

Our Navy



Fathoms Deep

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Would You Like To Be a Navy Deep Sea Diver?

By JAMES ROYCE

OVER seventy per cent of the surface of the earth is covered by water! The thought of the untouched treasures that fill this vast realm has intrigued the imagination of man since first he dreamed of unlocking the doors that opened onto this hidden wealth. "Twenty Thousand Leagues Under the Sea"—the lost continent of Atlantis—Davy Jones' Locker! Fiction and fable have constantly played with the idea of descent to the ocean floor, and the adventurous spirit of man has worked unceasingly to devise a method that could, in fact, defy the laws of nature. But where the romanticist dreamed, the practical commercialist, backed by science, put men in iron hats and rubber suits and sent them down into the sea to rob old Neptune of his spoils.

It was a little of all three motivations—adventure, commerce and science—that brought the U. S. Navy into the long struggle man has waged against the relentless, crushing pressure of the oceans, fathoms deep. Practical necessity dictated the inauguration of a Navy diving program. But the man who donned weighted shoes and bolted himself into the grotesque helmet was not visioning the advance of naval science; he was answering the same sort of lust for adventure that drives other men to climb the Matterhorn or risk their necks in midjet racers. Not that a Navy diver would admit to any such Quixotic impulse. They are a rugged lot and mostly inarticulate when the question is put to them, point blank, asking why they took up the trade. Their most eloquent expression, then, is apt to be a shrug.

The fact remains, however, that Navy divers are all volunteers. They get paid a little extra for their work, it is true, but not enough to justify the life they lead. Diving is hard work—often dangerous work. It is exacting labor that takes a lot out of a man, and more than one diver with a commission gained in the war just finished has been willing to revert to chief in order to get out on twenty "while I'm in one piece." They'll cuss their job—among themselves—and with some reason. Diving is a cold, dirty, uncomfortable way to make a living. But despite all this, there is something about the work, something indefinite and indefinable, that gets into a man's blood and won't let him quit.

Navy deep sea divers are trained at the Deep Sea Divers School, Washington Navy Yard. The school, commanded by Captain O. K. O'Daniel, is the best in the world. The place is not imposing, at first glance—a pair of buildings cramped in between the miscellany of the Navy Yard, a float or two on the river, and two little training craft, the USS CRILLEY and YDT 5. But since the school was established over twenty years ago, it has been turning out divers who have consistently performed with the best developed in commercial fields. Moreover, the Experimental Diving Unit, a corollary of the Deep Sea Diving School, has been responsible for experiments and developments that have advanced the science of diving and have made it possible for oxygen-breathing humans to probe deeper and deeper into the chill, dark seas.

The equipment at the school is com-

pact, modern and efficient. Here is no hastily constructed unit. Everything is as ship-shape and sparkling clean as a battlewagon's turret, and a visitor gets an impression of thoroughness and efficiency. He remembers that it was from this station that divers went out to help raise the S-4, the S-51, and the SQUALUS, and that the man who invented the submarine escape lung, the famous "Momsen lung," was director of the Experimental Diving Unit at one time.

It was here, also, that experiments were completed in the use of oxy-helium breathing, making possible dives beyond anything possible with ordinary compressed air.

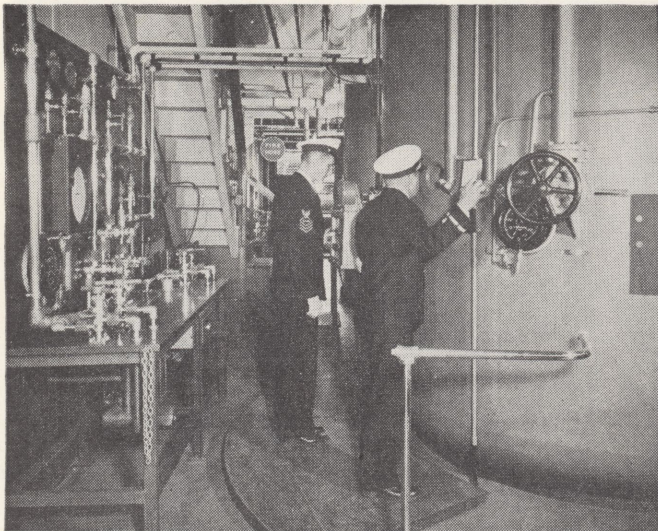
It is not surprising, then, to learn that there are far more applicants for training as divers than there are openings under the Bureau's quotas, despite the fact that applicants are restricted to the artificer ratings, and to Boatswain's Mates, Gunner's Mates, Torpedoman's Mates, and Pharmacist's Mates.

Candidates to the school must be *third class petty officers or above*, except for Pharmacist's Mates, who must be at least second class. The physical qualifications, as outlined in paragraphs 1535-36 of BuMed Manual, weed out those unfit for the rigorous work of diving—ears, sinuses, heart and lungs getting the most careful attention. Hypersensitive, high-strung individuals are passed over in favor of the phlegmatic, unimaginative type. Brilliance is not a requisite of diving, but thoroughness, carefulness and persistent attention to details are. A diver is on his own when he's ten fathoms down, and there's nobody to remind him that on his eternal vigilance depends his life.

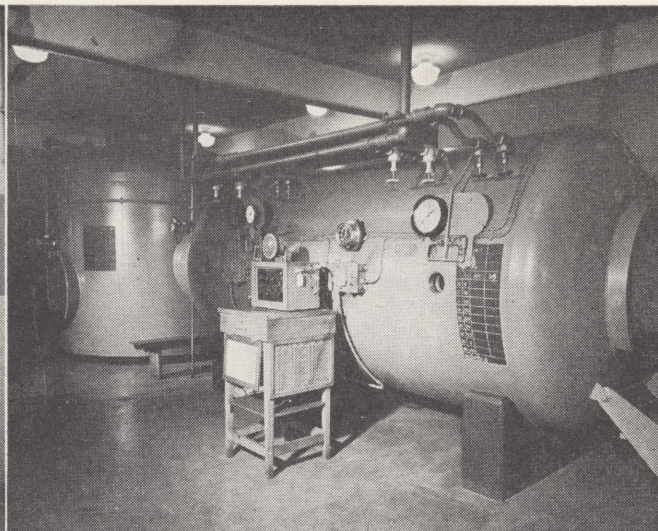
There are four classes of divers in the Navy—Master Diver; Diver, First Class; Diver, Second Class; and Salvage Diver. The last is trained at Pier 88, Hudson River, New York, and his training is in no way connected with the Deep Sea Divers School (OUR NAVY, *Mid Sept. 1944*).

BuPers Manual describes the Master Diver as "the most competent leading diver." Men are designated Master Divers only by the Bureau of Naval Personnel on the recommendation of commanding officers, after they have served at least one year as Diver, First Class. The Master Diver is a leader, and must have demonstrated his ability to direct two or more divers in their tasks, on the bottom. He must be competent to take charge of a diving operation in an efficient manner, and must, among other things, understand all types of compressors habitually used in diving operations, must understand the different forms of caisson disease (the bends) and treatments required, and must know the conditions under which oxygen poisoning occurs. There are other requirements—many of them.

The Master Diver receives \$20 a month additional pay as long as he holds the designation and is detailed or assigned to the duty of diving. The Diver, Second Class also receives 5 cents a foot for dives over 120 feet, or equivalent pressure, not to exceed a total of \$10 a month, plus \$5 an hour for each hour



The high pressure tank, equipped with high pressure air lines and valves, can simulate sea pressures up to about 800 feet.



The high pressure diving tank opens at top into the "igloo" pressure tank which connects with the recompression chamber.

or fraction of an hour while employed in diving in actual salvage operations in depths over 90 feet.

First Class Divers get their training at the Deep Sea Divers School and are the school's paramount concern, although Second Class Divers are trained there also, as well as in the Fleet. The Diver, First Class, must qualify at a pressure equivalent to 200 feet, and must be able to dive and accomplish work at depths of 150 feet in water. In actual practice at the school most First Class Divers qualify at depths of 300 feet on compressed air, in the pressure tank, and at 320 feet on helium and oxygen in the pressure tank. While the First Class Divers are not required to know the various techniques of diving as thoroughly as the Master Diver, their course at the Deep Sea Divers School leaves little for them to learn after they reach the Fleet, save that knowledge that comes from experience.

After they are qualified and have been given the designation, Divers, First Class, draw \$15 a month addition to the pay of their rate, as long as they hold the designation and are detailed to duty involving diving. They receive the same

compensation for dives beyond 120-foot depths as do Master Divers, save that they are allowed a maximum of \$15 a month through this source. They get the same pay for salvage work beyond 90-foot depths. Divers, First Class can qualify only at the Deep Sea Diving School.

The Second Class Diver, however, may be trained and qualified aboard any naval vessel or at any station having the proper equipment and competent officer personnel for efficient and safe instruction. The requirements for the designation are far below those of Master and First Class Diver. The Second Class Diver is required by BuPers Manual to be able to perform work at depths of 50 feet for 1 hour. During the six to eight weeks' course for Second Class Divers at the Deep Sea Diving School, students are given dives up to 150 feet. By order of the Bureau, divers in this class are not permitted to dive to depths greater than 90 feet, except at the Deep Sea Diving School, requalification, or in emergencies.

Divers, Second Class, receive \$10 a month additional pay, plus the extra compensations listed above for the other classes, with a \$20 maximum placed on the additional amounts he may receive for

"footage," work beyond 120-foot depths.

In addition to the pay additions already mentioned, an act of Congress approved in 1942, authorized enlisted men designated as divers, any class, employed as divers in actual salvage or repair operations in depths less than 90 feet, to receive \$5 an hour for each hour or fraction thereof while employed in the work, when the officer in charge of the salvage or repair operation finds that extraordinary hazardous conditions exist. Extraordinary hazardous conditions are defined by the Bureau as : dives made inside a sunken vessel; dives made alongside a wreck where a jagged plating, debris, or other wreckage may tend to cut the hose lines or tear the diver's dress; dives made in the open sea under adverse weather conditions or in the presence of a heavy ground swell or strong undercurrents; dives made in waters exposed to imminent enemy attack; and dives during which live explosives are handled under water.

Applications for assignment to the Deep Sea Diving School must be submitted directly to the Bureau of Naval Personnel, via the chain of command. Approximately 35 students begin a new class



The diving boat, CRILLEY, used to train student personnel



The Shipfitter Shop, showing students repairing diving gear.



Front view of lightweight diving outfit.



Complete deep sea diving outfit (air).



Converted MK III gas mask diving rig.

every two months, and the course is from twenty to twenty-three weeks for Divers, First Class, and from six to eight weeks for Divers, Second Class. Pharmacist's Mates have an additional two weeks in concentrated gas analysis and mixing. There are two periods a day, six days a week.

Every man whose application is approved by the Bureau and who arrives at the school full of confidence does not leave five months later with the coveted specialty mark of the diver, a white helmet embroidered on his sleeve. The pitfalls along the road are many.

The candidate must first pass the searching physical that greets him almost as soon as he drops his seabag to the deck. He has already been given a preliminary aboard ship or at his former station, but the Navy is thorough in such matters. If the newcomer successfully negotiates the gauntlet incident to Navy physicals, he is tested in the recompression chamber, at 50 pounds pressure, for equalization of the ears and sinuses. Those individuals who are subject to

claustrophobia—morbid dread of confined or narrow places—are also weeded out during this initial stage. Each new arrival is tested for that mysterious malady known as "oxygen poisoning" by having him breathe pure oxygen for half an hour at pressure equal to 60-foot depths. Oxygen poisoning is not serious. It causes nausea and physical discomfort to those subject to it, without leaving any prolonged effect.

Occasionally it is discovered that a man is unfit for diving because of his peculiar physical proportions—his head is too large or too long to fit the diving helmet, or his feet are too big for the standard diving shoes. Otherwise, size is no consideration.

The officer in charge of the Deep Sea Diving School, under Captain O'Daniel, is Lieut. (jg) E. D. Buie, USN, who, before he was commissioned early in the war, was a designated Master Diver. Under Mr. Buie is a staff of instructors—nine Divers, First Class and four Master Divers, who can, if persuaded to talk, weave an exciting story of adventure

beneath the seas. Several of them have taken part in the famous diving jobs during submarine disasters before the war, and from 1941 to the fall of Japan they helped write the epic of men under the sea that stretches from Iceland to Tokyo Bay.

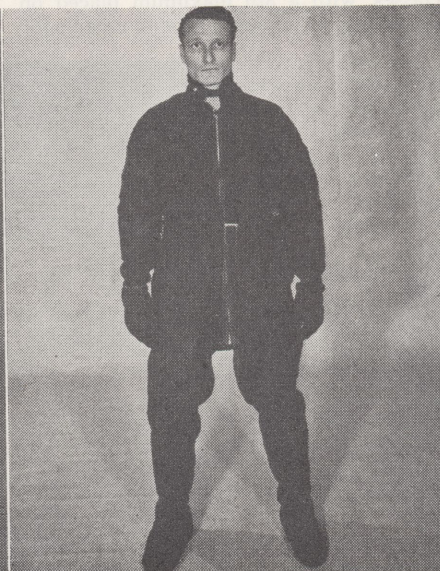
Two of the instructors now attached to the school were in the Philippines when the Japs swept over the islands, and were taken prisoner on Corregidor. They are P. L. Mann, CBM, and G. W. McCullough, CGM. McCullough, with nine years in the Navy, qualified as a Diver, Second Class, in 1936 aboard the USS MALLARD. He became a First Class Diver after a tour at the Diving School, and then went to the Philippines. He and Mann were aboard the USS PIGEON when the little ASR won the Presidential Unit Citation for her work in December of 1941, and were POW, at Bilibid, Cabanatuan and in Japan for four years.

The Japs had some sort of idea that they could salvage the sunken vessels crowding Manila harbor, and sifted the

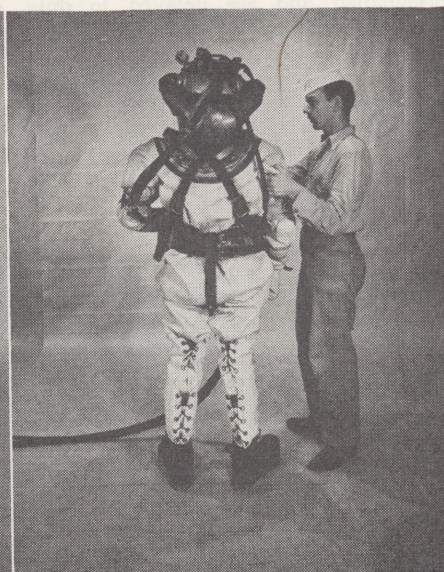
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Front view of diver in complete outfit of the helium-oxygen deep sea diving outfit.



This electrically heated underwear is worn for diving with helium-oxygen breathing.



Rear view of helium-oxygen suit. The canister contains a CO₂ absorbent.

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POWs for qualified divers to give them a hand.

"They didn't seem to know much about what they were doing," McCullough recalls. "They got some gear together and began sending us down on dives to look over small craft sunk in shallow water. There were a few Jap divers and a number of Filipinos in on the deal. None of the American divers were in any condition to do real diving, and the Japs made no efforts to feed us better than usual. However, we welcomed the opportunity because it gave us a chance to steal more food, and we were disappointed when they finally called the whole thing off and sent us back to Cabanatuan."

McCullough and Mann, after being away from diving for the duration of the war, were requalified at the Deep Sea Diving School, and are back in the game with none of their enthusiasm gone.

While men like McCullough and Mann were lying in Jap prison camps, other Navy divers were carrying out their hazardous duties in every theater of operation, jobs that ranged from patching torpedoed warships to mine disposal and torpedo recovery. Most of the heroics of these Knights of the Deep Sea are not available as yet. Censorship veiled their actions while hostilities were on.

It is not only in wartime that the diver is subject to hazard. Any descent into the deep is a battle against the sea, and divers have risked their lives on countless operations that were so routine they did not even reach the nation's press.

The records are not clear on just when the Navy first began its diving program, but it was apparently around 1912. When the first World War began, there were enough Navy divers to permit the assignment of a contingent to Europe where they performed valuable work in France.

The Navy had already begun experimenting, by 1924, in an effort to increase the depth at which divers could safely and efficiently work. At that time this depth was governed by the physiological effects of the compressed air supplied to meet the diver's respiratory requirements. With normal compressed air, the maximum depth which could be attained was approximately 300 feet, and the limit of time that divers could stay at that depth with reasonable safety rarely exceeded fifteen minutes. Even for a fifteen minute stay at this depth, using ordinary compressed air, a decompression of some two to three hours was required. Obviously, under such conditions, very little work could be performed by divers working at depths of from 275 to 300 feet. In order to keep continuous operations underway at the scene of a submarine disaster where speed was essential, it was necessary to have a large crew of divers at hand, and several large salvage vessels to service the divers. At the same time, submarines were being built to submerge to ever increasing depths, and in order to provide for rescue operations

in the case of disaster, it was mandatory that methods be provided which would allow divers to descend to deeper depths.

Consequently, investigations were begun to obtain more efficient techniques.

At depths of 300 feet, a diver, breathing ordinary compressed air, found himself reacting strangely. His mind became dulled, and there was a lack of coordination of mind and muscle. Experiments conducted as early as 1917 at the Deep Sea Diving School, then at Newport, Rhode Island, had indicated that deeper depths could be attained by reducing the oxygen content in the air. However, this necessitated increasing the nitrogen content, which, in turn, meant longer decompression periods. The tests had to be discontinued due to curtailment of diving activities on the outbreak of war.

When the experiments were resumed in 1924, the theory was advanced that if the nitrogen of normal air could be replaced by helium, an inert, non-explosive, non-toxic gas of greater diffusibility and lesser solubility in the blood and tissues than nitrogen, the object might be gained.

Chief Gunner C. L. Tibbals, after preliminary experiments, subjected himself to the first oxy-helium test on humans when he was Skipper of the famous old *FALCON*. Using pressure equivalent to that at 150-foot depths, he decompressed himself in fifteen minutes with no ill effects.

Further tests were made and in 1927 equipment was installed at the Washington Navy Yard, and Navy divers worked out the proper mixture of helium and oxygen up to depths of 200 feet.

In 1938 the world's diving record in standard diving dress was broken by two Navy Master Divers at the Deep Sea Diving School. J. H. McDonald and William Badders reached depths of 500 feet under simulated sea conditions in the diving tank. At the same time, all the First Class Divers of the experimental diving unit attained depths over 300 feet. In all cases the divers reported a remarkable clarity of mind that had never been known when ordinary compressed air was breathed. Subsequently, in open sea tests, during July, 1938, Master Diver Badders descended over 400 feet, working off the *USS FALCON*.

The Navy Deep Sea Diving School had led the way to a revolutionary technique in diving, and since that time the oxygen-helium mixtures have been used wherever they were available on dives over 300 feet.

That the mixture is not used exclusively is due to certain drawbacks that make compressed air more practicable for dives below the 250 foot mark. Helium is a conductor of heat, and tends to lower the temperature by rapidly dissipating natural body heat. This is an important consideration in deep water where the temperature hovers around the 35 degree level. Today, divers using oxygen-helium mixtures wear heavy, electrically heated underwear beneath the diving suit, with the heating current supplied by batteries topside.

A diver can work under ordinary compressed air at 150-foot depths, comfortably, and does not begin to encounter difficulties in muscular coordination until

he reaches 250-foot depths. Since the equipment necessary to supply compressed air is easily portable, and comparatively simple to maintain and stow, the more cumbersome oxygen-helium mixture assemblies are used only when necessity dictates. The mixtures must be prepared ashore under the most careful supervision, after which they are stored in tanks, and labeled so that the proper bank of storage tanks can be supplied for the depths at which the divers are to work. The mixing and care of helium and oxygen, and the process of supplying the mixture to divers at work is part of the curriculum of the Deep Sea Diving School.

The heart of the school today is the two "open" and two "pressure" tanks in building 214. The open tanks are just what the name implies—topless cylinders, provided with the necessary descending ladders, flooding valves, ports, and other equipment to provide facilities for preliminary training. The pressure tanks are a more involved affair. It is here that pressures simulating those found at depths up to 800 feet at sea can be provided by altering air pressure at the surface of the water.

The neophyte entering the school must first learn the fundamentals of diving—signals, the diving suit, the use of the telephone, the sequence of entering and leaving the tank; he is taught how to descend, how to use the chin valve, how to crawl, lie down, roll over, blow up, and float. The diving dress is a complicated affair, and the student diver must understand its intricacies before he ever makes an actual dive. The complete diving outfit, including telephone and line, costs \$1500 and upwards, and weighs over 200 pounds. The care and upkeep of diving gear is an important consideration.

Through the weeks of the course, actual diving is interspersed with sessions in the shop and classroom. More involved problems in diving are taken up during periods of work off the float, and in the final stages the students are taken out on the *CRILLEY* or the *YDT 5* for bonafide diving under sea conditions. Dives are made in the currents of the Potomac, and at Solomon Island an obsolete submarine has been sunk as an experimental laboratory.

There are some "bilges" along the way, the greatest number of casualties occurring in the first week or two of the course. After that the majority of men stick it out and wouldn't change places with any rate or specialty in the Navy. When they finally graduate, they are still Boatswain's Mates, Carpenter's Mates, or Pharmacist's Mates, but they are something more—they are Divers, First Class. From then on, as long as they continue to qualify at specified periods, they wear the diver's specialty mark on their arm—and eventually add, on the breastplate, a white "M" that signifies the cock-o'-the-walk, a Master Diver.

Sure, it's a tough grind—the life of a diver. Nobody likes the bends, nobody likes the cold and the wet and the weariness that goes with diving. But, you don't see any designated divers leaving the work. That should be the answer to whether it's all worth while!