SPUMS SCIENTIFIC MEETING 1984

HYPERBARIC FACILITIES IN VICTORIA

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The SPUMS scientific meeting in 1983 was introduced to the National Safety Council of Australia (Victorian Division) venture into hyperbaric facilities. The unit has now treated three people suffering from decompression sickness as well as featuring on ABC TV when Bob Cumberland and Paul Butler, who were with us in Fiji, rescued a "bent" diver from Piccaninny Ponds, called the NSCA and had him picked up from Mt Gambier, pressurised in a Dräger Duocom, and taken to Morwell where he was decanted, still under pressure into the large chamber where Dr Geoff Macfarlane "treated" him with excellent results.

Paul Butler told us about the neonate. I want to tell you about the infant and its older relatives.

The simplest way to catalogue the available chambers is to start in the North-East of the State and come south and west to Melbourne and then east again to Morwell. Following the Princes Highway south we first come to the turn-off for Mallacoota where the Abalone Fishermen's Co-op has a small two compartment chamber which has been used to treat many cases of decompression sickness. Recently one man was flown to Morwell for treatment in the NSCA facility.

Then in Bass Strait there are the chambers on the oil rigs and drilling and construction barges and ships. These are purely for the divers employed on the job. That is not quite true as early in 1982 a scuba diver, who had been to more than 200 feet on air, spent a week in the chamber on a barge. This case has been reported in the SPUMS Journal (April-June 1983, 13(2): 38-39).

The only multiman chamber in Melbourne is the Melbourne Metropolitan Board of Works (MMBW) chamber at Braeside which was installed to care for men working in compressed air digging sewerage tunnels. It is a large two compartment chamber with a limited depth capacity. It is operational when there is work going on in compressed air. At other times it is on a care and maintenance basis but can be activated at short notice. It is not available to other than MMBW employees except by express permission of the Secretary of the board

The other chamber in Melbourne is the one man Vickers oxygen chamber at Prince Henry's Hospital. This is mostly used for gas gangrene and other cases needing hyperbaric oxygen, but occasionally cases of decompression sickness are treated there. The present policy is to limit treatment at Prince Henry's to pain only bends and send the neurological bends to Morwell to the NSCA Multiman chamber.

The NSCA (Victorian Division) has two Dräger Duocoms and a two compartment multiman chamber (4m x 1.8m), which is mounted on a semi-trailer giving it complete mobility, with its own generator, compressors and air banks (Figure l). The chamber has an entrance lock and a medical lock. It started life as the property of a firm of diving contractors which went bankrupt. It was built with no regard for noise pollution, the inlet pipes just opened into the interior and blowing down was deafening. Even with the dispersers fitted now it is very noisy. It is rated to 50m (6 ATA).

The trailer carries a 10 KVA diesel generator for use when situated away from a mains supply. 50 m of electricity supply cable connects to the mains when this is possible. The compressor is an Ingersol Rand of 98 cfm capacity at 150 psi (10.2 atmospheres gauge) with appropriate filters. The banks of high pressure cylinders are G size. There are 30 cylinders (192,000L) of air, 10 (76,000L) of medical oxygen and 15 (106,500L) of heliox (80:20). The compressor is the normal source of pressure with the air cylinders as back up in case of failure.

The built in breathing system (BIBS) has two outlets equipped with Scott Aviation masks with overboard dump. An oxygen monitor is used to check that the overboard dumps work properly. There is a hull penetration for ECG recording. The main compartment is 2.7 m long, which gives plenty of space for two cot cases, one on each bunk.

Those in the chamber are constantly on show as two video cameras peer into two of the portholes. There is no lighting in the chamber and lights shine in through two portholes. Voice communications are by two helium unscramblers (Aqua Air Helium Voice Processor).

The control panel is in the crew room of the semitrailer. Beside it is the television monitor, and the communication with the chamber. Also available are radio communications with the NSCA base at Morwell and a telephone which can be plugged in up to 50 m away. In the event of the trailer being outside a hospital this could be plugged into the hospital telephone system giving the treatment team access to the hospital switchboard and all extensions. The creature comforts of the crew have not been forgotten. A table with a well padded bench, fridge, electric urn, and a microwave oven allow for a proper Australian diet of pie and tomato sauce washed down with tea. There is even a sink to wash the dishes in.

The chamber has been mounted under cover with side screens to keep off the sun and wind. The chamber shell has been covered with insulation (a layer of foam covered by a reflective layer). Chambers heat up during compression and cool with decompression. In hot climates, and Victoria is hot occasionally, the metal heats up considerably unless adequately shaded and cooled. The chamber at Nauru, which is just below the equator, was inside a building and so out of the sun. Even so those inside sweated heavily all through the treatment and in spite of unlimited fluids lost up to 4 kg in weight. Such dehydration must alter haemodynamics, as must the skin vasodilation which accompanies a hot environment, and not necessarily in ways that increase the elimination of an inert gas load. Conversely in cold, wet and windy conditions an unprotected chamber can get very cold indeed.

Climate control in the chamber is achieved by "blowing through", changing the atmosphere by venting and filling

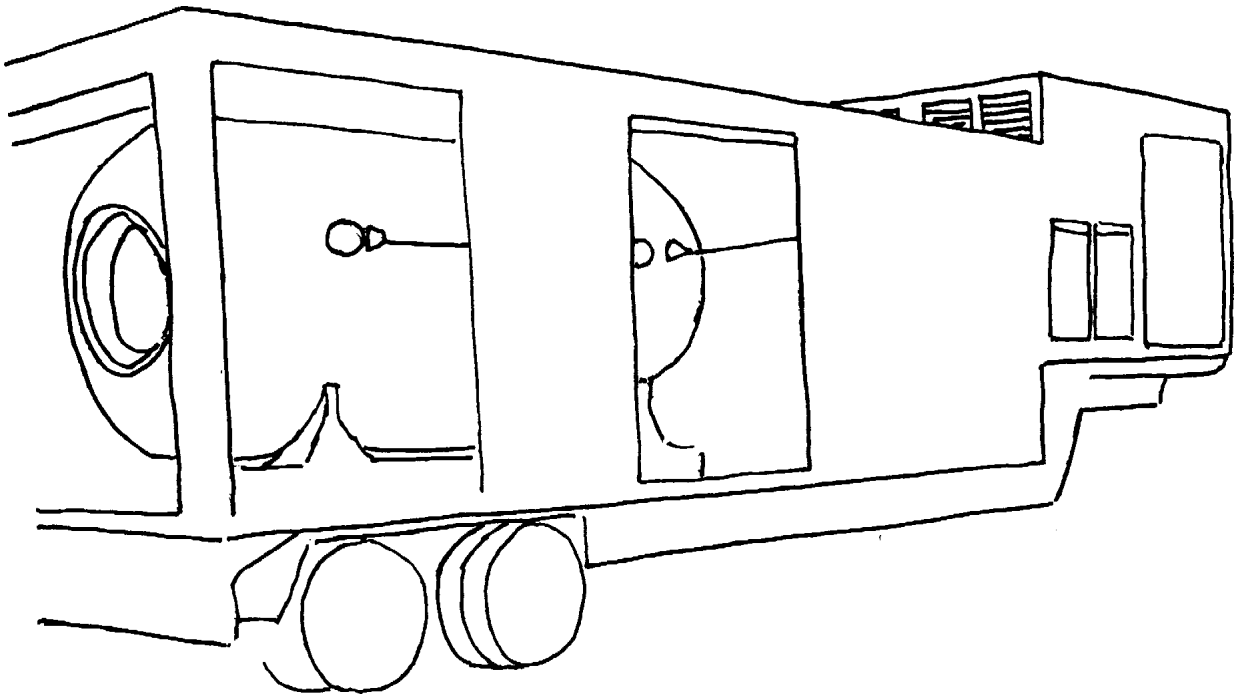

FIGURE 1

DIAGRAM OF NSCA MOBILE CHAMBER

The entrance is to the left. The left hand porthole looks into the entry lock. The compartment to the right of the chamber is the control room. The compressor and high pressure gas cylinders are in the compartment over the trailer's turntable.

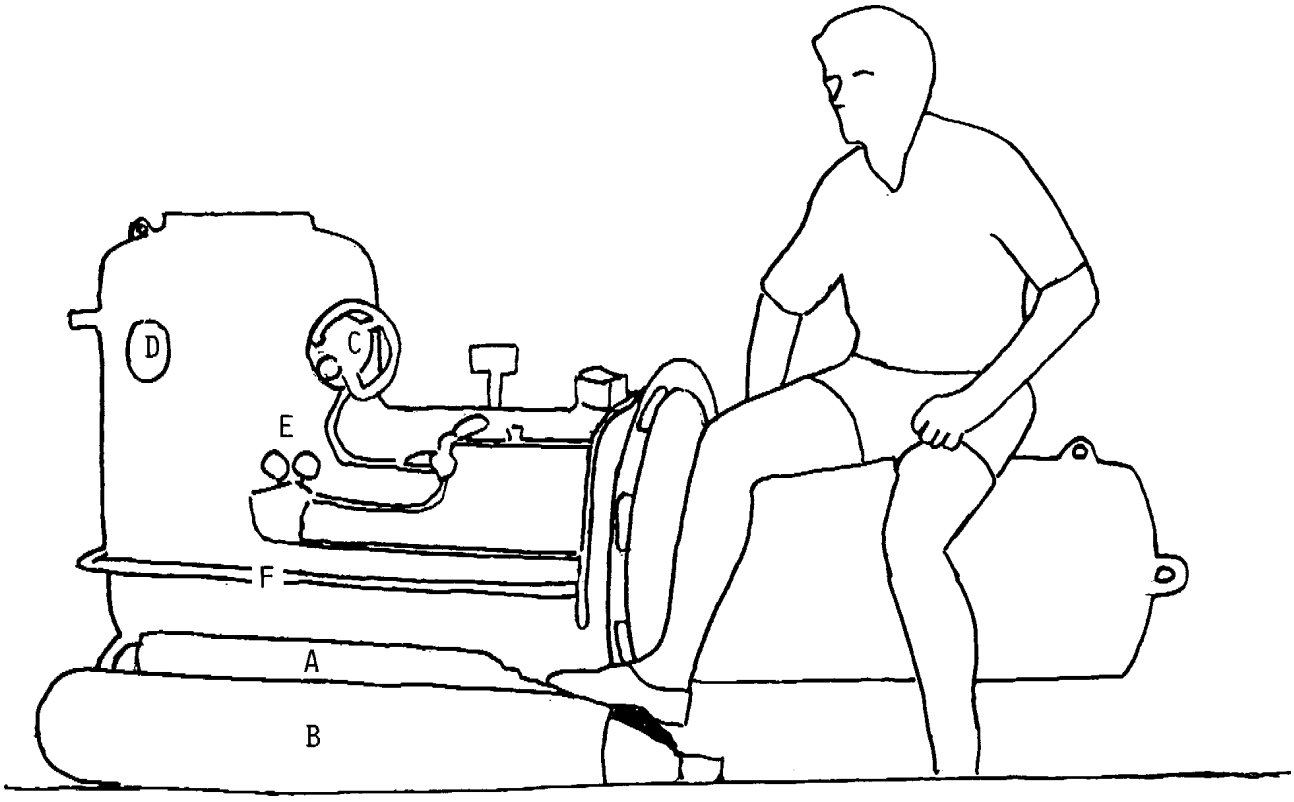

FIGURE 2

DRÄGER DUOCOM

The drawing gives an idea of the size of this portable chamber. The man is 1.8 m tall. A. Cylinder mounted on the chamber. B. E size spare cylinder. C. Medical Lock. D. Porthole. E. Gauges. F. Lifting rail.

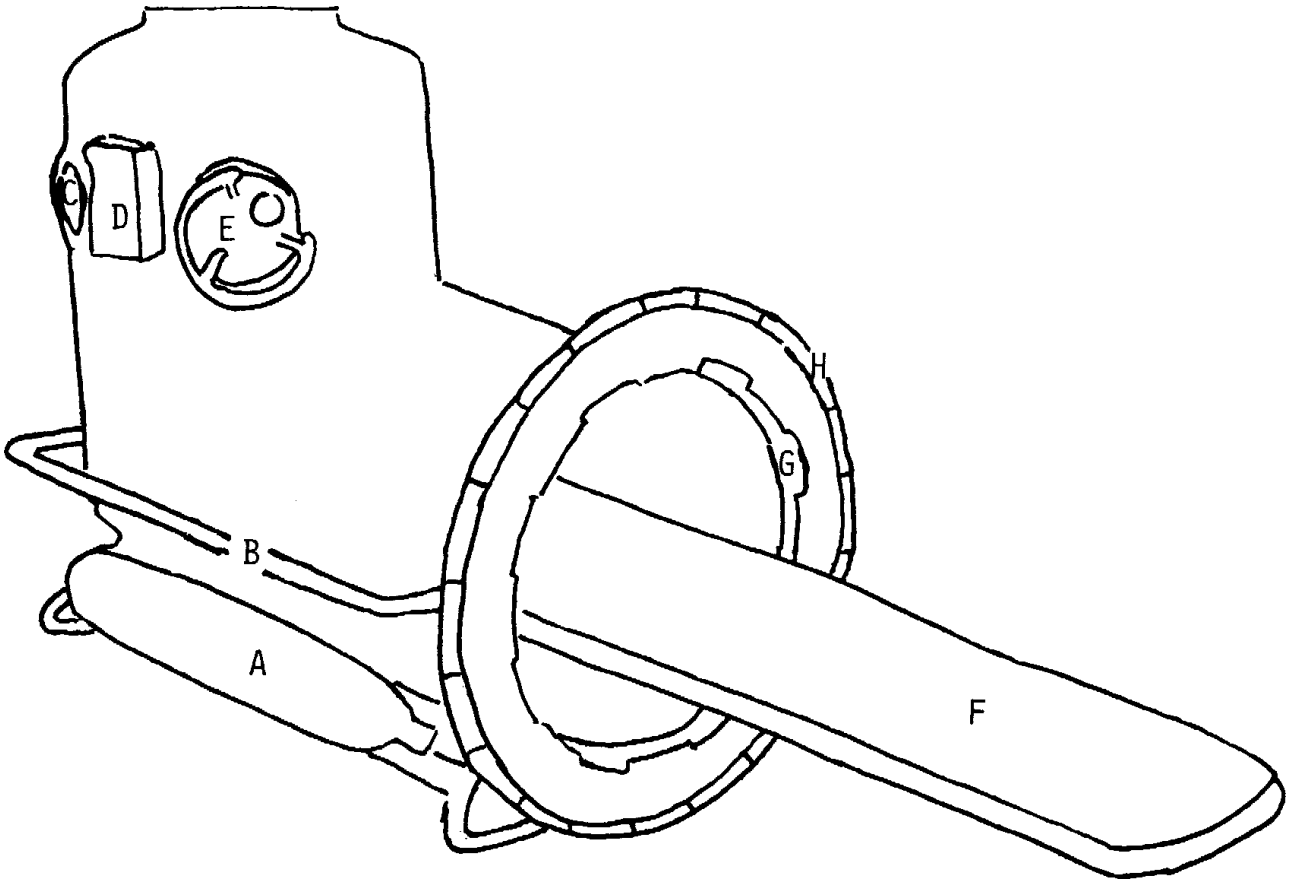

FIGURE 3

DRÄGER DUOCOM OPEN

A. Cylinder mounted on the chamber. B. Lifting rail. C. Porthole. D. Communications. E. Medical lock. F. Stretcher. G. Bayonet lock for the other half of the chamber. H. Bayonet lock for a larger chamber.

at the same time and at the same rate, without altering the pressure. Using air as the compressing gas saturation, if needed to treat refractory spinal problems, is possible (if a little smelly).

The hatch to the outer lock has been modified to accept the Dräger Duocom portable 2 man chamber. By partly rotating the Duocom the bayonet fitting engages forming an air tight seal allowing the victim to be transferred under pressure from the small to the large chamber.

The Duocom is a boot-shaped chamber (Figure 2). It comes apart at the "tarso-metatarsal joint" as it were (Figure 3). Once apart the attendant gets in and sits with his head and body up the "ankle" and his feet out straight. The patient, on a stretcher is slid in, on rails fixed above the attendant's legs, so that his head is in the attendant's lap. The "forefoot" is lifted over the end of the stretcher and rotated to lock. The chamber can then be pressurised. It is fitted with 2 BIBS for oxygen, although usually only the patient breathes oxygen. The Duocom has its own air and oxygen cylinders attached to it and larger cylinders can also be connected. The chamber can be manhandled into larger helicopters (such as the Bell 212) and light aircraft (such as the Beechcraft King Air) and flown to Morwell where the patient is transferred, still under pressure, to the large chamber.

This system of retrieval and transfer has been in use in Switzerland, using Duocoms and helicopters, for some years. I believe that it is also well suited to Australian conditions. The helicopters have a range of 400 km at 100 knots while the King Air has a range of 1920 km at 250 knots.

It is hoped to obtain an extra chamber to add to the hyperbaric complex at the Underwater Training Centre, also at Morwell and also run by the NSCA, so that the Duocom can be locked on to the deep (200m) chamber. This chamber was made by Comex and has Comex's small hatches, which will not accept the Duocom. When the extra chamber is added to the deep system the NSCA (Victorian Division) will have the only system, available to civilians in Australia, that enables the patient to be taken deeper than 50 m in stand-up comfort.

Since this paper was presented more patients have been treated in the NSCA chambers, including one who required saturation therapy. The extra chamber mentioned in the last paragraph has been added to the complex.