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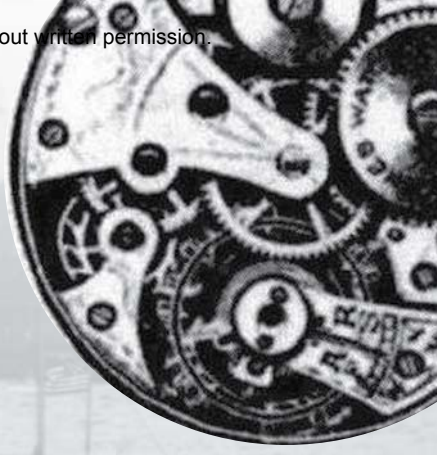
The Submarine Commanders' Watch



by David Boettcher (UK)
with Richard Edwards

A Waterproof Tavannes Wristwatch from 1917

Introduction

Since my research into the development of the waterproof screw down crown,[1] which was eventually most famously used in the Rolex Oyster, I have been interested in early waterproof watches. In an article in the British Horological Institute *Horological Journal* (HJ) of 1998[2] about early wristwatches, I found a reference to an earlier HJ article describing a waterproof wristwatch commissioned by two submarine commanders during the Great War (World War I) in 1917.[3] Naturally, this caught my interest, so I obtained a copy of the original article. Unfortunately, it was very short—more of a "news item" than an in-depth article—and contained few details of the watch. It is reproduced in full here:

THE DEVELOPMENT OF THE "SERVICE" WATCH

The war has led not only to new inventions, but to the development and improvement of things previously known. In the latter category may be included the wristlet watch, little used by the sterner sex before the war, but now to be seen on the wrist of nearly every man in uniform and of many men in civilian attire. The first wristlet watch was naturally a small pocket watch fitted into a leather holder and strapped on the wrist. This was soon improved by soldering to the sides "knuckles" or loops, through which the strap was passed. But such a watch worn on the wrist was so open to dust, and so much exposed to the effects of the weather, that it quickly became dirty. To obviate this the case was next made in one piece, into which the works were screwed; but this device was found to have certain disadvantages. With the advent of war a great demand arose for a watch that would stand the hard wear incidental to "service" use, and it is claimed that the demand has now been adequately met. Two submarine commanders approached a certain firm, and asked them to consider the construction of a special watch suitable for their work. It was explained that it must fulfil certain conditions. (1) It must be water-tight; for even when a submarine is on the surface the deck is always more or less awash. (2) It must be non-magnetic; for under water the submarine is driven by electricity, and in such a limited space watches made of magnetic materials are necessarily affected. (3) As, for the same reason, a compensation balance of the ordinary kind is impossible, the balance must be of some material which shows a minimum of expansion and contraction with variations in temperature. This condition is met by the employment of an alloy of iron and nickel, which expands and contracts so little that this factor may be disregarded. (4) The face must be quite legible at any time, and as the usual yellow luminous figures, when placed on a white dial, are not really discernible in moonlight, twilight, or subdued artificial light, a black dial is used, thus making it easy to read the exact hour in any light. A watch fulfilling every one of these conditions, and fitted in addition with a small luminous seconds-hand, has now been on the market for some months, and appears to have before it a distinctive sphere of usefulness.

I sent a copy of this article to my watch collector friend, Richard Edwards, and was rather more than astonished when he told me that he had a wristwatch matching the description of the one in the article. It is Richard's wristwatch that is described in this article. Although there is no direct link between Richard's watch and the one described in the HJ article, I am sure that the watch is the same as the ones described. This is partly because there were no other waterproof wristwatches like this one in 1917; they simply did not exist. Also, there are many similarities between the description in the HJ article and the actual watch, which briefly are as follows:

- The hallmark date of the watch and the date of the HJ article coincide: 1917.

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• The HJ article says that a waterproof wristwatch was commissioned by two submarine commanders; the watch is a waterproof wristwatch, and it has "submarine" on the dial.

• The watch has a black dial with luminous hands, which is nothing unusual, but the watch has a luminous subseconds hand exactly as described in the article. I have seen pocket watches with luminous seconds hands, but it is much more difficult to skeletonize the smaller seconds hand of a wristwatch for luminous paint, and consequently they are rare.

• The watch has an uncut yellow-white monometallic balance and yellow-white balance spring. These have yet to be proved to be the non-magnetic and temperature invariant iron/nickel alloy discussed in the HJ article, but they are certainly different in appearance from the cut bimetallic balance and blue steel spring, which were normal then and which this caliber usually has.

For a description of the watch and these points in detail, please read on.

Figure 1. Luminous black dial.

Figure 2. Watchcase with milling.

Figure 3. Stem seal and case threads.

The Submarine Watch

The watch was made by the Swiss watch company Tavannes. See Bruce Shawkey's article in the *Watch & Clock Bulletin*[4] for the history of the Tavannes Watch Co.

Figure 1 shows the front face of the watch. The dial is black with luminous hands and numerals. The numerals have lost their radium-based luminous paint over the years, a common occurrence because the radiation from the radium damages the structure of the paint over time.

Someone has clearly thought carefully about making the numbers on this dial as visible as possible in the low light conditions described in the HJ article. Watches with black dials have the numerals either outlined in skeleton form on an overall black dial, relying on infill paint to make them visible, or blocked out in white as this watch. Block white numerals such as this give the greatest contrast to the black of the dial and are clearly visible even when the paint is missing. To make them easily visible in low light and in the dark they were covered with a clear varnish containing a radium-based luminous material that glowed all the time. The white background of the numbers ensured that light emitted backward from the luminous material and was reflected forward, maximizing the luminous effect, rather than being absorbed in the dial as it would be with a black background.

The hands are skeletonized to carry luminous paint, and an unusual feature for a wristwatch dial of this period is that the seconds hand is also skeletonized and carries luminous paint, exactly as described in the HJ article. In a wristwatch it is usually only the hour and minute hands that carry luminous paint; the seconds hand is usually a simple unadorned baton.

The watch is made watertight by a screw on back and a screw on bezel with gaskets, and a waterproof gland seal in the stem tube. The case back and the bezel have coin edge milling around their edges (Figure 2) to grip while screwing them on and off the case middle part.

Figure 3 shows the stem sealing arrangement dismantled. There is a gland or packing ring in the stem tube, secured and compressed onto the stem by a round brass nut, which is externally threaded and screws into the outer end of the stem tube. The original gland was oiled leather and has been replaced with one of modern rubber. In Figure 3 you can also see the threads on the middle part of the case for the screw on bezel and screw on back. The gland is compressed by the nut onto a perfectly smooth section of stem, shown in Figure 4, and gives a very effective seal.

Figure 5 shows the case back. The recess machined around the case back inside the screw threads carries a sealing gasket, and there is a similar recess inside the

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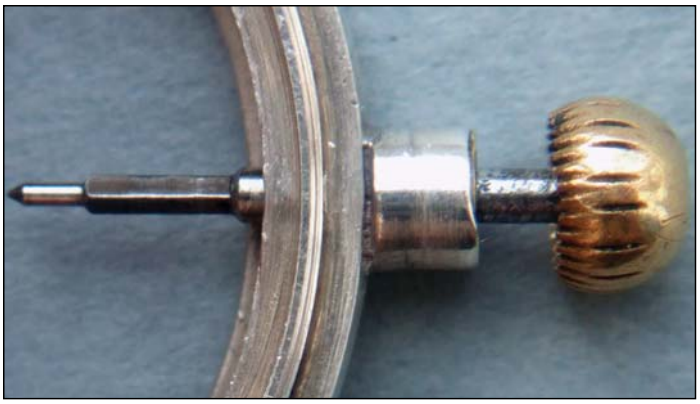

Figure 4. Stem detail.

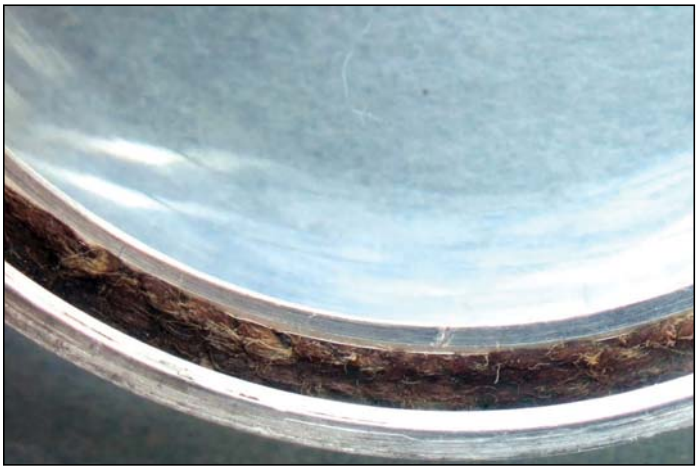

Figure 6. Plaited gasket.

screw on bezel. The gaskets are a form of plaited ribbon, shaped to fit in the bottom of the milled channel and probably originally impregnated with grease or wax. Figure 6 shows remnants of one of the original gaskets.[5]

The case back carries the Glasgow Assay Office town mark for an imported watchcase[6] of two opposed block

Figure 7. Tavannes movement.

Figure 5. Case back with gasket.

letters F prone, the date letter "u" for the Glasgow hallmarking year 1917 to 1918, and the 925 of sterling silver. The import mark shows that a watchcase was not made in Britain; this one was certainly made in Switzerland for Tavannes and the watch cased up by them and imported complete. The sponsor's mark is JW, registered by James Weir of Glasgow who effected the British assay and hallmarking for Tavannes.

To send an item for hallmarking in Britain, a person has to register a British address and a unique "sponsors mark" with an assay office. Foreign companies without a permanent representative in Britain had to use a British sponsor to get items assayed and hallmarked before they could be sold or traded in Britain. In 1926 a sponsors mark "SFC" in a fancy shield was registered by Schwob Freres & Co. Ltd SA at the Edinburgh Assay Office for use by Schwob Freres, Tavannes and Cyma. The same mark was registered at Glasgow, possibly earlier than 1926, but the records have been lost; evidently, in 1917 neither Schwob Freres nor Tavannes was registered with an assay office, so they used the services of James Weir for the process of British hallmarking.

There is a reference in the case back to a Swiss patent ("Brevet +"), but unfortunately no patent number, and I have been unable to trace any patent by Tavannes for a waterproof watch.

The movement, shown in Figure 7, was made by Tavannes. Figure 8 shows an entry for this movement from the Tavannes section of the 1936 edition of Jobin's "Classification."[7] These Tavannes movements often bear a reference to a U.S. patent "U.S. PAT 24 May 1904." This is a reference to U.S. Patent No. 760647 for a negative set stem- winding and -setting mechanism (keyless work) granted to Sandoz on that date, a U.S. version of a Swiss patent CH 28243 granted to Sandoz in 1903. This could be the unspecified patent referred to in the case back.

The movement of the submarine watch has a solid yellow-white monometallic balance and yellow-white metal balance spring, rather than the cut bimetal-

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lic compensation balance and blue steel spring usually seen at the time. These have not been tested for composition, but it seems likely that these are the "alloy of iron and nickel, which expands and contracts so little" and is non-magnetic as described in the HJ article. It has not been possible to ascertain the effects of temperature on the rate of the watch in tests because the escapement is not in sufficiently good condition and its random variation exceeds any effects of temperature.

Figure 8. Jobin.

Figure 9. Balance and spring.

The HJ article says that "a compensation balance of the ordinary kind is impossible, the balance must be of some material which shows a minimum of expansion and contraction with variations in temperature." The principal effect of temperature on the rate of a watch is due to the loss of elasticity of the balance spring with increasing temperature. A bimetallic "compensation balance" compensates for this by curving its arms inward as the temperature rises, reducing its rotational inertia to compensate for the weakening of strength of the balance spring but the bimetallic arms, being made of a sandwich of steel and brass, are susceptible to magnetic fields. The balance and balance spring of the submarine commanders' watch must be non-magnetic and, because therefore a bimetallic balance cannot be used, must be also either insensitive to changes in temperature or auto (self) compensating.

During my research into the Rolex screw crown I tried to find out more about the two inventors of the screw down crown whose patent Hans Wilsdorf purchased, Paul Perregaux and Georges Perret. In the course of these investigations I found a Paul Perret (1854-1903), and what a very interesting fellow he was. He took out the very first Swiss patent, No. CH 1, in 1888 and in early 1897 discovered that Invar had a positive temperature coefficient.[8] On May 6, 1897, Perret registered a claim for a patent for an escapement with a balance spring whose strength increased with temperature sufficiently to compensate for the increase in moment of inertia of a plain (uncompensated) balance. This patent was published in Switzerland on January 15, 1898, as CH 14270, in Great Britain on February 5, 1898, as GB 25,142 and in the United States on March 12, 1901, as U.S. 669,763. Throughout the rest of his career Perret continued to work with Guillaume on autocompensating balance springs, springs that compensate for their thermal expansion and the balance by

Figure 10. Perret's balance springs.

Réglage de montres
Rapidité — Bon marché — Exactitude

Les **meilleurs réglages** s'obtiennent, spécialement pour montres **non-magnétiques,** avec le **spiral acier-nickel,** s'adresser au fabricant **Paul Perret, Fleurier.** H 3577 N 1502

Défauts comparés des différents spiraux:

Le spiral non magnétique ordinaire						varie de	15	à	18^{s}	p^{r} degré centigrade.
»	»	d'acier trempé soigné				»	9	»	11^{s}	» » »
»	»	**Acier-nickel** demi-compensateur de **Paul Perret**				»	3	»	5^{s}	» » »
»	»	»	**compensateur**			»	0	»	1^{s}	» » »

Le spiral **acier-nickel** permet de supprimer le balancier bi-métallique coupé. Le balancier tout en laiton donne les meilleurs résultats.

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having an elastic modulus that increases with temperature, and balances.

Perret evidently went into production with his patented balance springs. Figure 10 shows an advertisement from La Fédération horlogère suisse dated September 15, 1901. Under the title "Timing of watches" the ad says that "The best timing is obtained, especially for non-magnetic watches, with nickel-steel balance springs, contact the manufacturer Paul Perret, Fleurier." Examples of changes in daily rate caused by increases in temperature are given and range from ordinary non-magnetic balance springs, which are said to vary from 15 to 18 seconds per degree centigrade, through to Paul Perret's nickel-steel non-magnetic compensation balance spring, which is said to vary from 0 to 1 seconds per degree centigrade. The remark at the bottom of the ad says that Perret's nickel-steel balance springs allow the elimination of the cut bimetallic balance and that balances made all of brass give the best results.

In studies on compensating balances and hairsprings by Perret that were published in 1905, after his death, one of the companies Perret mentioned working with was Tavannes, whose founder Henri-Frédéric Sandoz (1851- 1913) was a talented and inventive watchmaker, designing not only his own calibers but also the machines to make them.[8] At the time compensated balances were used mainly for observatory work and chronometers, although David Read informed me[9] that a large proportion of Tavannes watches from this period have monometallic alloy balances with balance springs that are not blued steel and that Tavannes seem to have been unusual in this respect, suggesting that they were an early user of nickel/steel alloys for monometallic balances and balance springs. Surely, it is no coincidence that Tavannes made this wristwatch with its apparently non-magnetic and temperature invariant balance and balance spring.

Commissioning the Watch

There is no suggestion that the design of this wristwatch was ordered by the British military authorities. The HJ article makes it clear that it was the initiative of two British submarine commanders. In the British services there was a long tradition that officers were expected to furnish a great deal of their own kit. Because officers were drawn from the upper classes rather than promoted through the ranks they were from a small privileged population who largely knew each other and went to the same clubs. I can imagine the two submarine commanders in question, on leave in 1917, discussing in their London club how inconvenient it was not to be able to use their watches on the conning tower of their submarines because of the constant drenching they received, when another club member hearing the conversation said, "I say chaps, why not speak to old "X" over there, he's the London agent of "Y" (a Swiss watch company), I'm sure they could come up with something." To have a few wristwatches made to their specification, perhaps worked out there and then in the club on the back of a napkin over brandy and cigars, could be a trivial cost for two gentlemen; the wealth of some sections of the Georgian British aristocracy was vast before it was decimated by the cost of the Great War and the social upheavals that followed.

Conclusions

One question that puzzles me is why these historically important waterproof wristwatches appear to be almost completely unknown. I have never seen them mentioned in any book or previous article except for the one in the 1917 *Horological Journal*. It might be supposed that the answer could be found in the way the watch came about, during the depths of World War I as the result of a request by two submarine commanders. The extra work involved in making the watch waterproof and antimagnetic would have made it more expensive, and the military involvement could have made it hush-hush, but the HJ article says that it had been "on the market for some months," which implies that it might have been made in production quantities.

These watches were clearly fully waterproof some ten years before the Rolex Oyster, which many people think of as the first waterproof watch, or at least the first waterproof wristwatch. They were also very practical compared with the Rolex Oyster; there is no need to unscrew the crown to wind or set the watch and, therefore, no threads on the stem tube to wear, a serious problem with early Oysters before automatic winding was introduced. They also remain waterproof while both winding and setting the watch, which the Oyster does not; there is no need to remember to screw down the crown after winding, a feature that has caused grief to many Oyster owners over the years.

It could be argued that the compressed gasket sealing for the stem is perhaps not as ultimately waterproof as a screw down crown in withstanding water pressure at diving depths, but then again, Rolex didn't make any claims about this for the first Oysters, allowing Omega to make the claim of producing the first diver's watch in the 1932 Omega Marine as discussed in my article in the *Watch & Clock Bulletin*.[10] This watch and my other research into the development of the waterproof watch has shown that there had been many successful waterproof watches, and indeed screw down crowns, before the Rolex Oyster, but that there was perceived to be no popular demand for a waterproof watch at the time. It seems it was probably because Wilsdorf, not knowing about these other developments and not knowing that there "was no demand," heard about Perregaux and Perret's screw down crown and appreciated the marketing opportunity that a waterproof watch offered that the Oyster was developed, not vice versa.

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The watch also appears to have an early example of a non-magnetic and auto temperature compensating balance and balance spring. It is likely that the real reason for the lack of commercial success of the submarine wristwatch was probably that very few people actually needed or wanted a waterproof wristwatch in 1917, when it was only military men who wore wristwatches, and few of them needed their watches to be waterproof and non-magnetic, perhaps only submarine commanders. The overwhelming fashion for civilian men was the pocket watch, and of course none of them would have contemplated tucking a pocket watch into their bathing costume—or at least the manufacturers thought so.

The launch of the Oyster waterproof wristwatch in 1927 was a transformational event for Rolex. But the successful promotion of a waterproof wristwatch with a modern style advertising campaign, as something that the average person should want or needed, was a particular vision of Hans Wilsdorf, similar to the way that Steve Jobs had a vision for the iPod, iPhone, and iPad and almost single-handedly created markets for portable MP3 players and tablet computers. Waterproof watches existed before the Rolex Oyster, but they needed advertising and promotion, such as the famous cross-Channel swim of Mercedes Gleitze carrying an Oyster, to make their very existence known and to capture the public imagination.

Without such a visionary to champion its cause, the revolutionary waterproof submarine wristwatch, like its eponymous creators and their submarines, disappeared beneath the waves of history.

Notes

1. David Boettcher, "The Rolex Screw Down Crown and Its Antecedents," *NAWCC Watch & Clock Bulletin,* No. 389 (December 2010): 677-688.

2. Dennis Harris, "The Early Wrist Watch in Times of War 1899-1920," *Horological Journal* (August 1998).

3. *The Horological Journal* (December 1917): 41. No named author.

4. Bruce Shawkey, "Tavannes: Rebuilding a Brand," *NAWCC Watch & Clock Bulletin*, No. 402 (March/April 2013): 175-179.

5. Compressible gaskets made of materials such as leather and this plaited material were used from the nineteenth century in silver screw back and bezel cases, because the silver threads could not stand a high force and the screws were closed by hand. In the late 1920s stainless steel screw back cases came into use. These were stronger and could be closed by spanners or keys, and lead gaskets began to be used.

6. From June 1, 1907, the cases of all gold and silver watches imported into Britain were required to be assayed and hallmarked at a British assay office with hallmarks that were different from those on watches made in Britain to identify easily watches of foreign manufacture.

7. "La Classification Horlogère des calibres de montres et des fournitures d'horlogerie Suisse," A. F. Jobin, 1936.

8. In *Swiss Timepiece Makers* Kathleen Pritchard, apparently quoting ftom Haswell, says that Paul Perret was a precursor of Guillaume in inventing an autocompensating material for balance springs, but this appears to be incorrect. When Guillaume announced his discovery of Invar in 1896, Perret immediately asked him for a small piece, which he made into a balance spring. Perret found that a watch fitted with this spring gained in rate with increasing temperature, discovering that the temperature coefficient of elasticity of Invar was positive, something Guillaume hadn't tested for because he was principally interested in dimensional stability. Guillaume and Perret collaborated on researching materials for balance springs and balances until Perret died in 1903.

9. David Read, private communication with David Boettcher, June 19, 2013.

10. David Boettcher, "The Omega Watches Marine and Marine Standard: Two Unusual Waterproof Watches from the 1930s," *NAWCC Watch & Clock Bulletin*, No. 395 (January/February 2012): 34-45.

Acknowledgments

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David Boettcher is a Chartered Engineer with a background in nuclear power, retail and information technology. His interest in vintage wristwatches was sparked when he inherited his grandfather's 1918 silver Rolex wristwatch. His watch interest website is www.VintagewatchStraps.com, and he welcomes comments or questions by email to David.B.Boettcher@gmail.com.

Richard Edwards has collected and restored watches for more than 40 years, and he teaches watch servicing, repair, and conservation. He has a particular interest in the development of the wristwatch from its earliest manifestations, and has researched and presented talks on this subject. He can be contacted by email at eddywatch@hotmail.com.