Adjusting the Escapement

With the pendulum rod vertical and still, and the weight supports in the up position, the top surfaces of the arms were arranged to be below the weights by half the impulse distance. Hence, when the pendulum swings past the vertical, the arms lift the weights. The weight support stops were adjusted, so that with the weight supports in the down position, the pendulum arms lifted the weights clear of the weight supports, again, by half the impulse distance (the full impulse distance being about 0.5 to 1.0mm). In other words, impulse is symmetrical about the pendulum's vertical position. This satisfies what is known as “Airy's Condition.” Sir George Biddel Airy was an English nineteenth century mathematician and Astronomer Royal. He showed that this condition negates escapement error. A further implication is that this minimizes timing deviation due to changes in impulse. Of course, the whole idea of the SGE is that the impulse does not change. Nevertheless, as an added precaution, the escapement may be set to satisfy Airy’s Condition.

It will be appreciated that as a pendulum arm lifts its weight clear of a weight support, the other arm lowers its weight onto its weight support. The weight supports are fitted with counterweights. These are adjusted so that, with the weights lifted clear of the weight supports, and with the props in the lower position, the distal ends of the weight supports lower against the stops. The pivotal action must be reliable, but not too forceful, since excess force interferes with the unlocking action of the props.

The prop counterweights are adjusted so that, with a weight resting on a weight support, there is insufficient torque on the prop to overcome the frictional resistance between the roller clutch and cam of the weight support, to allow the ball bearing roller of the locking arm,
to roll off a tooth of an escape wheel. It will be realized that in this condition, the frictional resistance between roller clutches and cams is greatly increased because the roller clutches cannot turn. Hence, the escape wheel remains locked.

Conversely, when a weight is lifted clear of its weight support, the frictional resistance between the roller clutch and cam is reduced. The torque applied to the prop, via its counterweight, is then sufficient to cause the prop to pivot. Hence, the roller of the locking arm rolls up the flank of an escape wheel tooth, allowing the tooth to “escape,” and the escape wheel assembly to index. It will be appreciated that during “unlocking,” the periphery of the roller clutch does not roll, but slides against the cam. However, as mentioned earlier, without the weight in place, the force between cam and roller is minimal. The torque provided to drive the escape wheel must be sufficient to reliably index the escape wheel once within half the cycle time of the pendulum, but not enough to prevent the roller of the locking arm from unlocking the escape wheel.

Second Impulse Mode

Figure 16 is a front view of an SGE in which the pendulum is impulsed in one direction only. The construction is virtually identical to that shown is Figures 3a-8c. However, the LH flat cam is replaced by a concave cam, and the LH weight support stop is no longer needed. The radius of cam is struck from the pivotal center of the LH prop assembly. Hence, as the prop pivots, it supports the weight support but does not cause it to move up or down. Furthermore, the length of the cam is shorter than the LH cam and, as the RH prop pivots fully clockwise, its roller exits the edge of the cam, causing the RH weight support to lower and be constrained by its stop. The RH reset lever is replaced by bent reset lever. The bend gives clearance to the resetting rollers of the escape wheel assembly, prior to their resetting action.

The pivotal shaft of the RH prop assembly extends through the front plate and on it is fixed an impulse control lever (Figure 17b). The distal end of this lever terminates in a ball bearing roller. The roller acts on an impulse control cam, which is mounted on the shaft of the escape wheel assembly. The control cam has major and minor peripheral regions. In this example, which provides a pendular impulse once per revolution of the escape wheel, the minor diameter encompasses teeth 1 and 6, relative to the escape wheels. For two impulses per revolution of the escape wheel, the minor diameter would be extended to encompass teeth 3 to 6. For less frequent impulsing than once every revolution of the escape wheel, the control cam, with an appropriate form, would be driven via the escape wheel shaft, but at a slower speed.

When the RH prop pivots clockwise, as the RH weight is lifted clear of weight support, and roller of the impulse control lever coacts with the major diameter of the control cam, the prop roller is constrained to remain within the confines of the radius region of the RH weight support cam. Hence, the weight remains at the same height, and no impulse is imparted to the pendulum by the RH weight. However, when the roller of the impulse control lever coacts with minor diameter of the control cam, the roller of the RH prop exits the edge of the cam, causing the RH weight support to lower. Hence, impulse is imparted to the pendulum by the RH weight (as described in modes 1 and 2). As the escape wheel assembly continues to index, the control cam controls when impulse occurs. In this example, it is once every complete turn of the escape wheel, or every sixth swing of the pendulum.

Third Impulse Mode

Figure 17a is a front view of an SGE, where the impulse occurs once for every complete cycle of the escape wheel. The construction is similar to Figures 3a-8c and Figure 16, but with the following differences:

The RH flat cam is replaced by concave cam, and the RH prop stop is no longer needed. The radius of the cam is struck from the pivotal center of the RH prop assembly. Hence, when the roller acts within the radius of the cam, it supports the RH weight support but does not cause it to move up or down. However, the length of the RH cam is shorter than the LH cam and, as the RH prop pivots fully clockwise, its roller exits the edge of the cam, causing the RH weight support to lower and be constrained by its stop. The RH reset lever is replaced by bent reset lever. The bend gives clearance to the resetting rollers of the escape wheel assembly, prior to their resetting action.