

Paul Garnier, a Clever and Creative Carriage Clock Maker

by Tom Wotruba and Doug Adams (CA)

Those of us who appreciate and collect carriage clocks owe a great debt of gratitude to Paul Garnier, who has been recognized as the founder of the Paris carriage clock industry.¹ In this article we attempt to highlight some reasons why he has gained this tribute. Born Jean-Paul Garnier in Épinal, France, in November 1801, he was obliged to start working at an early age because his father died when he was only ten. Paul (his preferred name) moved to Paris at age 19 to work for the clockmaker Lépine and attend the clock-making school of Antide Janvier. About five years later he established his own business in Paris, showing great creativity and cleverness through inventions such as his version of a constant-force frictionless remontoire escapement, which he incorporated in a complicated mantel regulator shown in the 1827 Paris Exhibition. He died in 1869 and his business was taken over by his son, also Paul, who continued the family name, exhibiting carriage clocks in the Paris Exhibition of 1889, and maintaining what was most likely a retail operation in Paris until he died in 1916.²

Throughout his life Garnier had wide-ranging interests, but in this article we concentrate on his work as a carriage clock maker and the various clever and creative things he did in that capacity. He was the key instigator in popularizing carriage clocks, and he did

this with efficient production of attractive case designs and movements (including specifically his patented escapement as noted later) while building his reputation using various versions of his signature, which often included descriptive and impressive titles to distinguish and add value to his work.

Creator of the Paris Carriage Clock Industry

Garnier did not invent the carriage clock—that was more certainly achieved by Breguet around 1800—and there were even earlier makers who had devised portable clocks suitable for moving about, because they were spring-driven and did not involve a pendulum. Breguet's carriage clocks were expensive because of their complications and elaborate decorations and were sold primarily to royalty. Garnier, with his simpler product and quantity production, created carriage clocks well within the budget of many in the marketplace. Britten³ wrote that the carriage clock as known today was France's principal contribution to the horological field after 1830, and it owes its origin to Paul Garnier of Paris whose efforts increased the vogue for carriage clocks quickly and widely. Allix⁴ said it this way: "There's no doubt whatever that the first production or semi-mass-produced carriage clocks, entirely standard and satisfactory, were made in Paris from

Figure 1A, left. Clock number 491, Series 0, alarm and plunge-wound quarter repeating on one bell; 4-3/16" high (all measurements in this article exclude the handle). **Figure 1B, center.** Clock number 1103, large Series I, petite sonnerie with quarter and hour repeating on two bells; 5-3/8" high. **Figure 1C, right.** Clock number 928, small Series I, striking only; 4-9/16" high.



COURTESY/DEREK ROBERTS, CARRIAGE AND OTHER TRAVELLING CLOCKS, FIGURE 6.6, P. 85.

1830 by Paul Garnier.” In the Paris Exhibition of 1834 Garnier was awarded a silver medal for his extensive display of carriage clocks, and a reporter for that Exhibition noted that Garnier had sold more carriage clocks in the preceding two years than had been made in the entire history of horology.⁵

Case Designs and Styles

Garnier made a variety of portable clocks with different case styles and movement complications and, with only one exception known at present, these clocks were all numbered.⁶ He may not have thought of his clocks as fitting into specifically different “series” but others have categorized Garnier’s carriage clock output

into four groups, typically designated as Series I through Series IV.⁷ A few novel and inventive examples preceded the series production and are sometimes noted collectively as Series 0. In addition, he produced very few clocks with markedly different case designs that have not been given any formal designation. After studying the sources noted in this article, we devised Table 1 to highlight the major characteristics of the four main series, and we offer the following discussion of these along with some comments on the Series 0 clocks.

Series 0: This small grouping is composed of at least six currently identified carriage clocks very cleverly designed with movement complications.⁸ They are

TABLE 1. Features of Garnier Carriage Clocks: Series I to Series IV

Series No.	Case Style and Doors	Dials and Hands	Escapement	Type of Strike	Size
Series I (large)	One-piece, plain, not engraved; wood block in base; front winding accessed by lifting front glass and top rail. Some later numbered clocks had enameled dials, rear-lifting doors, and rear hand-set arbors	Engine-turned, Breguet-like (moon) hands manually set; a few with concentric alarm setting hands	Chaffcutter (two-plane); balances were gold more often than brass	Rack striking on a bell; many petite sonnerie	About 5-3/8" high not including handle
Series I (small)	Same as earlier large Series I	Same as large Series I but rarely an alarm setting hand	Same as large Series I; balances usually gold	Same as large Series I but none w/petite sonnerie	About 4-1/2" high not including handle
Series II	One-piece, engraved; arched cutaway in base and no wood block; fixed front panel and rear opening door with shuttered holes for winding and hand setting	Enameled dials with trefoil and sometimes cruciform hands; some with alarms in subsidiary dials numbered anti-clockwise	Same as large Series I	Same as small Series I	About halfway between the large and small Series I; some variation (4-3/4" to 5-1/4" high not including handle)
Series III	Multipiece; corniche style; engraved and otherwise similar to Series II	Same as Series II	Same as large Series I and II	Same as Series II	Same as Series II
Series IV	Beveled cases with canted sides; fixed front and back panels, the back with shuttered holes for winding and setting hands, wood block in base with no cutaway	Same as Series II and III	Most have chaffcutter; a few later clocks have been found with a lever escapement that may have been added later as a replacement	Count wheel strike usually on a bell but a gong on a few later clocks	About 4-5/16" high not including the handle

housed in one-piece cases, 4-3/16" high, with watch-type quarter-repeating work on a single bell, wound from the front by lifting the front glass and top rail. Exceptional in quality, these might have been fashioned as praiseworthy showpieces for exhibition or possibly to test the market for clocks with this quality and complexity. Subsequent production by Garnier continued these case designs but pared back the movement complications, possibly because these clocks proved too expensive. Figure 1A pictures a Series 0.

Series I: These were the first styles of carriage clocks produced in quantity. Two sizes were available, described as large (about 5-3/8" high excluding the handle) and small (about an inch shorter). Both sizes had one-piece cases with front winding accessed by lifting the front glass and top rail. They contained rack striking on a bell and incorporated a block of wood in their base on which was written the clock's number and a two-digit code believed to identify the assembler in Garnier's workshop. Dials usually had engine turning and used moon hands reminiscent of Breguet. The small version had no repeating work while some of the large ones had complications such as alarms, quarter-striking, and occasionally grande sonnerie. See Figures 1B and 1C. The earliest Series I clock known is number 218 and the last is 1167, though other Series I clocks may exist outside this range and even have modified case designs.⁹ These numbers suggest, however, that Garnier may have made upwards to 900 Series I carriage clocks prior to moving on to his Series II.¹⁰ These Series I clocks, particularly the small size with their simple but elegant design, their easily assembled movements inside dust-free cases, and their affordable prices launched the appetite for carriage clocks in a growing market.

Series II: Garnier's clocks designated as Series II retained some features similar to those of Series I, such as the one-piece case, his patented escapement, and rack striking on a bell. But Series II differed because winding was accessed from the back through a hinged door that also contained shuttered winding holes. The front panel was fixed, and setting the clock hands was now done from the back as well. Since hand-setting was no longer done with fingers, the hands could be made more delicate such as with trefoil or cruciform designs. A peculiar feature of Garnier clocks is the subsidiary alarm dial numbered in anti-clockwise fashion (i.e., 12 to 11 to 10, etc., reading clockwise), and these began to appear in Series II. Other specific changes in Series II involved the shift from plain to engraved case finishes and from engine-turned to enameled dials, a few with engraved dial masks. An arched cutaway in the base signaled that the wood blocks of Series I were gone. See Figure 2 for an example of a Series II clock.

Series III: Series I designs most likely ceased soon after Series II case styles were introduced. However, Garnier's num-

Figure 2, above right. Clock number 2563, Series II, striking hours and half-hours on a bell with hour repeat. Approximately 5" high.
Figure 3, below right. Clock number 1971, Series III, striking hours and half-hours on a bell with hour repeat. Approximately 5-1/4" high



COURTESY JOSEPH PANELLI, A CENTURY OF FINE CARRIAGE CLOCKS, P. 53.



COURTESY TOM WOTRUBA.

bering system demonstrates that his Series II, III, and IV outputs overlapped in time.¹¹ Series III cases were distinguished by being multipiece rather than one-piece and fashioned similar to the corniche case style, which was eventually to become very popular. In general the other features from Series II remained in the Series III cases—enamel dials within engraved cases having shuttered and hinged back doors for winding and setting hands and a cutaway in the base as illustrated in Figure 3. And of course Garnier’s patented escapement continued to be used.¹²

Series IV: Substantial changes marked Series IV. The case designs contained canted or beveled angles supporting the four fixed glass panels. Winding and setting were accomplished through shuttered holes in the back. Rack striking used in the prior three series was usually replaced by a count wheel, in which cases the strike itself had no repeat; exceptions to this did occur as in the later-numbered example shown in Figure 4. The wood block returned to the base of these clocks, so there was no cutaway. The design economies and lower quality represented by these simpler clocks suggest Garnier’s interest in them may have begun waning as he turned his creative energies elsewhere.

Signatures and Inscriptions

As his work progressed, Garnier inscribed his clocks with various versions of his signature and associated descriptors, which we can assume were meant to lend prestige to his products and eventually to his own name. In today’s business terms, we might call this a strategy of building brand recognition and image. Some clockmakers are very conservative in this regard, identifying their products only with their name (and sometimes only their last name as with Barwise and Vulliamy). But Garnier, not reluctant to seek recognition and to impress, looked for clever and creative ways to promote his name and work.¹³ Six distinct versions are evidenced in the inscriptions and signatures he used.

Retailer Name: In some of his early clocks when Garnier’s own name was not well recognized, he signed his retailers’ names, particularly those in Paris. One such retailer’s name is Guyerdet ainé à Paris, found on the backplate of one Garnier clock and on the dials of others.¹⁴ Other prominent Paris retailers whose names appear on Garnier clocks are Dent and Leroy et Fils.¹⁵ Identification with such retailers presumably provided legitimacy to Garnier’s products and prestige to his designs and reputation. In addition, the retailer undoubtedly preferred to publicize his own name rather than that of the manufacturer.

P. G. Breveté: This phrase is stamped on the backplate of most Garnier clocks that have his unique escapement for which he (P.G.) received a patent (breveté) in 1830. Some of his early clocks, including

COURTESY / CHRISTIE’S SOUTH KENSINGTON, JULY 14, 2004.
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Figure 4. Clock number 3333, Series IV, striking and repeating on a gong with lever escapement. Approximately 5" high to the top of the handle posts.

those carrying retailers’ names, are not otherwise signed by Garnier, so this stamped phrase plus his escapement were the identifying marks of his work. But this stamp was also placed on later clocks containing his escapement, whether otherwise signed or not, with the apparent intention of promoting and protecting his patented achievement.

Élève de Janvier: Garnier never worked for the famous clockmaker, Antide Janvier, but he did attend a prominent horological school run by Janvier. Garnier sought permission to use this “student of Janvier” title, which was granted in a letter from Janvier to Garnier in February 1827.¹⁶ This association of the young 26-year-old Garnier with the established and famous Janvier could certainly be seen as boosting the prominence of the young clockmaker. The inscription, “Paul Garnier Élève de Janvier,” has been found on three of Garnier’s Series 0 clocks, the last being clock number 492 dated 1834, but may have been placed on still others made soon after 1827. Garnier subsequently moved on to a new signature and inscription that he most

likely believed to be even more beneficial, which was at about the same time that Janvier died in 1835.

Horloger du Roi: Researchers have found no formal record of Garnier receiving a royal appointment as clockmaker to the king, though he used this title (along with *Élève de Janvier*) in a written statement to the jury of the Paris Exhibition of 1844 in which he reported making a clock (not a carriage clock) in 1840 for King Louis Philippe I. Some of the earliest clocks known with this signature and inscription are large Series I carriage clocks numbered 541 and 568, made ca. 1836.¹⁷ This signature and inscription were not always similar in form, however. For instance, 568 was signed PAUL GARNIER HGER DU ROI while 799 was signed PAUL GARNIER H. DU ROI A PARIS on the back and PAUL GARNIER HORLOGER DU ROI on the front. Other variations center on the word “horloger,” which is sometimes stated as HER and other times as HR. See Figures 1B and 1C for two different versions of this inscription. Apparently, whatever appointment was granted to Garnier, it included no prescribed standard for this wording.¹⁸

Horloger de la Marine: After the Revolution of 1848 in France came the Second Republic and the Second Empire of Napoleon III, and any reference to the king would have been severely punished. Thus, Garnier adjusted his signature and inscription to be PAUL GARNIER HER DE LA MARINE A PARIS, which translates as Clockmaker to the Navy. The earliest numbered clock now known with this inscription is 1971 (a Series III), and a subsequently numbered clock with the same signature is 2563 (a Series II). These two clocks are shown in Figures 2 and 3. Clocks with later numbers have puzzled Garnier researchers as to their date of production. For instance, clocks 2679 and 2982 are both signed as Horloger du Roi, raising the question of whether they were made and sold before the Revolution or sold after the start of the Third Republic in 1870 when clockmakers found it acceptable to use their prerevolutionary titles because a restored monarchy was then no longer possible. A complicating fact is that clock 2706, a number between the prior two, is signed Horloger de la Marine. No definitive answers to this puzzle have been determined.¹⁹

Paul Garnier: This very straightforward signature, sometimes with the word Paris added on the same line or underneath, occurred on some early clocks prior to his use of retailers’ names. One such clock signed simply Paul Garnier is number 341, a portable (but not strictly carriage clock) in a rosewood case with a spring dated 1833. An early carriage clock, number 198 (Series 0) is similarly signed. This signature returns on some of his later clocks such as numbers 2156 and 3333 incorporating ordinary lever escapements which, as noted in footnote 12, may have been replacements of Garnier’s original patented chaffcutter.²⁰ Thus,



Figure 5. Garnier’s chaffcutter escapement in clock number 1971 shown in Figure 3.

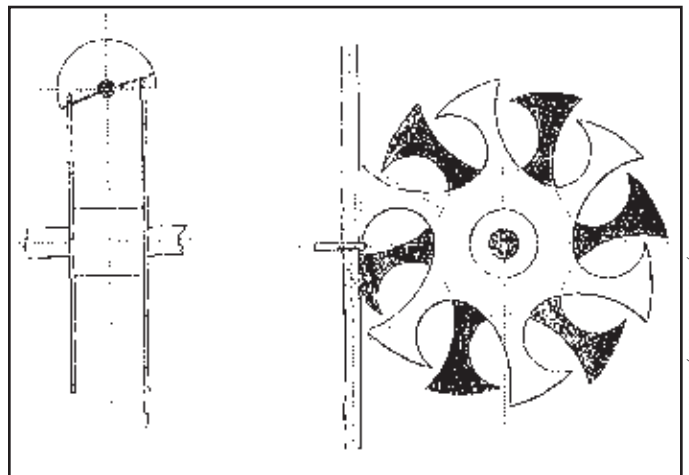


Figure 6. Garnier’s own drawing of his frictional rest or chaffcutter escapement included in his letter of September 2, 1851 published that year in *La Tribune Chronométrique*, pp. 261-262, explaining the antecedents of his escapement.

COURTESY/DEREK ROBERTS, CARRIAGE AND OTHER TRAVELLING CLOCKS, FIGURE 3.3, P. 40.

Garnier’s signature and related inscriptions had come full circle.

The Chaffcutter or Two-Plane Escapement

One of the keys to Garnier’s success in larger scale production of carriage clocks was his use of the chaffcutter escapement as pictured in Figure 5. It provided a relatively low-cost escapement compared to those previously produced by Breguet and others. It could be manufactured readily and provided timekeeping that was competitive with the cylinder and common lever escapements of the day. As already noted, Garnier was granted a French patent for the chaffcutter escapement in 1830. The escapement uses a pair of escape wheels, which straddle the balance staff as shown in Figure 6. The escape wheels impulse the balance assembly via a semicircular disc mounted on the balance staff, with the tips of the escape teeth resting on

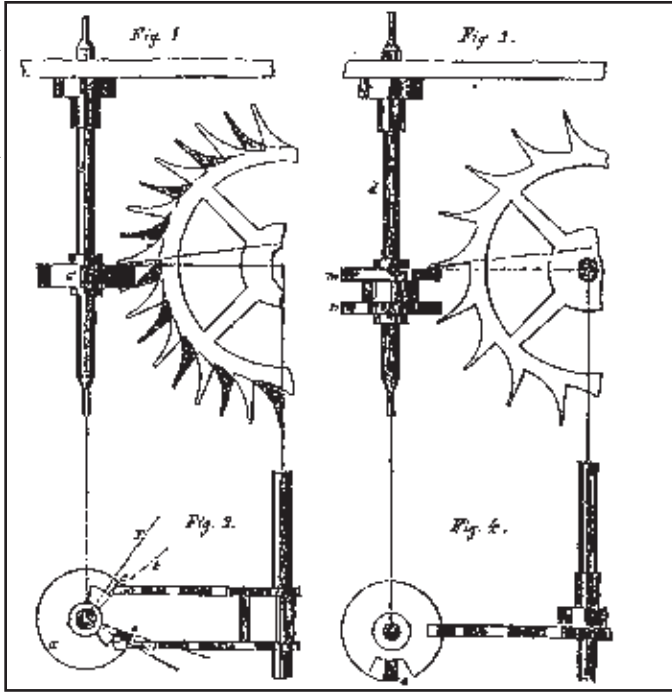


Figure 7. Enderlin's escapement (left, marked Fig. 1 and Fig. 2), and Sully's escapement (right, marked Fig. 3 and Fig. 4), in an article by P. Dubois, *La Tribune Chronométrique*, Paris, 1851, p. 231.

the disc in between impulses. Thus, it is a frictional rest escapement. The escape wheels are arranged so that the teeth of one wheel are lined up with the spaces between the teeth of the other wheel. Hence, the teeth alternate between giving an impulse to the balance in one direction and then in the other direction. Most, if not all, of the earlier escapements used polished ruby discs. The escapement produces a reasonable arc of vibration (approximately $\pm 160^\circ$), allowing it to keep time within a minute over a week's winding period. The clocks were not prone to stopping during transport or position changes, although they do not rate quite as well in positions other than vertical. The 90° change in angle between the escape wheel and the balance wheel eliminates the need for the contrate wheel required in virtually every other carriage clock escapement to transition between the vertical plane of the clock's gearing and the horizontal plane of the balance wheel.

Garnier's chaffcutter escapement has its apparent roots in an escapement devised by Pierre Debaufre, ca. 1700. Debaufre's escapement used a pair of escape wheels and differed from Garnier's escapement in that it had pointed escape wheel teeth. The disc on the balance staff was relatively thick, with angled faces on the disc providing all the impulse action to the balance assembly. As with Garnier, the disc was made of ruby material. Debaufre's design placed the mean impulse point of the tips of the escape teeth at the center line of the balance staff. In 1721 Henry Sully devised an

"advancement" of this design, using a single escape wheel and double discs as shown in the right half of Figure 7. The escapement still had all the impulse lift on angled faces on the discs. By necessity, the impulse point of the escape teeth was pulled away from the center line of the balance staff. In 1736 Enderlin devised yet another variation, keeping Sully's practice of pulling the escape wheel(s) away from the balance center line, but restoring it to a pair of escape wheels with a single disc as shown in the left half of Figure 7. In this case the disc had a relatively narrow impulse slot as opposed to Debaufre's 180° disc.

Garnier's design restored the escapement to Debaufre's principle of using a 180° disc with the mean impulse point of the escape teeth at the center line of the balance staff. However, the fundamental difference of the chaffcutter from all of the above escapement variants is that he put all the impulse lift on the angled faces of the escape wheel teeth, giving much more satisfactory results. Although Garnier's escapement would seem to be an obvious progression of the above escapements, he took issue with this publicly. In 1851 *La Tribune Chronométrique* published an article lauding Garnier's escapement, but attributing it to the Sully and Enderlin designs (Figure 7 is from that article). Garnier promptly wrote a letter of reply, which was published in the correspondence section of *La Tribune Chronométrique* (Figure 6 is from this letter). He stated that his escapement design was instead inspired by the cylinder escapement design. The cylinder escapement uses an escape wheel with all the impulse lift on the curved faces of the escape teeth and with two lips on the cylinder for receiving alternating impulses. He pointed out that the chaffcutter loads the lower balance pivot in the axial direction, whereas the cylinder escapement loads both balance pivots in the radial direction, giving the chaffcutter an advantage in having lower friction at the pivots.²¹

Garnier's Interests Beyond Carriage Clocks

As already noted (footnote 10), Garnier made other portable clocks not strictly classified as carriage clocks but many of which included his patented escapement. Beyond these, Garnier's interests included other kinds of mechanical devices. For example, at age 28 he presented to the Académie de Sciences a medical instrument (called a sphygmometer) he designed to measure pulse rate and blood circulation. A number of years later he developed an engine counter to record the running time of a machine and the number of strokes or other periodic movements of the machine while running.²² When applied to steam locomotives, for instance, it could aid in calculating distance covered, average speed, fuel consumption, and engine efficiency. Incorporated into this machine was a clock containing Garnier's patented escapement, of course.

Subsequently, he produced under contract with the Ministry of Works an electrically operated master and slave clock system, the first such system ever made for railway stations in France. Given his creative and engineering talents, it is very likely that he constructed his own machines for clockmaking in his workshop as well.

Conclusion

In both artistic design and in mechanical achievement, Paul Garnier's contributions have given him good standing in the world of horology. Garnier was not only clever and creative but also a prolific clockmaker. Based on his numbering system, we can estimate that Garnier made approximately 6,000 clocks.²³ At least one location where his clocks were produced and assembled was located at rue Taitbout in Paris.²⁴ While he may have obtained some components from outside suppliers, his escapements were undoubtedly made by his own workers.²⁵ Because of his productive efforts, he expanded the market for portable timekeepers to a broader population and supplied those buyers with many high-quality products. Nowadays his clocks appear frequently in major auctions and are eagerly sought after by collectors. We hope this article offers some interesting insights into the character and creativity of Paul Garnier.

Acknowledgments

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Notes

1. Derek Roberts, *Carriage and Other Travelling Clocks* (Atglen PA: Schiffer Publishing Ltd., 1993): p. 41. Much of Garnier's background history here is from this source. See also Charles Allix, *Carriage Clocks: Their History and Development* (Woodbridge, Suffolk: Antique Collectors' Club, 1974): pp. 55 and 397-398.

2. Roberts (footnote 1, p. 61), Allix (footnote 1, p. 440), and Tardy, *Dictionnaire des Horlogers Français* (Paris, 1971-1973): p. 246.

3. Cecil Clutton (ed.), *Britten's Old Clocks & Watches and Their Makers*, 9th edition (London: Bloomsbury Books, 1982): pp. 269-270.

4. Allix (footnote 1, p. 54).

5. Charles Allix, "Paul Garnier Revisited," *Antiquarian Horology*, vol. 20 (No. 5, Spring 1993): p. 416.

6. Allix, footnote 1, Plates II/26, II/27, and II/28, pp. 60-61.

7. The most comprehensive discussions of Garnier case styles occurred in two lectures by Christopher Hurrion and Charles Allix: the first to the Main Meeting in London of the Antiquarian Horological Society on March 18, 1993, and summarized briefly in *Antiquarian Horology*, vol. 21 (No. 1, Autumn 1993): p. 27; and the second to the South Eastern Section of the Antiquarian Horological Society on August 3,

1996, and summarized briefly in *Antiquarian Horology*, vol. 23 (No. 4, Summer 1997): p. 360. Discussions of Garnier case styles are also found in Roberts (footnote 1) and Allix (footnotes 1 and 5).

8. Some or all of clocks numbered 179, 198, 200, 491, 492, and an unnumbered clock made for the Paris Exhibition of 1839 have been designated as Series 0 by various writers. (For example, see the transcript of the second lecture cited in footnote 7, p. 13.)

9. These numbers are stated by Roberts (footnote 1, p. 59) and the second Hurrion/Allix lecture (footnote 8, p. 6). But Allix mentioned number 1291 as a small Series I clock with original mainsprings dated 1840 in his letter to the editor in *Antiquarian Horology*, vol. 20 (No. 6, Summer 1993): pp. 556-557. In addition, Antiquorum sold number 1269, described and pictured as a small Series I clock but with a white enamel instead of the usual engine-turned dial, at auction October 12, 1996.

10. Included in this range are Garnier clocks that Allix (footnote 1, p. 58) describes as *pendules portatives* (small moveable house clocks) as distinct from *pendules de voyage* (carriage clocks designed to be taken away from the house). Based on this distinction the number of true carriage clocks within this range cannot be established precisely, though Allix reported (footnote 5, p. 424) that in a sample of 48 known Garnier clocks from the period 1831 to 1838, about one-third were *portatives* and two-thirds were carriage clocks.

11. For instance, clock number 2105 is a Series IV, 2218 is a Series III, and 2220 is a Series II.

12. Exceptions may have occurred. Garnier's clock number 2156 (sold by Antiquorum on October 12, 1996) has a lever escapement in a gorge case though otherwise is most similar to a Series III. Clock number 2982 (pictured in Allix' book, footnote 1, p. 63) has a plain unengraved cornice-style case (Series III) and a lever escapement. Clock number 1470 (sold by Antiquorum on May 14, 2006) has a one-piece case wound from the back similar to a Series II style but with a lever escapement. Hurrion (footnote 8, p. 26) noted that lever escapements may have been used in Garnier clocks toward the end of his life or possibly after his death, but in later correspondence with the first author he suggested another possibility that lever escapements may have been added to replace original patented Garnier escapements in those clocks that were broken and not easy to repair.

13. Allix (footnote 5, p. 414) noted: "It is abundantly clear that he was boastful by nature and that throughout his career he never missed any opportunity for 'blowing his own trumpet'."

14. For example, it is on the backplate of clock 349 pictured in *An Exhibition of Rare Carriage Clocks* (Asprey & Company Ltd., 1975): p. 7; and on the dial (no clock number given) shown in Kenneth Ullyett, "Carriage Clocks: A Study in Depth," *The Antique Dealer and Collectors Guide* (March 1971): p. 86.

15. The backplate of the clock in Figure 1a is signed Leroy et Fils, Hgers du Roi. A list of ten Paris retailers and three outside Paris who sold Garnier clocks is in Roberts (footnote 1, p. 50).

16. The letter and further discussion are found in Allix (footnote 5, pp. 412-413).

17. Hurrion (footnote 8, p. 17) noted in 1996 that 568 was the first known extant clock with this signature, but subsequently 541 came to light as lot 154 in Sotheby's Amsterdam auction of May 20, 2003.

18. These examples come from various photos in both Roberts and Allix (footnote 1). Further explanation regarding the title "Horloger du Roi" is found in Allix (footnote 1, pp. 76-79).

19. Roberts (footnote 1, p. 52) considered that 2679 was probably old stock, while Allix (footnote 1, p. 62) believed that 2982, because of its case and other features, was sold after 1870.

20. Number 3333 is shown in Figure 4. It is signed on the backplate Paul Garnier Paris, but it is not signed on the dial. Hurrion (footnote 8, p. 26) noted that clocks with this signature and lever escapement may not have come from Garnier's factory manufacture although they had an unmistakable air of his style.

21. See Allix (footnote 1), pp. 396-397 for a more detailed discussion of that letter.

22. See Christopher Hurrion, "Paul Garnier's Engine Counter," *Antiquarian Horology*, vol. 20 (Summer 1993): pp. 541-546, for further discussion of these and other devices.

23. Clock number 5645 is noted in Allix (footnote 5, p. 424) and clock number 5952 was offered as lot 548 in the Antiquorum auction of April 20, 1996. Not all of these were true carriage clocks (see footnote 10), but it is likely that most if not all after about clock number 1000 were carriage clocks.

24. Allix (footnote 1, p. 106).

25. For example, Allix (footnote 1, p. 56) noted that *blancs roulants* (unfinished movement frames) were likely supplied by Pons of Saint-Nicolas d'Aliermont.

About the Authors

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Doug Adams has a BSME degree from the University of Buffalo. He is a manager of product design for engineered pumps and related drilling equipment in the heavy oil refining industry, and holds patents for the equipment. He has been repairing timepieces since 1971 and has been a member of the NAWCC since 1990. He specializes in the repair of complicated watches, pocket chronometers, and high end carriage clocks. This involves the manufacture of watch gearing, balance staffs, and other watch components. He has given talks for the national and regional conventions as well as classes and talks at local chapters. He is currently vice-president of Chapter 69, past-president of Chapters 69 and 4, and currently on the Board of Chapter 4.

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