Italian *grande-sonnerie* whizzing work striking

John A Robey*

This article discusses the specifically Italian system of whizzing-work that produces grande-sonnerie using only one striking train. After describing the principles of whizzing-work, four clocks are considered that all employ this idiosyncratic system. While the basic method is the same for the first three clocks, which have two-hands, they show regional variations and different arrangements to produce similar results. The fourth clock is likely to be the earliest one described here, and differs considerably in the layout of its striking-work. All four clocks have different escapements and dials, two of the dials being very unusual, possibly unique.

As an alternative to either a countwheel or rack-and-snail to control the strike, 'whizzing work' (known in German as *Surrerwerk*) was used about 1760–1840 on some wooden Black Forest clocks for twelve-hour striking. The origin of this system is not known, but a variant was used on an unsigned experimental longcase clock of about 1680 attributed to Abraham Fromanteel.[1] It is also known on a late seventeenth-century spring clock by Henry Younge[2] and a longcase clock of a similar period by Henry Jones, both of London.[3]

It was also widely used on some Italian clocks for *grande-sonnerie* striking, where both the quarters and the previous hour sound every quarter of an hour without the need for a separate wheel train for the quarters. The use of whizzing work appears to be earlier in Italy than in the Black Forest, with a clock in the Deutsches Urenmuseum, Furtwangen by Antonius Venturi of Florence being dated 1738.[4] These clocks continued to be made in Italy for about a century, with one by Jusignano Lorenzo Antonioli being dated 1832.[5] Almost nothing substantial appears to have been published about these clocks, and this article introduces this idiosyncratic striking system to those who may not be aware of it. The various arrangements of the main components are discussed using four examples from the eighteenth century. These Italian versions are invariably of short duration with separate weights for the going and striking trains that need winding daily. They have posted frames — either similar to lantern clocks with brass finials and feet, or simple square-section pillars held by screwed nuts. They strike the hours and quarters on two bells, often held on a two-armed or semicircular bell stand.

The basic principle of Italian whizzing-work (Fig. 1) is a series of hammer pins of graduated lengths with the hammer tail pushed, or 'pumped', to the rear against a biasing leaf spring and lifted by the appropriate number of pins. The distance the hammer tail is pumped is controlled by steps on a face cam and a

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1. Robert Loomes, 'An Early Repeating Longcase Clock', *Horological Journal*, October 1994, 550–3. The attribution to Fromanteel is by the present author. John A. Robey, *The Longcase Clock Reference Book*, (Mayfield Books, revised 2nd edition, 2013), volume 1, pp. 293–4.

2. S. Dzik, *Beneath the Dial: English clock pull repeat striking,* 2023, pp. 160–4.

3. Information from Richard Higgins.

4. Helmuth Kainer, 'Ein Surrer aus Überitalien', *Alte Uhren*, April 1982, 308–311. Venturi is not recorded as a clockmaker apart from this clock. The spring for the hour hammer is fixed to the bottom plate, with the spring for the quarter hammer fixed to the top plate..

5. Information from Niels van der Meche.

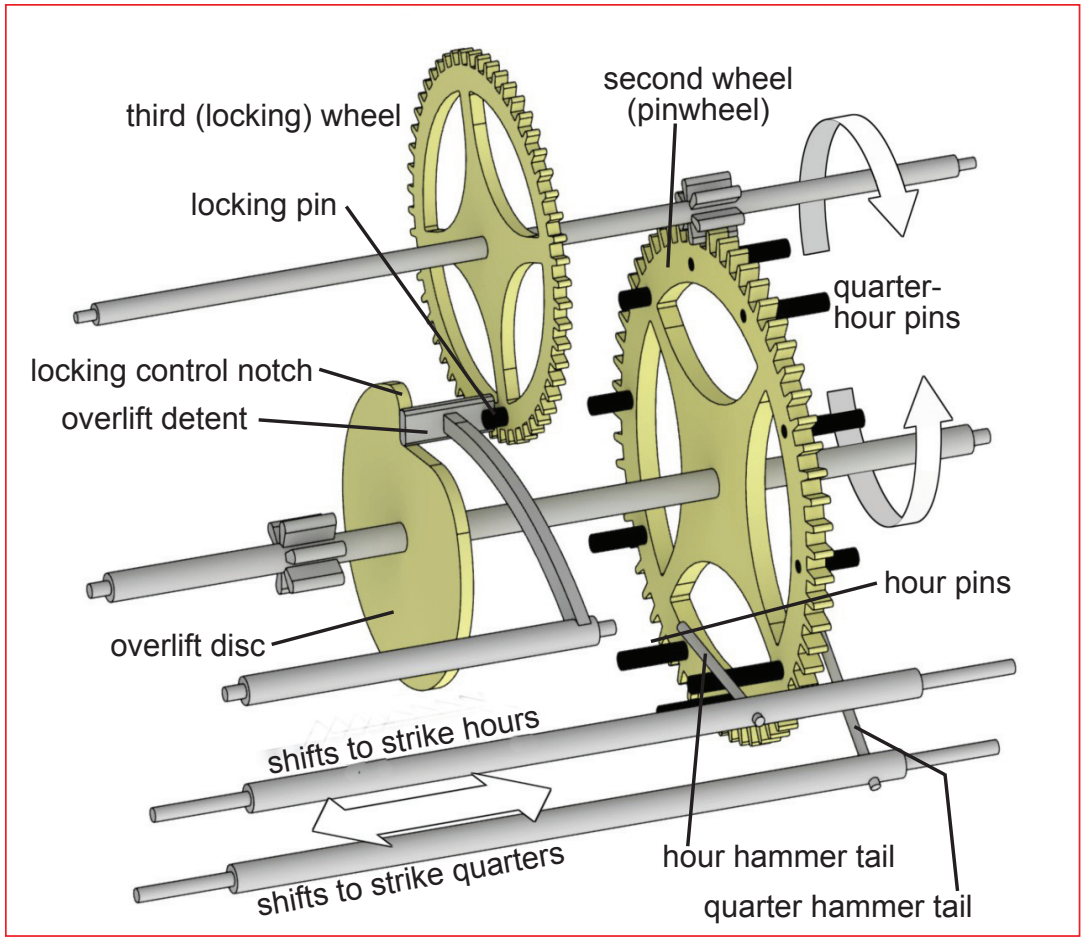

Fig. 1. The basic principles of Italian *grande-sonnerie* whizzing work striking. (CAD drawing by Arnaud Mornet)

	Clock 1	Clock 2	Clock 3
Striking sequence	6 hours + 4 quarters	6 hours + 4 quarters	3 quarters + 6 hours
Pumping lever position	Wide movement bar	Plate on RH pillar	Separate bar
Quarter cam	Minute wheel	Wheel-of-report	Minute wheel
Hour cam on starwheel	6 steps, 12 arms moved by 2 pins on minute wheel	6 steps, 6 arms moved by 1 pin on minute wheel	2 x 6 steps, 12 arms move by 2 pins on wheel-of-report
Hammer pins	6 hour pins + 4 quarter pins on 2nd wheel	6 hour pins on 2nd wheel 4 quarter pins on disc	6 hour pins + 3 quarter pins on disc
Hammer tail arbors	Separate bars	Plates on RH pillars	Separate bars
Hammer pivots	RH pillars	Top plate	Separate bars
Hammer springs	RH pillars	Bottom plate	Hour on bottom plate, quarter on top plate

Table of the variations in the technical features of the two-handed clocks discussed in this article.

lever that is usually, but not always, pivoted in the centre. One end of this lever acts as a cam follower, while the other end pumps the extended pivots of the hammer-tail arbor. The cam follower has to climb the steps, aided by slopes between each step, otherwise it would not be able to climb from the lowest step onto the highest one.

The specifically Italian version uses separate pins, hammers and cams for the hours and quarters, which are struck on two bells. This is known as *suoneria sui pironi* (striking on pegs) or *suoneria a canne d'organo* (striking on organ pipes, indicative of their graduated lengths), depending on the region.

There is usually double-six hour striking, as often found on Italian clocks. Both hour and quarter pins are either on the second wheel, or on a notched disc on the second arbor. Nag's head striking is usual and when the overlift detent is in the notch the locking detent blocks a pin on a wheel higher up the four-wheel striking train. When the nag's head is lifted the locking pin is released and the train runs until, after a full revolution of the second wheel, the overlift detent falls back into the notch and the train is locked again. The strike sequence can be repeated at any time and there may be a short brass lever for this purpose.

When the hour hammer tail arbor is in the forward position only one pin engages the hammer tail, and when it is fully pumped to the rear all the pins lift the hammer tail to sound all six hours. In an analogous way, when the quarter arbor is pumped to the forward position, all pins lift the hammer tail; and when pumped to the rear, only one quarter pin lifts the hammer. Whereas with countwheel striking the pin wheel only rotates sufficiently to strike the necessary number of blows, with whizzing work the pin wheel makes a complete revolution for every sequence, whether it is for only one quarter and one hour or four quarters and six hours. Hence there is a good deal of wasted power, accompanied by a whizzing noise when the train rotates without tripping the hammers.

The quarter and hour stepped cams have to rotate once an hour and every six hours respectively and since there are usually both hour and minute hands (but see Clock 4 for a rare exception) it is usually not convenient to fix the hour cam on the hour wheel. To locate the levers and sliding arbors in more convenient positions the hour cam is fixed to a starwheel that is advanced by a pin on the minute wheel or the wheel-of-report[6] and located by a spring-loaded jumper.

There are many variations in the layout of the basic two-handed system due to different regional clockmaking traditions and each maker's personal preferences. Since my experience of these clocks is limited to the examples discussed here, it is likely that there will be other variations. These regional variations include:

- The four quarters may strike first, closely followed by the previous hour (Clocks 1 and 2). Or the hours may strike first followed by the quarters (Clock 3). There may be no quarter strike at the full hour to distinguish it more easily from the previous strikes. To avoid a varying delay between the strikes on the two different bells, the shortest hammer pins are placed at the beginning of one sequence and placed at the end of the other sequence.
- The hammer pins for the hours and quarters can be on opposite sides of the second wheel (Clock 1), either side of the notched disc (Clock 3), or one set on the wheel and the other set on the disc (Clock 2).
- The levers that pump the hammer-tail arbors can be pivoted on blocks fixed to an extra wide front movement bar (Clock 1), on iron plates screwed to the front right-hand pillar (Clock 2), or on a separate brass bar (Clock 3).
- The arbors for the hammer tails may pivot in plates screwed to the right-hand pillars (Clock 2), or in separate bars (Clocks 1 and 3).The hammers may pivot between the right-hand pillars (Clock 1), or in separate bars (Clock 3), or in blocks screwed to the top plate (Clock 2). The hammer tails are mostly connected to the hammer arbors by wire links.

6. This is the wheel on the greatwheel arbor that drives the minute wheel, but it does not have an accepted term; it is *not* an intermediate wheel, as sometimes stated. Since the pinion-of-report drives the hour wheel, by analogy the minute wheel is driven by the wheel-of-report, a term used by some collectors of Comtoise clocks.

Fig. 2. Clock 1 with a cowtail pendulum and a later painted iron dial.

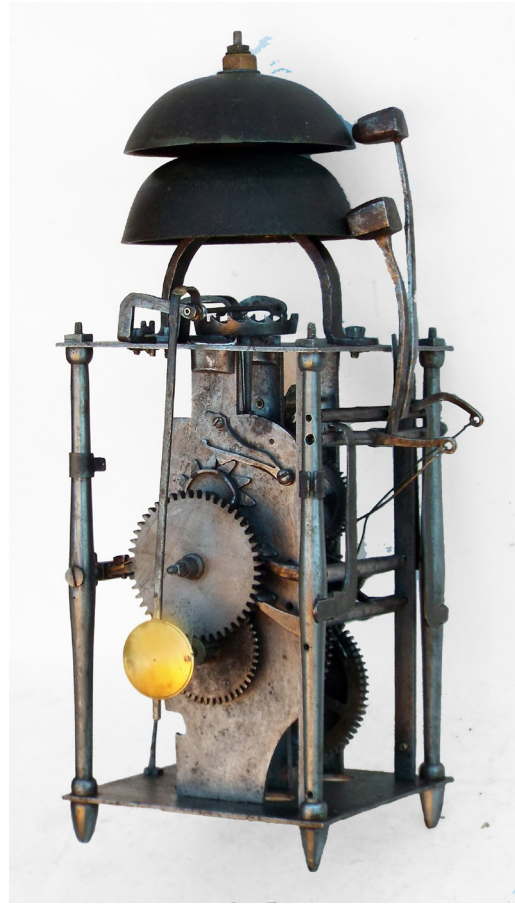

Fig. 3. Clock 1, front of the movement.

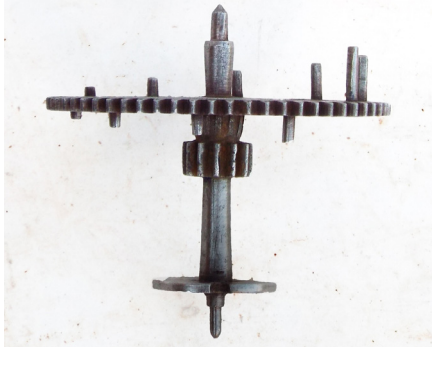

Fig. 4. Clock 1, graduated hammer pins on either side of the striking second wheel and the notched overlift disc.

Fig. 5 (right). Clock 1, wide iron front movement bar with the stepped quarter face-cam on the wheel-of-report, the hour face-cam on a starwheel, and the two rocking levers to pump the hammer-tail arbors.

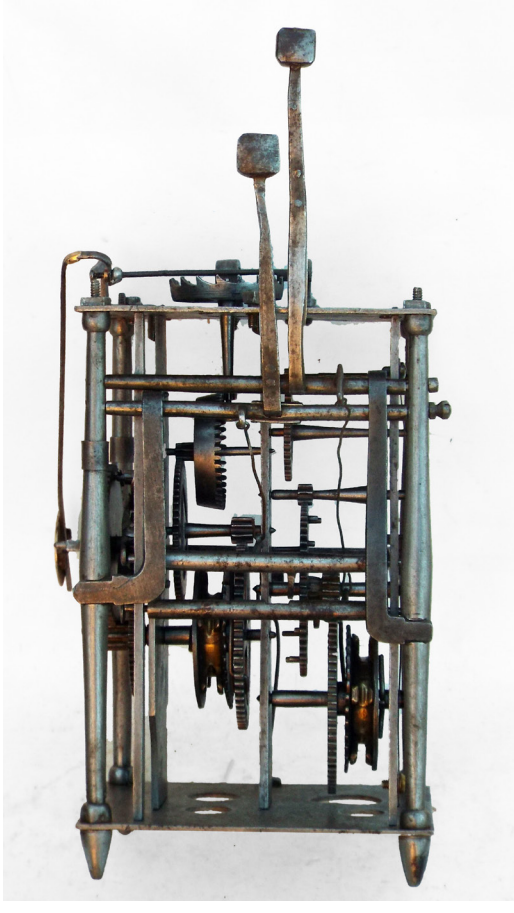

Fig. 6. Clock 1, right-hand side of the movement showing the arbors for the hammers and hammer tails, and the hammer springs dovetailed into the pillars.

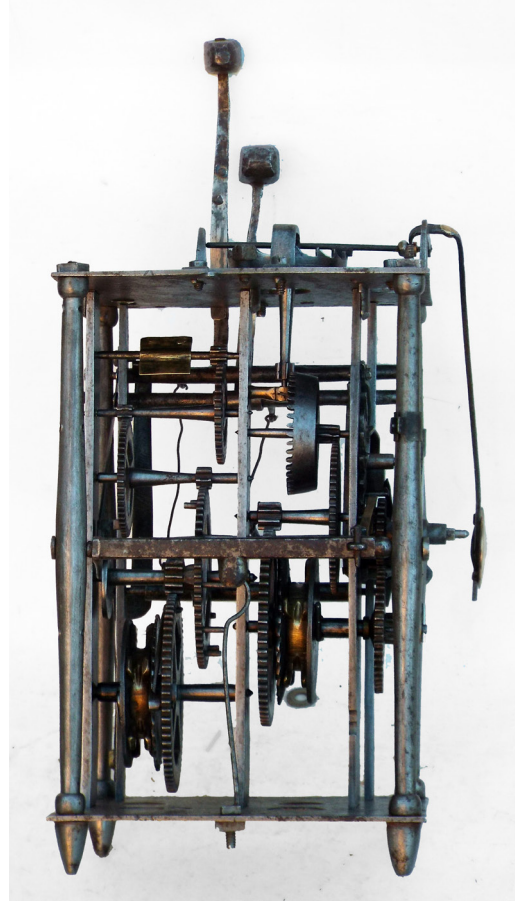

Fig. 7, Clock 1, left-hand side of the movement showing hammer pins on either side of the striking second wheel.

• The quarter steps may be fixed to the minute wheel (Clocks 1 and 2), which also has four pins on its rear side to let off the quarters. Or the steps may be on the wheel-of-report that drives the minute wheel (Clock 2).
• The hour steps are on a starwheel with either twelve arms (Clocks 1 and 3) or six arms (Clock 2) and advanced by one or two pins on the minute wheel. Or there might be two sets of six steps with a twelve-pointed starwheel advanced by two pins on the wheel-of-report (Clock 3).
• Escapements vary from a cowtail pendulum (Clock 1), a rear-mounted verge pendulum (Clock 4), an anchor escapement (Clock 3) or a pinwheel escapement (Clock 2).

Clock 1. Lantern clock with an iron frame and wheels. dated c.1750, possibly from Liguria, unsigned.[7]

This clock has a verge escapement, a cowtail pendulum, and strikes the quarters followed by double-six hours every quarter of an hour, on two bells using whizzing work (Figs 2–7).

The movement is completely original, apart from a later iron dial painted in a much earlier style, and the later iron hands. The frame has round-section pillars, swelling out

7. John A Robey. *Gothic Clocks to Lantern Clocks, Short-Duration, Clocks & Rural Clocks, 1480–1800*, (Mayfield Books, 2021), pp. 164–171, includes additional detailed images of Clocks 1 and 2.

in the centre, with stumpy cone-shaped feet which cannot be removed. The top plate is held by screwed nuts. The front movement bar is extra wide to accommodate the pivoted levers that push hammer-tail arbors that slide in two separate narrow bars, the rear one with biasing leaf springs.

Both trains have one-piece iron wheels fitting directly onto tapered arbors, with three crossings, apart from the greatwheels which have four crossings, and are driven by original chains instead of ropes. Six double projections cast into the central brass boss of the pulley hold the outside of the chain links, while both weights hang on the left-hand side.

Face cams on the motion-work push the hammer-tail arbors, via short centrally-pivoted levers to engage with lifting pins of graduated lengths on the second wheel of the striking train. The minute wheel has four steps on its front face for the quarters and four pins on the rear side to let off the strike every quarter hour. Two of these pins are longer than the others to advance a twelve-pointed starwheel, with six steps for the double-six hour strike.

The second wheel of the four-wheel striking train has an overlift cam and hammer pins, while the third wheel has a locking pin. The second striking wheel has six hour pins on one side and four quarter pins on the other side, all of graduated lengths. The strike-work has a nag's head, an overlift detent and a locking detent.

The hammer tails operate the two hammers via wire links, with the hammer arbors pivoting in the right-hand pillars, while the hammer springs fit into dovetail slots in the pillars.

In English silent-pull clocks, such linkages are often associated with the fact that the pin wheel must rotate in the 'wrong direction' during 'pulling' and the linkages allow the pins to slide past the hammer tails without disturbing the hammers. Of course, none of that applies here. Rather, the linkages are needed so that the pumping arbor may move back and forth while the hammer arbor is fixed. Were there just one arbor, the head of the hammer might not be striking the correct bell.

Clock 2. Small lantern clock with a pinwheel escapement. dated c.1760, unsigned

This small clock (Figs 8–12) has iron pillars and plates, brass finials and bun feet, brass wheels, a pinwheel escapement, and strikes the quarters and double-six hours every quarter hour. The rectangular brass dial, which, as usual on rural Italian clocks, is not silvered, is engraved with a chapter ring which overlaps the edge. Despite having two simple iron hands there are Roman hour numerals, but no minute numbers.

Apart from the iron minute wheel, all the others are brass with three crossings, including an escapewheel with pins instead of cut teeth. The large iron-spiked rope pulleys have thick click wheels riveted to the inner side, the going ratchet being a solid disc, the striking one a ring. Instead of a friction spring behind the wheel-of-report that drives the minute hand, there is a click wheel squared onto the greatwheel arbor and a click on the wheel rim, for hand setting.[8]

The deadbeat pinwheel escapement has a single pallet arm, with two plates separated by the pin diameter forming a 'gate' with sloping edges acting as impulse faces. Each of the forty-five pins drops in turn onto the top plate, slides down the slope to impulse the pendulum, then drops onto the lower plate and slides down the slope to impulse the pendulum again as it swings in the opposite direction. The pallet arbor is very sturdy with a front pivot of almost 3/16in (4.6mm) and almost 7/32in (5.2mm) diameter at the rear. It pivots in a curved iron front cock and a sturdy two-part arched back-cock held together by a screw. The pallet arm is adjustable on the arbor for setting it in beat, and is locked by a small wing nut.

The strike-work arbor on the left has the usual nag's head with overlift and locking detents, and also a brass tab for manual repeat of the strike. The whizzing work has a pinwheel with six graduated hour pins on the front face of the second wheel of the striking train, and four graduated quarter-hour pins on the single-notched overlift disc. The pins are arranged so that the previous hour follows

8. John A Robey, *Gothic Clocks to Lantern Clocks*, shows similar click-operated hands, Clock I/2, pp, 139–41, for alarm setting, and clock F/3, pages 184 –7, for hand setting.

Fig. 8. Clock 2, lantern clock with brass finials and bun feet, with two hands but no minute numbers.

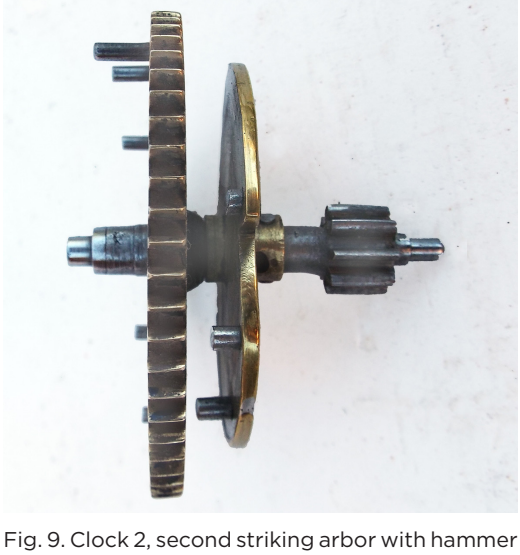

Fig. 9. Clock 2, second striking arbor with hammer pins on the pinwheel and the overlift disc.

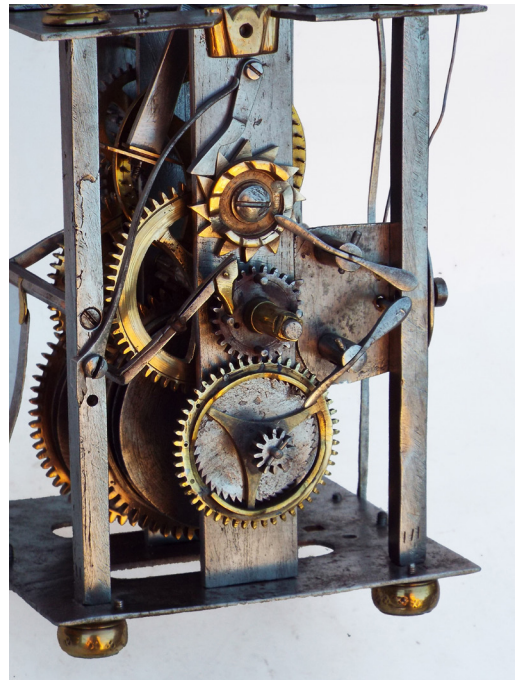

Fig. 10. Clock 2, front of the movement with the hour wheel removed to show the nag's head, stepped face-cams and the centrally pivoted levers to pump the hammer-tail arbors.

each quarter to produce *grande-sonnerie*.

Each hammer tail has extended pivots at both ends that slide in two small iron brackets screwed to the right-hand pillars. The front bracket also carries the centrally pivoted levers that pump the arbors of the hammer tails. Short arms on these sliding arbors are connected to the actual hammers on the top plate via wire links, with long hammer springs fixed to the bottom plate.

Centrally pivoted levers are pushed by the face-cam steps on the wheels of the motion-work to determine how many pins trip the tails. Four steps on the wheel-of-report control how far the quarter tail is pumped and hence how many quarter pins trip the hammer that strikes the small bell. The minute wheel has four pins to lift the nag's head and also an arm at the rear. Just before each hour this arm advances a six-pointed starwheel and the hour face cam on the front movement bar with the aid of a spring-loaded jumper.

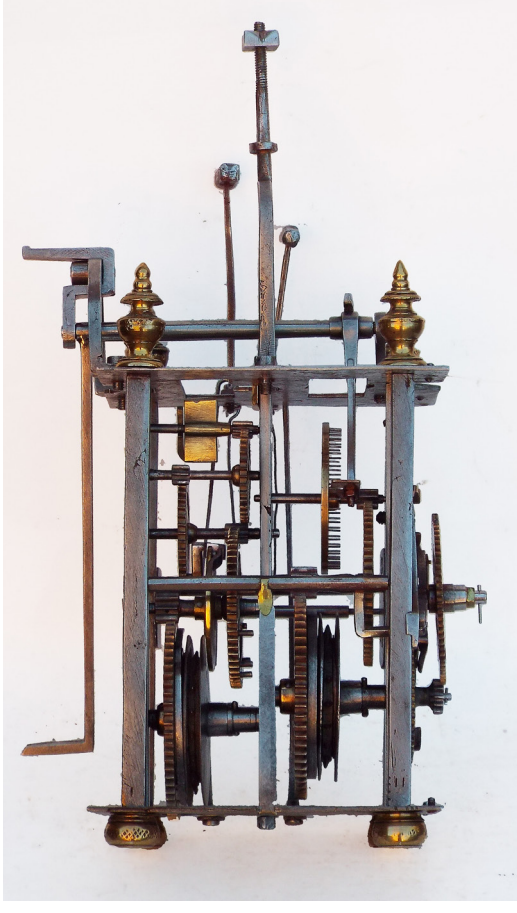

Fig. 11. Clock 2, left-hand side of the movement showing the pinwheel escapement and the hammer pins.

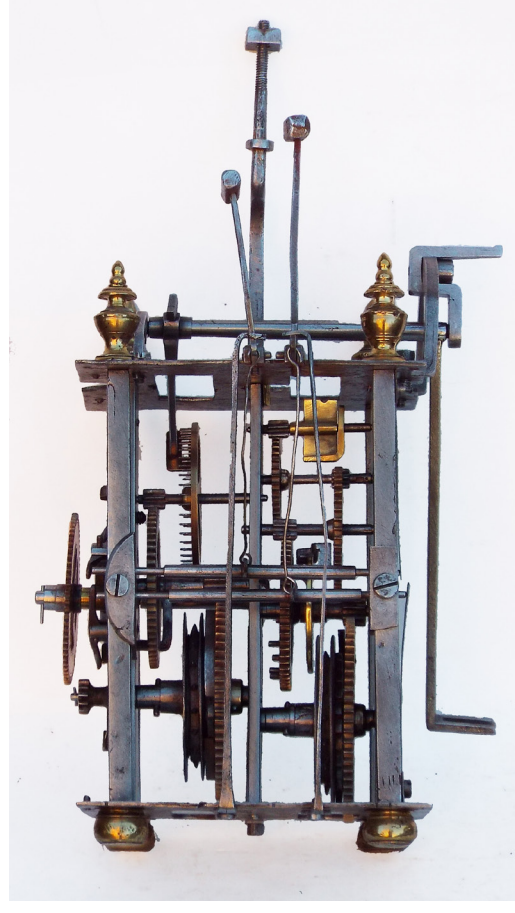

Fig. 12. Clock 2, right-hand side showing the sliding hammer-tail arbors with wire links to the hammers pivoting on the top plate.

Clock 3. Clock with an unusual chapter ring. c.1780, probably from Emilia-Romagna, unsigned

This posted-frame clock (Figs 13–18) has iron pillars, brass plates, brass wheels, and an anchor escapement. Instead of the hammers and strike-work being pivoted in the corner pillars, they pivot in two pairs of rectangular brass bars. The front bar on the right has pivot holes for the hammers and hammer-tail arbors, as well as carrying both the starwheel for the hour cam and the pivoted lever for the hours. The left-hand pair of bars only serve to pivot the nag's head arbor and the end of a long lever to shift the quarter hammer-tail arbors. There are no decorative finials or feet. The unengraved 8in (203mm) wide arched brass dial has identical cast-brass rococo spandrels in the corners and in the arch. The pewter chapter ring has scribed circles, but the hour and minute numerals and the minute divisions are painted. Even more unusual, the minutes are numbered 5, 10, 5, 20, 5, 30, 5, etc. Neither of these features are known on any other clock. The chapter ring and spandrels are riveted to the dial plate. The hour hand is original, the minute hand is a restoration.

The two bells are supported by a typical Italian semicircular iron bell stand screwed to the top plate. All the wheels are brass with three crossings, while the fly is a small solid casting. The pivot holes in the movement bars are recessed to form basic oil sinks.

The strike-work arbor on the left has the usual nag's head with a combined overlift and locking detent. The second arbor of the striking train has a flat ring with pins of

Fig. 13. Clock 3, brass dial with Rococo brass spandrels and an unusual painted pewter chapter ring.

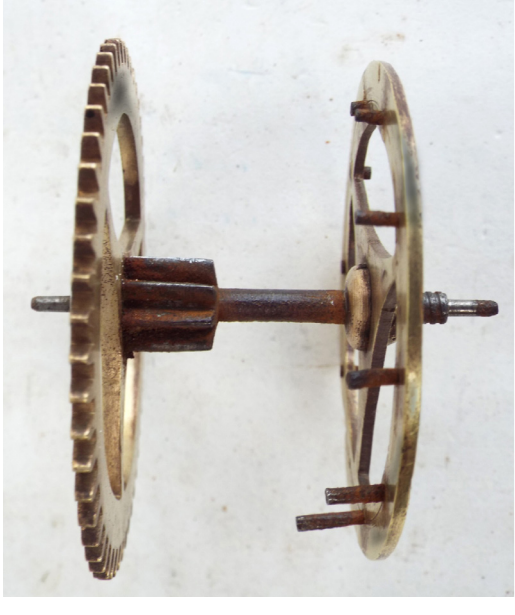

Fig. 14. Clock 3, the striking second wheel with the hour hammer pins on the front of the overlift disc and the quarter pins at the rear.

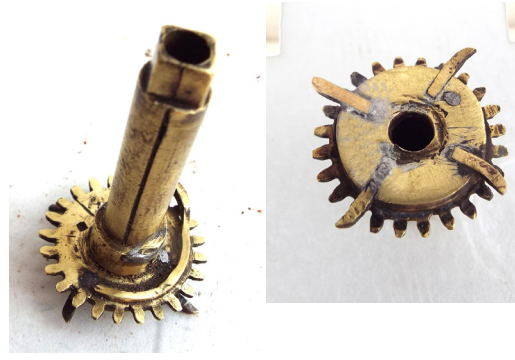

Fig. 15. Clock 3, minute wheel with quarter steps on the front, and four let-off arms at the rear.

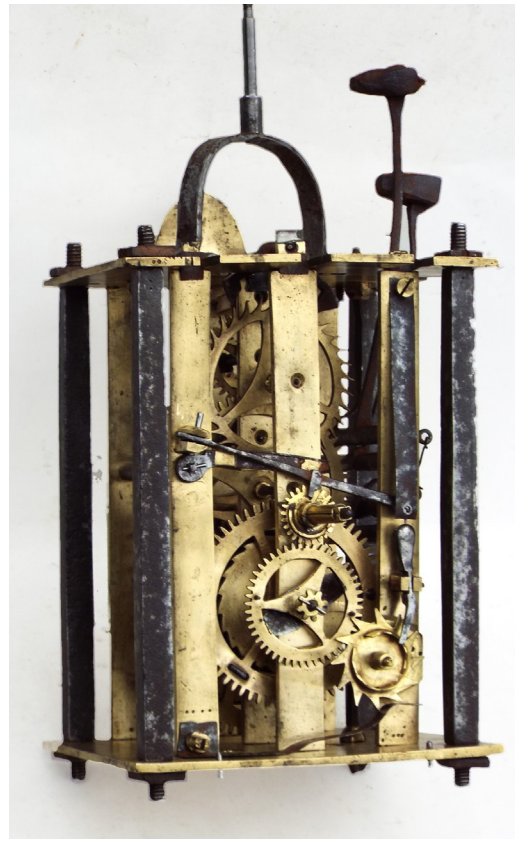

Fig. 16. Clock 3, removal of the hour wheel shows the nag's head, the long quarter lever and the hour and quarter step cams.

increasing lengths that makes a full rotation for each sequence of strikes, after which the overlift detent drops into a notch in the rim and the locking detent blocks a pin on the fourth wheel. There are six graduated hour pins on the front face of the disc for the

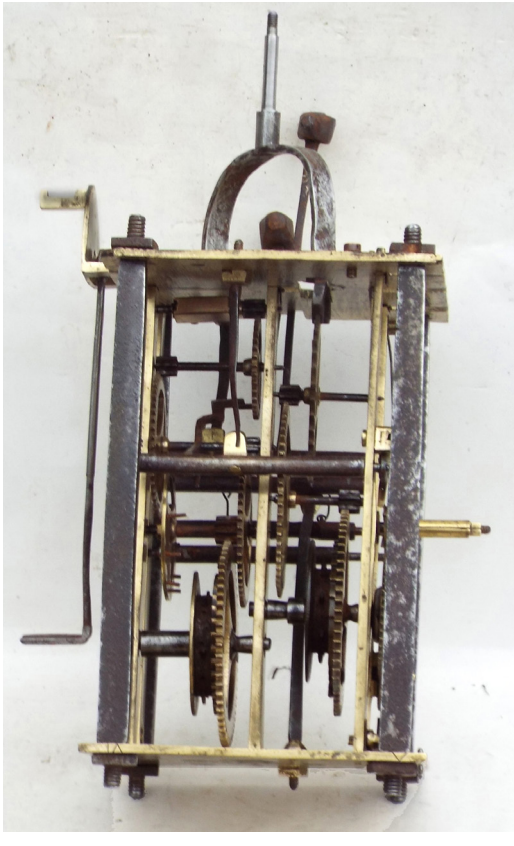

Fig. 17. Clock 3, left-hand side of the movement.

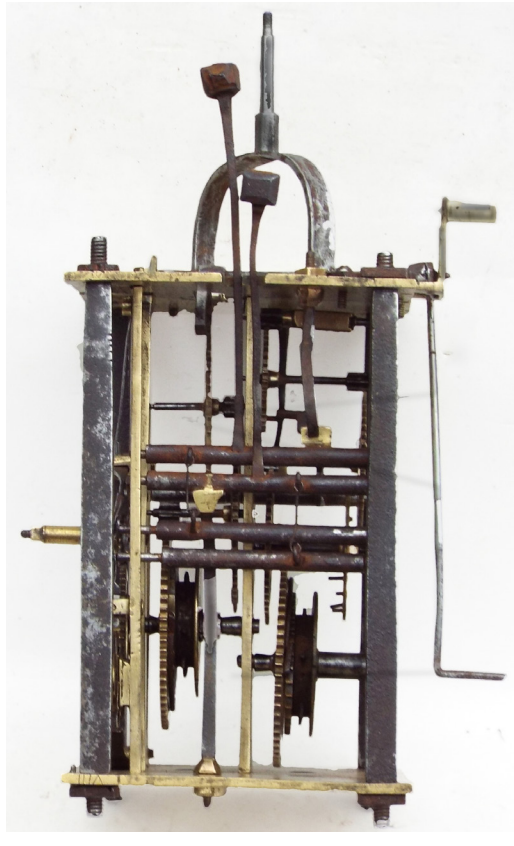

Fig. 18. Clock 3, right-hand side of the movement, showing the arbors of the hammers and the hammer tails.

usual double-six hour strikes, but only three graduated quarter-hour pins on the rear face. The pins are arranged so that the quarters follow each hour strike, and at the hour there is no quarter strike, making it easier to identify the full hour from the previous hours repeated every quarter.

The extended pivots of the hammer tail arbors slide in holes in the right-hand pair of bars, and are linked by wires to the actual hammers pivoted a little higher in the same two bars. The spring for the hour hammer is fixed to the bottom plate, with the spring for the quarter hammer fixed to the top plate.

A small detent in the centre of a long lever hinged at its left-hand end is pushed forward by four steps on the front of the minute wheel. The right-hand end of this lever slips over the front end of the arbor for the quarter hammer tail, and is located by a taper pin. Hence the tail is pulled forward rather than being pushed to the rear, as is more usual. A four-armed disc on the rear of the minute wheel lifts the nag's head to let off the strike sequence. Two pins on the wheel-of-report, which rotates once in two hours, advance a twelve-pointed starwheel just before each hour, aided by the usual spring-loaded jumper. The starwheel has two sets of six steps at the front that pump a short centrally-pivoted lever to determine how many hours are sounded.

This clock was probably made in a rural area near Bologna or Ferrara in the Emilia-Romagna region of northern Italy.

Clock 4. Brass lantern clock with a six-hour dial and a single hand, c.1740, from the Marche region, unsigned

This rare version of *grande-sonnerie* whizzing work (Figs 19–27) has many features that differ from the other examples discussed in this article. Many of these unusual features

Fig. 19. Clock 4, single-handed clock with whizzing work.

Fig. 20 (left). Clock 4, the six-hour dial with pierced Roman hour numerals.

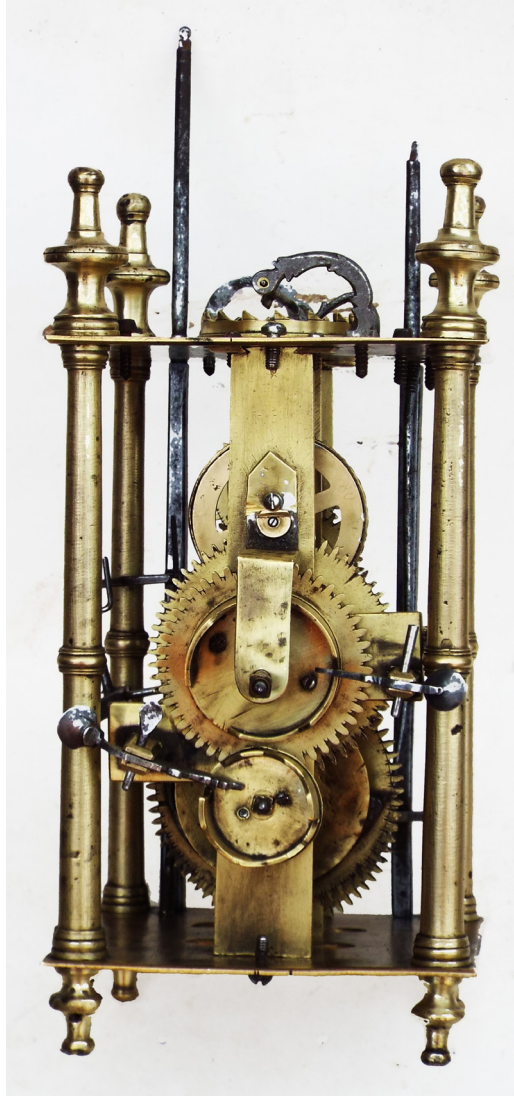

Fig. 21. Clock 4, front of the movement showing the hour cam screwed to the hour wheel, the quarter cam screwed to the large pinion-of-report, and the levers that pump the hammer-tail arbors.

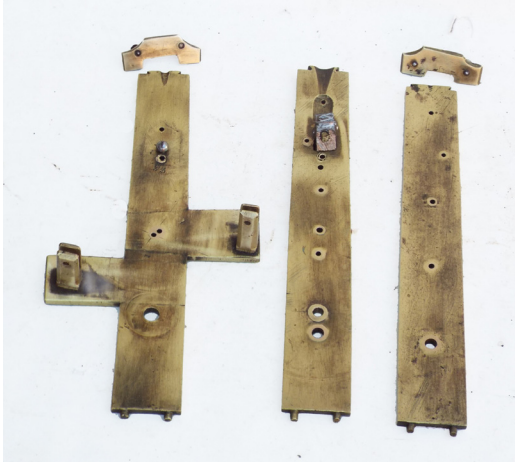

Fig. 22. Clock 4, the front (left) and rear (right) movement bars are held at the top by small plates having dovetailed recesses. The arms on the front bar are fixed by dovetailed half-lap joints

Fig. 23. Clock 4, rear of the pinwheel (striking second wheel) with six outer hammer pins for the hours, and three inner pins for the quarters. The overlift disc has a single notch.

Fig. 24. Clock 4, the pinwheel with hammer pins of graduated lengths: six shorter hour pins and three longer quarter pins.

are a consequence of its having only one hand and two vertical swivelling hammers on opposite sides of the frame. These features are regularly found on Italian clocks with countwheel striking but are unusual on clocks with whizzing-work, include:

- The hammer lifting pins are all on the front side of the second wheel. The six hour pins occupy about half of its circumference and are positioned close to the outer edge. The three quarter pins are set at a smaller radius than the hour pins and are longer so that each hammer tail is only lifted by the relevant set of pins.
- The nag's head is lifted every quarter hour by one of eight pins on a brass disc on the rear of the going greatwheel, which rotates once in two hours.
- The quarter face cam, with two sets of four steps, is held by screws to the large pinion of report, while the six-stepped hour face cam is similarly held by screws to the hour wheel. There is no necessity for a separate starwheel.
- The small pivoted levers that pump the hammer-tail arbors pivot in brass blocks fixed to short side arms on the front movement bar.
- The arbors for the hammer tails pivot in the pillars, the hour arbor on the right, and the quarter arbor on the left. The arms that link to the vertical hammer shaft push against extra long hammer links to allow for the sliding of the arbors.

The shaped brass six-hour dial has a very low arch and the integral chapter ring overlaps its sides. There are narrow bands of decorative engraving, and stylised flower-bud half-hour markers, while the centre is plain. Most remarkable are the Roman hour numerals, which, instead of being engraved as is usual, are pierced through the dial sheet. This appears to be unique and there is no logical reason for it — there is no evidence,

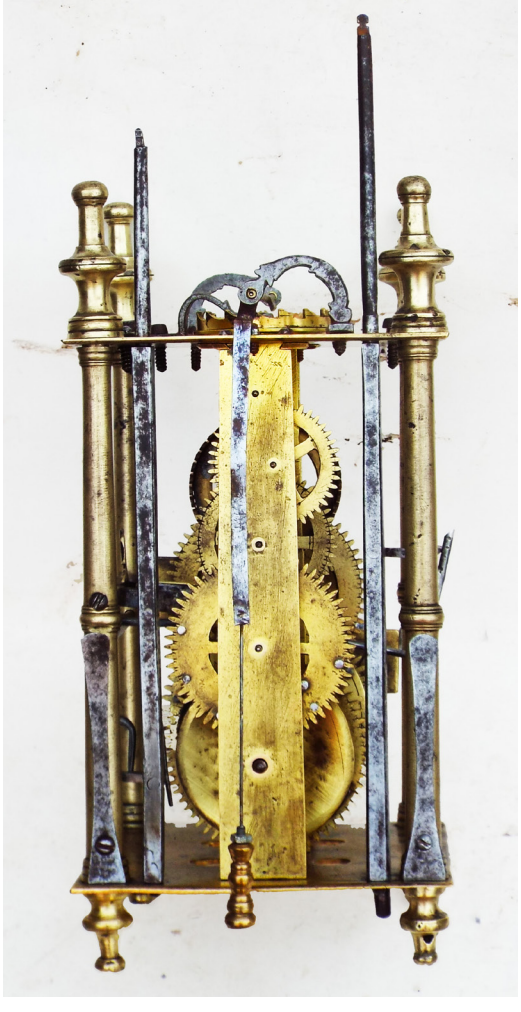

Fig. 25. Clock 4. rear of the movement showing the square-section vertical hammer shafts, and the biasing springs for the arbors of the hammer tails screwed to the rear pillars.

or even room behind the dial, to suggest it was a night clock, though it might have been intended to suggest one. The sturdy iron arrow-head hour hand has a baluster shape.

The all-brass frame has round-section pillars with 2in (50mm) tall finials and 1in (25mm) tall feet. The central and rear movement bars are straight, while the front one has side arms to support the centrally pivoted levers that pump the arbors of the hammer tails. These arms are attached to the vertical bar by slightly tapered dovetailed half-lap joints and are locked by taper pins. This construction requires a great deal of skill. The central bar is held at the top by a wedge, the other two bars have short dovetailed tabs that fit into corresponding notches in small brass plates screwed underneath the top plate, and locked by a screw through the top plate. These fixing plates have not been seen before.

The brass train wheels have four straight crossings, apart from the solid going greatwheel, which has a domed rear disk with eight lifting pins to let off the strike every quarter hour. This disc is a friction fit to the greatwheel to allow for hand setting. The face cam for the quarter-hour strike is fixed to the pinion-of-report by small screws (which are widely used on this clock), while the cam for the hours is screwed to the hour wheel. The hours sound first followed by the quarters, with no fourth quarter strike.

The vertical swivelling hammer shafts have vertical wire springs, which are usual for this type of hammer. The sliding hammer tail arbors have links that push against similar links on the hammer shafts, in the usual manner. The latter are longer than usual to allow for the sliding motion of the links on the tails and are of a Z-shape with the elbows acting as stops against the nearby pillars. The other links have forked ends to encompass the hammer links, though they are not really necessary.

The hammer lifting pins are fitted to the second wheel of the striking train, with a locking pin on the third wheel. The second arbor also carries the overlift disc with a single notch. When the locking detent is in the notch the train is locked, with both the hour and quarter pins below the centre and out of contact with the hammer tails of the hour (on the right) and the quarters (on the left). When a lifting pin on the going greatwheel raises the nag's head the locking detent is lifted out of the notch and the train runs for a complete revolution of the pinwheel, as usual with whizzing-work. This rotates anticlockwise, tripping the tail of the hour hammer. This tail is not long enough to be lifted by the quarter pins. After the last hour blow the tail of the quarter hammer is now in position to be lifted by the longer inner quarter pins

The shape and design of the dial, pillars, finials and feet indicate that this clock was made in the Marche region of Central Italy, on the Adriatic coast.

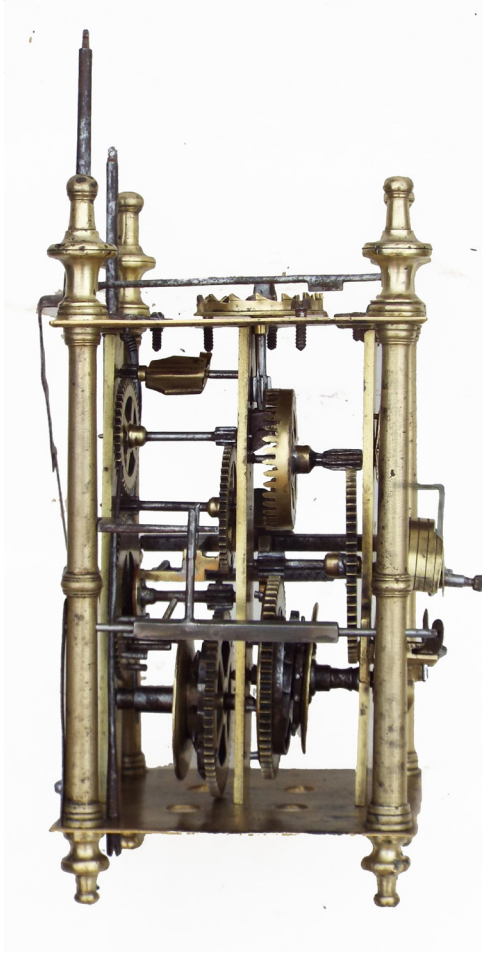

Fig. 26. Clock 4, the left-hand side showing the horizontal sliding arbor with the quarter hammer tail and extended pivots.

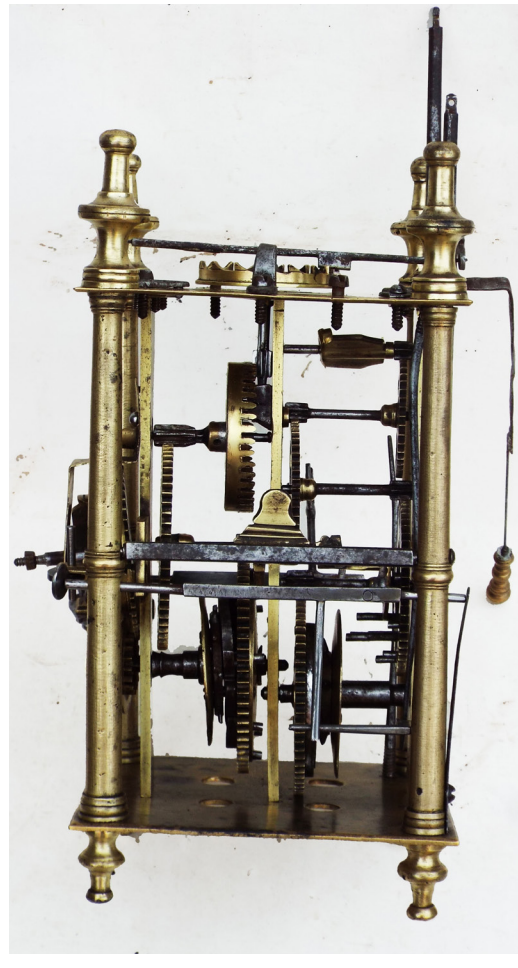

Fig. 27. Clock 4, the right-hand side with the strike-work arbor above the arbor of the hour hammer tail.

Conclusions

Italian clocks have a wide range of stylistic and technical features, yet they are often overlooked outside their country of origin — especially in Britain. As well as having the usual twelve hour dials, they can have twenty-four or six-hour dials, or even just four hours for timing church sermons. Striking work is especially varied, often using double-six striking, with either a twelve-hour or six-hour dial, and often including *ribotta* — repeat of the hour strike a few minutes later. Or *petite-sonnerie* striking using a compound countwheel to control both the hour and quarter strikes. While twelve-hour whizzing-work striking is found on some Black Forest clocks with wooden movements, Italian clockmakers developed the system of *grande-sonnerie* striking using just one train of wheels. These clocks were made in northern and central Italy (though not the far north), mainly by rural clockmakers, and often housed in the most basic of wooden wall cases. It is hoped that this article will encourage collectors to investigate the fascinating world of Italian clocks.

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