Iron Clock with a Side Pendulum

With Unusual Curved Verge Pallets

John Robey

If the clock shown in **Figures 1–3** was German it would be called an *Hausuhr* (literally 'house clock'), which is the term used for a weight-driven iron clock larger than a domestic clock, such as a Gothic clock, but not as large as a small turret clock. But since it is likely to have been made in France, where there is no special word for this type of clock, we have to call it simply a large iron domestic clock or a 'great chamber clock'. It is not only size that that sets it apart, but its other unusual features include: the construction of the frame (known as the cage in France), a longer than usual duration with wooden pull-wind barrels, a vertical crownwheel with the pendulum on the right-hand side, curved verge pallets and a brass countwheel with internal teeth.

The Frame

The frame measures 9¼in (235mm) square and 12½in (320mm) tall, while the heavy bell is 6¾in (170mm) diameter.[1] Unfortunately the single hour hand and the dial, whose former existence is confirmed by four screwed fixing holes in the front

Figure 2. Rear view showing the internally-toothed brass countwheel and the side pendulum.

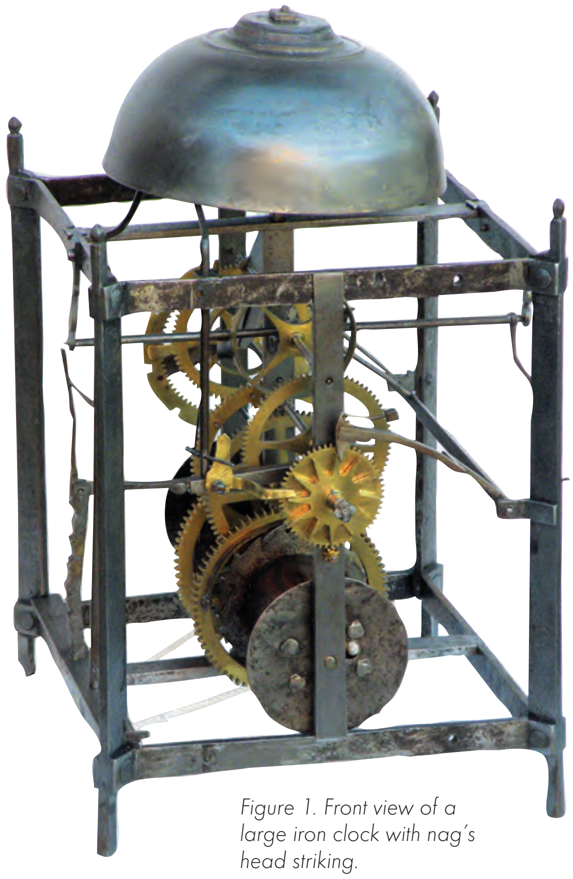

Figure 1. Front view of a large iron clock with nag's head striking.

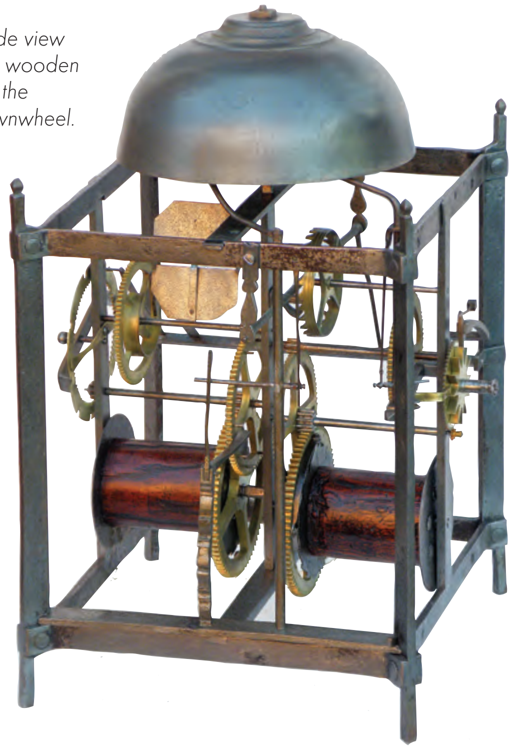

Figure 3. Side view showing the wooden barrels and the vertical crownwheel.

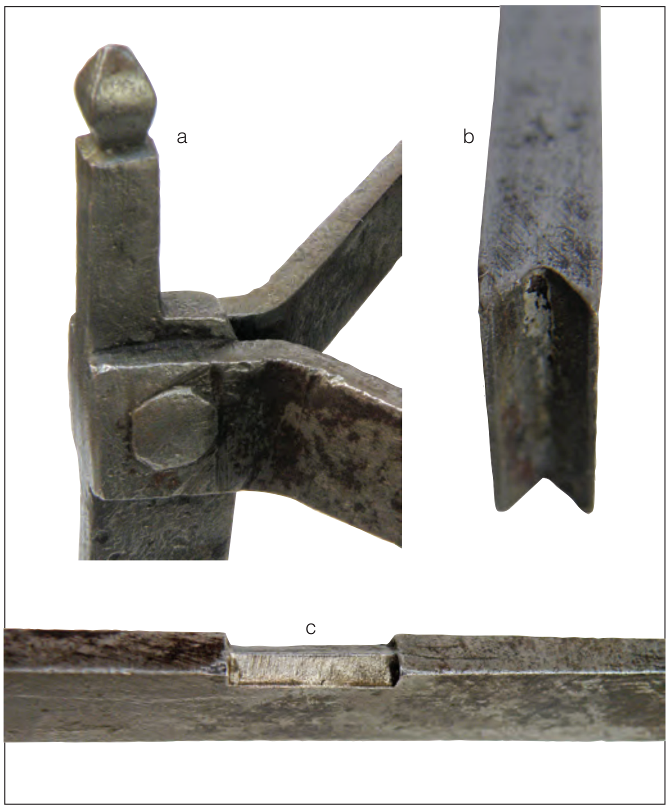

Figure 4. Details of the frame construction. a: corner pillars with riveted joint and finial; b-c: V-notch in the movement bars fit into a corresponding cutout in the frame.

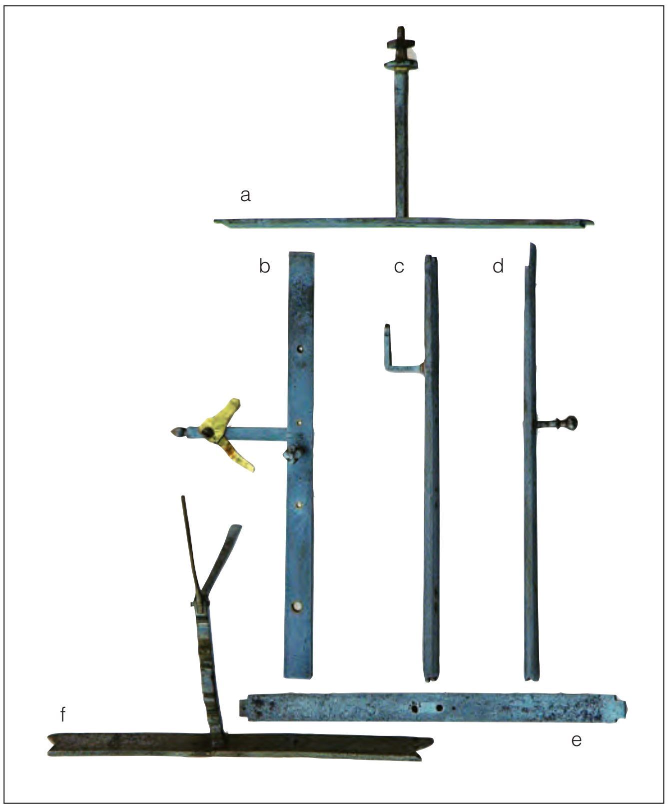

Figure 5. Removable parts of the frame. a: upper cross bar with bell stand; b: front bar with lifting piece for a passing half-hour strike; c: central bar with support for the rear crownwheel pivot; d: rear bar with a shouldered screw for the countwheel; e: lower cross bar; f: hammer tail on a removable bar.

of the frame, are missing. The former existence of a dial, probably made of painted iron, confirms that it was intended to be used in a domestic setting, perhaps sitting on a bracket high on the wall of a manor house or château. The rectangular-section corner pillars are set at 45 degrees to the frame and fixed in a manner that is unusual. While it would be imprudent to claim that it is unique, no other example has been found in the literature and no turret clocks constructed like this are known.[2] The ends of the eight iron bars that comprise the top and bottom horizontal sections have been forged over by 45 degrees and then riveted in pairs to the pillars (**Figure 4a**). This simple arrangement might be easier to make than forging two square frames of identical size. The result can be regarded as a very late and debased version of a Gothic clock, but apart from reduced sections at the lower ends for the feet and at the top to form small finials, there is little of the decorative ironwork typical of a true Gothic clock.

There are the usual two trains arranged end-to-end with the arbors pivoted in vertical iron movement bars. The central bar fits into a sturdy lower horizontal bearer that is located into notches in the sides of the frame and an upper bearer fixed with horizontal wedges. This central bar is held in the same manner as English and French posted-frame clocks, which is quite different to the method on Germanic domestic clocks. However, the front and rear bars are held in a manner which has not been seen before. A V-notch in the lower end sits in a corresponding notch in the frame (**Figures 4b-c**), while a dovetailed recess at the top simply clips under the top of the frame into a matching notch. There are no taper pins and this method is reminiscent of Gothic clocks where all eleven components of the frame are held together with dovetails, there being no rivets, and are then locked solid with just one taper pin — a testament to the smithing skills of these early clockmakers. The removable bars of the frame are shown in **Figure 5**.

The Going Train

All the wheels are made of brass, the going train being shown in **Figure 6**. The train counts are:

escapewheel	25 — 8
3rd wheel	80 — 8
2nd wheel	80 — 10 — 8
greatwheel	80
hour wheel	56

Since this is a single-handed four-wheel train the hour wheel is driven from the second arbor by a pinion, in this case of eight leaves. The wooden barrels of both trains, which appear to be made of pine, have wrought-iron sheet shrouds with ratchet teeth filed into to edge of the inner ones. The clicks pivot on shouldered screws on the greatwheel, but the end has a slot which straddles the teeth and prevents the barrel from moving sideways (**Figure 7**). Hence there is no need to have a separate retaining ring or taper pin to prevent the barrel from rubbing on the movement bars.

Each train has one rope for the weight and one wound on the barrel in the opposite direction for pull-winding. For a 5ft (1.5m) weight drop the duration is 5.8 days, which might confirm the suggestion that the clock was situated high on a wall where it could achieve a full week's running. Of course having a barrel rather than a spiked rope pulley does nothing the increase the duration, this — all other factors being equal — being determined by the drop. Having a barrel is a much more practical proposition with the heavier weights needed for

Figure 6. Brass wheels of the going train. The wooden barrel has iron shrouds.

Figure 7. A slot in the click restrains the barrel's sideways movement.

Figure 8. Alternate leaves of the pinion-of-report are of only half height.

Figure 9. The spring for hand setting made from an old thin file.

durations longer than a daily wind, though spiked pulleys are known on a very few 8-day English longcase clocks.

This train gives a beat of approximately $1\frac{1}{4}$ seconds and a 5ft (1.5m) pendulum (missing), another reason for suggesting that it was intended to be situated high up. The use of eight-leaved pinions gives less engaging friction, but lower counts, as commonly found on English thirty-hour clocks, would have reduced the pendulum length considerably.

The small eight-leaf brass pinion of report, shown in situ on the end of the second-wheel arbor in **Figure 6** and in close-up in **Figure 8**, has an unexplained feature. Every alternate leaf has been reduced to half its height — which would not have been a particularly simple task using hand tools. The hour wheel engages with the lower part of all eight leaves and it is difficult to imagine how the four full leaves could mesh with a wheel of similar pitch circle to the present one. Was it an aborted attempt to use a shorter pendulum (at the expense of reduced duration)? Both this pinion and the hour wheel appear to be original. Suggestions welcomed. A further interesting detail is the friction spring on the hour wheel for setting the hand (**Figure 9**). This has been made from a thin file, with the remains of the file teeth visible on both sides.

It is the arrangement of the crownwheel-and-verge escapement that deserved most attention. The crownwheel, like the other wheels in this clock, is vertical as in early lantern clocks. But instead of a vertical verge with the pallets acting on teeth at the top and bottom of the crownwheel, as with a balance clock, the verge is horizontal with the pallets contacting teeth on the left and right sides of the escapewheel. The verge is pivoted between two iron brackets hanging down from the top of the frame, with a pendulum crutch on the right-hand side (**Figures 1-2**). This arrangement avoids the need for a contrate wheel and its support cocks. This type of escapement is known on a few Italian turret clocks with early pendulums, that are said to be original.[3] It was also a simple method of converting early turret clocks to pendulum, with the foliot and vertical verge replaced by a horizontal one and a pendulum crutch at the side. An even simple conversion is the replacement of the foliot by a thin horizontal rod extending either to the rear or side and passing through a vertical slot in a pendulum rod. This is known on some conversions in The Netherlands, no doubt influenced by this arrangement being used on some Dutch *stoelklokken*. Since the foliots of turret clocks often have a beat as slow as 3 seconds, the very long pendulum is suspended high on a wall with the lower end engaging the horizontal rod.

It might be thought that the side pendulum on this clock is a conversion from a foliot or balance, but there is no evidence for this. The rear support for the crownwheel, necessary so that the verge can sit between the teeth tips and the central movement bar, does not permit a vertical verge and there was never a top support or suspension for a foliot or balance. In any event the vertical bell stand is riveted where such a top support would be located with no indications of an alternative position. There are no unused or filled-in holes, nor indications that any of the bars have been replaced, the texture and finish of the ironwork being consistent throughout.

The pallets on this clock are quite long and curved, rather than flat (**Figures 10-11**). A couple of other examples of curved pallets are known,[4] and they are slightly curved on Comtoise clocks with inverted verge escapements. Instead of being forged from an iron bar, as is usual with smaller clocks, the pallets have been made separately, fitted into dovetail slots in the arbor and riveted together so that the joint is barely visible.

Instead of the two pallets being at about 90 degrees or less for verge escapements on clocks with a balance or a short pendulum, these are at an included angle of about 110 degrees between the tips. This results in a smaller arc of the crutch, which would be an advantage for a long pendulum suspended above the movement. If the pallets had been flat the contact or impact angle of the crownwheel teeth tips on the pallets would be much higher than the recommended optimum of 15–20 degrees. Greater impact angles than this produce excessive wear on both the pallets and pivots with reduced impulse. The curved pallets not only reduce this angle but also maintain a more even transmission of energy to the pendulum. With flat pallets the transmission of energy increases rapidly as a tooth travels to the tip of the flag. Curved pallets are a desirable feature on recoil escapements, but the difficulty of forming and polishing them precludes their wider use.[5]

A small bent brass bracket for a thread suspension was screwed to the top bar of the frame. This was one of only two non-original features (both made of brass) and is not included in the photographs, so it is not known if this was how the pendulum was intended to be located. As suggested earlier it may have been suspended on a wall above the movement. At present a suitable location for the clock has not be decided, so the most practical pendulum arrangement awaits further investigation.

The Striking Train

The striking train is shown in **Figure 12**, the counts being:

fly		— 5
hoop wheel	80	— 8
2nd wheel	80	— 10 — 10
(10 hammer pins)		
greatwheel	80	
countwheel	78	

Apart from the fly pinion, which has only five leaves, all the other pinions, like those of the going train have relatively high counts. The countwheel is driven by a pinion on an extension of the second arbor, similar to the drive for the hour wheel. Like the going train, all the wheels have eighty teeth.

Striking uses the single-arbor nag's head system without warning.[6] Germanic clocks use a cam, known as a 'heart' from its shape, to provide overlift, whereas on this clock overlift is by means of a hoop wheel. Readers will be familiar with the hoop wheel on English thirty-hour clocks where the hoop is primarily used for locking. Here is used for both locking and lifting the detent — and hence the lifting piece — so that the nag's head can drop down on the trailing side of the pin, or in the case of single-handed clocks, the starwheel, that lifts it to let off the strike. **Figure 13** shows the single arbor with a combined locking and overlift detent. On small clocks the return of the nag's head is usually assisted by a spring, while on turret clocks its own weight is sufficient. On this intermediate size of clock there is an added counterweight, which I have not seen before.

The countwheel is the one-piece type with slots on the outside and internally-cut teeth, normally associated with iron clocks, such as Gothic and early turret clocks, but here it is made of brass. The iron two-armed crossing has to be offset to allow the pinion to engage fully. On iron clocks the countwheel normally has a pipe on the rear side of the crossing that rotates on a post riveted to the rear movement bar, but here the crossing just pivots on a decorative shouldered screw. Since there is no pipe to prevent wobble a thin brass strip screwed to the front side of the rear movement bar steadies the countwheel and keeps it in position.

This is the only wheel with punch marks on the tips of the teeth for dividing. Iron wheels were usually marked out using a dividing plate,[7] the spaces then sawn and the teeth filed to shape. Brass wheels could be slit with a wheel-cutting engine,

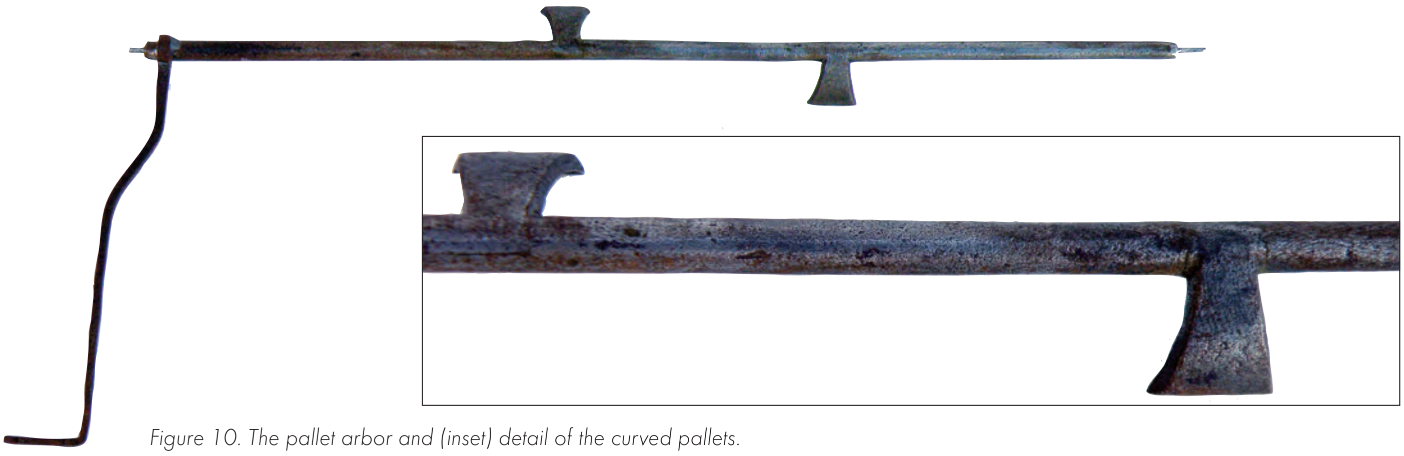

Figure 10. The pallet arbor and (inset) detail of the curved pallets.

Figure 11. The curved pallets with a very wide angle between them.

Figure 12. The strike train. The hoop is fixed to the crossings, rather than the rim. Iron fly and countwheel crossings.

Figure 13. The one-piece arbor for warnless striking using a nag's head.

but this was not possible for the internal teeth of this type of countwheel. They would have been marked out with a dividing plate and then slit by hand.

The hour hammer has a vertical arbor with a twisting action via a separate hammer tail and arm with a vertical wire spring, not the strong hammer spring seen on English posted-frame clocks. A twisting hammer arbor is often found on Continental clocks, but rarely on British ones, though most readers will be familiar with the system on French carriage clocks. The hammer tail pivots on a stout arm which is one of the few components with any decoration. Instead of being fixed to the lower frame member it is riveted to a horizontal strip (**Figure 5**) that fits into slots and is held in place by a wedge. This seems an unnecessarily complex construction, but appears to be original. There is a similar hammer system for a passing half-hour strike, though the brass let-off lever is the other non-original component. Both hammers strike the inside of the large bell.

Where & When?

It remains to determine where this unusual clock was made and at what period. The lack of a dial means that there we are denied one potential source of information, but even if it had survived it is unlikely to have been signed with the maker's name and place of work. No comparable clock has been found in the literature, so that line of approach is of little help. As most Continental country-made clocks are unsigned reliance has to be placed on technical features characteristic of a particular country or region. Germanic (ie from Germany, and the German speaking regions of Austria and Switzerland) *Hausuhren* do not have this type of frame construction and the nag's head striking usually employs a 'heart' cam to give overlift. On French clocks with nag's head striking the overlift is usually by means of a hoop wheel, and France is a contender for the origin of this clock.

Countwheels with internal teeth and made of brass are unusual, but examples are known on clocks from Catalonia, northeast Spain, and these also use nag's head striking.[8] Lantern and other posted-frame clocks from Normandy and other areas of northern France have warned striking, so it is likely that this clock was made in southern France, or possibly just over the Catalan border. Estimating its age is equally difficult, and my best guess — and it is no more than that — is the first half of the 18th century.

If any other examples of this type of frame construction or verge-and-crownwheel arrangement are known, the author would be pleased to receive details.

NOTES

1 Somewhat larger and earlier German/Swiss chamber clocks were sold by Dreweatts, Newbury, 6 September 2011 (lot 113, dial missing), 22 February 2012 (lot 255) and 20 February 2013 (lot 144).
2 Information from Chris Mckay.
3 Information from Stefano Benedini, Mantua. See also Kenneth Ullyet, *In Quest of Clocks*, (London: Barrie Books Ltd, 1950), plate LXXXII. This shows the Medici Palace clock, Florence, made with a pendulum before 1659 and possibly earlier than that by Huygens.
4 J. H. Leopold, *The Almanus Manuscript*, (London: Hutchinson, 1971), 15-16, 240. The late John Hooper reported an English lantern clock with curved pallets.
5 John A. Robey, *The Longcase Clock Reference Book*, (Mayfield: Mayfield Books, rev. 2nd edn., 2013), vol. i, 139, illustrates and describes the use of the dividing plate.
6 John Robey, 'Nag's Head Striking', *Horological Journal*, Nov 2011, pp494–7.
7 John A. Robey, *The Longcase Clock Reference Book*, (Mayfield, Ashbourne: Mayfield Books) revised second edition, 2013, Vol 1, p139, illustrates and describes the use of the dividing plate.
8 Jaume Xarrié & Eduard Farré, *El Rellotge Catala*, (Barcelona: Editorial Efadós, 2008), 141, 145, 147, 156, 163, 208, 225, 227, 249, 263, 264. Professor Eduard Farré has not seen a similar clock to the one described here — information via Howard Bradley.