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A Weight-Driven Silent-Pull Timepiece

Mechanism of an Eighteenth-Century Bedroom Clock

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Pull-repeat clocks that strike the hours and quarters on demand fall into two broad categories. Firstly, two-train clocks that sound the hours during normal running, but when a cord is pulled and then released the quarters are struck, followed by the previous hour. These appear to have been made to entertain the owner and demonstrate to visitors that he was wealthy enough to own what would now be called an 'executive toy'. Their regular hourly strike would disturb the sleeper and make them unsuited to bedroom use. The second type was a single-train timepiece that would only sound the hours and quarters on demand. This was more practical as a bedroom clock, especially as it often included an alarm. These are also often referred to as pull-repeating clocks, but since neither the hours nor quarters have previously struck, they have not repeated and are more correctly termed 'silent pull', i.e. they are silent until pulled.

Both types of clock were popular in Britain in the late seventeenth and eighteenth centuries, with every maker devising his own mechanism, ranging from Thomas Tompion's ultra-complex system to Joseph Knibb's simple silent pull. They were usually high quality spring clocks in fashionable cases and only rarely the work of provincial clockmakers. It could be argued that tradesmen, merchants

Figure 1. The dial.

Figure 2. Mary and Child.

Figure 3. St John of Nepomuk.

and even farmers or important servants (such as butlers or housekeepers) had a greater need of a silent-pull timepiece than those further up the social scale. While country-made versions do not appear to have been widely produced in Britain, they are known in Germany. This article describes a silent-pull weight-driven wall clock, probably made in the mid-eighteenth century, with a naïve painted iron dial, iron movement plates, an alarm and a weight-driven silent pull of a type unlike those normally made in Britain. Since this type of clock is quite different from those with which most readers may be familiar, a general description is included as well as the silent-pull mechanism in greater detail. It is a bedroom clock that needs winding in both the morning and the evening, with pull-strike to tell the time to the nearest quarter of an hour when it is dark, an alarm to wake the sleeper in the morning and images of the Virgin and Child as well as a saint to keep watch during the night. Like most Continental rural clocks, it is unsigned.

The rectangular painted iron dial, **Figure 1**, has the Virgin and Child on the left, **Figure 2**, and St John of Nepomuk (born around 1345) on the right, **Figure 3**, with red roses in the spandrels and within the chapter ring, all on a dark blue ground. The hour and minute numerals are bordered by red rings. The saint is readily identified by his white priestly clothes, a black or blue cloak and black hat and is holding a crucifix. He drowned in 1393 and his statue often adorns bridges, such as the Charles Bridge in Prague. He is the patron saint of Bohemia (the Czech Lands), which may indicate the origin of the clock, or, more likely, just the dial. The brass hands and alarm-setting disc are restorations.

The iron movement plates have four rectangular-section iron pillars with extensions at the front to support the rear of the dial, which is screwed to three brackets on the front plate, **Figure 13**. The top bar that supports the verge escapement, the cowtail pendulum and the top pivot of the crown wheel, are pinned to short brass uprights riveted to the plates. The movement is enclosed in a sheet-iron box, **Figure 4**, with a hanging hoop and spikes on the rear, opening side doors, and two bells on the top cover with clearance slots for the hammers. Since the hands are not in the centre of the movement, the latter is offset to the right-hand side of the dial.

The brass great wheel is solid without crossings and with a separate brass ratchet riveted to the usual Germanic type of iron vee-pulley. The contrate wheel has iron crossings, while there are decorative rings turned on the second arbor; otherwise the brass wheels with three crossings of the going train are conventional, **Figure 5**. The alarm, **Figures 6 and 7**, has iron pins on a brass disc, instead of a crown wheel with cut teeth, while a step in the edge of the disc serves to lock the alarm. The release lever is a one-piece forging that pivots between the front plate and a cock at the rear. The restored alarm verge pivots in a cock at the bottom and in the top of the case.

The motion-work, **Figure 8**, comprises an integral pinion-of-report to drive the hour wheel and a wheel to drive the minute wheel. Since the pinion is formed as three pins on a brass pipe, and the concentric pipes of both hands sit on a post, the usual slip washer to compress the hand-setting friction spring is not practical. Instead, an off-centre taper pin sits in a deep groove near the front end of the great wheel arbor. The pinion-of-report meshes very deeply with the long teeth of the iron hour wheel, **Figure 9**. Twelve holes in the hour wheel have no function and may indicate a previous use

Figure 4. The iron case, hammers, bells, hanging hoop and short spikes.

Figure 5. The going train.

Figure 6. Alarm release lever, crown wheel with pins and weight pulley.

Figure 7. The alarm.

Figure 8. The motion-work (left), quarter locking cam, pinion, rack, starwheel with hour snail and jumper (right).

Figure 9. The pinion-of-report meshes very deeply with the hour-wheel teeth.

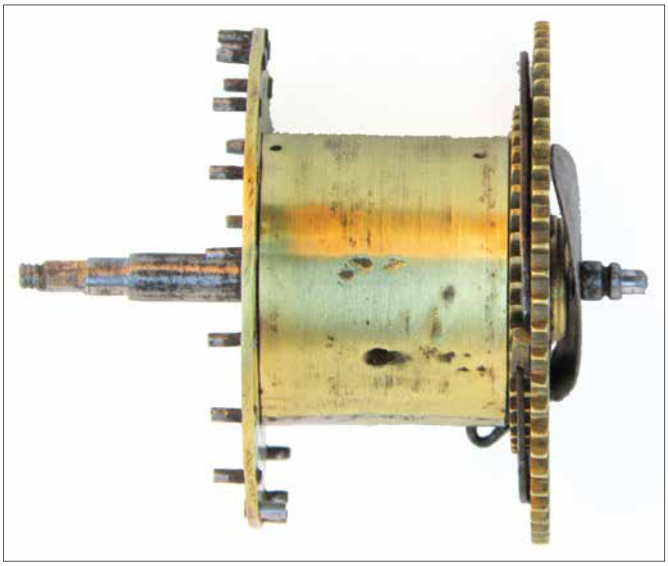

Figure 10. Silent-pull weight barrel with pins to trip the hour and quarter hammer tails.

Figure 11. Silent-pull runners.

to let off the alarm on an earlier clock. A brass hour snail on an iron starwheel with a brass jumper is indexed by a short arm on the front of the minute wheel, which has a quarter snail on the reverse.

The strike operates by pins round the edge of a small weight barrel, **Figure 10**, rather than the more usual spring barrel, tripping hammers for the hours and quarters. An inverted three-wheel train of 'runners', **Figure 11**, all with three crossings, including a great wheel with the usual click system, and a fly, which is fixed to its arbor, regulates the speed of striking. The disc on the front end of the barrel has eighteen divisions, with 12 hour pins on the front face, then two divisions without pins to give a short pause, followed by four quarter pins on the rear face. An eight-leaf brass pinion and a quarter locking cam are squared on to the front extension of the barrel arbor, and are held with a square iron nut. How far the barrel is pulled determines the number of hour strikes, and how much further it is allowed to rotate before locking occurs determines the quarters.

The pinion engages with a toothed iron rack, **Figure 12**, which, when a cord round the barrel is pulled, moves the rack until a brass sensing arm contacts a step on the hour snail,

Figure 12. The rack driven by a brass pinion on the barrel arbor.

Figure 13. Front of the movement with the silent pull locked.

and when released the appropriate hour strikes. The quarters are sensed by an articulated two-armed lever, one end contacting the quarter snail, the other end locking on one of the steps of the quarter cam at the end of the strike. The front of the movement (without the escapement) is shown in **Figure 13**.

This vital two-part component was missing and was restored, **Figure 14**, based on a German iron spring clock with the same type of silent pull, aided by images and information supplied by Ian D. Fowler. The quarter lever consists of a pivoted detent that falls on to the quarter snail and a separate locking arm. Instead of there being a pivot post on the movement front plate, there is just a short stub with small notches on either side. Attempts to retain the detent using a slotted washer proved unreliable and the best solution was to press on a brass collar. If the original method is eventually discovered, this can be removed and no alterations were made to the movement. The locking arm pivots on the detent, with a shouldered screw keeping them in alignment, while a light wire spring biases the detent downwards. When pressure is applied to the end of the locking arm its pivot point is such that the quarter detent is lifted off the quarter snail.

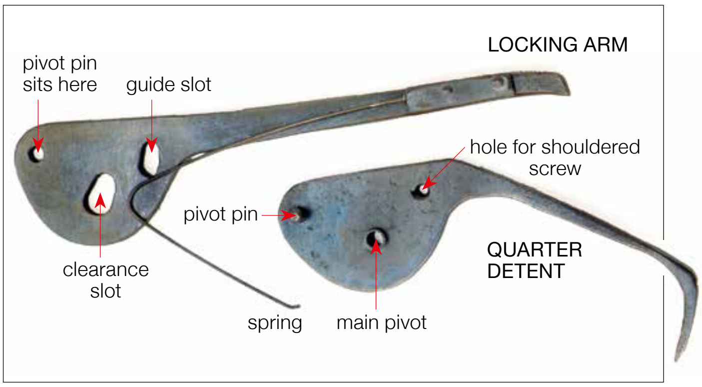

Figure 14. Restored components of the silent pull.

The cycle begins with the train locked by the arm engaged with one of the steps of the quarter cam and the rack fully to the right. As soon as the pull commences, pressure is taken off the end of the locking arm, allowing the detent to fall

Figure 15. Hour and quarter hammers with pivoted tails and biasing springs.

on to a step of the quarter snail. The rack then moves anti-clockwise until stopped by a step on the hour snail. When the pull is released, the rack moves clockwise to count the hours and continues to include up to four quarters. How many is determined by which step of the quarter snail the detent falls on to and hence which locking step the arm engages. The locking pressure lifts the detent so that it does not jam on the highest (fourth quarter) step of the snail during normal running. A hump on the quarter cam ensures that the locking lever is lifted high enough so it can fall on to a high step if it had previously locked on a lower one.

The pins on the barrel trip the hour and quarter hammers, whose tails are pivoted so that they slip past the pins without tripping the hammers during the pull, and only strike the bells when the cord is released. Since the tails are not heavy enough to fall positively under gravity alone, thin wire springs on the hammer arbors ensure that they fall after the pull, ready to trip the hammers, **Figure 15**. Views of the movement from the right-hand side and the top are shown in **Figures 16 and 17**. Wheel and pinion counts and dimensions are given in the panel on page 117.

Like Joseph Knibb's silent pull, the system described here must be pulled fully to ensure that the correct time sounds. The hours are counted by the same method used by Knibb, but while his system pumps over the hammer tail to count the quarters, this German method is more complex. This clock is a good example of what is usually regarded as a feature confined to more sophisticated mechanisms, applied to a country clock.

While the restored parts may not be exactly the same as the missing originals, conservationists can be assured that, to paraphrase what is said on some television programmes involving animals: no movements were harmed in the restoration of this clock.

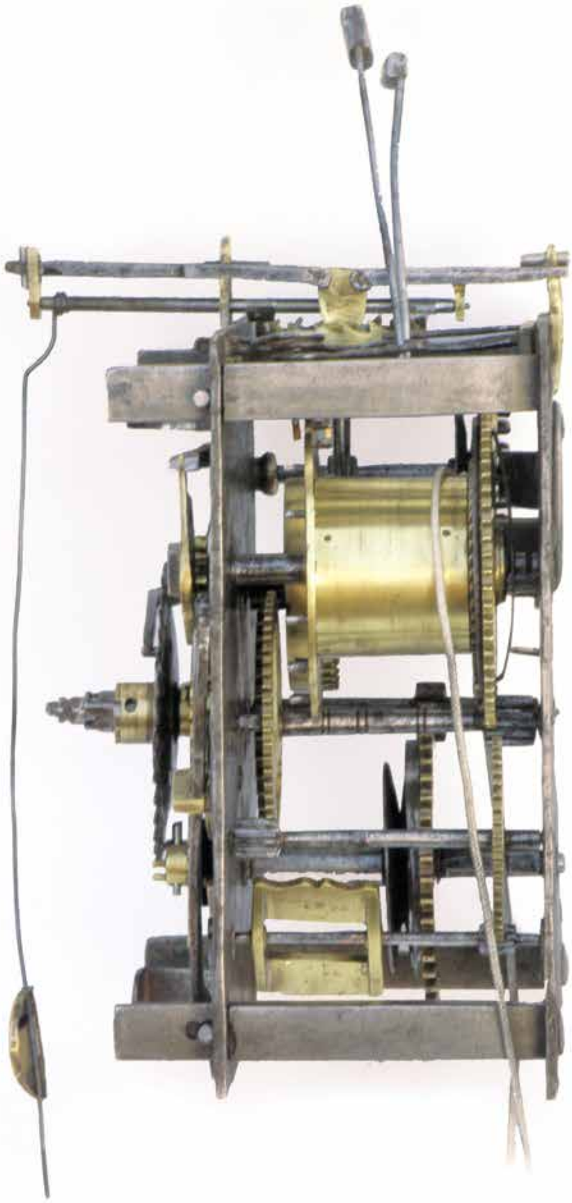

Figure 16. Wight barrel, runners and verge escapement with cowtail pendulum.

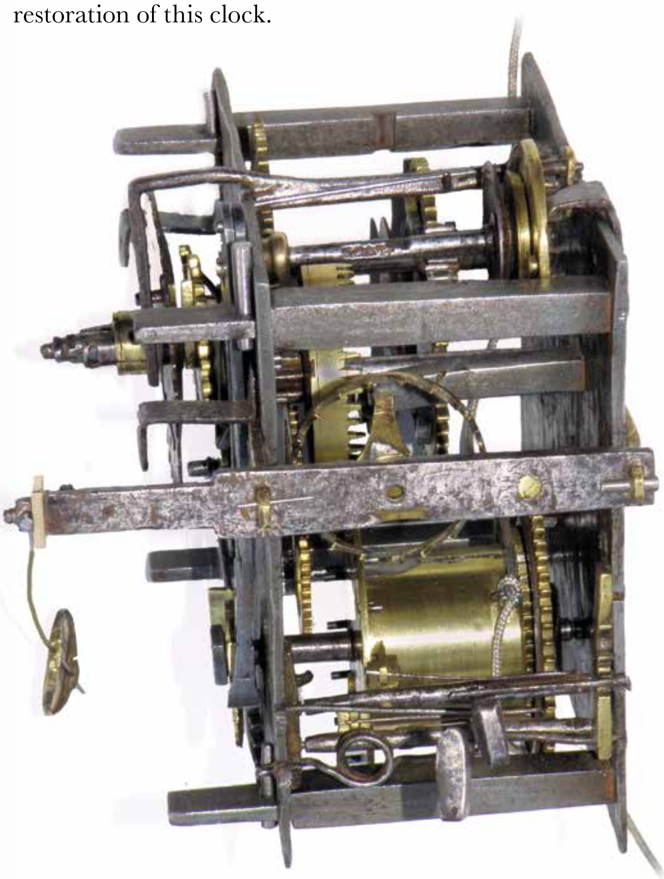

Figure 17. Top view of the movement.

	Numbers of teeth in the wheels	Numbers of leaves in the pinions
Going train		
Crown wheel	19	6
Contrate wheel	42	8
2nd wheel	60	8
Great wheel	50	3
Hour wheel	36	
Drive wheel	19	
Minute wheel	19	
Beat = 0.29 seconds		
Repeating train (runners)		
Fly	6	
3rd wheel	48	8
2nd wheel	60	8
Great wheel	60	
Duration = ½ day		
Overall dimensions		
11in tall x 8¾in wide x 5¼in deep (280 x 222 x 132mm)		
Case: 6¼in tall x 6in wide x 3½ deep (160 x 152 x 90mm)		

Acknowledgement
Grateful thanks are due to Ian D. Fowler for his help in understanding the operation of the silent-pull mechanism and its restoration.

Figure 18. The German silent-pull timepiece alongside a French rack striking lantern clock (see 'French Lantern Clock with Rack Striking', HJ, May 2016, pp222–8).