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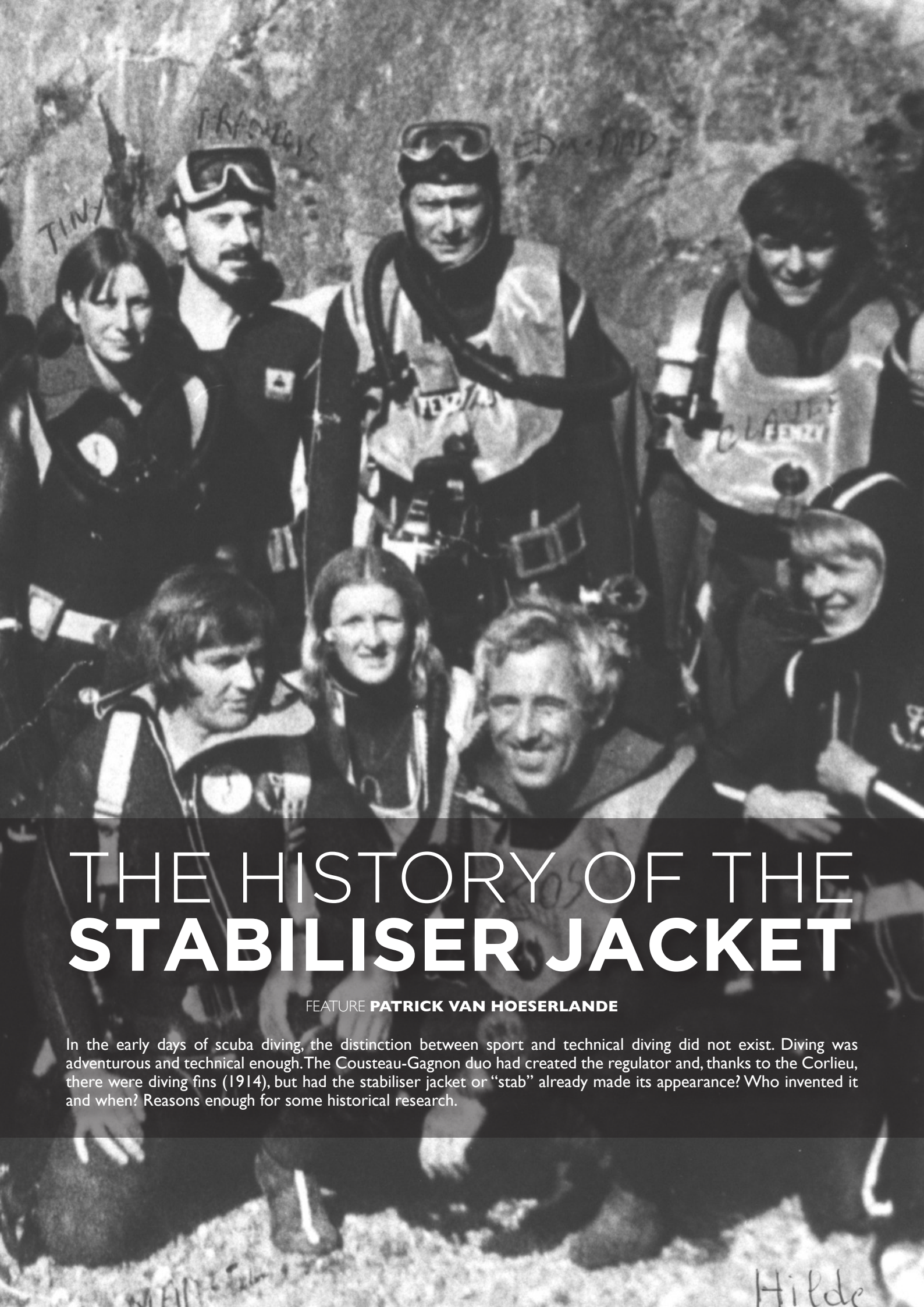


THE HISTORY OF THE **STABILISER JACKET**

FEATURE **PATRICK VAN HOESERLANDE**

In the early days of scuba diving, the distinction between sport and technical diving did not exist. Diving was adventurous and technical enough. The Cousteau-Gagnon duo had created the regulator and, thanks to the Corlieu, there were diving fins (1914), but had the stabiliser jacket or "stab" already made its appearance? Who invented it and when? Reasons enough for some historical research.

ABOVE: The oldest depiction of divers is found on an Assyrian woodcut of swimmers with air-filled animal skins.

In the early days of scuba diving, the distinction between sport and technical diving did not exist. Diving was adventurous and technical enough. The Cousteau-Gagnon duo had created the regulator and, thanks to Corlieu, there were diving fins (1914), but had the stabiliser jacket or "stab" already made its appearance? Who invented it and when? This was reason enough for some historical research to be done.

If we want to delve into history in search of the ancestry of our diving equipment, we have to determine exactly what we are looking for. Although we use it as a common name for this particular type of diving equipment, you will read further on in this article that a 'Stab Jacket' is in fact a type of 'Buoyancy Compensator Device' or BCD. A BCD is a device attached to a diver that can hold a variable amount of air to influence the diver's buoyancy. By this, changes in the diver's buoyancy caused by other dive equipment is compensated.

A life jacket has a positive influence on a diver's ability to float, but since it can only be used once, we do not classify it as a BCD. If this lifejacket could be used several times and if inflation is not an all-or-nothing condition, an adventurous diver would use it as a BCD. Although the above definition is not perfect, it allows us to dive into history in search of the origins of this piece of equipment.

THE BEGINNING

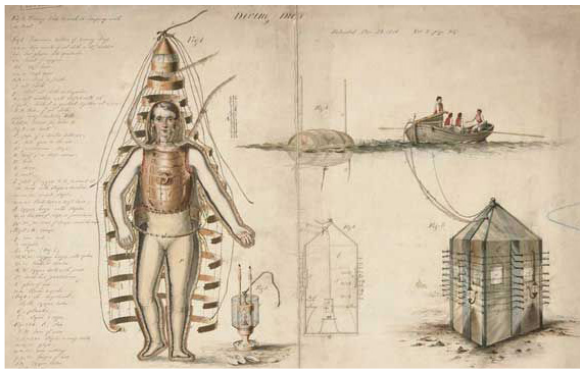
Herodotus wrote about the most famous diver of antiquity: the Greek, Scyllis. When he was brought on board as a prisoner of the Persian King around 460BC, he heard that Xerxes was planning to attack the Greek fleet. He grabbed a knife and jumped overboard. Under the cover of night and with the help of a hollow cane, he swam from ship to ship and cut all the anchor lines. As a result, the entire fleet drifted off and a Persian victory was foiled. However, in freediving or snorkelling, even between enemy ships, there is no need for a BCD. So we can leave these disciplines aside in our search.

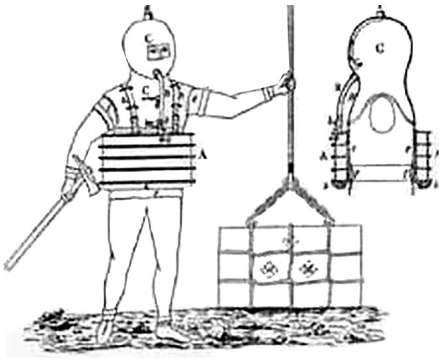
The oldest depiction of divers is found on an Assyrian woodcut of swimmers with air-filled animal skins. Was this bag an air supply or a means for floatation? If used as an air supply, the diver probably exhaled into the water. Blowing the air back into the animal skin would have led to headaches that early divers would have quickly experienced. This is a pity, because we would have discovered the first application of a 'Closed Circuit Rebreather' (CCR). Assuming that the bag was an air supply, the diver's buoyancy would have decreased the longer he stayed underwater. A BCD could then have been useful, but his 'diving bottle' did not have the capacity to inflate it. Unless he blew out into a second bag or counter lung, which would not have influenced his buoyancy. The woodcut, however, does not show two bags and so the Assyrians cannot lay claim to the first BCD.

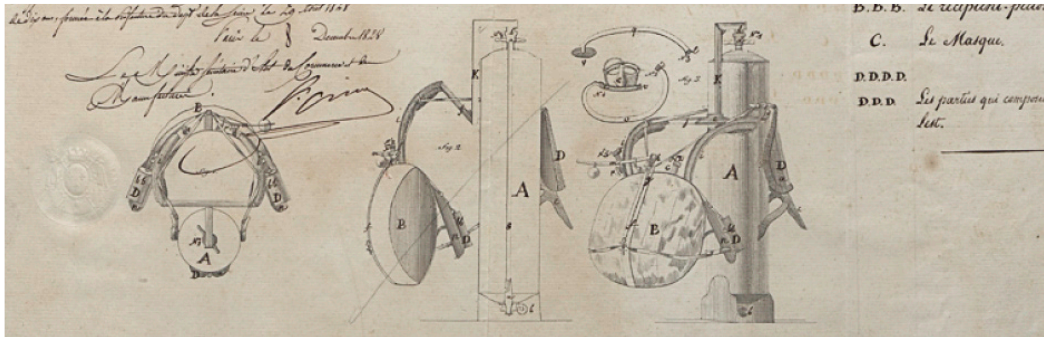
We find references in ancient Egyptian, Greek and Roman writings of underwater activities with diving bells and freedivers, so the credit to inventing the BCD does not go to any of these peoples. However, we must give a Greek a share of the credit, although he did not realise it at the time. Archimedes was a well-known scientist 200 years before our era, and as such, received a special assignment from his king. The king had had a crown made from a lump of gold. But was the crown made entirely of gold, or had the goldsmith added silver on the sly? The goldsmith lived beyond his means and the king found that suspicious. The weight was right, it was exactly as much as the lump of gold that the king had given to the royal goldsmith. That did not prove that the crown was made entirely of gold and with the science of the day it was not possible to prove that the goldsmith had stolen from the crown.

The brooding king asked Archimedes to investigate whether the crown was 100% gold. Archimedes went to work. He knew that gold had a greater density than silver, but in those days one could only calculate the volume of regular figures. He was able to hammer the crown into a cube, but the king had explicitly instructed him not to damage the golden object.

Archimedes decided to take a bath to think for a while. He sat down in his bath and watched the water rise. Then it suddenly hit him! If an object sinks into water, the water rises. And so he figured that objects made of the same material and having the same weight should also move the same amount of water. "I've got it!", he cried, "Eureka!" He jumped out of the bath and ran naked into the street, shouting "Eureka!" over and over again. Later, he showed the king and the court how he could determine the volume of an object by the amount of water that ran out of a bucket. According to Archimedes' calculations, the crown was indeed not made of gold alone.







ABOVE L-R: Giovanni Borelli's drawing of a CCR; Chauncey Hall's Diving Suit; William James' iron belt connected to a copper helmet; Charles Condert's diving apparatus based on William's patent and the Deane brothers' diving suit; and Lemaire d'Augerville's copper air cylinder. As can be seen in the drawings, the rig was equipped with an independent 'Adjustable Buoyancy Lifejacket' or ABLJ, with its own emergency cylinder, with both an inflation valve and an exhaust valve for ascending and descending. The weight belt could be released quickly by operating a lever at chest height. When the diver ran out of air, he dumped his weights, stuck his finger in the exhaust valve and inhaled the remaining air in the air pocket until he reached the surface. This is the first, real BCD!

Archimedes' law, together with the ideal gas law, plays a major role in the functioning of the BCD.

After antiquity, interest in the underwater world ebbed away. Until the Renaissance, no noteworthy attention was paid to underwater activities. However, some devices were invented during the Renaissance. For example, Leonardo da Vinci (1452-1519) described systems for breathing underwater and is sometimes credited with the first design of scuba equipment. There were probably people who did something similar before him, but his sketch is very similar to our current equipment. In his Codex Atlanticus, he described a piece of equipment with an air supply and a means of controlling the floatation. He did not want to give details so as not to give ideas to unsavoury types (to sink ships or to rob and murder). That was not such a strange thought at the time. He had designed the equipment to sink the Turkish fleet that threatened Venice. Unfortunately, the Turks were driven out before his scuba equipment could be used. Nevertheless, Cousteau would have been inspired by this design.

THE FIRST ATTEMPTS

Giovanni Borelli (1608-1679) was a mathematician and physicist. He was very inventive and is often remembered by diving enthusiasts for his drawings of a CCR. His illustrations show a giant bag of chemical components that was supposed to allow the diver underwater to breathe in and out of the bag without getting a headache, unlike the Assyrians. Although the device probably never existed, its design with fins on the feet, is the first to depict a free-swimming diver. Since this diver is not required to walk on the ground, he must be able to control his buoyancy. Staying with one's feet on the ground is a matter of carrying enough weight, free swimming requires more finesse. Pressure had yet to be invented, otherwise the designer would have realised that his invention could not work.

If you look closely at the drawing, you will discover a one-metre-long piston-like device that the diver holds in his hands. This device is a BCD with a rigid body. The volume does not vary with depth, but only by the diver's setting. I do wonder what the maximum depth was at when the diver still had the strength to adjust the volume by means of the lever.

Some historians call Doctor Freminet the father of scuba because of his 'Machine Hydrostatergatique' invention in 1771. He is said to have reached a depth of 15 metres and stayed there for several minutes with the help of a copper helmet and an air tank. Unfortunately, his design did not require a BCD.

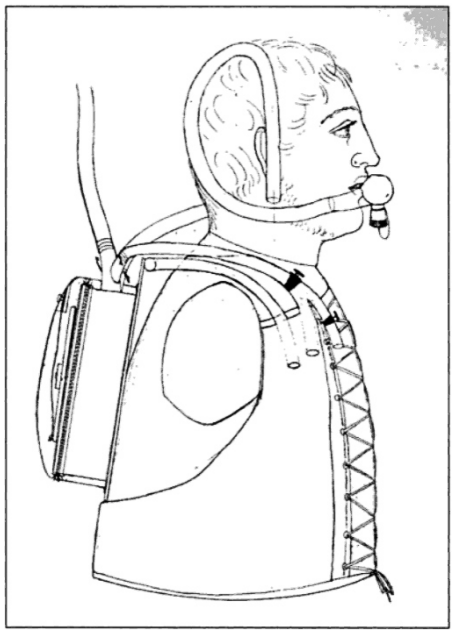
In the early history of diving, people sought refuge in diving bells for deep and long dives. Equipment for free-swimming divers was difficult to design and manufacture. In 1810, Chauncey Hall filed a patent for a special one-person diving bell, 'Hall's Diving Suit'. An interesting feature of this design is the manually operated valve in the centre of the diver's chest. On the drawing, this valve appears to be in a protective cage. It probably served to let excess air escape at depth. Although this suit dates from the period when the supply of air by means of pumps began to develop, air circulation was ensured by two pipes, each with a one-way valve which were blown by bellows. Bellows were more reliable than the first piston pumps.

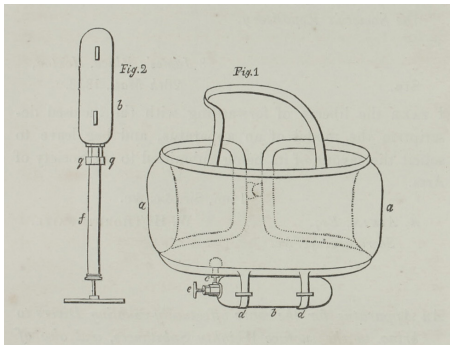
However, it is possible that Hall's valve did not only serve to release excess air from the suit, but was part of an early buoyancy control device. The idea of a diver-controlled ascent to prevent further problems at the bottom was very popular in Britain in the 1830s. However, it is guesswork whether this was the case, as without written specifications we cannot know for sure.

In 1825, the English inventor William James developed scuba equipment consisting of an iron belt connected to a copper helmet. The belt contained enough pressurised air (up to 30 bar) for a 7-minute dive. Although William applied for a patent, he probably never built his device.

Three years later, Charles Condert built a diving apparatus based on William's patent and the Deane brothers' diving suit. He made several dives to 6 metres with it. Although this would make him the original scuba inventor, we do not find a BCD in this design either. A cord with a weight can hardly be recognised as a real BCD.

In that same year, 1828, the French dentist Lemaire d'Augerville took scuba a step further with a patent for a copper air cylinder at 23 bar that was worn like a rucksack. A hose delivered air to the diver, which constantly flowed into an air bag attached to the chest. When the diver went deeper, he operated





M. SIEBE'S IMPROVED PUMP AND DIVING-DRESS.

TOP TO BOTTOM (L-R): Manuel Théodore Guillaumet's double hose regulator; Hoxton Thornthwaite's inflatable belt winning design; Augustus Siebe's combination of a diving helmet made by the Deane brothers with a waterproof, rubber diving suit; Frédéric Dumas' 'bouée collerette gonflée'; and Maurice Fenzy's invention to become the first commercially successful and fully-fledged BCD. **OPPOSITE PAGE:** SCUBAPRO's Stabilising Jacket, better known as the Stab Jacket; the Watergill At Pac; the Dacor Nautilus; and the BCD as we know it today.

a valve to get more air. A diver could reach a depth of 20 metres and dive for an hour. As can be seen on the drawings, the rig was even equipped with an independent 'Adjustable Buoyancy Lifejacket' or ABLJ, with its own emergency cylinder, equipped with both an inflation valve and an exhaust valve for ascending and descending. The weight belt could be released quickly by operating a lever at chest height. When the diver ran out of air, he dumped his weights, stuck his finger in the exhaust valve and inhaled the remaining air in the air pocket until he reached the surface. This is the first, real BCD!

Ten years later, in 1838, the French doctor Manuel Théodore Guillaumet of Argentan applied for a patent for a double hose regulator. The diver received air from the surface by means of a hose connected to an 'on demand' regulator. The exhaled air escaped through a second hose. He presented his device to the committee of the French Academy of Sciences. The doctor provided the diver with a vest that he could inflate or deflate at will. Although this is clearly a BCD, the drawing does not show how the diver used the vest.

In the same year, Hoxton Thornthwaite won a prize in London for his design of an inflatable belt for divers. This band was worn under the arms around the waist and equipped with a cylinder of compressed air. The description mentions a turn of a crane to fully inflate the belt. As there is no other way to inflate the belt, we must conclude that this is a rescue belt and not a BCD.

This fruitful period for inventions of floatation devices came to an end around 1837. In that year, the German Augustus Siebe was the first to combine a diving helmet made by the Deane brothers with a waterproof, rubber diving suit. This fully enclosed diving suit with helmet quickly became the standard equipment for helmet divers and is still the prototype of today's equipment for professional divers. Siebe has been described as the father or godfather of diving.

Working at the bottom of the sea by no means meant that divers were condemned to a benthic existence. With some skill, they could ascend and descend in the water by regulating the amount of air in their suits. Siebe's helmet-suit combination allowed them to use their entire diving equipment as a BCD. This feature made the pressure to develop a BCD disappear and is probably the reason why the BCD was forgotten for about 120 years. Cousteau and Gagnon may be considered by most divers as the real fathers of sport diving, but they were diving without any means of influencing their buoyancy.

USABLE BCDS

This was the case until 1950 when Frédéric Dumas, together with Jacques-Yves Cousteau and Philippe Tailliez, one of the diving pioneers and then a contractor at the 'Groupe d'Etudes et de Recherches Sous-marines' (GERS) of the French Navy, brought this invention out of its lethargy. He calls it a 'bouée collerette gonflée' or loosely translated a 'blown up collar buoy'. In fact, in his own words, he "invented and cobbled together an underwater safety collar". The collar could be inflated by means of the mouth or the air supply and was thus possibly more than just a life jacket. He also added a function that he specified as follows in his first description of this piece of equipment: "If during the ascent, with the collar inflated, the need to breathe becomes urgent, one can breathe the air that escapes from the buoy".

We have to make a time jump via the British Fleet Air Army, where in January 1940, a journalist described the pilots' equipment. When he talked about the life jacket, he mentioned that it was better known under the name 'Mae West'. An inflated life jacket would bear some resemblance to the large bosom of the American film actress Mary Jane 'Mae' West

(1892-1980). Because years of experience had been built up with this type of life jacket and there was an oversupply after World War II, they soon appeared in the world of diving. In the beginning they were mainly used to increase the buoyancy at the surface, but soon the use evolved to self-rescue at depth. In 1958, variants were first offered in the US Divers catalogue. The lifejackets, specially designed for divers and equipped with a between-the-legs harness, could be inflated with a CO_2 ampoule or by mouth. At the time, self-rescue for divers was a growing market with, among others, the Res-Q-Pac.

In 1961 Maurice Fenzy applied for a patent for a device invented by the French GERS. This ABLJ consisted of an inflatable ring that, in the first versions, was inflated underwater by mouth. Later versions had their own cylinder with compressed air mounted on it. Some had an ampoule of carbon dioxide, a development that was abandoned when valves were introduced that enabled divers to breathe from the inflatable inner bag. Due to its ease of use and durability, within a few years divers all over Europe were wearing 'Fenzys'. With the possibility of using air from the dive tank, his invention soon became the first commercially successful and fully-fledged BCD.

Ten years later SCUBAPRO introduced the 'Stabilising Jacket', better known as the 'Stab Jacket'. With its classic look and increased stability thanks to a patented design of a 360 degree flow of air in the jacket, this trim vest caused a revolution. That it was a revolution can be seen in the use of the word 'stab jacket' as a synonym for a BCD.

The manufacturers did not sit still and improved their various models and their components year after year. The inflator was important in these improvements. Not only did it become more powerful, but it also integrated inlet and outlet buttons and got a "quick disconnect". In 1978 SCUBAPRO applied for a patent for the AIR II. This complete inflator also integrated a second stage.

In order to circumvent the Stab Jacket patent, the vest was split under the arm. Another method was to replace the front part by a strap, later a detachable strap. The BCD began to resemble the current models.

In 1972, the company Watergill Manufacturing launched the 'Watergill At Pac'. This model contained a number of introductions, such as the 'cummerbund' or waistband, the wings, and the integration of the regulators in a 'shell system', whereby everything is neatly stored in a hard shell. It was also the first integration of lead into the BCD. The diver could discharge the lead pellets in case of an emergency. With so many novelties in one model, the design was considered dangerous and it was advisable to undergo special training before diving with it. The model was not a success, but the ideas did find their way via later models to the diving community.

In 1976, the Dacor Nautilus came onto the market, which worked according to the principle of the rigid body BCD of Giovanni Borelli. This time the diver did not have to manually adjust the piston as the volume was kept constant by an automatic valve and compressed air. The promise of a continuous adjustment of the fluidity was not fulfilled by the variations due to the air consumption and the compressibility of neoprene. As a result, this innovative design also slipped into oblivion. History teaches us that an invention must not only be innovative, it must also be written down and preserved. In addition, it must not be too innovative, otherwise it might have too many design issues or fail to catch on.

Based on a traffic sign, cave diver Greg Flanagan made the first back plate in 1979, and he drew inspiration from the SCUBAPRO Stab Jacket. Intelligent copying is a good way of innovation. Similarly, the side mount grew out of the use of English cave explorers to carry scuba tanks into caves in case they had to pass through a flooded section. The idea was 'designed' by Lamar Hires in the mid-1990s and distributed by the company Dive Rite as the first commercial side mount system.

In recent years the BCD design has not changed much, at least not to the extent that it deserves a note in the history books. The manufacturers have not introduced a completely new approach, but have concentrated on comfort, design, models, sizes, and streamlining. Perhaps the application of new technologies will soon change this? Or will they make old, forgotten ideas possible again?

SCUBA

Christian Lambertsen invented the 'Lambertsen Amphibious Respirator Unit' (LARU) rebreather in 1939. The US Navy initially rejected his invention, but three years later he successfully demonstrated the LARU to the Office of Strategic Services (OSS), the predecessor of the CIA. Over the years, he became responsible for most of the technology used in Combat Swimming Operations in the USA. His inventions laid the foundation for technology used by NASA, the Navy SEALs, the Green Berets, the US Coast Guard, and diving enthusiasts around the world. He is sometimes called the 'Father of the Frogmen'.

In 1952, Lambertsen and a colleague wrote a paper for the National Academy of Sciences. In it they described the "Self Contained Underwater Breathing Apparatus", which they abbreviated to "SCUBA". This was the first time the word SCUBA had been used.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