A Royal 'Haagse Klok'

Reviewed by Keith Piggott

Contents

A Royal 'Haagse Klok'

"Severijn Oosterwijck Haghe"

"met privilege"

Reviewed by Keith Piggott

Frontispiece: Fig.1. [01_F1.jpg)]

Introduction. ▲ (Back to TOC)

Severijn Oosterwijck's earliest known spring-driven pendulum clock was first published by clockmaker-restorer Paul Shrouder Hon.FBHI, (see ***"A Mantle Clock",*** Horological Journal, BHI, Sept. 2008). Paul recorded his restoration and he alluded to its history. Dr.Jeff Darken, then editor of '***Antiquarian Horology***' the journal of the Antiquarian Horological Society, first drew my attention to this so called **Mantle Clock**. I recognised its historic significance and contacted the BHI, subsequently, at Mr Shrouder's workshop, I met the privileged owner with his rare Hague-clock (NL. '***Haagse klok***').

First I established there were no commercial interests to serve, only horological and historical ones. I was told that, by family tradition, also cited in Wills, and by descent, this little Hague clock has been in the family since its gift in June 1660 to their ancestor **Sir John Shaw (1615-1680)**, with a Knighthood, from **King Charles the Second** on Restoration of the Monarchy, in gratitude for John Shaw's generous financial support in exile during the long and uncertain interregnum, from 1649 to 1660, (***Appendix Six***). No antiquarian could want for a more tantalizing provenance, nor a more dynamic period in early pendulum history. I was not disappointed. Certainly, it is one of the earliest Hague pendulum clocks extant, and a 'Striker' too.

First Impressions.

Some works of art and clocks have the power to hold the observer; this is one such. At first sight, the regularity and quality of both the movement and the dial-plate presented features and components I had not seen in a Hague clock. I also observed evidence of an ancient accident, involving both the case and its movement. Its workmanship is outstanding, superior to Coster's first pendulums notwithstanding the latter's superb watches and table clocks in the balance-wheel era.

Now I better understand why the Earl of Kincardine Alexander Bruce (c.1629-1680) in March 1662, then Monsieur Zulichem, Christiaan Huygens (1629-1695) in mid-1663, each chose the young Severijn Oosterwijck (pre-1637-1694?) to make their Longitude '*sea-clocks*' (both inherently flawed by pendulum control in first instance); then to add Huygens' new (but fatally flawed) *weight-remontoir* in 1664. In these the workman excelled, whereas the scientists floundered.

Oosterwijck's 'Haagse klok', or '**Haagse klokje**' (little Hague clock), deserves the fullest appreciation; see **Figure 1**. Its privileged owners would remain anonymous, yet know more of their heritage - also its historical context; the restorer would publish via the BHI, a technical audience not versed in Huygens; and I would bring this rare Hague clock into the antiquarian fold via the Dutch Horological Foundation, *<www.antique-horology.org>*, providing abundant images also vital dimensions to promote new research. Knowing that I cannot succeed equally, I offer my findings at **PART I, *'HOROLOGIUM',*** also my perspectives and new hypotheses at **PART II, *'OSCILLATORIUM'*.**

View: Charles II (1630-1685) In Middle Age.
[02V_Charles2] [02V_Coronation]

HUYGENS' AUTHORITIES ▲ (Back to TOC)

Readers not familiar with Christiaan Huygens and the early pendulum-era will find the Horological Foundation website invaluable. It includes a Compilation on the Hague Contract of September 3rd, 1657, between young John Fromanteel (1638-1692) and established Hague clockmaker Salomon Coster (1623-1659), the pendulum patentee appointed by Huygens as inventor. One long misread, still misunderstood clause alludes to a '*secreet*',that cannot be the pendulum or crutch which John already had seen and made. It taxes us yet. This clock may have great relevance to that lost secret.

Collections and Exhibitions.

G.B.Shaw once wrote, "if I had had more time, I should have written a shorter letter!" But gone are the days when Drummond Robertson could review ***two?*** neglected Coster clocks in just two paragraphs, (Robertson J.D, "***The Evolution of Clockwork*****",** Chap.VI, pp.76-81).

Scholarship has moved on apace, with specialist articles, new reference works; two magnificent Dutch exhibitions, **"*Octrooi op de Tijd*"** (Museum Boerhaave, 1979), **"*Huygens Legacy*"** (Paleis Het Loo, Apeldoorn, 2004); also great private collections, with Mr H.M. Vehmeyer's astonishing catalogue and Hans van den Ende's museum at Edam -- I was privileged to attend its opening, I stayed three days! My own study of Hague clocks was helped by many, especially the late Willem Hana, also Dutch restorer L.H.J. 'Berry' van Lieshout; many rely on his wide knowledge and unique horological archives.

Didactic Scholarship.

Professor Dr. Ir. Reinier Plomp has long promoted ***"Hague clocks"*** *(NL.Haagse klokken)* by erudite articles and standard reference work, **"*Spring-driven Dutch pendulum clocks, 1657-1710*"** (***'Pendulums'***, Interbook International BV, Schiedam, 1979). For the privilege extended to me, I presented copies of Dr.Plomp's book to the clock's owners also to Mr Shrouder. Dr. Plomp identified ***"The Prototypes of Hague Clocks and Pendules Religieuse"*** (***'Prototypes'***, Antiquarian Horology, AHS, June 2007); and defined significant characteristics, "***The Earliest Dutch and French Pendulum Clocks***", (***'Chronology'***, HF website 2008.). His sampling of 25 clocks established some craft lineages and chronologies, ('***D1***', etc., for Dutch pendulums; '***F1'***, etc., for French pendulums). In 2008 he also published ***"A Longitude Timekeeper",*** on Huygens' balance-spring sea clock made by Isaac Thuret', (***'Longitude'***, *HF website*). His academic and horological credentials place Reinier Plomp at the fore. As this review is posted to this site he privately published his eagerly awaited ***"Early French Pendulum Clocks 1658-1700 known as Pendules Religieuses"***, the French derivatives of Coster's pendulum clocks (***'Pendules'***). I am delighted to have it from him, with kind words of encouragement. Here, I follow his line; he may have to revise his 'chronology'.

Dr.Plomp's '*prototype*' characteristics, as he points out, are not the only ones to be observed in a Hague clock. Several are too general to be useful; others are too infrequent to compare, yet still important. Among these is, or *should be*, the unidentified *'secreet'* construction; although many have made diverse attributions that ultimately stood no real test. In a paper for the Dutch Horological Foundation, I cited research by Berry van Lieshout and myself, *<Compilation 2005>*. Implicitly, on Mayday 1658, a '*secreet*' was to be shared between Fromanteel's and Coster's clocks. I pointed out, 'secreet' seems not a Dutch word at all, and *"its etymon seems entirely English; if so, what then?"* I believe that overlooked etymon confirms a conspicuous and even important linguistic clue. Might that contractual secret now also be found here in young Severijn Oosterwijck's Royal Hague clock?

Who was Severijn Oosterwijck? (pre-1637-1690/94?)

Notable authorities, (Robertson, Morpurgo, Edwardes, Dobson, and Plomp), have cited his life and work. Berry Van Lieshout records, "Severijn was born before 1637, son of Adam Oosterwijck clock-maker of Middleburg who employed Pieter Visbagh from 1649 after completing his apprenticeship with Salomon Coster. Severijn died circa 1694. In 1657, he married Sara Jans van Dueren at Rotterdam"; [***KP***. *Did he then know Mr Simon Douw, the ingenious Clockmaker of Rotterdam? Severijn was already a fine clockmaker, see* ***'Huygens Legacy'****, exhibit* ***#07****, still balance controlled, dated to 1655 although it bears a* ***Hague*** *address*]. "Severijn is only first mentioned in the Hague in 1658, when his first son Adam was born; he registered there in 1659, first renting near the Spui [river]; in 1660, he bought '*De Drie Vergulde Mollen*' and he took Pieter de Roo as apprentice". In 1662, for Alexander Bruce (Earl of Kincardine), Severijn made two copies of Bruce's first Longitude pendulum sea-clock fitted with fusee and double-fork **F**-crutch; first shown to Huygens in London in 1661; both were tested by Captain Holmes. He constructed Huygens' 1663 Longitude design, and by August 1664 he also had incorporated Huygens' ingenious but flawed weight-remontoir, for which Huygens would obtain a Dutch patent; but chided by Sir Robert Moray, that priority for the remontoir was [Ahasuerus] Fromanteel's, he assigned his English Patent of 3rdMarch 1665 to the Royal Society. Robert Hooke had scoffed; he understood that a pendulum is inappropriate for any sea-clock, like its weight remontoir; but inherent defects do not reflect on Oosterwijck's craftsmanship. In 1664 Lord Brouncker, Charles II appointed First President of the Royal Society, had one of his Seconds' regulators; Sir Robert Moray in Maastricht had one too.

"Severijn had four sons, all clockmakers; in 1687/8, he and Adam (1658-1695) petitioned the Hague Magistrates for a Clockmakers' Guild; on incorporation, Severijn became first Master. Around 1690 he made a year spring-movement for **Jean Brisson's** monumental case; [modelled on the more lavish **Breghtel-van den Bergh** case of 1665-1670, now in the V&A London]. Later, with third son Jacobus (1662-1711), he adapted it into a musical clock, which they signed jointly"). *<View Brisson>* [***KP***. *One of Holland's horological icons, I first saw it with Eugene Stender, at Sint-Michielsgestel, in 1976*] (**P.C.Spaans** Collection, Lot 421, Christie's Amsterdam 19/12/2007).

Any clock by this particular maker is of interest, for several reasons; his part in the birth of the Dutch pendulum clock; his abilities as a craftsman; also his early part in experimental maritime navigation to determine longitude by pendulum time-keeping, (see *Appendix Five*). The subject Hague clock ticks the first two boxes, hence this Royal patronage; Alexander Bruce, and Christiaan Huygens himself, ticked the third box. His name never disappoints. Yet I was still unprepared for the hidden (secreet?) device contained within this fine movement.

GENERAL OBSERVATIONS ▲ (Back to TOC)

The Inspection: Paul Shrouder took down, measured all parts, and counted trains, as I made notes and shot images (of variable quality). The minutia of our record is essential towards a better understanding of "*the evolution of clockwork*". For researchers, vital dimensions, components, also wheel-trains, are all recorded under ***Appendix One***; ***Appendix Two*** cites conservation needed to preserve the unique case; ***Appendix Three*** offers promising lines for study, an *'open-research'* Web project. Additionally, **Horological Foundation** internet version ***Matrices*** has user-input of *Data*. Didactic images show ***Comparables*** (similar pendulum constructions); also ***Memoranda*** (pendulums in the public domain); also ***Patterns*** for convenience in using Matrices, extending *Cescinski & Webster's* numerical system - now to identify Hague patterns. Additionally, ***Appendix Four*** reveals **Simon Douw's** patent (***longitude***) time-keeper; and ***Appendix Five*** examines two of **Alexander Bruce's** English and Dutch '*Sea Clocks*' of 1661-1664; ***Appendix Six*** cites Royal provenance, via **Sir John Shaw** (1615-80). Further appendices shall be announced in opening Table of Contents.

Originality: Antiquarian catalogues rarely reveal the extent of any 'restorations'. For the benefit of researchers, my examination found Oosterwijck's movement to be very original. The few exceptions are; the mainspring is replaced; the original *four-spoke* escape-wheel's collet and pinion are newly made by Paul Shrouder with a new collet for the original *four-spoke* contrate wheel; he also gave the original pendulum-rod a new bob and suspension hook ~ its original Huygens' *pulley-bracket* was removed before I saw it; [all parts retained]. The glass is replaced. A restorer's defacing scribbles infer he moved the hammer and adjusted its clapper, the strike-lever is untouched. One function has been lost, a strange 'cam' on the barrel arbor and vacant pivot holes in plates offer clues to a unique feature, (see **Wind-Me**).

Fig.2. **The Striking Movement, Pivoted Outwards.** [03_F2.jpg]
Note the inferior sound-hole just below the dial-mounted bell, the second sound-hole is at lower left side - also adjacent to the bell.

Oosterwijck's spring clock has the typical strike-gates and central countwheel, with early internal bell, but also unique features like the pendulum holdfast (Figure 2) never before seen in a Hague clock; but present in what I believe to be Bruce's first London sea clock (1661).

Unique Features: Among "*Hague-clocks*", Oosterwijck's ***movement*** has features that I believe to be unique, namely; octagonal pillars; Fromanteel type strap-potence; watch-stop work concealed under the barrel ratchet work; its *four-spoke* 'escape' also 'contrate' wheel crossings are exceptional. One lost feature, an Up-Down mechanism? certainly would be unique in a Hague-clock. His ***dial*** too has unique features, namely; a folding pendulum-holdfast; an obelisk bell-stand; and rare sector cut-out. His early '*Lieberge*' timepiece-alarum (*1661*) has the first date-sector above XII, like his later clock, (see R.Plomp, Op.Cit., *"Pendulums"* #84). Oosterwijck's ***box-case*** is unique too, having hardwood carcass and backboard constructed from expensive show-wood, being used in the solid. My initial recognition of it as '***Kingwood***' (*Dalbergia Cearencis)* has gained expert support.

Having early *strike work* and new ***split-barrel**** (i.e.one spring barrel, serving multiple trains) also mark it out as special**. ***sometimes being called **a *combined*** or ***double-action*** barrel; [Note, ***Tandem-barrel*** is misleading, being two or more barrels serving a single train].

Notwithstanding the cited changes, this is a most original Hague clock and, whilst not '*virgo intacta*', unquestionably it is of enormous academic significance. But how does it square up with Dr Plomp's "*earliest characteristic properties*"? (Op.Cit. '***Prototypes***').

Characteristic Properties, *vis a vis* Oosterwijck's Royal Clock:

Windows-	**P1**	Earliest ***box***, (2nd smallest), no windows, but has ***sound-holes*** adjacent to the Bell, in the left face and base of the box-case.
Door Frame-	**P2**	Early plain section box; door hinges set under ebony veneer in 45 deg. mortices.
Plate Aperture-	**P3**	No back plate aperture, (due to ***RH*** having a higher central escapement).
Pillar Shape-	**P4**	Octagonal, (unique among Hague clocks)
Steady Holes-	**P5**	Two steady-holes, but here for a strap-potence, (***RH*** has a higher escapement).
Door Key-	**P6**	Winding-key also locks the door, (needs no special furniture key).
Chapter Ring-	**P7**	Pinned onto the dial, (ie. not riveted).

To pre-empt conjecture, although the subject clock possesses some of the very earliest characteristics, it probably falls outside the first experimental year (1657). Significant negatives include: Dial plate is not made of Iron (unlike one extant Coster timepiece, provisionally '***D1***', Plomp "Pendulums"; #34); Dial plate is not fixed, and the case has no rear-door nor removable back-panel, (unlike another Coster timepiece provisionally '***D2***', Plomp, #35); Hinges are not combined for the dial and door (unlike another Coster '***D3***', also Fromanteel's English box-cases); Spandrels were never fitted to this dialplate.

Comparables: Oosterwijck's 30-hour spring clock with hour strike is directly comparable with Salomon Coster's extant striking clocks; being '***D8***' '***D10***' in Dr.Plomp's ***"Chronology"***; (see **"Pendulums"** #38; **"*Prototypes*"** Figs. 6,7,8; also **<*Obliques*>)**. And Oosterwijck's clock even has '*Coster hands*', rarely seen with any other maker.

Coster's split-barrels (***D8***, ***D10***) have significantly larger diameters, also larger centre pinions, than Oosterwijck's Royal clock, but all have similar durations around 30-hours, (see *Appendix Three*, Table). Other than its tortoiseshell frame, Coster ***D8***'s box-case is remarkably similar to Oosterwijck's *smaller* case, also having two sound-holes. Probably these two cases were made by the same furniture maker.

Whereas, Coster's next known striker '***D10***', also Oosterwijck's '***D9***' in Dr Plomp's chronology, (see '*Huygens Legacy*', Op.Cit., **#11**), each possess more decorative hands, bolder signature plates, ornate cases, mouldings, movements; all of which signify later dates. Internally, both ***D9*** and ***D10*** are laid out like the earlier Coster ***D8***, and also like the subject ***Royal Haagseklok***. All four have 30-hours duration, all have 4-wheel trains; but dispel any prejudice, as Huygens himself much preferred fewer wheels for their having less friction.

Coster '***D8***' is, presently, regarded as being the first Hague clock to include strike-work. However, I shall advance a new hypothesis - that Oosterwijck's Royal clock is its predecessor, and is also the pattern for Coster's, Visbagh's even Pascal's earliest striking clocks. I also propose a new *'open research'* project, (***Appendix Three***), to compile and collate wheel trains and other technical data that, eventually, may reveal trains' evolutions, chronologies, and to test all new hypotheses.

PART I
"H O R O L O G I U M"
THE CLOCK

THE VELVET DIALPLATE. ▲ (Back to TOC)
Overview: Oosterwijck's brass dial plate (21.2 x 16.5 cm) is smaller than all but one of Coster's - a sure indicator of an early Hague clock. His superb dial even creates the illusion of a Coster clock, it even has the earliest steel-tipped minute hand and lobed hour hand, being typically set on (later) velvet of Indian-red. Only Oosterwijck's trade mark *spring-flower* half-hours reveal his hand. Swivel pins (L) allow the dial to swing outwards - also to be demounted from the box case.

Fig.3. Oosterwijck's Velvet Covered Dial. [04_F3.jpg]

The velvet-covered dial also retains Coster's brass winder-collet, that preserves the fabric. The central cannon opening is oddly irregular, but I could not find any evidence for separate alarm work like Coster '***D5***', nor integral like Coster '***D8***' (seemingly contemporary addition). The engraved Lambrequin signature plate covers the dial access hole, needed to restart the pendulum, but the later velvet has no opening. Being fragile, it was not removed to examine obverse of dialplate.

Co-operation between these two earliest Dutch ***pendulum makers*** is writ large. Even Coster's immediate successors, Frenchman Claude Pascal, or even Visbagh his first Dutch apprentice, rarely replicated Coster hands, but they instead re-introduced decorative piercings.

The earliest Dutch *pendulum* movements are rarely signed, so only its original signature cartouche denies Salomon Coster all credit for Severijn Oosterwijck's rare clock and outstanding quality of work.

Just as their iconic *square* pillars were initially adopted, the velvet dials saved the greater expense of engraving, or matting, and speeded up the fabrication of these new clocks to meet demand. Nevertheless, velvet became the reigning fashion for decades in Holland, Flanders and France to 1700, but only rarely in England.

Purple-velvet, dyed from the *Purpura lapill*us mollusc, probably was used originally; like a later ***Royal*** patron's baroque, gilded, console-clock by **Johannes Van Ceulen** ~ its case now attributed to **Daniel Marot**, ***View Ceulen1***, (Adriana Turpin ***"A table for Queen Mary's Water Gallery at Hampton Court***", fig.14, p.11, *Apollo Magazine*, Jan.,1999). Matching purple-silk replicates the original appearance of its dial and protects rare original purple-velvet, now faded and worn where not concealed by skeleton chapter ring and French style Chronos mount on rare **wooden-dial** (*Limewood*), as Thuret had first used. Here without a *false-plate*, (Plomp, '***Pendules***', p.28, fig.21).

Black or scarlet velvet cannot be ruled out, but my reasoning is that Charles Stuart (to be crowned King Charles II) already possessed his executed father's French tastes and he then still held to the doctrine of "*Divine right of Kings*". Therefore immediate visual impact, showing *His* personal clock's *Royal* status, would have been irresistable. [The Clockmakers' Museum's Pieter Visbach, (Plomp ***D18***), has modern velvet, but gives an idea of the striking effect of purple on ebony].

Signature Plate. The typical wrought and gilded brass lambrequin plate, now with a pinned repair to one hanger, is finely engraved (not etched), and bears a full signature, also Huygens' license; *Seueryn Oosterwijck Haghe met privilege*". Note, "met privilege" is engraved, (not scratched like ***D1***,***D2***), also 'Severijn' is spelled phonetically.

Fig.4 The Gilded 'Lambrequin' Signature-Plate. [06_F4.jpg]

Early signature plates hang on wire loops, over an access hole in the dialplate for restarting the pendulum. The dial hole is present, but the later velvet is uncut. Although it bears no date, here I do not doubt that this is the original signature plate, and probably is even sourced from Coster's usual engraver; unlike the *repoussé* plate of his next surviving clock, (see Plomp, ***"Prototypes",*** Op.Cit., '***D9***').

[**V**an Lieshout, privately, suggests that Huygens should never have granted "met privilege" while Coster lived, he demised in December 1659. It is a telling point, since the assigned Octrooi was granted to Coster for a term of 21 years, so it would require both to consent. Even Pascal's earliest Hague clocks do not bear the legend. ***KP.*** *Yet, also in 1657, Huygens did grant a second privilege, to Jan van Call of Nijmegen, (*Morpurgo *E,"**Nederlandse klokken en horlogemakers vanaf 1300",*** p.30, Scheltma & Holkema, 1970, Amsterdam*); Berry himself privately records a dated clock by Pieter Visbagh, bearing the legend "Met privilege 1659"; and even Dr Plomp's '**Chronology**' puts Oosterwijck '**D9**', bearing the legend, before Coster's similar striker '**D10**'. So was Coster, perhaps, incapacitated? Did Huygens anticipate his decease, by granting the coveted privilege to other Dutch clockmakers? Conversely, after Coster's death, and within a remarkably short time, those very few makers who had in fact been granted the 'Privilege' seem to have stopped using the legend. Was that because the market, by then, made no differentiation between Huygens' licensed or pirated pendulums, or was it because of the influx of competing foreign systems from England and/or France?*]

Relative not Absolute Dating: Herein therefore, I shall interpret and assess the subject '***Royal Hague-clock***' only against the published evidence of extant comparables and their more authoritative dating. However, in the light of the re-discovery of Oosterwijck's clock, also my new evidence, I do anticipate lively contributions on this point.

Fig.4a. The Repaired Hanger Over Uncut Velvet. [07_F4A.jpg]

Chapter Ring. The gilt brass ring is typically narrow (2.0 cm), of small diameters, (14.3/10.3 cm). It is finely engraved and very well finished. Among early Hague clocks, based on Plomp's chronology, its design represents what I putatively identify as *Fourth-state* (p.5).*

Roman Chapters, **I-XII**, mark the ordinal hours. Half-hours have become Oosterwijck's trade-mark stylised *spring-flowers* now having the Quarters scribed within the narrow inner band; still with Coster's enclosed ordinal Minutes shown in fine Arabic ciphers, **1-60**, within a wider outer band; each Minute, from 10 to 60, is scored through in Coster's early manner. Seconds' are not shown, although Huygens showed how in **'***Horologium'* and Philipp Treffler's 1658 *copy* does, (see Part II, Perspective 6, *A Seconds' Hiatus:* also ***MemoTrefler***).

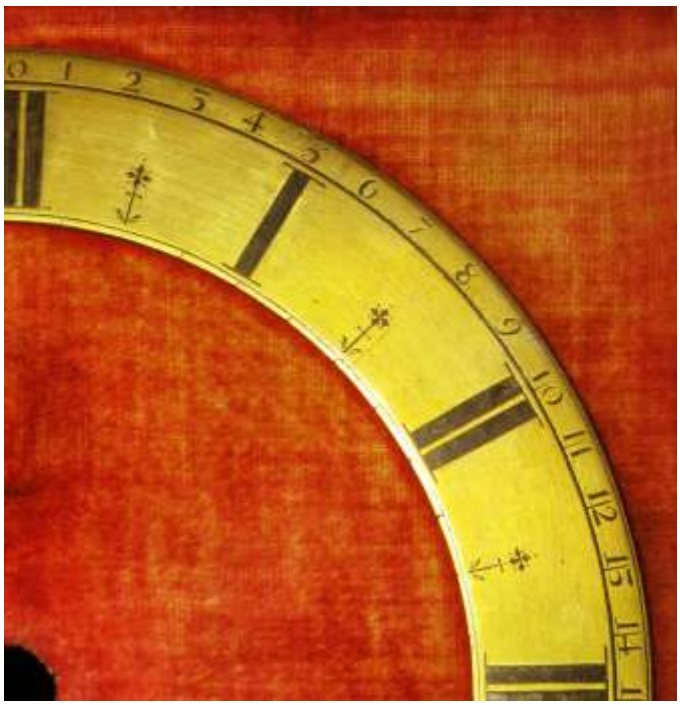


Fig.5. Gilded Chapter Ring; Pattern 'Fourth State'. [08_F5.jpg]

*** I**n Dr.Plomp's Chronology Coster ***D1***'s *'First-state'* chapter-ring has no inner quarter-line, arrow-heads mark half-hours; (ditto ***D2, D5***); a *'Second-state'* adds an inner line, still without quarter marks (***D4***); a '*Third-state'* adds spring-flower half-hour marks still without quarter-marking (***D8***); Oosterwijck ***RH*** *'Fourth State'* has his spring-flowers, now introducing quarter-divisions; a '*Fifth-state'* is like the *First*, now with quarters, the arrow-heads sprouting from basal flowers (***D10***); a *'Sixth-state'* is based on ***RH*** *Fourth*, with an additional inner-line to enclose Quarters, with simplified cruciform half-hour marks, (see ***D9*** and 'Lieberge' by Oosterwijck, ***D18?*** by Visbagh?). Extant Costers do not favour Quarters, (see ***D1, D2, D4, D5***, ***D8***); Coster's use of scored through single minutes (1-9) is limited to ***D1***, ***D5,*** also one by Pascal who adopted Coster's arrow-markers, (see ***'Huygens Legacy',*** #**09)**. Any particular 'state' (see *Patterns PCR*) probably depended on the engraver chosen, or a patron's wishes. Other than ***D8***, Coster uses arrow-heads; ***D8*** has Oosterwijck's flower-heads. ***D3's*** *'non sequitur'* chapter-ring might possibly be French - but I can find no counterpart.

Fig.5a. **Chapter Ring- Obverse.** [09_F5A.jpg]

Chapter ring styles soon proliferated as new pendulum workshops sprouted across Europe. Mr Hans van den Ende is preparing a tome on ***Early Box-Cased Pendulums***, he too shall touch on this aspect.

The reverse side is well finished but still showing tool marks, also an indistinct cipher (?) and a Roman **XII** 'scribed at the top stud. This is the original chapter ring, fixed by integral round studs pinned to the dialplate - not riveted like ***D1, D2, D3*** (see Plomp, ***'Chronology'***).

Fig.5b. Chapter Ring - Reverse. [10_F5B.jpg]

Coster-Hands. Oosterwijck's '*Coster-hands*' are finely wrought and sculpted in gilded brass. These are the original hands; despite evidence of maltreatment each retains most of their original fire-gilding; formerly the minute hand's original steel pointer was blued.

The rare moon-pierced minute hand, with early steel tipped pointer (7.05 cm), is held by a domed collet, having a collar and pin-slot The lobed hour hand (5.1 cm) is secured to the hour-cannon by two transverse pins, (Fig.6a). It is instructive to compare the subject hands directly with Coster's, which are rarely seen on another maker's clocks; see ***<Coster Hands>*** also ***<Memo Coster D4>*.**

Fig.6. **Oosterwijck's Gilded Brass 'Coster' Hands**. [11_F6.jpg]

Oosterwijck's next extant clock (**Plomp** ***D9***) retains Coster's minute hand, but its broad hour hand has *teardrop****** piercing, silvered to match the silvered chapter ring in contrast to its black velvet dial.

*** W**hen discovered, Coster ***'D3'*** had an untypical carved and pierced *teardrop* hour hand with a trident-tail, ***<View>***, more reminiscent of early alarum table-clocks. Its *teardrop piercing* is soon re-adopted in Oosterwijck's "***Lieberge***" timepiece-alarum and next striking clock, '***D9***'. Whereas Coster '***D10'*** has a more ornate version of the teardrop, having three enclosed loops ***<PH6-D10>***, like Pascal's single-hour-hand, (see Vehmeyer, 1994, p.293, V50). Might these recall Coster's *perhaps original* '*teardrop*' hour hand? (***Appendix Three****, also p.37).*

Fig.6a Pins Fix The Hour-Hand To The Canon. [12_F6A.jpg]

Exceptions having Coster' hands include several by his first French assistant Nicolas Hanet; one by his former apprentice Pieter Visbagh; and probably *unlicensed* pendulums; see "Francoise Gilbert Angers", ("***Huygens Legacy"***, nr.15); see "Bernard van Stryp Anvers", c.1660, (Lloyd, H.A., **"*Old Clocks*"**, figs.14c, 14d, p.65; David Thompson, ***"Clocks"*** , pp.66-67, The British Museum Press, 2004).

I observe that Coster's licensed, also unlicensed, acolytes adopted his typical *Dutch stud-block* upper escapement potence, also most of his other constructional features. Whereas Huygens complained about plagiarism, it does seem Coster had a better case. Yet local variations already were appearing, in Antwerp, Bernard Van Strijp's pendulum cheeks have *round cocks*, like the subject Oosterwijck; *bold baluster pillars*, like Edward East's; also a *five-wheel train*, like Ahasuerus Fromanteel's *1658* timepiece. ***<Memo Stryp>***

Dial Sector. On seeing the dialplate, already with its movement demounted, I spotted the unusual sector opening, an inverted-keyhole below **XII**, in the upper zone showing the facing velvet is not cut out.

Fig.7. **The Dialplate, Pivoted Out From The Box.** [13_F7.jpg]

If for display, like Oosterwijck's later *'Lieberge'* clock (see ***Appendix Three***), it would be a rare exception to early Hague practice. I first took it to be for Huygens' *Seconds'* window, (see *"Horologium Oscillatorium*") alternatively for Deities or Weekdays. It proved to be a *'red herring'*; when the movement was returned to its dial, the vertical motion-cock recessed flush into that sector. [Coster ***D8*** has a canted cock, ***D10*** has no cock]. Had extra depth for the strike-lever been overlooked? Such oversights might be significant. I had not seen dial cut-outs for motion work in any Hague clock, except Coster ***D4*** having very short 6mm dial-feet, (Science Museum), also in Van Ceulen's Marot inspired***** French wooden dial. ***<View Ceulen1a>***

Oosterwijck's brass dialplate also has the typical rectangular access hole, to restart the pendulum, faced by later velvet, also being uncut like the 'keyhole-sector' above. Tiny vestigial dial studs might be changes of mind, a clockmaker's 'pentimenti'. The unique holdfast is shown pivoted out to the 'rest' position, being held by a sprung geometric lock sited below the tapering obelisk bell stand.

*** N**ote**.** Early *Pendule Religieuse*, circa 1660-1670, typically by Isaac Thuret of Paris often have fixed wood dials, some have a false-plate riveted to a dialplate. Thuret's fixed iron dial ***<View>*** is reminiscent of the earliest extant Costers; ***'D1'*** has an ***iron*** dial, but pivoted; ***'D2***' has a ***fixed*** but brass dial. Note Thuret's octagonal steel work to his typical vertical hammer post, but here mounted on the dialplate (see MemoThuret also Dr.R.Plomp, ***'Pendules'*****,** Op.Cit., **p.28, Fig.21).** Claude Pascal in the Hague, set his vertical strike lever on the edge of the front-plate, (see Plomp ***D11***, ***'Pendulums***', nr.87, pp.184-185).

Dial Latch. The typical Coster pattern fabricated brass latch, having a broad flattened spring reversing on itself and turning into a single scroll foot, being riveted behind the brass dial plate. The latch has a brass slider protruding through a horizontal dial slot. Coster's many acolytes adopted it. The surprising exception is Coster '***D10'*** which has a brass latch but a straight spring. [Fromanteel's English box-clocks have brass latches with longer '**S**' shaped springs, yet still are recognisably derived from Coster - ***<Fromanteel Latch>***]

Fig.8 The 'Coster' Dial Latch. [15_F8.jpg]

Pendulum Holdfast. In any moveable spring clock a 'holdfast' seems a practical idea, even in seldom moved wall-clocks. This exceptional folding holdfast pivots in robust dial brackets; its lobed base forms a geometric lock against a broad spring with '**T**' shaped foot fixed onto the dial by iron rivets. The long, cranked and folding, arm ends in a squared fork, having a delicate swivel-hook to enclose and hold the pendulum-rod fast. All the edges are neatly chamfered, it is masterly, and, to my knowledge, it also is unique in a Hague clock.

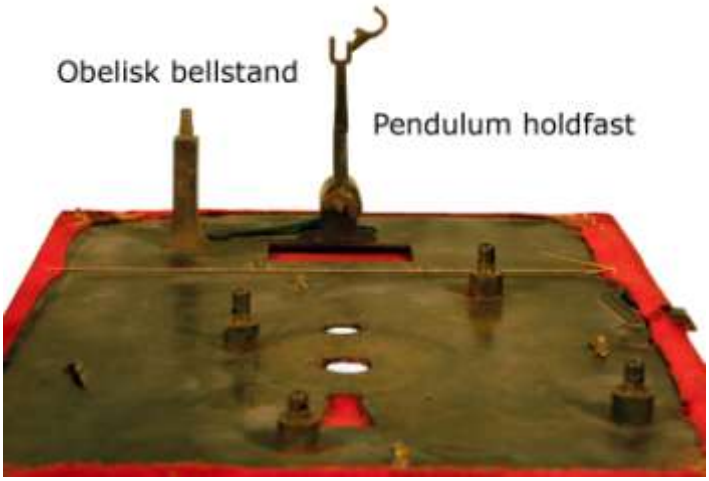


Fig.9. Holdfast Extended, Swivel-Hook Open. [16_F9.jpg]

Evidently Oosterwijck foresaw that his Royal clock would frequently be moved**.** So why is the holdfast not seen in other Huygens-Coster spring clocks being exported to Italy, Germany, France and England? I suggest it was envisaged that, once delivered, Coster's spring-clocks were expected to live out a sedentary existence. Whereas, this unique pendulum clock was made for a King's ***Royal Court*** which, then, in the changing fashion of the time, was often in progress around His Realm, enjoying the hospitality of great liege families. Evidently, this clock was intended to be included in every Royal baggage train.

[Note. Based on photographs**,** Van Lieshout suggests this device is not original, saying if a holdfast ever was fitted to this Hague clock then it might have been pegged into the backboard, in one of two extant holes. ***KP.*** *I do not share this view as the quality, colour, and the patination of this unique device matches the dialplate reverse*].

THE MOVEMENT PROPER. ▲ (Back to TOC)

The Plates. The rectangular plates (11.5 x 9.4 cm) are conventional, any gilding is now fugitive. '**V**' notches (NL. *paringtekens*), mark the intended orientations, evidently ignored when being drilled, (see fig.15b). That oversight had no further consequences. Original clock pins are notched, to ease extraction. The one-piece front plate is rebated at the left edge for the return of the drop-hammer; whereas the striking Costers (***D8***, ***D10***) have no cut-out, spacing is greater, hammer stems straighter, the clappers rebated. Oosterwijck's front plate has two brass studs to locate a trapezoid bridge, for the motion

work, just as Ahasuerus Fromanteel used. Whereas, Coster ***D8*** and Coster ***D10*** both have integral brass studs set into the bridge itself.

Fig.10a Front Plate - Obverse. [17_F10A.jpg]

A central steel hammer stop-pin has been made redundant by the hammer move. There is a steel steady-pin to the left, possibly for a cock to a lost device (see "Wind-me"). In the lower right corner is a, now misformed, "L" shaped, brass hammer spring - formerly to assist a gravity-drop-hammer. The thick brass '**L**' shape hammer-spring is held by integral steady-pins pressed into the plate, its long tail is now reshaped, curled oddly upwards, again caused by the hammer being moved. Between the central pivots at the lower edge is a steel post.

Fig.10b. Front Plate - Reverse. [18_F10B.jpg]

Four, unique, simple undecorated '*octagonal'* pillars are riveted to the plate, giving 38mm separation; being 1.5mm wider than Coster's ***D1-D5*** plates, but exactly according with Huygens's spacing, "*one and one-half inches apart*", (see ***'Horologium Oscillatorium'***, p.15).

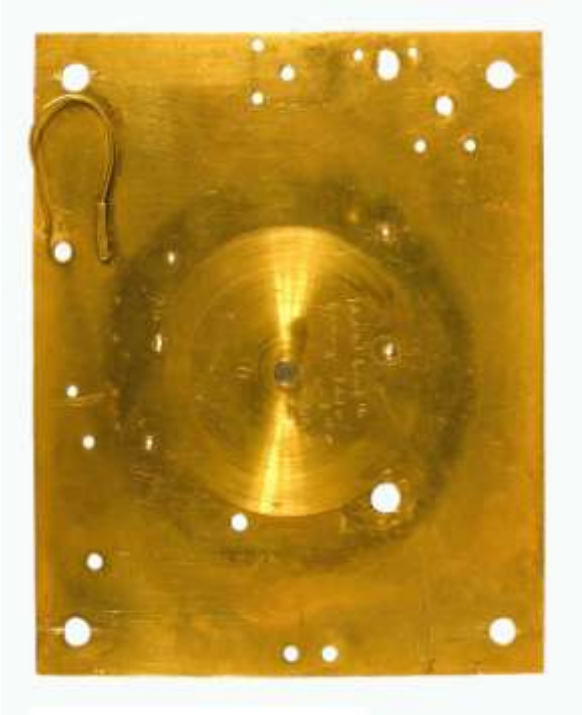


Fig.10c. Back Plate - Obverse. [19_F10C.jpg]

The single back plate is undecorated and also is unsigned, quite usual for all first-period Hague clocks, (compare his next clocks, see Plomp ***D9***, ***'Huygens Legacy'*** *Nr.11*, also his '*Lieberge*' alarum). I should want to planish out both of the former 1970 restorer's accusatory inscriptions, this -under the count wheel- defaces the back plate.

The back plate has a central steel stud for the large count-wheel; the brass detent-spring is held by two integral studs. The two small holes adjacent to the detent position are probably for the spring's first plant which Oosterwijck then changed (maybe for obstructing its detent).

Fig.10d. Back Plate - Reverse. [20_F10D.jpg]

Riveted inside the back plate is the long brass tapered post of the lower potence, having dovetail jaws beneath, holding a steel wedge that bears under and also supports the vertical escape arbor-pivot.

Both the verge-cock and the upper strap-potence, each have integral steady-pins. Individual pendulum suspension 'cheeks' are screwed high on the back plate. Original tool marks abound, some finishes remain; Paul Shrouder has conserved these all.

Dr Plomp suggests the five extant Coster timepieces, having regular plates (109/110 x 58/59 mm) and square pillars, were in fact all made by the young John Fromanteel. Whereas Coster's first striking-clock '***D8***' required larger plates (120 x 98 mm), like Oosterwijck's similar '***D9***'(117 x 95 mm), both similar to the subject plates (115 x 94 mm); which, *significantly*, also are the *smallest* of the earliest striker series. Is that mere co-incidence, or had Oosterwijck full access to Coster's workshop, therefore to John Fromanteel, and thus to the newest developments in England, even to a shared 'secreet' construction? Suddenly, attention to every detail in this clock became paramount.

Octagonal Pillars. Four octagonal brass pillars **(**3.8cm between the plates), are proudly riveted at the front plate and pinned at the back plate, without flourishes. One of Coster's balance clocks has twisted octagonal (or hexagonal) pillars, but this simple form is the first seen in any Hague pendulum. Note the simple early strike-detent 'gates'.

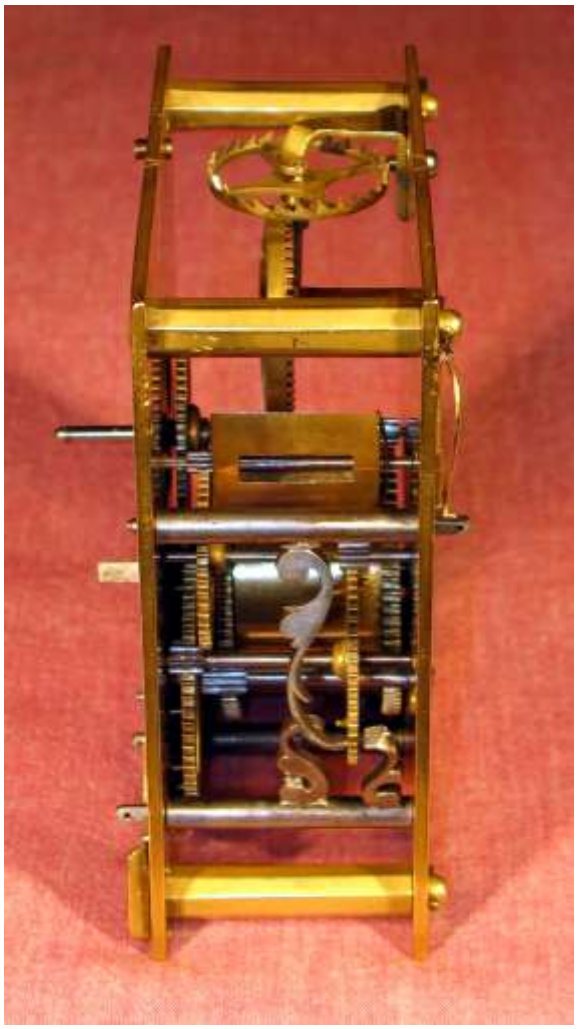


Fig.11. Unique Octagonal Pillars. [21_F11.jpg]

These recall the square pillars, used by Coster, and also Ahasuerus Fromanteel (1607-1693) in England, to reduce time, also costs, in bringing their new pendulums more quickly to ready markets. One Coster balance-wheel table-clock has **hexagonal** twisted pillars, also **square** dial-feet, (Vehmeyer, Op.Cit, Pt.II, Chapt.2, LC7, pp.274-5). **Square** pillars are uncommon, but several earlier ones are known, [see Vehmeyer, Op.Cit, Pt.I, pp.140-161; by **Johann Sayller** of Ulm, (G23, G24, G25); by **Andreas Raeb** of Hamburg, (G29); lastly in 1651, by **Jacub Gierke** of Vilnius, (G33)]. On evidence of Coster's table-clock (LC7), I am inclined to give him the credit for the time saving *square* pillars used in these early Hague pendulum clocks. He may have proposed these *octagonal* pillars to mark a special clock.

Whereas Coster acolytes around Europe all adopted round pillars, here, Oosterwijck seems to take his lead from 'Fromanteel-Coster' square pillars. Oosterwijck's curious and rare '*Huygens-Thuret'* style long-pendulum Hague 'regulator' has heavy square pillars. (Sotheby's New York, 13/10/04, "Time Museum", Part.4, Vol.1, lot 518); but now in a most remarkable Dutch collection. ***<View Regulator>***

Ahasuerus Fromanteel's early movements often have octagonal dial-feet, like his roller-cage clock, (Museum of the History of Science, Oxford). Whereas, Coster's Hague clock dial feet are mostly round; except '***D8***' having hexagonal dial feet, and '***D5***' having square dial feet like the pillars to its movement and separate alarm. However, I do not know of another Hague clock having octagonal pillars; whereas octagonal steelwork is more common. ***<View Thuret>***

Oosterwijck's octagonal pillars probably gave him subtle savings in costs and time, to fulfil his Royal client's order for a new *Huygens'* pendulum clock, but having a visibly superior movement and the additional novelty of hour striking - but no alarm. King Charles left the Hague in May 1660, for England and His Coronation, we may now presume, with His new striking Hague clock in His luggage.

Motionwork. The wrought brass bridge, notched with a '**V**' slot matching the front plate, its trapezoid feet planted on brass studs set into the front plate and fixed by screws. (Fromanteel's early bridges are also set on plate-studs, later ones have integral steady pins). Coster ***D8*** and ***D10*** have rectangular bridges ***<View Frontplates>***; ***D10*** minute wheel has no cock, (Dr Plomp, private communication).

The 'up-stands' to Oosterwijck's wider bridge are each slotted, for the reverse-minute wheel and the strike lever. The cannon is plug-riveted into the bridge. The wrought brass vertical cock, of the reverse minute wheel, with integral steady-pins is fixed by a dome-screw, it recesses flush into the dial sector already described.

The frontplate motion work gearing (32_32/6_72) is identical to all the extant Coster's, but Oosterwijck's ***ten*** strike pins and countwheel pinion of ***ten*** are unlike all other, ***subsequent***, Hague striking clocks.

A hooked barb to the original long steel strike lever is tripped hourly by a pin set on the central minute-wheel. The weighted strike-lever, [Coster ***D8*** is of thinner steel, ***D10*** of brass, both with return springs] goes diagonally across front-plate to the lower of two plain arbors, to pivot the arbor of the scrolled pinwheel gates, all crafted in steel.

Fig.12. Motion and Strike work. [22_F12.jpg]

The hammer arbor, now, is wrongly planted from adjacent pivots to its left. As a consequence, its brass clapper has been moved along its integral dovetail to further extend its reach, the clapper shaft is bent,

and the hammer spring awkwardly reshaped. [Coster ***D8*** and ***D10*** have flat steel hammer shafts, with two steel (assist and stop) springs mounted above and below their similarly positioned hammer pivots].

This simple form of hour strike, now regarded as '*English striking*', is also the model for the two known striking clocks signed by Salomon Coster, ***D8*** also ***D10***; also the model for several by Claude Pascal, (***D15***, also Plomp ***'Pendulums',*** **#91**); and the model for Pieter Visbagh's ***D18***; and even for Coster's former apprentice Christiaen Reijnaert's earliest Hague and Leijden clocks (Plomp, ***'Pendulums'***. **#.96, #97**). Whilst details do vary, general layouts are all the same.

THE FOUR-WHEEL TRAINS. ▲ (Back to TOC)
Overview. Oosterwijck's movement breaks new ground, firstly in having a new *'experimental'* split-going-barrel driving its two trains. I have yet to see this device in any earlier European going train, where the former practice was to reserve barrels solely for single or double striking work, and to always apply a fusee for the going.

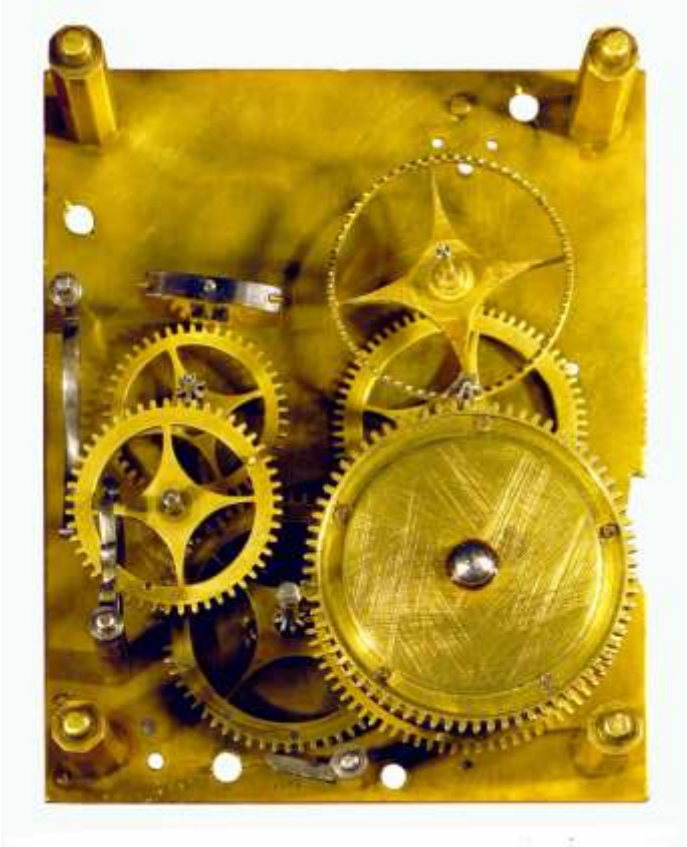


Fig.13. **Front-plate: Original 4-Spoke Going-Train.** [23_F13.jpg]

The four-wheel trains are remarkably original, the strike entirely so. Leaf-shaped pinions, tapered arbors and ringed wheels, are hand-cut, finely made yet all individual. The rear barrel cap is left roughly filed, the teeth to both main wheels are undercut, a feature I associate with the best Parisian work; "*many hands make light work*!"

Fig.13a. **Undercutting to Ground Teeth (G1).** [24_F13A.jpg]

Other wheels have similar evidence of marking-out by punch, or radial scoring, by which I was able to show that the abused contrate is the original wheel. Domed brass collets to the centre-wheel, crutch, warning-wheel and the last strike wheel are all originals. Dutch trains are usually 'scribed, *Gaan* or ***'G'*** (going) and *Slag* or ***'S'*** (strike); here a single ***'S'*** is inscribed, oddly enough, on the unmistakable warning wheel. I wonder why? The rare four spoke contrate and escape wheels are exceptional in any Hague clock, (see Figures 13 and 15d); Hague clocks' invariable *standard* being just *three* spokes.

Several teeth exhibit normal wear deformations, (see Fig.13a), but scarred edges to several teeth along one sector of the centre wheel (see Fig.14), also the scarred pin-wheel, warning wheel, contrate and escape crossings probably, are all due to trains running-on from a plate derangement in the accident I have cited. However, none of these now detract from the Royal clock's normal functioning.

Fig.14. **Centre Wheel (G2) Sector Edge Damage.** [25_F14.jpg]

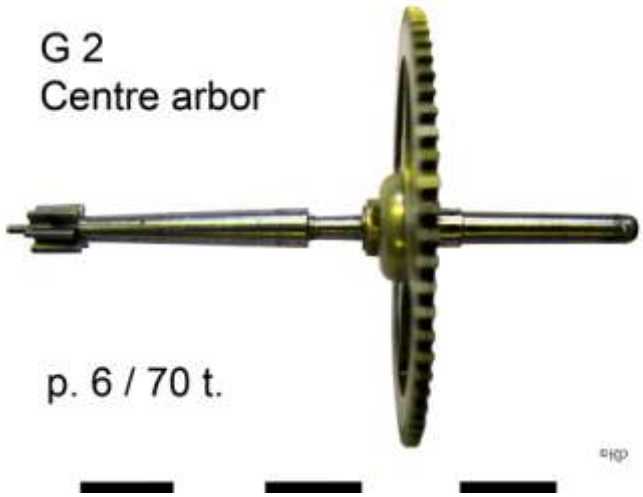
Yet I regard all these cuts and bruises as '*age-marks*' which neither detract from the movement's rare originality, nor from the clock's undoubted academic interest. Practical horologists will find the train wheel-counts and other dimensions at *Appendix One*, with Coster's comparable wheel trains of the timepiece '***D3***' and his first with strike '***D8***', (Courtesy of "Museum of the Dutch Clock", Zaandam).

THE WATCH (Going) PART: ▲ (Back to TOC)
Overview. The four-wheel going-train is planted vertically above its spring-barrel, (see Fig.13), like Coster timepieces and comparable striking clocks, (see Plomp R, ***"Prototypes"***, p.202, Fig.8). ***<Going>***

Fig.15. **Going Train on a single "Split-Barrel".** [26_F15.jpg]

Oosterwijck's centre-pinion is driven from the rear going wheel, like Coster's trains, but his is now detached from its centre-wheel which is planted at the front plate and fixed to the centre arbor with a double-domed brass collet**; *déjà vu, Fromanteel*!**

Fig.15a. **Centre Arbor (NL. *Centrumrad*)** [27_F15A.jpg]



The tapered centre arbor, with centre wheel displaced from the rear pinion, is a new feature for Hague clocks. The deep filed (not turned) relief suggests an *ad hoc* revision by the clockmaker, to correct his initally too small a clearance for the split-barrel's strike-wheel (S1).

Probably, in that distant accident the front pivot of the verge was damaged, re-cut and given a new extended bushing to accommodate the shorter, being re-cut, front pivot. (see Fig.15b). The open screw holes are for the individual suspension cocks to Huygens' cheeks, that hold the silk suspension and work towards eradicating *circular error*.

Fig.15b. **Verge (NL. *Spil*) Set Across The Plates.** [28_F15B.jpg]

Both the contrate-collet and the escape-collet are new replacements made by Paul Shrouder; his new escape-pinion of five replaces much worn original pinion, (all the damaged original parts were retained). However, the two potences, verge-cock, and two suspension-cocks, are all the originals. The deformed *four-spoke* contrate wheel was painstakingly reshaped by Paul Shrouder; although much abused, it nevertheless is the original wheel. The four spokes, from its collet to its rim, are slighly dished. My proof of originality being, its hand-cut teeth, individually marked out by punch*****, and having a double-ring**.**

[***D**utch marking-out of teeth is more typically scribed, as Michiel van Hees privately confirms, so this small detail might, again, be further, implicit, new evidence of an English Fromanteel influence?]

Fig.15c. **Contrate-wheel (NL. *Kroonrad*).** [29_F15C.jpg]

Accidental damage has also caused the escape wheel's thick toothed-rim to be re-cut. Extensive scarring to the rare original four-spoke crossing and strap-potence are clearly evident, (see Fig.15d).

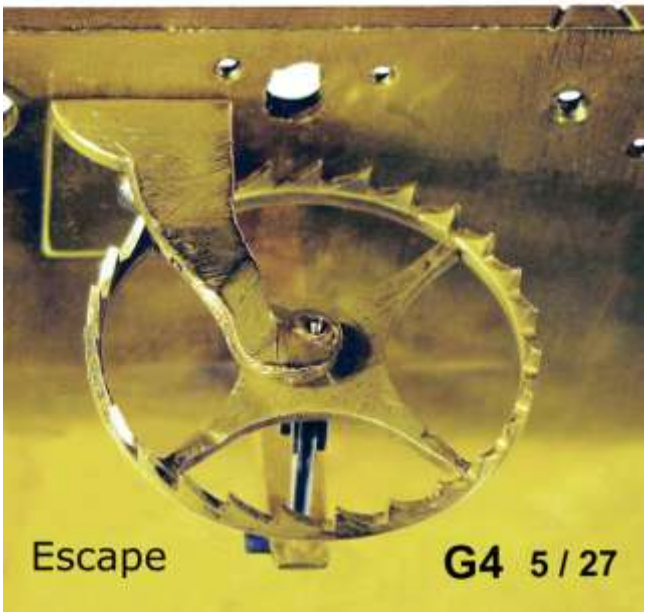


Fig.15d.**The Escape (NL. *Spillerad-Schackelrad*).** [30_F15D.jpg]

Again I stress, in any Hague clock, having four spokes to the upper going train is exceptional, the '*standard'* is just three. Dr Plomp has privately confirmed that he only recalls one other, by Claude Pascal, (see Vehmeyer H.M., **"*Clocks, Their Origin and Development 1320-1880*"**, Vol.I., Pt II.,Chap.2, LC14, pp.288-9). Privately, Michiel van Hees cites another example by Pieter Visbagh, at the Museum of the Dutch Clock (MNU); but admits that has various restorations: so has the Clockmakers' Museum's much restored 4-spoke Visbagh (***D18***?).

Conversely, in Ahasuerus Fromanteel's early *pendulum oeuvre* three spokes are infrequent, although the original strike train of his most famous *pre-pendulum Chef d'Oeuvre*, (a Solar-Zodiac-Musical clock, made in 1649 for Dudley Palmer of Gray's Inn, the most famous English clock of its time), has *three-spoke wheels* on high domed collets. But that clock was then, is still, unique. (see p.11 View **31V**).

We may assume, therefore, that in John Fromanteel's use of *three* spoke upper-train going wheels, in Holland, he was copying Coster's own pattern, being under contract. Oosterwijck's independent use of *four* spokes, in his upper going train, together with his novel centre arbor layout, and a strap potence, might all infer an unknown and earlier connection to the Fromanteels in London, or an intimate knowledge of their contemporary (*pendulum*) clocks.

Early Hague clocks did evolve very quickly; a minor consequence of their early hand cutting is that the upper wheels are often larger, with coarser pitch having fewer teeth, than later engine-cut equivalents. Trained watchmakers, like Coster, had their own higher standards. [Note. the early conversion of Fromanteel's Zodiac-Musical clock, from cross-beat and spring-remontoir to his verge pivoted-pendulum, added remarkably small *solid uncrossed* contrate (7/28) and escape (8/11) wheels, in place of its former Burgi "*saw-wheel*", a retrograde step, reversed within the decade for tic-tac and anchor escapements].

View: Ahasuerus Fromanteel (1649), Strike-Train Crossings.
(Mr Dudley Palmer's Solar-Musical G/S Clock) [31V_AF1649]

Another consequence of the rapid evolution, in Hague clocks, is even Coster's going trains are not uniform. (see *Appendix One, Tables 4,5*, also *Appendix Three*, *Table*). Oosterwijck's train relates directly to Coster's timepieces ***'D1'***, '***D3***' and striking clock '***D8***'; Timepiece escape wheels are **5/27**, Striker has 5/29, Severijn's ***RH*** is **5/27**; Timepiece contrates are 5/64 , Striker **5/60**, Severijn's ***RH*** is **5/60.** Such similarities are not merely by chance; they might even hint at Severijn's ***RH*** going train being a transition, ie. between Coster '***D1,' 'D3***' timepieces and '***D8***' striker. It is compelling evidence, but of what; fraternal co-operation or industrial espionage? I prefer the first, there are just too many other internal similarities not to ignore.

Future researchers may give greater weight to the evidence of wheel-counts and train designs, to determine origins and chronology. Here I give credit to Dr.Jeff Darken and the late John Hooper who recorded all wheel trains in their book, ***"English 30 Hour Clocks"*,** (Penita Books, 1997). Those typical English trains have upper pinions of 6 or 7, even 9, whereas Renaissance pinions of 5 are typically found in early Hague clocks. Berry van Lieshout has long recorded the details of their trains, in his unique database, notes, images, also AutoCad layouts; but Berry also adds a caveat, "the demands of any train may well give identical and yet independent solutions".

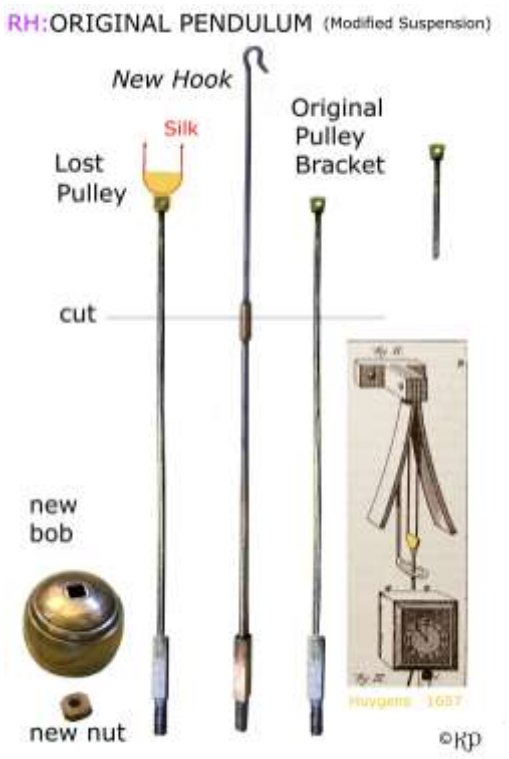
Nevertheless, it is possible to deduce much from wheel-counts, also wheel forms. Arbors and collets too can reveal lineages. Coster '***D1***', '***D2***', '***D3***' , '***D4***' also '***D8***' all share integral steel collets at the front of the centre arbor; whereas '***D5***' does not; only the barrel-arbors of '***D3***' and '***D4***' extend beyond the back plate, only '***D4***' has a turned flourish (like Reijnaert's pillars). Coster '***D1***' and '***D3***', have square collets, behind the contrate; Coster '***D4***' has a shapely *French* collet at the front. And Coster ***D3***, alone, has a dovetailed barrel-cap; also thinner and unrounded ends to its pillars; and when discovered an unique hour hand with an open teardrop trident pointer - not out of place on a Renaissance table clock. There is an abundance of similar *unpublished data* with Van Lieshout and others, therefore I propose an *Open-Research* project under aegis of the Horological Foundation from data inputs by owners, curators also restorers of early pendulum clocks, (see ***Appendix Three, 'open-research'***, ***Data Matrices***).

Astronomy's Pendulum. Huygens was fully aware that the real kernel of his intellectual property, which he assigned in Coster's June 16th 1657 Patent, was in his *crutched verge*, that regulates his clock directly from astronomy's freely *suspended long pendulum*, loosely held in the jaws of his patent crutch. It was a simple construction, yet a profound insight. He deserved his glory, but he guarded it rather too zealously - one might even say from a characteristic '*paranoia*'.

Yet Huygens' way, with 99.4cm and 24.9cm suspended pendulums, (Coster's are 13.8cm to 16.1cm), was unlike Simon Douw's *spring-remontoir with a beam-balance* (cross-beat?) which he with Coster had failed to quash in ill-motivated 1658 litigation, (*Appendix Four*). Huygens' way was superior to Galileo's 1642 *pivoted-pendulum*, but not Galileo's '*pin and saw wheel*' dead-beat escapement*; better too than Fromanteel's *pivoted-pendulum* whose first pendulums were just '*four thumbs*' (Dr.John Wallis) like his 4.5" pendulum for Davis Mell. However, by mid-February, 1664, even Huygens had to acknowledge Fromanteel's '*new way of long-pendulum*', his long-pendulum cross-beat, which then founded a long English ascendancy. [My review of Fromanteel's *equation clock*, at Belmont Park in 1993, first revealed its several conversions; originally a *long-pendulum on crown-verge*, c.1661/2; around 1664, given *cross-beating pallets on new saw-wheel* (Burgi's 3rd cross-beat) still long-pendulum; then c.1670s given so-called '*original' anchor*; finally given incongruous regulation system on a new top-plate; (see ***First 12 Years***, nr.10; also ***Iden Collection***)].
***Huygens never designed *escapements*, he kept ancient *crown/verge*.

Oosterwijck's original Huygens'-type pendulum rod, shown in Paul Shrouder's images (HJ, Op.Cit. p.382, Photo2), then, still retained a small, flattened, bracket plate at the top. He made a new brass bob, but he also replaced that tiny '*beaten*' bracket with a hook; more appropriate for later Hague clocks and French variants. Yet that tiny vestigial bracket, certainly, had once held a small shrouded pulley or spreader for the silk suspension chord. Now known only to Huygens' scholars and Hague clock specialists, few Hague clocks still retain it. I have not seen it in any *Pendules Religieuses*. Yet it can be seen in Huygens' original 1657 Patent design, (see Figs.I,II, ***Horologium Oscillatorium***,1673); also in Perelli's 1770 drawing of J.P.Treffler's 1657/8 copy of Coster's clock (Plomp. Op.Cit. Fig.9); also in Isaac Thuret's regulator (H.M.Vehmeyer, Op. Cit., Vol.II., Part II., Chap.5. pp.810-811, F20). Oosterwijck's *regulator* has reconstructed *pulley*, also a pendulum-rod *'banking-plate'* that the *pulley* had preceded.

Fig.16. Original 'Huygens-type' Pendulum Rod. [32_F16.jpg]



This small part, seemingly inconsequential, actually has an empirical purpose; it spreads and flattens the silk suspension chord, to squarely strike the face of the cheeks. Whereas hooks give a closed strand, more prone to twisting and 'banking'. [Huygens' spreader's ultimate expression was in his triangular pendulum]. Happily, when I first saw the clock, Paul had kept the removed part. I recommend that it be reinstated to Huygens' original design as Oosterwijck had intended.

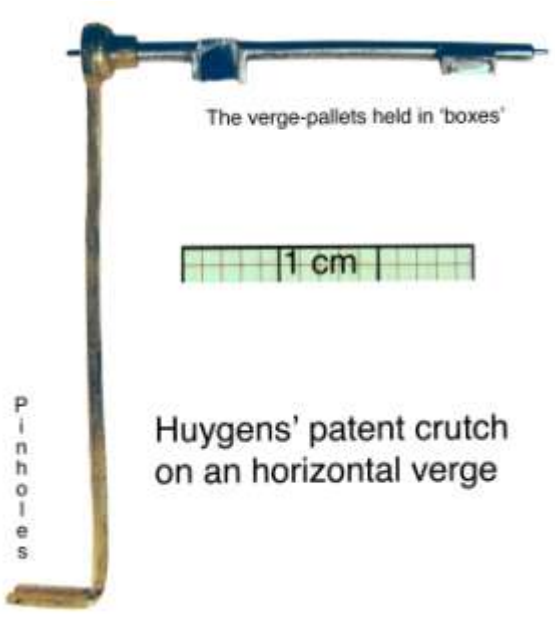
In the course of examining other early Hague clocks, I realised how such minor details as the original pendulum rod prove this Royal Oosterwijck's early uniqueness. Unlike all extant Coster pendulums, its round rod has no flattened section at the crutch jaws; instead it is just as Huygens showed. All of Coster's extant pendulums, now have suspension hooks with banking-plates; which do have the singular advantage of preventing rotation as the bob is being adjusted.

Crutched-Verge. **O**osterwijck uses Huygens' *patent-crutch*. The accident-reduced steel verge is pinned to its brass crutch through the collar of a domed brass collet; unlike the steel block of Fromanteel's pivoted pendulum. Mr Shrouder refaced the pallets set into boxes on the verge which appears to be the original. Similar pallets are seen in Hague clocks, but those are mostly reconstructions. The long stem of this thick brass crutch is bent outward and open-forked, to accept the round iron pendulum rod which I determined is the original rod. [Van Lieshout suggests these may be English *book-pallets*, inferring post accident replacement - rather than repairs? ***KP.*** *I suggest a competent repairer would not repair a broken pivot, add a new form of pallets, only then to extend the front bushing to accept his shorter verge]*.

The unusual open-fork has two transverse pin-holes, unique in my experience. Their purpose must be to contain the pendulum, like Coster's loops, but probably are easier for making, also for attaching the simple rod pendulum - without the later *anti-banking* flat section.

The crutch was the intellectual core of Huygens' pendulum invention, as patented by Coster, also as used here by Oosterwijck with both their consents, as evidenced by the legend, ***'met privilege'***

Fig.16A. Huygens Patent Crutched-Verge. [33_F16A.jpg]



The Verge-Cock. **T**he wrought brass, single-foot, verge cock has integral steady-pins, fixed by a single external screw. It is planted at left, opposite the internal strap potence. It is the original cock, but its form, size and position is unlike any Coster clock, (or Hanet, Pascal or Visbagh); with the significant exception of Coster's first striker ***D8*** which also is on the left, but has a trefoil foot. (Coster's timepiece alarum ***D5*** has a *double-foot, back cock* like Fromanteel's, but that appears to be a late French reconstruction). The subject clock's recent conservation and corrected verge alignment had left an extra pivot hole from a poor repair - when broken in the cited accident.

Fig.17. Oosterwijck's Verge-Cock. [34_F17.jpg]

Like all Hague clocks, of all periods, this verge pivot has not the benefit of Fromanteel's earliest *steel-shim, roller-cage,* or *steel knife-edge*; being his trademark attention to details - towards perfection.

Suspension Cheeks. **H**uygens' famous '*Cheeks*' were not part of his design, he claimed for Christmas Day 1656, (Plomp R, Op.Cit. Fig.4). However, he quickly identified circular-error (*periods of oscillations varying, due to the changing amplitudes of fixed-radius pendulums)* that Galileo and Wendelin had observed, but had not resolved. Seeking to cure that significant defect by empiric means, early in 1657, Huygens first arrived at cheeks to change the radii of a suspended pendulum with changing amplitudes, to end circular error.

Huygens' *privilege* also extended to Oosterwijck using pre-cycloid cheeks, evidently without any allegation by Coster or Huygens of plagiarism or litigation: which indicates to me their full cooperation in this English Royal commission awarded to their countryman.

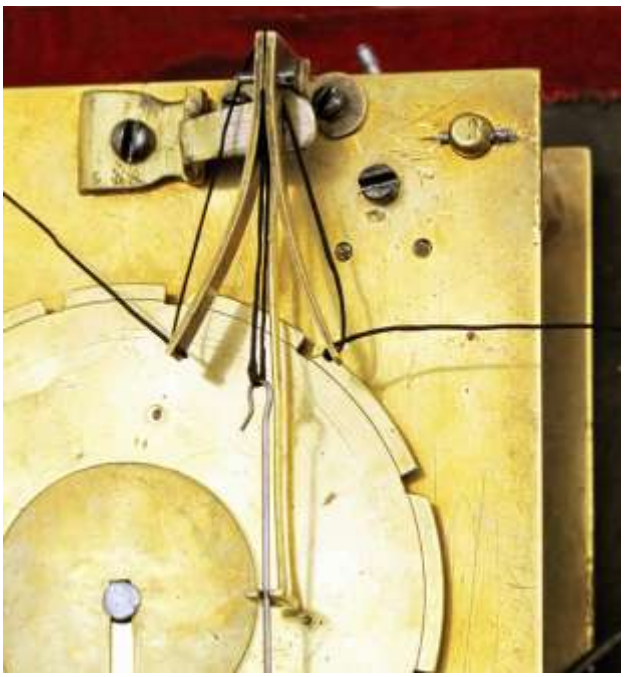


Fig.18. **Oosterwijck's Original Pre-Cycloid Cheeks.** [35_F18.jpg]

Oosterwijck's two laminae (Cheeks) are set higher on the back plate than Coster's. Each separate cheek has a round cock (foot), fixed by elongated ball-head screws, joined at their contact point by a single screw clamping the thread. These original unmodified cheeks are an incredible rarity. [Van Lieshout identified the baroque Marot-Van Ceulen repeating movement as another, no less rare in a later period].

Each cheek has two pinholes at its lower end, I had not seen that before although Coster '***D1***' does have single larger holes at the top. Paul Shrouder neatly resolved these pinholes, by threading the silk suspension so as wear occurs new thread may be pulled through. There may be no extant precedent, but this is a plausible solution.

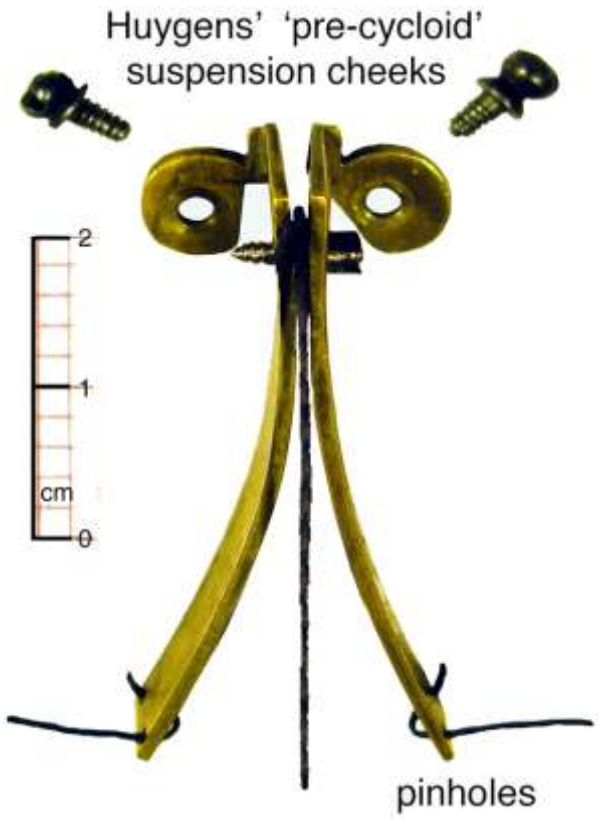


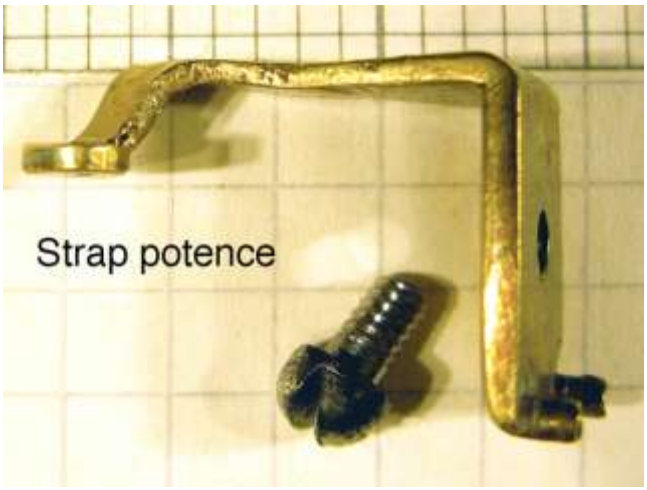
Fig.18a. Pre-Cycloid Pendulum 'Cheeks'. [36_F18A.jpg]

Oosterwijck's suspension cheeks already display Huygens' empiric form but are still, technically, '*pre-cycloid'*, like Huygens' original 1657 timepiece (see 'DØ1' below) and, oddly, are still depicted in Horologium Oscillatorium [*Part I, Fig.II*] that had first published his Cycloid Theory and Proof, where true cycloid-form cheeks also are shown, (Part.I, p.21, Fig.2). [Huygens' original patented Seconds' clock had his empiric suspension cheeks, being temorarily abandoned in his subsequent 'OP' design in February 1658, intended to reduce its half-second pendulum arc to eliminate or further reduce the circular error, (see '***Horologium'***, *September 1658)*. Yet by February 1660, he had already determined its ideal shape was a *Cycloid*. Probably, some cheeks were probably reshaped retrospectively; but many were later abandoned, and some have been reconstructed (like ***D8***). But his geometrician's *incremental evolutes* proof was only published in *1673*; when, rather notably, he credited Christopher Wren as being the first to determine a *cycloid's arc-length*, (see ***'Horologium Oscillatorium',*** Part II, Proposition xv, Part III, Propositions VII, IX)].

Strap Potence. Dr.Plomp regards the simple Dutch verge-cock as an English tradition (Plomp, *"Chronology",* Op.Cit. Conclusions, pf.3). He says nothing about the typical Dutch escapement *'potence block'* (riveted or screwed) used since Gerardus Vibrandi's time - derived from earlier German watches. Pertinently, Coster was firstly trained as a watchmaker, who later took to making balance table clocks before Huygens fortuitously offered him the pendulum Patent rights.

Oosterwijck's four-wheel train's high escape wheel and extra long verge does not follow Dutch practice. He has resolved his higher geometry with a strap-potence, of wrought brass, mounted on the going side, its foot fixed by integral steady-pins and a screw; its curved pivot-arm bends under the verge to the escape wheel's top pivot. This part, too, appears to follow an entirely English tradition.

Fig.19. Oosterwijck's Wrought Strap-Potence. [37_F19.jpg]



I believe this strap-form of top-potence is unique among Hague clocks*****. Oosterwijck's novel strap potence has an external screw, which enables the escape wheel to be detached without separating the plates. It is far closer to the English form - as adopted by the Fromanteels for their horizontal verge with *pivoted-pendulums*, ie.being suggestive of a contemporary English pivoted-pendulum. ***Déjà vu,* Fromanteel!** [*****A strap-potence in the Guildhall's Visbagh is misconstrued restoration, a cutout for block potence is now vacant]

Post Potence. The lower potence is a long, tapering, brass post, riveted into the back plate, having inferior dovetail jaws holding a steel wedge to bear the escape-arbor's pivot. Whereas all Costers', also his acolytes' clocks, have the typical Dutch screwed or riveted escapement block, with a lower strap-potence on screwed cocks, with similar dovetails. [**N**ote, ***D1*** also ***D4*** retain their steel pivot wedges, whereas ***D3*** now has a brass rivet set through the reduced dovetail].

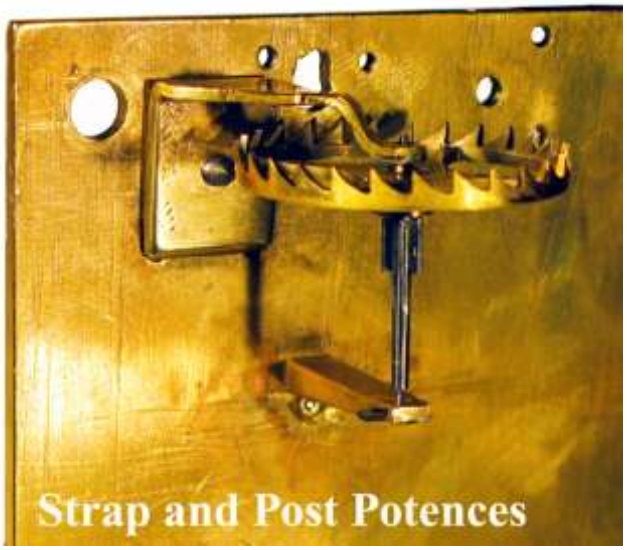


Fig.19A. The 'English' Escape Potences. [38_F19A.jpg]

Oosterwijck's might be mistaken for Fromanteel/English potences; that may prove significant. Among Hague clocks, this is an isolated or even unique appearance of the upper strap-potence that Ahasuerus Fromanteel favoured, which had originated from vernacular lantern clocks. (Lee, Ronald A, ***"The First Twelve Years of the English Pendulum Clock 1658-1670"***, Exhibits 3, 13, 30, Byfleet, 1969).

[Note. as happens in research, I have learned of a second Oosterwijck movement with strap-potence, also a fusee, exceptional in Hague clocks. After 1680, some Hague clocks were fitted with fusees, see Ceulen3. By then, several English makers, **Joseph Norris**, the **Fromanteels** and **Steven Tracy** had set-up shops in Amsterdam and Rotterdam; where they first adopted Hague going-barrels, only later introducing fusees as standard, even with Cheeks - "*when in Rome*"]

However, Coster's escapement block is seen in the rebuilt, 1658 dated, Fromanteel timepiece, (Plomp R, Op.Cit. Fig.22), yet Simon Bartram's pendulum watch-clock, now, has Fromanteel's strap-potence, (see "*Horological Master-works*", Exhibit 6, AHS, Oxford, 2003). However, the authors cite evidence of a *"Dutch type top stud [potence] as illustrated by Huygens in Horologium Oscillatorium which carried the crown wheel and front verge pivots"*. A cautionary caveat, to those who would impose their own agenda in restorations.

Among Huygens' many sketches and diagrams, only one depicts a strap-form top potence, (see *Horologium*, Fig.1, Sept.1658). Being uniquely intended for Huygens' verge-pendulum, was that strap form known to him from an English model, or from Oosterwijck's extant clock? The latter might suggest his design was only prepared after seeing the subject Royal clock; the former might infer Fromanteel's pendulum, in fact, was contemporary with Coster's, or earlier?

When Oosterwijck made his Royal striking-clock it was *'state of the art'*, and approved by Huygens, certainly not a pirated copy. His next striking clock (Plomp ***D9***) has similar cheeks but these (now) mimic the true cycloid shape. (see *Huygens' Legacy*, Op.Cit. nr.11, p.35). **T**he authors date that lavishly decorated clock, "c.1660". Here I stress, it is exceptional for any extant Hague clocks to have original and unmodified cheeks. So many have been modified, improved or added, mostly during commercial restorations. When discovered, Coster '***D8***' had Fromanteel's flawed pivoted verge-pendulum; Dutch pride has required its present Huygens' system to be reconstructed. [Conversely, superb English turn-table clocks by East, Matcham, and Ebsworth, all found in Europe, had all been ***improved*** by conversion to Huygens' superior suspended-pendulum]. ***<View Ebsworth>***

THE STRIKE PART: ▲ (Back to TOC)

Overview. Huygens had always disclaimed striking systems as being already well known and not part of his invention, ('***Horologium'***, 1657, p.15). Here I can find no evidence for any case mounted alarm work, unlike Coster '***D5***', nor any integral alarm such as was added to the plates of Coster '***D8***" by a different yet contemporary hand. But, this is one of the first Hague clocks to have striking, *if not the first*!

Like the extant Coster striking clocks, Oosterwijck's clock strikes the full hours only, not half-hours; being now called '*English striking'*. Like Coster's, his 4-wheel strike-train runs diagonally across the plates, (see Fig.13 above); Dr.Plomp suggests that Coster ***'D10'*** is *"actually a timepiece with a striking train added"*, (Plomp R, ***"Prototypes"***, Op.Cit. p.202, Fig.8). Curiously, for that decorated, therefore later clock, ***D10***'s plates (109 x 84 mm) are smaller than the *earlier* ***D8*** plates (120 x 98 mm), and are also smaller than the subject Oosterwijck's plates (115 x 94 mm). It needs considering.

Is there an anomaly here? It would seem so as, generally with Hugue clocks, smaller is earlier. Only the plates of London's Guildhall Clockmakers' Museum Hague clock, circa 1659/1660, are smaller (at 100 x 78 mm). That early clock bears Pieter Visbagh's shield, with "met privilege"; if right, his first known; being '***D18***' in Dr.Plomp's chronology. Might '***D18'***, and Coster '***D10***', be using earlier plates set aside and only used later? Or is it new evidence of sparing use of expensive materials? We must expect anomalies in any study. Here I suggest, if Oosterwijck's subject clock had lost its signature plate, then its dimensions, plain gate arbors and steelwork would now see it lauded, indisputably, as the '**earliest**' in Coster's striking-clock chronology. [One of Van Ceulen's finer spring-clocks has suffered that misattribution, being given an inapproriate skeletonised signature of Pieter Visbagh, see H.M.Vehmeyer, Op.Cit.,(1994), p.334.nr.71].

Strike 'Gates'.
Hague clock ***strike-gates***, warning and pinwheel detents, in brass or steel, are relics of their Renaissance table-clock antecedents. A long weighted steel strike-lever goes, from its hooked barb at the minute-wheel, down and across the front-plate, to the lower of two plain arbors bearing original scroll-leaf gates crafted in steel, mounted across the plates; the earliest layout for all Hague strikers. ***<Strike>***

Fig.20. Oosterwijck's First Strike Detent 'Gates'. [39_F20.jpg]

Oosterwijck's steel gates are of scroll form, on simple round arbors, and are comparable to Coster's - but being on plain arbors are earlier. Among comparables, Coster's '***D8***' has more central, reversed, 'C' scrolls, set upon decoratively turned arbors, with plain locking detent and steel spring; now with replaced fancy detent and spring, (Plomp, ***"Pendulums",*** Op.Cit. #38). Subsequent Hague clocks follow ***RH***, Oosterwijck's ***'D9'*** etc., also Hanet, Pascal, even Visbagh's '***D18'.*** Coster '***D10'*** has even more ornate gates, and bolder baluster arbors, also an untypical (if original) rudimentary steel spring to a stubby angular locking detent. Details may differ, but their layouts comply.

Evidently, in their pendulum clocks, English makers omitted strike gates. Even Claude Pascal's first gates are quite rudimentary; but, subsequently, Dutch and French gates soon became most elaborate, later becoming vestigial again, and finally discontinued after 1700.

The Fly. A heavy, cast-brass, lozenge (Rhombus) section fly is held by a narrow *bow-spring* slotted across its rear face, (cf. Fromanteel at MHS Oxford). Its arbor has a 5-leaf pinion. **T**his fly's inertia, also its momentum, must be considerably more than any thin-vaned fly.

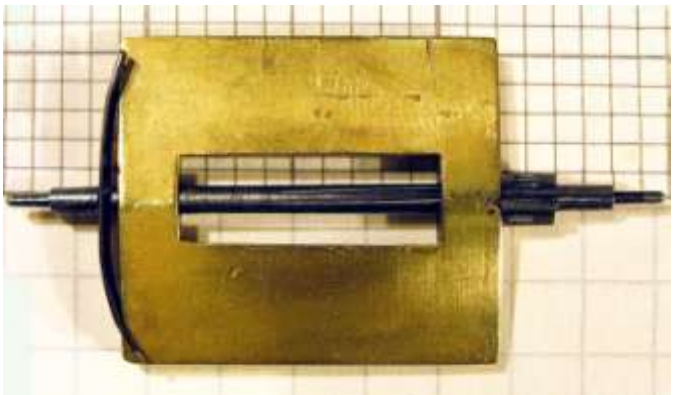


Fig.21. The Rhombus (Lozenge) Section Fly. [40_F21.jpg]

This lozenge fly is also found in the *seventh* Coster, '***D10***'. Whereas, Coster '***D8***' has an unreduced profile with a wider open section, to further reduce the fly rotation speed with its 6-leaf pinion? Coster fly-chronology seems reversed but Dr. van Grimbergen, director of the Museum of the Dutch Clock, Zaandam, suggests that Coster '***D8***' had originally possessed a 5-leaf pinion. Was its consequently slower fly, then, a lozenge? [Van Lieshout suggests the subject fly-pinion, being 5 off 48 teeth, is unusual; he also suggests its heavy lozenge fly is probably to counter a stronger second, *post-accident*, mainspring].

[***KP**. In view of the subject clock's known long English provenance, why then does its Rhombus fly exactly match Coster's on '**D10**', and be so similar to Coster '**D8**' too? Osterwijck's subsequent clock, '**D9**', also has the heavy lozenge fly, but its four planes are filed into ogee profiles; <**Obliques**>. Nevertheless, all four are clearly from the same stable. I regard that fact as clear evidence of an uninterrupted single-path evolution - if Oosterwijck **D9** be assumed to post-date Coster **D10**. And **D18** too, (Visbagh?), is most closely related to **RH**, **D8** and **D9**, but now has a Fly of thin plate -- being "much altered and rebuilt during its life*", (see lable of the Clockmakers' Museum).

Count wheel, Detent and Spring. The long front plate strike-lever, with a large barbed drop, resembles English lantern clock practice. Like early Fromanteel also Knibbs, the lever is directly tripped at the minute-wheel, not from the reverse-minute wheel.

The large plain central count-wheel (7.2 cm diam.) is set on the back plate, mounted onto a central steel stud secured by a circular brass key-plate. It has a flat profile, it is un-numbered and ringed, being controlled by a simple steel detent having a looped brass spring. Vacant holes below the detent were possibly for a trial or prototype spring that, perhaps, obstructed the detent's free operation?

Fig.22. The Plain Unsigned Backplate. [41_F22.jpg]

A thick round brass spring, is fixed to the back plate, held by integral steady pins pressed into the plate, its reversed tail tensions the spur of the vertical locking-detent; like Coster ***D8***. [Note., Coster? ***D10*** has much smaller detent and spring components. <***Backplates***> Whereas ***D18*** Visbagh? has similar gates, detent, and count-wheel to ***RH***, but has a simple wire detent spring set across the plates. <***Obliques***>

Riveted to the reverse of the large count wheel is a four-spoke driving wheel of 5.0cm diameter. having the standard 78 teeth, but driven by a small brass pinion fitted onto the squared end of the pinwheel arbor and having only **10*** leaves, (see Figure 22a).

The pin-wheel too has only **10*** steel pins. The warning wheel has two brass pins, one pin being re-sited by 18mm, probably due to the cited accident. I suggest the use of ***tens*** is strong persuasive evidence towards an earlier chronology than Coster's striking Hague clocks.

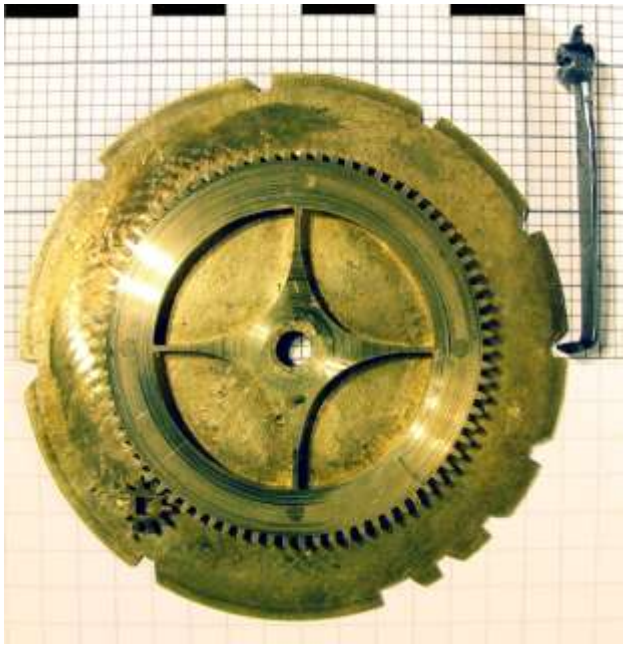


Fig.22A. Locking-Plate (Count Wheel) Reverse. [42_F22A.jpg]

Evidence for chronology? C**oster 'D8***' and '***D10***" each have **12-pins** and **12-leaf** pinions, not Oosterwijck's Royal clock's **10 pins** and **10-leaf** pinion, (ditto his'***D9***'); otherwise all have identical gearings. Therefore, the change from **10s**, henceforth, to a new standard using **12s**, again points to Oosterwijck's Royal clock as being earlier in the Dutch chronology than Coster's ***D8, D10***. Therefore, Oosterwijck's ***Royal Haagseklok*** is not the derivative that I had first assumed.

This is new evidence; and it infers that Hague clocks having **12** pins also a **12** leaf-pinion as the ubiquitous new standard, are actually all derivatives of Oosterwijck's new *prototype* model, uniquely with **10**s.

Anomalies such as these, (initially shall I put it no higher), do at least make the case for a well supported open-research project to assemble and to collate all the physical data for custodians and researchers to access, (see ***Appendix Three, open-research*** <***Data Matrices***>).

Hammer. The brass drop-hammer, with steel striker, is dovetailed to a long steel stem, which pivots along the plate like early horizontal table clocks. The hammer arbor is now mis-planted in secondary pivots, (see Fig.23), requiring the brass clapper to be extended along its dovetail stem, both to reach the bell and to clear the frontplate relief. Note original stop-pin, and former shape of hammer-spring. At first we took these vacant pivots to be for a half-hour passing strike, but that would not require the unique barrel-cam probably associated with vacant pivots, also screw holes and posts for cocks, (see 'Wind-me'). Fig.24 shows the hammer set in its correct pivots.

Fig.23. The Drop-Hammer Showing Original Plant. [43_F23.jpg]

The Royal clock's nearest comparables, Coster's ***D8*** and ***D10***, have the same general layout and similar proud rivets to their pillars. ***D8***'s diagonal strike lever is of thinner steel, its hammer is all steel having a thick flat-stem to a rebated pear shape clapper -needing no front plate cut-out. It too pivots along the plate from the right side. Its long diagonal hammer spring is set high on the left with a stubby stop-spring below. Coster ***D10*** is very similar but with a brass strike-lever. Whereas the winder squares of both ***D8*** and ***D10*** have unusual cross-pins at the front plate which are neither for ratchet, nor stop, nor motion work, ***<Frontplates>*****.** [Van Ceulen weight clock (see Part II), has most unusual separate winding squares pinned on round arbors].

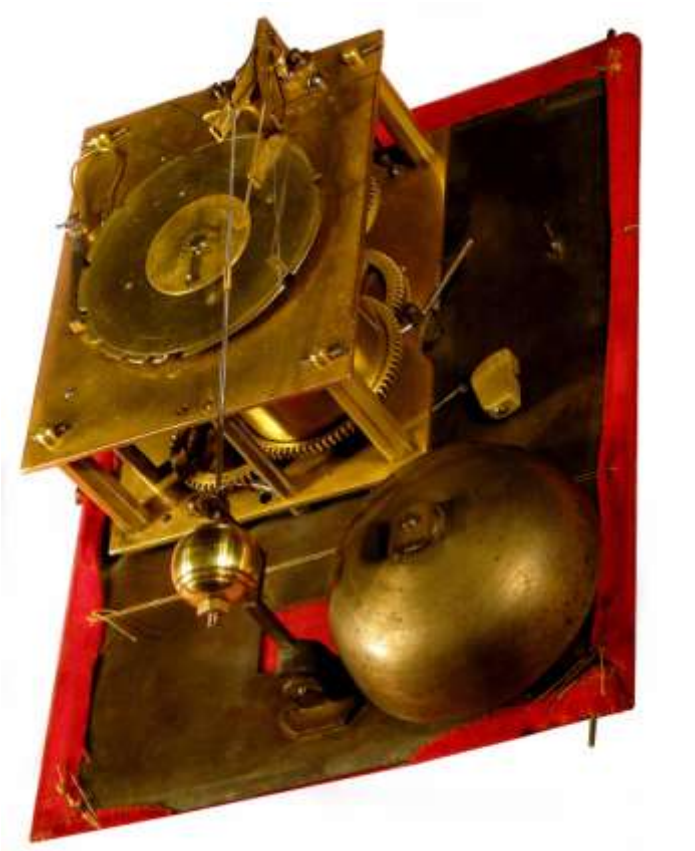


Fig.24. Arrangement Of Strike, (Hammer In Correct Pivots). [44_F24.jpg]

[**V**ertical hammer-posts first appeared circa 1659/60, probably being introduced by Hanet or Pascal. That soon became the Franco-Dutch standard, but even having a short lived English manifestation, with Fromanteel and his several acolytes, including famous Joseph Knibb, Samuel Knibb's renowned nephew].

Dial Mounted Bell. The undisturbed bell stand with its original high-domed heavy bell, is mounted on the rear of the dial plate, on a beautifully crafted obelisk, with the dome facing out like the two known striking clocks which bear Salomon Coster's name.

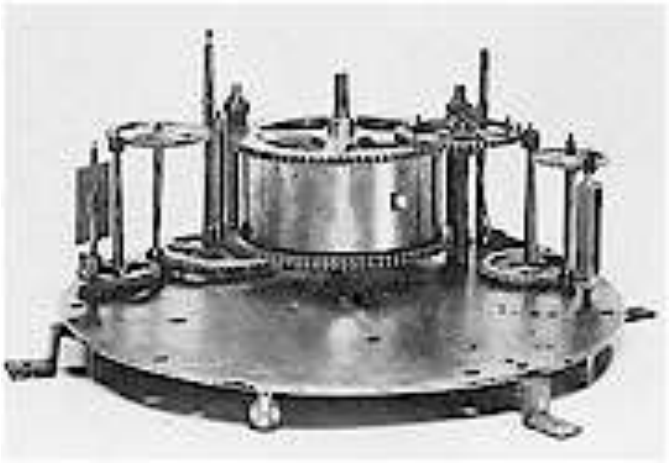
THE SPLIT (*Going and Strike*) BARREL ▲ (Back to TOC)

Overview. The single advantage of the 'going-barrel', over the fusee system, is uninterrupted power to its going-train while rewinding; it needs no maintaining power but its varying force is uncompensated. Therefore, historically, it was used only for subsidiary trains, not for timekeeping. The ancient spring-barrel evolved to drive two trains, so I have given it the nomenclature of '*Split-Barrel',* or pedantically, '*Split-Subsidiary-Barrel'*. Certainly, this device did not first appear during the mid-1650's coincident with Coster's new 'Haagseklok'.

Jost Burgi (1552-1632) of Uranienborg and Prague, clockmaker to Tycho Braye, then Johannes Kepler, the greatest astronomers of their time, is lately credited with inventing the first known ***'split-barrel'***, driving his separate Quarter and Hour trains in his famous series of Globes; the first circa 1582 (at Kassel); the last (in Paris) *dated* 1594 (and signed) being inspired by Eberhard Baldewein's '*Himmelglobus*' c.1575, driven by single fusee without strike or divided spring barrel.

Burgi is best known to English readers due to outstanding horologists Dr Hans von Bertele and H.Alan Lloyd. However, an excellent monograph adds greatly to our biographical knowledge, (Mackensen, L.**,"*Die erste Sternwarte Euopas mit ihren Instrumenten und Uhren 400 Jahre Jost Burgi in Kassel*"**, Verlag Calwey, 1979).

Views: Jost Burgi, [45V_Burgi] celebrated clockmaker to Tycho Brahe and Johan Kepler. Burgi's 'Split-Striking-Barrel' is seen in his '***Armillarsphaere***' circa 1585 [46V_Split-Barrel] also later Globes. (Acknowledgements to Nordiska Museet, Stockholm).



Within Burgi's *Armillarsphäre,* for Anton Eisenhoit circa 1585, is the *'split-barrel'* he had developed to drive two trains -- for striking the Hours and the Quarters. Two of Burgi's Globes are Kassel I (c.1585), and *Kassel II* (c.1590). The latter also incorporates two striking trains driven by his innovative single ***'split-barrel'***. Burgi's Globe in Paris is the only one to be dated (1594), and the only one to be signed.

Subsequently, for decades, German clock makers used the split-barrel exclusively for that purpose; never for going trains; the *Fusee* alone reigned supreme in their dominant City Guilds: (see Birkmann-Aug). In 1657/8, Philip Treffler of Augsburg added his *fusee* to Coster's *going-barrel*, **[**as Bruce also did in his sea-clocks ***(Appendix Five)*****]**.

Exactly when, where and who adapted Burgi's *split-striking-barrel* for Striking ***and*** **Going** is not known. Significantly, the ***going-barrel***, also its variant the ***split-going-barrel***, were only possible assuming an erroneous premise that Galileo's new pendulum, used in Huygens' way, had no need of fusee-modified power. Mr Simon Douw's Patent

Application (August 9th, 1658) nailed that canard; All of Huygens' ancient crown and verge escapements, irrespective of drive types, were affected by changing forces; Douw's was not! Dutch, English, and French makers relied on Huygens' erroneous premise. German and ultimately English makers did not. Fromanteel was one of first to use going-barrels, also one of the first to uncouple his trains, barring Treffler, was probably first to re-introduce fusee, with his own spring maintaining-power (derived from his 1649 spring-remontoir).

It is '*written in stone'* Salomon Coster made the first Dutch pendulum clock, also the first to have strike-work. His strikers, '***D8***' and '***D10***', share Oosterwijck's split-barrel. It became ubiquitous in Holland, the French makers adopted it; but they soon re-adopted multi-barrel formats, as the English had previously; both long before the Dutch. Dr.Plomp cites the *"tandem-barrel"* as Coster's contribution, (Plomp, ***'Prototypes'***, p.202). Notwithstanding Huygens' later commentary in '*Horologium'* (Sept.,1658), neither the *going*-barrel nor tandem (*split*) barrel are *necessarily* attributable to Coster, (see p.18 and Part II, §3).

Having studied Oosterwijck's subject clock, I now suggest that this seemingly mundane device is fundamental to any understanding of 'Hague-clocks' and, very probably, to understand the Hague Contract of September 3rd,1657, between Coster and Fromanteel; or, was it *Fromanteel and Coster*? In the light of Oosterwijck's constructions, Coster's asserted priority must now be re-examined. Herein, I shall re-examine and consider this device as, potentially, the *secret device*, and I will also review the circumstantial evidence to discover whose intellectual property it might be, and whose it is not, citing '*priorities*' with all consequences also considered. (See Part II, ***Perspective*, §.4**)

Pendulum Applications.
Oosterwijck's split-barrel (diameter 4.3 cm, 2.5 cm long), drives separate first-wheels for his *going* and *strike* trains. Its weaker new mainspring (the clock's *third)* has thirteen turns, but only six are useable. That gives a duration of 30 hours; (longer without striking). [Going-wheel **G1,** has **72** teeth; The Strike-wheel **S1,** has **80** teeth].

Fig.25. **Oosterwijck's *'Split-Going/Strike-Barrel'***. [47_F25.jpg]

Oosterwijck's new split-barrel has a deceptively simple appearance, showing bold ratchet-work at the front. But, it is much more complex than is readily apparent. Here I describe its parts, so its underlying characteristics and unique intellectual property is made clear.

Having by this time already formed a considered view, that both of Coster's extant striking clocks are later than the subject clock, and on the basis of features I shall now disclose, this may well be the earliest "*split-going-barrel"* yet observed in any extant pendulum clock.

The Going-Wheel, (**G1**, 72 teeth, 4.94 cm diameter), is riveted to the rear of the barrel. It drives the centre pinion (6 leaves) with a shaped arbor having a centre-wheel (70 teeth) at the front; unlike any of Coster's movements. The barrel's rear cap has been left roughly filed.

The Strike-Wheel, (**S1**, 80 teeth, 4.95 cm diameter), forms a front cap, being pinned onto the squared arbor. A set-up ratchet is affixed fronting onto the wheel, unlike Coster's timepieces with ratchets set on the front plate. (Whereas, Coster 'G5', early Pascal timepieces, and many later Hague clocks, set pierced ratchet-work on the *backplate*). So Oosterwijck's 'split-barrel' appears to be conventional**. It is not!**

Ratchet-Work: [Ger. *Sperrad, NL. Palrad,* Fr. *Rochel*].
The purpose of ratchet-work is to set up a *minimum spring tension*, to get a more equal mid-range force. Further, if a strike train is fitted, to always reserve sufficient spring-power to operate the strike to the full duration. Comparable Coster strikers, ***D8*** and ***D10***, have ratchets on the front cap, behind the front plate. Both have cross-pinned winder squares - which at present I cannot fully explain without dismantling - although one Van Ceulen ***(JvC2)*** has its winder squares pinned to round barrel arbors [KP. I invite any similar examples to be shared].

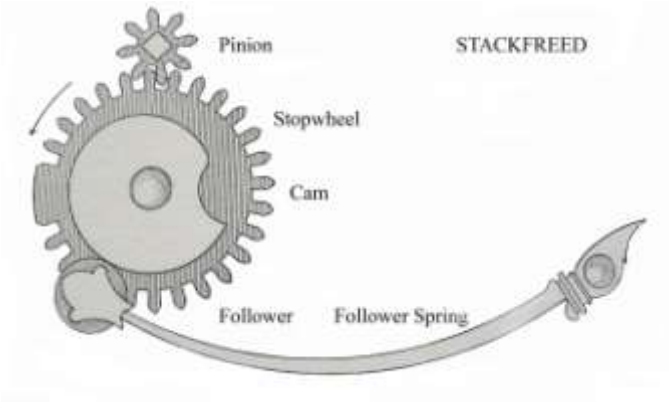
Fig.26. Oosterwijck Barrel-Mounted Ratchet Work. [48_F26.jpg]

A solid, seemingly ordinary, strike-wheel (S1/80T) apparently forms a front barrel-cap. Set proud, it mounts a thick circumferential brass-spring to a steel click, engaging with a domed steel ratchet (3.44cm, 21 teeth), being secured in place by a pin, under a stubby steel collar, having an unusual '*spur-cam*', at the lower of the two stepped squares below the winder. This appears to be a typical split-barrel, having a typical set-up ratchet and click pegged onto the barrel, like Coster ***D8*** and ***D10***, also having a strange cam; but *without* stop work**.** ***It is not!***

Stop-Work: [Ger. *Stellung, NL. Opwindbegrenzing,* Fr. *Arretage*].
The purpose of stop-work is to *limit spring tension* and to *prevent over-winding*, that might bind the spring or damage its two attachments**.** (Britten, FJ. "Watch and Clock- makers' Hand- book Dictionary and Guide", SPON, 1938, p.415). If ratchet work were not fitted, the stop alone might also 'fix' a *range* of travel for the going, and maintain minimum power for strike if fitted.

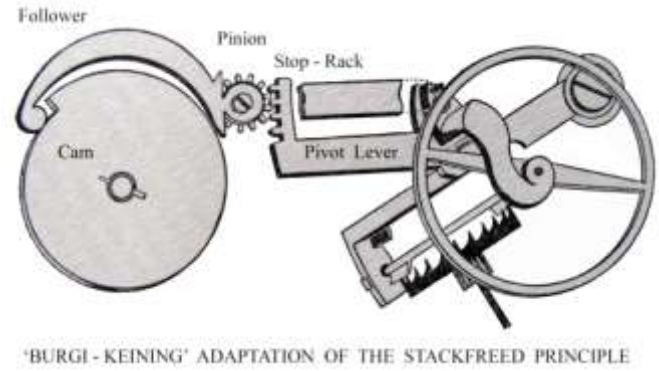
Stop work is not invariably found in all Hague clocks, although the purported *earliest* extant Coster-Fromanteel '***D1***' scratch-dated 1657 has it, but Coster '***D4***' and '***D3***' never had. Almost invariably, it is absent in French derivatives, "***Pendules Religieuses***". **T**heir ancestry might be Coster's ***'D3-D4'*** line, which in fact may antedate putative '***D1***', and might even be *pre-contract* clocks, (Part II, ***Perspectives 4, 'Secreet' Constructions)***. This, seemingly unremarkable, device now warrants a special survey. Yes, it first appears in Hague and London pendulums c.1657, but already it had a very long German ancestry, at least back to the early16th century.

German Origins. Stop-wheels, fixed onto movement plates, early **stops** often being shaped like a *'Maltese Cross'*, form an integral part of an ancient German craft device to modify the force delivered by a spring barrel; namely the '***Stackfreed***'. That combines a rotating barrel-cam, limited by interrupted stop-wheel, having a sprung roller-follower that manages spring forces (torque) delivered to the train. (Baillie, G.H., "Watches", pp.84-85, Plate XIV; Bassermann-Jordan, **"*Book of Old Clocks and Watches*",** 4th Edition, p.180, Fig.40b).



View: The Ancient Stackfreed. [49V_Stackfreed]
(Acknowledging G.H.Baillie, "***Watches***", Pl.XIV)

Much later, Hans Keining adapts it to modify his *verge-pallet depths*, and *incidence angles*, with changing spring-power, (see Lloyd H.A., "***The Collector's Dictionary of Clocks***", p.122, Fig.319; Lloyd**, *"Old Clocks"***, p.52, Fig.9). But Dr.Von Bertele ascribes Keining's clock to 1595, and attributes the original '*adaptation*' to Keining's master **Jost Burgi,** again! (Dr.Hans Von Bertele, **"*Precision Timekeeping in the pre-Huygens Era*"**, Horological Journal, BHI, Dec.1953).



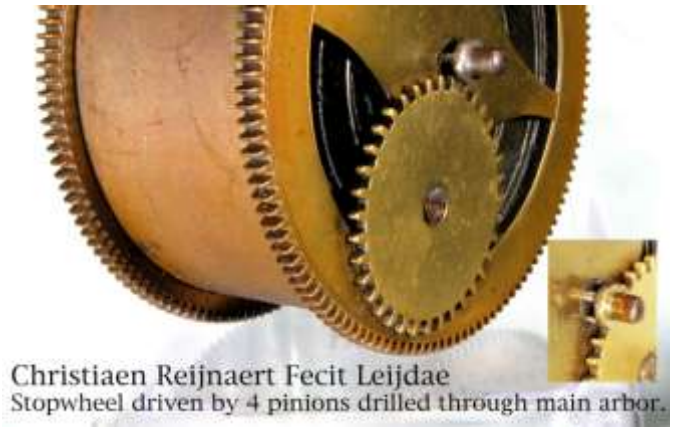
View: **Burgi's Adaptation.** [50V_BurgiAdapt]
(Acknowledging H. Alan Lloyd, ***"Old Clocks",*** Fig.9)

This adaptation of the Stackfreed was first observed by Dr Hans von Bertele (Op.Cit.), in ***Jost Burgi's*** '*aequating'* book-clock, circa 1591. Its principle had also marked Burgi's earliest Uranienborg remontoirs

Sometime later, either in the Hague or possibly in London, now without the cam and its follower, the stop-wheel is itself re-adapted to a new purpose; not to manage power but to cut-off top-end torque; also to prevent spring derangements at clients' hands; a desirable feature in any clock, but especially in any clock destined for export.

When present, early Dutch stop-work usually takes the typical form, with a visible stop wheel set onto the barrel-cap, being turned by a pin or pinion on its arbor (see Plomp R, ***"Pendulums"*** Op. Cit. Fig.55). Coster's successor, Pieter Visbagh, continued to use it. Berry named it "***Flying Stopwork***", to differentiate from fixed onto plates.

A curious variant may be seen in clocks by Christiaen Reijnaert, at Leiden, Coster's last apprentice who in 1660 was taken over by Pieter Visbagh, later to be his brother-in-law. Reijnaert's ***stop wheel***, often occupies the full radius of large split-barrels. In this case 34+2 teeth engage a *cross-drilled barrel-arbor*, (pinion of report), to a massive spring-barrel, as an integral pinion of report, allowing eight turns for longer duration and additional power. Reijnaert's known examples all have 'twin-click' ratchets at the opposite end of his large split-barrels. <51V_2Clicks.jpg>



View: Reijnaert Stopwork, Thru' Arbor Pinion. [51V_Reijnaert]

[**T**o digress, I am only surprised whenever this form of arbor-pinion of report survives intact, several do. Relevantly, Coster's only alarum timepiece, ***'D5,'*** with an external bell, probably, had this form of 'Reijnaert' stopwork, (made under Coster's aegis?), to maximise its duration. Evidently, it failed and was replaced with a plain arbor, but without replacing the arbor's integral pinion, nor barrel's stop-wheel. Happily, its present absence nevertheless corroborates its Coster (workshop) pedigree, see Part II,§2, also <*MemoCosterD5*>].

Hidden Stop Work. Oosterwijck's little clock has already presented surprises; did it surprise Coster too? On removing its front ring-collar, with the spur-cam; then combined barrel-cap strike-wheel and ratchet; a hidden inner-cap is revealed. His split-barrel's inner-cap is mounted with diminutive '*watch*' stop-work, concealed, unique **i**n my experience, at least in Hague clocks. But why was it hidden in this fashion? Its perplexing construction raises challenging questions.

Fig.27. Oosterwijck's Unique Hidden Stop-work. [52_F27.jpg]

This stacked, concealed, arrangement is doubly unique, as, whenever ratchet work and stop work are fitted, these '*always'* occupy the opposite ends of their barrel, or the ratchet work *moves* onto either of the plates. I should like to know of another such example, in any reader's experience. All my enquires, to date, have found none!

Whatever Oosterwijck's intent, his '**flying stopwork**' was not for convenience of making. Might it be a purloined secret, or have been constructed around Mayday 1658 when the famous Contract terminated? Might it even be the actual model being there described?

A diminutive stop-wheel, just 10.3mm, with six teeth cut, (8 scribed), permits six windings to the stop-sector, being driven by a pin set in the barrel arbor, below stepped squares for the ratchet wheel and winder key; Hague practice uses very little taper to winder squares.

Riveted onto the internal, (true), barrel-cap is a thin brass spring, possibly an afterthought, which engages the stop as a simple click**.** Oosterwijck's barrel cap bears an indistinct cipher. If original, whose monogram is it? Has any comparable similar markings? (See p.28).

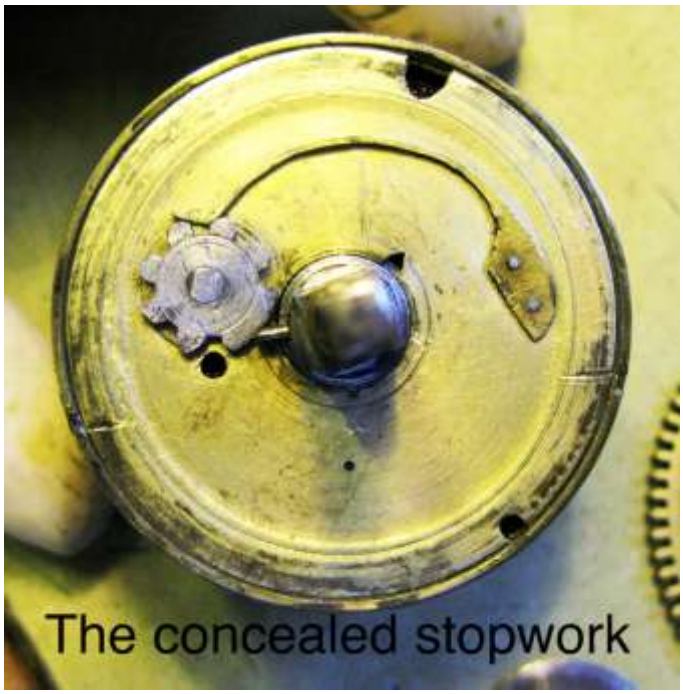


Fig.27A. Oosterwijck's Concealed Stop-wheel. [53_F27A.jpg]

My composite image, see Frontispiece and below, shows the highly complex nature of the unique layered construction on the front barrel cap; i.e. mounting the normal first wheel of the strike train, with the soon to be typical set-up ratchet encircled within its spring, but also the spring barrel's uniquely hidden stop-work. To my knowledge, this is the first example ever to be seen; and probably is the only example of its kind extant. I await knowledge of any similar construction.

View: Split-Barrel's Unique Front Constructions. [53A_Secreet?]

Coster's timepiece, ***'D3'***, now in the collection of the Museum of the Dutch Clock, Zaandam, has a similarly pierced winding arbor, above its rare dovetail barrel-cap, but that piercing is for the pin to secure the ratchet on the front-plate, in common with his other timepieces. Inspection of the two "Coster" striking clocks (***D8*** and ***D10***) reveal they have unusual *cross-pinned* barrel winding squares, (fronting the plate); their purpose is not for ratchet or stop-work, but a steel *collet*.

English Variants.
Few early English pendulum clocks with going or split-barrels are extant; excepting by later English makers trading in Holland; Joseph Norris, Steven Tracy, and Fromanteel brothers. At ***Appendix Three***, I identify earlier English examples, by Fromanteel, East, Bartram, etc., but whenever striking is added to English clocks then a secondary going-barrel is more typically used instead of a split-barrel.

England's present lack of extant split-barrels well reflect their abject failure as timekeepers, especially when used for Fromanteel's pivoted pendulums, i.e. the *'worst case scenario'* which probably accounts for his much earlier readoption of the fusee and his evident preference for weight clocks (like Huygens). Both are indicative of his *'test-and discard'* approach, striving for better accuracy. Whereas, the Dutch clockmakers stayed with this basic *1657-pattern* even into the 1690s, consequently Holland fell far behind England, (see ***Perspectives* 4**).

Watch-stop work, like Oosterwijck's but lacking his spring, is seen fixed to the front barrel-cap of Fromanteel's dated timepiece, c.1658; Simon Bartram's watch-clock has two similar, but set on the back plate, having separate spring-barrels for going and strike, (c.1659). Both these have the new English five-wheel trains, for a longer duration, probably a Fromanteel innovation. Oosterwijck's subject stop-work relates more closely to these than the Coster timepieces ***D1*** and ***D2***. Have those English stops relevance to dating Oosterwijck's clock? Are they suggestive of Severijn's earlier contact with London, and even to the Contractual 'secreet'? Possibly. This should now be investigated and new didactic arguments developed, replacing dogma and mantra. (see, **Part II, *Perspective* 4**, ***'Secreet Constructions'***).

But who invented, or first adapted, simple stop work? And how did Oosterwijck, Coster, also Ahasuerus Fromanteel in London come to it? Is John Fromanteel the link for a London origin? That invention's history is vital to our understanding, This rather technical aspect of Hague and London pendulums has never, properly, been addressed.

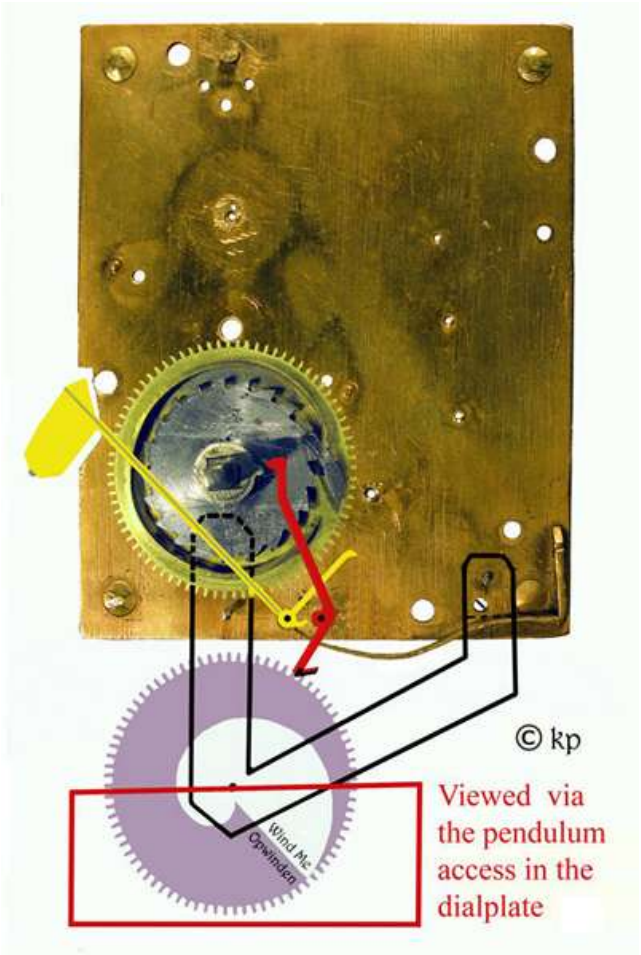
Taking a new account of this unique simple stop-work, under ratchet-work, with novel split-going-barrel, admittedly first observed in the subject Oosterwijck clock, we should now seek out comparable split-*going*-barrels and stop-work in pre-Contract clocks. Publication may well bring other unknown early pendulums back into the antiquarian domain, or, as already appears to be the case, cause owners also custodians to revisit their charges to inspect them with new keenness.

A 'WIND-ME' MECHANISM? ▲ (Back to TOC)
The curious much worn 'spur-cam', pinned to the barrel arbor at the first stepped square, sets the most intractable puzzle. Paul Shrouder and I considered its possible function. This barrel-cam appears to relate to central pivots below the barrel, (now wrongly occupied by the hammer), also relating to a reduced internal steel post, between the front plate pivots. The evidence for the hammer being mis-planted; a hammer stop-pin at its original pivot; the clapper now 'bumped' along its stem dovetail to extend its reach; the angle of the front plate relief for a more upright hammer; the long **'L'** spring now awkwardly bent upwards, over the hammer-spur; whereas formerly it extended along the plate to beneath the hammer spur. Correcting the hammer position would clear those secondary pivots for the mystery feature. We considered a passing strike at half-hours, but the well worn barrel-cam and its arbor position both suggest otherwise.

The stop work of this 30-hour striking clock allows six-windings of the spring, unwinding once every five hours on average, but at irregular rates according to the hours being struck. Such an irregularity precludes any feature that marks time, but would not preclude the barrel spur tripping a detent to show the *state of winding* also called "up-down", often being flagged on dials as "*Wind Me*".

Up-Down cannot be shown on this dial; we dismissed the sector or even the centre openings. And any device like Fromanteel's globe-moon set upon the case, (see Ronald A Lee, Op.Cit, Pl.92-97), at the two extant peg-holes, is not viable mechanically, The back plate offers no evidence. This missing construction is not yet resolved, but I have proposed an hypothetical solution, one which naturally is fully demountable. My solution might be suspended below the movement, fixed to long cocks from vacant sites on the front plate. It has one obvious drawback; such a 'dial' would only be visible by lifting the signature plate over the pendulum access hole. In any 30-hour clock 'Up-Down' would seem to be superfluous, no doubt the reason for its eventual removal ~ if in fact that was ever its intended purpose.

My projected, hypothetical, demountable, construction would be set on two long cocks at the front plate on vacant studs and screw holes; one set just below the winder, one above the '**L'** spring. Investigation continues, better solutions are invited. For the record, I stress, there are no plans to *'reconstruct'* this (nor any other) hypothetical system.



View: Project: 'Up-Down' Display. [54V_Project]

OOSTERWIJCK'S UNIQUE BOX CASE. ▲ (Back to TOC)

Overview. These early pendulums were popularly regarded as being the panacea of timekeeping and the zenith of 'scientific' instruments. They were being rushed into production to meet eager new domestic and international markets. I suggest, for that reason alone, not for any Calvinist or Puritan dogma, earlier fripperies were stripped away. But an emerging French taste soon adorned these imported Dutch cases, also their own derivatives, with new pediments, crestings, mouldings and even superb metal mounts. The two (brass or steel) suspension eyelets (NL. '*ophangers*') are missing; later strips set across the base steady the '*Mantle Clock*' - as this Royal clock has been addressed.

Externally, Oosterwijck's ebony veneered box case, (see Figure 1), looks like Coster's. However, at just 25.4 x 21.0 cm, and 9.25 cm deep, with a dial reveal of 20.7 x 16.2 cm, it actually is smaller than most known Costers, excepting "***D4***' also '***D10***'. Oosterwijck's dial at 21.2 x 16.5 cm, is also one of the smallest known; and, in Hague clocks, smaller infers earlier. Its true chronology might well antedate some Coster-Fromanteel timepieces? Technically, I can see no reason why its chronology would not. (see Part II, "Coster's Clockmakers").

Show-Wood Carcass.
Whereas all of Coster's ebony box cases are veneered onto deal, like the comparables and other Hague clocks, (nb. Fromanteel, and Van Stryp Antwerp, used oak), Oosterwijck's rare box appears to be constructed from an expensive show-wood used in the solid.

Even before opening the box, the most unusual, '*full-span'*, (rather than the normal 'framed'), backboard glows with its exotic hardwood carcass. Typically, Typical Hague clock carcasses are deal, veneered inside with Indian Rosewood (*Dalbergia latifolia*) and/or Padouk (*Pterocarpus spp)*, all having *windmill-lapped* Ebony veneers; their softwood backboards are normally set in thick frames, formed by the sides of their box carcasses. Only Coster '***D4***' has a full-span back-board, being exceptionally of *Oak* like the carcass of its box.

Fig.28. Unique Solid Kingwood Full-Span Backboard.
[55_F28.jpg]

I knew this vivid hardwood as Kingwood, (*Dalbergia Cearencis*); several furniture experts have since concurred. [Mr Howard Page suggests *Cocobolo–Dalbergia Retusa*, sourced from South America]

Inside and out, the backboard figuring is identical. However the sides might require a more invasive examination by conservators. Where cut out for the sound holes, and later pendulum arc, the box-carcase seems to be solid revealing typical vivid ochre sapwood of Dalbergia.

Probably, Oosterwijck's show-wood carcass of solid Kingwood is unique. Recalling its Royal association, might his choice of 'a Royal' timber be a visual and metaphorical pun? The opportunity to make any invasive tests, including timber density and species, is left to an appointed conservator who can properly investigate.

Normally, such expensive woods are only ever seen as veneers; as in Ahasuerus Fromanteel's only slightly later long-case of three-months duration timepiece, (British Museum, ex-Rous Lench Coll., possibly Hollar 1667 frontispiece at *Appendix Three*); also Samuel Knibb's Royal longcase, Kingwood on oak. (see Lee, R.A., Op.Cit., Pl. 91)*****.

***** Ronald A.Lee repatriated this gem, formerly at Windsor Castle. Samuel Knibb's few known clocks demonstrate ties with Ahasuerus Fromanteel. Samuel's clock has Fromanteel's own *bolt and shutter* spring maintaining-power also his pivoted short-pendulum to the typical verge-escapement, also having rare early quarter-strike train.
I shot a series of images at Ronald Lee's galleries in Bruton Place, after this magnificent classic Kingwood case had been restored, (by Matthew King). To Ronald's chagrin, it soon returned to America, again unhindered by public petitions or legal barring under a 50-year rule for re-export licenses of repatriated Heritage objects.

View: Samuel Knibb's Royal Kingwood Longcase. [56V_Knibb] Knibb's exquisite hour-hand may be compared to an earlier example by Ahasuerus Fromanteel on a Hood-clock, (see Patterns ***<Ornate>***).

Construction. Oosterwijck's simple box has no side windows, an early feature [***P1***] which Coster abandoned. in 1659, with ***D10***. The dial's single winder gives us no clue to the presence of a new striking train, but the two fabric backed sound holes at the lower left corner clearly denote its striking movement within.

Similar sound holes are also seen on the two extant Coster striking clocks, '***D8***' and '***D10'***, although not on the alarum timepiece, '***D5***', which has its bell mounted outside, above the case. *<Cases>*

Fig.29. Sound Holes Denote a Striking Movement. [57_F29.jpg]

The winder key opens a sturdy internal double-jawed crocodile lock at the large round hole on the right **(III)** face. That releases the door-frame's flat brass staple, from its slot in the box stile. A brass slider then unlatches the pinned dial, which swings open to the left, with the movement attached, just as Coster arranged. The chamfered left stile of the box is to clear the pivoting dial. The case does not require the furniture key of Coster's earliest spring-clocks.

With the movement exposed, its split-barrel and strike train are self-evident. The thick bell stands proud below the movement on the **IX** side of the dial-plate, dome facing out, set on an obelisk bell-stand.

The dial plate is located into the box by two plates having swivel-pins, held in wire staples set below the veneers with ends just visible.

Fig. 29a. The Lower Swivel-Plate Showing Pin And Staple.

[57a_F29a_Pivot.jpg]

The lower dial pin-plate has integral steady-pins, and is screwed to the dial after its pin has been set into the recessed lower staple. The upper dial pin is fixed to a flat plate riveted onto the dial. The arrangement allows dial and movement to be demounted as one unit.

Outer surfaces of the box case are veneered in thick sawn ebony. The side-edge veneers, around the box and the door, all run clockwise - abutting at each corner-face in a so called *'windmill'* pattern. Only the box's top veneer is set between both faces, a minor exception to the golden rule of veneered Hague cases. All forward faces are mitred at their corners. The thick carcass (2.5 cm sidewalls, including veneers), has no inner returns, but a small rebate seats the dial. The dial latch has its own small recess. The large round hole on the right face is for the clock's winder key, which closes the lock in either direction, only releasing at the centre-point of the internal *crocodile-jaws*.

Thick door stiles (2.5 cm x 1.65 cm) match the box behind, but are marginally larger because a protruding thick veneer sill overlaps the box on three sides to exclude dust. Coster's cases share this feature; presumably being by the same case maker, being yet more evidence of these two pendulum clock makers closely cooperating.

Fig.30. Door Frame With Dust Excluder Sill. [58_F30.jpg]

The lower right corner has evidence of impact damage. The upper hinge is fatigued, so I advised its immediate repair. Paul Shrouder's chosen glass has nice irregularities; I took it as old. Thin brass hinges are set with their plates made invisible under the facing veneers.

Fig.31. **Hinges set beneath ebony veneers.** [59_F31.jpg]

Everything so far mentioned places this case in the earliest period, being almost in a class of its own. An accident has left its mark, the backboard split, the hanging-eyes are lost, the door edge crushed, and its movement 'ran-on'**.** Perhaps it fell, but these repairs are more recent than Huygens' clocks that were crushed in book-piles during carriage to Paris in 1664, (Plomp, ***"Pendulums"***, Op.Cit. p19).

Damage Control. Unfortunately, some damage and alterations detract from the case's structure and interior. The evidence supports an accidental fall, that also damaged its movement. The back board was split, and is now filled and glued. Mismatched veneers front the dial-pins, where the heavy movement (***1.01 Kg.)*** broke away from its box at this weakest point, despite an internal reinforcing staple. Currently the ebony veneer is patched with pine trim, stained black. The hangers are gone, probably capstans with small rings, or one-piece eyelets, both their screw-holes are now capped off with plugs. The backboard now has two holes drilled to secure it to the wall.

Fig.32. Interior of Oosterwijck's Unique Box. [60_F32.jpg]

Abrasions, seen here in the lower backboard, testify to earlier repairs of the escapement. Sensitive conservation is being recommended.

The box's inner faces are now chopped-out for a wider pendulum arc. Whether for a King or a commoner, Severijn Oosterwijck would never have despatched his exotic Kingwood-Ebony case in this state. [The Science Museum's Coster '***D4***' also has scalloped side-walls, but with neater ellipses]. First I assumed that some miscreant restorer had failed to properly repair the accident damaged escapement, so he had simply rebated the box for his new wider arc. But Paul Shrouder disabused me, "*original pendulum amplitudes are never bettered by later repairs*". Berry Van Lieshout suggests that the real culprits for these chopped-out side were the stronger *second* spring (recently substituted for another weaker spring), probably also with shortened pallets and with re-cut escape teeth. [My deliberate abstention from the horological bench evidently has certain disadvantages].

Redundant wooden pegs are now set through the upper box. On reflection, these probably supported a pediment or Royal Arms added for its putative arrival in England in June 1660. Dr.Plomp identified several of Claude Pascal's earliest Hague clocks where his plain Dutch cases were similarly modified soon after their arrival in Paris.

[Van Lieshout suggests these peg-holes might even be evidence for a gimbal or Cardanus' pendant, for use on board ship? ***KP****. I had not considered that possibility; there are no pressure marks to indicate clamping bolts. Conceivably, a wide "Phase-1 Knibb"' handle might have been added, although I still incline to a pediment or crest. One of Oosterwijck's sea-clock was damaged by a fall in December 1662, but they were timepieces; they probably showed Seconds'; and they had fusees. However, if Berry is right about this extant verge being an English repair, then conceivably a different crutch might have been removed; But why pinholes to the jaws of crutch? It would suggest a later also a very different clock, and one having quite another provenance. Here I do not anticipate any further debate*].

Beneath, and right across the base of the box, are two black-stained wood strips roughly nailed to steady the clock and raise the door-sill, also reflecting its present status, so called, "***Mantle Clock****"*.

Mortised Hinges. Since I made my inspection, Mr Philip Oliver was instructed to repair the fatigued upper hinge. Unfortunately he took no photographs, but he reports that the hinges are not fixed square on the box or door. Each hinge-plate is deeply rebated, into a 45 degree mortise; ebony veneers obscure that interesting construction detail.

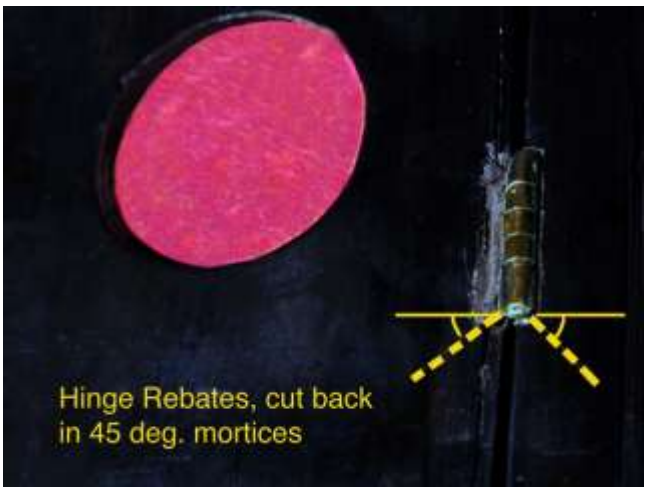


Fig. 33. **Hinge Plates, Set in 45 Degree Rebates.** [61_F33.jpg]

This aspect of original construction may assist researchers, and prompt investigations into other early case construction techniques. [Berry Van Lieshout informs me that he has already noted this form of hinge construction, others may not have had that opportunity].

Oosterwijck's abused box may now be attended to by one of today's very competent furniture conservators, who can recover its original beauty, once befitting a King. (Refer to ***Appendix Two***)

FIRST ASSESSMENTS. ▲ (Back to TOC)

Certainly, Severijn Oosterwijck's Royal Hague-clock proved more challenging than I had anticipated. On first reading Paul Shrouder's article, I recalled Huygens' price list of January 1659, to Boulliau in Paris, which omits any mention of 30-hour spring clocks with striking. That seemed to be a certain bar to earlier dating, but its Coster features suggested 1659-1660 as a safe date; which I later found to coincide with the family's extraordinary provenance.

Dr.Plomp suggests that Oosterwijck, also Visbagh, did not make **'prototypes'** before Coster died in December 1659, (Plomp R, ***'Prototypes'***, p.203, pf.2). Whereas, his new ***'Chronology'*** places Oosterwijck's '***D9***', also bearing legend "*Met Privilege"*, before Coster's '***D10***'. He then was unaware of Oosterwijck's assuredly even earlier Royal Hague clock. So, clearly, there do remain uncertainties, both about the historical events and about the chronologies, which my proposed 'open-research' project is intended to now address.

At my own inspection, constructions not seen in another Hague clock sparked association to research long in hand with Berry van Lieshout in Holland. We do return to these subjects as new evidence presents itself, as in this instance with Oosterwijck's *'Royal Haagseklok'*.

Oosterwijck's clock demonstrates the earliest use of the ***split-going-barrel*** with ***hidden flying stop-work***; very probably the only extant in a Hague clock. Dr Plomp ascribes what he calls ***'tandem-barrel'*** to Salomon Coster. But the ramifications of that claim has led me into uncharted historical waters eventually to my concluding perspectives.

The greatest of horology's early innovators, clockmaker Jost Burgi of Prague, (formerly at Uranienborg with the great Tycho Braye), first incorporated his original compound **'*split-barrel*'** in a series of mechanical Globes c.1582, to drive two strike systems off one spring.

The subject clock's split-barrel with ***strike and going***, surely, is an adaptation derived from Burgi, being (in the parlance of that time) ***'a new invention'***. But how did Oosterwijck and Coster come to it? With no English comparable now extant (?), evidentially it would appear to be a Dutch adaptation, as Dr Plomp has claimed. But was Coster or Oosterwijck its Dutch 'originator'? Who actually made or licensed the craft *'secreet'* that would be disclosed on Mayday 1658? And is the split-barrel with its hidden stop-work part of that secret?

After long deliberations I now consider this clock to be a forerunner of its type, and, if the dating of its extant comparables can be relied on, then made no later than 1658. Huygens' price list to Boulliau, dated 16th January 1659, omits 30-hour spring-clocks with striking, but he shows instead 8-10 day duration *weight* clocks with striking. Would a King choose a 30-hour clock, if an 8-10 day striking clock were already available? Therefore I should not be surprised if my provisional dating were moved nearer to the time of signing the Fromanteel-Coster Contract, on September 3rd 1657, because striking clocks were long established and popular demand for striking already existed at all social levels - and ***RH*** was made as a ***traveller's clock***.

The famous, September 1657, Notarial ***Akte*** (Contract) is somewhat obtuse, therefore I have considered other scenarios. The split-going-barrel might be a reliable work-horse, but it is also a *Chimera*. Like its simpler going-barrel, it is not suitable for precise timekeeping - even were it to indicate Seconds' no scientist would use it. Huygens' own experiments always used weight clocks, (see PART II, *"Hiatus of Seconds"*). So was the split-going-barrel a commercial gimmick? In his own Patent Application, on 9th August 1658, Simon Douw correctly identifies several defects of the Huygens-Coster pendulum, also their spring and weight systems; evidently Douw was neither a simple craftsman nor a sly plagiarist - as Huygens' always alleged!

Might another clockmaker, and possibly even its true originator, have understood or discovered the going and split-barrels' inherent defects as a timekeeper, which he then abandoned on a Hague negotiating table to extract a bigger prize? It is an aspect none have considered, it certainly makes for a rather more intriguing ***multi-cornered*** suit.

I became confident that Oosterwijck's Royal Hague clock was made during Coster's lifetime and, very probably, it is the first of its type now extant; ante-dating both ***D8*** and ***D10***, the Coster ***Comparables***.

It also demonstrates more clearly than words, just how Fromanteel's influence extended deep into Coster's workshop, and also perfectly explains the use of an English word, 'secreet', in a Dutch Contract dated 3rd September 1657. That linguistic clue must assume a more significant new role in resolving this 350 year old puzzle.

These opinions will not sit well with all authorities, and might even be regarded as controversial. Therefore, I suggest all amateur and professional enthusiasts participate in **'open-research'**, to provide the evidential base, and then allow an informed debate on the evolution of components and chronology of Hague and other early pendulum clocks. Only similarly thorough re-examinations of all the few extant comparables will suffice to fairly answer my new hypotheses.

In the meantime, Matthew King accepted the challenge of carrying out the sensitive repair and furniture conservation of this unique case. At this early stage of conservation, the distressed, later and probably inappropriate, Indian-red velvet shall be left in place until a census of experts agrees on the colour of a velvet replacement. The first fruits of Matthew's conservation of the case furniture include repairs to the ebony veneer at lock-slot, frame, and door. Well-selected Kingwood veneers now conceal the chopped-out sides - leaving the underlying evidence (see Fig.32) intact for future researchers. These covers will be thinned down before final fitting. [62V_Conserve]

View: **The Kingwood Masks.** (Image courtesy of Matthew King).

In this intentionally didactic paper, with many unpublished images, I have allowed several perspectives, pertinent digressions, even some conclusions to emerge. However, readers themselves can now form a judgement on the importance of Severijn Oosterwijck's rediscovered Royal Hague clock within its own historical context.

As the first antiquarian reviewer of this privately owned clock, not available to general view, any opinion being expressed herein has to be responsible and balanced to best serve those who are unable to inspect the physical evidence for themselves.That has been my goal.

For those who weigh conundrums, my concluding perspectives may confirm, entertain, challenge or even, hopefully, awaken new interest in this period. Here, I shall leave behind the artefact, and embark on what I regard as the more significant historical perspectives of its context, with further evidence being adduced, also personal insights.

END OF PART I ~ 'H O R O L O G I U M'

PLEASE GO TO PART II

A Royal 'Haagse Klok'

"Severijn Oosterwijck Haghe met privilege"

Reviewed by Keith Piggott ▲ (Back to TOC)

PART II
"O S C I L L A T O R I U M"
PERSPECTIVES & HYPOTHESES

Foreword: Part I describes the clock, its components, its context**. Part II** is intended to be a catalyst to promote and to accelerate wider academic study of this extraordinary period by new open research, (replacing cellular research). ***Appendices*** and ***Matrices*** set out areas for open research, both in contexts of Oosterwijck's and of his Dutch contemporaries' earliest pendulums and competing clocks, ie.Douw's.

Appendix Three, ***Data Matrices***, covers construction and dimensions of the extant and recorded early pendulum clocks. ***Appendix Four*** submits Simon Douw's remarkable also revealing Patent Application, accounting for Huygens' displeasure, paranoia and libels that still colour modern opinion, (***'Huygens' Legacy'***, p.87). In that context, I revisit the Huygens and Coster versus Douw litigation during 1658, which, by omission, reveals something of covert migrations of this most arcane of crafts; and which, by omission, infers Oosterwijck's close involvement with Coster and Huygens. Unfortunately, Hague Archivists are unable to rediscover the Court papers (*'proces-verbaal met daading'*), that Willem Hana and myself repeatedly sought, seeing Drummond Robertson had reported their remarkable contents back in 1931, (Op.Cit., pp.124-126). Mislaid primary sources do not help research! War intervened, so was this archive rifled? ***Appendix Five*** (pending) first describes Alexander Bruce's Longitude sea-clocks; one by Oosterwijck (1662); one rediscovered English by John Hilderson (1663) or Ahasuerus Fromanteel (1660/1). ***Appendix Six*** (new) recites Sir John Shaw's provenance of the ***Royal Haagseklok.***

Oosterwijck's ***"Royal 'Haagseklok'"*** with its simple hour-strike is a superior example, with a unique continuous provenance, by gift from a grateful and newly crowned Monarch. However, I had not expected to be led into uncharted and troubled historical waters; yet even if my perspectives do not always take the *rhumb-line*, I do hope to have steered a sound course. I hope, too, to have kindled new interests.

Few antiquarian horologists now give any thought to those historical matters long '*established*' in the standard texts and glossy catalogues. So I do not apologise for asking my hypothetical, even provocative, questions. Some questions have never been posed, others are rhetorical. Hopefully, open research shall determine new facts and lead to answers. History is a deceiving mistress, but minds open to the unexpected might better expect to observe clues others miss.

Nevertheless I consider my exploration of historical contexts, also the circumstantial evidence, also my consideration of new hypotheses, to be fully justified by the new evidence found in Oosterwijck's Royal Hague clock. However, *I stress*, none of the following '*perspectives*' is intended to be dogmatic, but are meant only to shine a light into obscure historical corners where even primary sources, *Contracts*, *Patents* and *Court Papers*, have long been misread, misrepresented, and even misunderstood. Here I consider eight conundrums, in this important but tenuous early pendulum history, ripe for open research.

1. Coster's Other Contracts?

Seeing that Oosterwijck evidently had remarkable access to Coster's Hague workshop, known by telling similarities in their construction, dimensions, trains, wheel-counts; and seeing the famous notarized Contract between Salomon Coster and John Fromanteel signed 3rd September, 1657; here I ask. would not Mr Coster have demanded a similar Contract with Oosterwijck; also with his own appointees Hanet, Pascal, also his former apprentice Pieter Visbagh? If not, then why not? If yes, then where are all those, so called, *employment* also *licensing* Contracts? Their absence tells of very different relationship.

Further, was it intelligence, or invitation, that brought those *foreign* clockmakers so rapidly to Coster's service from London, then Paris? Would each have provided their own materials, too? So was Coster incapacitated? Could Coster not recruit native Dutch clockmakers? Or did Huygens have a hand in steering his foreign contacts and their clockmakers, or even relations***,** towards Coster? **[***Genealogists might investigate whether **C**laude Pascal was related to Etienne Pascal (1588-1651) and his famous son, mathematician Blaise Pascal (1623-1662) both early correspondents of Christiaan Huygens].

Furthermore, the plain fact that neither Huygens nor Coster ever cited Oosterwijck as a plagiarist, nor ever litigated against him, is the best evidence I know of a fraternal craft relationship and the probable sharing of a "secreet" new construction on offer in September 1657 shared on Mayday 1658. Who else strode the Hague's stage? What do we really know of the wider historical context of this most secretive of crafts' international affiliations with Coster's workshop? Huygens' promotion of the workshop is well documented, Dr Plomp has enumerated exports to Paris, achieved by Huygens' efforts, but, as always, barring the September 1657 Contract, these fine craftsmen themselves have left no voice to us - except their silent handiwork.

2. Coster's Clockmakers?

Foremost authorities, Dr Reinier Plomp and Berry Van Lieshout, are agreed that John Fromanteel made all five extant 'Coster' movements with *square* pillars; ***D1***, ***D2***, ***D3***, ***D4***, ***D5*** that even has *square* pillars to dial feet and separate alarm. By this single attribute, all the Coster timepieces become *post-Contract*; **despite generally inferior quality unrelated to Ahasuerus' high standard!** Whereas Huygens' original 1657 Patent drawing shows *round* pillars; being evidence to infer Coster's original pillar shape, from mid-June until September 1657, when jointly his own and Huygens' design and by his own hands?

Privately, on the evidence of pillar shapes, also other components, Berry Van Lieshout suggests that Pieter Visbagh or Claude Pascal made the extant 'Coster' striking-clocks, ***D8*** and ***D10***, which possess round pillars -again- but having slightly different profiles. Might that infer after Mayday 1658, (when John Fromanteel is presumed to have left the workshop), for twenty months, until Coster died in December 1659, the assistants remaining were then set to work to produce new striking clocks; all clearly based on Oosterwijck's ***Royal*** prototype?

So did Salomon Coster actually make any of ***his*** extant pendulums or did he, then, relegate himself solely to being the workshop overseer? And who made his alarum-timepiece ***D5***, with *first-state* chapter ring (single minutes scored through), but having *Franco-English* double-cock, also having first known Dutch example of *back-plate ratchet* work, and also once having what I have term '*Reijnaert*' stopwork?

Huygens' disclaimer in *Horologium* of any rights to strike-work also means earlier 'Coster' striking clocks should not, (**cannot**), be ruled out; even without the split-barrel, much as Fromanteel and Bartram made using twin-barrels or weights. And why, too, should all his pre-Contract spring-clocks necessarily be timepieces, even then regarded as the poor man's relation to strikers? No evidence has ever been adduced for the present hiatus of pre-Contract pendulum clocks.

Now a new candidate has emerged as the maker of Coster's original striking clock, namely Severijn Oosterwijck. Here is a man, clearly gifted, already having a King's patronage, in whom Bruce and Huygens would soon show every confidence in 1662-1663, by appointing him to make their Longitude-clocks, adding Huygens" new weight remontoirs in 1664. [Dr Plomp showed Isaac Thuret had improved Huygens' little remontoir chains - all for no thanks]

Consider Oosterwijck's Royal clock. Its watch stop-work concealed by ratchet-work is both unique and most inventive; ditto his thread-holes in pre-cycloid cheeks; ditto his pendulum retainer pinholes in open-jawed crutch instead of usual loop. Are these departures, from Coster's designs, best evidence of Oosterwijck's own experiments? Was his hidden stop-work and split-going-barrel had by influence, or stealth? I would suggest that only the former fits my new evidence, and fits the absence of any cited conflicts with Huygens or Coster!

Hague striking-clocks introduced new features, but similarities in movements can provide compelling evidence. Comparing the front-plates of ***RH*** and Coster ***D8*** is instructive. <RH/D8> And, as I have said, we may also assume that early pendulum trains and even wheel counts were still evolving, (*Appendix One, Appendix Three*, also see *open-research matrix*). Coster's escape wheels in timepieces ***D1, D2, D3***, and ***D5*** are all **5/27**, [***D4*** has 5/25];whereas ***D8*** has **5/29**; however Oosterwijck's is also **5/27**. Coster's contrate wheels in ***D1, D2, D3, D4*** and ***D5*** are all **5/64**; but ***D8*** has **5/60**, and Oosterwijck's is also **5/60**. Such close similarities are surely not random, but rather they do suggest Oosterwijck's part in the early wheel train evolution.

All of these early Hague clocks' first going wheels all have ***72*** teeth. However, centre pinions/wheels appear to evolve from 8/70 to 8/65, to 6/70 to 6/65. Strike wheels show less conformity yet have similarities too, originally all had 5-leaf fly-pinions. Both of Coster's strikers ***'D8'*** and ***'D10'*** have new standard **12 pins** to the pin-wheel with **12 leaf** pinions onto the count-wheel, whereas Oosterwijck's evidently unique first adoption of **10's**, most likely infers that his clock is lower in the evolutionary chain; ie. ***earlier***. But wheel counts alone can mislead, yet other evidence too is inextricably locked into all man-made constructions. Therefore, my plea for *open-research*.

These early pendulum clocks mark the first, *Dutch*, appearance of the spring *'going-barrel'*, the *'split-going-barrel' also 'flying stop-work'*. All of the cited comparable **'strikers'** *postdate* Mayday of 1658; all have a new and *identical* layout of trains; motion work; strike-levers; strike-gates; drop-hammers, position of bells; two have ***RH's*** cast lozenge-section fly, two more have its derivative. Details may differ, but their form is common. Even Oosterwijck's non-conforming upper strap-potence might be his own 'prototype', he later revised to adopt Coster's Dutch form. [Normally I deplore use of "*prototype"* because we cannot expect ever to see any makers' original workshop models].

Research is needed before my new hypothesis, that *"Oosterwijck's pendulum clock with striking set the pattern for Coster's"*, can be proven. Yet, the clinching evidence may well lie under our noses; in the two *accepted* 'Coster' striking clocks ***(D8, D10)***, and even in the timepiece alarum (***D5***). Do these all share detailed finishes with Oosterwijck's ***RH*** and ***D9***, or with subsequent versions by Visbagh, (***D18***), or Hanet and Pascal? I have prepared images of ***Comparables*****.**

What of Coster's timepiece alarum ' ***D5'***? It is a curious beast, now revealing the 'English' feature of a double-foot back cock; yet other constructions back its Coster pedigree. It too has square movement pillars, also square dial-feet and square pillars to an original separate alarm fixed to the case. (Coster ***D8's*** contemporary integral alarm work, now removed, is by a different hand). I infer that originally, ***D5*** had the first known 'Reijnaert' stopwork, having an integral pinion of report cut through its barrel arbor, to gain a larger stop for more turns. So was arbor-pinion fatigue, with distortion or breakage, the ultimate result? It seems now to have a replaced barrel-arbor since its winding square is untypically tapered, and the arbor lacks a pin or pinion for its original stop work, which although missing has left behind the telling evidence of its screw mounting on the barrel cap.

Coster's stop-wheel was not refitted, so it is probable that its present arbor was made in France, where stopwork is typically ignored and even removed. (If there had been no evidence of a stop-wheel then I should suspect, either, the clock was made in France, or, it had been made by Coster himself before the '*secret*' of stopwork and split-barrel dropped into his lap. Considering the extant construction, I do suggest that ***D5's*** former 'Reijnaert' type stopwork cannot antedate Oosterwijck's stopwork. Therefore, ***'D5,***' too, must also be later.

Furthermore, Coster '***D5***' ratchet-work is also removed from the front plate, (or barrel), onto the back plate; sharing first honours recorded with England's Ahasuerus Fromanteel's (*1658*) and Flanders' Bernard Van Stryp 5-wheel timepieces. Like Fromanteel and Stryp, unlike Reijnaert, it has one click, with circumferential brass spring fixed by screws. Whereas, early springs and clicks are pegged, or posted, *in-situ*. All these facts formed my singular hypothesis that Oosterwijck's Royal Hague-clock, most probably, ante-dates Coster's timepiece alarum, presently given ***'D5'*** in Dr Plomp's new Dutch chronology.

Oosterwijck's first signed timepiece alarum, (Appendix Three, the ***'Lieberge'***), has its alarum bell fixed inside, on the dial plate, like the subject clock. The bell on Coster's only extant* alarum ***D5***, is set above its case, which soon became the standard for Hague clocks. In this instance, ***D5*** may betray a French hand in its making- perhaps Hanet, (see "*Huygens Legacy"*, nr.16). [****D8*** had an alarm removed].

Comparing the earliest of Hague striking-clocks <see Frontplates>, relates Oosterwijck ***RH*** with Coster ***D8*** and ***D10***. Oosterwijck's ***D9*** is not yet available but his later striker, now having vertical hammer, shows its true colours, (see Nr.**84**, Dr R Plomp *"Pendulums"*, Op.Cit, p.33, figs.46-49, and pp.178-179. I am grateful to Dr Plomp for his image). Nr.**84's** front-plate is like ***D8*** and ***D10***; its layout, generally, common with preceding striking movements but has iron bridge-plate set on brass pedestals; like Coster's timepieces ***D1, D2, D4, D5,*** (refer to ***MemoCosterD3***, p.4). Nr.**84** also has cylindrical '*cannon'* pillars, like his ***D9***; its heavy fly profiled like Coster ***D10***; and it has alarum - not unlike Coster ***D8*** when found, but set on lower dialplate like ***RH*** bell; Nr.**84** strike has novel vertical hammer post, probably imported from France by Claude Pascal. Among these earliest Hague striking clocks, an unbroken lineage now becomes compellingly obvious.

What must now be generally accepted, Salomon Coster, then, was more *overseer* than clockmaker. Here I have advanced Oosterwijck's Royal clock's chronology before Coster's two signed striking clocks ***D8 and D10,*** also timepiece alarum ***D5,*** and I advanced his name as presumptive sole-candidate for making the first striking Hague clock.

3. Fromanteel Connections?

If accepted wisdom is correct, then all the early pendulum-clock technology flowed from Salomon Coster to John Fromanteel. But here it is quite evident that the Fromanteels brought much more into Coster's work place, where Oosterwijck already had open access; probably also to the negotiating table, being hammered out in Notary Putter's office even before the extant draft form of Contract was ever signed. What is never remarked upon is, the Draft's revisions actually mark the Parties' ***disagreements,*** ie. John is protesting a Dutch diktat. The received wisdom, therefore, is suspect and even flawed.

Evidence of Oosterwijck's connection with John Fromanteel, at least, (and I do not discount some earlier connection with London), may also be seen in his wheels, trains, escapement, layout of centre wheel, pillars, etc. His verge goes across the plates; his unique strap-potence is set beside his escape wheel - like Fromanteel's, but unlike Dutch potence-blocks set above the timepieces' inaccessible escapements.

If such a craft lineage is proven, it may confound those vociferous adherents to Huygens' singular priority, who all deny Ahasuerus Fromanteel's contribution -by his older craft-based methodology- to applying the pivoted-pendulum to clockwork earlier than Huygens' new astronomer's way being patented by Coster in June 1657.

Admittedly, the plethora of extant early Hague clocks weighs heavily in favour of a Huygens-Coster priority. But is that imbalance really conclusive? Dutch clocks remained stuck at 1657, for decades; later English makers in Holland firstly even had to adopt the local norms of split-barrels and cheeks. But the Dutch were long overtaken by English, and even French, advances; therefore their obsolescent, but not quite obsolete, clocks largely survived. Whereas, Fromanteel moved quickly onwards, testing new drives, new pivots, inventing spring maintaining power, also new escapements; and discarding the obsolescent. Was the pendulum holdfast also Fromanteel's - a later, simpler, form is seen on Bruce's surviving English Longitude clock.

Might Ahasuerus, possibly, have seen the split-going-barrel as a *Chimera*, having no place in good timekeeping- his singular goal? Might he have originated it, then discarded it, and only then astutely traded it off to advance his son John's place with Coster?

4. 'Secreet' Constructions?

In his **Millennium Transcript**, Barry van Lieshout was the first to spot significant error in all earlier transcripts of the famous Contract; so the *secreet's* new line of investigation was his initiative. I posed questions; *"Had Fromanteel brought something to the negotiating*

table that had justified a Draconian financial penalty-clause which ***Coster*** *had freely accepted? Why would the holder of Europe's then hottest Patent accept a penalty at all? Why did he not charge large premiums for the unique privilege of access to his new technology?"*

Now, I also ask; "Why did Oosterwijck go to such lengths to hide his flying stop-work, when Coster and his acolytes set their ratchet and flying stop, *visibly*, at opposite ends of their split barrels or moved their ratchet work onto the plates?" It is a most curious and, perhaps, also a very significant presentation. Did Severijn act for Coster, for Huygens, for the Fromanteels, or might he have *invented* it entirely by himself? That is the *multi-cornered suit* which I have referred to.

Unknown Originator. Where, when, or who 'invented' the classic *'going-barrel'*, also its derivative the *'split-going-barrel'*, is not known. But the basic '*split-barrel' is* far older than Coster's striking clock, older even than any pendulum, and not Dutch at all.

German Antecedents. Berry Van Lieshout and I had long realised that the split-barrel, itself, has a far longer history than Dr Plomp's attribution of it to Coster - in his earliest extant striking clock '***D8***'.

Klaus Maurice, too, is unequivocal, (see ***"Die deutsche Raderuhr****",* Verlag C.H.Beck, Munchen 1976). He shows the '*Split-Barrel'* first appeared in the late sixteenth century, with German based makers, to drive both their Quarter and Hour strike-trains; (*'beide Raederwerke werden von einem Federhaus angetrieben*').

The first known examples found by Maurice are Jost Burgi's '*Globes'* c.1582. Burgi has previously entered into my study of Fromanteel's 1649 Masterpiece, when, like Dr Hans von Bertele's recognition of a Radeloff cross-beat, I recognised the vestigial signs of a Fromanteel spring-remontoir, ie. *only known from Huygens-Moray letters*; also a Fromanteel radial cross-beat, ie. *unknown in any early English clock*. So I am surprised and delighted to see my old familiar now enters the pendulum history that he was tantalizingly close to in his lifetime.

Burgi's ***split-striking-barrel*** next appears in quarter-striking *clocks*; by **Georg Wildt** of Frankfurt, 1589; **Hans Koch** of Munchen, 1591; **Isaac Habrecht** of Strasburg, c.1594; **Andreas Stahel** of Augsburg c.1600; and **Johann Sayller** (Zuyller) of Ulm, c.1630; (see Maurice, K., Op.Cit. Band I, pp.100,135,149; Band II, Afbn.114-116,118-119,129, 239, 254, 506).

Although many German Guilds and makers used Burgi's split-barrel in their multiple striking trains, no member of any City Guild would, or could, omit the fusee -which long continued to reign supreme in their highly ordered, regulated, craft regimes. Naturally, technology flows. Visitors to Jost Burgi in Prague saw amazing things, some eye witness reports, Hevelius and Becher, were then misinterpreted, and perplexed modern horologists G.A.Baillie, H.A.Lloyd. Nevertheless, by 1649, Burgi's arcane craft knowledge had flowed to England's then premier clockmaker ~ Ahasuerus Fromanteel.

Fromanteel's solar-musical clock of 1649 has twin reliefs in a lower pillar; one possible inference being that these were cut out for a subsidiary split-barrel for the "***innumerable motions***", cited by John Evelyn, (*Diary*, August 9th 1661), *"I din'd at Mr.Palmer's in Gray's Inn, whose curiosity excell'd in clocks and pendules, especialy one that had innumerable motions, and plaid 9 or 10 tunes on the bells very finely, some of them set in parts, which was very harmonious. It was wound up but once in a quarter."* The relic formerly possessed at least six spring-barrels, three being set across the lower part. Might these have been true ***tandem-barrels,*** to provide the additional power and duration that Evelyn here infers? Dudley Palmer's musical clock, here unattributed by Evelyn, was recited by William Leybourne in "***Pleasure with Profit", 'Mechanical'***, *XXXVII,* London, 1694), as being Fromanteel's 1649 Solar-Zodiac, multi-Musical, spring-clock; previously cited by Evelyn (Nov.1st, 1660) then in the **King's Closet of Rarities**; by which citations the extant relic was identified by this author in 1989; being ratified by Ronald Lee and 'Peter' Gwynn. The relic is also described in the author's original 1993 thesis, ***"Emerging From The Shadows, The True Patriarch of English Clockmaking, Ahasuerus Fromanteel The Elder",*** **(**Antiquarian Horological Society, referees, also limited private circulation)

View: **Fromanteel's Double-Rebated Lower Pillar.** (Palmer's 1649 Solar Musical Clock). [63V_AF1649R]

Application to Galilei's Pendulum.

The crucial and here relevant innovation of a spring-barrel being coupled directly to drive the going-train, rests with some later yet unknown originator. Just as for the Hague-type flying stop-work, that originator was far removed both in time and distance from its true origins. But the *sine qua non* for its use, as a split-going-barrel or as a single-going-barrel, had to be a reliable method of controlling the time standard independently of its variable driving force. Did that mid-seventeenth century originator regard Galileo Galilei's new pivoted-pendulum, alone and unaided, as that panacea?

Or did Huygens' new *cheeks* and suspended-pendulum convince our unknown originator that the pendulum's already known defects, finally, had been bridged? Which assumption, **Galilei?** or **Huygens?**, would determine when the spring-barrel was first incorporated into a *going-train.* It is not unlikely that unsuccessful earlier attempts were made. Even Fromanteel had initially set his pivoted-pendulum direct to going barrels; the *worst case* timekeeping scenario, that he soon recognised, to quickly then evolve new constructional solutions.

Might stop-work, whether visible or concealed, be part of the same intellectual property as the split-going-barrel? Dr.Plomp attributes invention of the '*tandem-barrel'* to Salomon Coster. Yet here we see the split-barrel in Oosterwijck's surely earlier clock; antedating Coster '***D8***'! Dr Plomp has identified Coster's early clocks as the models that the French adopted for *'pendules religieuse'*. France also adopted the going and split-barrels, but few incorporated stop work, then rarely. If that were indeed Coster's *secret*, would he not have licensed it too? Why did France steadfastly ignore barrel stop-work? And why did Giles Martinot or Isaac Thuret reverse the Strike to the **IX** side, which quickly became the French clockmaking standard?

Remarkably, this seemingly mundane mechanism, already having stop-work, has for too long been overlooked, despite it being an intellectual property first observed in the earliest ***Dutch*** going trains of ***pendulum*** spring-clocks; and also found in contemporary English and French movements. I suggest that Oosterwijck's Royal clock represents and embodies the mysterious contractual 'secreet'; being antiquarian horology's *'Holy Grail'* for early pendulum clocks, and lest it be forgotten, not only for the Hague but also for London.

View: Galileo Galilei (1564-1681). Copy of Uffizi Gallery portrait, circle of Justus Sustermans. (Courtesy of Gorringes Auctioneers). [64V_Galilei]

Here I propose that that contractual secret is now being revealed; a mysterious craft's secret; originating in Germany with Jost Burgi in 1582; secretly adapted for use with a form of pendulum in or before 1657; also antedating 'Horologium' by a year at least; also being the secret finally put on the negotiating table in 1657; between Coster and a young son of Ahasuerus Fromanteel; probably with Ahasuerus and Severijn having supporting roles as *eminences gris*es?

Foreknowledge of Burgi. Rarely do independent inventions mirror each other; even to achieve the same end, technical solutions are likely to be different. During the 1939-1945 war, Germany went with new, axial-flow, turbo-jet engines, but Britain adopted Whittle's older centrifugal-flow jets. But that inventive independence is absent whenever Burgi's inventions reappear in new guises. The sudden appearances in Holland of *'flying stop-work'* also '*going/split-barrels'* are merely new clothes, not '*inventions'* in our sense, simply Burgi's old devices reworked and adapted to deliver new tasks in quickly made Hague clocks to meet eager markets. But no less vital for that.

Therefore, to know sources, I ask,who best discloses foreknowledge of the great innovator, Jost Burgi? If that craft knowledge came to Holland by his work master *Benjamin Bramer* then, reasonably, we might expect our Dutch principals should be the first to benefit. However, apart from Simon Douw in Rotterdam, it would seem not.

In their bitter, also quite unfounded, litigation against Simon Douw in 1658, alleging patent infringements and sly technical espionage, but in fact to stop him selling clocks in the Hague, neither Coster nor Huygens, nor even their experts, recognised nor admitted to any familiarity with Douw's single-beam (cross-beat) with patent spring-remontoir that owed much to Burgi, (see ***Appendix Four***). Douw's Patent withstood the Court's challenges and tests, he was awarded a license to sell in the Hague, also *to receive an equal third-share* of all Huygens and Coster pendulum profits! Huygens became embittered; probably because Douw's Patent Applications tellingly point to empiric failings in all his and Coster's various pendulum clocks.

View Christiaan Huygens (1635-1695) by Caspar Netscher, 1671. (Courtesy of Haags Historish Museum). [65V_Huygens]

Huygens also overlooked the obvious merit of Douw's mechanisms; the potential maritime Longitude applications of Douw's Patent of Jost Burgi's systems. Douw had very wisely kept his counsel about any intended maritime application - for his home port of Rotterdam. He died on September 9th, 1663, probably before putting his method to test to resolve longitude; I examine his devices at ***Appendix Four***.

Huygens should have saved himself the years wasted on his intrinsically flawed concepts of a *pendulum* sea-clock also his *weight*-remontoir that predictably failed, as Robert Hooke always understood. Huygens shows a weight drive, incomprehensible in a sea-clock. whereas Bruce's sea-clocks sensibly incorporated a fusee, still with pendulum control. By early 1665, while ill in bed, Huygens observed *"pendulum sympathy"* (anti-phase synchonocity) of clocks on a beam. He hoped it might be to advantage at sea, but the Royal Society realised it was a nail in the coffin of pendulum longitude clocks, as it proved. ('***Huygens' clocks***", pp.563-579, Bennett,Schatz, Rockwood and.Wiesenfeld, **Royal Society** 10.1098/rspa.2001.0888).

Even in 1664, Huygens still defends his own weight-remontoir by deflecting Sir Robert Moray's blunt challenge with an admission of Fromanteel's priority for a spring-remontoir, but with not a mention of Burgi who had invented the forerunners of both. (***Appendix Four***)

So, I suggest, if adaptations of Burgi's split-*going*-barrel with *stop-work* is the Contractual 'secreet', then that secret is unlikely to be Huygens' or Coster's. Then to whom must we now look?

Whereas, Ahasuerus Fromanteel's 1649 Solar-Musical clock, clearly, is indebted to Jost Burgi; in its spring-remontoir; in its radial cross-beat; and possibly even a subsidiary split-barrel for strike. Therefore I suggest it more probable that Ahasuerus adapted the split-barrel and stop-work to drive going-trains, and then inveigled son John into Coster's employ in September 1657. Did John have orders to first disclose the 'Stop', to tempt Coster to capitulate to get the 'Split-Barrel'? Or is accepted wisdom correct, did Coster simply give away invaluable 'inventions', and yet, simultaneously, pledge himself unto a youth ~ one not even a Free Clockmaker in England? For what?

In my opinion, only the former would account for the Contract's peculiar employment terms, with its Draconian financial sanctions. Why should Coster put his all wealth at stake, for a youth's bench skills? Why have no other of Coster's *'employee'* Contracts at Notaris Putter's come to light? The promise of Fromanteel's son disclosing a craft secret, that would benefit Coster and Huygens to export more reliable also cheaper to make striking clocks, could well explain all.

The Secret Outed? My 2005 Compilation paper challenges many presumptions. As to the 'secreet', in the Notarial Akte of September 3rd, 1657, many authorities had subscribed, variously to, *"remontoir; pendulum; escapement; OP-gear; endless rope;* or even *theoretical calculation."* None are convincing, and all placed the secret's gift solely in Coster's hands, regardless of Huygens' interest. But Berry van Lieshout's new '***Millenneum Transcript***', having the first correct decipherment of Coster's ***name*** in its 'secreet' clause, caused us to re-investigate other devices, centred upon the stop-work also the split-barrel. Berry inclined to stop-work; I inclined to the split-barrel; each of us finding reasons to prefer Ahasuerus Fromanteel's priority for the '***secreet***.' Without Berry's inspiration, his long amassed evidence, our many penetrating dialogues, this perspective could not be written.

It does seems that the secret has just become less elusive; perhaps ***simple flying stop-work***, or perhaps the ***complex split-going-barrel***? Or perhaps both? Here it was not my intention to solve that hoary old Contractual 'secreet', but it does seem in this review of Severijn Oosterwijck's Royal clock the '*secreet'* has quietly resolved itself.

View: Monograms on Oosterwijck's *RH* hidden stopwork and on Ahasuerus Fromanteel's wheel. (cf. John Fromanteel signature).

On all the evidence, I regard Ahasuerus Fromanteel, *True Patriarch of English Clockmaking*, as being the most likely 'originator' who first adapted Burgi's *split-strike-barrel* to drive the principal going train too, who then traded it off as the 'secreet' for John's odd entrée to Salomon Coster. My hypothesis cannot be *proven* definitively, yet. Are any similar monograms to be found on Salomon Coster's clocks?

I also regard the split-going-barrel, and adjunct flying stop-work, as being the strongest candidates yet to resolve the Contract's mystery. What is certain, Coster did not invent the 'split-barrel'. Therefore I suggest that all horologists now re-examine evidence for *flying stop-work* in pre-1657 *spring-barrels;* and collate all pre-1657 *split-going-barrels*. Coster partisans must now explain, or better still find by open research, and put evidence on the table for scholarly debate.

Derivatives. Oosterwijck's concealed watch-like flying stop work is quite unique. Being hidden, beneath an outer barrel-cap, strike-wheel and ratchet might denote it as a 'secreet' construction, alluded to in the 1657 Contract. Fromanteel's and Bartram's seem to be related, which is the derivative? The late 1657 Coster-Fromanteel timepiece, '***D1***', now zealously guarded by Museum Boerhaave, has far simpler and also visible flying stop work. So did Severijn share that secret? Perhaps Coster (or Visbagh) partisans will argue that this clock was sold to Oosterwijck, to then re-badge for a King? Unthinkable**!** "*One Swallow does not a summer make"*, nevertheless, I informed Berry van Lieshout also Dr Reinier Plomp of my discovery. The absence, today, of any extant English split-barrel is most puzzling, but even that might well be explicable - as I will propose in Whose Secret? (e).

Whose Secret? Impartial scholars will know the available evidence is incapable of any absolute proofs, but the plethora of Dutch split-barrels and the dearth of English ones, in itself only circumstantial, is, on the face of it, a rather telling fact. **Case closed? "*Not quite!*"**

Coster was a most able clockmaker. I give Coster full credit for his evident skills in this most secretive of crafts. Independently, he could have developed a split-*going*-barrel, as Dr.Plomp suggested. His renaissance apprenticeship may well have given him access to the German split-*striking*-barrel of Burgi, whose rare systems and even rarer clocks had reached Flanders by 1617, when Jan Brueghel (1568-1625) included one such clock in ***"Allegory of Hearing",*** (see Klaus Ertz, ***"Jan Brueghel D.Å. Die Gemalde"***, Fig.420, p.351, *DuMont, 1979*). He could well have adapted Burgi's split-barrel to drive his going train, regulated by great Galilei's panacea pendulum, now corrected by Huygens' new crutch and cheeks; but where does Coster ever demonstrate any knowledge of Jost Burgi's inventions? I reiterate the available evidence, admittedly entirely circumstantial;

a) From **'*Horologium*'** (p.15) in 1658, we read, Huygens' clockmaker [Coster] was already adopting spring-going barrels, also with strike work (thus split-barrels), a clear demonstration of his confidence in Galileo's panacea, or in Huygens' new way; (Huygens himself seems more equivocal). Huygens' failure to claim the split-barrel for himself, or to provide his usual explanatory technical description, would be entirely out of character were he indeed the author or originator of the device; so I assert that he was not. But, prior to the 1657 Contract, might Coster have first used a fusee for his pendulums? It was in his tradition, and in Huygens first concept at Christmas 1656. Did Treffler, in fact, copy a Coster fusee too? Might Coster too have made pendulum striking clocks having two independent spring drives? In both technical and historic terms, there is absolutely no reason why either scenario might not be the case.

b) By October 1658, Coster and Huygens had joined to challenge Simon Douw's spring-remontoir to a single-beam probably 'cross-beat' escapement, (see ***Appendix Four***), that he surely derived from Burgi's fertile *Oeuvre*. Neither ever cited Burgi's priority for either device; Douw wisely kept his counsel, but challenged Huygens to calculate his (remontoir) wheel-train that in Court defeated even Huygens' mathematics tutor, his witness, Prof. Frans Van Schooten.

c) Even in late 1664, when answering Sir Robert Moray's challenge on priority for a remonoir, Huygens (Coster's patron and mentor) partially concedes to Fromanteel's, but still omits to acknowledge all remontoirs as Jost Burgi's - the original great innovator.

d) Whereas, even by 1649, Fromanteel evidently had had access to Burgi's craft secrets for his Chef d'Oeuvre, probably via Benjamin Bramer***** (1588-1652), Burgi's own Dutch brother-in-law (G. *Schwager*), who in 1648 first published Burgi's old triangulation instruments. (see Mackensen, L**., "*Die erste Sternwarte Euopas mit ihren Instrumenten und Uhren 400 Jahre Jost Burgi in Kassel*",** Verlag Georg Calwey, 1979, p.8, p.34 Fig.24, p.59 Fig.14). *****Later Fromanteels then in Amsterdam, also Willem Bramer of Campen & Zwolle, signed *identical* back-plates of **spring-balance** travelling-clocks, which I suggest reflected their fathers' much earlier contacts.

e) The absolute preponderance of the earliest Hague clocks over similar London clocks would seem to weigh heavily in favour of Huygens or Coster. But might not that be read, *possibly*, as Dutch technology being stuck at 1658 for long decades, with their antiquated obsolete clocks surviving; whereas Fromanteel forever advances, testing, discarding, improving; so might he have found or anticipated that the going-barrel (also its derivative *'split-barrel'*) was

actually a Chimera, having no place in precision timekeeping, just a bargaining chip; his *loss-leader* into new Dutch-European markets?

f) If my reading of Oosterwijck's Royal Hague clock is correct, then his own *split-barrel* appeared well before '*Horologium'* (September 1658), quite possibly even before Mayday 1658, thus, by inference, might even have been constructed before the September 3rd, 1657 Contract. That too, again, infers it was not Coster's device; unless one envisages this 'invention' being leased to Severijn in this special clock for a King; also being given away to a foreign lad. But I cannot see Salomon Coster going so far; he perhaps hoping that King would come to him; and his young English lad being already paid his dues, and full board. Dutch merchants never overpaid, still not.

g) Undoubtedly, for Salomon Coster's suddenly busier workshop, exporting Huygens' new pendulum clocks, any device to prevent derangement by over-winding, also to make reliable striking clocks more cheaply, using the stop and split-barrel, was a *must-have* acquisition. Coster's *Oeuvre* reveals his inheritance of technology; significantly, the split-going-barrel and stop-work do not appear in his *pre-pendulum* Oeuvre*; nor in Van Lieshout's "*only true Coster-Coster*" ***D3,*** nor in ***D4***. We have no evidence of *flying-stop work* ever being used before Fromanteel's Contract; and all modern authorities agree (and/or infer) the *split-barrel* striking Hague clock is not seen before the Contract's maturity on Mayday 1658, when a 'secret' had to be mutually disclosed between the parties. But a prototype must, then, have existed as the model, evidently. So who made that model?

h) Might there have been a prior collusion between Severijn and one of the Contractual Parties, to include the 'secreet' herein, being prepared in advance, to be revealed only on Mayday 1658? The *argumen*t applies equally to both parties, but here I suggest my *craft-evidence* weighs in favour of the Fromanteels.

j) Finally, I return to the proven venality of business, in any era. What had persuaded wealthy Coster, holding the only key to Huygens' invention, then to pledge his "*present also future wealth"* simply to *employ* a foreign lad; furthermore, to promise him the *gift* of a secret craft device ~ whether his own, or Huygens'? Usual terms, Fritz? Get a reality check. [* BVL records a *non-genuine* example]

Impartial readers realise issues cannot be closed. The circumstantial evidence (***a-g***) is just too challenging. The fair-minded, at least, must engage in new studies of all the available evidence. To the majority Coster partisans, I recommend the Open Research project (***Appendix Three***) in which to unearth all the facts -tangible and intangible- for a new evidential base to then, objectively, determine both the ***secret's*** evolution and chronology in the earliest pendulum clocks.

5. Personal Associations?

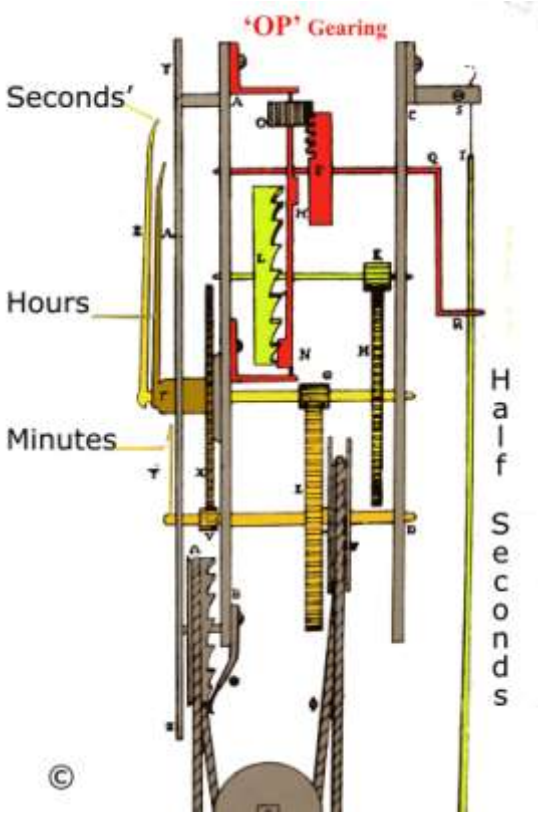
Huygens' correspondence, "***Oeuvres Completes de Christiaan Huygens***" (edited by Nijhoff, then Vollgraff), reveals his personal associations with Severijn Oosterwijck, Alexander Bruce (Earl of Kinkardine) and Sir Robert Moray. The latter was an intimate of the exiled Charles Stuart, benefactor to the present owners' ancestor, Sir John Shaw, knighted in July 1660, created First Baronet Shaw in April 1665. Family genealogy indeed shows continuity of descent, so I leave it to them to trawl family archives and Wills, in which I read *"the clock given to Sir John Shaw Bart by Charles II"*, to document its provenance from their Royal patron, by His gift to a new English Merchant Knight, for his services rendered in those uncertain and dangerous times. Much hangs upon that historic provencnce, linking us directly to that time, more than any similar extant Hague clock.

Nevertheless, there is good reason to accept that the future King Charles the Second of England already had a prior access to the patrician Dutch scientist Christiaan Huygens - not least by their illustrious fathers' long personal contacts, and thus to Severijn Oosterwijck. Then, the pendulum clock was the most sought after personal acquisition of its day. Surely a King-in-Waiting could have one; one made by Severijn Oosterwijck; perhaps recommended by Moray or Huygens; and upon His accession to the Throne, in May 1660, the new King might well award this valuable gift to His loyal supporter in exile; "*Arise Sir John Shaw*". *M*y research at National Archive traced Wills of the first and second baronets, also ***Charles'*** letters importuning funds, but their Probate Inventories are not yet found. However, this Dutch clock also its Royal provenance is mentioned in later bequests that I am privileged to have seen].

6. The Seconds' Hiatus?

Britten's great opus, "*Old Clocks and Watches and their Makers*" of 1894 devotes Chapter III to "Counting the Minutes", with "Counting the Seconds 1750 to 1830" at Chapter V. However, even before 1596 the great astronomer, **Tycho Brahe** (1546-1601), possessed several astronomical clocks, all by ***Jost Burgi***, which all showed Seconds'. These were rightly famous. Yet the new "*Hague clocks*", purportedly '*invented*' by another famous astronomer, and some sixty years later, *almost never* show Seconds'. It is surely an odd paradox. Certainly, clocks without Seconds would have held no interest for the astronomer, Christiaan Huygens; but Seconds' then had no popular application. The first Hague clocks were relatively expensive, too, costing from *fl.*80 to *fl.*120, excluding spring-driven strikers. So I suggest Dutch burghers, then, would regard any extra charge for the Seconds' as being ***'a florin too far' -*** *already paying for the Minutes!*

View: 'Horologium' 1658 'OP' (DØ2W). [66V_OP_DØ2W]

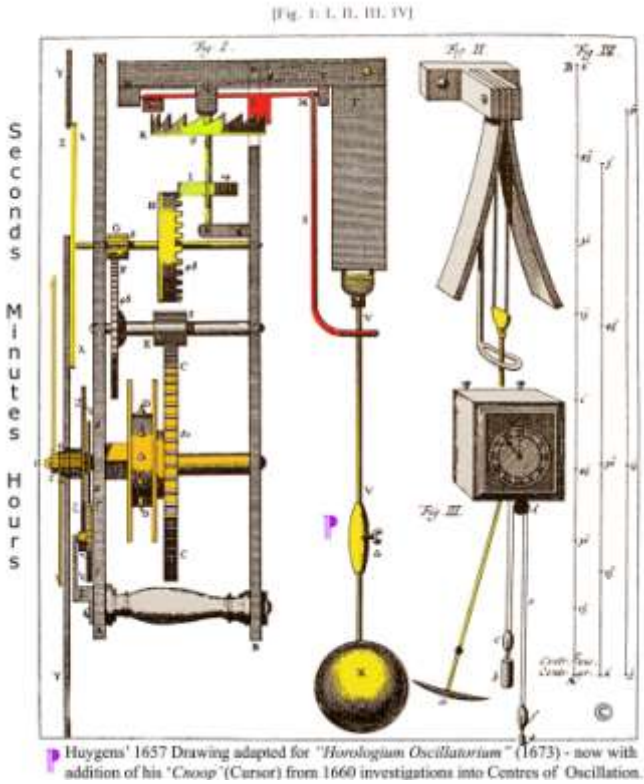


Leiden University possesses Huygens' first rough sketch, of February 1658. Science Museum has a *reconstruction*, ascribed to 1657(sic).

What relevance has that, or my *red-herring* dial sector (see Velvet Dialplate), to Oosterwijck's or any other Hague clock? In my 2005 paper (Op.Cit.) I suggest, in ***"Horologium"*** Huygens disingenuously revealed• his complex ***'OP'*** Interim design, that beat half-seconds, yet displayed Seconds *from the centre*, rather than reveal his simpler horizontal-verge, that he and Coster saw as their real money spinner. [*****Huygens paranoia is like the great Florentine architect Filippo Brunelleschi, (1377-1446), who drew-up misleading plans to keep secret his great Dome's ingenious double-skinned and spirally-braced brick construction. Both were geniuses, each rightly deserved their glory, yet both feared craft plagiarism].

When Huygens did finally publish his original 1657 Patent design,* ***"DØ1W"***, surprisingly some sixteen years later, in 1673, it was then seen not only to beat Seconds but it also showed Seconds in a dial sector, (see ***Horologium Oscillatorium***, Part I, Figs. I-IV). It was laid out much like Coster's spring-timepieces, but having an ***equal train***. That Ahasuerus Fromanteel made such clocks is proven by the Royal Society Minutes, also by an extant unique English case for a long-pendulum weight movement with striking, <*View*>. Whereas, the 1658 ***"DØ2W"*** beat half-seconds and showed seconds. Why was that train not immediately adapted direct to spring-clocks? It seems there simply was no call for a common Seconds' timepiece. *New evidence proves Huygens issued a woodcut-design in Dutch pamphlet of 1657.

I gave these dateable Huygens' designs, being omitted in Dr Plomp's extant chronology, my coded nomenclatures **'*DØ1W*'**, and **'*DØ2W*'**; (ie. **D***=Dutch; **Ø**=not in Plomp's chronology; **W**=Weight driven). These identities are temporary, until 'open research' (*Appendix Three*) can establish a proper evolution and a fully comparative chronology. *Re, **"D"** - some Dutch authors prefer to use **N**=Nederlandse.



Huygens' 1657 Drawing adapted for *"Horologium Oscillatorium"* (1673) - now with addition of his *'Cnoop'* (Cursor) from 1660 investigations into Centres of Oscillation.

View: Huygens' 1657 Patent Clock, (DØ1W). Above 1673 edition, for *Horologium Oscillatorium* incorporates his pendulum '*Cnoop*' (c.1661), but still shows '*pre-cycloid*' cheeks. *[67V_PAT_DØ1W]*

Seeing all the contemporary evidence, why did typical Hague ***spring-clocks*** omit Seconds, and where are Salomon Coster's *pre-Contract* pendulums with Seconds', as Huygens published, and Treffler made? Dr.Plomp always separated the domestic by-product which he named '***Hague clock***', from any scientific purposes, (*"Pendulums"*, Op. Cit., p.11, Chapt.1, *The beginning*). Therefore, it appears, the Hague ***long-pendulums,*** made solely for scientific purposes, have been ignored.

Other than his June 16th 1657 ***Patent*** model, Coster's earliest dateable Hague clock probably is the timepiece Senor Burratinij sent to Grand Duke Ferdinand de Medici on September 25th 1657, (Plomp R, "Pendulums", Op.Cit. pp.15,16). Probably that clock was Coster's own work, but, being already three weeks after his Contract, John Fromanteel, possibly, could have made it. Coster's Medici clock is described in a 1690 inventory, it is larger, having a short pendulum, in an ebony case with a "*wavy cornice"* like Dutch picture frames - an exception to Dr.Plomp's characteristic 'P2**'.** Presuming that it was a *spring clock* and using Plomp's chronology, I named it ***'DØ'.***

Treffler's 'Copy'.
The present whereabouts of Burratinij's gift to Ferdinand de Medici, Coster ***'DØ'***, is now unknown. Fortunately, late in 1657, the Grand Duke ordered his clockmaker Johan Philipp Treffler of Augsburg to make a '*copy',* and that movement survives; but its case was destroyed in Florence's 1966 flood. (Inventory 3557, Istituto e Museo di Storia della Scienza, Florence). I therefore have named Treffler's movement, **'*DØ copy*'**.

Treffler's timepiece has a short pendulum suspended between cheeks, like all Costers, but it also shows '*seconds*'! (Plomp R, "Pendulums", Op.Cit. p.16, Figs.9,10, 11). Leaving aside Treffler's claim to priority for the pendulum, I now reason that he probably followed Coster's *short-pendulum* train, even if he did add the Augsburg fusee. It would appear that Coster **'*DØ*'** was spring driven, whereas Huygens' Patent timepiece **'*DØ1W*'** was weight driven.

View: Treffler's Pendulum Timepiece [68V_Treffler] Courtesy of Museum of the History of Science, Florence. Image origination ©℘ Wooden *Tabernacle* Cases were already a long Continental practice.

Huygens' "Description of the Pendulum Clock" (***DØ1W***) is a weight driven timepiece, having four slender baluster pillars (like Longitude clocks), with a 3-foot pendulum, slung on a little suspension pulley, and having a Seconds' disc within a dial sector. None are known; Thuret's surviving regulators are its nearest representations.

Yet Huygens' 1659 letter to Paris, omits mention of his Seconds' clocks from his latest price-list, (see Dr R Plomp, "Pendulums", Op. Cit. pp.32-33). Huygens mentions duration, striking, weight also spring drives, but not his own invention's very *raison d'etre*! Nevertheless, Huygens did promote his Seconds' regulators, on weights, to other scientists. Licensed models were made by several makers, including Ahasuerus Fromanteel for Dr.Ward in 1661/2. Clearly, Huygens' price-list only reflected the popular dictates, little wonder that neither his Seconds' indicating Patent clock (DØ1W) nor his OP-gear clock (DØ2W) are thought to have survived.

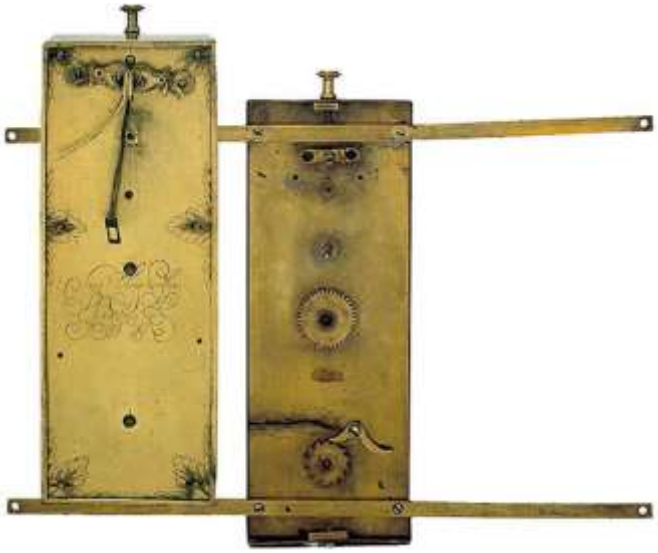
Although Huygens' Patent timepiece ***DØ1W*** was first published only in 1673, this represents his original, 16 June 1657, Patent Application via Salomon Coster. Note, the pre-cycloid cheeks, the box case with no windows, the suspension pulley to pendulum, which all are to be found in Oosterwijck's *Royal 'Haagseklok'*. Both Huygens' Dutch top potence and delicate round pillars are pre-Contract designs - so let us say Dutch in their concept, and most probably in their execution too.

The same parochial isolation cannot be said of his next clock he published in ***Horologium*** during September 1658, this was designed while John Fromanteel worked for Salomon Coster; English ideas had arrived. Huygens then depicts upper potence of strap-form, like the Fromanteels in their London clocks, and also like Oosterwijck's subject clock. Hyugens also shows his new endless-rope maintaining power - that would be compared unfavourably in a Dutch Court with Simon Douw's patent invention of a spring-remontoir, (***Appendix 4***).

So it seems today we only know the popular form of Coster's 1657 Patent*;* a *mass market spring*-clock without Seconds'; whereas even Treffler's four-wheel train probably mimics the astronomer's own, *albeit in a spring clock*. If correct, this relic ***'DØ copy'*** may represent Huygens' arrangement ~ known only from his 1657 drawing, first published in ***Horologium Oscillatorium***, also Isaac Thuret's extant regulators in the Boerhaave and Vehmeyer collections.

Tragically, Florence's disastrous floods in 1966, destroyed Treffler's ornate Augsburg Tabernacle case, and damaged his rare movement. Dr Plomp had illustrated its Tabernacle case, (Op.Cit.,***"Pendulums"*** Fig.10,p.16), so beloved of Italy and Germany, being forerunners of Fromanteel's Zodiac-Musical clock's case. (At ***'Comparables'***, is an even older Augsburg tabernacle cased clock circa 1625, formerly in **P.C.Spaans'** Collection (Christie's, Op.Cit., Lot 420, 19/12/2007**).**

Here I cite basic details of Treffler's copy. The large gilt-brass dial was fixed onto the front door, retained by two straps. It has a delicate seconds ring, yet its broad pewter chapter ring and ornate case appear to be anachronisms but follow the contemporary German also Italian practices. It also mimics Coster's pendulum escapement, but with longer plates (190 by 90 mm), needed for the fusee – which forces Coster's pinioned-centre wheel onto the *front*. The ratchet is on the front plate, like Coster timepieces. Six plain *round* pillars, (35mm long), are pinned at the back plate which is richly decorated and fully signed, ***"Gio: Filippa Trefler Augosto"*** [access new ***MemoTrefler***].



View: J.P.Treffler's Signed* Relic Movement, 1658. (Courtesy *Istituto e Museo di Storia della Scienza*,Florence). [69V_Treffler2]

[* Extant Coster back-plates bear no inscriptions, but did Drummond Robertson record one in the Rijksmuseum, or has he been misread? "*A plain spring movement without any adornment of engraving on the back-plate*". (Robertson, Op.Cit.,pp.77-78). SebastianWhitestone and I regard any *inscription* as being upon the shield. Sebastian also convinced me there was just one clock; no ***single-hand*** pendulum by "***Samuel*** Coster Haghe *met privilege 1657"*, wrongly attributed as John's ***first*** contracted clock by E.L.Edwardes & R.D.Dobson in '*The Fromanteels And The Pendulum Clock*', (AHS, Antiquarian Horology Vol.14, Nr.3, p.253, Sept.1983). *Fromanteel's 1658* movement is so signed. Was Burattinij's gift perhaps signed in that English fashion?]

New images show a bifid cock with one surviving Huygens' cheek, also a back-wound fusee-arbor; the front plate having motion-wheel above the ratchet to the spring barrel; spidery bars fix the movement onto the door frame, and secure the dial plate. Seen here, the plates have a brass dust cover whose age is unstated. In due course, I shall return to Treffler's early pendulum timepiece.

Treffler's '*DØ copy*' now assumes huge significance, to establish the wheel train and escapement of Coster's *'DØ'*. Nicolas Hanet took several of Salomon Coster's seconds' clocks to Paris between 1658-1660, but neither do we know if these were spring or weight driven; might these, too, have mimicked Coster *'DØ'*, or Huygens *'DØ1W*?

Questions of construction and originality will only be answered by examination, I have invited Florence's **Museum of the History of Science** to review their newly significant relic - probably the oldest original pendulum movement extant. I hope, eventually, to add its wheel train to the '*open-research'* spring-clock matrix with other contemporary pendulum trains, at ***Appendix Three***.

Later Seconds' Clocks.

Huygens professed his ablest clockmaker to be Johannes van Ceulen (1656-1715). He provides exceptions to this hiatus of Seconds'.

View: Van Ceulen's Royal* Seconds' Pendulum Weight Clock.
Original meaning of ***'Royal Pendulum', "the (anchor) ***Escapement*** having ***Dominion*** over the ***Weight***, (John Smith). [70V_Ceulen2]

Circa 1680,Van Ceulen made at least two observatory regulators with long pendulums beating 2-Seconds, matching Thomas Tompion's at Greenwich; one remains at Kassel, a second similar *relic* is now in a Dutch private collection, (see J.Zeeman, "***De Nederlandse Staand Klok"*,** Ch.IV. Den Haag, Figs.1-4, pp.199-201, Van Gorkum Assen, 1977). Probably, these fourteen-foot pendulums were inspired by his patron Huygens, whose links to the Royal Society were always strong. Van Ceulen also made rare weight-driven Hague long-cases beating and showing 1-Seconds. The example above is month going with striking, having a monumental Dutch anchor escapement, with several idiosyncratic features; elaborately pierced and blue steel-backed cocks and countwheel; fully signed on the backplate; with winding squares formed by sleeves pinned over round arbors; also having a strike set-off in the dial sector at the II side; and formerly having an alarum. [Note. It has been suggested that, originally, its untypical circular-dial was squared; but Eugene Stender and Willem Hana thought not, and I concur. Yet a subsequent owner fitted a mask to square it up for his replica ebonised case. Constructional features suggest this movement was made circa 1685-1690, when the French already had broken with formal rules and introduced circular dials in spring-clocks and long-cases. (Tardy, ***"La Pendule Francaise***", 1949, Vol.1, Louis XIV, p.97, ***'Tete de Poupee'*** by Pierre Du Chesne, also p.107, ***'Regulateur de Parquet'***). After his return from Paris, even Huygens designed circular dials].

Van Ceulen also introduced Joseph Knibb's silent pull-quarter repeat, for night use, into Hague clocks, (see his Marot cased console clock). However, separate Quarter-strike trains are rarely seen until the late 1680s, (Plomp, ***"Pendulums"***, Op.Cit., nr.131, pp.238-239), but an unsigned 3-train Hague movement suggests these were being made by 1670. (Dreweatts Auctioneers, ***<DNFA>*** 09/09/09, Lot.87). Van Ceulen's workshop, too, also made pull-quarter-repeating movements for domestic and foreign makers: viz.***"Jacque' Benoist Fecit Cleve"*** in Germany, apparently signed by Van Ceulen's engraver. ***<Benoist>***

Van Ceulen's large month spring-clock originally showed Seconds'; having a Seconds' pendulum extending through the base plate. For a Hague clock, it has the rarest of features like his Kassel astronomical clock; ie. a split-back plate, also two fusees. Remarkably, it is housed in a superb French case of ebony with unusual and excellent ormolu mounts; the rear door inlaid with an ivory Coronet and Star badge; circa 1690. It has an Aristocratic, ornate silver-mounted, folding-key for both doors, a late example of Plomp's characteristic property *P6*.

View: Van Ceulen's 'Regulateur de Parquet'. [71V_Ceulen3]
[Note. the verge escapement has been altered to short pendulum; both the dial's seconds' ring also dial regulation have been removed; the bells have also been relocated to the interior, the conversion probably carried out in France, (see Christie's London, 22-3-1989, Lot. 21)].

This typical Paris-made case* usually houses movements by Thuret, Martinot, Gaudron, or Gribelin; yet another of Van Ceulen's Franco-Dutch collaborations at the highest level - thanks to Huygens. It stood on a pedestal as a '*Regulateur de Parquet'*, for a noble French family. Seconds' had become *de rigueur* in France; and the Fromanteels had opened shop in Amsterdam, finally the *Royal-pendulum* longcase had arrived in Holland. *Plomp cites André-Charles Boulle as casemaker.

The back plates of all these Van Ceulen clocks are each fully signed with his address shown as *'Hagae Hollandiae'*, first used by Claude Pascal (***'D6'*** Vehmeyer *V50*) circa 1660, now thought to signify being *'made for export'*. Whether true or not, clocks bearing this form of address are more interesting in concept and of a significantly finer quality than clocks not so addressed, see ***Planetarium*** at Boerhaave.

Of course, even as Johannes Van Ceulen relocated, from Maastricht to The Hague, in 1675, English clocks were then in the ascendant and had surpassed all Europe. By the late 1680s, some English makers had relocated to Holland; ie. Joseph Norris, the Fromanteel brothers, Steven Tracy; later William Gibb; some even set up supply chains or trading links, as John Drury with Fromanteel, Clarke, Dunster, (Hans Kreft, ***"Rediscovering the Fromanteel Story",*** HF website, 2005).

Not until 1700, in Rome, do we see Pierre (Pieter) van Stryp (Strijp) making a spring clock utilising Treffler's fusee, having a half-second pendulum on its (apparently original) **'tic-tac'** escapement, to indicate Seconds' on the integral combined chapter ring.

This imposing Seconds' indicating spring-clock also has quarter strike and alarum, housed in an English inspired case and dial, having both Day and Date sectors. (Sotheby's London, *Clocks*, lot.38, 28th January 1977). Note. STRIJP (*Stryp*) was then a small village, now absorbed by the city of Eindhoven. The family names of Pieter van Stryp, in Rome, also Bernard van Stryp, in Antwerp, were probably derived from there. For that biographical information, and original image, I am indebted to an old contact, Mr.P.Th.R.Mestrom Ph.D, author of ***"Uurwerken en uurwerk-makers in Limburg 1367-1850"***.

View: 'Pierre Van Stryp Romae', (Seconds') [72V_VanStryp]
(Provenance; *Euro Art Centre;* Private collection, Belgium.)

Oosterwijck's Options.
Returning to the subject Royal spring-clock, it now appears that Oosterwijck, all along, had had the means to describe '*Seconds*'; and yet, and like all of Coster's many acolytes, he chose not to engineer seconds into a spring wall-clock having a short-pendulum. Evidently, that choice had wider implications among The Hague's clockmakers.

From 1661, and using Cardanus' suspension, Alexander Bruce was first to design and commission short-pendulum sea-clocks showing Seconds', Longitude required it. Huygens was next in 1663/4, (see Robertson, Op.Cit. Chap.IX, Figs.23-24, pp.143-174; also Leopold, J.H, ***"The Longitude Timekeepers of Christiaan Huygens",*** under ***"In Quest of Longitude",*** pp.102-114, edited by William Andrews, Harvard 1998). Tony Weston describes one surviving *wedge-shape* movement by Severijn Oosterwijck, probably made in 1662, copying Bruce's original 1660-1661 London model. I wonder if he saw this movement, he cites an engraved four-minutes* back-dial, (Weston, A. ***"A Reassessment of the Clocks of John Hilderson"***, Antiquarian Horology, Vol.25/4, p.431). Recently I recognised a second wedge shape movement, clearly English work, once fusee, but now weight driven, also with a back-dial on its contrate arbor, but engraved ***0-60*** (Seconds?). ***Appendix Five*** shall examine both these Bruce relics.

Link to my new Appendix Five.

***F**our minutes represents one degree of longitude in solar transits; 24hrs/360deg=4minutes. But Weston's "four-minute" dial perplexes every authority. A colleague from my first squadron, noted for his didactic mindset, world pilot and solo-mariner Brian Walton, put his mind to my interrogations. He pointed out that the Babylonians had divided their 24 *unequal* hours by 360 to arrive at the "*Ush*", (four minutes), as a unit to calculate eclipses. He also pointed out that four minutes also has a special significance in sidereal time, for star transits; 4-minutes sidereal is the difference between the sidereal day and mean day; whereas 3min.56 secs. is the difference measured in mean time; but still needing solar equation conversions from periodic tables for known Latitudes - not always certain. Brian suggests this longitude clock might be rated to sidereal time, using star sightings, so eliminating the need for solar equation tables. The clock would be rated on land, and be used at sea to determine the longitudes, both to predict the known and to chart the unknown landfalls, without need for solar equation tables. Oosterwyck's '*four-minute*' back-dial is thus

resolved, it is typically simple, and it is ingenious; nevertheless it was derived or copied from Bruce's original London made sea-clock!

Furthermore, its origins are known to have been in London, with Alexander Bruce (the Earl of Kincardine), at the Royal Society before mid-1661 when he first showed it to Huygens in London! Might Robert Hook or Christopher Wren have been involved with whomever made Bruce's original Longitude clock? I am unaware of Huygens considering sidereal rating for his own Longitude clocks, if he did, I have not found it although he was fully conversant with uses of sidereal time in his earlier correspondence with other astronomers.

Assuming Bruce's openness, one must wonder why Huygens had persisted with equation tables, unless intended solely for the rating of terrestrial regulators. He went on, ultimately, to invent* an automatic equation kidney-cam, in 1694/5, which he notified to Tompion and Quare via the King's secretary, his brother Constantijn, in London in 1695, who, upon Huygens' untimely death in that same year, each incorporated Huygens' kidney-cam in very different ways to claim "*inventions*" in their own names. **[*** In this, I follow H.Alan Lloyd, ***"Some Notes on Very Early English Equation Clocks and Joseph Williamson's claim to have made them all!"*** BHI, *Horological Journal*, December 1943, pp.314-333). I responded to one author of '*Huygens' Legacy*' on the curious absence, in their otherwise superb catalogue, of any recognition of Huygens' part in inventing the '*equation kidney-cam'* in the Quare-Williamson double-pendulum equation clock (exhibit **90**). Strangely, for a tribute exhibition, in this one respect at least, the Dutch would give England all credit for the equation kidney-cam - *yet never for any contemporary pendulum!***]**.

John Hilderson is said to have copied one of Bruce's damaged sea clocks, it is also said to have been the older original. Was Bruce's first Longitude clock made by Fromanteel, who had wisely retained the fusee for such an exacting purpose and its unstable environment - as Hooke then had already realised? If not, then by whom? Certainly not by violinist-clockmaker? Davis Mell, whose even earlier pivoted-pendulum clock was made to the highest standards of the time, with a unique verge-pivot steel-shim, which I now attribute to Ahasuerus Fromanteel Snr. Certainly, in 1660 London, Fromanteel was the man. (*Bruce's Longitude-Clocks* is now in preparation as ***Appendix Five***).

The origin and maker of Bruce's first Longitude clock is of much greater import than has previously been realised. Bruce may have been inspired by the new pendulums when he visited the Hague in 1660 to escort Charles II to London. But he was in England from June 1660 to March 1662, so who there made his ***"F"*** double-crutch and pendulum? Dr Dereham (1696) has all the pendulums made in England before the Royal Society's clock (mid-1662) as being Dutch, or made here to Huygens' design. Evidently, again, he was mistaken.

Admittedly, Bruce's ***'F'*** double-crutch relied on Huygens' Patents, but I suggest that his original longitude-clock is yet another pointer to Fromanteel's involvement in manufacturing pendulum sea-clocks. Would Bruce go to an independent English clockmaker who had not made suspended-pendulums, or to one who had already had made his own pivoted-pendulums? Furthermore, that *unnamed* English maker also saw a definite advantage in fitting a fusee -rather than a going-barrel, but especially not the weight drive that Huygens applied. We know that fact from Oosterwijck's surviving copy. The English sea-clock has a rudimentary holdfast - Oosterwijck's sea-clock has not!

Today no complete early English or Dutch longitude-clock is known, (see ***Appendix Three,*** Wenceslaus Hollar's engraving, dated 1667), although relic movements of Bruce's English and Dutch fusee sea-clocks still exist. That fact suggests, even on land, Huygens' Dutch pattern weight remontoire sea-clocks were at best unreliable, so did the Dutch public then reasonably infer that all Seconds' clocks were just too troublesome for domestic use? Anyway, all these ships' *pendulum-clocks* were ultimately proven to be unsuccesful.

One wonders, too, why Huygens committed to paper his impractical and flawed designs for weight driven sea-clocks also having weight remontoirs, unless, once again, it was to mislead competitors, like his *'OP'* pendulum he published in *Horologium*. Robert Hooke's opinions on Huygens' Patents of June 16th, 1657, and March 3rd, 1665, were most forthright, also perceptive, much like Simon Douw's in 1658, (see British Museum MSS -Sloane 1039, folio 129).

By an extraordinary omission, this most obvious hiatus of Seconds' in Hague clocks has never been the subject of research or comment. But it is so absolute an hiatus that I surmise the Dutch makers of spring-clocks, (also English and French makers too), had agreed, or seen fit, not to offer Seconds' to their general clientelle, but had reserved that application solely for scientific purposes. However, why would the English King not pay the extra, had he, too, no need for Seconds'?

7. Claims to Priority.

Oosterwijck's **Royal Hague clock**, with hour striking, in Kingwood and Ebony box case, within the known canon of such Hague clocks, may justifiably claim to be, or at least be reasonably considered as;

- only known 'Royal' Hague clock of the first period, (The Royal Van Ceulen-Marot console clock, c.1690);
- only Hague clock with known, unbroken, provenance;
- only known with a (solid) *Kingwood* carcass;
- first Hague clock to be fitted with a (Royal) '*Crest*'.
- only known Hague clock having 'pendulum-holdfast';
- earliest to mark the Hour-Quarters (my Fourth State);
- earliest to have a strike train (unique 10 pin/leaves);
- earliest observed '**split-*going/strike*-barrel**';
- unique concealed '***flying stop-work'***;
- probably unique 'spring up-down' (Wind-Me) device;
- being made with Huygens' also Coster's fiat, (possibly sharing,(made at least partly in), Coster's workshop);
- the original model for Coster's two known strikers;
- the original model for Visbagh's and Pascal's strikers;
- presenting English innovations and craft practices of Ahasuerus Fromanteel, learned from John in 1657, or unrecorded earlier connection to London workshops;
- made for, or very soon after, the agreed Mayday 1658 disclosure, when Contract '*secreet'* was to be shared;
- probably incorporates, and therefore finally reveals, the September 1657 Contract's ***"secreet"*** construction.

Although Huygens' *Seconds'* option was not fitted, this indeed is some ***"Mantle Clock"***. **[80 Obliquel]**

The quality and symmetry of Severijn Oosterwijck's unique Ebony veneered Kingwood box-case becomes evident; inspiring Fromanteel's own *box-cases* for weight, going, and fusee clocks.

8. Valuation?
Financial interests were ruled out but the owners would now insure their rare clock, (valued at £20,000). Unrecorded early Hague clocks rarely appear, those with Royal provenance never have. In 1998, two unrecorded early Pieter Visbagh *Haagsekloks* surfaced in Ireland and were bought for £14,000- each [re-sold in Holland for realistic sums]. Lately, two Coster pendulums did come to auction in New York and Amsterdam, (see ***Memoranda, D3/D5***). The first, ***'D3'***, proved better than was supposed, (Sotheby's NY, Time Museum, Part.4, Vol.1, Lot.519, 13.10.2004), now at Museum of the Dutch Clock, Zaanse Schans, Zaandam. The latter, ***'D5'***, from P.C.Spaans collection, made a magnificent price of €470,000- to an English collector. (Christie's Amsterdam, 19-12-2007). Notwithstanding, the **'Royal Oosterwijck'** is irreplaceable, literally! Yes, it lacks Coster's magical name, but then who did actually make Coster's pendulums? Monetary valuation must be subjective, also confidential; and mine reflects this antiquarian's honest appreciation of its claims to priority and historic importance, as a ***Dutch cultural property*** and ***'World Heritage Item'.***

DEDICATION: I dedicate this review of Severijn Oosterwijck's ***'Royal Haagseklok'*** to Professor Dr. Ir. Reinier Plomp, who initiated my interest, and from whom I acquired my first 'Haagseklok' (*David Lamy, Hoorn*) and first 'Pendule Religieuse' (*Claude Raillard, Paris*), in 1975 - and for whom I acquired the earliest Dutch ebony longcase by "*A Fromanteel Amsterdam"* (now in H.M.Vehmeyer collection).

ACKNOWLEDGEMENTS:
First I thank the privileged owners who kindly invited me to review and appraise Sir John Shaw's superb Royal Hague clock by Severijn Oosterwijck. I also thank the British Horological Institute (BHI), also clockmaker-restorer Paul Shrouder, and BHI editor Jayne Hall who both promoted and tirelessly edited this review for publication in *Horological Journals*, (October 2009 to March 2010). Paul facilitated my examinations and answered all my questions, with helpful advice and sketches, he has also advised the BHI in their production of this review. Similarly in Holland, Horological Foundation's Fred Kats, one of the remarkable antiquarian horologists I first met in 1974, has made his typically invaluable contributions, to bring this to the HF website, not least by patient coaching through tortuous **IT** log-jams.

I thank all those others whom I have cited in my review; especially Professor C.A 'Kees' van Grimbergen, Carel Hofland, and Pier van Leeuwen, respectively director, manager, and curator of the Museum van het Nederlandse Uurwerk at Zaandam, for providing records of wheel-trains and images of their two Coster clocks (***D3***, ***D8***), with consent to use in new "open research". Would that all museums held such complete records, and were so co-operative. I am again indebted to Sebastian Whitestone, who in 1990 divulged William Leybourne's description of Fromanteel's 1649 *Chef d'Oeuvre* for Mr Dudley Palmer; and for his recent new exchanges. Also, I am indebted to Sothebys' Jonathan Hills for images and consents to publish Coster's most enigmatic timepiece (***D3***), and other clocks; also to Christie's Jamie Collingridge for images and consents to publish Coster's unique timepiece alarum (***D5***), and other clocks.

Dutch colleagues and friends, Hans van den Ende, Hans Kreft, Berry van Lieshout, Dr Ruud Mestrom, Dr Reinier Plomp; latterly Nicole Brandt of Nationaal Archief, also Michiel van Hees, Erik Glasius, Frank Reith, Ewoud Sanders; each provided useful insights into other Hague clocks, Netherlands' social history, language, even suggesting the ***Royal Haagseklok*** as part of ***States General*** gifts to Charles II.

Thanks are due to the British Museum's Curator of Horology, David Thompson, also Horogist Oliver Cooke, who both were helpful; Oliver shot supplementary images of Bernard van Strijp's hybrid Antwerp "*Hague-clock*". Their open-door policy, and ease of access to horological collections, is most refreshing. Thanks, too, to Alison Boyle, Richard Horton and Francis Brodie of the Science Museum, London, for helpful access and consent to publish Coster (***D4***); also my old friend Brian Walton, a former squadron colleague, later world airline pilot and solo ocean mariner, who provided valuable insights into basic longitude finding also a sidereal relevance in Oosterwijck's 4-minute back dial. I also thank the private owners of Fromanteel's Masterpiece Solar-Musical Clock, Samuel Knibb's Royal 'kingwood' longcase, also Van Ceulen's Hague clocks of the later period.

I also thank Senor Georgio Strano, Curator at Museum of the History of Science, also independent conservator Professor Andrea Palmieri in Florence, who kindly undertook to re-investigate Philip Treffler's 1657-8 timepiece, (***DØcopy***), for this project; See *MemoTrefler*, which should raise its academic profile. Thanks to Simon Chesters-Thompson of National Trust, also Tom Boggis, House & Collections Manager at Lyme Park, also Horological Curator Jonathan Betts, for invitation, *eventually*, to see Ahasuerus Fromanteel's 1658 timepiece on the bench. In due course, I hope to review that iconic timepiece.

Museum Boerhaave at Leiden, also has a Coster pendulum timepiece dated 1657, (Plomp ***'D1'***), but originally withheld all access, even its wheel train details, on curious ground that the museum is studying it themselves, with a view to publishing an article. Yet this clock was centrepiece in their own landmark exhibition, ***"Octrooi op de Tijd"*** (Exhibit #2), where I first saw it. It never has been independently scrutinised nor published in full, other than sketchy details cited by Dr Plomp (see Op.Cit,***'Pendulums'***, #34), also "***Huygens Legacy***" catalogue (exhibit #08). I arranged for Museum Boerhaave to receive ***Horological Journals*** presenting **"*A Royal Haagseklok*"**. Happily, an invitation has been extended. All custodians of our horological heritage should realise the advantages of *open research*, both to their collections and their public organisations too. It is a shared heritage.

Again I acknowledge indebtedness to the late Ronald Lee and Peter Gwynn, connoisseurs and business partners who both encouraged my original research into Fromanteel's early *Oeuvre* and Dudley Palmer's unique spring-clock in particular; without whom I should not have presumed to challenge Horology's mantras. Finally I must commend Dr. Elspeth Knights D.Phil. for proof-reading my first drafts, despite her unfamiliarity with horology. Remaining errors are mine alone.

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- **Hans van den Ende sr Hans van den Ende jr *"De Eerste Nederlandse Slingerklokken"***, TIJDschrift 10/4 Dec.2010.

CORRECTION (23-12-09): **A**rising from my 2005 paper for the Coster-Fromanteel Compilation website, **Erik Glasius**, Dutch editor of *'TIJDschrift'*, also Chairman of ***'Federatie Klokkenvrienden'***, now refers me to Latin etymology of *"secreet"* being known in old Dutch, (Verdam J, *"Middelnederlandsch Handwoordenboek"*, as revised by C.H. Ebbinge Wubben, 'sGravenhage, 1964; also *"Beknopt Latijns-Nederlands Woordenboek"* (Dr. F.Mullerand and Dr.E.H. Renkema, 12th Ed., revised by Dr. A.D. Leeman, Groningen, 1970). **Michiel van Hees** subsequently cited an old Franco-Dutch root to *'secreet'*. He referred the matter to a Dutch language expert, **Ewoud Sanders**, who provided citations of its use from the 16th century. Oddly, in preparing my 2005 paper, none of my Dutch authorities, dictionaries, nor editors, gave any contrary advice. As the author, I accept full responsibility for misleading readers. Yet, I would suggest, it must remain entirely plausible that *'secreet'*, not the Dutch *'geheim'*, was chosen precisely for its Anglo-Latin root, to be mutually understood between Coster and Fromanteel, also their Notary. A consequence, of that word for *'secret'* being expressly chosen, might confer authority to either of the two contractual parties. However etymology helped their mutual understanding then, now it gives us no other clues about the secret itself, nor its proprietory owner, which concerns me more. Here I shall leave readers to decide on the value of the etymology which in itself does not alter the real challenge of illuminating these shadows, by new *perspectives*, first to identify the secret, then to award that intellectual property the proper attribution to one or other party; based on evidence of their actions, agreements, constructions, statements, or even their silences. ***With apologies, Keith Piggott***

POSTSCRIPT: **S**ubsequent to drafting this review, Mr.Sebastian Whitestone, with Jean Claude Sabrier, has published an exciting new discovery and Sebastian's new hypothesis, **"*The Identification and Attribution of Christiaan Huygens' First Pendulum Clock*"** (see Antiquarian Horology, Dec. 2008). In my *'Compilation' paper*, (2004/5) I merely cited earlier paradigms, and Huygens' significantly disingenuous first disclosure of pendulum in "***Horologium"*** *(1658)*, also his unfounded litigation against Simon Douw. But Sebastian has definitively proven my postulated chronology, with Benjamin Martin's woodcut and his annotations in ***"Horologium Oscillatorium".*** Sebastian postulates an even earlier Huygens' pendulum, as being made by ***Isaac Thuret of Paris***. He submits that clock as physical evidence. It certainly stands the test as an early also remarkable regulator, worthy even of being called '*prototype*'? Might a **Huygens-Thuret** Contract now be found?

[**N**ote. Thuret's pyramidal 'plumbs-crews' are reminiscent of the level-screws in the ill-starred **Jan van Call** 1657 'prototype', (see Sotheby's, 16/10/86, Lot.128). In our own preview of that so called 'prototype pendulum', Berry van Lieshout expressed concerns at internal geometry; he declined to bid for premier Dutch collection. I am now informed that all forensic tests (to show it a fake) prove inconclusive? Perhaps that *academic orphan* should again be revisited, although.Sebastian privately disclosed his observations and opinion, confirming Berry's]. **Link to *"Going Dutch"*.**

Sebastian's new thesis would remove Huygens' pendulum timeline, backwards, possibly even to 1655? As one who believes Ahasuerus Fromanteel probably displayed his own secret 'invention' to Cromwell in 1655 to earn his Freedom of the City of London in January 1656, I have no difficulty in accepting the possibility of Huygens arriving at his pendulum earlier than he himself had claimed in his correspondence to Boulliau in Paris. But is Sebastian premature, even mistaken about his evidence of ***'Cycloid'*** cheeks being mounted on Thuret's purportedly pre-Coster verge-cock? Cheeks were not declared as part of Huygens' invention, purportedly on Christmas Day 1656, but only appearing early in 1657 prior to the Patent Application, then having only an empiric form - which nevertheless could have approximated Cycloids. But, in Holland, his true Cycloid form depended on long theoretical correspondence with other mathematicians from mid-1658; his final Cycloid form is first mentioned in correspondence only in late 1660, after Christopher Wren's crucial ground work on cycloid arc-lengths, being long before his mathematical proof was completed or published. [Note. For a mathematician's explanation of Huygens' remarkable insights, I refer readers to Alan Emmerson, ***"Things Are Seldom What They Seem - Christiaan Huygens, The Pendulum And The Cycloid",*** *[as PDF, pending <http://gallica.bnf.fr/ark:/12148/bpt6k3360z> on-line*].

Nevertheless, Thuret's suspended long-pendulum with a horizontal crutched-verge was still Huygens' intellectual property; being my "*astronomers' way*". [Johannes Hevellius, the Danzig astronomer, had applied it differently, setting his movement *within* a suspended pendulum - a style which the French revived in the 19th century].

[Note. Whereas my *'craft-way'*, the mechanical pivoted-pendulum proposed to the Dutch Marine by astronomer Galileo in 1635, was adopted by Ahasuerus Fromanteel, possibly even in 1655, before the Lord Protector Cromwell's learned doctors, to earn his unexpected *Freedom of the City of London*, in January 1656; the month before Hooke's *pendulum-escapement* for Dr Ward at Oxford! Coincidence? Might Fromanteel's presumed 1655 demonstration of *some invention* to Cromwell have been perceived to have a *maritime import* such that Cromwell elevated it to a **State secret**, therefore never published; and naturally denied to other sea powers or their scientists. The same security may have applied to Elizabethan scientist Leonard Dygges' ***'perspective-glasses'*** of 1571, which some authorities believe was the first true ***'telescope'***, perhaps why his descendant, Gray's Inn lawyer Dudley Palmer, held a permanent seat on the **Royal Society** *Optics & Astronomy* committee. **Britannica, In Omnibus Princeps!]**

Reflecting on the 1657 Contract. **S**ebastian's new thesis does not affect the importance of Severijn Oosterwijck's ***Royal*** Hague clock, within its paradigm of Hague pendulum spring-clocks. With renewed confidence, I now regard Oosterwijck's ***Royal*** Hague-clock, with hour strike (now called "*English striking*"), as the original on which the Coster, and also Pascal-Visbagh, striking clocks were modelled after Mayday of 1658, when a *secreet* changed hands. Others may disagree, I shall look forward to reviewing their contra-evidence.

My 2005 'Compilation' paper recalls Ahasuerus Fromanteel's parallel contributions by his early pivoted-pendulum. Huygens, rightly, was lionized for his horological achievements, but it takes nothing from him to credit Ahasuerus' contemporary solution by his older craft way. Here, in my new evidence of Oosterwijck's ***Royal 'Haagseklok'***, Fromanteel's influence is now seen to extend deep into Coster's own workshop. I also observed, the etymon of the contractual 'secreet' seems not Dutch but English. The Dutch even adopted it for a '*privy*'! Still, it remains a conspicuous linguistic clue that must now assume a new significance, to help us finally to resolve this hoary conundrum.

Cavet: If it were proven that Isaac Thuret, a Frenchman no less, had first applied Huygens' pendulum before Coster, and before John Fromanteel's 1657 Contract, then, certainly, that would make any "Coster secret" appear even less dependable - *at least to this writer*.

Littera Scripta Manet ~~~~~~~~~~~~~~~~~~~~~~~~ Keith Piggott

FINALE: The long gestation period of this review, written to meet an early 2009 deadline in the BHI *Horological Journal*, meanwhile delayed and being continually revised, has allowed the rare box-case to be sympathetically conserved by Matthew King. I am pleased to include new images. Further images shall be posted.

[77_Back2.jpg]

[76_Open.jpg]

View: Matthew King and the unique *"Royal Haagseklok"* by *'Severijn Oosterwijck Haghe met privilege'*, following his superb conservation of its Ebony and Kingwood Box-Case.

Finale - Open and Running!

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