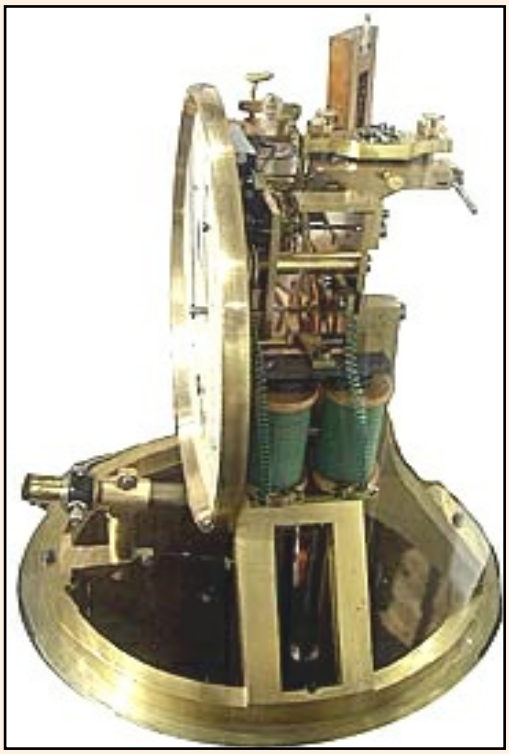
THE WILLIAM SCOLNIK COLLECTION OF PRECISION ELECTROMECHANICAL CLOCKS

RIEFLER ASTRONOMICAL CLOCK No. 147

S. Riefler No. 147 - Munchen 1905



Below is a copy from the Riefler archives showing the entry for Riefler No. 147. The entry indicates that the housing is glass and Pendulum # 727 type J(1) was supplied with the clock.

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RIEFLER ASTRONOMICAL CLOCK No. 147

From the beginning of the 20th Century, Riefler Clocks were the de facto precision timekeepers used in Astronomical Observatories as well as the central time service installations frequently used as the Primary National Standard Timekeeper in many countries. The stated precision for the Type D clock was 10 milliseconds per day although better rates were frequently achieved. Riefler made a total of 779 recorded clock of every type by the time manufacture ceased in 1965. Of this number fewer than 15% were in glass cylinders and very few of them survived to this day. They ceased to supply clocks in glass by 1915 and are extremely rare.

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Riefler Astronomical Precision Regulator #147 has an interesting history and has only changed hands twice. It was originally acquired by the Weston Electrical Instrument Company directly from Clemens Riefler in 1907. The Weston Electrical Instrument Company was founded in 1888 and became one of the larger firms making precision electrical instruments. By 1909 they were one of the largest manufacturers in New Jersey and were located in Newark. When the clock was purchased it was originally installed in a tenperature controlled chamber which was magnetically shielded. It was used to transmit highly accurate seconds impulses for the control of the factory generator speed

(Left) A photograph of the Riefler Type D from an early catalog.
.(Below) A Riefler Catalog from Ca. 1915 showing the Type D on the cover in a copper cylinder.

(Above) A detail showing the microscope for the adjustment of the pendulum amplitude.

(Left) The original vacuum pump used with Riefler #147 to reduce the effect of barometric pressure and to make adjustments to the rate.

used in the calibration and standardization of frequency meters. The clock was actually selected by Professor A.F. Ganz of the Stevens Instutite Hoboken, NJ who was commissioned by Dr. Weston to visit Riefler directly. Since at that tine, it was the most accurate clock made, Professor Ganz selected the type with electric drive and Invar pendulum with a stated rate of less than 30 milliseconds per day.

I acquired this clock aproximately 32 years ago It is in fine original condition with the original pendulum and original vacuum pump. It is complete with the original stick barometer and original thermometer. It is currently running and keeps an excellent rate. According the the original Riefler archive records, the pendulum supplied with the clock was type J(1) fitted with a weight pan, adjustment scale for the microscope and micrometer bob height adjustment. At the time, no finer or more accurate clock could be purchased.

The clock is complete with a copy of the Riefler setup instructions and an original price list.

14” diameter, 55” high

ENGLISH SHORTT FREE PENDULUM CLOCK No. 47

The clock is complete with a copy of the setup instructions and a copy of the Synchronome catalog describing the clock.

Free Pendulum: 9 1/2" diameter, 51" high
Slave: 13 1/2" wude, 55" high. 9" deep

The English Shorttt clocks were legendary for their ability to keep precision time. Up until the time the Shortt-Synchronome clock was perfected, Riefler clocks were considered to be the most accurate timekeepers made.

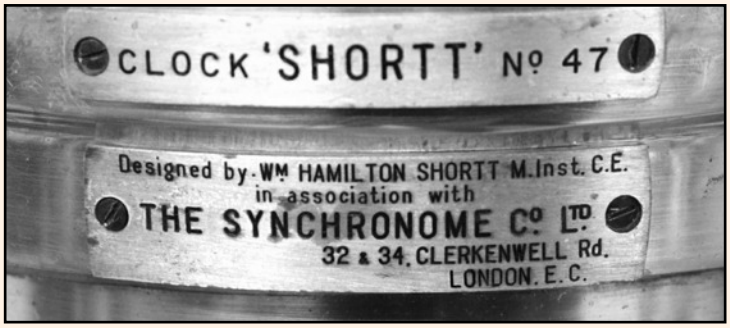
The Shortt-Synchronome free pendulum clock was a complex precision electromechanical pendulum clock invented in 1921 by British railway engineer William Hamilton Shortt in collaboration with horologist Frank Hope-Jones, and manufactured by the Synchronome Co., Ltd. of London, UK. They were the most accurate pendulum clocks ever commercially produced, and became the highest standard for timekeeping between the 1920s and the 1940s when mechanical clocks were superseded by quartz time standards. They were used worldwide in astronomical observatories, naval observatories, in scientific research, and as a primary standard for national time dissemination services. The Shortt was the first clock to be a more accurate timekeeper than the Earth itself; it was used in 1926 to detect tiny seasonal changes (nutation) in the Earth's rotation rate. Shortt clocks achieved accuracy of around a second per year. About 100 were produced between 1922 and 1956.

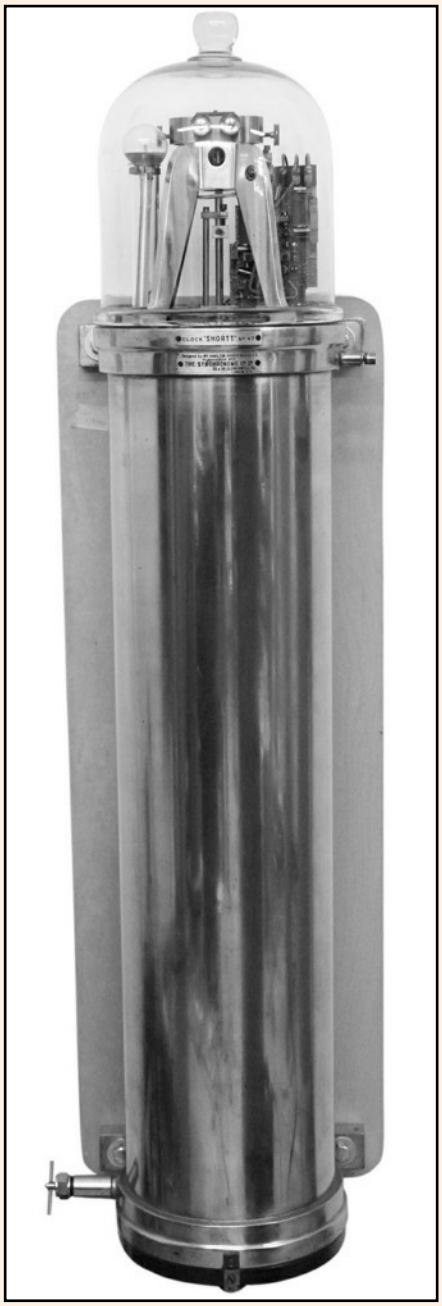
Shortt clocks kept time with two pendulums, a master pendulum swinging in a vacuum tank and a slave pendulum in a separate clock, which was synchronized to the master by an electric circuit and electromagnets. The slave pendulum was attached to the timekeeping mechanisms of the clock, leaving the master pendulum virtually free of external disturbances. (1)

Of the 100 Shortt Clocks produced by the Synchronome Company, 7 clocks were shipped to Russia for use in various scientific and astronomical observatories. Shortt No. 47 was shipped to the Gaish Observatory probably in the late 1930's.. I acquired this clock directly from the observatory in the late 90's and did minor restoration to bring it to operationg condition. The clock is in excellent original condition. Today original Shortt clocks are quite rare in operating condition and there are not many in private hands.

After WW2 began, it was no longer possible for the Russians to acquire English Shortt Clocks.

ENGLISH SHORTT FREE PENDULUM CLOCK No. 47



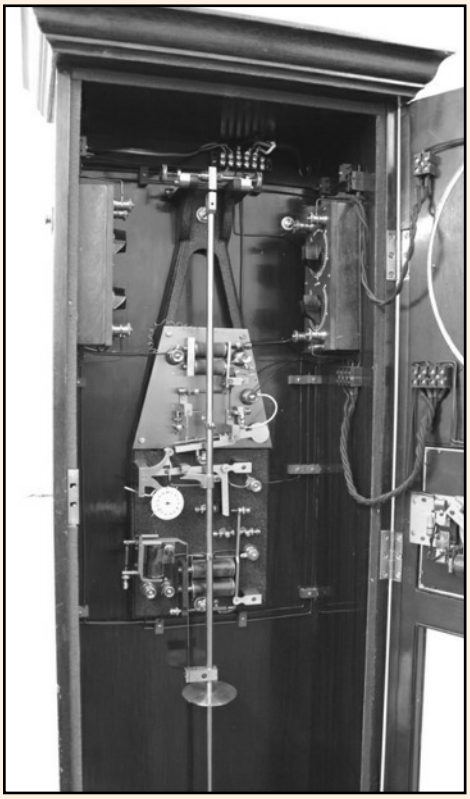


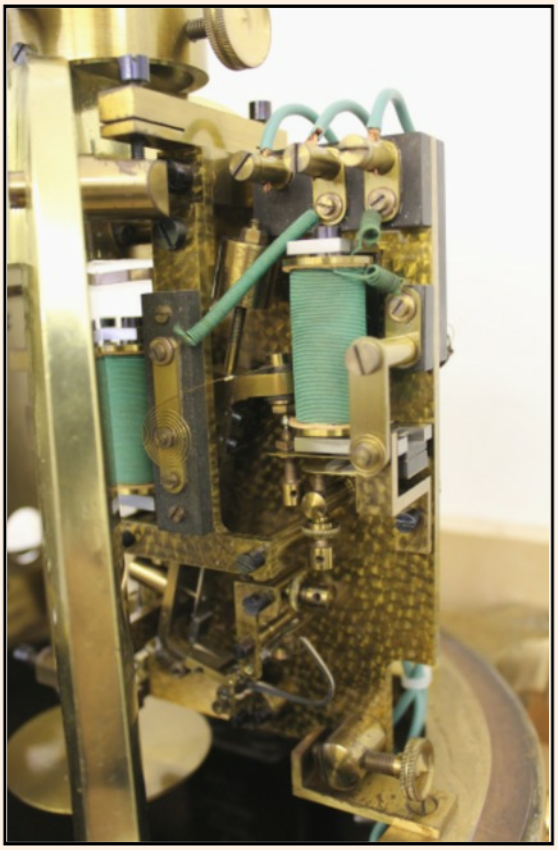
(Far Left) The Type A slave of the Shortt Clock. The main dial indicates the mean time or sidereal time depending upon the setup of the clock and the two smaller dials below the main dial indicate the free pendulum time and the slave time. The Type A slave contains the special synchronizer circuit which keeps the slave clock in synchronization with the Free Pendulum (Shown on the right). The Type A clock also contains the Synchronome seconds switch and also transmits seconds impulses as well as half minute impulses.

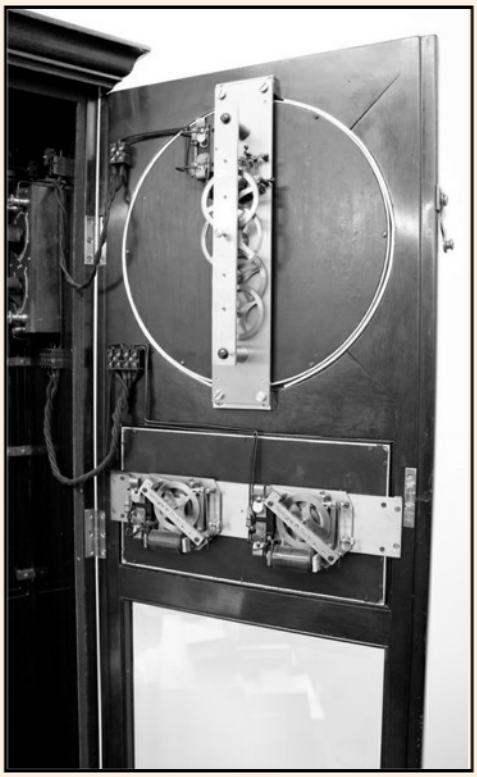
The Free Pendulum contained in a vacuum chamber maintains its motion without an escapement in the traditional sense. The pendulum is impelled by the fall of the synchronome switch and the release of this arm is affected by the slave clock kept in phase synchronism with it. This system of feedback is extremely clever.

The pendulum rod of the Master Clock is made of Invar and is provided with a weight tray for exact regulation. There is a beat scale at the bottom of the pendulum which is observed through the glass bottom of the copper tank by means of a mirror and microscope.

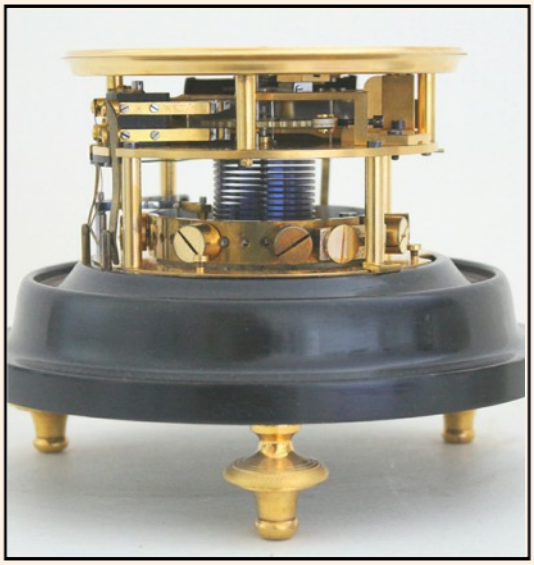
ENGLISH SHORTT FREE PENDULUM CLOCK No. 47







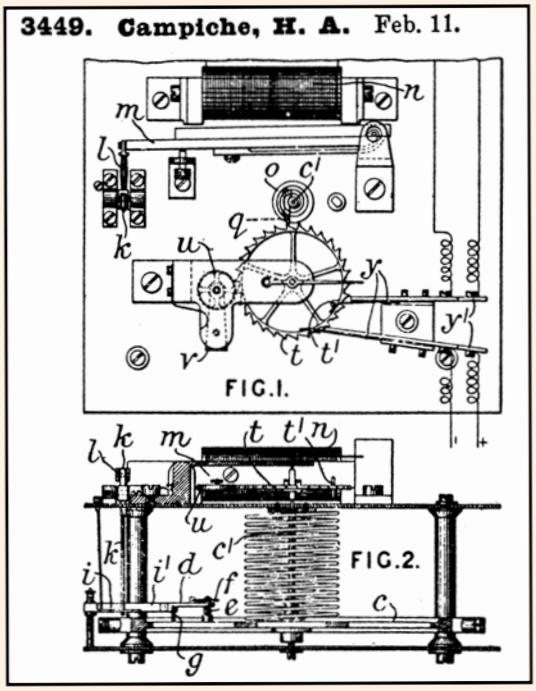
RARE H.A. CAMPICHE ELECTRICALLY IMPULSED DISTRIBUTING CHRONOMETER No. 2



Patented in 1904 by H.A. Campiche, precision electric timekeepers of this type are rare for the period. The silvered dial is engraved *Distributing Electric Chronometer No.2.* The movement is of full plate construction in several tiers. The blued balance spring with terminal curve is of the helical type and the bimetallic compensated balance wheel is exceptionally large. There is a large solenoid coil that is mounted between the plates which attracts a pivoted armature when it is energized. The armature operates a system of levers to give impulse to the large balance through a brass piece attached to the balance. Mounted on the end of the balance staff, a disc with a spring loaded pallet gathers the teeth of a wheel which carries the seconds hand and turns once a minute. This wheel also carries a metal pin arranged to brush a pair of contacts at the appropriate moment which energizes the coil. Another set of contacts can be used to operate a slave dial.

Campiche made a very small number of chronometers of this type, probably fewer than 10. There are currently 3 that are known to exist all with serial numbers less than 8.

7 1/2” diameter, 10” high



A copy of the 1904 Campiche Patent

FEDCHENKO ASTRONOMICAL PRECISION CLOCK No 10

12” diameter, 69” high

The Development of Fedchenko’s Clock

In 1948, Feodosii Mikhailovich Fedchenko, working in the Time Laboratory of the Kharkov State Institute of Measures and Measuring Instruments started investigating methods of making an isochronous pendulum. In order to obtain isochronous oscillations of a free pendulum, F.M. Fedchenko in 1952 designed, built and developed an isochronous suspension. At the Kharkov Institute during 1954, Fedchenko designed and built an astronomical pendulum clock of a new design, the AChF-1. In 1956, the investigation of AChF-1 and its improvements were transferred to the All Union Scientific Research Institute of Physicotechnical and Radiotechnical Measurements.

The AChF-2 clock was built in 1952 and finally the last development of the clock, the AChF-3 was built in 1958. It has a precision in relative units of 2-3x10(-9) which was in the range of precision of quartz clocks. The clocks were manufactured and tested at the Research Institute. (1)

The “secret” of the clock was in its special type of pendulum suspension which F.M. Fedchenko designed and discovered as a result of a serendipitous mistake in his experiments..

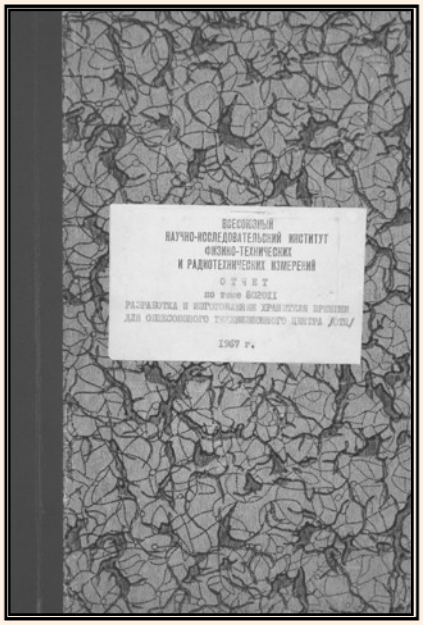
The Fedchenko clock was the last and most accurate clock in a line extending from Riefler, through Shortt and to the final development in precision pendulum clocks, the Fedchenko. The Fedchenko was almost unknown outside of Russia. It was Dr. George Feinstein who, to the best of my knowledge, became aware of the existence of the Fedchenko clocks although there were none outside of Russia at the time.

(1) F.M. Fedchenko and his Pendulum Astronomical Clocks by Dr. G Feinstein. NAWCC Bulletin, April 1995

FEDCHENKO ASTRONOMICAL PRECISION CLOCK No 10

The Fedchenko Astronomical Precision Clocks were literally unknown outside of Russia. Sometime in 1996, I received a phone call from a friend Dr. Jerry Walker. He had a telephone call from a Russian contact offering him several "clocks of high precision", one of them being a Fedchenko. He subsequently telephoned me and after considerable negotiation, I managed to purchase the very first Fedchenko clock to come to the United States. There was a great deal of difficulty in shipping the clock so I arranged to have it driven through Poland to Germany where a good friend took possession and had it shipped to me. When I received the clock, it was in excellent condition with the exception of the unusual pendulum drive system. Fortunately, my engineering background enabled me to restore it to it's original condition and now I had the first operating Fedchenko clock in the US. To my knowledge, it was the first of its type to leave the Soviet Union.

There were very few Fedchenko clocks made, probably fewer than 30. This clock came from a Scientific Observatory in the Ukraine where it had not been used for many years. Fortuitously, it was mounted in a secure room in the basement so it remained undamaged. There is speculation that the first dozen or so were produced under the direct supervision of Fedchenko himself.



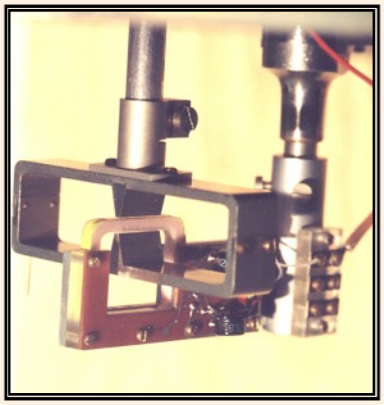
The clock is complete with the astronomical slave unit which is in itself unusual. The astro-dial is the only Fedchenko slave I've seen with one, most slave dials having a more modern simple look.

There is also an original Fedchenko Clock manual which is signed in several places by Fedchenko himself. And is entitled "Development and Manufacture of Master Timekeeper for (OTTs)".The manual is bound, typewritten and signed. With board covers.

The clock has it's original adjustable amplitude microscope as well as the original battery container (the clock was originally battery operated). The battery could run the clock for a number of years it operated so efficiently.

In addition, It comes with a Wallace and Tiernan Precision Mercurial Manometer Type FA-173 so that the vacuum in the clock tank can be adjusted very accurately. The Manometer can be seen mounted to the right of the clock.

In 1999, Philip Woodward wrote a series of articles in the BHI Horological Journal based upon data which I provided him from this clock. The articles were later incorporated in a book of Woodward's articles on Time published by Bill Taylor and the British Horological Institute.



The very clever pendulum impulse mechanism. You can see the double wound coil and the exotic material double magnets attached below the pendulum bob.

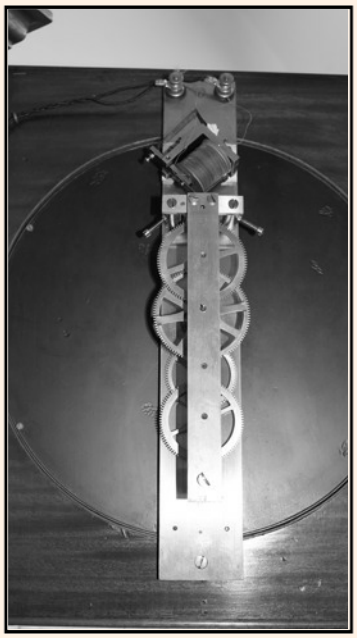
SHORTT OBSERVATORY ELECTRIC REGULATOR

Starting around 1911, William Hamilton Shortt began a series of experiments in an attempt to make a very precise clock by impulsing the pendulum from below. He called this an Inertia Escapement and conducted his experiments in conjunction with the Synchronome Company. He published his escapement in the British Horological Journal in 1912. In this escapement, the pendulum was given impulse from below every second. The Synchronome Company produced approximately 12 of these clocks with Shortt's Inertia Escapement but they proved to be somewhat disappointing in that they never excelled the performance of the standard Synchronome clocks and no more were manufactured. The clocks themselves are extremely rare being of a more or less experimental nature (although, according to Hope-Jones, a dozen were manufactured and tried on "responsible" jobs).

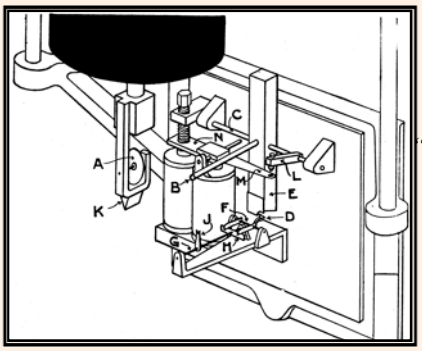
In the first editions of F. Hope-Jones book "Electric Clocks" he spends a good deal of time discussing the experiments and testing of this first Precision Regulator by W.H.Shortt and it's certainly interesting to note that in the following editions of "Electric Clocks" this Shortt Inertia Clock is not mentioned. Hope-Jones himself, who some would consider to be somewhat arrogant and officious, claims that "*It must not be thought that this period of experiment(with this escapement) and research yielded only negative results. It produced one real achievement, the disassociation of the impelling and switching function which introduced a time lag, not appreciated then, but destined to contribute to the solution of the problem of the Free Pendulum"* By this statement, Hope-Jones claims that he anticipated the development of the Shortt Free Pendulum.

There are to my knowledge, only two examples of this type of Shortt Clock known, this one and one in the Science Museum in London. I expect this is so because so few were actually made. In this example, the case is mahogany with a beveled glass door and twin brass latches. The silvered regulator dial is signed *Synchronome Electric* in the seconds ring and *London* within the hour ring. The hands are blued steel. The Invar pendulum is suspended from a massive bracket with a substantial steel suspension spring. The beat scale is of bone and fixed to a brass bar suspended by two vertical steel bars. There are two mahogany cased slave dials included with the clock both with regulator type dials and both signed as above. The dial movement in the clock is stamped with the number 12. The construction of the dial movements is straight line and quite unusual.

The regulator slave dial. There are two of these that are part of the clock..



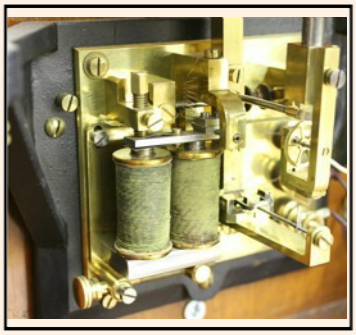
The straight line movement used in the clock and also both of the slave clocks. It is impuklsed by means of the electromagnet at the top. It actually requires a very small amount of power to impulse.



A drawing from the F. Hope-Jones book "Electric Clocks", First Edition showing the operation of the Shortt Inertia Escapement

SHORTT OBSERVATORY ELECTRIC REGULATOR

13” wide, 55” high, 7” deep

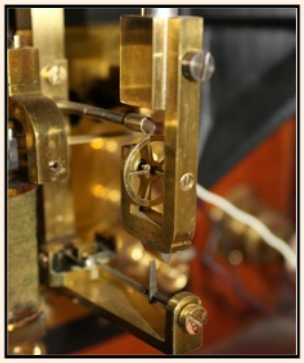


A closeup of the Shortt Inertia Escapement. The iimpulse arm amd impulse wheel can be clearly seen. The two solenoids on the left were used to reset the impulse mechanism after the pendulum had passed.

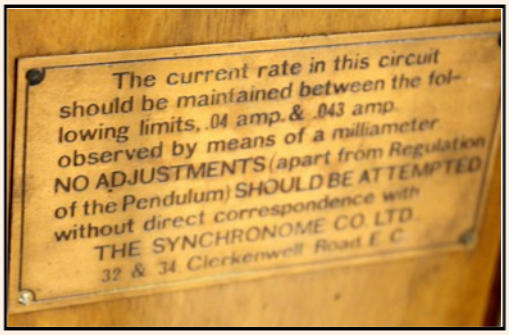
A view of the clock showing the relationship of the pendulum to the Inertia Escapement.

As the pendulum passes dead center a small arm drops on the freewheeling impulse wheel.

A closeup showing the relationship between the impulse wheel which is attached to the bottom of the pendulum rod and thethe arm that drops on the wheel as the pendulum passes.



This plaque is attached to the clock back board

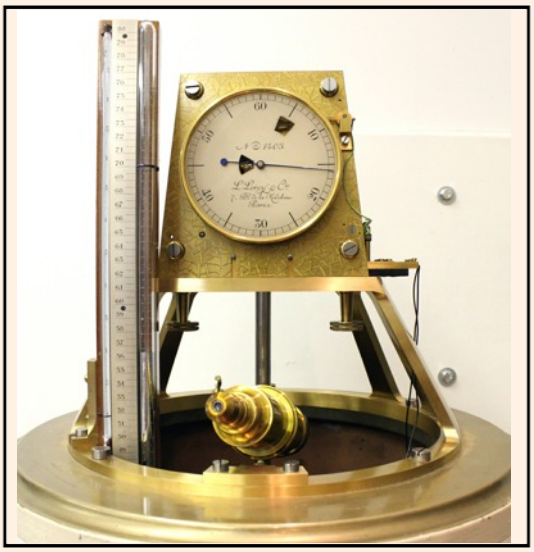


RARE LEROY CONSTANT PRESSURE OBSERVATORY PRECISION REGULATOR No. 1403

"Pendule a pression constant"

12" diameter, 58" high

I acquired this clock 12 years ago but because I lacked the necessary room to hang it, it remained in it's original, very large shipping crate until only last week. Had I known how absolutely unique and interesting this Leroy clock was, I certainly would have made room to install it and enjoy its unique and elegant mechanism. I sometimes reflect on collecting and collectors and I've concluded that in my case at least, anticipation is a very powerful part of acquiring something. I think in the case of this clock, I carried anticipation a bit too far by waiting so long to actually see it and enjoy it!



This clock was originally commissioned by an important American collector, the brother of Jonn Foster Dulles (the US Secretary of State under President Eisenhower) on January 27, 1930 with a deposit of 10,000 Francs requesting a *Pendule a Pression Constante* with a glass dome according to his own sketch. The account was settled on August 8, 1930 for a total price of 25,000 Francs. The regulator was delivered almost a year later on December 2, the same year at the Morgan Bank in Paris. The clock has only changed hands once since purchased having remained in the family until then.

.The firm of L. Leroy & Cie were specialists in the production of Constant Pressure Observatory accurate regulators, able to keep time with the highest precision. The Paris Observatory was

RARE LEROY CONSTANT PRESSURE OBSERVATORY PRECISION REGULATOR No. 1403

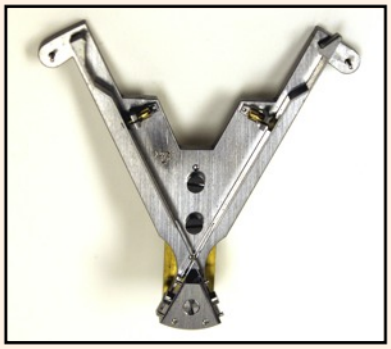
"Pendule a pression constant"

equipped with three clocks of this design mounted in the Catacombs beneath Paris at a depth of 26 meters. Electrical impulses were sent to the Service L'Heure to provide precise time and to service the time signals sent from the Eiffel Tower.

In order that the observatory clocks be as accurate as possible, they only show seconds, the reason being that Leroy felt it was important to eliminate the friction that adding the additional gears needed to drive the hour and minute hands produced.

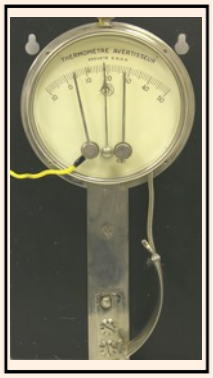
The observatory clocks are also unusual since they beat 61 times in 60 seconds. By doing this, it was possible to set the clocks more accurately using audible time signals. This is a kind of vernier system which was actually used for the first time by Earnshaw, enabling him to set the rate of his chronometers very quickly - something his competitors were never able to do.

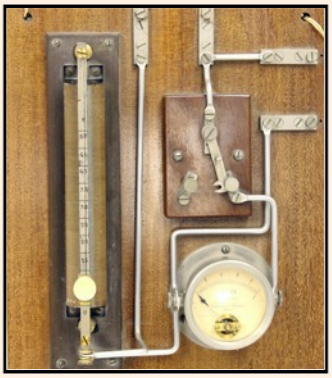
The clock movement has beautifully damascened plates with a matte silver dial. The two dial observation apertures show the remontoire action and the 'scape wheel. The clock uses a specially adapted Reid type escapement which acts on the pendulum directly. The pendulum is Invar as is the pendulum rod. There is a calibrated vernier below the pendulum bob to make adjustments. The clock is fitted with an exquisite thermometer/barometer within the tank. A double contact is activated by the pendulum and both circuits are closed momentarily with each oscillation except on the 61st swing when they are bypassed in order to mark the minute.

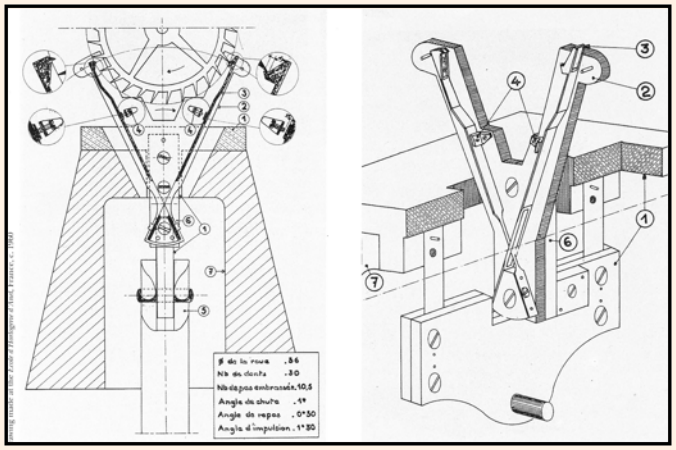


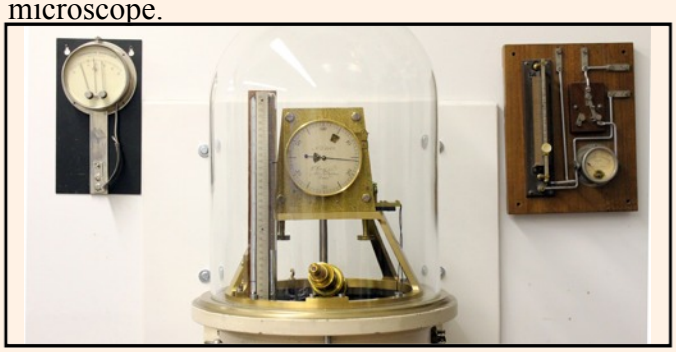
The special pallet arrangement of the Reid Escapement

Supplied with the clock is the original voltage control panel as well as the original large temperature controlling thermometer. It is most unusual to find original accessories of this type still with the clock. The clock is in excellent original condition, complete with the original amplitude microscope.









RUSSIAN "ETALON" SHORTT TYPE OBSERVATORY CLOCK No. 6

Tank containing the free pendulum

The slave clock with synchronizing device used with the free penudlum

The history of the Etalon Factory Shortt type observatory clocks is an interesting one. Initially, the Russians imported several English Shortt clocks to be used in their scientific labratories and observatories. After studying the Shortt Free Pendulum system, they decided that they could improve upon the system and in 1934 at the All-Union Scientific Research Institute of Metrology (VNIIM) I.I. Kvarnberg with the participation of Professor N. Kh. Preipich started work on producing their own high precision pendulum astronomical clock aimed at raising still furthur the precision of timekeeping. Two years later, the Etalon factory (in 1936) made and started testing the first models of the clock developed by Kvarnberg and Preipich with a free and synchronized working pendulum. The Second World War however, prevented successful completion of the work which was then interrupted. Work on the clock was resumed after the end of the war. At the end of the research in 1952 and the improvement of this clock, the diurnal variation of its movement - according to the factory records was only 1 msec per day. This would have amounted to about 1/3 of a second per year which at the time for a pendulum clock was quite

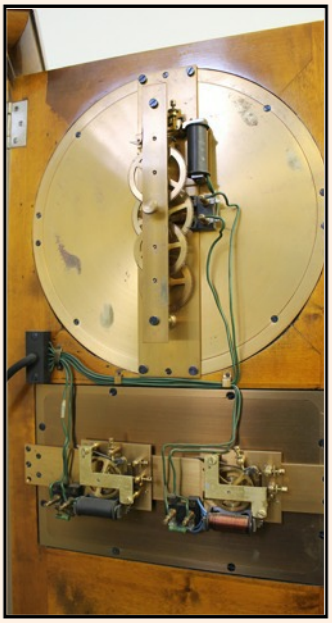
RUSSIAN "ETALON" SHORTT TYPE OBSERVATORY CLOCK No. 6

amazing. The existence of the Russion "Etalon" Shortt style clocks was literally unknown outside of Russia just as the Fedchenko clocks were also virtually unknown. I believe that the reason for this was that precision pendulum clocks were rapidly being supplanted by crystal clocks which were being used as time standards and frequency standards here in the United States for many years by that time. Certainly in this respect, Russia was well behind the rest of the world. The crystal clock was really not well developed in Russia until 1948, many years after their use in most modernized western countries. As a result of this, the interest in precision pendulum clocks, particularly outside of Russia, waned and as the years past were completely supplanted by more accurate electronic standards.

Very few Etalon Shortt clocks were produced and there is no one that seems to know exactly how many. I personally think that fewer than 30 or so were made and that most were destroyed in the Second World War. I only know of 4 Etalon Shortt clocks outside of Russia, two here in the US, one in England and one in Germany. It's possible that one or two others are extant but they are exceedingly rare.

This one is Ne. 6 and was probably made under the direct supervision of I.I. Kvarnberg. It's in excellent original condition and comparing the "Etalon" Shortt and the English Shortt side by side really makes an interesting exercise. The Russian Etalon Shortt is far more robust and has some interesting improvements which include jewelling in the free pendulum movement and a slightly different way of applying impulse to the free pendulum. The finish of the movements is better and the movements themselves are heavier and sturdier than the English Shortt clocks. The large slave clock is most attractive and made of fruitwood. It is quite heavy and exceedingly well made. There is an unusual double door arrangelment and all of the wiring is concealed under a false back as opposed to the English Shortt which uses surface wiring on the backboard. From many points of view, the "Etalon" Shortt - even though it was inspired by the English Shortt - is in many respects a better version. Being able to make the side by side comparison shows this clearly.

I believe that this was the first Etalon Shortt clock to leave Russia.



(Above left) The slave clock movement beautifully finished
(Above right) The dial movements in the door of No.6

(Above) The identification label which appears on both the free pendulum and inside the slave.

Free Pendulum: 9" diameter, 51" high
Slave: 14" wide, 55" high, 9" deep

UNUSUAL PRECISION TANK REGULATOR BY GODMAN

11” Diameter, 55” high

High precision regulator clocks that are designed to run in a vacuum are in themselves quite rare because of the additional cost and complications required in designing, making and maintaining an appropriate enclosure. For truly high precision clocks, running in a vacuum has a number of particular advantages that contribute to the timepiece’s ability to achieve its excellent rate. One of the primary and most obvious reason is that the variations in atmospheric (barometric) pressure are completely alleviated and there are advantages with regard fluctuations in temperature also. In addition, rate can be carefully adjusted by changing the amount of pressure in the vessel containing the clock permitting very fine rate adjustments.

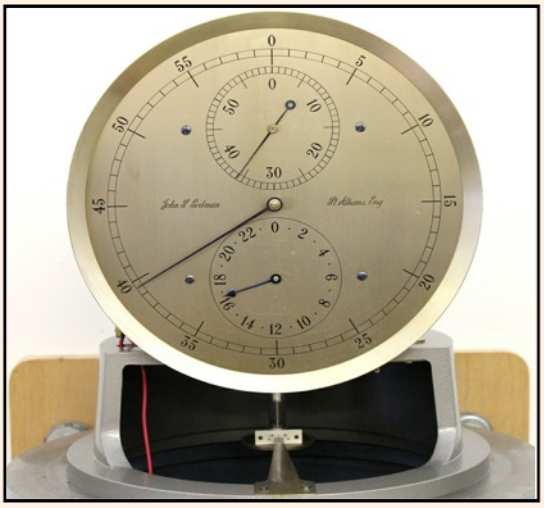
This particular Precision Regulator was made by John S. Godman of St. Albans most likely in the late 60’s or early 70’s while he was working for Mercers. It’s contained in a grey steel cylinder with a round glass dome covering the dial and mechanism. The movement itself is a variation of Riefler’s double wheel escapement with his improvements in which impulse is given through the suspension spring. Riefler’s rementoire weight drive in which an arm is lifted by an electric solenoid periodically resets a rectangular weight which supplies power to the train. The brass bob pendulum has an invar pendulum rod and is a copy of the Riefler Type K Pendulum with micrometer adjustment at the bottom.

There are very few clocks by John Godman known to exist. I know of three others, one with standard Graham Dead Beat escapement and two with Riefler’s Escapement in wooden cases. The Riefler type is in the British Museum in London. It is my understanding that this Precision Tank Regulator was used as the factory timepiece in the Mercer chronometer manufacturing facility for a number of years where John S. Godman worked for his entire career along with his brother Bill Godman. It appears to be the only tank regulator he ever produced. And is in excellent condition.

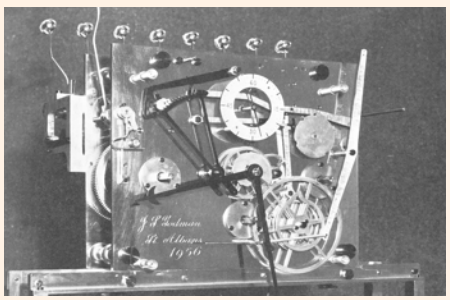
John S. Godman came from a long line of clockmakers established in St Albans since

UNUSUAL PRECISION TANK REGULATOR BY GODMAN

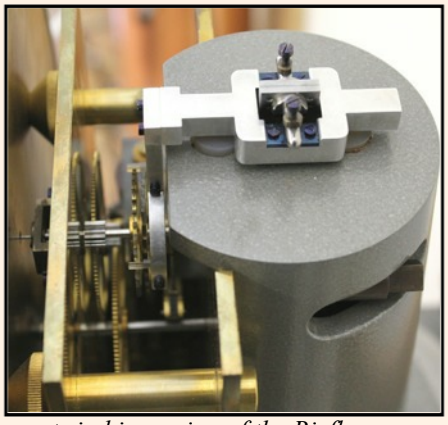
at least 1553. John S. Godman's Grandfather was an organist, tithe collector and maintained all of the church clocks in St. Albans. He was a good friend of Lord Grimthorpe. He made the Abbey Chimes for Lord Grimthorpe and it is certain that he perfected Grimthorpe's three legged gravity escapement. He died in 1909 at age 79. His cousin, also named John worked for Thomas Mercer and when Thomas Mercer died, Frank Mercer immediately took him into his employ. In 1913, John was instrumental in moving the Mercer factory to it's new home. He designed and built many of the machines used in the manufacture of various parts of the Mercer Chronometer and was known as a clever, ingenious engineer



John died during the war but had two great nephews, John S. Godman and Bill Godman. John S. started his career at Mercers and later become responsible for the machine shop. On retiring, he set up his own machine shop where he made a number of very fine clocks including a chiming regulator with perpetual calendar and several copies of the Mercer-Cottingham Observatory Regulator. John S. Godman died in 1973.



Detail of a striking regulator with perpetual calendar made by John S. Godman in 1956. It is an exceptional piece of work



A detail of the movement showing the swinging suspension holder and pallet arrangement The Riefler style double wheel escapement can also be seen here Godman introduced a number of improvements in his version of the Riefler escapement. One of the more interesting ones was his use of aluminum to make the suspension holder and pallet arms. By doing this, he reduced the effects of inertia on the escapement considerably making the impulse to the spring more efficient.. He also used knife edges and sapphire plates for the suspension holder.

(left) The solenoid that sets the winding rementoire.

(right) A view of the double wheel escapement

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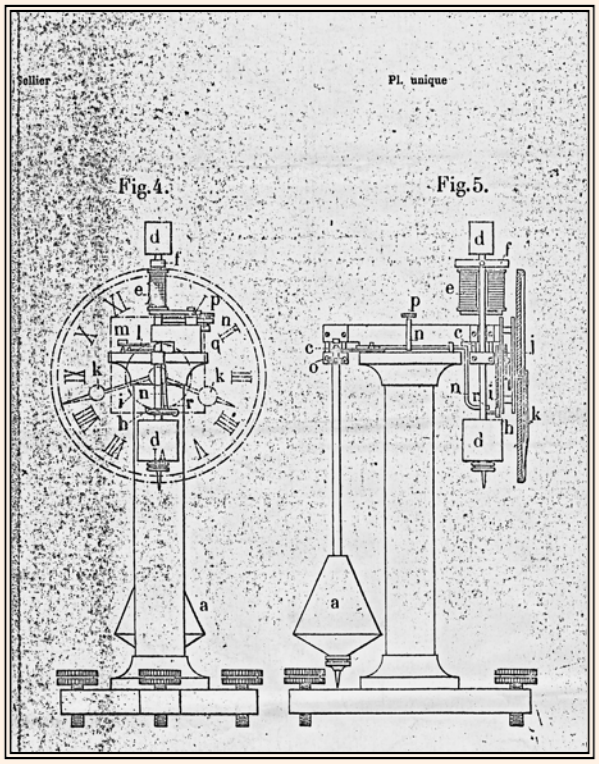
SELLIER PATENT DOUBLE PENDULUM HIGH PRECISION CLOCK

In January, 1909 Pierre Sellier of Loriet, France patented an exceedingly interesting Constant Force Escapement, Free Pendulum clock which utilized two pendulums on a single movement, It appears that only one example was built as attempts to manufacture it failed. This is the only example of the clock that is known. The French Patent No. 398809 is listed under the heading "Precision Instruments, Electricity, Clocks".

According to Henry Belmont(1) in a letter dated October 1972, I think that this is a single experimental model, constructed by a French inventor, who has attempted, without success, to interest an American Manufacturer. - The idea was very interesting because it consisted of making a very high precision clock by the association of a relatively free regulator pendulum and a "slave " clock mechanism which operates the hands. The principle implemented is similar to the Shortt-Synchronome astronomical clock".

The operation is very interesting. The large trapezoidal bob in the rear of the clock is actually the free pendulum. A small hardened steel piece protrudes from the pendulum rod at the point of suspension. The compound bob which is just behind the dial, is electromagnetically impulsed and regulated by the free pendulum itself. As the compound pendulum oscillates, it drops a small weight on the arm protruding from the free pendulum giving it impulse once per second. It's an extremely clever arrangement.



(Above) A rather poor photocopy copy of a page from the original patent document clearly showing this clock.

(1)Henry Belmont, letter on YEMA stationary dated 10/18/1972. Henry Belmont is the holder of most of the patents used in the entire world under the designation "ATO License"

, 9" diameter, 24" high

A little additional information about Bill Scolnik and the collection

For almost all of my adult life, I've had an abiding interest in time. I really can't say why that's the case but I realize now at 74, that most of the things I've done over my lifetime led in one direction. My interest in things related to time and timekeeping, precision time in particular, took me along an interesting and at times a rewarding path. After graduating as an Electrical Engineer, I worked at that profession quite successfully for a few years, but it wasn't completely satisfying. In the early 60's I started a business restoring and dealing in mechanical musical instruments which eventually lead to repairing, restoring, buying and selling rather interesting timepieces and automata. One day while visiting a dealer friend of mine, I noticed in his basement a rather unusual clock. I made an offer for it and it was eventually mine. The clock was a fine 18th Century organ clock made by Pierrre Jacquet-Droz. I spent several months restoring the clock and advertised it for sale. One evening I received a telephone call from Seth Atwood. He had seen my advertisement and had recently become interested in clocks. He eventually purchased this clock and visited me in New Jersey. He told me that it was his first clock purchase and he appeared to be extremely pleased when he saw the clock. Seth eventually went on to create the Time Museum, one of the great clock museums in the world which has since been dispersed. Years went by and in the late 60's I became interested in pocket watches. I apprenticed to a well trained Russian watchmaker for many years and became a restorer, dealer and expert in complicated pocket watches.

During my frequent horological travels in Europe during that period, I had the opportunity to visit many museums in England and on the Continent. I became aware of an unusual class of clocks that were amazingly interesting to me and were directed to one end – precision timekeeping. They appealed to me from many points of view. They were invariably mechanically interesting and they combined mechanics with electricity to create precision time and the creators and inventors of these clocks were scientists in the true sense of the word.

I started collecting precision electromechanical timepieces more than 40 years ago. As the years passed, I refined my collection to what I thought were the best and most interesting of these clocks. Because of the esoteric nature of precision time, by most standards, few of these clocks were produced. I expect that because they were not "decorative" in appearance, and as they fell into disuse and as better standards were produced, they were not preserved. As a result of this, very few really important precision electromechanical clocks survived. The fact that clocks of this type were produced for Only 50 years or so also added to the few surviving number. I've had a great deal of pleasure and excitement over the years pursuing these clocks, understanding them and working on them. It has been a great part of my life and I would have to say most satisfying.