built is the start/stop mechanism that allows the roller to make one complete revolution when the model is fed with a penny. A sliding tray is obtained from two 3½ in. Angle Girders 52, joined by a 1½ in. Flat Girder 53. A 3½ in. by ½ in. Double Angle Strip 54 and a 1 in. by 1 in. Angle Bracket 55 is bolted to each Angle Girder, then a 2 in. Flat Girder 56 is attached to Angle Brackets 55 by ½ in. by ½ in. Angle Brackets. Fixed to the horizontal flange of each Angle Girder 52 by a ½ in. Bolt are two 1½ in. Strips 57, one on top of the other, seven Washers on the shank of the Bolt spacing the Strips from the Girder. The completed tray will be mounted on two 5½ in. Rods 58, held in the bosses of Cranks bolted to the inside of Strips 6 at one side of the model framework, but it is advisable to finish the internal linkage before doing this.

First of all a simple device for ensuring that the penny drops from the sliding tray when the tray is returned to the normal position is obtained from a Pawl with boss mounted on a ¾ in. Bolt held by two Nuts in an Angle Bracket bolted to Upper Girder 4. The Bolt passes through the longitudinal bore of the Pawl boss which is spaced from the first Nut by four Washers. A counterweight is provided by nine Washers on the shank of a ½ in. Bolt screwed into one tapped bore of the Pawl boss. If positioned correctly the Pawl should 'dangle' behind and in the centre of Flat Girder 7. Next, one end of a 3½ in. Strip is lock-nutted to the centre arm of the Motor switch while the other end of the Strip is lock-nutted through the second hole of another 3½ in. Strip to the lower end of which a Crank is bolted. This Crank is mounted on a 3 in. Rod 59, journalled in Girder 10 and Double Angle Strip 16, then a container for the pennies is provided by a 3½ in. by 2½ in. Flanged Plate 60 attached to appropriate Angle Girder 15 by two Nuts on a ¾ in. Bolt.

Before the sliding tray can be mounted in place, two return springs are required. We used two suitable lengths of light springing, obtained from most hardware stores, but several Compression Springs separated by Washers would do equally as well. The tray is fitted by holding it in position with the end lugs of Double Angle Strips 54 behind the bosses of the Cranks bolted to the inside of Strips 6. Rods 58 are then passed through the other lugs of Double Angle Strips 54, the return springs are added and the Rods are finally fixed in the bosses of the Cranks with approximately two inches protruding at the other side.

Lastly, an End Bearing carrying a Centre Fork 61 is bolted, tight, to the right-hand arm of the Motor switch while a Flexible Coupling Unit 62 is fixed in the centre transverse bore of Coupling 29. The theory of the start/stop unit should now become evident. When a penny is placed in the sliding tray and the tray pushed in, the penny should press against the 3½ in. Strip attached to the Crank mounted on Rod 59. This, in turn, moves the Motor switch to the 'on' position, and the model begins to play. However, the gearing is so arranged that Coupling 29 revolves at exactly the same speed as the roller so that, provided Flexible Coupling Unit 62 is positioned correctly, it should strike against Centre Fork 61 and turn the Motor off after the drum has made one complete revolution.

Parts Required

2 of No. 1a	2 of No. 16b	1 of No. 94
55 of No. 2	1 of No. 22	2 of No. 96
1 of No. 2a	1 of No. 23a	1 of No. 103g
8 of No. 3	1 of No. 25	2 of No. 103h
10 of No. 5	4 of No. 26	3 of No. 109
4 of No. 6a	1 of No. 26c	3 of No. 111a
4 of No. 8	1 of No. 27	1 of No. 115
5 of No. 8a	3 of No. 27a	3 of No. 126a
2 of No. 9	1 of No. 27d	1 of No. 147a
4 of No. 9a	1 of No. 29	8 of No. 147b
8 of No. 9b	2 of No. 32	1 of No. 154a
1 of No. 11	242 of No. 37a	1 of No. 154b
39 of No. 12	236 of No. 37b	9 of No. 166
2 of No. 12a	70 of No. 38	1 of No. 175
1 of No. 13	3 of No. 48b	1 of No. 186
1 of No. 13a	1 of No. 52a	2 of No. 190
1 of No. 14	3 of No. 53	3 of No. 196
2 of No. 14a	35 of No. 59	1 of No. 197
1 of No. 15	3 of No. 62	1 E15R Electric Motor
3 of No. 15a	2 of No. 63	1 Xylophone
1 of No. 15b	1 of No. 65	
1 of No. 16	2 of No. 72