Chapter 11
Strasser & Rohde

Much of the information in this chapter comes from the excellent book on this maker by Hans-Jochen Kummer[1] which contains a section on his precision pendulum clocks by Herbert Dittrich. The latter has also been reproduced in a series of articles in *Uhren*[2]. I am most grateful to both of these authors for allowing me to reproduce several of their illustrations here.

The origin of the design of the Glashütte precision pendulum clocks (G.P.P.U.), which were adopted by Strasser & Rohde, and others, probably goes back to the regulator which Johann Heinrich Kessels (1781-1849) produced. He was the first in Germany to modify the Graham escapement, shortening the long pallet arm and reducing the number of teeth of the escape wheel spanned to 5-1/2, 6-1/2 or 7-1/2. He also introduced a method of adjusting the compensation of the gridiron pendulum and specified the basic layout of the regulator dial.

Between 1826 and 1840 Friedrich-Wilhelm Bessel (1784-1846), working with Kessels, carried out various tests on his regulators at Königsberg Royal Observatory, including the effect of changes in barometric pressure, and his findings were to be built on by both Grossmann & Strasser who incorporated many of Kessels' design features in their regulators.

To understand the history of Strasser & Rohde (Fig. 34-1) one needs to go back to a somewhat earlier period. By the 1850s there were four watch manufacturers in Glashütte, one of which was Grossmann[3], who was to become well known for his technical writings. Whilst working in Altona with Krille he made precision pendulum clocks and chronometers and sold clock parts to other manufacturers. It was from this that the Glashütte regulator was to evolve. It was from Grossmann that Ludwig Strasser, born in 1853, learnt much of his craft working with him in Glashütte from 1871-73.

In 1876 the School of Watchmaking was founded in Glashütte with Grossmann playing a leading role in this, visiting many other schools of horology including Paris. When the school opened in 1878 Grossmann was put in charge of teaching. It was in this year also that he published his fundamental description of the German precision pendulum clock (G.P.P.U.) and Strasser published his treatise on the Graham escapement. He expressed the opinion that if it was made to the correct principles it was, in its simplicity, an admirable escapement which no other equaled, which was still being used almost exclusively on observatory regulators.

Strasser considered that all aspects of the design of the pallets and escape wheel should be calculated and in particular the impulse faces, the ideal angles for which he produced in the form of a table. Grossmann had expressed similar sentiments in 1866, saying that despite all the objections, it was still the best escapement. He advocated spanning 6-1/2 to 7-1/2 teeth of a 30 tooth escape wheel and gave the mathematical calculations for producing the correct profile of the pallets.

It was to be used, in the somewhat modified form he suggested, in many of the regulators made by Strasser & Rohde, for the following seventy-five years. It was also adopted by the German School of Horology and incorporated in the design which was to evolve for the precision pendulum clock.

It was Grossmann who in 1875 suggested to Ludwig Strasser that he should go into partnership with Gustav Rohde (1849-1930) and thus the business of Strasser & Rohde (Fig. 34-2) was founded.

In the early days they started by manufacturing new inventions such as taxi-meters, speedometers, adding machines and measuring instruments, and finally they made their first precision pendulum clock (P.P.U.).

Fig. 34-1. Strasser & Rohde's headed paper showing the numerous international awards gained.

Fig. 34-2. L. Strasser and G. Rohde alongside one of their portable regulators, c. 1880.

The Glashütte Precision Pendulum Clock

Following the foundation of the German School of Clockmaking a standard design for the precision pendulum clock evolved which was referred to as the G.P.P.U. It was used until 1908 by makers such as Kessels, Grossmann, Dietzschold, Sievert, Strasser & Rohde, and many others, including students at the School who were encouraged to make their own regulators.

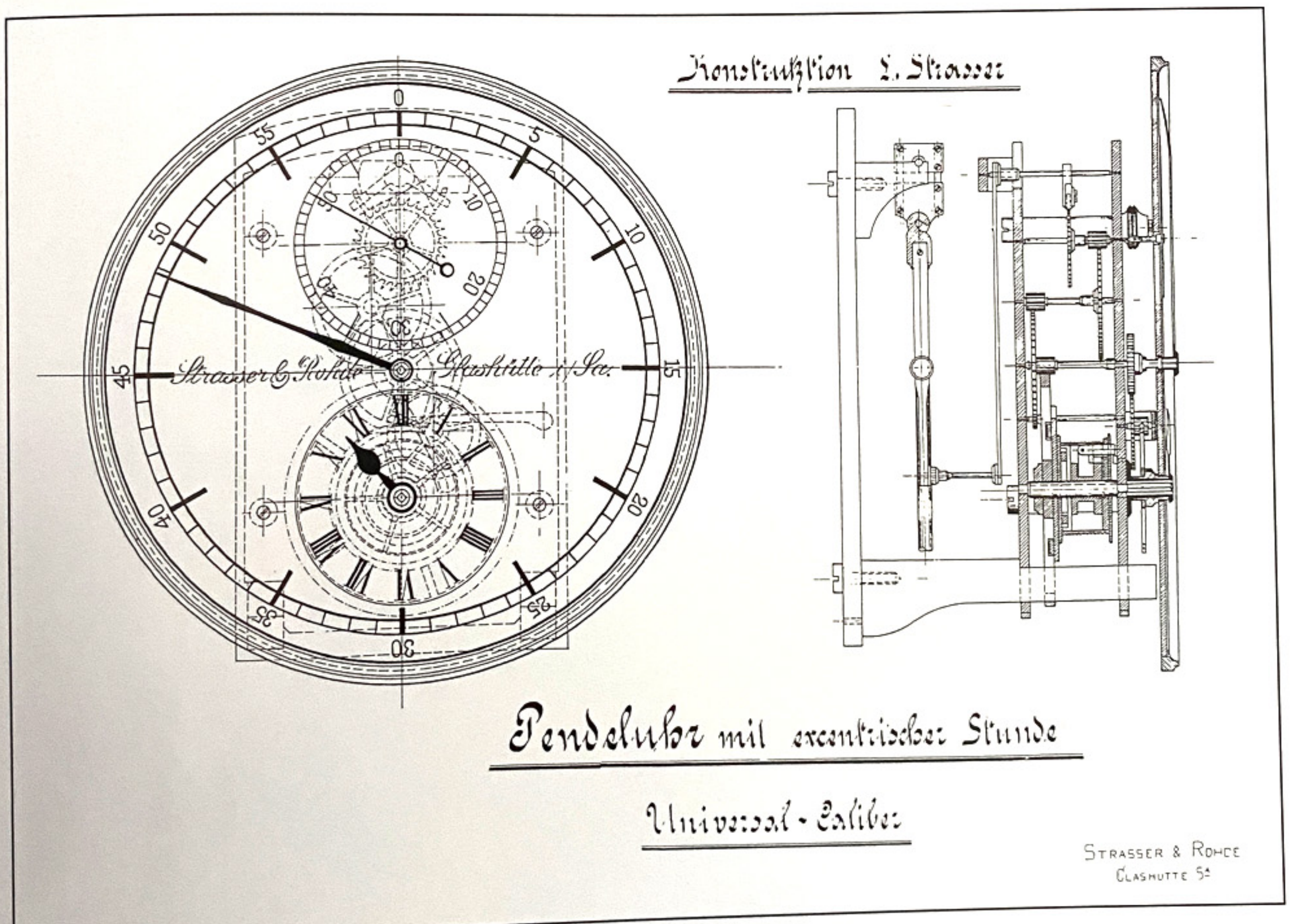
The details laid down for the design were quite precise. The dial, for instance (Fig. 34-3A) should be 25cms in diameter, 2.5mm thick and have a space of 12.5mm between the outside of the minute ring and the bezel to give a "harmonious" appearance. The basic layout had a center sweep minute hand and separate rings for seconds and hours. The center of the seconds ring was fixed at 51cms (or 48cms) from the center of the dial. The mid-point for the hour ring was also specified and as winding took place through the center of this it also determined the position of the barrel arbor. Thus the layout of the movement (Fig. 34-3B) and the size of the wheels and pinions were largely governed by the dial layout.

The thickness of the plates was given as 3-4mm and could be made with or without jeweled pivot holes. The escape wheel arbor was carried by a bridge at the front and at the back in the plate and these pivot holes were to be jeweled. After the introduction of the Strasser escapement on various clocks the pallet arbor was supported at the back by a bridge and ran in a jeweled pivot hole.

Harrison's maintaining power was adopted in a form somewhat modified by Grossmann and Strasser, not only to keep the clock going during winding, but also to protect the pallets and the teeth of the escape wheel.

The driving weight adopted was 1800 grams, with the weight either falling centrally, when the fall was 820mm, or offset to one side, using a second barrel, when the fall was 900mm. The former required 13 turns of the 19mm diameter barrel which had grooves 1.26mm deep and the latter 14.3 turns. With the weight descending centrally the duration was 8.1 days and if offset 9 days.

On the first grade G.P.P.U.'s stop-work was provided, although on observatory regulators it was omitted to avoid the vibration which was likely to occur when the weight hit the stop-work. The minute hand was counter-poised and friction provided on the arbor.



Figs. 34-3A, B. The "Universal Model" of the Glashütte Precision Pendulum Clock (G.P.P.U.) as constructed by Strasser & Rohde.

Post 1906

The design of the G.P.P.U. was revised in 1906. The depthing throughout the train was specified and also the increase in size of the wheelwork when a 30cm diameter dial was chosen. Beat regulation was also specified.

The period 1900-1910 was one of great activity for Strasser & Rohde, involving the development of Strasser's escapement and the introduction of the Invar pendulum, first with one bob and later employing two cylindrical bobs.

The desire of the German Clockmakers Guild (D.U.B.) for an inexpensive precision clock resulted in Strasser & Rohde building movements with a common wheel train which could be mass produced. These complied with the 1906 specification of the German School of Horology for all wheels and pinions to have a common module of 0.5, and indeed gear trains made to this specification, designated D.U.B., were being produced industrially by firms such as Reinecker.

It was at this time that the mounting of the clock was changed (Fig. 34-4), the movement being held by two turned supports which passed through the plates and were secured by screws going through the bottom pillars. Both these supports, and that for the pendulum, were screwed onto a substantial cast iron plate 15 x 12 x 2.6cms which was fixed to the wall by a heavy iron plug. The clock case was only screwed onto the iron plate so that any shock would not directly disturb the movement or pendulum.

These movements were guaranteed by Strasser & Rohde to have an accuracy of 0.1 second per day. These changes resulted in the upgrading of all the different qualities of G.P.P.U. to this standard.

Detailed improvements were introduced over the years. For instance the profile of the wheel teeth was altered, using a flatter base and more pointed tip, to reduce friction and thus the power coming through the train. The tolerance throughout the wheels and pinions was also reduced.

It is probably helpful to mention at this stage the close relationship between Strasser & Rohde and the German Clockmakers' School (D.U.S.): indeed Strasser quite unconcernedly used the headed paper of D.U.S. for his own business interests; an example being to use the headed paper of the Clockmakers' School to respond to an allegation that he was overcharging. This sometimes led to accusations of deceiving and on occasions makes it difficult to know to whom to attribute various matters.

That Strasser & Rohde's regulators were competitive, so far as performance is concerned, at the beginning of the 20th century is indicated by the following recorded performance of five different regulators in the Geodetic Institute:

1. Riefler No. 20 ± 0.011 s/d. Riefler escapement and mercury pendulum.
2. Riefler No. 96 ± 0.009 s/d. Riefler escapement and J. type pendulum.
3. Dencker No. 27 ± 0.018 s/d. Graham escapement and mercury pendulum.
4. Dencker No. 28 ± 0.016 s/d. Graham escapement and mercury pendulum.
5. Strasser No. 95 ± 0.010 s/d. Strasser escapement and mercury pendulum.

Ludwig Strasser died on the 12th August 1917 and Paul Strasser (1878-1943) took over the running of the firm the following year, and continued to do so until his death in 1943. The reins were then taken up by his wife Margarethe (1888-1970) and in due course by her son-in-law Arno Wustlich (1922-1992) who ran the workshop. The firm finally went into liquidation in 1958.

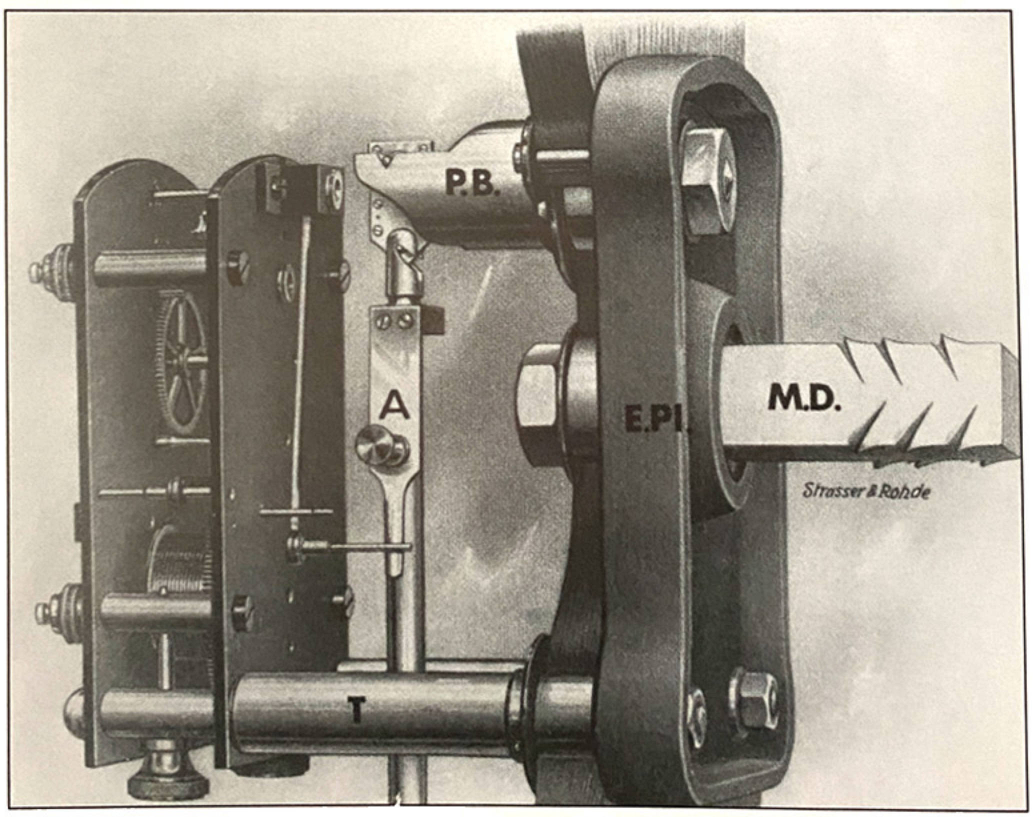


Fig. 34-4. The mounting of the Glashütte precision pendulum clock (G.P.P.U.) with a cast iron plate (E.P.I.) fixed to the wall by an iron wall plug (MD). The clock, with Graham escapement, is held by two circular bars (TT) which are screwed into the iron backplate. The pendulum is suspended from a further heavy turned bracket (PB) and details of the crutch assembly (A) may be seen.

Strasser's Escapement

Strasser's escapement (Figs. 34-5A, B) in which the pendulum is impulsed, as in Riefler's escapement, through the suspension spring, was described as "a free spring powered constant force escapement in which the pendulum swings independently and completely free of the clock movement."

The impulse takes place in the axis of oscillation of the pendulum and both the impulse and unlocking occurs as the pendulum passes through the mid-point of its swing and has its maximum kinetic energy. The impulse occurs very rapidly and because it is not received directly by the rigid pendulum rod, eliminates the risk of any shocks. Its action is described in Chapter 6 *Precision Pendulum Clocks, the Quest for Accurate Timekeeping*.

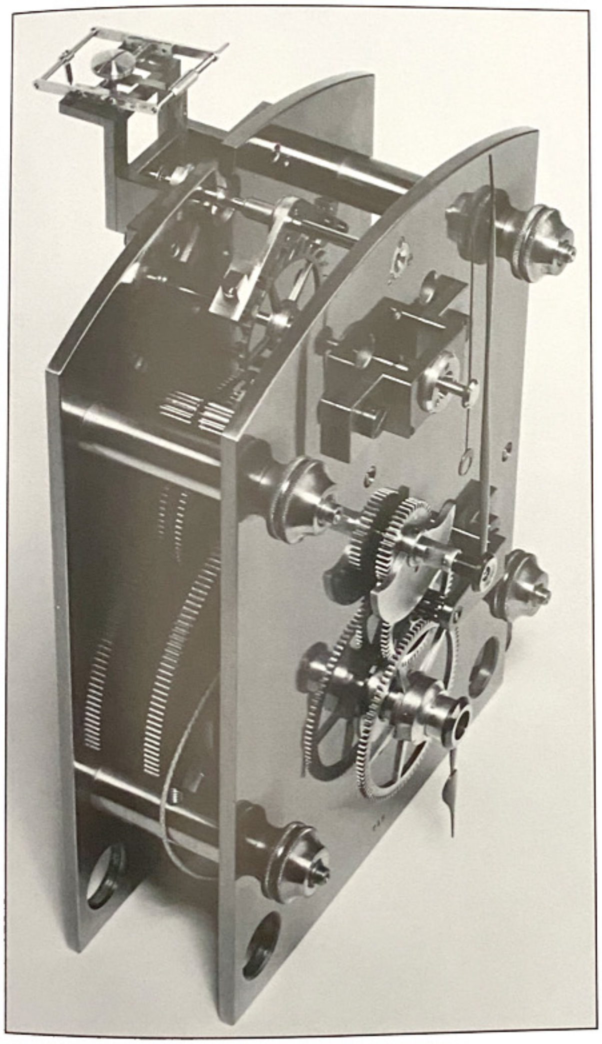


Fig. 34-5B

Figs. 34-5A-F. **Strasser & Rohde walnut veneered wall regulator c. 1925.** The bottom holes in the movement plates are for the bolts holding it to the wall bracket. The plate pillars are screwed to back and front, the latter using knurled nuts. The bracket carrying the pendulum can be seen and the two springs employed on each of the inner and outer top blocks of the suspension.

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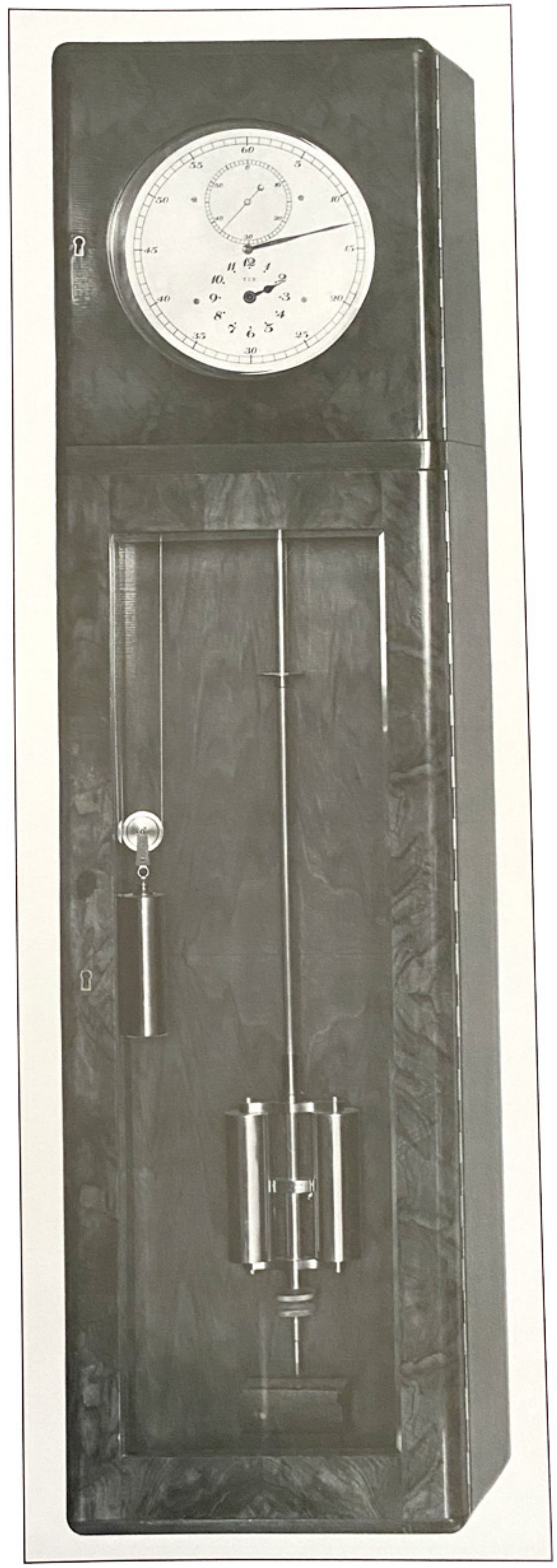
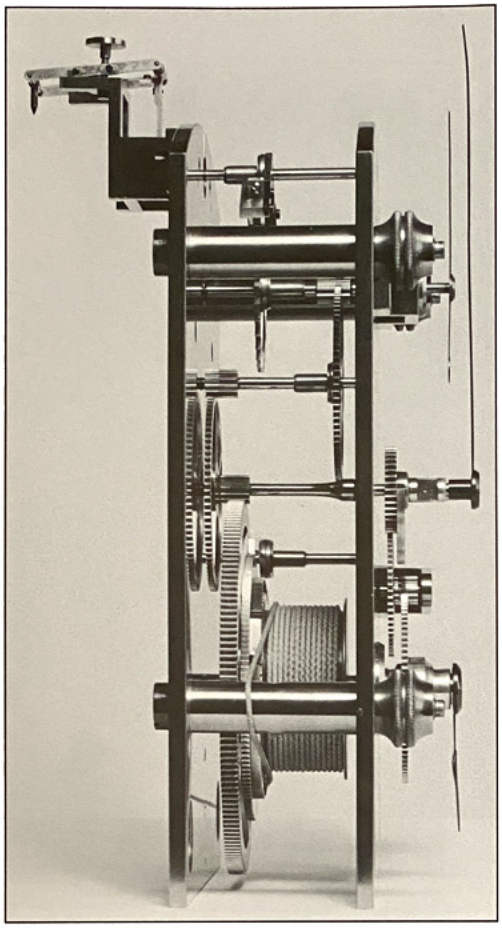


Fig. 34-5A



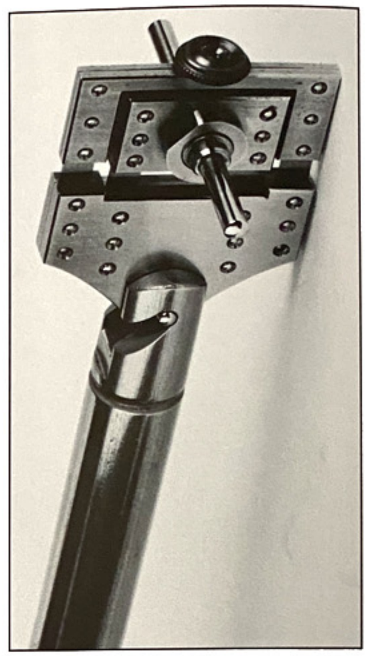


Fig. 34-5E

Fig. 34-5C

Fig. 34-5D

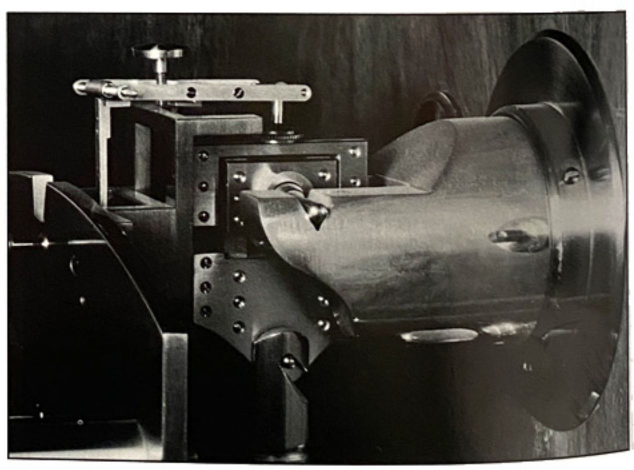


Fig. 34-5F

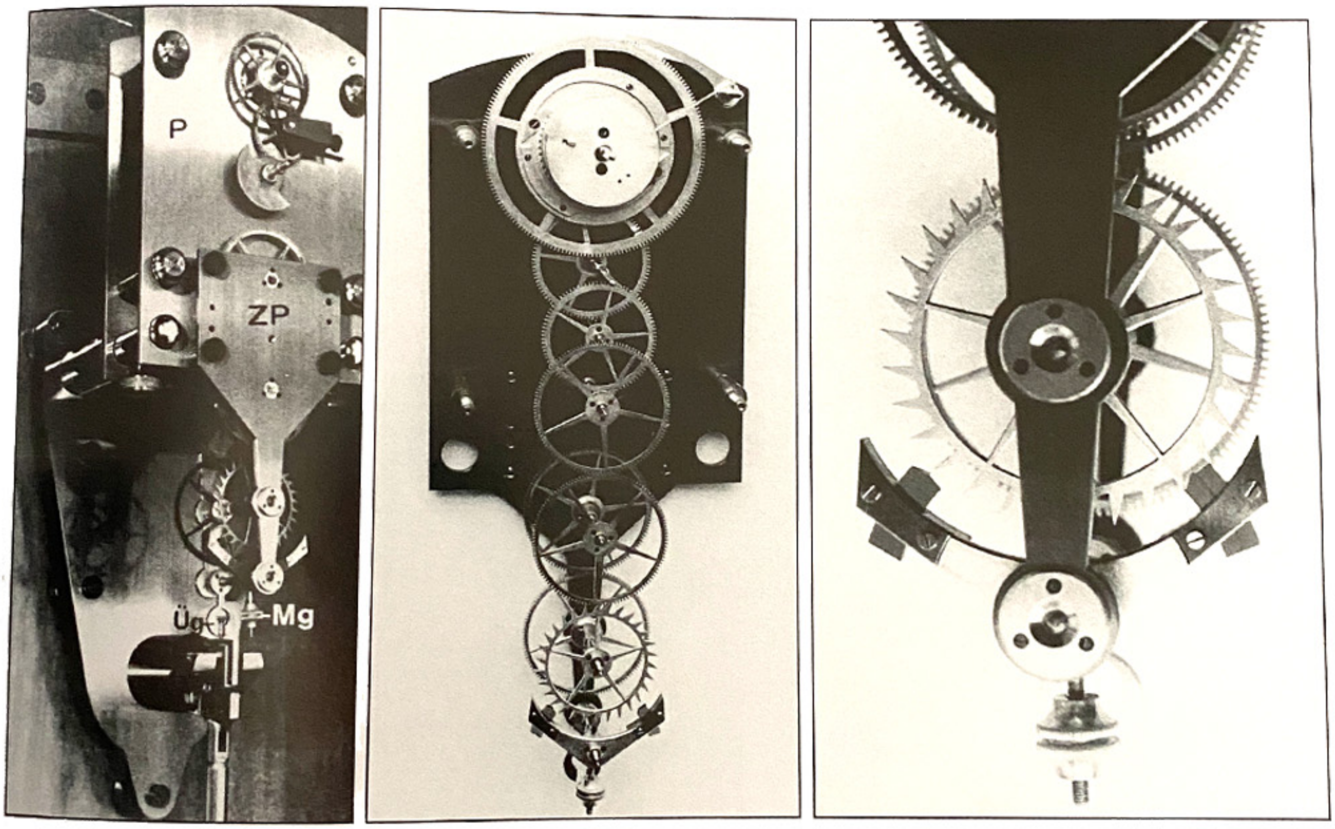
It was first commented on in the literature by Wilhelm Schultz at the time of the 1900 Paris World Exhibition where it was on display for the first time, and Strasser obtained a gold medal for his products. He referred to it as "Strasser's free escapement." It was subsequently patented (DRGM No. 258167). It has the same escape wheel as that used for the Graham escapement with Strasser's form of pallets.

It was used both in the manner seen in Fig. 34-5 and also inverted (34-6A, B), when it was referred to as the cascade design because it hung down below the movement.

Several modifications to Strasser's escapement have been suggested over the years (34-7A-G). In 1906 George F. Bley designed two, (DGRM No. 386665) (Fig. 34-7B,C), in one of which (7B) a lever at the top engages directly on the upper block of the suspension. These modifications were purchased by Strasser & Rohde in 1908 and included in their clocks.

A further modification was described by Charles Gros (Fig. 34-7D) in 1913 in his book *Echappements d'Horloges et de Montres* which has similarities to that suggested by Hoser (7A) and in 1930 Edmund Pfeiffer put forward two more (Fig. 34-7F,G). The first had a differently positioned way of impulsing the suspension spring and the second (7G) made use of an electro-magnet to deflect the pallet arms using an alternating switch. This became known as "Pfeiffer's Pendulum Motor" and was patented, DRGM No. 301087. It proved to be particularly useful for time service installations.

Besides the Graham & Strasser escapements, Strasser & Rohde also used Dennison's gravity escapement on a few clocks.



Figs. 34-6A-C. Strasser & Rohde No. 980 with movement in "cascade" form and inverted escapement.

Figs. 34-7A-G. The various modifications suggested for Strasser's escapement.

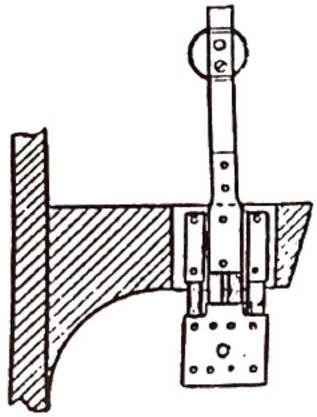


Fig. 34-7A. Those suggested by Victor Hoser in 1896.

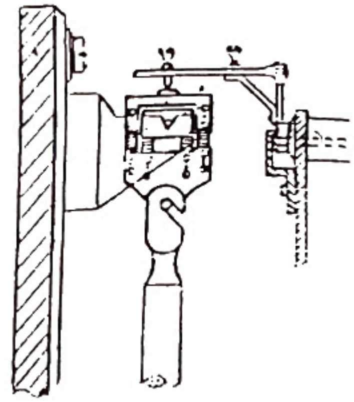
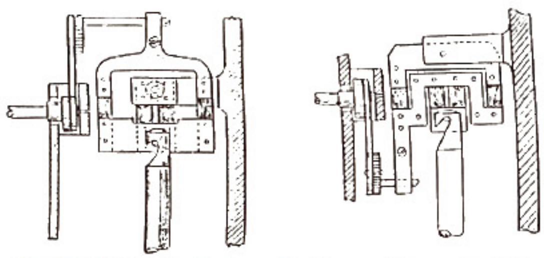
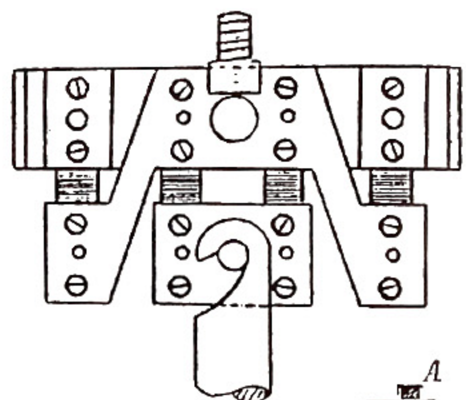


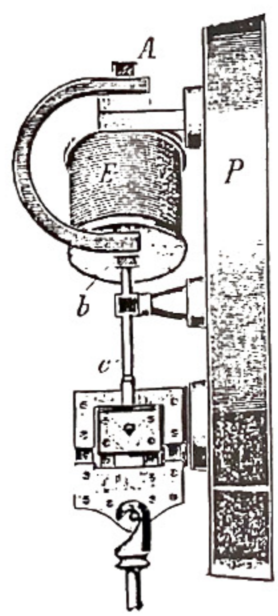
Fig. 34-7E. An alteration suggested by the Swedish Clockmaking School in Borensberg.



Figs. 34-7B, 34-7C. F. G. Bley's modifications, put forward in 1906, in one of which the lever at the top engages directly on the upper suspension block.



Figs. 34-7F, 34-7 G. Edmund Pfeiffer's two modifications of the Strasser escapement. The first (F) (above), altered the position of impulsing the suspension spring and the second (right), subsequently known as 'Pfeiffer's Pendulum Motor,' made use of an electro-magnet and alternating switch to deflect the pallet arm.



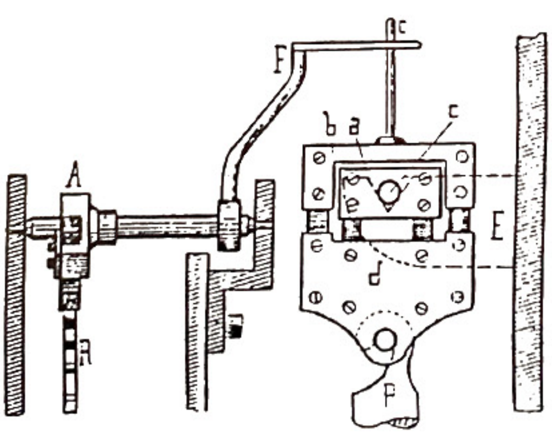


Fig. 34-7D. The modifications suggested by Charles Gros in 1913.

Strasser & Rohde Compensated Pendulums

Whereas Riefler only produced two basic pendulum designs, the first mercurial and the second employing nickel steel alloys (Invar and its derivatives) to which he added refinements to compensate for changes in barometric pressure and also stratified temperature, Strasser & Rohde produced at least thirteen different forms of compensated pendulum.

The first four were based on the gridiron with two incorporating zinc tubes, one employed a wood rod, one used mercury, and the remainder Invar. On some, an allowance was made for stratified temperature and barometric compensation.

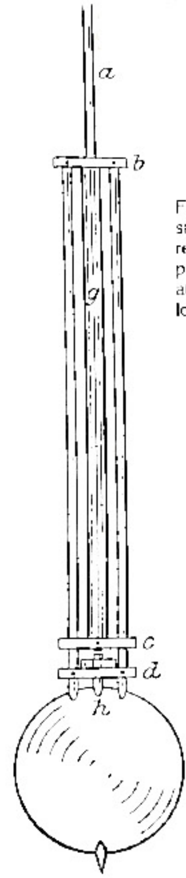
They are briefly listed here and are illustrated in Figs 34-8A-M by kind permission of Herbert Dittrich who has shown them in the past in *Ludwig Strasser*[1] and also a series of articles which appeared in *Uhren*[2], at the end of which is an excellent set of references.

1. A simple three rod zinc/steel gridiron pendulum (8A).
2. A zinc/steel gridiron pendulum with provision for adjusting the compensation in the lower part of the central rod (8B).
3. A five rod zinc/steel gridiron pendulum with the adjusting element at the upper part of the central rod (8C).
4. A non-adjustable five rod gridiron pendulum with provision for adding lead shot at the mid-point (8D).
5. A wood rod pendulum with cylindrical zinc bob (8E).
6. A mercury pendulum based on the standard Glashütte design (8F).

All the following pendulums have nickel steel compensation.

7. Strasser & Rohde's first nickel-steel compensated pendulum with nickel plated cast iron bob (8G).
8. In this design the bob is suspended from both sides and the compensation has been made adjustable (8H).
9. This is similar to the pendulum No. 8, but the bob is suspended centrally (8J, K).
10. A single cylinder nickel-steel compensated pendulum with the compensation unit above it (8L).
11. This is similar to that seen in No. 10 but has an adjustable compensation unit (8M, N).
12. A twin cylinder nickel-steel pendulum with the compensation unit placed between them (8P).
13. This is similar to that seen in No. 12 but has an adjustable compensation unit. This was used in the highest quality regulators for observatories and time service installations (8R).

In addition to their own pendulums they also bought them in from Riefler (Figs. 34-9 to 34-11) with whom they had a friendly working relationship.



1

Fig. 34-8A (Left). A simple zinc-steel compensated gridiron pendulum used for second class regulators. By 1890-1900 fine adjustment was provided by means of a small hollow cone attached half way up the central rod into which lead shot could be placed or removed.

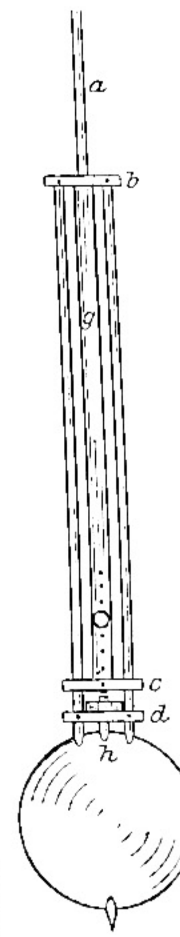


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Fig. 34-8B. In this design the central rod (a) passes down through the cross bar (b) and the zinc tube (g) and is pinned to the lower bar (c). The two outer steel rods go from the cross bar (b), through (c) and are pinned to the cross bar (d). The ends of the rods extend down into the bob which is supported at its center point by a short steel bar (h) which has a regulating nut above the cross piece (d).

The upwards expansion of the zinc tube compensates for the downward expansion of the steel rods. The compensation may be varied by altering the position of the pin passing through the lower part of the zinc tube and central steel rod.

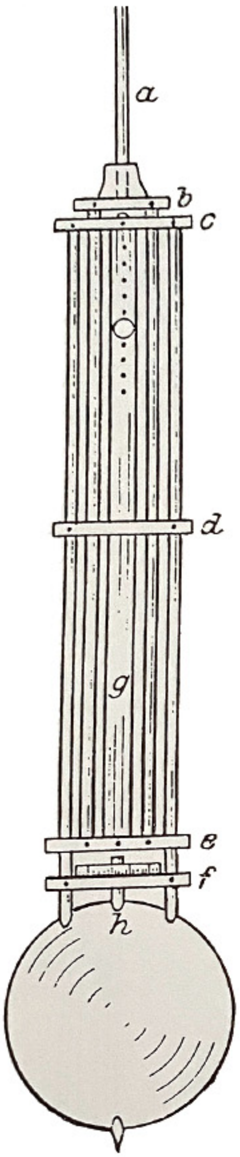

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Fig. 34-8C. A five rod zinc-steel compensated gridiron pendulum with the compensation adjustment in the upper part of the tube. In this design the central rod is shortened and pinned to the cross piece (b). The two steel rods attached to this extend down to the cross piece (e) to which they are fastened. The zinc tube (g) resting on this expands up, taking with it the cross piece (c). The outer rods attached to this are pinned at the bottom to the lower cross bar (f) from which the bob is suspended by a steel rod which passes through the cross piece (f) to a regulating nut above.

In the upper part of the pendulum a central steel rod, fixed to the cross piece (c), passes down inside the zinc tube to which it may be pinned in different places to vary the compensation.

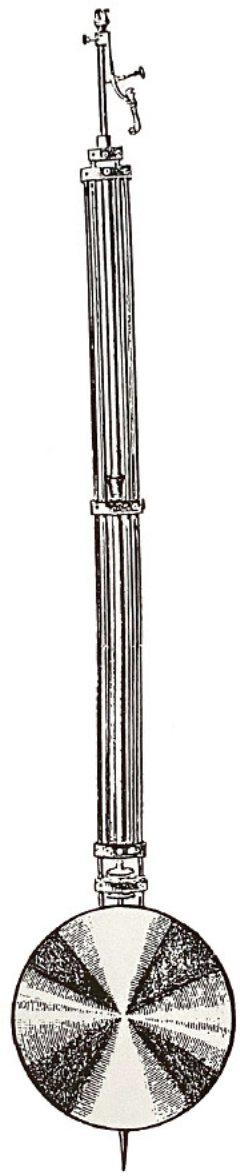

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Fig. 34-8D. This has a five rod zinc-steel compensated pendulum with provision for adding lead shot for fine regulation, without stopping the clock, but no provision for adjusting the compensation.

5

Fig. 34-8E. Wood rod compensated pendulum with cylindrical zinc bob.

6

Fig. 34-8F. Mercury compensated pendulum based on the Glashütte design. It has a cast iron jar with screw-on lid. The length of the column of mercury was calculated at 144mm.

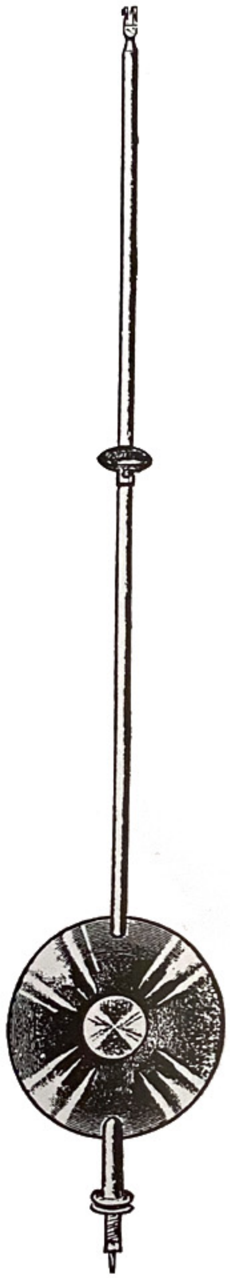

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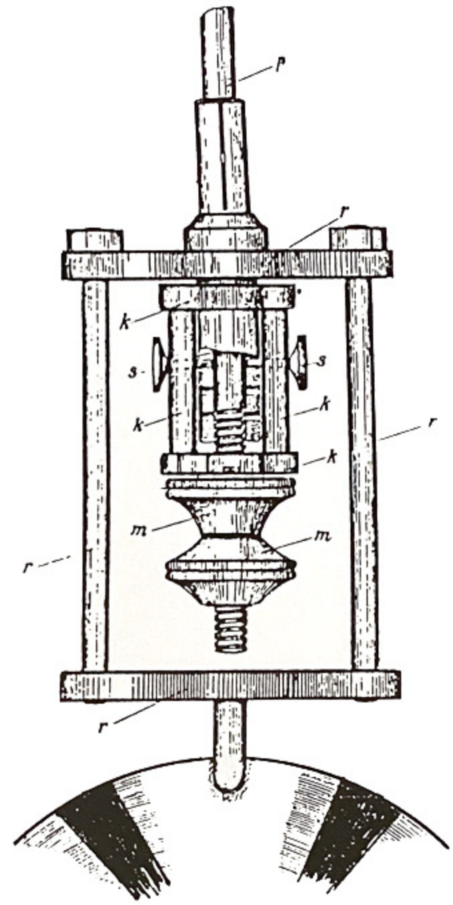
Fig. 34-8G. This pendulum has an Invar rod with a nickel plated cast iron bob which is supported at its mid point by a 10cm long brass compensating tube, beneath which is the regulating nut.

8

Fig. 34-8H (number 8). This pendulum also employs nickel-steel compensation but with the bob carried by two rods, one on either side of the adjustable compensation unit. The Invar rod passes freely through the upper cross bar and terminates just below the regulating nut. The bob is suspended from the cross piece by two side bars, which form a frame that is freely movable on the pendulum rod but has a pin which rests in a slot to stop rotation.

The compensation unit is made up of an inner iron tube and outer brass one which are pinned together through tubes which are movable on the rod. By changing the position of the pins the effective length of the compensation unit is altered; the higher the pins the greater the compensation.

9



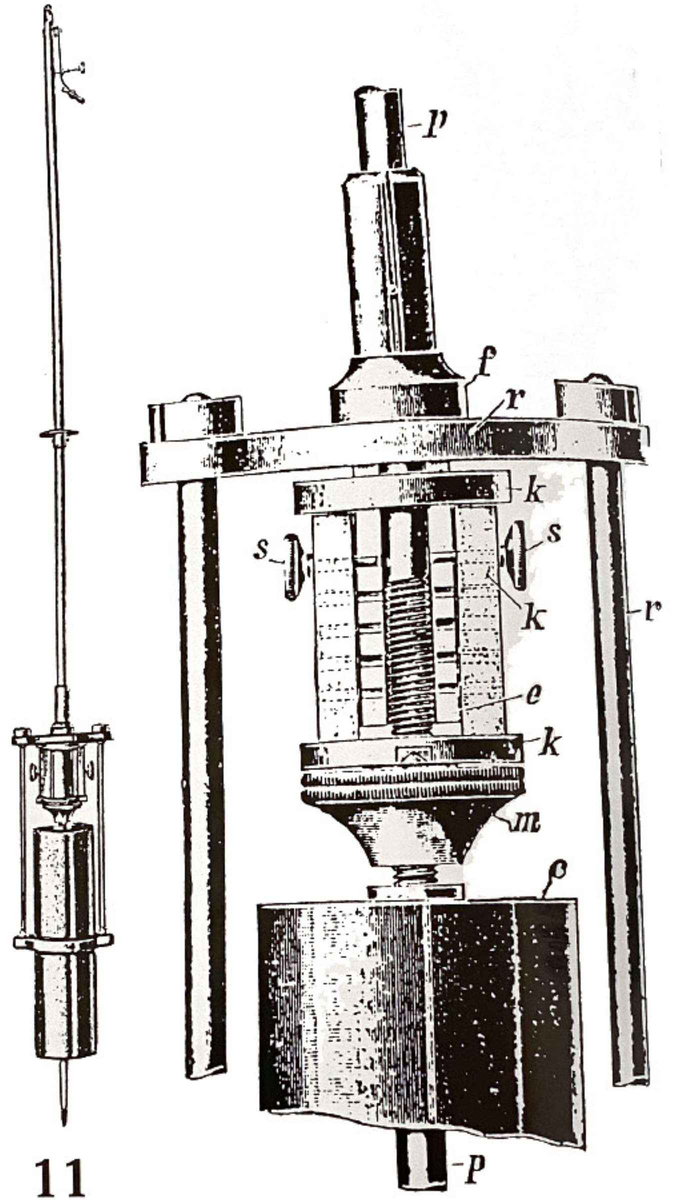
Figs. 34-8J, K (number 9). This pendulum (left) is similar to that in Fig. 8H but the compensation unit is more complex, consisting of tubes of different metals to achieve the correct level of compensation.

In the close-up of the compensation unit, 8K, it can be seen that the Invar rod ends just below the regulating nut (m). The bob is suspended from the bottom cross bar of a frame comprising two side and two cross-bars (rr). This frame is freely movable on the pendulum rod but is prevented from rotating by a locating pin resting in a slot.

The compensation element, (kk), is freely movable on the pendulum rod. It consists of two small outer pillars (kk) which are held by cross pieces, also marked (kk). Symmetrical holes are drilled through the side pillars at 6 - 8 points through which pins (ss) can be placed to engage the short nickel pipe within. By raising or lowering the position of the pins the degree of compensation being achieved can be varied; the higher the pins the greater the compensation.

10

Fig. 34-8L. **The single cylinder nickel-steel pendulum with the compensation element above the bob.** In this the frame with Invar side rods, which contains the upper half of the bob and the simple compensation unit, comprises a 60mm long iron tube within an outer brass one with a slot in it.



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Figs. 34-8M, N. **The single cylinder nickel-steel pendulum with adjustable compensation.** This is similar to that seen in Fig. 8H but the compensation achieved may be varied by changing the material used for one or more of a series of short compensation tubes as in Fig. 34-8K. (kk) are the side and top pieces containing the compensating tubes (c), and (ss) the locking pins which fix the tubes to the frame. By varying the height of insertion of the pins the degree of compensation may be varied.

Below the compensation unit is the regulating nut (m) which has sixty divisions on its outer edge. One turn of the nut varies the timekeeping by 40 seconds a day. A flat thread is used to eliminate any chance of the regulating nut unwinding during use.

The design of this pendulum was patented in 1906. DGRM No. 258137 and 275127.

12

13

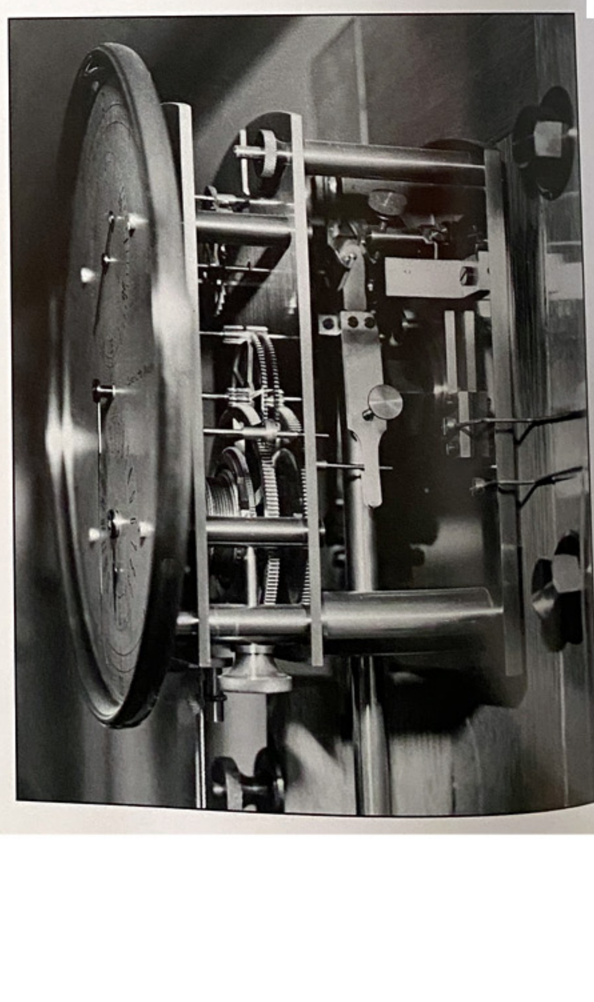
Far Left:
Fig. 34-8P. **The twin cylinder pendulum with fixed compensation element between the two bobs.** This design was introduced c. 1908-1910 and went on being made until 1958. The cylinders, 17.4cm high and 4.75cm in diameter, are connected by three horizontal bars. The cylinder of the compensating element is made of rolled steel and the compensation tube within it, some 10cm long and 1.8cm in diameter, is of iron. The central cross piece, to which the bobs are fixed, rests on the compensation tube which in turn is supported by the regulating nut. This pendulum was used in the best regulators, including those made for observatories, etc., its compensation being as efficient as that in the pendulums with a single bob.

Left:
Fig. 34-8R. **The twin cylinder nickel-steel pendulum with an adjustable compensation element.** This is very similar to the pendulum seen in Fig. 34-8P, having an adjustable compensation unit situated below the central cross-bar similar to that used in Fig. 34-8H, but with the holes drilled through the brass case and compensation tube being at the front and back instead of to each side. The compensation tube rests on the regulating nut.

Fig. 34-9. **Strasser & Rohde, Glashütte i Sachsen. Pendulum Patent Riefler, D.R.P. No. 50739, D.R.P. 60059, c. 1897.** An early weight-driven rosewood wall regulator with Riefler's mercury compensated pendulum and Strasser's form of Graham dead beat escapement. This case style is not recorded by Herbert Dittrich.

Fig. 34-10. **Strasser & Rohde. No. 245.** This walnut regulator with Strasser's escapement has an offset weight, ruby pallets, and the escape wheel and pallet arbors running in jeweled pivot holes. Riefler's Invar compensated pendulum is employed.

Figs. 34-11A, B. **Strasser & Rohde, Glashütte c. 1921.** This was made for the Urania Observatory, Vienna and used for a long period for geophysical measurements. To keep the temperature as constant as possible the entire case was enclosed within a sheet of copper. Two thermometers, seen inside the door, allow for any errors due to inaccurate thermal compensation in the pendulum to be calculated. The Riefler pendulum is of the first quality. A 24 hour dial was used and contacts provided to the side of the case.



The Quality of the Pendulums

Whereas the pendulum numbers 1 to 5 were all made to the same standard, the nickel-steel (Invar) pendulums were produced in two different qualities. Those of the best quality were heat treated and, after this, checked individually for the effect of any changes in temperature and barometric pressure and their isochronicity.

The pendulums of second quality had no such checks; however samples from each batch were taken out and tested as it is well known that the coefficient of each batch of Invar varied quite widely.

The air pressure constant for the pendulum was 0.02 s/d per 1mm difference in air pressure and the temperature compensation was less than 0.001 s/d per °C.

Barometric Compensation

Strasser & Rohde employed two different methods of overcoming this problem. The first was a mercury barometer (Fig. 34-12), as used by Robinson and Dent (Figs. 4-3 and 4-2 respectively, *Precision Pendulum Clocks: the Quest for Accurate Timekeeping*). It was employed by Strasser & Rohde on their two cylinder pendulums, being first used c.1919.

The second method made use of aneroid compensation similar in some ways to Riefler's but with two units (Fig. 34-13) with weights placed on top of them, the purpose of the multiple units being to avoid unbalancing the pendulum. They were fixed 38cms below the pivot point of the pendulum. Somewhat surprisingly Strasser does not appear to have produced any tank regulators to try and overcome this problem and also the need to minimize any fluctuations in temperature.

The speed of oscillation of a pendulum is affected by the force of gravity at the place where the clock is installed. Strasser & Rohde's pendulums were adjusted for Glashütte which is at latitude 50° 51' 10" and at an altitude of 325m above sea level with a mean barometric pressure of 730mm. After 1920 purchasers were given a table so that the pendulum could be adjusted to the position in which the clock was installed or, if they requested it, the pendulum would be adjusted for them prior to dispatch.

The price of Strasser & Rohdes' pendulums were as follows:

Pendulum	Price
Zinc/steel compensated gridiron pendulum in 1904	80 marks
Wood rod & cylindrical bob in 1904	35 marks
Mercury compensated pendulum in 1904	125 marks
Mercury compensated pendulum in 1913	125 marks
Nickel-steel pendulum in 1904 1st quality	200 marks
Nickel-steel pendulum in 1904 IInd quality	60 marks
Nickel-steel pendulum in 1913 1st quality	125 marks
Nickel-steel pendulum in 1913 IInd quality	85 marks

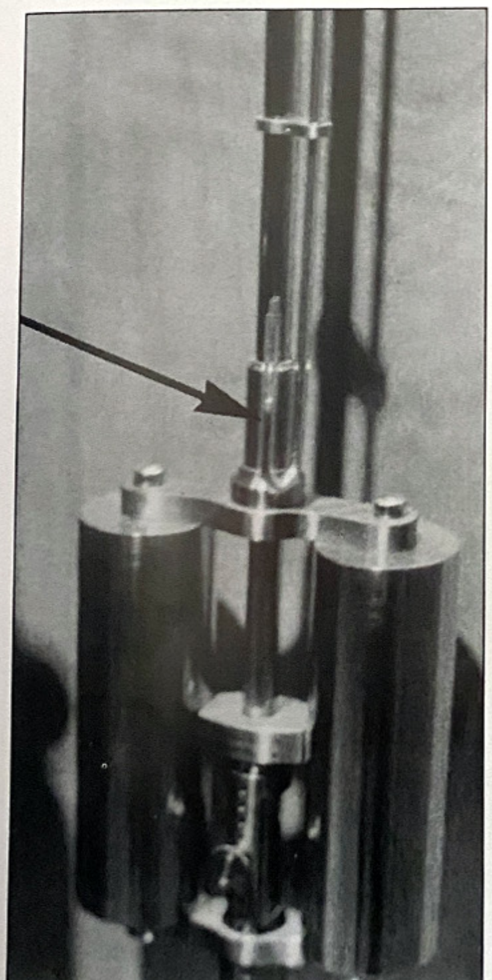


Fig. 34-12. Mercury compensation for changes in barometric pressure based on the design of Krüger and Oudmans which was used on Strasser & Rohde twin cylinder pendulums, Nos. 12 and 13 (Figs. 34-8P, 34-8R).

Fig. 34-13. Strasser & Rohde's aneroid compensation for barometric pressure employing two symmetrically placed units to avoid unbalancing the pendulum.

The Clock Movements

The choice of brass for the movement plates was carefully analyzed, and hard-rolled brass of the highest consistent quality was chosen for all the movements, although some clock makers such as Sievert still preferred hammered brass which, with its tiny inclusions of lead, was thought to have better lubricating qualities. For their first quality clocks the plate thickness was 4mm and for 2nd and 3rd quality clocks 3.0-3.6mm. The plate surfaces were ground lengthways and painted with a ruby shellac to which various other materials, in carefully defined amounts, were added. The wheels were made of the same material as the plates. On the top quality regulators they were polished, grained, and gilded. The wheelwork in the other regulators was grained and finished a matt yellow.

Strasser's own form of adjustable crutch was used on some of his regulators (Fig. 34-14).

The jewelling employed in the movement was made in Glashütte by the specialists G. Tiretschmar and their successors Uskar Dittrich, Willy Richter, and Gisele Gocht. Up until the 1920s sapphires were generally used and after this synthetic rubies. On all the different qualities of regulator produced the pallets were jeweled. In addition, particularly for the first quality regulators, the pivot holes for the pallet and escape wheel arbors were jeweled and sometimes also the other pivot holes.

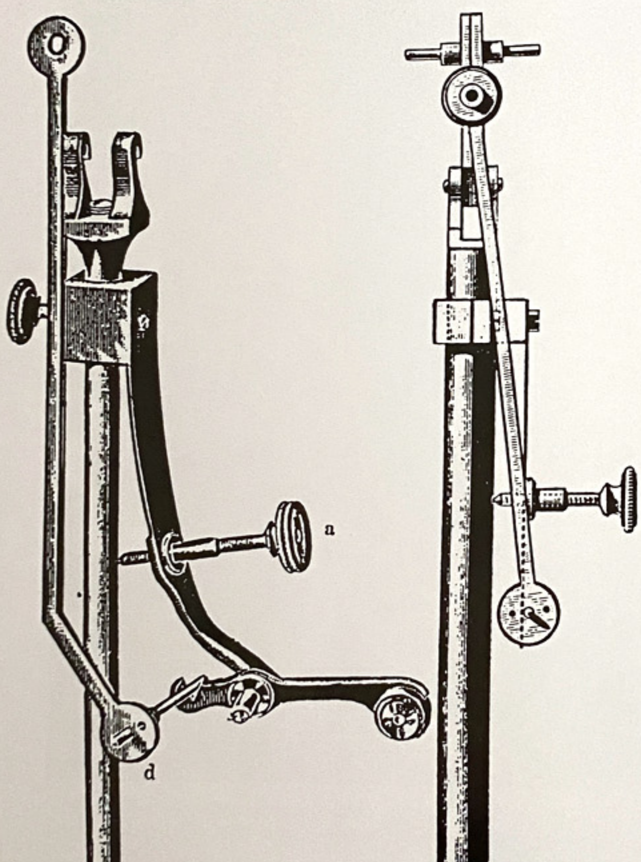


Fig. 34-14A, B. Strasser's form of adjustable crutch in which the impulse given could be altered. The one shown on the left was used up until 1906 and after this the one on the right.

The Dials

The dials of all the regulators had the same layout and were finished to the same standard. Up until about 1924 the numerals, rings, name, etc were partially deep etched and then engraved prior to being filled with black wax. They were usually signed by Strasser & Rohde, but if the firm purchasing the regulator wanted their name put on the dial this was done. They were all numbered and the plates were stamped with the firm's oval logo. All the dials were grained, either horizontally or vertically. Circular graining was never used by Strasser & Rohde.

Besides complete movements the company also sold individual components and complete kits with instructions for their assembly. In these instances no number or mark was applied. This encouraged clockmakers to make up a regulator themselves for use in their own workshop or showroom.

For the pendulum, U. Kremer attempted to establish a system of numbering them by the production number and year of manufacture. Most of the pendulums produced after 1906 had, on the reverse of the suspension, a production number but this did not agree with the works number and was used as a serial number for the type of pendulum being used.

The numbers on the earlier Glashütte pendulums bear no relationship to the factory numbering and likewise the production number on the pendulum was unrelated to that given to the regulator.

The Various Qualities of Regulator Produced

Before 1903 there was not believed to have been any division of quality, but from 1903 three standards were created.

From 1903 to 1918 the first quality movements have jeweled pallets and pivot holes for the escape wheel and pallet arbors, with the jewels held in place by screwed-on chatons. The wheels were gilded and the winding mechanism provided with stop-work.

The second quality movements have no jewelling to the pivot holes and no stop-work. The third quality movements just have jewelling to the pallets. The finishing of the non-working parts is kept simple and the wheelwork and pinions are not finished to the same standard as in the other two categories: however all the depthing of the train was carefully carried out and beat regulation provided.

From 1918 onwards the movements were divided into two categories:

Type A: These were all the regulators with the Strasser escapement. These were always made to what would equate to the previous first quality movements.

Type B: This included all those with the Glashütte form of Graham dead beat escapement.

These were produced in two qualities: BI and BII.

BI: These were made to the same standard as the previous type A.

BII: This equated to the old quality classes II and III. The pivots ran in hard metal bearings but, if requested, jewelling of the escape wheel and pallet arbors would be carried out. The pallets were always jeweled.

One of the main differences was that the general finish was to a lower standard. The price of the movements is given below.

Class:

A.	8 day movements	I	II	III
	From 1904-1912	390	335	280 marks
	From 1913-1918	430	375	310 marks
B.	Month movements			
	From 1904-1912	440	385	330 marks
	From 1913-1918	485	425	365 marks

Case Styles

Strasser & Rohde produced both wall and floor-standing regulators in many different styles of case. Most of them were made by the Glashütte cabinet maker Artur Guricke and may be divided into three periods.

The First Period 1875 to c.1900

During this time two wall and two floorstanding regulator cases were offered. The Type I wall regulator (Figs. 34-15, 34-17) was the most popular design over all three periods, with minor alterations. The earlier cases tended to be in walnut or mahogany and the later ones were made of oak; although Grossmann warned in 1878 that oak cases resulted in thickening of the oil while others suggested that they may cause rust; however there would seem to be no evidence for this.

The Type 2 was a more decorative case whilst the third type, later with extended base, was produced virtually until Strasser & Rohde ceased manufacture. The Type 4 is really a development of the Type 2 but more richly decorated.

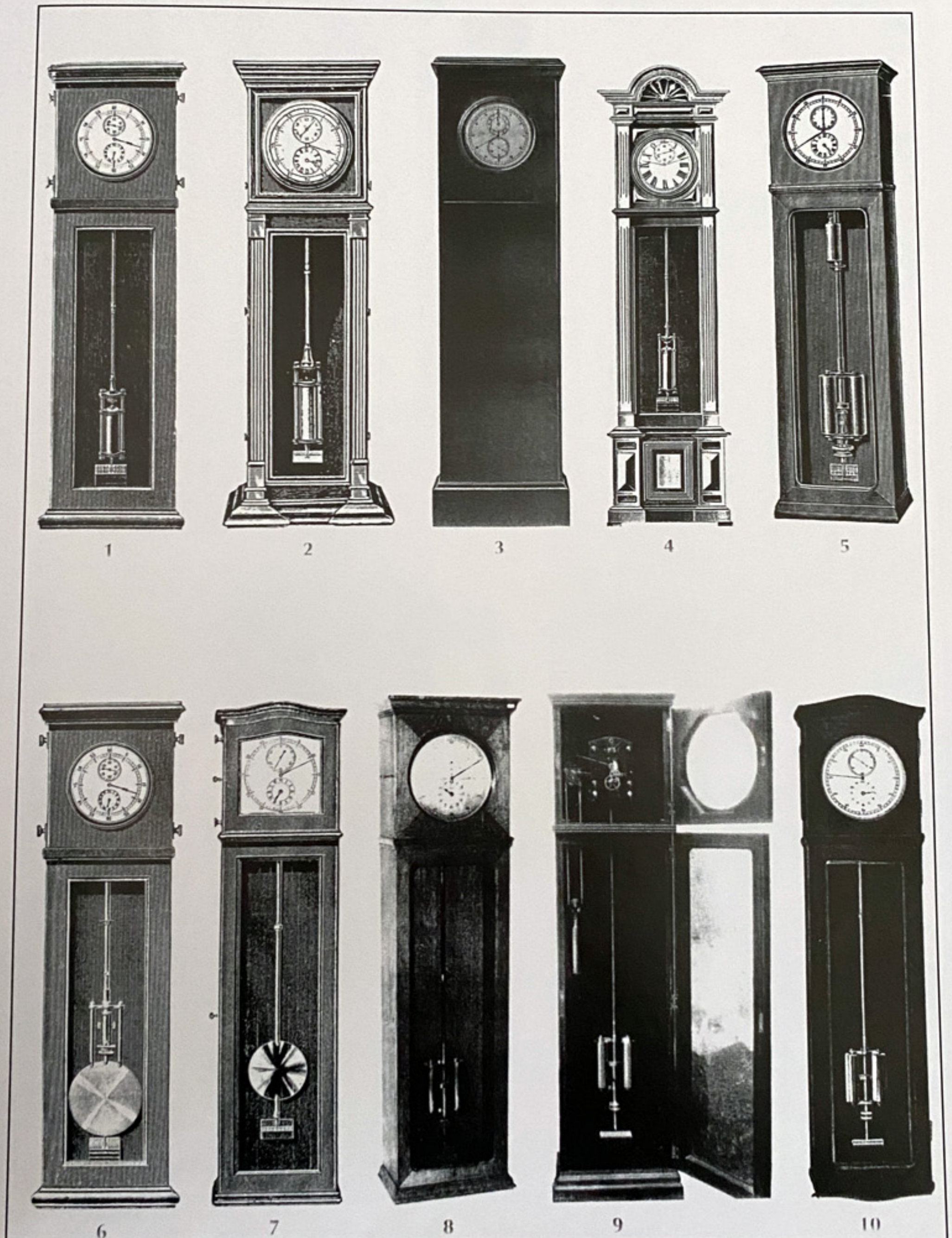


Fig. 34-15. **Strasser & Rohde's case designs 1 to 10.** Nos. 1-4, first period, were introduced between 1875 and 1900 and Nos. 5-8 between 1900 and 1918. Nos. 9 and 10 would be post 1918.

The Second Period 1900-1918

A further four styles of wall regulator were produced in this period: the Type 5 (Figs. 34-18, 34-19) which was similar to the Type 1 and was frequently made in oak for observatories in conjunction with a No. 13 pendulum. The Type 6 is a similar clock to the Type 1, but was provided with electric contacts. The Type 7 is characterized by the rectangular dial, slightly shaped at the top and is seen here with a lenticular pendulum bob. Type 8 is similar to Type 1 but more solidly constructed and provided with dust sealing to the door.

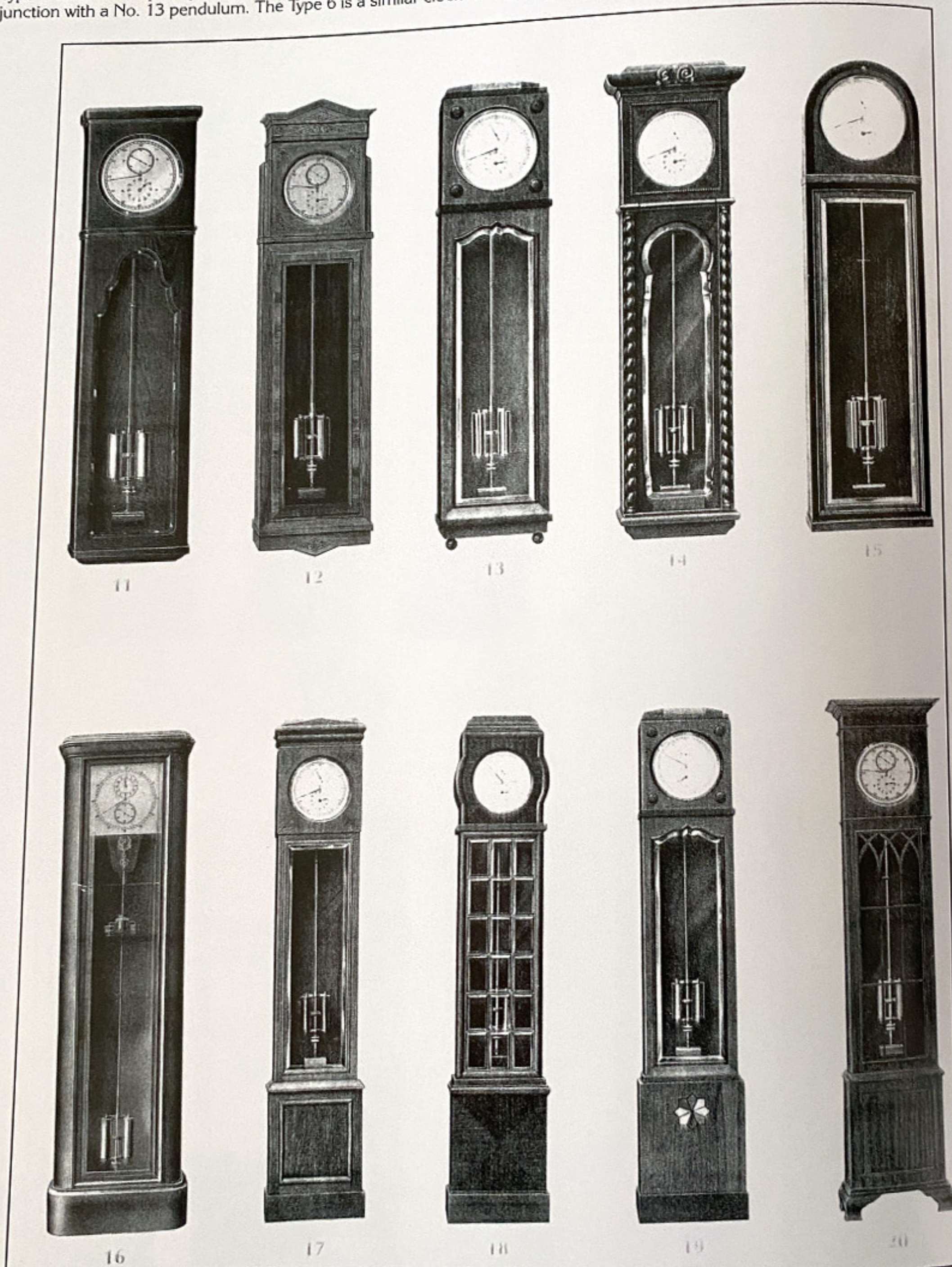


Fig. 34-16. Illustrations of case styles produced between 1919 and 1958. Variations of these were also manufactured.

Fig. 34-17. Strasser & Rohde No. 935 in a fine mahogany No. 1 pattern case having a Type A movement with Strasser's escapement with sapphire pallets and sapphires set in chatons for the escape wheel and pallet arbors. The Invar pendulum has adjustable compensation between two cylinders.

Fig. 34-18. Strasser & Rohde. A Style 5 oak cased wall regulator with Type 13 pendulum with adjustable compensation unit between the cylinders and Graham dead beat escapement with jeweled pallets.

Fig. 34-19. **Strasser & Rohde, Glashütte i/Sa.** It has an oak case, dead beat escapement with sapphire pallets and chatons for the sapphire pivot holes for the escape wheel and pallet arbors. The compensating unit between the twin bobs may be adjusted. The case is a slightly modified Style 5.

Fig. 34-20. **Strasser & Rohde No. 887.** This oak cased regulator, case style 11, with Type B movement, employs "Pfeiffer's Pendulum Motor" which impulses the suspension every second. The nickel-steel pendulum has a brass tray for small regulating weights. There is a dead beat escapement with sapphire pallets.

The Third Period 1919-1958

After Strasser's death Paul Weiss took over the stock of the business from Gustav Rohde, paying some 24,000 gold marks. One of the first things he did was to bring out a new catalogue containing case styles incorporating the new patterns of the 1920s (Fig. 34-16). Of the 12 basic models introduced seven were wall hanging and five floor standing. There were also variations in the case styles and individual designs were also used. The Type 9 was greatly influenced by some of the simpler designs from the earlier periods. This went on being produced throughout the entire production run of their precision pendulum clocks. Interestingly over 90% of the last 300 regulators sold were wall mounted. Many other case styles were produced (Figs. 34-20 and 34-21, pattern 11; Fig. 34-22, pattern 15) and also others, not shown in Figs. 34-15 and 34-16 such as those in Figs. 34-23 and 34-24, of these including a double one for an observatory in Stalingrad designed to house two movements, one showing sidereal and the other mean time (Fig. 34-25). A variant of pattern 17 is also illustrated (Fig. 34-26).

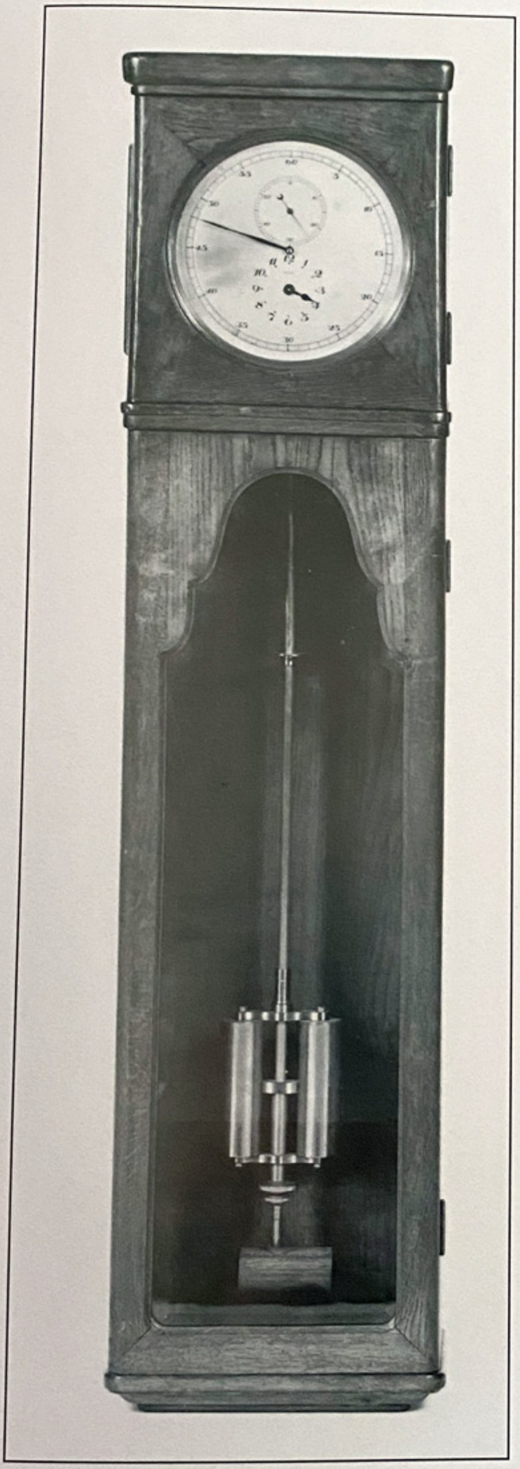
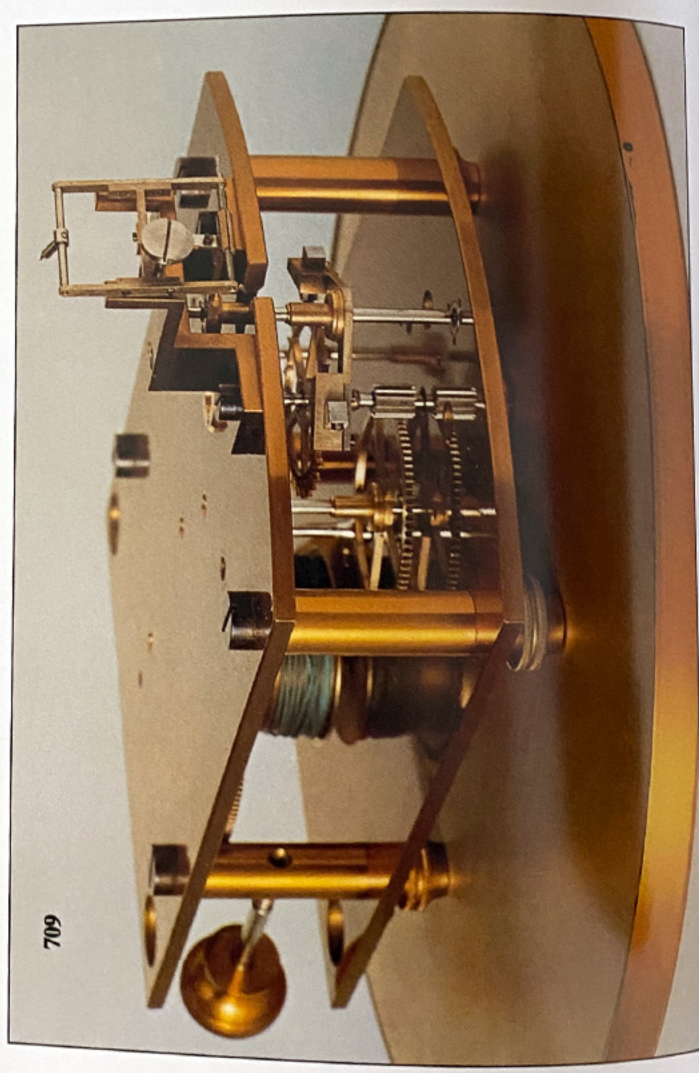
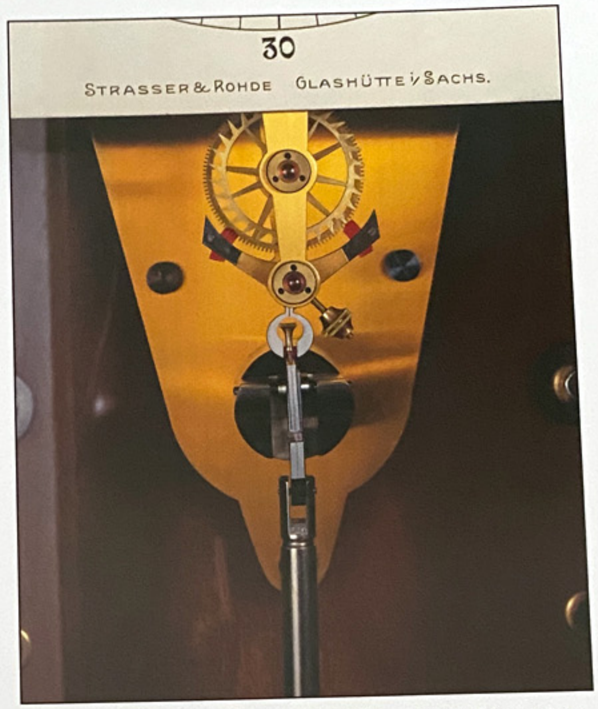


Fig. 34-21. **Strasser & Rhode No. 867.** An oak cased wall regulator with jeweled dead beat escapement, maintaining power and twin bob pendulum signed by the makers. The case corresponds with Strasser & Rohde's pattern No. 11.

Fig. 34-22. **Strasser & Rohde, Glashütte, dated on the dial 1935 and signed there by Karl Hanker.** It has a dead beat escapement, adjustable jeweled pallets, jeweled pivot holes for the escape wheel and pallet arbors, wheelwork with five crossings, maintaining power and a weight offset to one side. It has Strasser's two cylinder nickel-steel pendulum and his own form of spring impulse escapement. Case Style 15.

Figs. 34-23A, B. **Strasser & Rohde, Glashütte, No. 713.** A walnut cased wall regulator with Strasser's spring impulse escapement, offset driving weight and Invar pendulum with auxiliary compensation between the two cylinders.





Figs. 34-24A, B. **Strasser & Rohde, Glashütte, c. 1909.** This regulator, in a very substantial and somewhat elaborate case, employs Strasser's inverted spring impulse escapement with jeweled pallets and his twin cylinder Invar pendulum. The close up of the escapement illustrates his form of pendulum suspension, designed to protect it from any disturbance. *Musée International d'Horlogerie, La Chaux-de-Fonds.*

Fig. 34-25. **Strasser & Rohde Nos. 917 and 918.** These two regulators, one showing sidereal and the other mean-time, were made for the observatory in Stalingrad and housed in this specially designed double case. One wonders whether the proximity of two pendulums, within one case, beating at different rates, would have affected their performance.

Regulator Installation

Detailed instructions were given to owners on the installation of their regulator in the form of a color catalogue. By the time it left the factory, after 4-6 weeks testing, it had been rated to an error no greater than 0.25 second per day. If requested, the pendulum would be adjusted to suit the latitude, etc. of where the clock was due to be installed and the height above sea level, both of which will affect the gravity at this point and the latter the barometric pressure also.

It has been calculated that every meter the clock is raised slows the clock by 0.125 second a day so far as gravity is concerned, but the reduction in barometric pressure with an increase in altitude of one meter speeds the clock by 0.00015 second per day.

To adjust the clock initially, the regulating nut may be used and later very light weights are added to, or taken away from, the tray on the rods. These usually weigh 0.064, 0.32, and 0.64 grams and have an effect of 0.1; 0.5 and 1 second per day.

Other Manufacturers

Several other makers such as Trapp and Stübner produced regulators based on the Grossmann design which was evolved in Glashütte, and the German School of Clockmaking encouraged students to make similar regulators as part of their course.

Electric Contact Mechanisms

These were provided on request for the seconds, minutes and hours so that slave clocks could be run off the master clock. They were also used for time service installations such as the Imperial Post Office in Berlin and indeed a variety of contacts were provided over the years to serve many different purposes.

Geodetic Field Clocks

These were portable clocks, (Fig. 34-27) designed to measure the earth's gravitational pull at different points on its surface, and thus the distance from the center of the earth at that point. They could also be used for estimating, for instance, the height of a mountain or the depth of a mine. They were made with half seconds' and seconds' pendulums and ordered for a variety of purposes such as survey work and the German South Pole Expedition of 1901-03.

They always had a 24 hour dial and were provided with an Invar pendulum, initially with single, and later with a double bob. The cases were lined with copper. The upper door had an aperture for the dial and the lower one an opening through which the point of the pendulum could be seen. A tripod support for the case was used, as on the earlier survey clocks. In all three different designs produced with the facility for clamping the pendulum.

Several of Strasser & Rohde's regulators were used over the years for time services and in Fig. 34-28 we see one being used in the offices of the German Clockmakers' Journal.

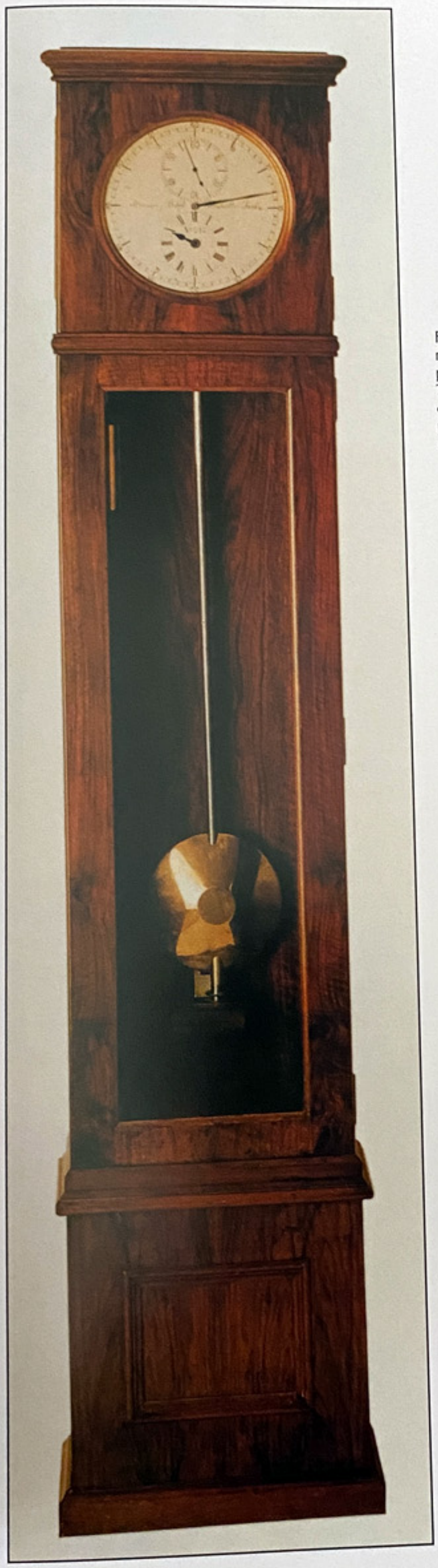


Fig. 34-26. **Strasser & Rohde No. 245.** This is a Type A regulator with Strasser's escapement in a modified pattern 17 walnut case, and a Riefler Invar pendulum. The four pillar movement, with jeweled pivot holes set in chatons for the escape wheel and pallet arbors, have ruby pallets. The weight is offset to the side and a four spring suspension is used.

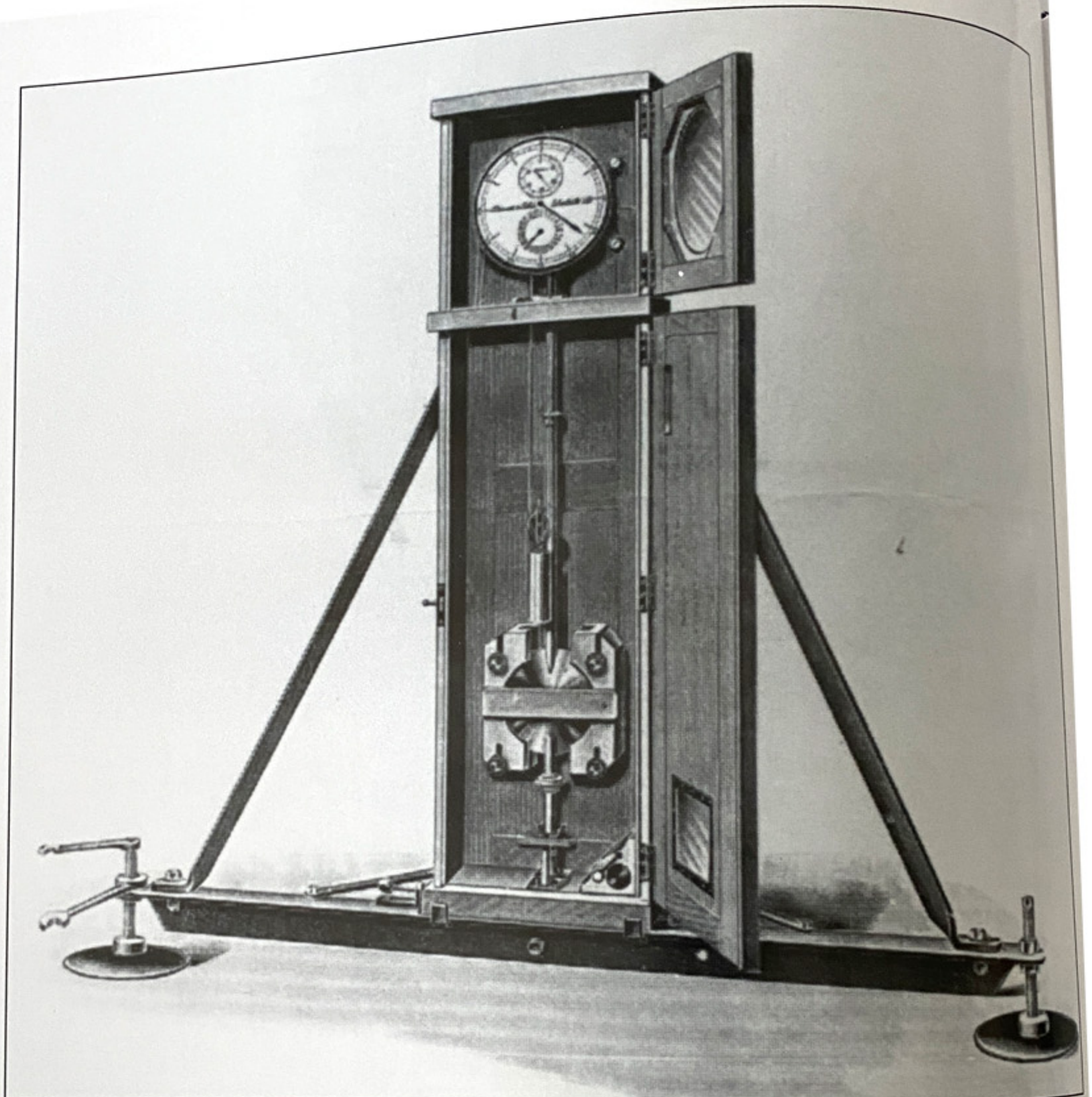


Fig. 34-27. **Strasser's Geodetic field clock.** It has a type I movement. The nickel-steel bob is seen here secured in place, ready for transportation.

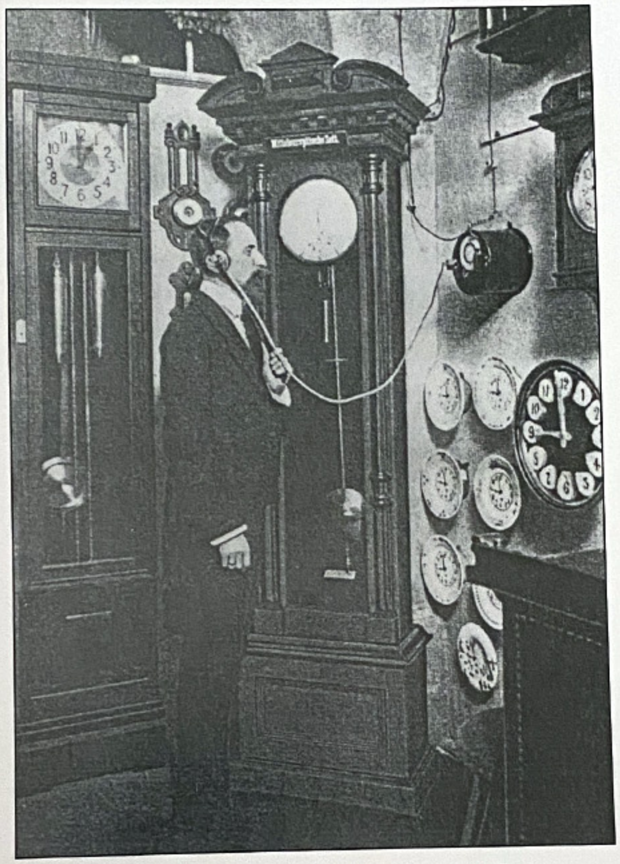


Fig. 34-28. The time service installation at the offices of the German Clockmakers' Journal, which was controlled by Strasser & Rohde's Precision Pendulum Clock.

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