

MASTER CLOCK
and
SLAVE CLOCKS
half minute impulse

**General description
and instructions for
installing**

English Clock Systems

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SMITHS

THE MASTER CLOCK

The half minute impulse Master Clock is designed to conform to the accepted principles of all "free" pendulum Master Clocks. The full seconds pendulum consisting of an 'Invar' alloy rod and a cast iron bob weighing 17 lbs. is kept in vibration by the gravity impulses of a weighted lever which are imparted to it at regular half minute intervals through the medium of a roller on the gravity lever and an inclined plane or impulse pallet fixed to the pendulum.

SLAVE CLOCKS

The half minute impulse movements fitted to the slave clocks incorporate a single wheel having 120 teeth which is mounted direct to the spindle carrying the minute hand.

A pawl attached to the armature of an electro magnet holds the wheel in a locked position. As each half minute impulse is received from the Master Clock the armature is energised causing the pawl to be withdrawn sufficiently to engage the next tooth in the wheel; when the current is broken again a driving spring propels the pawl forward to its locked position and in so doing moves the wheel one tooth.

WIRING

The Master Clock, slave clocks and batteries are connected in simple series circuit. It is recommended that, because of its mechanical strength, 600 megohm grade electric wire 3/.036" gauge is used instead of single strand wire.

BATTERIES

Any form of good quality primary cell may be used. The quantity required can be calculated on the basis of one volt for each slave clock of 12" diameter or less plus seven cells ($10\frac{1}{2}$ v.) for the Master Clock. Normal operating current should be between .3 and .32 amps.

Alternatively, accumulators may be used—the quantity required being calculated in the manner described above. When accumulators are used a trickle charger must be installed to maintain a constant voltage. Primary (dry) cells are calculated at $1\frac{1}{2}$ volts each; secondary (wet) cells at 2.2 volts each.

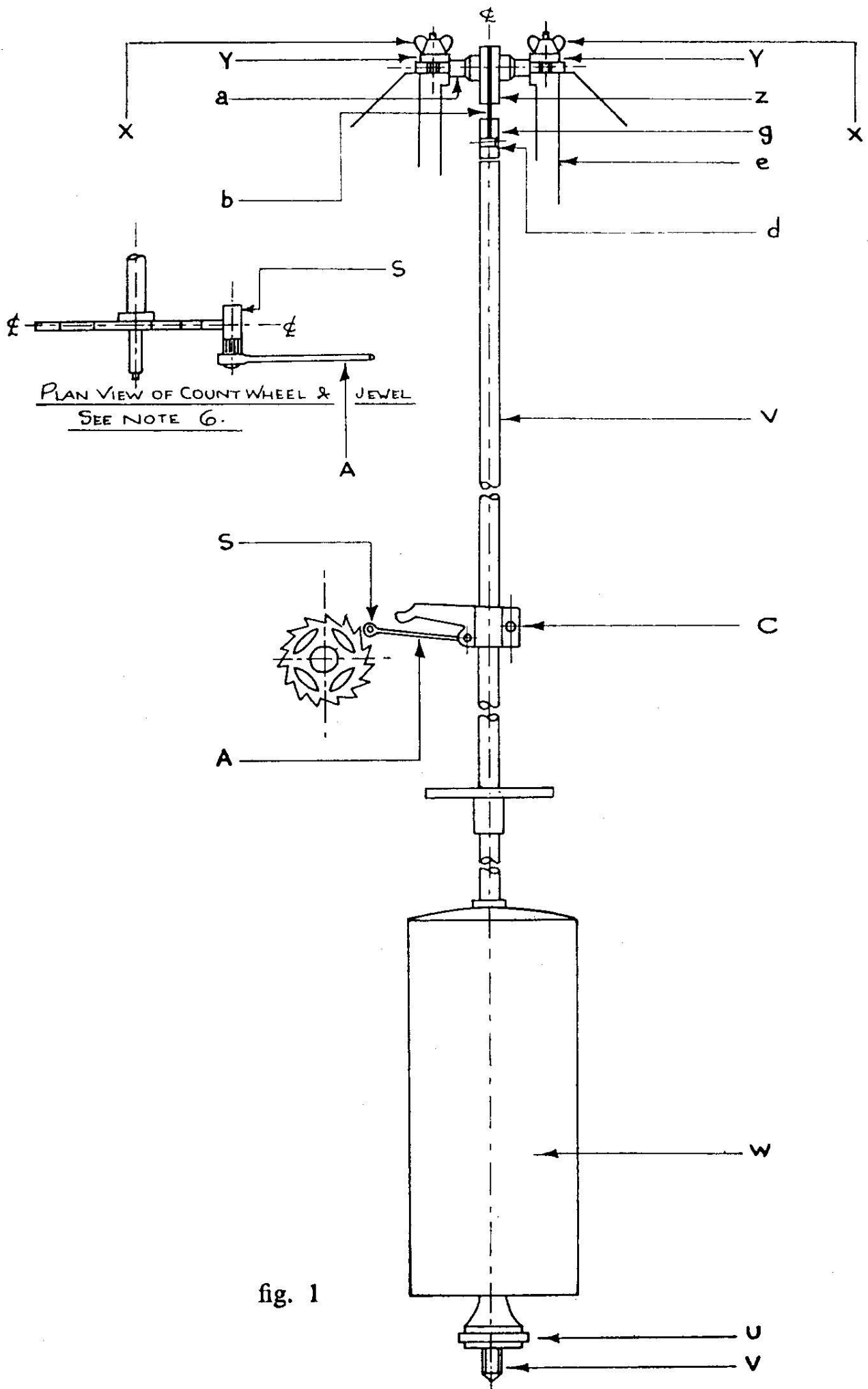


fig. 1

ERECTION

Carefully remove all packing materials and, by means of the hanging plate fitted at the back of the case, hang the Master Clock on to a firm wall. Use a plumb line to ensure that the case hangs vertically both from front to back and from left to right; when this has been done, secure the case in position by (i) passing 4" No. 12 round head screws through the two holes on either side of the pendulum suspension on the movement frame and screwing into *Rawlplugs* in the wall and (ii) by screwing one 2½" No. 12 countersunk screw through the hole located in the back of the case approximately 5 inches from the base.

PENDULUM ASSEMBLY—see fig. 1.

1. Remove packing material to expose click jewel wire A and pallet C.
2. Unscrew rating nut U from pendulum rod V.
3. Place pendulum bob W in position and screw up the rating nut U until the top of the bob bush registers with the mark 'O' on the front of the pendulum rod.
This will give approximate regulation.
4. Unscrew wing nuts X, swing out clamp plates Y and lift off the brass suspension chops Z complete with trunnion *a* and suspension spring *b*.
5. Place suspension spring *b* between brass chops *g* and loosely insert screw *d*.
6. The whole unit should then be hung by means of trunnion *a* and positioned on the top of movement bracket *e* so that the centre of the jewel S is in line with the teeth of the count wheel when viewed from above—see diagram in fig. 1.
7. When this adjustment has been made, tighten screw *d*, close clamp plates Y and tighten wing nuts X.

TO START THE CLOCK—see fig. 2.

Before starting the clock, obtain the correct line current of between .3 and .32 amps by connecting a milliammeter in series with the circuit; close the circuit by holding contact T up to contact M and adjust the 100 ohm variable resistance housed in the top left hand corner of the case. (See also note under 'Regulation' on page 5.

Gently set the pendulum in motion and observe that, when swinging, the top surface of the pallet C clears the roller D (on lever H) by notepaper thickness.

When the pendulum is swinging normally, the arc of vibration will be approximately $1\frac{1}{2}$ deg. to 2 deg. each side of the zero position on the scale at the bottom of the case.

The click wire A attached to the pendulum, turns a 15T count wheel one complete revolution every half minute. The release lever RL fixed to the count wheel arbor releases catch G and allows the gravity lever H to fall thereby imparting an impulse to the pendulum via pallet C which is sufficient to maintain the constant vibration of the pendulum for the following half minute.

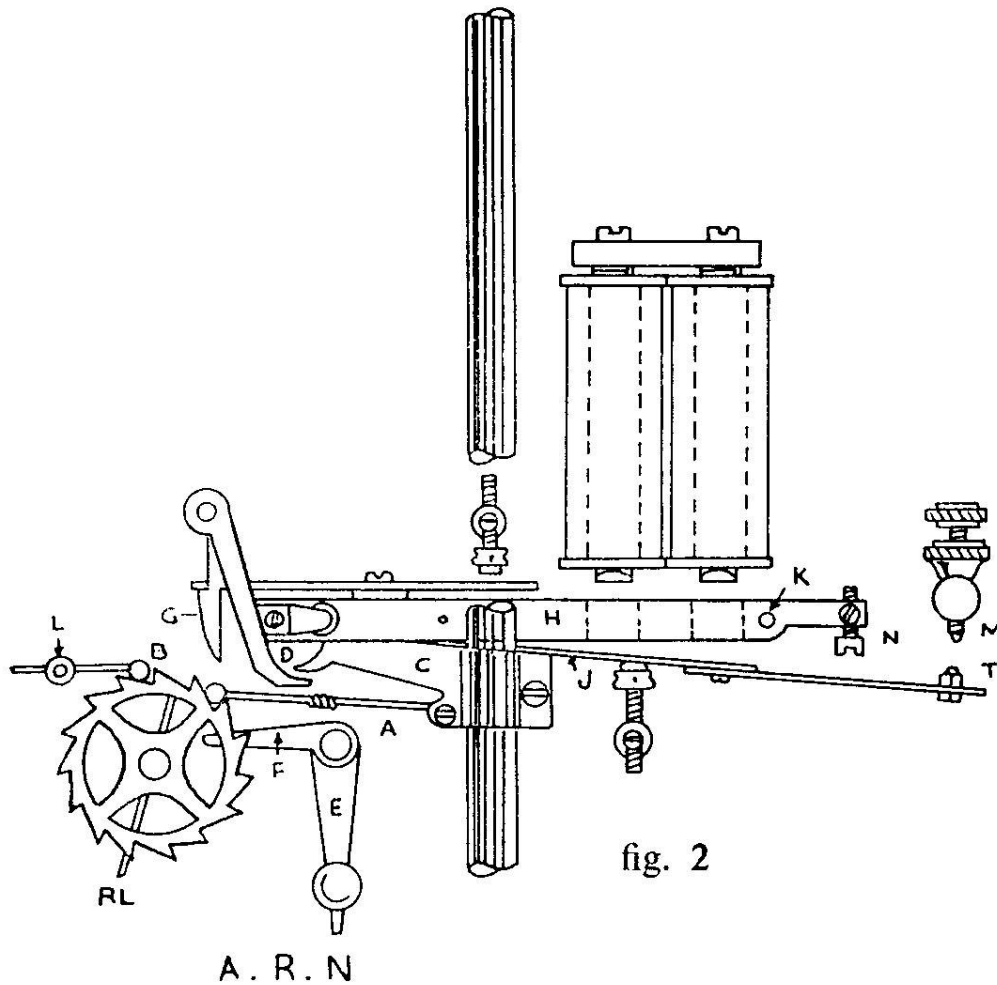
When the pendulum has completed its impulsed swing to the right, the spring mounted contact T on the gravity lever comes into touch with the corresponding contact M fitted to the baseplate and in so doing energises the armature which, in its movement towards the magnet, carries with it the impulse gravity lever and replaces it on its catch ready for the next half minute release. When the gravity lever is on its catch, the contacts are separated and the armature returns to its normal position.

The three positions of control lever E function as follows :—

N—for normal running, the lever extension F allowing the free passage of click A.

R—for retarding, the lever extension F lifts click A clear of the count wheel and the pendulum swings idly.

A—for advancing, the lever extension F engages catch G and releases the gravity lever H at every swing of the pendulum.



REGULATION

Raising the pendulum bob by one complete turn of the rating nut will accelerate the clock by approximately one half minute per 24 hours. To avoid damage to the suspension spring grasp the pendulum rod firmly at a point just above the bob.

Before starting the clock, place four weights on the tray on the pendulum rod.

If the degree of error over a period of several days is only very slight, a correction can be made without disturbing the pendulum by adding or removing weights. One weight effects a difference of approximately one second in 24 hours; add weights if the clock loses, remove weights if it gains.

BREAKDOWNS

In the event of a breakdown, it is desirable to communicate without delay with any of the addresses listed on the front of this booklet.

MASTER CLOCK : To ascertain the cause of a breakdown note first of all if the gravity lever is supported on its catch. If it is, gently swing the pendulum and if at the completion of one revolution of the count wheel the lever is released, contact is made and the lever replaced, it will be known that the circuit wiring has not failed. This being so, the fault may be due to excessive friction on one of the moving parts of the escapement which can be remedied by the application of a drop of good clock oil to the pivots and click jewel.

When the gravity lever is not replaced by the armature, except with assistance from the pendulum, it can be assumed that the batteries require attention.

If, when the contacts are closed, the armature makes no attempt to move, the fault may lie in a break in the wiring, contacts or loose connections at the terminals of the master clock, batteries or slaves.

Do not interfere with the Master Clock adjustments.

SLAVE CLOCKS: If an individual slave clock stops or loses time it should be taken out of circuit and returned for repair or replacement. When taking a slave clock out of circuit care must be taken to ensure that the circuit is not broken at the time of an impulse from the Master Clock otherwise the remaining clocks in the circuit will be out of step to the extent of half a minute due to a false or indefinite contact.

When it is necessary to advance an individual dial to bring it into step with the system a $1\frac{1}{2}$ volt dry cell should be used to make repeated contact at the terminals of the particular clock until the hands stand at the required time. If a slave clock is fast, the terminals of the clock should be shorted out until the clock is correct.

The hands of a slave dial must not be moved manually.

NOTES