1933: THE ORIGINS OF NIVAROX AND INCABLOC

BY STEPHEN FOSKETT / GRAIL WATCH

Two revolutionary technologies emerged nearly simultaneously in 1933. Nivarox and Incabloc addressed the key shortcomings of watches in daily use: accuracy and durability. Both were created by colourful engineers, and they reflected the transformation of the Swiss watch industry and materials science. Let us consider these technologies, created 90 years ago and still with us today!

MONTRES INCASSABLES

Pas un caprice de mode créant des stocks rapidement démodés, mais un progrès définitif

Les montres de précision conservent leur précision et acquièrent 3 qualités nouvelles:

1. Les pivots les plus fins et pierres de balancier ne peuvent casser, être pliés ou blessés en cas de chutes ou de chocs.
2. Prolongation du temps de conservation de l'huile.
3. Possibilité de nettoyage des pierres de balancier sans toucher le spiral.

Par le palier élastique „INCABLOC", seule solution du problème de la fragilité de la bonne montre, suffisamment **simple et conforme aux conditions de précision** pour avoir l'approbation unanime des horlogers.

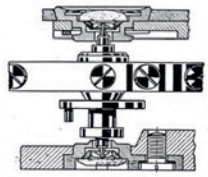
Protégé par les Brevets Marti suivants:

Allemand (accordé)	M	118727	IX/83 a, 10/1/33	**Français**	750497	29/5.33
Allemand (accordé)	M	121462	I/46 e, 21/10/32	**Suisse**	157933	23/10/31
Américain (demandé)		656579	13/2/33		97521	9/2.33
					98003	2/3/33

Seul Fabricant: LE PORTE-ECHAPPEMENT UNIVERSEL S. A.
Rue du Parc, 137, **La Chaux-de-Fonds**

Matris new firm quickly claimed patent protection for Incabloc, their revolutionary shock absorber. Surprisingly, most of the patents referenced in this September 1933 advertisement were not yet awarded or were incorrectly referenced!

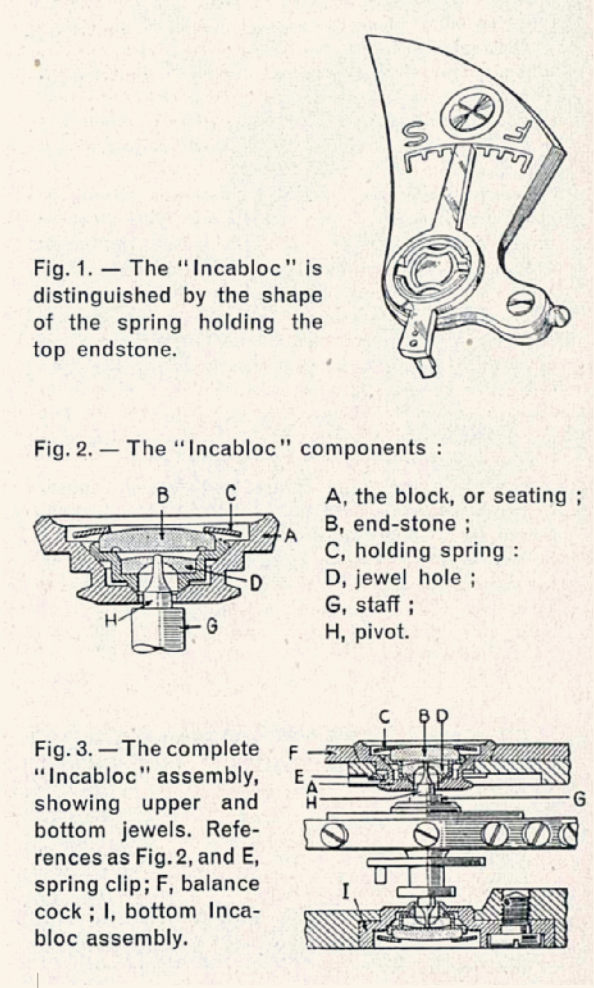
Although watches are no longer judged purely on their accuracy and reliability, these qualities were key selling points in the 20th century. So it can be surprising to learn just how fragile they were a century ago. Changes in temperature, magnetic fields, and rough handling were enough to send a watch back for service, and proper time keeping required skillful hand tuning. Although the basic materials used were familiar to us, the steel and brass and glass of the time was quite different in quality. Following the switch to mass production in the late 19th century, the next great leap forward was in materials science.



Turn-of-the-century watchmakers were keenly focused on a combination of critical components including the escapement, balance, and hairspring. These were historically produced and selected separately from the rest of the movement, and it was a high form of engineering art and science to bring these components together properly. This was a highly competitive field, and the best regulators competed for prizes and acclaim in competitions held by observatories and schools.

The pride and care of these regulators made them skeptical of mass production and new technologies, but they all recognized that the hairspring and balance were far too susceptible to magnetism, temperature, and shock. Even minor fluctuations of hot and cold due to daily wear impacted timekeeping, and this was amplified as watches moved to the wrist and were worn in more strenuous activities. Changes in temperature caused the balance to expand and contract and affected the elasticity of the hairspring. The best they could do was match the spring and balance and tune them by hand to cancel out some of the error.

The regulators and watchmakers were aghast in 1895 when every maker of hairsprings merged as the Société des Fabriques de Spiraux Réunies (FSR), doubling the price and restricting the supply of these critical components. Watchmakers struck back at an 1898 meeting, funding a competing spring factory called the Société Suisse des Spiraux (SSS) and vowing to break the cartel. But a new spring material, introduced that same evening, promised to change the game entirely.



This illustration of the Incabloc system was published in *Europa Star's Eastern Jeweler* in 1954, by which time it was found in over half of all Swiss lever watches

Guillaume, Perret, and Invar

Charles-Édouard Guillaume is often credited as the great innovator in watch springs, and his research was rewarded with a Nobel Prize in Physics. But Guillaume was quick to share credit for the temperature-resistant spring material known as Invar with regulator and inventor Paul Perret, who was already a controversial figure in watchmaking. He invented an automatic regulation machine in the 1880s that enabled his La Chaux-de-Fonds workshop to perform the task far quicker than competitors. The watchmaking establishment scoffed at his claims but his Campyloscope and Talantoscope ultimately proved to be useful tools for the next generation. But the theatrics of Perret and his supporters made him an outcast, notably his campaign for the establishment of patents in Switzerland and his camping out overnight to receive Swiss Patent number 1 in 1888!

Given his reputation, it is quite surprising that watchmakers and regulators allowed Perret to take the stage at all that night. But when he explained the benefits of Guillaume's alloy of nickel and steel they immediately recognized the strategic and commercial possibilities. It helped that he had the support of chronometer specialists Paul-David Nardin and Paul Ditisheim, who showed that Invar could be used to make a resilient balance, as well as the endorsement of Guillaume himself. The alloy was named Invar for its "invariability" to thermal expansion, and Perret demonstrated that such a hairspring would beat true from 0° to 30° C when paired with a conventional split balance.

The watchmaking industry supported Paul Perret's quest to productize a hairspring that would make the FSR cartel obsolete, but nothing went as planned. The forges at Imphy, France struggled consistently to supply the correct alloy and Perret's Invar springs were soft and easily damaged. Shortly after setting up a factory in Guillaume's home town of Fleurier, Perret faced bankruptcy and died in 1904. The operation was purchased by the FSR cartel in 1906, and Invar did not so much as dent their dominance.

Reinhard Straumann and Fritz Marti

The task of addressing the durability and reliability shortcomings of watches fell to the next generation. Reinhard Straumann and Fritz Marti have similar beginnings, with both born in 1892 to humble families in German-speaking Switzerland. Their legacy continues as well, with Nivarox springs and Incabloc balance settings nearly ubiquitous even 90 years after they were introduced. But these two engineers were remarkably different.

Reinhard Straumann was a business leader for whom Nivarox was just one among many interests. After studying aeronautics in Lausanne, Straumann joined Thommens Uhrenfabrik in Waldenburg and quickly rose to become technical director. An avid ski jumper, Straumann was hospitalized after an accident in 1925 and spent his long stay studying the cause of his injuries. He soon published papers on the structure of bone, theorizing new alloys for implantation, and perfecting the design of ski jumps and the form of jumpers. He spent his free time studying new alloys at his personal metallurgical laboratory in Waldenburg with his wife serving as his assistant, secretary, and partner.

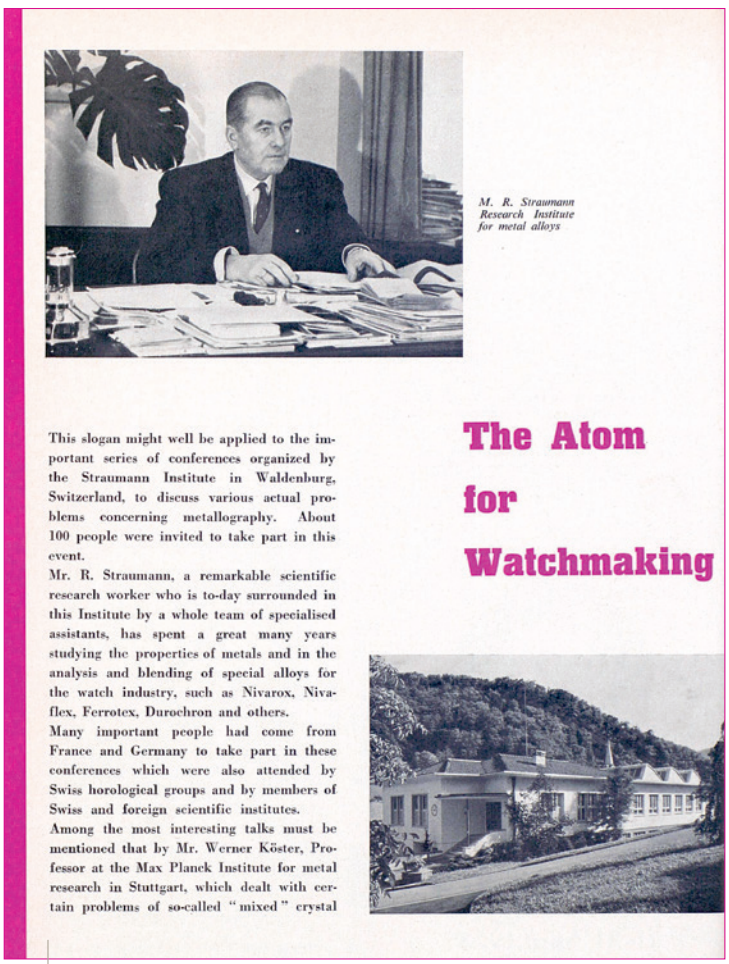
Friedrich "Fritz" Marti was a quiet and focused engineer who credited others for the commercial success of Incabloc, one of 130 patents he filed. Marti studied at ETH in Zurich,

where he served as an assistant to Albert Einstein for a time. Declaring that "knowledge has no age", the president of the Technicum in La Chaux-de-Fonds hired the 23-year-old Marti as director after graduation. But Marti was tempted away from academia by his friend and classmate Georges Braunschweig, who needed help optimising manufacturing processes at his family's mass-market watchmaking company, Election. It was at Election that Marti realized that breakage of the balance pinion was the most common reason that customer watches were failed.

The invention of Nivarox and Incabloc

The optimisation of alloys for balance springs crossed all of Straumann's interests, so he naturally continued Guillaume's research. He reached out to the German firm Heraeus to use their vacuum smelter in Hanau, developing an exceptional new spring material that was resistant to temperature, magnetism, and oxidation in 1931. Although the material was developed on his own time, the name Nivarox ("nicht variabel oxydfest", non-variable non-oxidizing) was registered by Thommens the following year. Nivarox balance springs were perfected in 1933, patented in 1935, and soon went into production at Karl Haas in Schramberg, Germany.

Deeply concerned about German control of this promising material, the Swiss watchmaking cartel ASUAG pressed for native production. They funded a joint venture between Werner Ruch of Saint-Imier, who had avoided the cartel by focusing on other types of springs, and Straumann himself, who left Thommens in 1934. Ruch died suddenly the next year and the aggressive Straumann carved off his balance spring operation, which became Nivarox SA in 1937. By this time the properties of his material were well known and Nivarox springs would be adopted across the entire Swiss watchmaking industry.



M. R. Straumann
Research Institute
for metal alloys

The Atom for Watchmaking

This slogan might well be applied to the important series of conferences organized by the Straumann Institute in Waldenburg, Switzerland, to discuss various actual problems concerning metallography. About 100 people were invited to take part in this event.

Mr. R. Straumann, a remarkable scientific research worker who is to-day surrounded in this Institute by a whole team of specialised assistants, has spent a great many years studying the properties of metals and in the analysis and blending of special alloys for the watch industry, such as Nivarox, Nivaflex, Ferrotex, Durochron and others.

Many important people had come from France and Germany to take part in these conferences which were also attended by Swiss horological groups and by members of Swiss and foreign scientific institutes.

Among the most interesting talks must be mentioned that by Mr. Werner Köster, Professor at the Max Planck Institute for metal research in Stuttgart, which dealt with certain problems of so-called "mixed" crystal

The Straumann Institute is likened to Oppenheimer's Los Alamos in this 1958 article from *Europa Star's Eastern Jeweler*

At the same time, Fritz Marti was developing an "incassable" (unbreakable) balance mount, with conical jewels capped with a movable block jewel under a metal clip. Seeing the commercial potential, the invention was patented by Marti in 1931 and named Incabloc in 1933. Election was rocked by a financial scandal at that time, so Marti set up a new firm with his former student Henri Quaile to produce standard escapement components, including his patented lyre-shaped Incabloc shock absorber. Georges Braunschweig officially joined his friend at Le Porte-échappement Universel SA once his name was cleared in 1934.

The legacy of Straumann and Marti

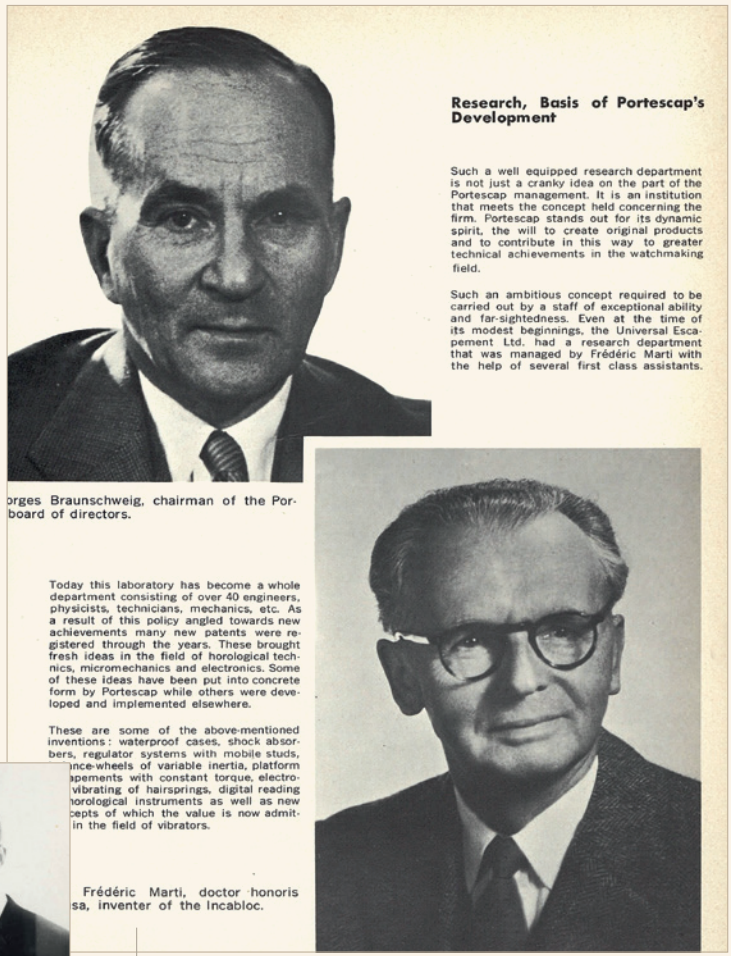
Reinhard Straumann was a bold polymath who built a notable art collection, promoted culture and musical performances in Waldenburg, and ran multiple companies. He was even elected district administrator but resigned after being pulled into a scandal in 1946. His personal research spawned an eponymous institute to study ski flying, materials, and test equipment and is now mostly focused on dental implants as Straumann AG.

Straumann died in 1967, just short of 75 years of age, and his legacy was continued by his son and grandson. Nivarox SA merged with the Fabriques d'Assortiments Réunis (FAR) in 1984 to become a technical cornerstone of Swatch Group known as Nivarox-FAR. Precision Engineering AG, founded by Reinhard Straumann's grandson Thomas, now

produces precision escapement components including balance springs using a new alloy known as PE 4000 alongside H. Moser & Cie. within the Moser Watch Holding group.

Fritz Marti lived a quieter life, though he was remembered for his many eccentric hobbies. He remained involved in Incabloc production through the 1960s, when over 80% of all watches relied on his invention and many included the brand name on the dial. Among his other inventions was a workable electric clock licensed to LIP in France.

While receiving an honorary doctorate from the University of Neuchâtel, Marti famously downplayed his legacy, saying that Incabloc was the only "beef" he produced and giving credit even for its success to others. His company, later called Portescap, would become one of the largest employers in La Chaux-de-Fonds and diversified into micro-motors. Fritz Marti died in 1983 at the age of 91. Incabloc was spun out as a separate firm in 2003 with Portescap becoming part of the international conglomerate Danaher.



Research, Basis of Portescap's Development

Such a well equipped research department is not just a cranky idea on the part of the Portescap management. It is an institution that meets the concept held concerning the firm. Portescap stands out for its dynamic spirit, the will to create original products and to contribute in this way to greater technical achievements in the watchmaking field.

Such an ambitious concept required to be carried out by a staff of exceptional ability and far-sightedness. Even at the time of its modest beginnings, the Universal Escapement Ltd. had a research department that was managed by Frédéric Marti with the help of several first class assistants.

orges Braunschweig, chairman of the Portboard of directors.

Today this laboratory has become a whole department consisting of over 40 engineers, physicists, technicians, mechanics, etc. As a result of this policy angled towards new achievements many new patents were registered through the years. These brought fresh ideas in the field of horological technics, micromechanics and electronics. Some of these ideas have been put into concrete form by Portescap while others were developed and implemented elsewhere.

These are some of the above-mentioned inventions: waterproof cases, shock absorbers, regulator systems with mobile studs, nce-wheels of variable inertia, platform apements with constant torque, electro-vibrating of hairsprings, digital reading orological instruments as well as new cepts of which the value is now admitin the field of vibrators.

Frédéric Marti, doctor honoris sa, inventer of the Incabloc.

Fritz Marti was happy to share the spotlight with Georges Braunschweig: The two had worked together since attending ETH in Zürich and the technically-focused Marti appreciated his old friend's business skills.

This 1965 publicity photo shows Georges Braunschweig, Fritz Marti, and Philippe Braunschweig celebrating the opening of the new Portescap factory, the largest employer in La Chaux-de-Fonds!

It is remarkable to consider the parallels between the lives and legacies of Reinhard Straumann and Fritz Marti. Born the same year, they followed similar paths into the world of watchmaking and invented key technologies that were introduced simultaneously 90 years ago. These two men, entirely different in character and personality, stand as exemplars for the engineers, inventors, and businesspeople who brought accuracy and durability to Swiss watches in the 20th century.. ◆