2015

Photo: © Chronométrie Ferdinand Berthoud SA

Chronomètre Ferdinand Berthoud FB 1
Introduced in 2015

Features:
- Calibre FB-T.FC manual-winding movement
- More than 1,120 components
- Chronometer-certified
- Movement diameter: 35.50mm
- Movement thickness: 8mm
- 21,600 vibrations per hour (3Hz)
- 46 jewels
- 53 hours power reserve
- Balance wheel diameter: 12mm
- Tourbillon cage diameter: 16.55mm
- 3 Hz low-frequency tourbillon with central seconds
- Suspended fusée-chain constant-force transmission regulation
- Suspended mobile power reserve cone
- Balance spring with hand-shaped Phillips terminal curve
- Nickel silver half-bridges supported by stylised titanium pillars
- Hours and minutes at 12 o'clock on a white lacquered dial
- Power reserve display in an openworked subdial at 9 o'clock
- Tourbillon at 6 o'clock
- Vertical satin-finished ruthenium dial with cut-out centre, 18K blued gold hour, minute and power reserve hands, blued bronze seconds hand
- Crown in 18K rose gold with black ceramic medallion
- 44mm diameter case in bimetallic 18K rose gold with black ceramic inter-horn space, 13mm thick
- Water-resistant to 30m
- Octagonal case fitted with four watertight portholes in glare-proofed sapphire crystal
- Domed, arched and glare-proofed sapphire crystal
- Screw-in case back with glare-proofed sapphire crystal
- Hand-sewn, rolled-edge alligator leather strap
- 18K rose gold double-blade adjustable safety-fold clasp

Limited to 50 pieces
Recommended retail price: SGD310,000

Photo: © Chronométrie Ferdinand Berthoud SA

Ferdinand Berthoud was a prolific writer on horology. In 1763, his book, *An Essay on Horology; in which we deal with this Art in relation to its civil application, to Astronomy and to Navigation* (*L'Essai sur l'horlogerie; dans lequel on traite de cet Art relativement à l'usage civil, à l'Astronmie et à la Navigation*) was published. On the book is a Ferdinand Berthoud pocket watch made in 1806. Both book and watch are the property of Chopard L.U.C.EUM museum in Fleurier which is owned and managed by Chopard.

FERDINAND BERTHOUD REDUX

WHY DID CHOPARD GROUP RESURRECT THE FERDINAND BERTHOUD LEGACY, NOTABLY WITH THE CHRONOMÈTRE FERDINAND BERTHOUD FB 1?

BY TIMMY TAN

The Chronomètre Ferdinand Berthoud FB 1, launched in late 2015, hails yet another milestone in the history of Chopard for it is the first product of the Ferdinand Berthoud brand name that it acquired back in 2006.

Underpinned by amazing technical features, the high horology Chronomètre Ferdinand Berthoud FB 1 has a pillar-type architecture featuring the tourbillon with central seconds, a suspended fusée-chain regulating system and a mobile cone that indicates the power reserve, features which have been patented.

Ferdinand Berthoud (1727 to 1807) was a well-known Swiss-born horologist based in France who was appointed official watchmaker to the French king during the reign of

Photo: © TANG Portfolio. Elfa / Timmy. 2016 Singapore

Karl-Friedrich Scheufele
President
Chronométrie Ferdinand Berthoud SA

Louis XV (who ruled from 1715 to 1774). King Louis XV (1710 to 1774) was also known as *Louis le bien aimé* (Louis the Beloved).

Ferdinand Berthoud is not an unfamiliar name for historians, watch collectors and enthusiasts as he played a significant role in the history and development of horology. The highly talented Ferdinand Berthoud was an inspiration for Michel Parmigiani, founder of the Parmigiani Fleurier brand, to take up watchmaking. Even Gerd-R. Lang, founder of Chronoswiss, is a fan of this famous Swiss horologist.

In 1768, two marine chronometers made by Ferdinand Berthoud underwent sea trials that lasted 18 months onboard the French corvette L'Isis. This warship travelled from Rochefort to Santo Domingo. During the trials, Ferdinand Berthoud's No. 8 marine chronometer was able to determine the ship's position on the map and calculate longitude within half a degree.

With the development of accurate marine chronometers, France was able to compete with England for maritime supremacy during the Age of Discovery.

Berner's *Illustrated Professional Dictionary of Horology* lists Ferdinand Berthoud as the inventor of the detent escapement. The spring detent was incorporated into the ultimate marine chronometers, states Eric Bruton in the book, *The History of Clocks & Watches*.

"Ferdinand Berthoud defined watchmaking as what we know of today," surmises Vincent Lapaire, general manager, Chronométrie Ferdinand Berthoud.

Ferdinand Berthoud passed away in 1807 at 80 years of age but the family's chronometer business carried on as it was managed by his nephews, Pierre-Louis Berthoud (1754 to 1813) and Charles-Auguste Berthoud (1798 to 1876).

Though the Ferdinand Berthoud name is well-recalled in horological and maritime history, including timepieces and marine chronometers bearing the brand name, the watchmaking business subsequently went into obscurity.

"It remains a mystery why the Ferdinand Berthoud name disappeared more than a hundred years ago," adds Lapaire.

With high horology Chopard timepieces already offered with their L.U.C collection made in-house at the Chopard Manufacture, is there truly a need for another watch brand? In addition, what led to the decision to resurrect the Ferdinand Berthoud brand name?

"The Ferdinand Berthoud project didn't arise because we needed an additional brand. Commercially speaking, there is no reason for it. It is also not about more sales. For me, it is about the discovery of Ferdinand Berthoud," explains Karl-

Photo: © Chronométrie Ferdinand Berthoud SA

This Ferdinand Berthoud Marine Clock M.M. No. 6 (circa 1777), from the Chopard L.U.C museum, was one of the main sources of inspiration for the Chronomètre Ferdinand Berthoud FB 1.

Friedrich Scheufele, president, Chronométrie Ferdinand Berthoud SA, who is also co-president of Chopard.

"I purchased the Ferdinand Berthoud name because I had read books about him and decided that this is a name that should be revived," he continues. "Tributes should be made to the gentleman who represents one of the foundations of watchmaking.

"This is not a marketing decision but another sub-category for the Chopard Group. I saw an opportunity and it was a passionate decision and less on necessity," Scheufele reiterates.

Why did it take such a long time to eventually launch the Chronomètre Ferdinand Berthoud FB 1, given that the name was acquired in 2006?

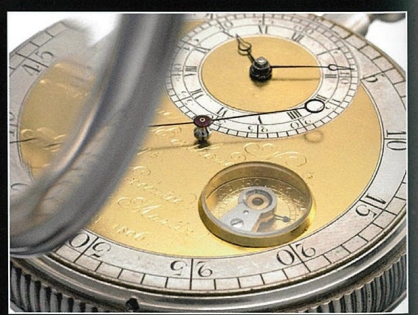
"I was busy with Chopard which was my priority and still is," says Scheufele. "Without Chopard, we will not have Ferdinand Berthoud. I was tied up with Chopard's 150th anniversary [of its founding (1860 to 2010)]. After 2010, I made more time for Ferdinand Berthoud. Basically, it took five years [to launch the FB1 and not nine years]."

What made Ferdinand Berthoud so special? "What struck me was Ferdinand Berthoud's career. He was born in a small village in Fleurier and lived up to 80 years old.

1806

Photo: © Chronométrie Ferdinand Berthoud SA

Ferdinand Berthoud pocket watch
Made in 1806
Chopard L.U.CEUM museum
*L.U.CEUM is Chopard's museum in Fleurier



"During the 18th century, he left his hometown for Paris and began his career when he was around 20 years old. He became watchmaker to the king of France, survived the French Revolution and was even watchmaker to Napoleon. These were difficult times.

"The clocks he made were on French expedition ships. What an incredible career. Ferdinand Berthoud has a patrimony of interesting watches and clocks which we even have in our L.U.CEUM museum.

"I have also come to realise that there are not many names of such magnitude around, of which one is Breguet. Perhaps only 10 people from that era have made a huge and significant mark on horological history.

"Ferdinand Berthoud's legacy is unlike many others. He was also writing about watches during a time when people in watchmaking were guarding their knowledge.

"For those who don't know about watches, Ferdinand Berthoud shared his observations through technical drawings. Just imagine that. So how can watchlovers, myself included, not be touched by his legacy?" Scheufele asks rhetorically.

Photo: © Chronométrie Ferdinand Berthoud SA

Karl-Friedrich Scheufele holding the Ferdinand Berthoud pocket watch made in 1806 with the master watchmaker's book, *L'Essai sur l'horlogerie.*

Photo: © Chronométrie Ferdinand Berthoud SA

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Photo: © Chronométrie Ferdinand Berthoud SA

The fusée-chain system of the Chronomètre Ferdinand Berthoud FB 1. The aim of fusée-chain systems of the 18th century is to compensate for the variations in torque of the mainspring according to its degree of winding.

The fusée-chain system of FB 1 is secured to the mainplate. When the mainspring is linked to the fusée, the spindle-like element, the barrel drum rotates in one direction when the spring winds down and rotates in the other direction when it is wound up.

The drum's rotation causes the chain to coil around the fusée. To ensure that movement does not stop during the winding, the fusée mechanism in FB 1 is equipped with a special differential gear.

The barrel is linked to the Maltese cross stopwork device that limits the winding turns of the mainspring and ensures pre-determined constant-force transmission during the winding down process.

One particular horological book written by Ferdinand Berthoud in particular, is *An Essay on Horology; in which we deal with this Art in relation to its civil application, to Astronomy and to Navigation* (*L'Essai sur l'horlogerie; dans lequel on traite de cet Art relativement à l'usage civil, à l'Astronmie et à la Navigation*). It was published in 1763.

"Ferdinand Berthoud has written more than 4,000 pages of horological literature," notes Humbert. "It was also mentioned in one book that Ferdinand Berthoud had at one time even worked with Abraham-Louis Breguet [1747 to 1823]," she adds.

As for Ferdinand Berthoud timepieces, there is a Ferdinand Berthoud pocket watch made in 1806 and a marine chronometer from 1850 at the Chopard L.U.CEUM museum. What is most significant is the Ferdinand Berthoud Marine Clock M.M. No. 6 made in 1777.

Why? "The design of the Chronomètre Ferdinand Berthoud FB 1 which is disruptive, was inspired by this Ferdinand Berthoud marine chronometer. The dial of the FB 1 is inspired by the longitude pocket watch [made in 1806]," says Humbert.

The movement of the Ferdinand Berthoud Marine Clock M.M. No. 6 has a pillar-based architecture, a fusée-chain transmission system and a constant-force module.

Such features can also be found on the Chronomètre Ferdinand Berthoud FB 1. The Calibre FB-T.FC manual-winding movement, comprising more than 1,120 components, powering the FB 1 is housed in a pillar-type architecture reminiscent of marine chronometers built by Ferdinand Berthoud. It took three years of research and development to realise the Calibre FB-TC.1 movement.

Its fusée-chain system has a "suspended" construction and is secured to the mainplate. A 28-centimetre long chain consisting of 474 steel links and more than 316 pins, each barely 0.30mm in diameter and hand-assembled, links the barrel and the fusée.

"The fusée-chain system and barrel are 'suspended' as there are no screws and no bridge connecting them. It requires two days just to assemble the 30cm long chain with 790 elements [474 steel links plus 316 pins]. There is torque of 3kg between the barrel and fusée," says Lapaire.

The fusée-chain system has a safety feature to prevent overwinding. The 790 elements of the fusée-chain system account for some 70% of the 1,120 components in the Calibre FB-T.FC movement. "It requires 147 hours to hand-decorate and to assemble the movement," quips Lapaire.

There is a technical reason for the use of the fusée-chain system. Among the books written by Ferdinand Berthoud, there is one known as the *Traité des Horloges Marines or Treatise on Marine Chronometers* whereby he explained the theory of isochronism of the oscillations of the balance wheel via the balance spring.

Photo: © Chronométrie Ferdinand Berthoud SA

The Calibre FB-T.FC, comprising more than 1,120 components, has a pillar-type architecture and features a tourbillon with central seconds, a suspended fusée-and-chain regulating system and a mobile cone that indicates the power reserve. The movement is chronometer-certified.

"The fundamental prerequisite for isochronism is the generation of constant force to set the escapement in motion. The more regular and smooth the supply of energy, the more accurate and stable the rate of the timepiece," the brand, highlighting this book in particular, explains.

There are three methods to obtain constant force: by using a fusée to act on the mainspring and compensate for variations in power, or on the escapement by equalling out the force on this level, or between the two organs by building an intermediate store of energy by way of the *remontoir d'égalité* or remontoire.

Ferdinand Berthoud mentions the important use of the fusée to equal out the force of the mainspring in portable clocks in *Histoire de la mesure du temps par les horloges* (The history of time measurement with clocks) and applies this to his marine chronometers.

The Maltese cross stopwork device or "Geneva drive" is one of the main elements of the fusée-chain system. Fitted directly on the drum barrel and connected to it, the Maltese cross serves as a buffer, creating a locking point once the movement is fully wound. Coupled with a crown that can be disengaged, the mechanism's role is to prevent movement damage due to overwinding.

With the transmission of energy from the fusée to the barrel and limited by the Maltese cross mechanism, a constant energy source is supplied to the going train, resulting in a regular and controlled energy flow to the escape wheel.

Ferdinand Berthoud also noted that to maintain the constant force, the transmission of the energy to the escapement should not be interrupted during winding as it world lead to the loss of time.

This explains why Chronométrie Ferdinand Berthoud developed a differential-based winding system. The differential passes through the fusée and is incorporated with it in a suspended construction. The fusée is a "chassis" which means a thinner mechanism.

With the fusée-and-chain system with a differential, the FB 1 can be wound without interrupting the operation of the movement, thereby achieving additional reduction (gearing down) of the going train to facilitate winding. This is an operation that may require a force of up to 3kg on the mainspring, the brand highlights.

"We didn't get the fusée-chain system right the first time," reveals Scheufele. "We didn't have strong enough parts to resist the tension. We had to redo it two-to-three times to cope with the pressure and tension. We also realised the risk of overwinding and that explains the safety feature that is now incorporated into the winding mechanism."

The prototype of the Chronomètre Ferdinand Berthoud FB 1 which was worn and tested by Scheufele does not incorporate the overwinding safety feature. This means that he must exercise caution when winding the mainspring of this prototype.

Other key highlights of the Chronomètre Ferdinand Berthoud FB 1 are the tourbillon and the power reserve display. The power reserve indication is inspired by a mechanism made by British watchmaker George Daniels.

The tourbillon features a direct-drive seconds hand and its carriage completes one rotation every 60 seconds. What is interesting is the central seconds hand with its wheel linked to the tourbillon carriage.

The Chronomètre Ferdinand Berthoud FB 1 lives up to the "chronometer" designation in the purest sense as it is highly precise, having also been certified by the Swiss Official Chronometer Testing Institute or COSC.

"This is the first time a 'marine chronometer' featuring the tourbillon and fusée-and-chain system can be worn on the wrist. There are four patents for the movement and it is difficult to have a tourbillon fusée-and-chain system COSC-certified," notes Lapaire.

The requirement for accuracy in line with Ferdinand Berthoud's philosophy. "Ferdinand Berthoud's main occupation, especially later in his life, revolved around the precision aspect. He was always keen to improve.

Photo: © Chronométrie Ferdinand Berthoud SA

The tourbillon regulating organ features a direct-drive seconds hand and the variable inertia balance oscillates at the frequency of 3 Hertz. The tourbillon carriage makes a complete rotation once every minute.

The balance is made of copper beryllium (CuBe), a resistant copper-based alloy, and a self-compensating balance spring made of rust-free alloy with a terminal curve shaped by hand.

Made of 67 components, the titanium tourbillon carriage is secured by a bridge with a single arch and poised by means of two 18K gold studs.

The central seconds wheel has a common axis with the wheel driving the tourbillon carriage and a patent has been filed for this unique construction.

Photo: © Chronométrie Ferdinand Berthoud SA

The power reserve mechanism of the Chronomètre Ferdinand Berthoud FB 1 is directly linked to the barrel by a driving wheel. It uses the winding and unwinding motion of the mainspring which causes a truncated cone to move up and down an arbor secured to the main plate. A mobile arm with a roller jewel serves as a feeler-spindle to measure the motion of the cone and it transmits the power reserve level to the dedicated hand.

"Precision was therefore key. Chronométrie Ferdinand Berthoud's positioning is about having the highest levels of precision in watchmaking. This is our main message and every timepiece by Chronométrie Ferdinand Berthoud is chronometer-certified. In terms of quality, we actually surpass the minimum COSC standards. Our accuracy is now between plus and minus one second a day," says Scheufele.

Chronométrie Ferdinand Berthoud is described as a brand offering exceptional pieces and in a highly limited series. What does "exceptional" mean and how limited will its offerings be?

"As compared to Chopard L.U.C, Chronométrie Ferdinand Berthoud adopts a more out-of-the-box approach in terms of the way the movement is set up and designed. The tourbillon in FB 1 oscillates at 3 Hertz compared to either 4 or 8 Hertz for Chopard L.U.C. There is no cannibalisation as each has its own targets.

"We are offering a timepiece that is reminiscent of Ferdinand Berthoud's legacy which is really about the ship's chronometer movement that serves as an example for our first movement. Most importantly, it features the fusée-and-chain system, is related to the tourbillon and has columns [similar to Ferdinand Berthoud's constructions]. This is what we mean by 'exceptional'.

"Production will be in smaller series of 50 or less. Chronométrie Ferdinand Berthoud timepieces will be as rare as Ferdinand Berthoud chronometers made during the 18th century," says Scheufele.

The Chronomètre Ferdinand Berthoud FB 1 has an octagonal case, a shape inspired by the marine chronometers developed by Ferdinand Berthoud, particularly the gimbal suspension system.

"We wanted a contemporary design with a strong relation to the characteristics of a marine chronometer suspended in its case. For this reason, you find an inner tubular case held by a protective octagonal outer element reminiscent of the wooden box used for chronometers onboard ships.

"Most of the boxes were square-shaped but some had an octagonal shape. This way we obtained a very recognisable and strong design," says Scheufele.

Though Chronométrie Ferdinand Berthoud is a part of the Chopard Group, the brand states that the development, design and production of its watches stem from a separate, autonomous and dedicated creative process.

"There is sharing of component production [with Chopard Manufacture] such as the base plates," says Scheufele. "However, research and development, and the assembly of movements are separate. We will have dedicated Ferdinand Berthoud showrooms and watch workshops."

Chronomètre Ferdinand Berthoud FB 1 is intended as a natural continuation of the work accomplished by three generations of master watchmakers: Ferdinand, Pierre-Louis and Charles-Auguste Berthoud, states the brand.

Photo: © Chronométrie Ferdinand Berthoud SA

Case back of the Chronomètre Ferdinand Berthoud FB 1

Photo: © Chronométrie Ferdinand Berthoud SA

Time is indicated with the offset lacquered sub-dial at 12 o'clock via the dagger-shaped hours and minute hands. The slim central sweep seconds hand is made of bronze and has a round counterweight that is typical of Ferdinand Berthoud regulators.

The aperture in the centre of the dial reveals the seconds wheel-and-pinion and the driving wheel of the tourbillon carriage where each turns in the opposite direction to one another.

The power reserve indicator at 9 o'clock features a curved triangular tip. Haut is for "high" while "Bas" is for low.

"We have sought to transpose what Ferdinand Berthoud might have created if he was alive today. The contemporary translation of his genius consists of drawing inspiration from the master horologist's most remarkable accomplishments in order to offer modern creations bearing reinterpreted distinctive features and evoking emblematic historical constructions," concludes Scheufele.

The Chronomètre Ferdinand Berthoud FB 1 not only pays tribute to a great horologist but marks a new age of discovery for the Chopard Group. T

References:

i. *Longitude* by Dava Sobel
ii. *The Marine Chronometer* by Rupert T. Gould
iii. *The Marine Chronometer: Its History and Development* by John Cronin
iv. *Ferdinand Berthoud: Horologist-mechanic by appointment to the King and the Navy* by Chronométrie Ferdinand Berthoud SA
v. TimeWerke Volume X, Parmigiani In House by Timmy Tan, pages 255 to 261
vi. *Illustrated Professional Dictionary of Horology I + II* by G.-A. Berner
vii. *The History of Clocks & Watches* by Eric Bruton

1777

Ferdinand Berthoud Marine Clock M.M. no. 6
Dated 1777
This marine chronometer features a movement with the constant-force module, a fusée-chain transmission system and a pillar-based construction

Note:
This marine chronometer was one of the main sources of inspiration that led to the Ferdinand Berthoud redux via the establishment of Chronométrie Ferdinand Berthoud.
Chopard L.U.C museum

The dial is made of brass and is silver-plated. The hours are displayed through an aperture between 9 and 10 o'clock using Roman numerals (I to XII), the sub-dial at 12 o'clock displays the minutes while the sub-dial between 2 and 3 o'clock is for the sweep seconds.

Photos: © Chronométrie Ferdinand Berthoud SA

Movement with full plate, powered by springs and chain with a constant force via a fusee with regulated power. Detent escapement. To minimise friction, each end of the balance staff is centred between three large wheels. The temperature compensation relies on a grate made of iron and brass bars. The movement is suspended by gimbals inside a walnut box.

FERDINAND BERTHOUD (1727 TO 1807)

Ferdinand Berthoud was born on 18 March 1727 in Plancemont at Val-de-Travers, located in the canton of Neuchâtel in Switzerland, and he came from a family of clockmakers.

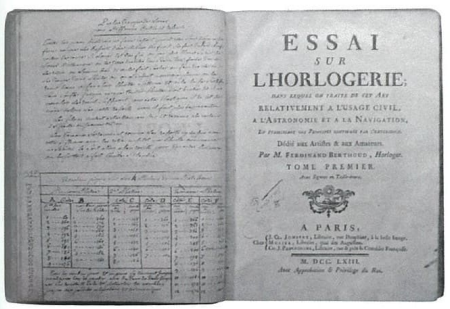
In 1745, the 18-year-old Berthoud was sent to Paris to study clockmaking. He thereafter spent most of his working life in France.

In 1753 and at the age of 26, Berthoud was given the title of "Master Clockmaker" by a decree of King Louis XV's council awards. With his *maître* title, Berthoud was allowed to open a workshop in Rue de Harlay, near Place Dauphine.

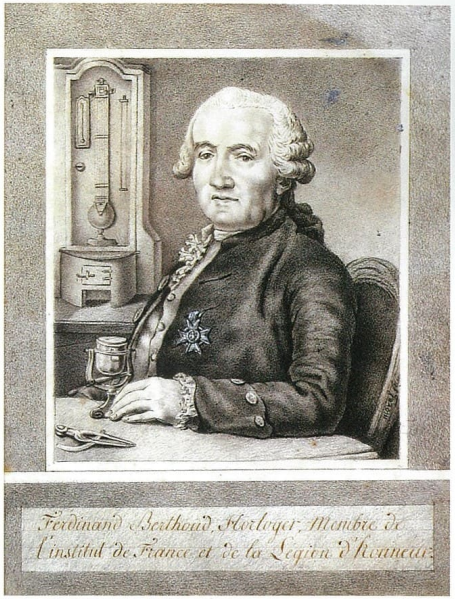
Berthoud's first marine clock project was an invention that he submitted to the French Royal Academy of Science in 1754. Included in his submissions were equation systems, including a longcase equation clock with concentric seconds marking the months and days of the month and leap years which could run for 13 months without being wound, and "a watch with seconds and equation, marking the months and days".

His first *horloge marine* (marine clock) was said to be completed in 1763, the same year his *L'Essai sur l'horlogerie; dans lequel on traite de cet Art relativement à l'usage civil, à l'Astronmie et à la Navigation* (An Essay on Horology; in which we deal with this Art in relation to its civil application, to Astronomy and to Navigation) was published, and the mechanism is mentioned in the publication. Berthoud's first marine clock is said to be kept in the Conservatoire des Arts de Métiers.

Berthoud was elected to the Royal Society in London as an associate overseas member in 1764 because of his creations and watchmaking publications.


ESSAI
SUR
L'HORLOGERIE,
RELATIVEMENT A L'USAGE CIVIL,
A L'ASTRONOMIE ET A LA NAVIGATION,
Par M. FERDINAND BERTHOUD, Horloger.
TOME PREMIER.
A PARIS,

Ferdinand Berthoud's *An Essay on Horology, in which we deal with this Art in relation to its civil application, to Astronomy and to Navigation* was published in 1763.



Photos: © Chronométrie Ferdinand Berthoud SA

Ferdinand Berthoud (1727 to 1807), master watchmaker, scientist and author

In May 1766, Berthoud suggested the construction of two marine clocks. César Gabriel de Choiseul, duc de Praslin, Secretary of State for the French Navy, was the authority commissioning Berthoud to construct marine chronometers No. 6 and No. 8 for the French King.

In 1768, these two marine chronometers underwent an 18-month sea trial onboard the corvette L'Isis which travelled from Rochefort to Santo Domingo. The No. 8 was able to determine the boat's position on the map and calculate longitude within half a degree, aided by astronomical observations.

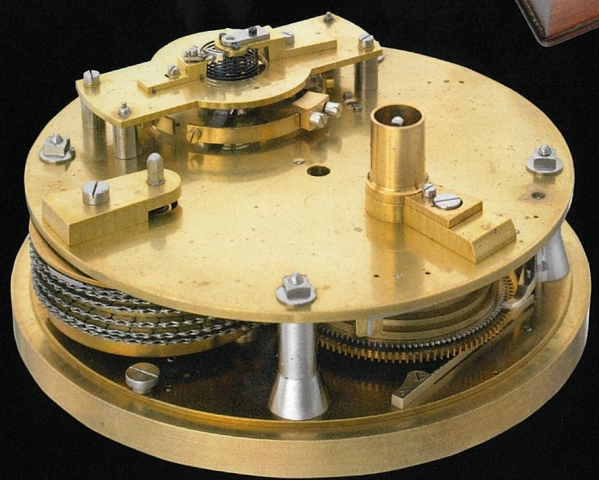
The marine chronometers No. 6 and No. 8 proved to be successful and on 1 April 1770, Berthoud was awarded the certificate *Brevet d'horloger Mechanicien du Roi et de la Marine ayant l'inspection de la construction des Horloges marines* (Watchmaker and Mechanic to the King and Navy with construction and inspection of marine clocks).

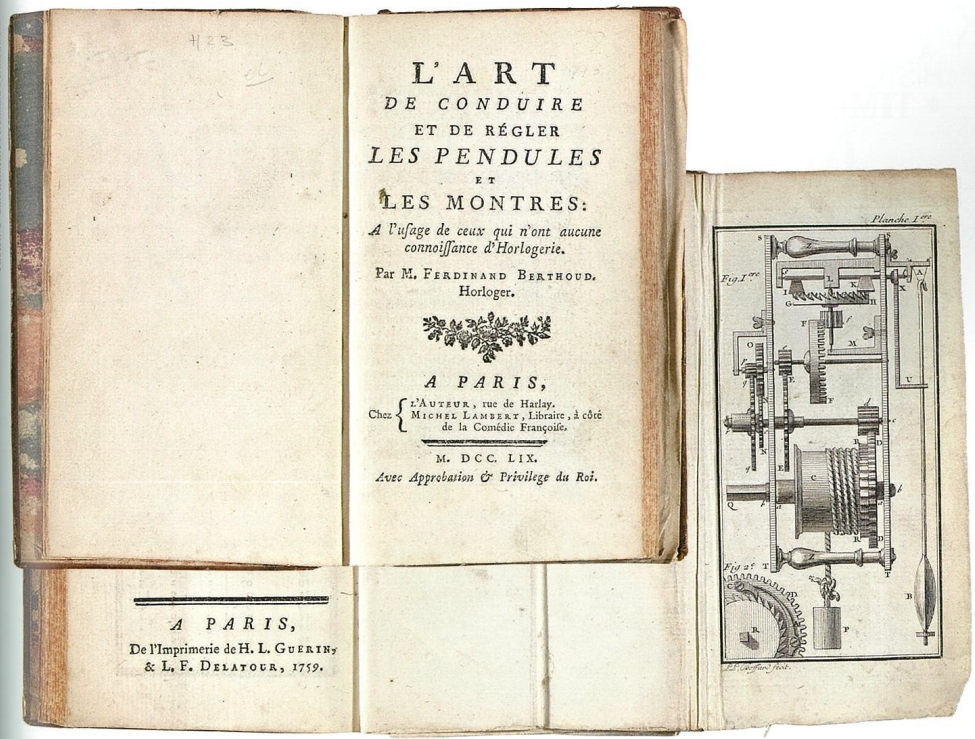
He then takes royal command of 20 marine chronometers for the French Admiralty and its numerous charting and marine surveys conducted in the late 18th century.

On 17 July 1804, French Emperor Napoleon Bonaparte (1769 to 1821) made Berthoud a Knight of the Legion of Honour as a member of Institut de France.

1850

Ferdinand Berthoud marine chronometer
Made in 1850
Chopard L.U.CEUM museum





L'ART
DE CONDUIRE
ET DE RÉGLER
LES PENDULES
ET
LES MONTRES:
A l'usage de ceux qui n'ont aucune connoissance d'Horlogerie.
Par M. FERDINAND BERTHOUD.
Horloger.

A PARIS,
Chez { L'AUTEUR, rue de Harlay. MICHEL LAMBERT, Libraire, à côté de la Comédie Françoise.
M. DCC. LIX.
Avec Approbation & Privilege du Roi.

A PARIS,
De l'Imprimerie de H. L. GUERIN, & L. F. DELATOUR, 1759.

The art of operating and adjusting clocks and watches. To be used by those with no knowledge of watchmaking by Ferdinand Berthoud published in 1759.

Berthoud passed away in June 1807 at 80 years of age in Groslay, Montmorency, France.

His nephews, Pierre-Louis Berthoud (1754 to 1813) and Charles-Auguste Berthoud (1798 to 1876) continued the family's chronometer business.

Louis Berthoud is said to have made more than 150 chronometers over a period of 27 years based on his uncle's later machines.

Berthoud is described as a "most voluminous author on horology", having written:

i. Reference papers for the *Encyclopédie méthodique* in 1755 which were edited by Diderot (1713 to 1784) and Alembert (1717 to 1783);
ii. *L'Art de conduire et de régler les pendules et les montres. Al'usage de ceux qui n'ont aucune connaissance d'horlogerie* (The art of operating and adjusting clocks and watches. To be used by those with no knowledge of watchmaking) published in 1759;
iii. the two-volume horological treatise *L'Essai sur l'horlogerie; dans lequel on traite de cet Art relativement à l'usage civil, à l'Astronmie et à la Navigation* (An Essay on Horology; in which we deal with this Art in relation to its civil application, to Astronomy and to Navigation) in 1763;
iv. *Histoire de la mesure du temps par les horloges* (A history of time measurement by clocks) which was published in 1802, a major piece of work that clearly demonstrates his vast knowledge of mechanics in horology; and
v. *Supplément au Traité des montres a Longitudes*, published in 1807.

In his lifetime, Berthoud produced more than 70 marine chronometers. John Cronin highlights that: "Constantly experimenting and improving his designs, his later machines differ very little from what became the standard nineteenth-century marine chronometers.

Though he spent most of his working life in France, Berthoud, notes Rupert T. Gould in the book, *The Marine Chronometer*, states that, "… he is justly regarded in his native land as one of the greatest of all the Swiss horologists who have done so much to advance both the science of horology and the prosperity of their country." T

References:
i. *Longitude* by Dava Sobel
ii. *The Marine Chronometer* by Rupert T. Gould
iii. *The Marine Chronometer: Its History and Development* by John Cronin
iv. *Ferdinand Berthoud: Horologist-mechanic by appointment to the King and the Navy* by Chronométrie Ferdinand Berthoud SA