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SOCIETY

Electrical Horology Group

The Synchronome Master Clock

Adjustments and Setting to work

by A. Mitchell

The erection and maintenance instructions originally supplied with Synchronome master clocks were completely adequate at the time of issue when a new clock was being installed which had been sent out from the factory fully adjusted. Generally the clocks recovered by collectors often need to be completely stripped down for cleaning and refurbishing. Certain adjustments are necessary during re-assembly and as far as is known these details are not readily available. To fill this gap the relevant details have been gathered and are set out in these notes. Additionally, because quite often the suspension spring is damaged and the gathering click missing, dimensioned sketches of these items have been included to enable these to be made if necessary.

The construction of the movement is relatively simple so detailed instructions for dismantling and re-assembling are omitted as is general cleaning and oiling information. One or two cautionary remarks, however, may be appropriate as follows:-

- a. Great care should be taken when handling the electrical connections, particularly the tails of the solenoid coils. These connections are of fine wire and are easily broken.
- b. Do not oil the gathering jewel pivot or the jewel itself or the teeth of the count wheel.
- c. Ensure the impulse curve of the pallet and the impulse roller are perfectly clean.
- d. With the pendulum assembly weighing some 16 lb no attempt should be made to hang the pendulum and get the clock going unless the case is properly supported and firmly fixed in position.

The Case

It is essential for the case to be firmly fixed vertically in both side to side and front to back planes. Verticality may best be achieved with either a plumb line hung at a front corner or with a builder's spirit level.

The Movement

Adjustment of armature buffers, contact screw, armature tail spring and gravity arm buffer. Fig. 1.

All adjustments made with gravity arm resting on its catch

- a. Push the armature against the left hand buffer. Adjust the buffer screw until the air gap between the top magnet pole end and the armature is 0.01 inches (0.26 mm.)
- b. With the armature still against the left hand buffer adjust the contact screw at the top of the armature until the air gap between the contacts is 0.07 inches (1.8 mm.)
- c. Allow the armature to fall back on its right hand buffer. Adjust the right hand buffer screw until the air gap between the contacts is 0.212 inches (5.4 mm.)
- d. Adjust the tension of the armature tail spring so that the armature returns to the right hand buffer easily. Very little tension is required in the spring when in its static state.

e. Adjust the gravity arm buffer until it barely touches the gravity arm when resting on its catch.

Note: Early models were not fitted with this buffer.

When all these adjustments are completed see that all screws are held tight with their lock nuts.

The Pendulum Assembly

Fig. 2 gives dimensions of the suspension spring.

Assemble the suspension spring in bottom chop and tighten securing screw until spring will just pivot in chop under thumb pressure. Spring should be neither sloppy nor tight.

Attach suspension spring to top chop and tighten securing screw until spring is clamped firmly. The securing screws in both top and bottom chops should face the same way.

Assemble remainder of pendulum. The majority of Synchronome pendulum rods have a small notch filed in line with the position of the top edge of the fixed bob collar. Screw up rating nut until bob is level with notch, approximately correct timing will then be achieved immediately clock is set going.

Before installing the pendulum inspect the slotted screw head on the back of the pallet and note how the gathering click will be held in place. Do not assemble click to pallet at this stage. Hang pendulum ensuring that the trunnion pivots and not the shoulder rest on the support, lightly tighten clamps.

By sighting, adjust trunnion so that its axis is parallel with back of case. Adjust pallet on pendulum rod until it also is parallel with back of case and approximately in its correct position under the gravity arm roller.

The Gathering Click

Fig. 3 gives dimensions of the gathering click. A Brocot escapement 'D' shaped pallet stone is a suitable jewel. Alternatively, a steel "jewel" may be made which should be dead hard and polished to a mirror finish.

The gathering click, held vertically, is fitted so that the angled end enters the central hole of the slotted screw head on the back of the pallet. The click is allowed to fall to the left into the horizontal trough in the screw head as the pendulum is drawn to the right.

The jewel of the click must be positioned so that the teeth of the count wheel meet the central part of the jewel's flat face. This positioning is achieved by moving the trunnion with the fingers and thumb either towards or away from the back of the case. When the jewel is positioned correctly the trunnion must again be checked for being parallel with the back of case. The trunnion clamps are now tightened.

Pallet/Roller Alignment. Fig. 4

- a. With the gravity arm reset, move the pendulum rod gently to the left until point A of the pallet is directly below the roller bearing. Adjust the pallet by raising or lowering it on the pendulum rod until the clearance between point A and the bottom of the roller is 0.01 inches. (0.26 mm.)
- b. Release the gravity arm and lower gently onto the pallet. Check by eye that if top of pallet is continued to left, it passes through the centre of the roller, Fig. 5. To align the roller correctly, first slacken the top chop trunnion locking screw. If bearing of the roller lies below the top line of pallet, lever the top chop to the left. If roller bearing lies above, lever top chop to the right. When correctly adjusted retighten top chop trunnion locking screw.

- c. With the gravity arm still lying on the pallet, sight from above to check that the centre of the rollers' curved face lies on the crest of the pallet curve. To adjust, slacken pallet clamp screw and rotate pallet about pendulum rod until roller is centred. Reset gravity arm and re-check clearance between bottom of roller and point A.

Adjustment of Gathering click

The gathering jewel must just clear the tooth previously gathered when the pendulum returns to the left. Adjust by carefully bending the click wire up or down. Check that the wire does NOT touch the N.R.A. wire when the indicator is at N.

Dial Movement. Fig. 6

The power to drive the slave dial ratchet wheel, motion work and hands is derived from a leaf spring. The solenoid and armature merely retracts the pawl ready to be driven forward under spring pressure. The spring pressure is adjustable by means of screw A. Screw B limits the armature travel and screw C limits the forward travel of the pawl and thus the ratchet wheel and ensures the correct travel of the minute hand tip.

- a. Adjust screw A until there is just sufficient spring pressure to move pawl forward.
- b. Adjust backstop screw B so that when the armature face just touches the magnet core the top end of the driving spring touches the stop.
- c. Adjust screw C so that one tooth only is advanced with each action of the armature. Give that clearance to the adjustment to ensure definite and reliable operation.
- d. Readjust screw A so that the armature operates with a minimum current of 0.22 amp.

When making adjustments ensure that the movement is held in the vertical or normal operating position to allow the gravity action of the backstop lever to take effect.

Electrical Circuit

Questions are often asked about the battery voltage required. The following rule of thumb may be used to determine the voltage for a particular installation. The master clock requires about 3 volts to operate the armature and reset the gravity arm and an additional 1 volt to operate its slave dial. A $4\frac{1}{2}$ volt dry battery is therefore suitable for operating a complete master clock. Where additional slave dials are included, for each dial add 1 volt.

The current flowing in the circuit is however more important than battery voltage and for correct operation of any installation it should be adjusted to 0.33 amps. (say $\frac{1}{3}$ amp for easy calculation). The resistance of the master clock solenoid is 8.7 ohms and that for its slave is 2.45 ohms. The resistance of any other slave clock varies with its size. In general the standard movement used for dials up to 10" dia. has a resistance of 2.45 ohms. Larger clocks have higher resistances and if any of these are included special account must be taken in the calculations.

The total resistance of the circuit will be

$$8.7 + 2.45 + \text{no. of slaves} \times 2.45$$

The resistance of the wiring should, of course, be included but for small systems this will be negligible. Divide the total resistance by 3 to find voltage required. For small systems say of two or three slave dials the nearest higher standard battery voltage obtainable, e.g. 6 volt will be satisfactory.

If a secondary battery and charger are already available it will probably be necessary to add a variable resistance in series with the clock circuit in order to match the voltage to the numbers of dials to be operated and ensure the correct current of 0.33 amps flows in the circuit. In this case multiply the battery voltage by 3. Subtract from this figure the total resistance of the clock circuit found as above. The result will be the additional resistance required in the circuit to limit the current to 0.33 amps. This can best be added to the clock circuit by means of a suitable variable resistor connected in series and adjusted to suit. For example for a system of five or six dials and say a 24 volt battery, a 0-100 ohm variable resistor would be necessary set at about 47 ohms. The variable resistor must, of course, have an adequate rating to carry the 0.33 amps of the circuit. It should be remembered that too high a current will reset the gravity arm with some vigour and make the master clock unnecessarily noisy.

Setting to work

When the master clock has been fully assembled, adjusted and connected up to the correct supply, position the beat plate block with the zero mark against the end of the pendulum rod. Move the pendulum to the right to the 2 cm. mark on the beat scale and release. Ensure pendulum swings in a plane parallel to the back of the case. See that click is gathering each tooth of the count wheel satisfactorily. Observe that gravity arm is released and reset satisfactorily. Leave clock for about 30-40 minutes after which time the pendulum should have increased its amplitude to about 3.5 cm. on the beat scale which is a sure sign that its operation is satisfactory.

Regulation

If the bob has been positioned with relation to a notch on the rod, timing should be very near correct. Further course correction should be carried out by adjusting the rating nut up or down. The nut is marked with divisions 10, 20 and 30 representing seconds per 24 hours, one full turn being equivalent to 30 sec./24 hours approx. Hold the pendulum rod firmly when adjusting the rating nut to prevent twisting the suspension spring.

Fine regulation is achieved by adding weights to the weight tray if fitted or to the top of the pendulum. If the weight tray is positioned halfway between the centres of suspension and oscillation then by adding or removing a 0.67 gramme weight the timing will be changed by 1 second/24 hours. When using weights for fine adjustment, the course correction should bring the pendulum to slightly losing. Then by adding weights whilst the pendulum remains swinging the final fine regulation may be achieved.

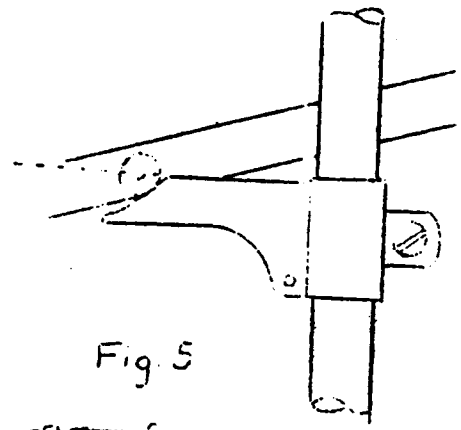
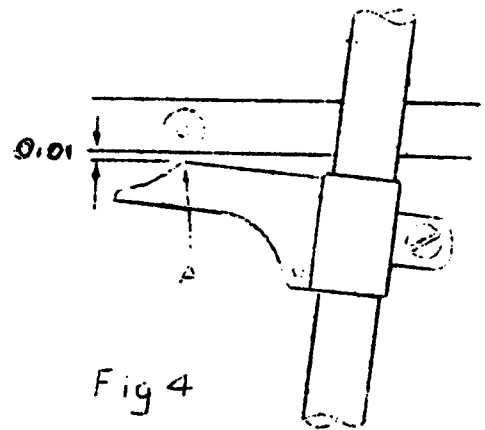
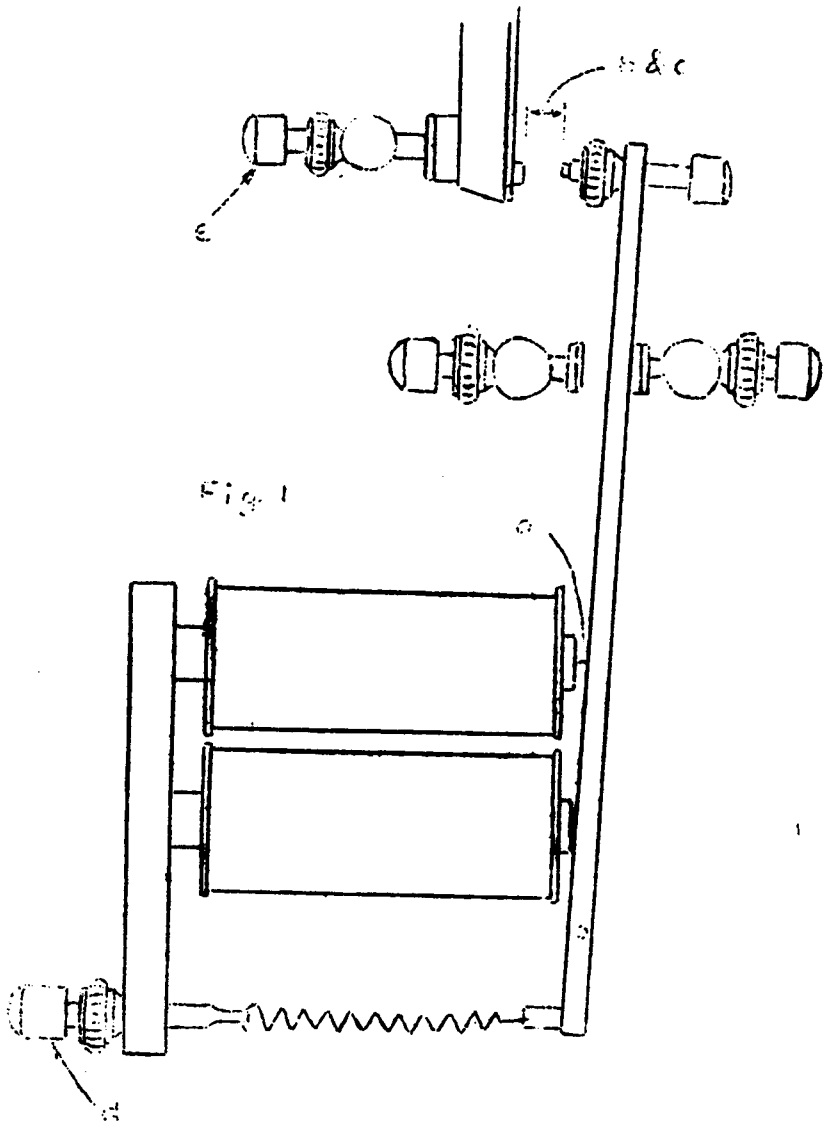
The Synchronome Co. guaranteed their clocks to an accuracy of 2 seconds per week, although this may be improved upon it is unlikely that the rate will be consistent over long periods.

Faults

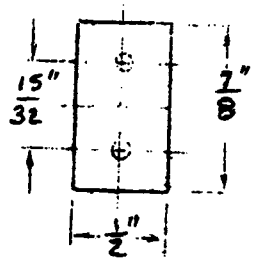
The Synchronome will operate continuously for many years without attention providing the power supply is not interrupted. The best indication that the clock is operating completely satisfactorily is to observe the pendulum amplitude. If this remains constant at about 3.5 cm. then all is well, if the amplitude gradually diminishes then it is likely that friction in the moving parts is increasing and the clock will eventually stop.

Should the clock stop for no apparent reason the fault can initially be categorised into an electrical or mechanical one by observing the position of the gravity arm. If the arm is in the reset position then the fault is mechanical if, however, the arm is resting on the impulse pallet then the fault will be electrical.

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Suspension Spring
0.005" thick



Gathering Click

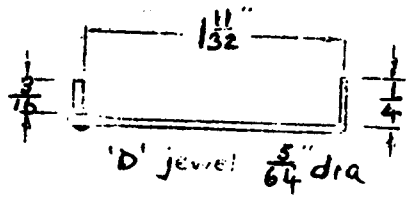


Fig 3
End Flattened and
bevel round jewel

