

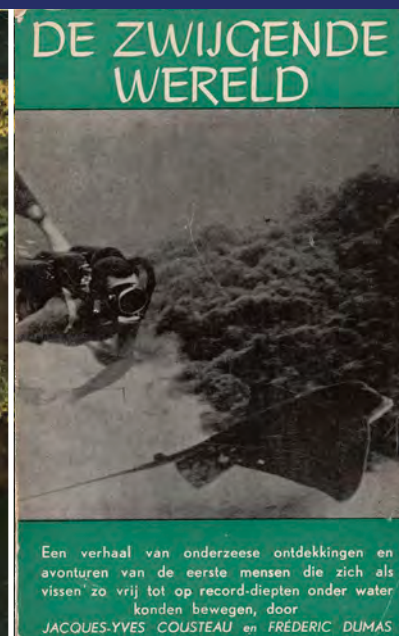
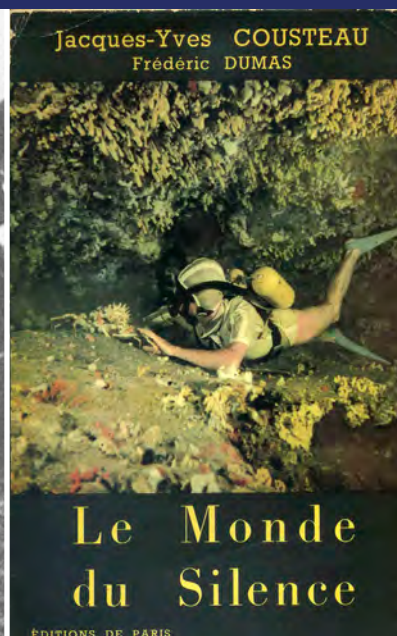
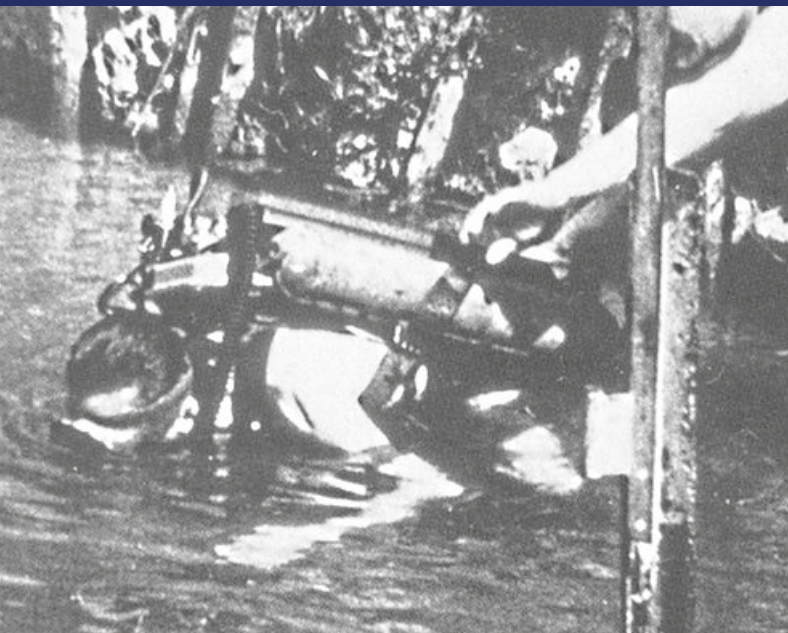
75 YEARS OF SPORT DIVING HOW IT ALL BEGAN

FEATURE **DIRK DERAEDT** AND **PATRICK VAN HOESERLANDE**

Assigning the origins of sport diving to one person or one company may be a little unjust. Many other dive pioneers, engineers and companies developed similar devices and many organisations introduced diving equipment and organised training.







TOP ROW: 1. Winter 1943, Cousteau is testing a first prototype of his regulator in the Marne. **2 & 3.** Book covers by *Le Monde du Silence* and *The Silent World*
BOTTOM ROW: 1. The two inventors of 'Le Scaphandre Autonome' – diving legend Jacques-Yves Cousteau (left) and engineer Emile Gagnan. **2.** Prototype of the first Cousteau-Gagnan regulator, also known as the CG43 or the 'Scaphandre Aïre Liquide' Photo ©Aqua Lung / M. Cabrière. Photo h: Cousteau is getting ready for a dive with a prototype.

2018 is a special year for us divers. In 1943, diving with an on-demand breathing device that allowed the diver to breathe air under water without a connection to the surface became a reality. This working prototype was designed by Jacques-Yves Cousteau and Emile Gagnan. Designed, however, is not the right word, because their device was based on, among other things, the model for which Benoît Rouquayrol and Auguste Denayrouze filed patents in 1860 and 1864. But more about that later.

Shortly after testing their invention the first regulators, based on the prototype from Cousteau and Gagnan, were marketed under the name Mistral from Aqua-Lung. This commercialization opened the door to diving to the general public. We can therefore say, that 75 years ago, diving as a sport was born. Reason enough to dedicate a number of articles on the first regulators invented. In the context of this anniversary, we will cover the following topics:

How It All Began: we look through the history of the regulator until the Mistral is invented. Le Prieur and Rouquayrol-Denayrouze's inventions are well known, but there were many others. For example, Georges Commines invented a working regulator almost at the same time as Cousteau-Gagnan, but died prematurely. We will describe and explain some of these inventions and why they did not make it.

How Does the Single Stage Regulator Work?: in this article we'll delve a little deeper into the technicalities of the first single-stage regulator than what is found in a standard dive book.

Vintage Diving: we'll explore diving with a single stage Mistral.

THE YEARS BEFORE

Although the history of sport diving is only 75 years old, our urge to swim amongst fish is probably as old as our race. We do not know that for certain because no evidence was found. Although some believe the theory of

"homo aquaticus", there was no evolutionary return to the aquatic environment as it happened with whales. Throughout the history of mankind we find evidence of a continuous desire to return to the world we as divers know so well. We are still not one with the fish, but we are not far away from that aspiration.

The invention of a technical masterpiece such as the single-stage regulator is the result of the combination of manufacturing possibilities (how exact and how strong can something be produced), material knowledge (what is known and available), many failed experiments (and therefore people willing to take risks), ingeniousness (new ways of solving problems), seeing opportunities and pure luck. 1943 was a year in which all the above-mentioned elements came together. So you may wonder for example, what would have happened if at the time of Rouquayrol-Denayrouze technology would have been mature enough to produce high-pressure tanks, then would they not have been the fathers of diving? And



LEFT: Cousteau getting ready for a dive with a prototype. **RIGHT: 1 & 2.** The legendary Mistral regulator (front and back). Photos by Dirk Deraedt. **3 & 4.** The Royal Mistral regulator (front and back). Photos by John Swinnen.

what if Europe would have lived in peace in 1943? Or if Gagnan as an engineer would not have been interested in gas reduction valves? We must therefore consider every invention leading to the year of 1943 as a necessary step in the development of our sport. Let's take a look at our heroes.

The most famous diver from Antiquity is the Greek Scyllis. When he was brought aboard around 500 BC, he learned that the Persian King was planning to attack the small Greek fleet. He grabbed a knife and jumped overboard. In spite of their efforts, the Persians could not find him and considered him drowned. However, he came back under the cover of the night. He swam from ship to ship with the aid of a hollow straw as a snorkel and cut through all anchor cables. This drove off the entire fleet and a Persian victory was thwarted.

Diving with a hollow tube had its limitations and taking a bag of air underwater did not meet expectations. The search for an improved

underwater breathing apparatus started early in history. In the third century BC, Aristotle mentioned a breathing apparatus that allowed a person to stay underwater for a longer period of time. However, much is not known about this device.

In order to have access to larger air supplies other than a pig's bladder, some adventurers experimented with diving bells (in 1535 Guglielmo de Loreno developed the first diving bell). These were in fact nothing more than a large, inverted bucket containing a bubble of air. After a dive, a free diver could, instead of surfacing, swim into the bucket to catch a breath of new air and stay at depth for a little longer and waste less time having to resurface. The diver could repeatedly do this until the air supply was no longer fresh enough. To stay down longer, they had to find a way to refresh the air. In 1650, Otto von Guericke invented the first effective air pump – an air ventilation system which could be connected to the dive bell. Edmund Halley patented it in 1691 as a

weighted diving bell with an umbilical cord attached to a surface pump.

The bell and pump scaled-down little by little from a barrel that enclosed the diver (in 1715 John Lethbridge constructed an oak dive cylinder which was placed under pressure via an air hose where the operator could move his arms through holes in the cylinder) to a helmet worn on the diver's head. This system was developed in 1826 by Charles Anthony and John Deane. They patented it in the same year a fireman's helmet was secured with straps to the body and connected with an air hose. Hard hat diving was born.

Diving in cold water for longer periods soon required thermal protection, and so the first diving suits came about. From then on, diving evolved fast. In 1828, the Deane brothers used their helmet in combination with a diving suit. A few years later, in 1837, the German inventor, Augustus Siebe who lived in England, had combined the Deane



TOP: Diving pioneers from the Groupe de Recherches Sous-Marines, including Cousteau (far left), Taillez (third from left) and Dumas (second from right).
OPPOSITE PAGE: Jacques-Yves Cousteau's wife, Simone Cousteau – the first female diver donning scuba equipment in 1945.

diving helmet with an air-cured rubber suit. This completely sealed diving suits connected to air pumps on the surface and became the first reliable suit of its kind. Because it is also the prototype of today's models, Siebe was awarded the title of "father of diving" after his death. When we speak about scuba diving and sports diving as we know it today, the inventors had to make away with the air hose. An interaction between technical possibilities and experimental ones was needed. A complex invention is rarely one created from a sudden idea, but usually the result of a continuous improvement of existing ideas, concepts and prototypes put together.

The English inventor William James won the race for the first workable scuba equipment in 1825. Unfortunately, there is no evidence of a dive actually performed with his equipment and his invention was not followed up. It was a dead end – he could hardly claim the title of "founder of recreational diving".

Interesting fact is that in 1828, Lemaire d'Angerville applied for a patent for his invention in which an air bag was placed against a divers chest. Sometimes old concepts are reinvented.

The French mining engineer, Benoit Rouquayrol and Navy lieutenant, Auguste Denayrouz came close to earn the title in 1865 with their patent for the 'Aerophore'. This device consisted of a horizontally fitted steel tank on the back of a diver which was

connected via a series of valves to a mouth piece. The innovative element of this device was that the air was only supplied when the diver inhaled. A membrane regulated the breathing pressure as a function of the ambient pressure that came from the low-pressure tank (15 to 25 bar), which was connected to a surface pump via an air hose. The diver could however disconnect the air hose to dive independently for a few minutes. The 'Aerophore' was the first 'on demand' autonomous underwater breathing apparatus and is therefore the forerunner of our modern scuba equipment. For years it was the standard equipment of various navies, and Jules Verne used it in his "20,000 Leagues Under the Sea".

Yet the duo Rouquayrol-Denayrouze did not win the title. Probably due to the technical limitations, they could only use a low-pressure tank, which restricted the diver's autonomy to a maximum of 30 minutes at 10 m in the most advanced version.

We have to wait until 1933 before the concept was greatly improved by the French captain Yves Le Prieur. He improved the invention of Rouquayrol-Denayrouz by combining it with a specially designed valve and a high-pressure tank (100 bar). As a result, the diver had a greater autonomy and was not hindered by all kinds of hoses and lines. However, the device was no longer on-demand. The diver could breathe by manually opening a valve. The exhaled air escaped along the sides of the

mask. Le Prieur realised that a great invention alone was not enough to claim the title and so he founded the world's first scuba diving club, called 'Le Club des Scaphandres et de la Vie Sous L'eau'. Too bad for him, his model did not receive enough support to give him a prominent place in history.

Why the 19th century invention of Rouquayrol and Denayrouze was forgotten, we do not know. The device was, however, the basis for further work. Until 1943, a "regulator" provided either continuous air, or after manually opening a valve.

COUSTEAU – GAGNAN

The years before the successful invention, Cousteau and his comrades had made various attempts to – with varying degrees of success – dive with other devices. Experiments with self-manufactured oxygen devices were almost fatal: pure oxygen was inhaled through a rudimentary rebreather; but at a depth of 15 metres the respiratory gas became toxic and Cousteau, after severe convulsions, lost consciousness as a result of which he nearly drowned... With the Fernez apparatus too, in which the diver was supplied with air by a pump through a hose, things went wrong: this time it was Dumas who almost died after a rupture of the hose caused a sudden under pressure in his mask. As mentioned before, Commander Le Prieur's device was too limited in terms of autonomy, so Cousteau continued to look for a device that was both safe and provided the necessary autonomy without being physically dependent on the surface.



In December 1942, thanks to his father-in-law and director of Air Liquide, Henri Melchior, Jacques-Yves Cousteau met the engineer Émile Gagnan from Air Liquide Paris. The latter was specialised in industrial gases and worked on a regulator for truck and car engines to run on coal gas. This regulator was needed to bypass the restrictions on petrol imposed by the Germans during the war. Cousteau understood that the regulator of Gagnan could be converted to advance the device of Rouquayrol-Denayrouze. Together they applied this improvement. After a few unsuccessful attempts, they succeeded and managed to put together an incredibly safe, reliable, and easy to use device. In January 1943, they connected this regulator to a dual air tank, and a mouthpiece. They tested this configuration in the middle of winter, in the river Marne.

The test dive was not without its problems. Upright, there was a constant flow rate with the head lower – however, Cousteau barely got any air. The device worked satisfactorily only in the horizontal position. Disappointed, he left the icy water, but on the way back home the two men made some adjustments, including a second hose so that the exhalation takes place against the membrane in order to minimize the pressure differences.

THE FIRST SCUBA DIVE

In June 1943, at 'La Plage de Barry', a small beach in Bandol in southern France, a skinny 33-year-old man gets ready to step into the water. Besides a diving mask, fins and a weight belt, he carries on his back a combination of three steel compressed air cylinders. At the top, the unit is equipped with a device the size of an alarm clock, which is connected to a mouthpiece by means of two rubber hoses. The man is an officer of the French navy and is called Jacques-Yves Cousteau. Cousteau is not alone, he is assisted by two friends – Philippe Taillez, a colleague marine officer and Frédéric Dumas, at that time the best free-diver and underwater hunter of the Côte d'Azur. Also present is Simone Melchior, Cousteau's wife.

Cousteau enters the water. After Dumas hangs several kilos of extra lead on his belt, Cousteau drops to the bottom until he lands on the sand a few metres deeper. "I could breathe without any trouble. There was a soft whistle when I inhaled and a faint gush when I exhaled again. The regulator adjusted the pressure precisely to my needs. With a feeling of being on forbidden territory, I was looking into the silent world underwater." The first ever scuba dive had become a reality.

FRAMEWORK

A HISTORICAL PLACE

The 'Plage de Barry' in Bandol is located on the Rue Albert. Since 1997 there is a memorial that refers to this first memorable dive, "Ici en 1943, les pionniers de la plongée sous-marine,

J.Y Cousteau, F. Dumas, P.Taillez, procéderent aux essais du scaphandre autonome." [Translation: Here in 1943, dive pioneers, J.Y Cousteau, F. Dumas, and P.Taillez, continued their tests in autonomous diving]. On the other side from the street is the 'Villa Barry', where Cousteau and his friends lived during the war. Now it is a hotel.

From then on, the trio – Cousteau, Taillez, and Dumas – made hundreds of dives. First in familiar places on the French Côte d'Azur, which they knew well from their countless free dives, and later, with the "Groupe de Recherches Sous-Marines", in other places all over the Mediterranean. Step by step they dove deeper, and with it, the underwater activities and the field of action expanded. The team photographed and filmed everything, they hunted for fish and dived all the wrecks. The French navy mines were laid, submarines were filmed, and the effects of explosions on the human body were tested.

FRAMEWORK

BOOK TIP: LE MONDE DU SILENCE

If you want to know the full story of these first dives, we recommend you read the book 'Le Monde du Silence', in which Cousteau and Dumas describe the pioneer years of scuba diving. The book is a series of fantastic adventures and anecdotes in the period from the first dive (1943) to the purchase of the Calypso (1950). That is if you can find the book, as unfortunately no more recent editions exist.

French version: 'Le Monde du Silence', Livre de Poche, 1959, ISBN-13 978-2253006572. Not to be confused with the film, 'Le Monde du Silence', a documentary about the first expeditions with the Calypso, about the period after 1950.

COMMERCIALIZATION AND FURTHER DEVELOPMENT

Cousteau and Gagnan patented their invention in 1945 under the names, "Scaphandre Cousteau-Gagnan 1945" and "CG45" and, for export to English-speaking countries, "Aqualung". The actual commercialization began a year later, on the 26th of May 1946, with the creation of "La Spirotechnique", a subsidiary of Air Liquide. The logo of the brand was inspired by a historical underwater photo from 1943 – the steering wheel of the Dalton. This wreck is located near l'Île de Planier, Marseille. The photograph was taken during the film "Epaves", the very first film recorded with the help of diving equipment of the Cousteau-Gagnan brand.

The CG45 is the first scuba regulator that came on the market. CG45 is actually a two-stage release, in which the breathing gas is reduced to the ambient pressure in two phases from the high pressure tank, a process for which a fairly complex mechanism is required. Both stages are located in one housing.

In 1955, "La Spirotechnique" presents an improvement (and partly also a simplification) of the CG45: the "Mistral". The Mistral is extremely simple in design and a very robust one-stage regulator in which the cylinder pressure is reduced in one step to the ambient pressure.

In 1963, "La Spirotechnique" introduces an improved version of the Mistral with the name "Royal Mistral". Again a single stage regulator, but more user-friendly and some versions have a high pressure port for the connection of a manometer. A DIN connection will then also become possible.

SUCCESS STORY

The Mistral becomes a success story, not only in France and Europe, but all over the world. Under the license of "La Spirotechnique", similar regulators worldwide are marketed by other producers and with other brand names. In the 50s, 60s and 70s, most people learned how to dive with a Mistral.

Although the Mistral was the preferred workhorse for many navies (the French navy used the Mistral until 1989) and other professional divers, in recreational diving during the 70s, the model was beaten by the more user-friendly two-stage single hose regulators, and "La Spirotechnique / Aqualung" lost its dominant market position.

The iconic Mistral, with its large chromed housing and the two ribbed rubber hoses that join together in a mouthpiece, is the regulator of the pioneers of our beloved sport. Not without melancholy, these pioneers look back to the charms of diving with a Mistral, and they muse on the bubbles escaping at the back, and the taste of water that they swallowed occasionally.

EPILOGUE

Assigning the origins of sport diving to one person or one company may be a little unjust. Many other dive pioneers, engineers and companies developed similar devices and many organisations introduced diving equipment and organised training. Nevertheless, the crucial role of the duo, Cousteau-Gagnan can hardly be overestimated. Making the CG45 and especially the Mistral available to the general public in the post-war years, certainly for recreational purposes, is the basis for the development of diving as we know it today. The phenomenal books and documentaries of Jacques-Yves Cousteau and his team did the rest.

FRAMEWORK

NOTEWORTHY FACTS

The first hundreds of dives with autonomous compressed air equipment were of course made by Cousteau himself, first on his own initiative together with his companions, Dumas and Taillez, and from 1946 as members of a research group set up by the French navy, the GRS (Groupe de Recherches Sous-Marines). It



Main Photo: The Cousteau underwater family portrait. L-R: Cousteau's son Jean-Michel, his wife Simone, Jacques-Yves Cousteau himself, and his son Philippe.
TOP RIGHT CORNER: La Spirotechnique's logo.

goes without saying that these very first dives also yielded many 'firsts', of which we mention a few below. The story of all these – some dramatic firsts – is described in detail in 'Le Monde du Silence':

- **The First Female Diver:** Cousteau's wife Simone Melchior.
- **The First Youth Divers:** Cousteau's sons, Philippe and Jean-Michel.
- **The First Wreck Dive:** on a tugboat submerged during the second world war, at a depth of 15 metres, in the port of Toulon.
- **The First Cave Dive:** 24th of August, 1946

with the GRS in the siphon of the Fontaine de Vaucluse near Avignon.

- **The First CO Poisoning:** during the above-mentioned cave dives where Cousteau and Dumas had a near fatal incident. They were taken out of the water by their employee Maurice Fargues at the very last minute.
- **The First Fatal Accident:** 17th September, 1947, Maurice Fargues of the GRS crashed in a record attempt to deep dive with Aqua Lung. At a depth of 120 metres he lost consciousness by nitrogen narcosis and/or oxygen poisoning.

- **The First Underwater Documentary:** 'Epaves' (1943) in which both the cameraman and the 'actors' dove with compressed air equipment.
www.youtube.com/watch?v=shv9f3rJ9cU

REFERENCES:

'Le Monde du Silence', Livre de Poche, 1959, ISBN-13 978-2253006572.

Information about the first scuba equipment can be found on numerous websites, including:

www.frogmanmuseum.free.fr

www.spiro-vintage.com