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DIVING

MAGAZINE

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Vol. 6 H.M.S. VERNON No. 1

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R.N. Diving Magazine

EDITORIAL STAFF

Chief Petty Officer R. L. Benfield, *Editor*.
Sub-Lieutenant E. Smith, *Treasurer*.
Instructor Lieutenant F. J. D. Kelly, B.Sc., R.N., *Secretary*.
Able Seaman A. Lyden and L/Sea. M. J. Brassington, *Cartoonists*.

Vol. 6 March, 1958 No. 1

EDITOR'S NOTES

The success of our Christmas 'bumper' issue is apparent from the number of complimentary letters we have received from subscribers. May I take this opportunity to thank you for them.

It is our intention to maintain this standard by increasing the number of articles of general interest to divers.

This is why we appreciate Sub-Aqua Clubs' reports on their activities. These obviously benefit Naval readers and it is hoped our experiences prove helpful to them.

The cover for the Magazine is under review. Here is an opportunity for any artists to see their work in print and we welcome all ideas.

TREASURER'S NOTES

At present we are holding our own as regards costs of printing and posting of magazines, but we must be able to sell all our copies at full price to be able to improve the quality of the magazine.

Although we are not a profit making concern, we must make a small profit in order to be able to insert more cartoons and pictures which cost between £1 to £2 10s. 0d. each to produce. Also we wish to change the design of the front cover every so often and the initial outlay to get the printers blocks made again is rather expensive.

The answer to all this would be for you to enrol all your friends as yearly subscribers on forms obtainable from the Editor or myself. All cheques or Postal Orders should be crossed and made payable to The Treasurer, R.N. Diving Magazine.

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HOW DEEP IS YOUR WATER ?

This article was written by an Officer who recently completed a short diving course at H.M.S. Vernon

It was perhaps appropriate that the Long T.A.S. Course should be the first to complete the new supervising officer s course; it was certainly an interesting exercise in instructional technique when one considers the variety of talent available. Our abilities ranged from a gallant diving officer from beneath the Southern Cross, through several semi-qualified divers to those who, like myself, considered at the outset that man was born to exist above the water and that diving was an activity that should be strictly reserved for the fishes.

We soon realised that a diving suit is a great leveller. Pleased I was to note that the fat looked no more portly than the thin, the flat-footed no more clumsy than their nimble mates, and even the distinguished bearded officer became a rather woe-begone rubberised walrus. But far more important was our immediate appreciation that no matter how many stripes on one's arm or how self confident one may feel on the deck of a ship, once below the surface one can only rely on one's wits and the intelligence of the man at the other end of the life-line. Our own experiences showed us how important it is that the supervising officer should understand the diver's problems and act accordingly in a tricky situation.

Our own experiences ! Imagine the delight in the mind of the enthusiastic long T.A.S. man who finds a lobster on the keel during a dive at night and immediately strikes out towards the surface clutching it as a baby would a new rattle. 'Look what I've got' he thinks as his head pops above water. But alas he was on the wrong side of the ship and as he swam towards the stern he got a mask full of water and tore it off. At the same instant his chum on the other side, having twice had no response from his signals began to heave in on the life-line. The prospects of being keel-hauled was enough to produce an ear-splitting cry for help and a nasty accident was just averted in time. The lesson learnt is obvious. On another occasion one of us ditched his set when his face-mask glass was knocked out during an exploration of the ship's keel. This unfortunate also surfaced on the wrong side of the ship, and found that he had joined up with another class. Meanwhile his own class instructor had pulled up the vacated breathing apparatus and was turning a delicate shade of grey, wondering what the ——— had happened to his pupil. These two experiences and many others less serious taught us more than any amount of lectures could ever hope to do.

What a charming place Horsey Lake is, we thought, as we splashed along on our backs like so many lovelies at an aqua show. The casual observer might remark that at this stage we had obviously not got the word about the mud. He would be quite right. Those of us who were able to speak after the delightful experience of squirming after our course officer as he sped gazelle-like over the slime were probably grateful that he had a sense of humour.

But in all truth we enjoyed our course and greatly appreciated the patience and interest of our instructors. Our impression was that the divers have got things pretty well organised. After our descent to 180 ft. in the pot we realised that this i the only branch of the Navy where one is paid for getting drunk. And who can complain if after a real hang-over one can have ten minutes on O_2 for free ?

MEDITERRANEAN FLEET CLEARANCE DIVING TEAM

Do you wake up feeling tired in the morning and have an unaccountable feeling that all is not well ? Then perhaps you too have been working with a film company !

We apologise for the absence of material lately, but during the past few months we have been slightly busy with one thing and another; from moving pictures underwater to flying to a far removed port on the North African coast for the serious duty of mine disposal.

In case you haven't had the experience of working with a film company—don't ! It is the easiest way of going right up the wall—we know. You don't have to be round the bend in film business—but it helps. The Romulus Film Company, having decided to make 'The Silent Enemy', the story of Cdr. Crabb's wartime exploits at Gib., when he had a private war with the Italians working from the interned ship *Olterra* at Algeciras, came to Malta to shoot the underwater sequences. Admiralty approval having been obtained, all the Team were detailed to do a bit of underwater acting. This ranged from driving 'Chariots' (two men torpedoes) to having a splendid fight in and around a sunken bomber in 30 ft. of water.

Filming can be interesting, it can also be extremely hard work. Imagine the following situation—at the end of the Blue Lagoon are three, hard to handle 'chariots', in the middle, four swimmers, and at the end, the camera. All are on the bottom. Without talking or signals we all had to arrive over the camera at the same time and give each other the 'thumbs up' signal. This took all forenoon to do and then the Director said, 'Very good, very good indeed—Now let's do it all over again !'

The average daily routine of Lieut. Honour, who took over Officer Commanding 'Chariots' after the departure of Lieut. Cdr. Brooks, was something like this:—0630—board H.M.S. *Forth* to supervise the loading of the three 'chariots' onboard an M.F.V. which took two hours to reach the location at Blue Lagoon. After a day's diving and filming the 'chariots' which weigh almost a ton each were returned by hand on board the M.F.V. Another trip lasting two hours brought us back to *Forth* where the 'chariots' were serviced for the following day. This normally finished at 2230.

The film was written and directed by Lieut. Cdr. William Fairchild, R.N. (Retd.). The actors and actresses you probably know are:—Lawrence Harvey, Dawn Adams, Valli, Michael Craig and a host of Italian Gentlemen.

Three 'chariots' were specially made for the film under the expert supervision of Lieut. Cdr. 'Joe' Brooks, who brought them out by air to Malta, and taught us how to drive them. Two 'chariots' were made of fibreglass and the third was a converted Mk. II torpedo. When the company departed to Gibraltar, they were accompanied by A.B. 'Yorky' Wilkinson who acted as 'Naval Diving Advisor'. His relief, 'Jock' Adam had arrived before shooting commenced. Wilkinson also went to the Studios in London. We would like to say that he did a responsible job extremely well. We hope AI Mess, H.M.S. *Vernon* is as comfortable as the Rock Hotel, Gibraltar!

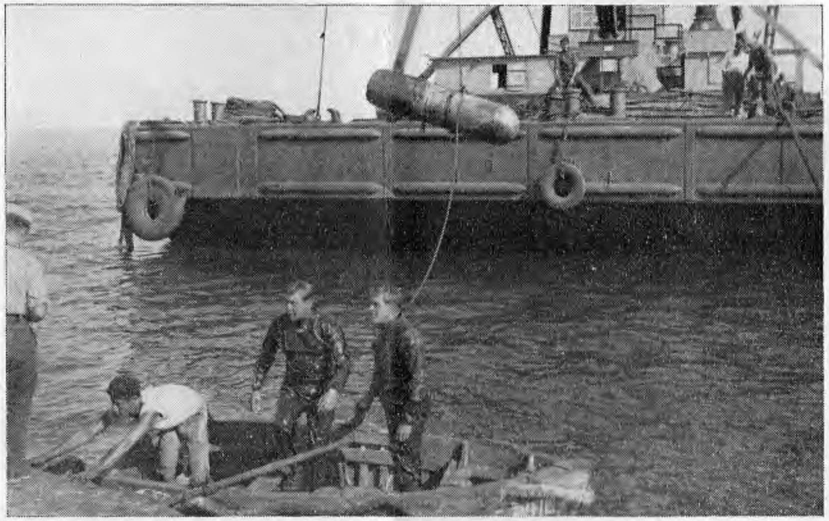
We say welcome this week to Lieut. George Wookey, Q.D.D. who has taken over the Diving School next door to Lieut. Foster. There is a buzz that all Shallow Water Divers qualifying, are now going to do a 600 ft. dip in their third week! Lieut. Foster will of course be remembered here, for his efforts in erecting the new Diving School to replace the shaky nissen huts.

Recently, Malta was honoured by the visit of the First Sea Lord, Admiral of the Fleet, Earl Mountbatten of Burma. We are pleased to relate that one of the priorities on his very full programme was to go aqualunging in his old haunts along the Malta coast. As his safety number, who accompanied him (and had a hard job keeping up) I can report that the First Sea Lord is quite an underwater man.

There has been a healthy crop of babies in the Team of late. Bray and Graham produced boys, and the Audoire family, a wee girl. Mesdames Carter and Clark expect happy events at Christmas. Are two weddings and six babies in a Team in one year a record? Ten shillings will be paid to the writer with the best reply.

Adam and Audoire are waiting to take the next Seamanship Board for L.S.; Bray, Carter, Graham and Wilkinson have all passed for Leading Seaman. L.S. Cook and Clark have passed for Petty Officer. Should Adam and Audoire pass (and they had better) all the Team except two, will have passed for his next higher rate.

Some weeks ago the Team did a repayment bottom survey, for the 'Shell' Company at Benghazi. A new underwater oil pipe-line is to be laid there next year. We found a few oddments, including two German Type 'C' Magnetic Accoustic Mines. One was countermined, because it was outside the harbour—lovely bang. The other, as it was against the harbour wall in some 18 ft. of water and near the 'Shell' installations, quite obviously had to be rendered safe where it lay. The Lybian Government asked the Commander-in-Chief, Mediterranean if we might return and remove the monster, which weighed nearly a ton and was 10 ft. long. A section of the Team consisting of Lieut. P. A. White, Lieut. S. R. Honour, P.O. E. Counsins (U.W.I.), L.S. A. Whitton and A.B.'s R. M. Adam and R. P. Shore returned by air three weeks later, and the mine was duly rendered safe. The mine was in perfect condition. Every screw except two was removed with comparative ease. Pieces of the mine which were removed—primer, primer placer gear, detonator, bomb fuze and bomb fuze primer were as new as when the mine was laid. This confounds those who are of the opinion that missiles immersed for some 16 years, are now safe. And friends, it all comes to bits just like it says in the book—thank goodness! P.A.W.



Lieutenants White, Honour and the mine

MEDITERRANEAN TEMPORARY MEMORANDA

NOTICE BOARD ISSUE

Mediterranean Fleet Clearance Diving Team.

I wish to draw the attention of the Fleet to the work carried out during the past year by the Mediterranean Fleet Clearance Diving Team, which has involved some 50 separate operations to render safe, often underwater, and dispose of, over 900 missiles of various kinds. These have included the disposal of a live magnetic-acoustic mine containing 1,536 lbs. of high explosive, and a bomb containing 2,120 lbs. of high explosive. 18 bombs have been found to contain a particularly sensitive trembler type anti-disturbance fuze.

2. The operation concerning the mine mentioned above was probably the highlight of the year's endeavours. The mine, a German type C, which was found lodged against a jetty in Benghazi harbour, was rendered safe after 2½ hours work underwater, and subsequently lifted and ditched in deep water. Examination of parts removed from this mine showed that, despite 16 years immersion, it was still in working and lethal condition. Expressions of gratitude for this operation have been received from consular and local government authorities at Benghazi.

3. Thoughout all the operations undertaken by the Team there has run a spirit of cheerful endeavour, which, combined with courage, skill and careful planning, has enabled its officers and men to maintain the very high standard of effiency which we have come to expect of the Fleet Clearance Diving Team. Their work has been in keeping with the highest traditions of the Service.

Med. 828/41.

CHARLES E. LAMBE, *Admiral.*

OFFICE OF THE COMMANDER-IN-CHIEF,
MEDITERRANEAN, MALTA.
17th January, 1958.

THE THEORY AND PRACTICE OF WELDING UNDERWATER

by VINCENT R. FOSTER.

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The welding circuit, underwater, is exactly the same as that used in air. The factors that control welding are, arc length, speed of travel, machine settings and electrode angle, experience will be found to have the same relative importance as in above water welding. When the arc is struck below the surface, the water immediately around it is forced away in all directions, creating a bubble in which the arc stream flows to the work. This bubble is formed around the arc, and originates in two ways.

Firstly, we must consider the electrode coating. In surface welding, with coated electrodes, the steel core melts inside the coating, forming a short tube around the arc. This coating evolves gases, which rush outward at a very rapid speed and thus shield the arc and molten metal from an in-rush of air. The gases formed are hydrogen and carbon-monoxide, which are harmless to steel. This same action takes place underwater, only here the gases are required to also hold the water away from the arc.

Secondly, there are gases formed by the water being in contact with the high temperature of the arc. This intense heat turns the water into steam and then disassociates it into oxygen and hydrogen. The oxygen-hydrogen burns, which accounts for the small flame seen at the end of the electrode and explosive bubbles which appear on the surface. The chemical action of the arc produces the intense heat on the material you are welding. The finished bead has a very bright, clean appearance and is relatively free of slag due to lack of oxygen at the arc. The gases caused by the action of the intense heat and the electrode coating are what make it possible to weld underwater.

Striking the Arc.

The first thing the student must learn in underwater welding is how to properly strike an arc and what takes place as this is done. To begin with, the electrode is held at an angle of about thirty-five degrees to the

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surface of the plate and poised above the point where the weld is to start. The electrode end is then struck against the plate with a hard and sharp jabbing motion, still maintaining the same electrode angle. This completes the circuit, starting the arc and weld. The jabbing motion is especially necessary if the electrode has been partially burned, as the coating forms an excessively long tube of coating when used underwater and if it were only touched to the plate the electrode itself would not be near enough to complete the circuit, so it is necessary to jab the electrode against the work to get the arc started.

After the arc is started, the electrode is allowed to remain on the plate and a pressure exerted to keep it there. This crumbles the coating around the electrode end and forces the welder to hold the proper arc length. The student must remember, and train himself not to raise the electrode after he makes contact with the plate, as the arc will break and cannot be maintained if the electrode is lifted from the plate.

Difficulties Encountered in the Flat Position.

Heat settings for underwater welding are a source of trouble to the student as they must be accurate to do good work. In general they will be higher than for surface welding of the same kind. This is caused by the *conductivity* of the heat in the water, the increase in pressure at which the weld is taking place, and by the cooling effect of the water on the metal being welded. Usually an increase of up to twenty-five volts and twenty per cent on amps will be sufficient.

It is impossible to state exactly what settings should be used for a given job, as the depth of the water, the thickness of the plate, the size of electrodes, the technique of the welder, the loss of current through leaks in the equipment and the amount of electrolysis all have to be considered. The latter is the greatest source of heat loss, caused by metallic parts of the cutter or cable coming in contact with the water.

The welder should remember that even though the arc has a higher temperature under water, this temperature does not change as the settings on the machine. Changes in machine settings give more, or less, heat volume with little or no actual temperature change. The greater the depth, the higher must be the settings on the machine, not only because of the added pressure on the arc, but also due to additional current losses through the added length of lead. A thorough knowledge of proper heat settings for any given job, as in surface welding, is gained mostly through experience.

Electrode angle, as state above, is one of the most important factors in welding underwater and is often an important source of trouble.

This angle is referred to in two ways. Angle in relation to the line of weld, and angle in relation to a line at right angles to the weld. The first in relation to the line of weld, controls arc length, penetration and build-up. The lower this angle is the longer the arc, the less the build-up and the poorer the penetration. Increasing this angle will have the opposite effect in proportion to the amount it is raised. The student welder's

greatest fault in this respect is letting this angle increase as the electrode burns down, which means he is constantly changing the physical characteristics of his weld deposit.

The other angle, at right angles to the weld, controls the shape of the bead both as to penetration and build-up. In a true flat position this angle should be ninety degrees to the work. If the plate is slightly canted one way or the other, the electrode must be canted slightly more than the plate. This holds true for any position and works on the principle that the arc should play evenly on both plate edges being welded at all times. Failure to do this causes an uneven distribution of both build-up and penetration as well as undercutting on the least favoured side.

In this respect, the student usually has a tendency to pull the electrode toward the side he welds from. It is a fault easily corrected. The position of the diver in relation to the work is a third source of trouble for the student. Wearing a full rigged diving suit at any great depth is not the most comfortable way to do a job, but by the use of forethought and common sense, a diver may increase his efficiency to a marked degree. The diver should first picture to himself the welding job at hand. He should then place himself, through the use of staging if necessary, in such a position that he is afforded the maximum amount of ease and freedom of movement for that particular weld.

This position may have to be changed for each electrode that is run, although this will not usually be the case. At any rate, he must realize that he cannot weld from a cramped or swaying perch and that no matter how much time is spent in securing the proper position, he will be ahead in the long run. Visibility may also be increased through this medium and in many cases this will be the difference between doing, and not being able to do a job.

Butt Welds, Flat Position.

The fusing of two metals together underwater is carried out in the same manner as the application of beads to a plate. Many different types of joints may be used to accomplish this, in all the various welding positions, and the first joint the student must learn to do is the plain butt weld in the flat position. In learning this he will learn the principles of all fusion welding used underwater. In preparing the job for welding, the student should try to obtain as good a fit as the circumstances governing the job will permit.

In many cases this will be entirely out of the student's hands, but when possible, the edges to be welded should be rough ground to a fit, and all paint and scale removed as far as is possible. The removal of foreign matter from the weld area is often neglected by the underwater welder. Unless the surfaces are perfectly clean it will be almost impossible to apply the weld, as the paint or scale will burn and form *explosive bubbles* that will blow out the *molten metal as fast* as it is applied.

When the job has been cleaned and aligned, the weld may be started. The diver should position himself in such a way that the work is on a level with his *chin*, and should weld toward himself as much as possible. This places the electrodes between the diver and the arc stream, which enables him to see the groove he is welding in by reflected light. This also utilizes the electrode as a shield, preventing the arc itself from preventing good vision of the welder. The electrode angle should be slightly higher than for running beads, around 35 to 40 degrees. This causes the arc to shorten, prevents it going out when bumped and also enables the welder to get better penetration. The electrode should not be tipped or pointed to either side, as this will cause a lack of fusion on the side being favoured. The heat setting for this type of welding should be slightly lower than for running beads on a single plate. This is necessitated by the gap between the plates and if it is not lowered the welder will have trouble burning through the plate. No oscillation, or washing of the electrode should be used in welding seams with string beads. If a wider bead, or more build up is desired, a weave bead may be applied as a second pass, but small solid beads are preferred until thorough experience is gained.

Maintaining the Arc.

There are three important things that must be watched in order to maintain the arc. They are arc length, electrode angle and the pressure being exerted on the electrode by the welder. The proper length of the arc will be about the same as for surface welding, approximately half the diameter of the electrode, but the extended coating will always touch the plate. The cooling effect of the water will cause an extra long extension on the electrode coating. The electrode end must be kept much closer to the work than when surface welding. To do this, it must be pressed enough against the plate to crumble part of the coating away and allow the electrode end to take its proper distance from the work. Electrode angle must be considered with arc length, because along with the pressure being exerted on the electrode by the welder, it is what controls this weld. The higher the electrode angle, the shorter the arc. The lower the angle, the longer it is drawn out. Any change of angle on the electrode will change the arc length and in doing so change the characteristics of the weld. In the beginning the water is clear but after a few minutes it is not always possible to see clearly underwater, and other means than sight must be used to determine whether the weld is progressing correctly. This is done by feel, and by experience you will get also hearing, i.e. the sound from the electrode. A correct arc length will cause the welder to hear a low, even, rumbling sound, to see a whitish glow with a few sparks at the electrode end, and to feel a steady vibration in the electrode holder. A long arc will increase the rumble to a roar, will cause excessive sparking at the arc, and will increase the vibration to a great extent and cause a break-off of the arc. A short arc brings the noise down to a gurgle, will eliminate the sparks at the arc, change the whitish glow to a dull red, and will practically stop the vibration and stick the electrode.

If the student will seek this low rumbling noise, the steady vibration and the whitish glow with few sparks, he will find that he can maintain an arc with ease.

String Bead, Horizontal Fillet.

Running string beads in a horizontal fillet requires some variations to the technique used for flat beading. The diver will find that he should

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be in such a position that he is behind the arc, and then should weld away from himself. This will give him almost his best view of the arc in operation, and will allow him to observe how his bead is building up during the weld. On this type of string bead a slight oscillation of the electrode is used. This oscillation, or movement, is about $\frac{3}{4}$ of an inch down the line of weld and slightly away from the plate. It should be understood by the welder that an oscillation differs from actual welding inasmuch as no metal is deposited. No matter what the movement of the electrode is, if metal is being deposited, it is welding.

It then follows that to *oscillate*, the electrode end must be slightly raised from the plate, lengthening the arc, and it also must be moved faster than when welding. This oscillation gives more control over the puddle, by reducing its fluidity, and also greatly assists the welder in giving the deposited weld a final concave shape. The electrode angle in relation to the line of weld should be about ten degrees off the vertical, pointing forward in the direction of travel. The electrode angle across the line of weld should be about fifteen degrees up from the lower leg of the fillet. This means that the electrode will point slightly up and forward in the direction of travel, which is the electrode position found best for the oscillation movement. The speed of travel will be in accordance with the build-up, and can be determined by the diver by watching the shape of his deposited metal as it is shown by the glare of the arc. The machine settings are the same as for flat welding except that in most cases the voltage should be raised to allow the arc to be lengthened without extinquishing it.

To summarize, it must be stressed that the welder's position in relation to his work is all important. If this one thing is not right, it is almost impossible to perform the technique, or to see what is taking place in regard to the weld being deposited.

Other Effects of the Welding Circuit Underwater.

Wherever a welding circuit is in use there is a danger of shock, and this danger is greatly increased if the circuit is to be handled underwater. If proper precautions are taken and preventitive measures carried out, this hazard becomes negligible but any carelessness or thoughtlessness on the part of any person connected with an underwater job might easily result in a casualty.

The welding circuit should be turned off at all times that welding is not in actual progress. If left on, and the diver was to touch the holder to his helmet, he would blow a hole in it that could be fatal. If he is working off the bottom on staging and merely touches the holder with his hand, he will be jarred enough to lose his balance and fall, which, if far enough, will squeeze him fatally. A shallow water outfit should never be used for welding, as the operator's body is in direct contact with the water, which being a conductor, will assist in giving a violent shock. Also on A.C. a shock tends to make a person cling to the circuit, where in D.C. it tends to release him. If the welding circuit is properly insulated and the operator properly equipped and trained, there is no more danger to underwater welding than any other kind.

String Beads, Vertical Position.

The underwater welding student will find the vertical position similar to master. In this position the welder has a maximum range of vision as well as freedon of movement, and the metal flows into the plate much more readily than it did in downhand welding. This is mostly due to the welding heat being carried slightly upward as the bubble starts to the surface, and as vertical welding proceeds from top to bottom, this allows the molten metal more time to flow in and fill the undercut. A wider, flatter, bead may be deposited as this heat effect, plus the arc and water pressure, allows the molten metal to spread out to some extent. In running string beads the electrode is held at about a thirty-five degree angle off the plate, pointing up. The angle across the intended weld should be the same as for flat welding, ninety degrees. After the arc is struck, a slight pressure is exerted on the electrode holder straight in towards the plate, and at the same time the electrode is allowed to feed slightly up into the puddle.

If this is done properly, there will be a red glow, extending on each side and about $\frac{5}{8}''$ above the electrode end, which indicates that the arc length is right. The flux will be burned evenly and there will be a low, even, rumbling sound given off. If this pressure is too much the coating will burn unevenly, or fall off in pieces, the puddle will be hard to control, and the red glow will almost vanish. As in flat welding, the electrode angle must be correct to insure good welds. If the angle in relation to the line of weld is increased too much, the electrode will slip into the puddle and stick. This will also cause the bead to be uneven. If the angle is decreased too much, there will be very little, if any, penetration, a small, narrow bead, and the arc will be hard to hold. The angle across the line of weld should always be at right angles to the plate. This angle is changed by pointing the electrode to one end or the other. This will cause the red glow to vanish on the side the electrode points away from and gives an undercut and misplaced bead. When running in this position the welder is afforded a good view of the weld operation and if he will watch for the glow on each side and above his puddle, as well as assure himself the flux is burning off evenly, he will do good work.

Weave Beads Vertical.

Weave beads in the vertical position are accomplished in much the same way as string beads as far as electrode angle and machine settings are concerned. After the arc has been struck the electrode should be moved back and forth across the line of weld, to establish the size of the intended weld deposit. As in flat weaving, this movement is fast across the centre to eliminate excessive build-up and has a pause at each side to fill undercut. If the welding is being done properly, there will be a reddish glow around the electrode and signifying the puddle. If this glow extends more than a couple of electrode diameters up from the electrode end, too much heat is being used, or the speed of travel is too slow. When heat settings and speed of travel are correct, the red glow will be wider than it is long. It will extend completely across the puddle, constantly showing the right bead width. This can also be used as an indication of where to make successive cross-overs.

Each trip across the weld should lap half over the one before it, or half into the red glow. This crossing movement should be made with the wrist alone, allowing the upper arm to be held against the body for support. This will give better control than if the motion is attempted with the entire arm. If the elctrode arm is riding the bottom edge of the puddle, and the electrode angles are rigidly maintained at 35 degrees and 90 degrees, the welder should experience little trouble with this technique. The over-lapping beads assure that there will be no porosity.

Difficulties in the Vertical Position Welding.

Among the difficulties the diver will encounter in the vertical position, is the tendency of the puddle to get too fluid. Faster welding alone is very seldom the answer to this problem, as it will usually leave a scrimpy out of proportion *bead*.

When a great amount of vertical work is to be done, the welder should use *reverse polarity*, which keeps most of the welding heat in the electrode. He should also be sure that he does not allow his progress down the line of weld to stop, in his eagerness to fill in the seam. This fault of slowing down will cause more burned welds and hang-downs, than any other single factor. It is sometimes caused by high machine settings but too often the student will blame these settings and lower them, when it is really his slowness of advance that is to blame.

The student must always remember that the heat, in temperature of the arc, does not change much, no matter whether the settings are high or low, If the arc is held in one spot too long, the metal will be burned and will also run, due to the arc being about five thousand degrees hotter than the temperature needed to melt the metal. Rather than lower the settings, they should be raised, giving a greater heat volume, and enabling the welder to move faster yet deposit the same amount of weld.

Another fault the diver may develop is standing to one side of his weld and allowing this to pull his electrode off a ninety degree angle across the line of travel in order to shield his eyes from the arc. To avoid this the diver should take a position directly behind, or facing, the intended line of weld, for in this way he may utilize the electrode as a shield from the arc and also be in position to see that his electrode angle does not fall to the side. From this position, as long as the arc glow is the same on each side of the electrode, the angle is correct. Another fault in regard to the electrode, is allowing the angle in line with the weld to change, as the elctrode burns down. This is usually caused by the diver being unable to change the position of his hands as the weld progresses. He must place himself in such a way that his hands and arms move freely down the line of weld, far enough to use the entire *electrode*. By letting the hands move down with the electrode holder, the electrode angle in this respect may be held constant. Most of the difficulties arising in any position can be traced to improper electrode angle, either across the weld, or in line with it. If the diver will learn the proper angles and always be sure they are correct and unchanging the majority of his troubles will be eliminated.

Difficulties Encountered in Fillet Welding.

All welds, surface or underwater, can be divided into two categories: butt welds and fillet welds. The one used most by the diver will be the fillet, unfortunately the more difficult of the two. To be able to accomplish proper fillet welds, the diver must understand the basic difference between these weld types.

In butt welding, the metals being joined are in the same plane no matter what the position of the welding. If the electrode angle across the line of weld remains such that the electrode is the same distance from either plate, the deposited weld metal will be equally distributed between the two plate edges. In fillet welding this does not hold true. In all fillets, the plates being joined are in different planes which must be compensated for by a change in electrode angles. No matter what position the fillet is in, the electrode must be pointed towards the higher side. The easiest way of explaining this is to consider a fillet joint.

If the two plates form an upright vee and the weld is to be deposited into the bottom, the electrode angle across the line of weld is the same as for a butt joint, with the electrode straight up and down. If the vee were to be placed in the vertical position, the angle between the electrode and the top plate, would point the electrode toward the top of the joint. As the fillet is moved up into the overhead position, the electrode angles would begin to equalize again and when the vee became exactly upside down, the electrode would again be straight up and down. This is a very important point and must be remembered, as it is the cause of a large per centage of the trouble in fillet work, both above and below the surface.

In underwater welding only, there is one other very distinct difference between butt and fillet welds and it will cause the diver trouble if he doesn't understand it. Underwater fillet welds almost always require an oscillation, where underwater butt welds very seldom utilize it. The reason for this is that due to the difference in the joint, fillet welding requires more control and a higher heat setting. To perform this oscillation, the diver must point his electrode towards the direction of travel, or directly opposite to the conventional surface method. This must be watched very carefully, for if the electrode is allowed to slant in the other direction, that is to point at the weld, the electrode will freeze out each time the diver tries to make the oscillation movement.

In summarising the difficulties of fillet welding, the student should read back over this lecture. If he will analyse what he has just gone over, he will find that the controlling feature is the electrode angle. All that seems to be necessary is to learn the proper angles for each type joint and the job is easy. This is absolutely right, not only for fillets, but for all underwater welding. If the electrode angles across the line of weld and in line with the weld are maintained correctly, the diver will experience little trouble. If they are not right, a good job cannot be done.

Electrodes for Underwater Welding.

In general, electrodes used for underwater welding are the same as used on the surface. Some function better than others and some require different technique for their application.

All D.C. electrodes can be divided into straight and reverse polarity types, although some can be used in both, and each polarity has its good and bad points in relation to underwater work.

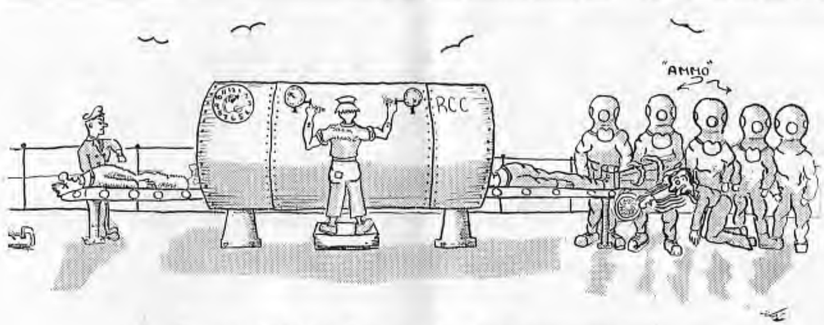
Where the welder has either one to choose from, he should use straight polarity electrodes for flat work, and all position fillets. In this polarity his work is the positive pole, which means that he will have sixty-five to seventy-five per cent. of his heat in the metal being welded. This makes the puddle easier to handle and gives it enough fluidity to fill in undercut to a great extent. It also causes the electrolysis to form on the work and suit, rather than the electrode holder, allowing the diver to control it with a zinc plate as previously explained.

Reverse polarity electrodes should be used for butt welding or crack welding, in the vertical and overhead positions. In this polarity the electrode holder will be the positive pole, and although trouble from electrolysis will be experienced, the fact that the majority of the heat will be in the electrode, will make the puddle much easier to control.

Concerning choice of electrodes, the welder should remember that either type will do a satisfactory job in any position. Different job conditions merely make the choice of one or the other advantageous as far as the case of welding is concerned. Electrodes, other than the shielded type, such as bare, washed, and light coated, may not be used for underwater work. Due to the absence of a sufficient flux coating, they will not create a gas pressure sufficient to hold the water away from the arc. There are other explanations of a more technical nature, but the fact remains that they will not work.

Action of the Electrode Coating.

As the manufacturers' coating on the electrodes makes underwater welding possible, its actions should be thoroughly understood by the welder. The first, and most important, is that it acts as a shield between the water and the arc. In surface welding gases are envolved as the coating burns, and these gases rush outward from the arc at high speed in such a way that oxygen cannot enter either the deposited or parent metal.



Time and Motion Study : Surface Decompression?

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" CHATS "

For a few fleeting moments we have taken our ease, but now with Christmas astern, and the New Year stretching ahead—it is time to prepare for the trials and tribulations of another training session. On reviewing our forces at Chatham we find we are left with a rather unbalanced team and this calls for some re-organising.

C.P.O.s. and P.O.s are streaming in from all quarters of the globe including to date:—P.O. Ellard (our dear 'Stinky'), who has been transferred from the jewel of the West Country—'Guz', and P.O. Kerr who has returned from his extended 'Leave' in New Zealand. In addition some of the *Kingfisher*'s team C.P.O. Hall and P.O's Nicholls and O'Connor are expected in the near future to take up temporary residence pending a decision on the future of their ship.

Of those who are shortly to leave, special note must be made of P.O. 'Nutty' Carr. (Special Note to Malta—Lock away your 'tot' bottles.) Also on the move are L.S. Spooner and A.B. Narris of B. and M.D. team.

Unfortunately, the trend is the other way with Junior rates. With drafts going out and no reliefs provided, we shall be somewhat depleted in this respect. Those affected by this are A.B's Owers, Curry, Cripps and Langley. Here's a sad note for some of the old stagers—soon to be lost to the fraternity is the inimitable 'Gibson,W., A.B.' who is unhappily forced to relinquish his diving status due to the after effects of an old back injury. Bad luck, 'Gibbo'. We hope South Africa will give you some measure of relief.

November 28th saw the Diving School Staff embarking on their Christmas 'run'—'The Green Man' at Leytonstone. It was a night filled with frolic and fun, in which we were joined by ex-P.O. 'Nobby' Foreman. It is the custom at Chatham to present all members of the Staff with a Tankard when they leave the service, but, due to the great speed at which 'Nobby' achieved this Valhalla of all serving members, the ceremony was not performed in his case. Happily, we were able to rectify the matter at 'The Green Man', and the Tankard was filled and refilled with whisky throughout the evening.

The evening ended, as one might expect, in a slight riot. Strangely, we are still *persona grata* at 'The Green Man' despite the removal of certain signs when we were leaving. On this score alone the evening must be accounted a success.

Apart from the light relief afforded by our outing the dying days of the old year were also enlivened by a very interesting case of 'bends'. A civilian from the Belvedere Power Station, was brought to the School suffering from acute pain and with a definite shortness of breath. The Surgeon Commander who attended the case stated 'His appearance would not have caused any comment in a Post-Mortem room, but fortunately he was more alive than his appearance suggested'.

After 38 hours and 17 minutes of re-compression, many gallons of tea, much loss of sleep and a near birth of kittens by the Diving Officer (Q.D.D.), he was brought to the surface a much fitter and wiser man. Just to help things along, one of the trainees decided to work much harder under water than was good for him, and this, while we were still trying to recover from the shock occasioned by the 'Orrible Body' we had just loaded into the 'pot'. The net result of this was a combined case of Oxygen and Carbon Dioxide poisoning which added considerably to our joy.

Such is life ! Though it does make a change from the usual monotony of foul screws and training classes. BADGER.

THE SILENT ENEMY

By LIEUTENANT-COMMANDER J. BROOKS, R.N.

The successful underwater saboteur is a contemplative man, not prone to impassioned outbursts, nationalistic pride or delusions of grandeur and bravado, but steadfast in his pursuit of the 'underwater cause'. It is to be hoped that those who filmed this subject have portrayed the Silent Enemy in his true light.

The film is based on the Italian attacks on our shipping in the Mediterranean during the last war and on the British efforts at counter measures. The Italian attacks were highly skilled and most successful.

The efforts of Commander Crabb and his team to reduce the number of casualties we suffered from the attacks at Gibraltar are well demonstrated in the film. The unit carried out this particularly dangerous duty magnificently without suitable equipment and unfortunately without much support.

A certain amount of theatrical licence may well be applied in shooting this part of the film, as the British public must be convinced that, in underwater warfare, we were much better than the Italians.

The Navy have ensured that their contribution to the film will be a success. Most of the underwater sequences were shot at Malta where the Mediterranean Fleet Clearance Diving Team did all the acting. The film rushes of these sequences looked very promising. They had to fight underwater, cut each other to pieces and generally do the most alarming things. In the course of this many interesting facts of diving life were discovered. A very good method of getting over a proto Cocktail is to change over to a ditched set underwater, spitting out the residue en route. One day it was raining ditched sets and cameras so hard that the 'chariots' were used to pick them up. And those poor dear cameramen were always in trouble. 'You can't imagine some of the things those deadful divers did to us. Why they filled poor Charlie with weights as a joke, and, do you know, he went to the bottom like a stone.'

In providing the facilities and equipment for making the film, it was necessary to construct three operable 'chariots'. The first two of fibre glass were built in two months from scratch which should make the blue print merchants sit up and think. The only mishap occurred when the first boat collapsed with a delightful 'Guff', at 30 ft., much to the grief of the makers and the amusement of the divers. But this fault was quickly rectified in the other two boats by the simple use of more jibs. The third boat was made of steel from the hull of an old torpedo. This one proved to be a honey even through it was knocked up in under a fortnight. All three craft ran beautifully in the Mediterranean with only minor defects. The Clearance Divers took to them with comparative ease and it speaks well for their training when one remembers that the Italians called them pigs because they are pigs to handle.

The crowning event of this Mediterranean interlude was the official commissioning ceremony of the three 'chariots' Nellie 3, 4 and 5, which took place alongside H.M. Submarine *Tudor*. In accordance with the best traditions of the service the senior officer of the squadron addressed his Commanding Officers and Ship's Company on the occasion of the recent arrival of the squadron to this station. 'Well now I've got you all together so that you can see me and I can see you. Now I expect every 'chariot' to be clean because a clean 'chariot' is a happy 'chariot' and rhubarb! rhubarb! rhubarb! This was done so well that the assembled audience on the casing of *Tudor* were falling into the oggin with mirth.

Let us hope the film will be a success.

THE LAND O' BURNS

Greetings Gentlemen and Clearance Divers from these Northern latitudes where we are still fairly busy, the work being evenly divided between disposal and diving jobs.

We have had the pleasure of the company of the two "B's" H.M.S. *Brenchley* and H.M.S. *Brearley* recently, and it is certainly good to have their 'smiling' faces around.

The former Clearance Diving Ship, H.M.S. *Dipper* has recently been sold to a private company at Milford Haven and has been re-named *Pembria*. It is with feelings of nostalgia that I shall watch the departure of this little ship which in my 'humble' and perhaps old fashioned opinion was one of the best Clearance Diving Vessels I have every dived from.

Ths title of this article is 'Land O' Burns' which is usually taken to mean the historic County of Ayrshire. Our team frequently visits Cairnryan, a military port near Stranraer, where we inspect Underwater Demolitions, and to get there we pass through Ayrshire.

Robert Burns or Rabbie Burns as they say in Scotland was born on 25th January, 1759, at a small village called Alloway, two miles South of Ayr. Next year there are to be extra celebrations throughout Scotland and the World to commemorate the 200th Anniversary of his birth. It was hoped to print a special stamp for the occasion but permission for this has not been obtained, although in Russia where he is said to be widely read they have actually printed special Burns' Stamps. One of Burns' most famous poems is Tam O' Shanter and it is from this poem that the famous sailing ship *Cutty Sark* got her name. A 'Cutty Sark' is Scottish for a 'Short Shirt' which Nannie the witch was wearing when she chased Tam over the Auld Brig O' Doon.

The South part of Ayrshire or Carrick which is the old name is steeped in history. This is the country of the famous Kennedy Family whose head is the Marquis of Ailsa. The ancestral home of the Kennedy's is Culzean Castle (pronounced Cullane) which stands out on a rocky promontory about 10 miles South of Ayr. It is now owned by the National Trust, but a suite of rooms in this historic Castle was given to President Eisenhower in appreciation of his services to the Allied cause in World War 2. Near to Culzean Castle there are many caves, and in these caves in the eighteenth century lived a wild man and his large family all closely inter-married. This wild character was called Sauny Bean and he and his family were actually cannibals, and used to kill and eat unwary travellers. Sauny Bean and his family were eventually caught and brought to justice, these facts being recorded in a book called the 'Grey Man'.

There is also a famous hill in South Ayrshire called 'Croy Brae' or the 'Electric Brae'. On this hill if riding a bicycle you can free wheel going up but you must pedal when going down, and water actually runs up the hill. It is said to be an optical illusion caused by the lay of the surrounding country.

Well folks, my haggis will be getting cold, so I'd better sign off. Best wishes to all, and remember the words of the immortal bard.

'Whene'er to drink you are inclined
Or Cutty Sark's run in your mind
Think; you may buy the joys owre dear
Remember Tam O' Shanter's Mare.

Yours aye, MAC.

THE ROYAL NAVY'S UNDERWATER AIR SET

by RONALD FLANAGAN

At long last, the Royal Navy is about to bring into service the air breathing set. Our new equipment will be named the S.A.B.A. an abbreviation for Swimmers Air Breathing Apparatus. A great deal of work has gone into perfecting the set by the scientist, manufacturers and the divers themselves.

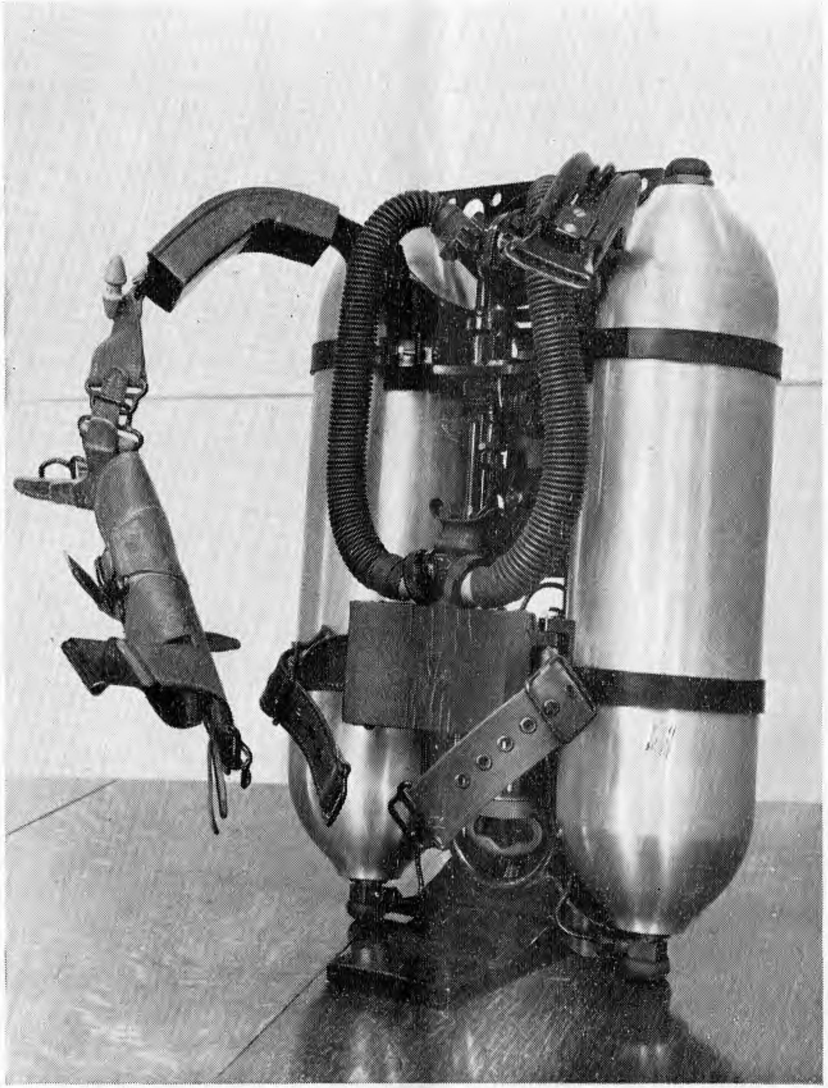
Although the S.A.B.A. will work at all depths safe for air it was designed for specific use between 30 and 50 ft. This is because the endurance must be considered. It has two cylinders, one on main flow and one, which can refill the main one by pulling down on a spring-loaded equaliser handle, as a reserve. It takes about 10 seconds to equalise the two cylinders.

H.P. air is supplied from *Light Alloy* Cylinders, tested to 3,600 lbs. per sq. in. and charged to 2,400 lbs. per sq. in. by opening a CONTROL VALVE between the two cylinders. From there it goes to a high flow, single stage REDUCING VALVE (fitted with a double compensating diaphragm and relief valve) which supplies air at 60 to 65 lbs per sq. in. into a tilt activated DEMAND VALVE and thence by breathing tubes to the diver. The breathing tubes contain two non-return valves which give little restriction to breathing, aid in cutting down dead space and help the diver when changing apparatus (clearing tubes routine) under-water.

The weights on the set are carried in a quick release ejector box located between the cylinders which is operated by a bowden cable similar to the one on the 5562. This is in a convenient position in the shoulder hook on the front of the set. Another weight pocket is carried on the front between the two shoulder hooks. This is an integral part of the harness and can be released completely by a toggle-slip action. 1 lb. slab weights are used.

The breathing on the S.A.B.A. is easier than on most sets. This is largely due to the tilt action DEMAND VALVE and the fact that it is backed up by a separate REDUCING VALVE. The demand valve breathing cycle works between $\frac{3}{4}$ in. and 3 in. water-gauge as opposed to commercial sets whose action is 2 in. to 5 in. water-gauge and at any time during inhalation the reducer pressure is not to be less than 50 lbs. per sq. in. Also the manometer must not exceed 3 in. water gauge during any part of the cycle-inhalation or exhalation.

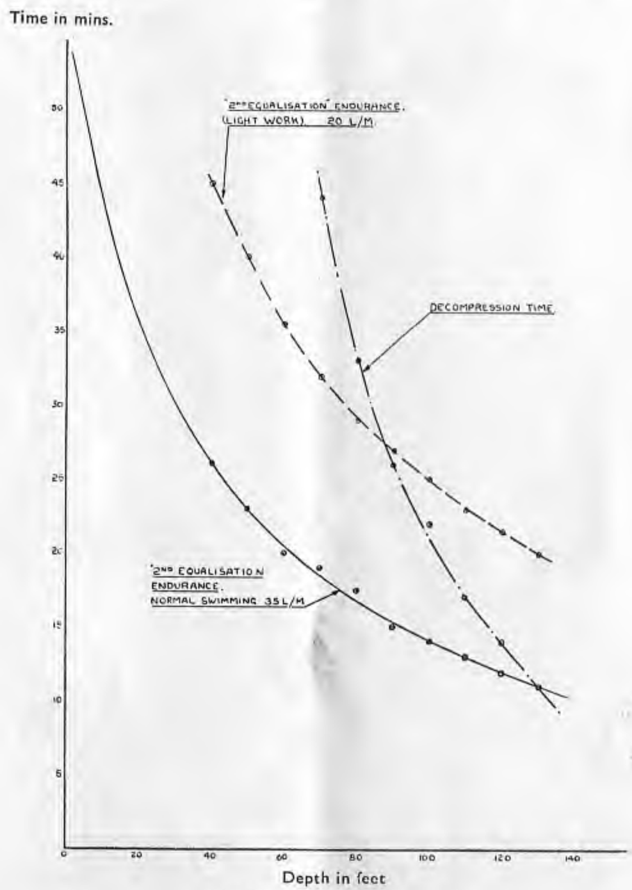
The Navy set will give the diver 35 litres of air per minute when working hard. Civilian sets give 28 litres per minute. From this it is quite apparent that the S.A.B.A. is designed for safe diving in medium depths.



Latest Twin Cylinder

The endurance depends on how much compressed air is contained in the cylinders initially and how quickly this is used by the diver. The cylinders have an uncharged capacity of 8·5 litres each. When charged to 2,400 lbs. sq. in., the air then available in each cylinder is 1,400 litres, which gives 2,800 litres in all. With this in mind and the fact that each man's breathing cycle is different, it is necessary to work out an answer for the average diver's consumption.

The following graph shows how the endurance varies with depth for light work and normal swimming. The endurance is taken from the commencement of the dive to the SECOND equalisation of the cylinders. Hence enough air remains in the reserve cylinder to allow the diver to surface.



Graphs showing endurance

It may be of use to know that a restriction to breathing is felt each time the pressure in the main cylinder falls below 100 lbs. per sq. in.

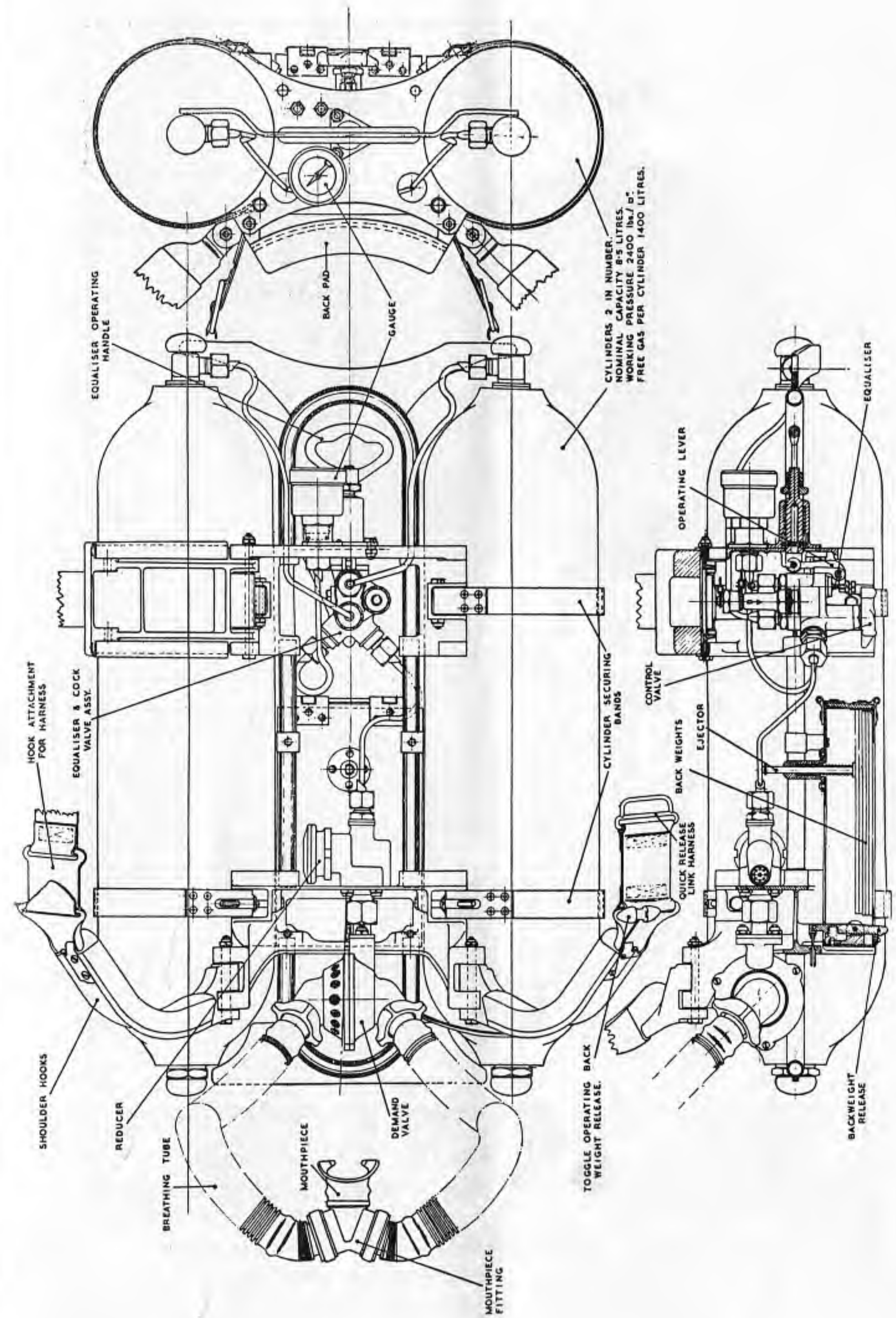


Fig. 1. Divers' Air Breathing Apparatus

This necessitates the use of the reserve cylinder by operating the equalising handle which allows the compressed air to flow into the main cylinder. When the pressure again falls to 100 lbs. per sq. in., a second equalisation is made, which gives the diver most of the remainlng air from the reserve tank.

Every diver is aware that as the air tanks in any self-contained under-water breathing apparatus are emptied more buoyancy in proportion to the weight of air in the cylinders is experienced. To help the diver to work out the weight he may require on the S.A.B.A. a few figures on these tanks seem necessary. When the tanks or cylinders, which ever you prefer to call them, are fully charged, their weight is 23 lbs each. Uncharged one cylinder weight is $19\frac{1}{4}$ lbs. This means that our set is $7\frac{1}{2}$ lbs. lighter when it is empty. Depending on the duration of the dive also the diver's specific water displacement, he must commence to weight this set accordingly.

When using a nose-clip with these air sets, the operator must ensure that he can equalise the pressure in the mask-space via the nose so that, at all times, the pressure in the lungs, mouth and face-mask are the same as the ambient water pressure at the working depth. If this is not done and the mask pressure is less than that pressing on the face-plate or that being taken in at the mouth, the higher pressure in the mouth and lungs will attempt to force its ways towards the lesser pressure zone via the eyes. The air may also take blood with it, producing blood-shot eyes and great pain. Throughout the time we were visiting our French diving colleagues, not once did we see a nose-clip used when dives were taking place using face-masks and compressed air sets. We also noted that not one case of 'Red-eye' was present in any of their teams. The technical term for 'Red-eye' is chorodic barotrauma.

A difference between the normal type of Aqua-Lung and the Navy set is that the demand valve. etc. need not be removed when charging. The S.A.B.A. fits on a special stand of aluminium, which cants the set at about 15 degrees to vertical. The back rest pad on the set is opened and the charging line attached to the charging connection which carries a non-return valve. When the charging line gauge shows the set is fully charged the nut on the connection is replaced, the set is tested for leaks, and once the back pad is put into position the set is ready for use.

Operation of Demand Valve and Reducer.

When the demand valve and reducer are assembled in the breathing apparatus and submerged, the local water pressure acts on the compensating diaphragm, the relief valve of the reducer and within the exhaust chamber adjacent to the diaphragm of the demand valve. At the moment between exhaling and inhaling, the exhaust valve is closed by water pressure acting on it, and, similarly, the tilt valve is held closed by air pressure from the reducer.

As the result of inhaling, the pressure within the inlet chamber falls and the ensuing pressure differential allows the water pressure to act as the diaphragm and move it towards the back of the chamber. This causes the diaphragm to move the tilt valve away from its rubber seat, thus releasing compressed air from the reducer to the demand valve inlet chamber.

Throughout the duration of the inhaling cycle, the tilt valve remains open. The latter closes again at the commencement of exhalation when the pressure differential is reversed.

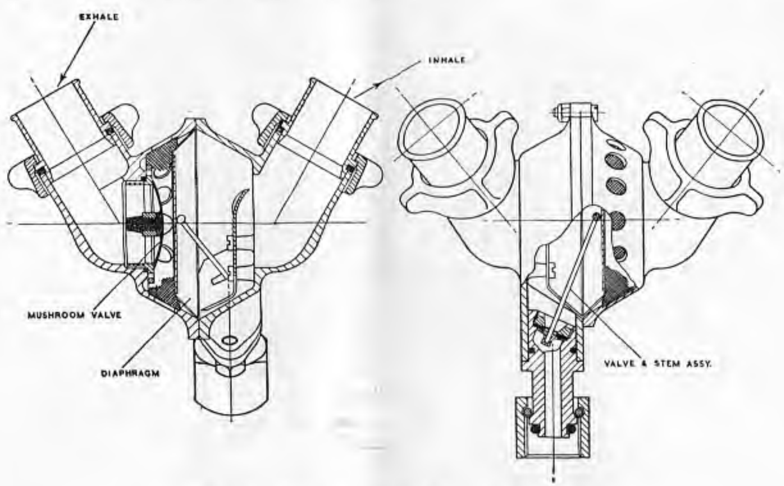


Fig. 2. Arrangement of Demand Valve

The exhaled air, at a pressure in excess of the water pressure, enters the outer chamber, forces the mushroom exhaust valve off its seating and is discharged into the water compartment. See fig. 2. The reducer automatically controls the delivery pressure and is illustrated in fig. 3 which shows the internal components in their relative positions prior to the introduction of the H.P. supply. The inlet valve is held open by the bellows end cap which is thrust towards it by the main spring.

When air from the H.P. supply is introduced, it passes through the open inlet valve to the reducer outlet and so to the demand valve. Assuming the tilt valve to be free, the pressure from the reducer acts on the back of the tilt valve and forces it against its sealing ring to produce a leak proof condition.

The pressure within the reducer continues to rise against the compression of the main spring. In so doing, the bellows end cap moves away from the head of the inlet valve guide and allows the inlet valve spring to close the inlet valve, thus isolating the H.P. supply. Opening the tilt valve permits flow and destroys this state of balance; the reduction of the outlet pressure acting on the bellows allows the main spring to re-extend the bellows and open the inlet valve.

The reducer components remain in this condition until the pressure is supplemented and the state of balance restored.

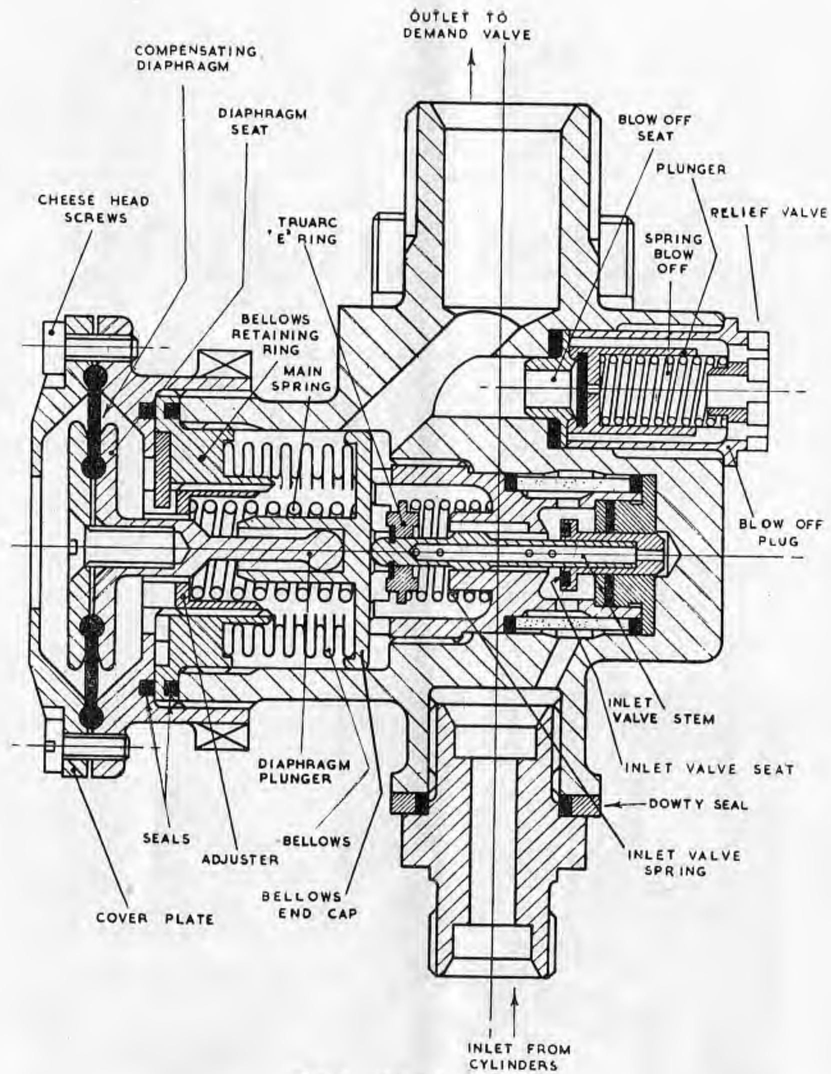


Fig. 3. Valve Reducer

The compensating diaphragm is sensitive to external water pressure which forces in on it progressively with increasing depth. As this takes place, an increasing load is imposed on the bellows end cap. This augments the main spring load and produces a higher differential and consequently a corresponding increase in outlet pressure.

The effective area of the compensating diaphragm upon which the water operates is double that of the bellows end cap upon which the air operates. The reducer is, therefore, said to be double compensated.

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Similarly, the blow-off relief valve is sensitive to external water pressure, which in concert with the spring, acts on the external area of the valve. If for reasons of internal leakage (e.g. due to embedded foreign matter on the inlet valve, etc.), the outlet pressure within the reducer continues to rise, it overcomes the external loading on the relief valve and discharges into the water. The relief valve is set to function between 240 and 270 lbs. per sq. in.

Other equipment supplied is a belt which fits round the diver's waist then over one of his shoulders where the operator secures his life-line to a metal ring at the s. blade apex. Snorkels are also supplied to help conserve the air when searching on the surface in clear water or, if the set is empty on surfacing, as the weight of the set tends to keep the swimmer's head low in the water.

In my closing paragraph I would like to thank the Boffins and staff at A.E.D.U. for their kind co-operation.

H.M.S. 'VERNON' NOTES

The falling axe will make a great difference to the diving fraternity in that we will lose a few old faces over the next three years. Before September 1958, we will be saying farewell to Lieut.-Cdr's. Wardle and Border, Lieut. Donaghue and Sub.-Lieut. Rock, and after September 1958 to Lieut.-Cdr. Franklin, Lieuts. Heatley and Mappley and Sub.-Lieut. Gould. We wish them for you every success in the cold, hard world outside. We welcome two new faces, however, Lieuts. Futcher and Lermitte. They have recently completed the C.D.O.'s course and are taking up appointments as below.

At present we are witnessing a shuffle round of appointments, Lieut.-Cdr. Franklin, who has worked extremely hard, often against tremendous odds, to build the diving branch up to something in which we can be justly proud, is going to Malta. In his place we welcome Lieut.-Cdr. Wilson from *Dingley* and the H.S.C.D.T.

Other appointments recently are:—

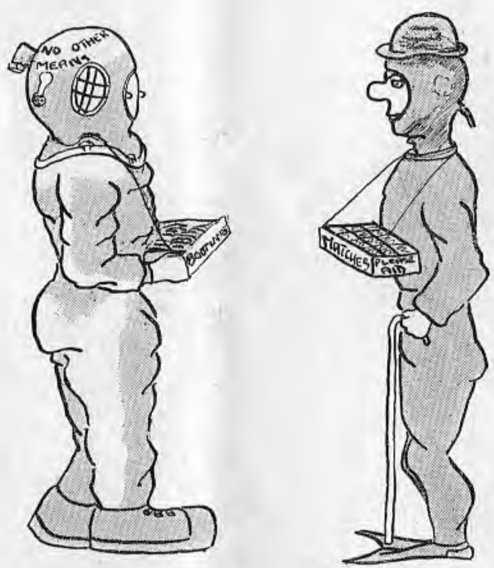
Lieut. White to general service.
Lieut Checksfield to Far East vice Lieut.-Cdr. Warner.
Lieut.-Cdr. Warner to *Vernon* Trials vice Lieut.-Cdr. Filer.
Lieut.-Cdr. Filer to *Vernon* Assistant S.O.D. vice Lieut.-Cdr. Wardle.
Lieut. Futcher to *Dingley* and H.S.C.D.T. vice Lieut.-Cdr. Wilson.
Lieut. Lermitte to *Vernon* vice Lieut Checksfield.
Sub.-Lieut. Grace from *Reclaim* to *Safeguard* vice Lieut. Dodd.
Lieut. Dodd to Chatham vice Sub.-Lieut. Otley.
Sub.-Lieut. Otley to *Vernon* vice Sub.-Lieut. Smith.
Sub.-Lieut. Smith to *Reclaim* vice Sub.-Lieut. Grace.
Sub.Lieut. Walker from *Kingfisher* to *Defiance* vice Sub.-Lieut. Rock.
C.P.O. MacKinley from *Vernon* to Far East C.D.T. vice C.P.O. Hopewell.

C.P.O. Hopewell to *Vernon*.
C.P.O. Foggin to Malta vice C.P.O. Fawcett.
C.P.O. Fawcett to *Vernon*.
C.P.O. Allen to *Vernon*.
P.O. Williams to *Newfoundland*.
P.O. Gordon to *Tyne*.
P.O. Rackett to *Kingfisher* vice P.O. Nichol.
P.O. Nichol to Chatham.
P.O. O'Conner to *Adamant* vice P.O. Black
P.O. Black to *Vernon*.
P.O. Clark to Malta vice C.P.O. Allen.
P.O. Morris to *Victorious*.

We congratulate P.O's. Holland, Bolton, Ashton, Scott, Wheeler and King on qualifying Diver First Class. L.S. McGrath and A.B's. Birrell, Turner, Jackson and Hunter, we welcome into the Diving Branch.

Now that the submarine branch has rejected the rescue bell as a means of escape, we wait with speculation as to the future life of the *Kingfisher* as a deep diving vessel.

It is gratifying to see the enthusiasm shown by the Sub-Aqua clubs which visit H.M.S. *Vernon* every weekend to see our equipment. Those authorised to dive are given a dip in the tank and we do not discriminate between the sexes. It is good to see that the ladies are just as keen as the men.



Bowler Hat Brigade

'HOW DEEP CAN YOU GO?'

Its a question that most free divers are asked at some time or other, and is both an interesting and intelligent one. Anyone who has used an Aqua-lung, or one of its counterparts has at some time asked himself the same question, and the answers that come up are varied indeed.

It is, therefore, interesting to go into the history, short as it is, of free diving and see from practical results just what the real answer is to—'how deep can you go?'

The Cousteau Gagnan apparatus was first tried in the water in early June, 1943. Its first trial was not the success it had promised to be, but the second trial, after suitable modification proved without doubt the value of such an apparatus. It was Cousteau himself who went down with the apparatus at Bandol, on the Riviera, and within minutes of entering the water had reached 60ft. By September, 1943, all the Cousteau team had reached 115 ft. and later the same year 140 ft.

On October 17th, 1943, off Maire Island, at the entrance to Marseilles Roads, Frederic Dumas, a member of the famous team dived to 203 ft. It was not an easy dive for him, and he re-surfaced soon after entering the water for a short rest, but on the second attempt attached his belt to the shot rope at the 203 ft. marker. Other members of the team were satisfied with this depth, as Dumas admitted symptoms of nitrogen narcosis, or 'rapture of the deep' as Cousteau called it.

By July, 1947 all the team, now called the Underwater Research and Study Group, had gone deeper than 203 ft. but only to a maximum of 213 ft. Cousteau then decided that the equipment could be used to achieve much deeper depths, and aimed at 295 ft. He dived off the coast of Provence, and, at the previous depth of 213 ft., the first symptoms of nitrogen narcosis appeared as a metallic taste in the mouth and hallucinations, but he continued down and reached 295 ft. Every member of the team attempted the same dive and all made the bottom and back without mishap.

September 17th, 1947 saw eight divers from the team onboard the *Elie-Mornier* off Toulon, ready to attempt a dive to 393 ft. On this occasion each diver was to wear a life-line, and Maurice Farques was to make the first attempt having felt the least effects of narcosis on the previous dive of 295 ft. For three minutes after entering the water signals were received on the life-line, but these suddenly ceased. The stand-by diver went down and at 160 ft. met the body of Farques that the attendants were hauling up. It was later found that he had achieved his aim as his signature was found on the 395 ft. marker tag when the shot was hauled up.

Cousteau decided the lesson was clear, all the team had achieved 295 ft. easily, but when the strongest member gave his life to achieve 395 ft. then the limit lay between 300 and 400 ft. There was little object in risking lives to prove the exact limit, and to this day 300 ft. is considered the maximum limit for an Aqua-lung dive breathing compressed air.

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If one wishes to argue as to the holder of the deepest dive, in free diving, then it must go to Frederic Dumas, who dived to 305 ft. in 1948, not as a record attempt but to clear the fouled cables of a minesweeper.

Attempts at free diving records continue of course, and an interesting dive was made by an American in 1953. Dr. Hope Root, a lawyer from Miami, at the age of fifty-two, dived the full length of a 400 ft. long shot rope. His progress was watched, and photographed on an echo sounder by both officials and the press, but he was not satisfied with 400 ft. and continued on towards the sea-bed. As he dived even deeper, the echo on the sounder weakened and faded away as Hope Root plunged to his death.

Considerable disturbance was caused in France on the 2nd September, 1954, when a French dentist by the name of Dr. Henri Chenevee announced that he went down in the Bay of Saint-Florent to a depth of 426 ft., duly witnessed and recorded by officials from Corsica. The French Club de la Mer looked into the claim, and, although were far too polite to say so, virtually accused him of entering the water and after a shallow dive hauling up the shot rope and getting the 426 ft. tag that way. Apparently the shot was only weighted with a twenty pound weight, so it could have been the answer. Anyway, a further attempt to repeat the claim, brought Dr. Chenevee to the surface after thirteen minutes, pale and spitting blood without even the first of the depth markers, set at 265 ft. Perhaps the fact that the shot this time weighed 200 lbs. had some bearing on things. Further amusing records have been claimed from time to time. One from a French expedition stated they had sent free divers 1,350 ft. below sea-level in the Dead Sea. It just so happens that the surface of the Dead Sea is 1,350 ft. below sea-level anyway. Andre Galerno has made the world's highest dive—namely, in a hydro electric dam in the French Alps. Various Americans have claimed records for staying under water for periods over twenty-four hours, recharged lungs being sent down to them; and distance swims of seven and eight miles have been made underwater.

So there it is, the record for free diving still stands at 305 ft. although the holder Frederic Dumas, doesn't think of it as a record and to quote his own words—'Doesn't give a damn anyway,' and considers record dives such as these 'imbecile'. C.P.O. R. LARN.

DIVING IN NEW ZEALAND

I expect by this time the stories of Christmas Island have been told and re-told by Lieut. Barrington, C.P.O. Lock, P.O. Collar and of course, P.O. Coleman, who were there in H.M.S. *Salvictor* when we arrived. It would be superfluous for me to enlarge on their tales of this epic—so I will pass on to the sequel, which concerned me very much.

On completion of the job at Christmas Isle it was announced that a Diver I was required to go to New Zealand to assist on a deep diving project there—and yours truly was shipped aboard H.M.A.S. *Rotoiti*, which was due to return to New Zealand about that time.

It was a very pleasant cruise, calling at the islands of Puka-Puka, Aitutaki, Tonga and Fiji. The ship was opened to visitors at each place. My sole responsibility at each place was to rig and inflate a Mark I Swim Suit which was suitably adorned with a Salvus set. It seems this was the cause of some considerable alarm among the children at Aitutaki—because on being prodded, the arms tended to flap about, and the cuffs which were blanked with beer tins (empty), caught a few unwary little boys a good clout on the ear.

Arriving in Auckland, I joined the Barracks, H.M.N.Z.S. *Philomel*, on the 16th July, where I was met by Bill Short, the Chief Diver I and for the first time was told the nature of the work to be done. Next day I was introduced to Lieut. T. Wickman, Q.D.D. (C.D.) who is in charge of the Diving School.

The first job in hand was to train the team in Deep Diving, and this we did in a few weeks.

Diving conditions around Auckland are very good, but, about October and November, the sea surrounding the Great Barrier Reef can become very temperamental, so we did lose a few days here and there for this reason.

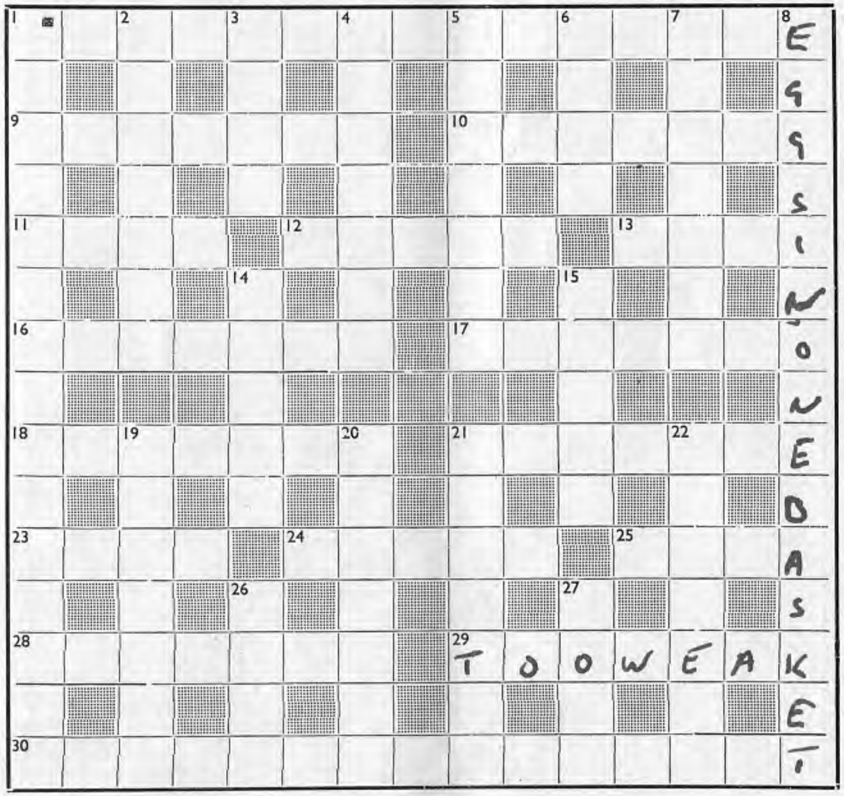
DIVERS' X-WORD No. 7

CLUES ACROSS

1. Mothers don't mind baby being so, but do if Dad is (4, 2, 3, 6)
9. Was Green St built by confused Viceroys? (7)
10. An edible sea slug which the Chinese use in a soup (7)
11. Appendages (4)
12. This is left after death (5)
13. Cockney third person, Latin second person and English first person. Needle clue! (4)
16. Cuddles up in bars and tins (7)
17. It appears that the Navy added nothing at the end of this battle (7)
18. Praise the Lord, who's Anna now? (7)
21. Jack disturbs Lee pest (7)
23. Not at an angle (4)
24. A Commanding Officer in the Navy—Seedy? (5)
25. Square feet denote this (4)
28. These cakes contain what a diver needs (7)
29 O.K. to awe? Definitely not strong (3, 4)
30. When this you lose (4, 3, 3, 5)

CLUES DOWN

1. The inventor puts the other side in to bat (5, 2, 3, 5)
2. Get guns for gold! (7)
3 .The upset snow possesses (4)
4. Change a set lass and thereby hangs a tail! (7)
5. Parent ails without equality (7)
6. All are welcome at this house (4)
7. He betrays a trust (7)
8. Suggests 100% risk for poultry-farmers (4, 2, 3, 6)
14. Do this to 24 across. It may be 1 down! (5)
15. Not quite snow (5)
19 Eat up the bird! (7)
20. He brings forth charges (7)
21. The back marker has a hundred charts to unravel (7)
22. Vulgar fellow who gets up too soon (7)
26. Fit a note together and lovers quarrel (4)
27. Pertaining to animals (4)



The solution to this X-word is on page 41

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All diving stops were done on a stage, which at times could be very uncomfortable, especially when, as often occured, a swell of 10 ft. or more was running. However all went well, the only exception being a 'bend' which Bill Short developed in the shoulder.

On our arrival back in Auckland we were surprised to learn that we had established a New Zealand deep diving record of 300 ft.—the fact being reported in the papers and broadcast. Bearing in mind that this was the first time any Deep Diving had been done by the New Zealand Navy the results were quite good.

All the diving had been done from the tug *Manawanui* which although rather small is well rigged out to cope with anything to a depth of 300 ft.

Great credit is due to Lieut. Wickman and Bill Short for the standard of diving and team spirit in New Zealand.

I enjoyed my stay in this lovely country and it was a real pleasure to work with the 'Kiwis'.

I left New Zealand from Whisnuipi air port on the 19th November to fly home. We stopped at Brisbane, Darwin, Singapore, Ceylon, Karachi, Iraq, and Malta before arriving at Northolt on the 27th November—thus completing a trip around the World. JOCK KERR.

NEWS FROM THE FAR EAST

'KUNG HEI FAT CHOY' is the cry now echoing around the colony of Hong Kong. For the enlightenment of our friends who have been no further than the Isle of Wight, this is the Chinese greeting for their New Year. No doubt the Scottish readers will be very envious when they realise that this is our second 'New Year' within two months. (To ensure complete participation the divers have suddenly developed slant eyes and pigtails.) The celebrations, which last for three days, take the form of continuous feasting and drinking to the accompaniment of the roar of fire crackers.

While on the question of noise, I am glad to say that the 'Silent Service' has become even more silent since the arrival of the talkative A.B. Le Cornu. Included in our most recent arrivals are L.S. Kempson and A.B. Phipps. Shortly after Christmas, we said goodbye to A.B. Wiggans and Carr, the backbone of the team, who will no doubt be sad to hear that the team is still going strong without them.

Once again we have been body-hunting. This time it was a Chinese Dockyard workman who fell over the side and didn't come up again. Our score is now thirteen-and-a-bit bodies in two years.

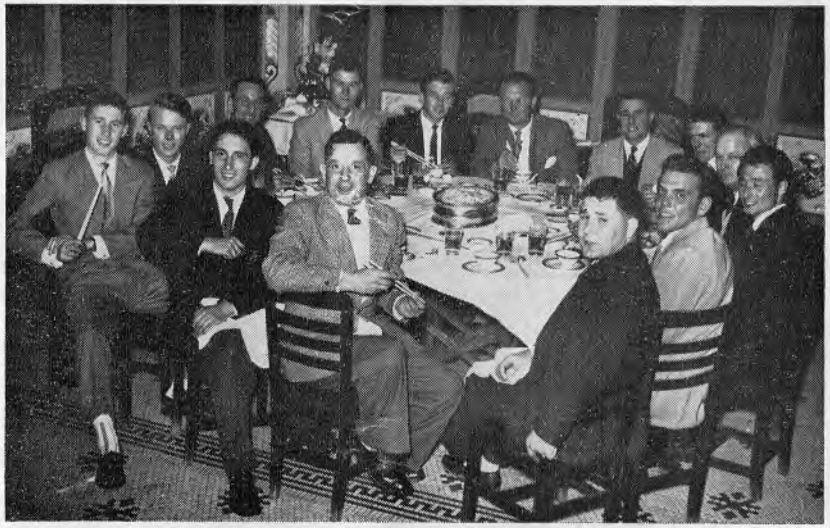
Recently the team competed in the inter-mess Football Shield. They drew twice, lost once and then decided to hang up their fins. They did very well considering the other messes fielded only nine men each time.

Last week saw the arrival in Hong Kong of the bronzed and healthy P.C.D.U. from Singapore, to assist in a harbour exercise. This, of course had to be followed by a combined teams run. Having satisfied their thirst they disappeared with some of our new equipment to do tropical and shark trials. It has been whispered that we are going down to show them how !

Latest flash:—The Chief has decided to stop smoking for Lent.
The Boss has decided to give up drinking for Lent.
And the rest of the team have just decided to stop working.

Flash flash:—The road to Hell is paved with good intentions.

M.C.



The Far East Teams settling down to a twelve course 'Chinese Chow'

SOLUTION TO CROSSWORD No. 7

Across—(1) Fond of the Bottle; (9) Regents; (10) Trepang; (11) Toes; (12) Relic; (13) Etui; (16) Nestles; (17) Salerno; (18) Hosanna; (21) Steeple; (23) Flat; (24) Acorn; (25) Area; (28) Eclairs; (29) Too Weak; (30) Down for the count.

Down—(1) First in the field; (2) Nuggets; (3) Owns; (4) Tassels; (5) Entails; (6) Open; (7) Traitor; (8) Eggs in one basket; (14) Plant; (15) Sleet; (19) Swallow; (20) Accuser; (21) Scratch; (22) Parvenu; (26) Tiff; (27) Zoic.

DIVER'S EMPLOYMENT BUREAU

The Bereau continues to function, and if you wish your name to be recorded please forward the undermentioned to the Employment Bureau.

Applicants must be either serving R.N. Divers or Ex-R.N. Divers who are subscribers to the *Diving Magazine*.

Full Name ....

Rating .... *Off. No.* .... *Age* ....

Time Expired or Expires ....

Private Address ....

....

Willing to Serve Abroad ....

Diving Rate .... *Date and Place Qualified* ....

Equipment Experienced in ....

....

Diving Experience ....

This information will be filed and referred to as and when diving employment is required. The Bureau does not assure you of a job, but it will advise applicants on vacant diving situations.

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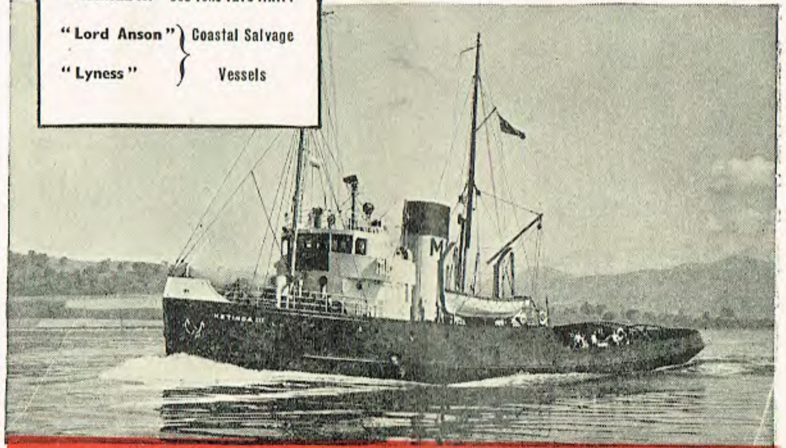

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