MASTER CLOCKS

The Master Clock is, as the name implies, master of the electric clock system. It is the controlling time piece for the system and its time is transmitted to all secondary apparatus by the means of wires and electro-magnets. Each Master Clock is fitted with a circuit-closer called an impulse contact. The impulse contact usually closes once each minute.

The Master Clocks are made with two types of drive, i.e. spring and weight driven.

The principle of operation and adjustments of these clocks are as follows:

SPRING DRIVEN MASTER CLOCKS

The driving power for these Master Clocks is derived from a small helical spring which, at all times, is kept wound to even tension by an electro-magnet and ratchet mechanism. When the minute impulse contacts close, they cause an electric circuit to be completed. This electric circuit energizes the coils of the electro-magnet and its armature is attracted. When the armature is attracted, a pawl attached to the armature engages the ratchet and winds the clock.

The winding ratchet is located on the center or minute hand shaft. The main spring is also on this shaft. Power is transmitted from this shaft through the train gears to the escape wheel.

The Graham Dead Beat type of escapement, consisting of brass escape wheel and hardened steel verge, is used as it is considered best suited for this type of clock movement.

The magnet wound spring driven Master Clocks are made for three different sizes, i.e. 60, 72 and 120 beat pendulums.

The principle of operation of all these clocks is the same. The contacts on all except the 120 beat clock are operated from a cam placed on an auxiliary shaft designed for this purpose. On the 120 beat clock, the cam to operate the contacts is placed directly on the escape wheel shaft.

The main spring, when fully wound, will run the movement from 51 to 53 minutes. The movement cannot be damaged from over-winding as stop pins are provided to protect it.

ADJUSTMENTS

1. The verge adjustments are standard for any Graham Dead Beat type of escapement. They are as follows: Escape wheel should run on the center of the pallets. To set verge, lower same by moving both bridges until escape wheel will not escape. Then raise in the same manner until the escape wheel teeth just clear throughout the circumference. This insures that the verge is set as low as possible without hitting on the escape wheel teeth and also that the verge shaft is in a horizontal plane. Under no condition must the verge bottom on the escape wheel. Adjusting screws are provided on all master clocks except the 120 beat for putting them in beat.

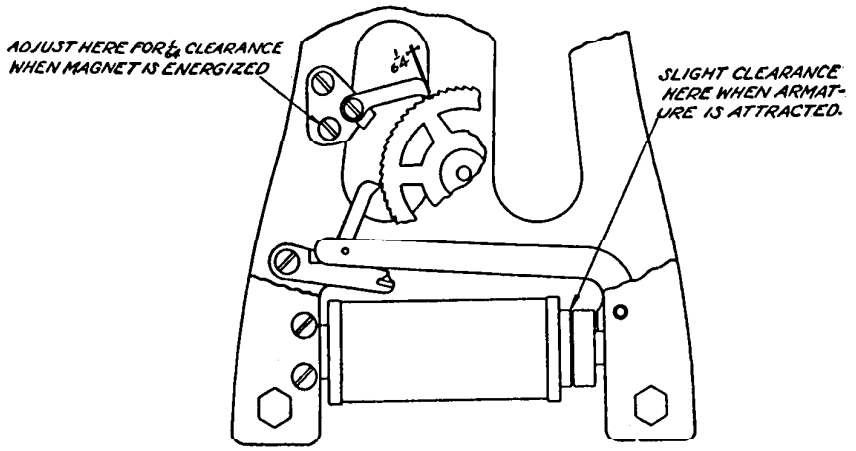
2. Liner must fit snugly against armature.

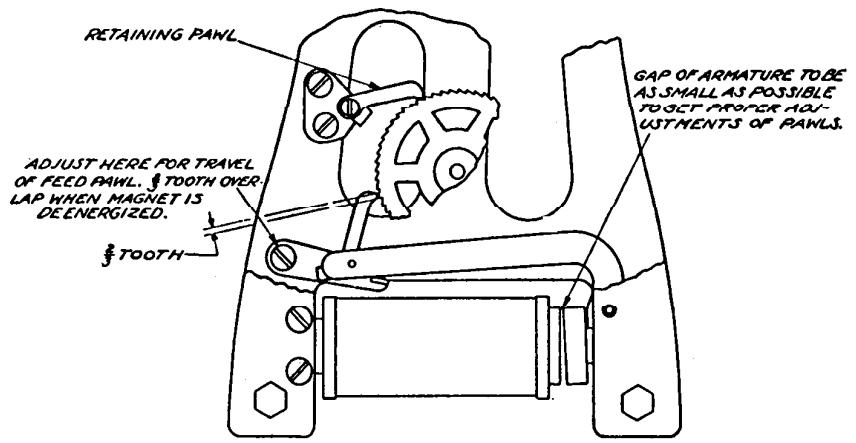
3. Armature must strike both poles evenly.

4. Adjust the armature and magnets for .003" clearance at the top of the armature when attracted.

5. With the armature attracted, adjust the retaining pawl for a slight clearance between the pawl and the ratchet tooth. This insures the retaining pawl dropping into the ratchet and holding same each time it is moved forward.

6. Adjust armature lever return stop so that the feeding pawl will overlap the ratchet tooth 2/3 of a tooth when in a de-energized position.





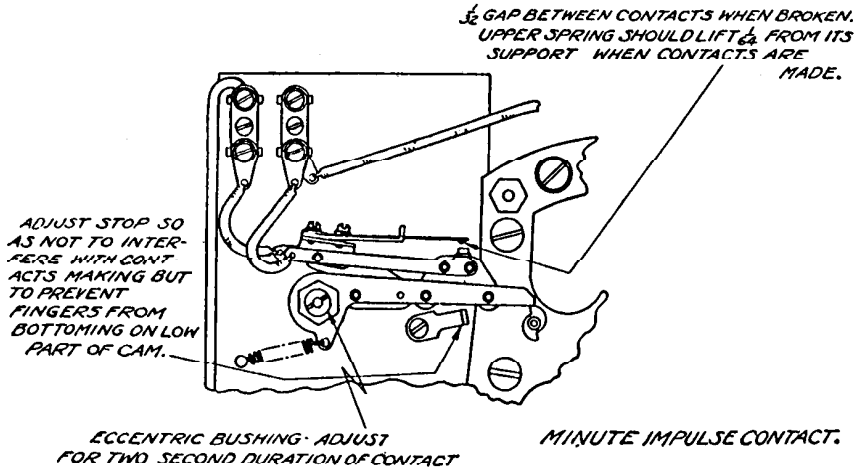
CONTACT ADJUSTMENTS

1. Adjust the minute impulse contact for two seconds duration on all clocks except the 120 beat. On the 120 beat, adjust for ½ second duration. This adjustment is made by moving the eccentric bushing at the pivot point. The contacts should make and break when the pendulum is near the zero on the scale.

2. Adjust the stop for the contact fingers so that they will not bottom on the cam.

3. Contacts should have 1/32" air gap when broken.

4. Upper contact should have 1/64" tension when made



Any Master Clock may be equipped with a duration contact which is operated from cams placed on the auxiliary shaft between the clock plates. The adjustments are standard except for the length of duration which may be varied to suit any special requirement. If the desired length of contact cannot be obtained by adjusting the eccentric bushing, the cams may be shifted changing the relation of the dropping off points.

WEIGHT DRIVEN MASTER CLOCKS

All of our Weight Driven Master Clocks are motor wound. The mechanism consists of two main parts; the clock movement itself and the back frame or casting upon which is mounted the motor for winding, the gearing immediately connected to it, the drum for carrying the cables to which the weights are attached and the switch for cutting the motor in and out of the circuit. The movement can easily be removed from the back frame by locking the weights with the pawl provided and removing the four screws.

The mechanism is so arranged that the clock will run between eight and nine days from the time it is fully wound to the time when the weights reach the bottom of the case. The above statement covers the condition when a mercurial pendulum is used. Owing to the greater diameter of the metal ball pendulum and its greater swing, it is necessary to shorten the drop of the weights and the full capacity of the run is then a little over five days.

In the ordinary operation of the clocks, approximately 30 hours elapses from the fully wound condition of the clock to the point where the winding switch is thrown. If there happens to be no current on at the time the switch is thrown, the clock continues to run, the winding switch remaining closed. It will be apparent that if no current is available for approximately a week, the Master Clock will continue to run.

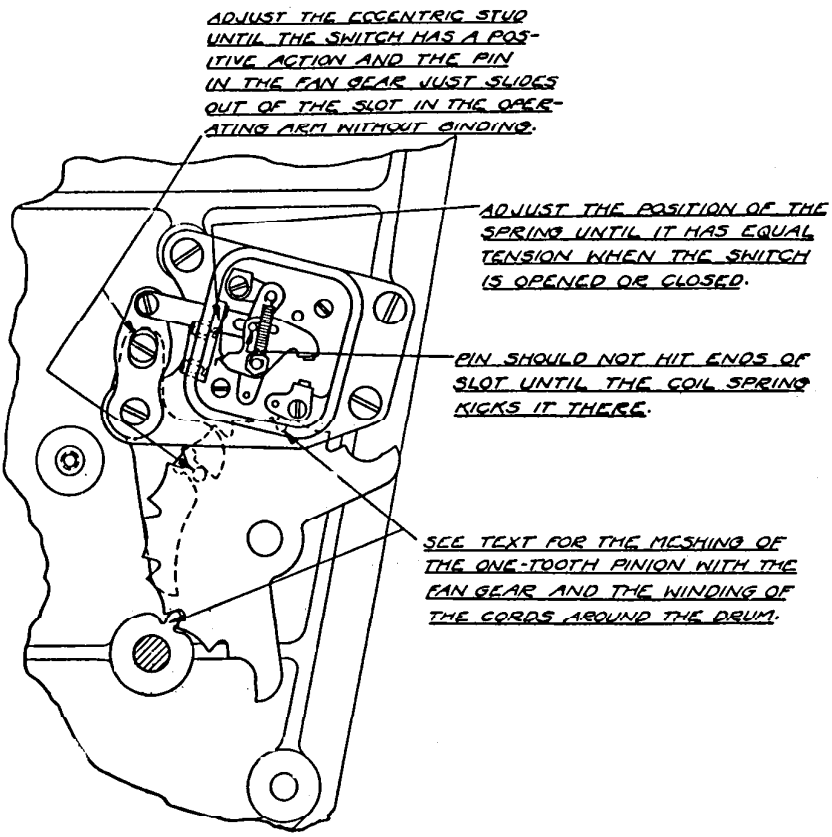
The winding mechanism consists of a universal motor which will run equally well on alternating or direct current. To reduce the hum of the motor to a minimum, it is mounted on flexible or yielding supports which keep it from direct or rigid contact with the back plate.

In the end casting of the motor is mounted a worm and worm gear, the purpose of which is to prevent winding at an excessive speed and to form a positive lock to prevent the weights from turning the motor armature backward when not winding.

The motor is connected to the winding drum by means of a fibre coupling. Differential gears are placed in the winding drum to insure power to the escape wheel while the clock is winding. The power from the downward pull of the weights is transmitted through these differential gears to the main driving gear and thence through the usual train of gears to the escapement.

To make the clock as near frictionless as possible, the winding drum and main gear are equipped with ball bearings.

The winding switch is so designed that the weights cannot rise beyond a certain point without opening the switch even though the switch may be out of adjustment so that it will not snap open. There is an eccentric screw in the switch arm which permits the switching mechanism to be adjusted so that it will snap open and closed with good tension and not bind. As stated before, the circuit will remain closed until the clock is wound.



If occasion arises to remove the winding drum from the back frame, care should be taken not to lose the ball bearings and also when reassembling, to get the one tooth pinion meshed properly with the fan gear. When the cords are out full length and the point where they are fastened to the drum is down, the one tooth pinion should be meshed in the second tooth from the end of the fan gear. This holds true when the long cords are used. If the short cords are used, the one tooth pinion should be meshed with the fourth tooth of the fan gear. Changing the number of turns of the cords around the drum has the same effect as changing the mesh of the gears. Under no condition should the top of the weights rise above the lower screw holes in the back casting.

If the weights do not hang even, small adjustments may be made by shifting or bending the support brackets slightly for the pulleys. Further adjustments may be made by tying new knots where the cords go into the weights.

This type of Master Clock uses the same minute impulse contact and duration contact as previously explained. This style of Master Clock is the only one used for synchronized and self regulating systems, the operation and contacts of which are fully explained in other bulletins.

MERCURIAL PENDULUM

Any sixty beat Master Clock may be equipped with a mercurial pendulum which, through the rising and lowering of the mercury in the glass jars, compensates for the expansion and contraction of the steel pendulum rod due to changes in temperature. Any Master Clock, when equipped with a mercurial pendulum, placed on a wall free from vibration and regulated to position, is guaranteed to rate within ten seconds per month of correct time.

When any clock is equipped with a mercurial pendulum, the suspension spring is much heavier to support the extra weight. On a spring driven clock, the main spring is heavier and on a weight driven clock, the weights are heavier as more power is required to swing a mercurial pendulum.

This pendulum is shipped from the factory knocked down and the mercury in jugs marked right and left, the glass jars being marked in the same manner. It is important that the mercury is placed in the glass jars as marked to insure the same conditions as in the factory test of the movement in question. It is advisable to strain the mercury through cheese cloth to remove all wax and dirt.

Before placing the mercury in the glass jars, always polish the inside of the jars. Care should be taken not to create bubbles when pouring. There are several ways to avoid this condition. One way is to pour slowly against the side of the jar. The most satisfactory method is to insert a piece of paper, coiled to a cylindrical form, into the jar so that it touches all points except the bottom. Make a funnel of another piece of paper and pour the mercury through slowly, keeping the orifice of the funnel below the surface of the mercury. When the cylindrical paper is removed, all bubbles that have formed will also be removed.

If any mercury is lost, it is permissible to even it up from the other jar, providing it is impossible to secure any from another source. Always replace mercury to correct height as soon as possible.

When installing a Master Clock, remember that the nearer plumb it is, the better time it will keep. Never go by the side or back of case in plumbing but rather by the pendulum and pendulum scale.