

# The world as it is

## The first Broome recompression chamber 1914–2004

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### Key words

History, pearl divers, hyperbaric facilities

### Abstract

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The history of the use of recompression chambers (RCCs) in Australia has not been well described. Probably the first records of the use of a RCC were over 88 years ago, when a pearl diver with spinal decompression sickness (DCS) was successfully treated in Broome, Western Australia. At that time Broome was supplying 75% of the world market of mother-of-pearl shell, used for the manufacture of buttons. After the introduction of compressed-air diving in the late 1800s, many divers suffered from 'diver's paralysis' (DCS). CE Heinke and Co, a British diving equipment manufacturer, in 1914 donated a RCC of their own design and patent to the pearling industry in an attempt to reduce the high death and injury rate that was occurring amongst the pearl divers. This paper presents the history of the first Broome RCC.

### Introduction

While there are many historical references to the use of recompression chambers around the world, there are few on the early history of recompression treatment in Australia. The earliest documentation I have found regarding the use of a recompression chamber (RCC) is for a pearl diver who was successfully treated for spinal decompression sickness (DCS) in February 1915 at Broome, Western Australia.<sup>1</sup> There are also several references to a RCC at Thursday Island, Queensland, around the same time, but I have not been able to verify this.<sup>2–5</sup> Two references state there had never been a RCC at Thursday Island.<sup>6,7</sup>

Pearl divers were essentially gatherers of mother-of-pearl (MOP) shell. The odds of finding a naturally occurring pearl in the shell has been estimated to be one in 1000.<sup>8</sup>

During the mid 1860s, when the North West of Australia was being explored to establish sheep and cattle properties, the local aborigines were noticed to be wearing large MOP shells as decoration. MOP shell was found to be plentiful and easily gathered at low tide along the beaches and an industry was born.<sup>4,5,9,10</sup>

By the 1880s, Australia was supplying 75 per cent of the world MOP shell harvest, and the then tiny town of Broome, North Western Australia, became known as the 'Pearl Capital of the World'. In 1889, the Eastern Extension and China Telegraph Company completed the laying of a transoceanic telegraph cable, coming ashore at what is now known as Cable Beach. This cable linked the isolated town directly with England, via Singapore, India, Aden, Egypt, Malta and Gibraltar, allowing Broome access to London market updates of the latest MOP shell prices in just a few hours.<sup>3,4,8</sup>

In 1912, the price of MOP shell was high, paying £264 per ton. In that year, 1,596 tons of MOP shell were exported from Western Australia, with a value £421,609.<sup>12</sup> This converts to over \$31 million in today's currency.<sup>13</sup> Up to 80% of MOP shells collected in Australia were used for manufacturing buttons mainly in Britain, Europe and, by the early 1900s, the USA.<sup>4,5,8,11</sup>

*Pinctada maxima* is unique to the regions of Northern Australia and is the largest MOP oyster in the world, growing to 15–20 cm span across the shell. It can be found from shallow waters exposed at low tide to a depth of 80 metres. The large size of the *Pinctada maxima* is attributed to the great tidal flows in this region, providing the filter-feeding oyster plentiful access to nutrients.<sup>4,5,8</sup> In Northern Australia, tidal variations have been recorded as great as 10 metres.<sup>8</sup> At Broome, the average tidal range is 7 metres, which results in the unusual sight of the sea being up to two kilometres from the high tide line twice a day.<sup>9</sup>

### Pearl luggers

The pearling lugger was a small ketch-rigged wooden boat commonly 16–17 metres in length, often built locally in Broome. Their flat-bottomed hulls allowed them to sit upright on the sand or mud flats during low tide. There were 300 to 400 pearling luggers registered in the North West of Western Australia between the years of 1910 and 1917.<sup>8,12,15</sup>

### Cyclones

North Western Australia has a tropical cyclone season, known locally as the 'wet' season. This runs from October to May although most of the storm activity occurs from December to March. Tropical cyclones (known as

'typhoons' in Asia and 'hurricanes' in the Atlantic and Eastern Pacific areas) can be destructive, especially on small sailing ships.<sup>16</sup> During one storm in March 1899, 307 people died.<sup>4</sup>

### The pearl divers

Local aborigines were used to gather MOP shells from the beaches at low tide and were also 'encouraged' to work as free divers. They were reported to be excellent free divers.<sup>3,5,10</sup> In 1868, compressed-air diving, using copper-domed helmets, canvas suits and lead-weighted boots, was introduced to the pearling industry of Western Australia.<sup>5</sup> Compressed air was supplied by a manual pump, usually operated by relays of two deckhands.

Up till that time compressed-air diving had been used mainly for engineering and salvage work over a fixed location. Initially, it was not a success in the pearling industry due to the large tides with current flows up to 12 knots.<sup>4,8</sup> Eventually, a successful system was devised in which the pearl lugger drifted with the tide, with the diver trudging along the seabed. The lugger would then sail back against the tide, turn and drift back down to cover an area that may be rich in shell.<sup>2,4,6-8</sup>

The aboriginal people were not proficient with the cumbersome, claustrophobic copper helmets and canvas suits. However, the people of Asia showed aptitude for this form of compressed-air diving. Japanese divers proved to be the best, and for many years dominated the diving side of the industry.<sup>4,5,8,9</sup> In 1912, a group of ex-Royal Navy divers was employed in an attempt to break the monopoly that the Japanese divers had in the pearling industry, in what came to be known as 'The White Divers Experiment'. This trial ended disastrously with many of the English divers dead or suffering spinal DCS. This sad saga is well described in several publications.<sup>4,5,8,11</sup>

### Empirical diving

*"In the old days Broome and T.I. (Thursday Island) were pitiful with the wrecks of fine men who had suffered the bends because the art of staging was not then thoroughly understood".<sup>2</sup>*

In 1905, the first scientific research into the effects of compressed air diving was conducted by John Scott Haldane, Arthur Boycott and Lieutenant Guybon Damant. The results were published as the Admiralty Diving Tables (staged decompression tables).<sup>4,8,11</sup> By then, the pearl divers had evolved their own empirical system of diving with compressed air, which was passed on from one diver to the next.<sup>4,5,8,9</sup>

This method of diving was kept a closely guarded secret and exact bottom times and ascent rates were not recorded. What is believed to have occurred is that after each drift

with the tide, lasting probably an hour, the diver would return on board and, with only the helmet removed, sit quietly having a cigarette. This respite would last for about 15 minutes or so as the lugger sailed back up against the tide. He would then repeat his underwater trawl for shell. Diving would continue from dawn to dusk for six days a week during the 'dry' season. There are several suggestions that some 'staging' occurred on the last dive of the day.<sup>2,4,8,9</sup> At the end of the day the diver would sit very still as his diving gear was removed. Only after an hour of minimal motion and no occurrence of pain or niggles would a diver then go to his cabin to eat and "*fall into his bunk exhausted*".<sup>2,4,5,7,8,14</sup>

The working depth was usually not more than 20 metres, that being the length of the umbilical from the hand-driven air pumps.<sup>5</sup> Deeper diving was being done as described in 1911 by Francis Rodriguez, pearl diver and owner of the Continental Hotel, Broome:<sup>17</sup>

*"I have personally been to 30 fathoms [55 metres] with four men on the pump and if I had two more, making six men on the pump, probably would have reached 40 fathoms [73 metres]".<sup>18</sup>*

The divers were sceptical about the Admiralty Tables, particularly the Japanese. They continued to use their own methods of decompression, and were said to be stoic about their chances of 'diver's paralysis'. The Japanese divers have been quoted as saying "If its not my time, its not".<sup>2-4,8</sup> Between 1900 and 1917, there were 145 deaths attributed to 'diver's paralysis'. Many more died from drowning (particularly during cyclones), shark and crocodile attack, umbilicals caught on coral, other diving equipment mishaps, beriberi and other ailments.<sup>2-5,8,15</sup>

Japanese cemeteries in Broome, Cossack, Darwin and Thursday Island have grave sites marked with sandstone tablets of the region. These cemeteries have been described as a "forest of headstones".<sup>2</sup> There are over 700 grave stones in Broome's Japanese Cemetery alone.

### Diving equipment

The two main manufacturers of diving equipment at that time were CE Heinke & Co and Siebe & Gorman Ltd. The founders of both companies were German immigrants who settled in England in the early 1800s, and initially the factories were less than a kilometre apart in Central London.<sup>19</sup> After more than 100 years of rivalry, Siebe & Gorman Ltd finally bought out CE Heinke & Co in the early 1960s. After the takeover, unfortunately, few records remain of Heinke & Co's achievements and activities,<sup>5,19</sup> which makes sourcing for information on this company challenging.

The importance of the pearling industry to these two companies is demonstrated by the visit of Mr Frederick Sprang, the then General Manager of CE Heinke & Co, to

the two main pearling centres of Australia (Thursday Island and Broome) in 1911.<sup>20</sup> James Davis, brother of Robert Davis the General Manager of Siebe & Gorman Ltd, was the Broome representative of this company in the early 1900s until he died in 1912 when the *Koombana* (the fortnightly steamer from Fremantle), was lost in a cyclone.<sup>11</sup>

In December 1913, Mr Sprang wrote a letter to Mr Arthur Male, Chairman of the Master Pearlmen Association, which was printed in the *Nor'West Echo*, Broome's bi-weekly newspaper, stating that CE Heinke & Co were planning to send a recompression chamber to Broome.<sup>21</sup> In May 1914, Mr Sprang sent further correspondence (again quoted in the *Nor'West Echo*):

*"I wish to bring to your notice a cylindrical chamber that I am having made under my own patent for the purpose of saving lives and alleviating the suffering of divers, who, by remaining too long under water, or by going too frequently, contract paralysis...from experiments and actual experience, one may say that recovery is assured. My desire is to send this first chamber out to Broome free, that it may be used for the relief of divers and at the same time serve to demonstrate its utility and value to pearlmen".*<sup>18</sup>

### Patent

Frederick Henry Sprang, Submarine Engineer, of 87 Grange Road, Bermondsey, London (the new CE Heinke & Co premises) applied for a British patent for a "re-compression apparatus" on 23 December 1913 and was accepted 10 December 1914 – patent number 29,625. (Figure 1).<sup>23</sup> A small recompression chamber (2.74 metres long and 66 cm internal diameter) was proposed. This could be used for recompression treatment as well as a back-up air reservoir for divers on luggers that had engine-driven compressors. A pulley system converted the chamber to an air reservoir by pulling a second, high-pressure door against the bolted, outer low-pressure door. It was designed to withstand a pressure of 250 psi (1723 kPa).<sup>22,23</sup>

There was a pressure gauge and "connections and valves for regulating the admission and exhaustion of air to and from the interior and thus controlling the pressure and ensuring ventilation when the chamber is occupied." On the outside door of the chamber, two small round "scuttle windows" 12.7 cm in diameter, were "strongly glazed to resist internal pressure". One window was for "casting a light upon the head of the occupant who is introduced into the chamber feet foremost". There was a handle for turning an "appliance to rub over the internal surface of both windows, so as to remove the moisture or mist which is liable to accumulate upon the glass". An air lock was bolted into the door "through which food, stimulants, etc, could be passed to the patient without affecting the air pressure inside". The air lock was a simple box-like structure measuring 18 cm by 28 cm the pressure in which could be equalised using a valve on the outside door (Figure 2).<sup>22,23</sup>

Mr Sprang's initial offer to send the chamber to the Broome hospital was declined, the reason cited being that the hospital did not have a local board of management.<sup>21</sup> The Master Pearlmen Association then stated they "...were prepared to take charge of the plant and to provide housing accommodation...The association has not been slow in taking action as was evidenced by their recent application to the local council for a portion of Bedford Park which was readily granted".<sup>22</sup>

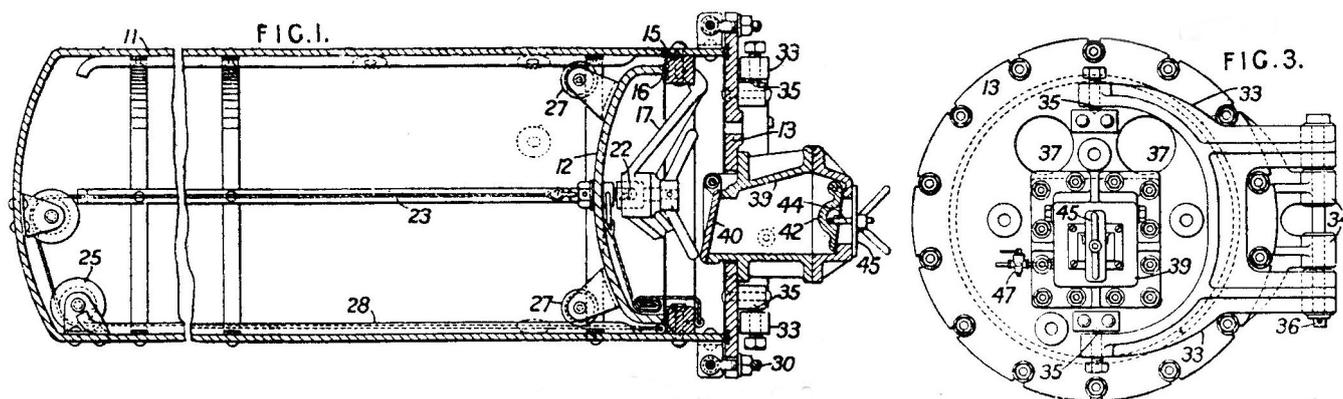
The chamber arrived in Broome in October 1914 and was set up in a corrugated iron building in Bedford Park (Figure 3). It was situated near the Continental Hotel, as this was the only place in town to have electricity at that time. The rest of the town was lit mainly with gas lights.<sup>24</sup>

Perhaps due to the 'wet' season, when little diving was conducted, the first diver was not treated until February 1915. This was enthusiastically reported in the *Nor'West Echo*, February 1915.

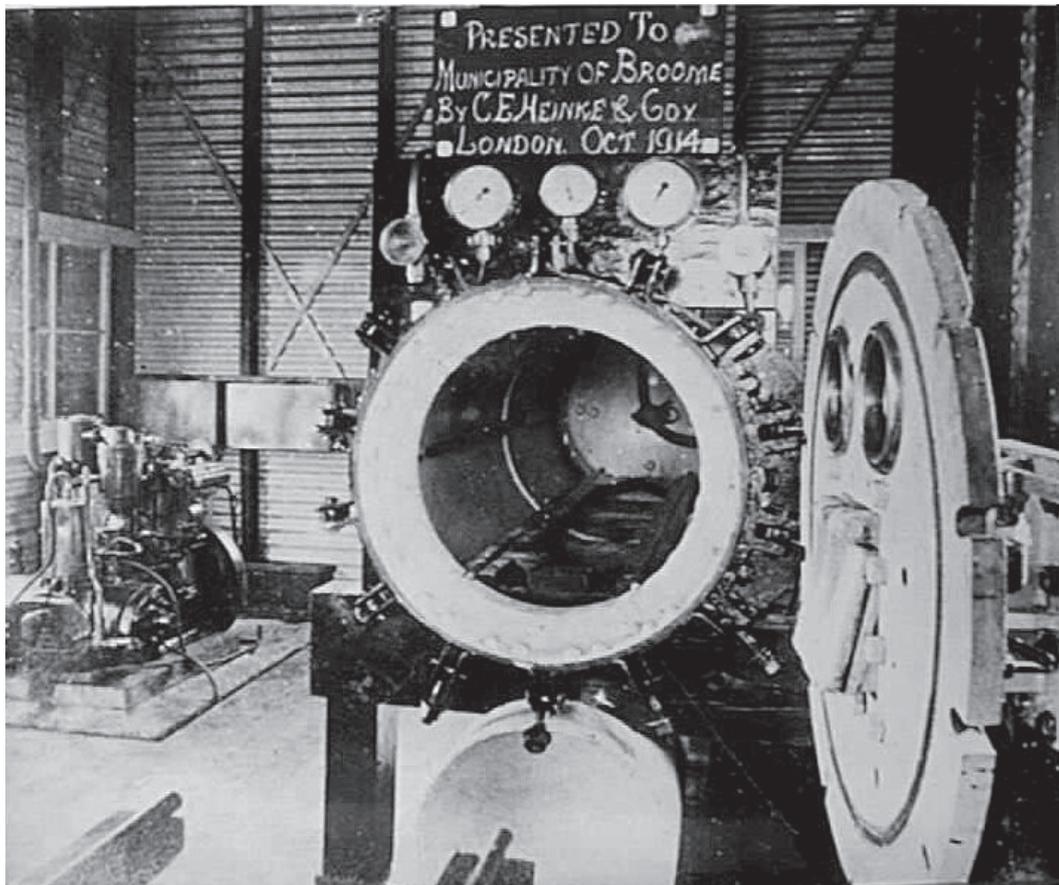
*"A Japanese diver was paralysed on 15<sup>th</sup> February in 20 fathoms [36 metres] of water and brought to Broome*

Figure 1.

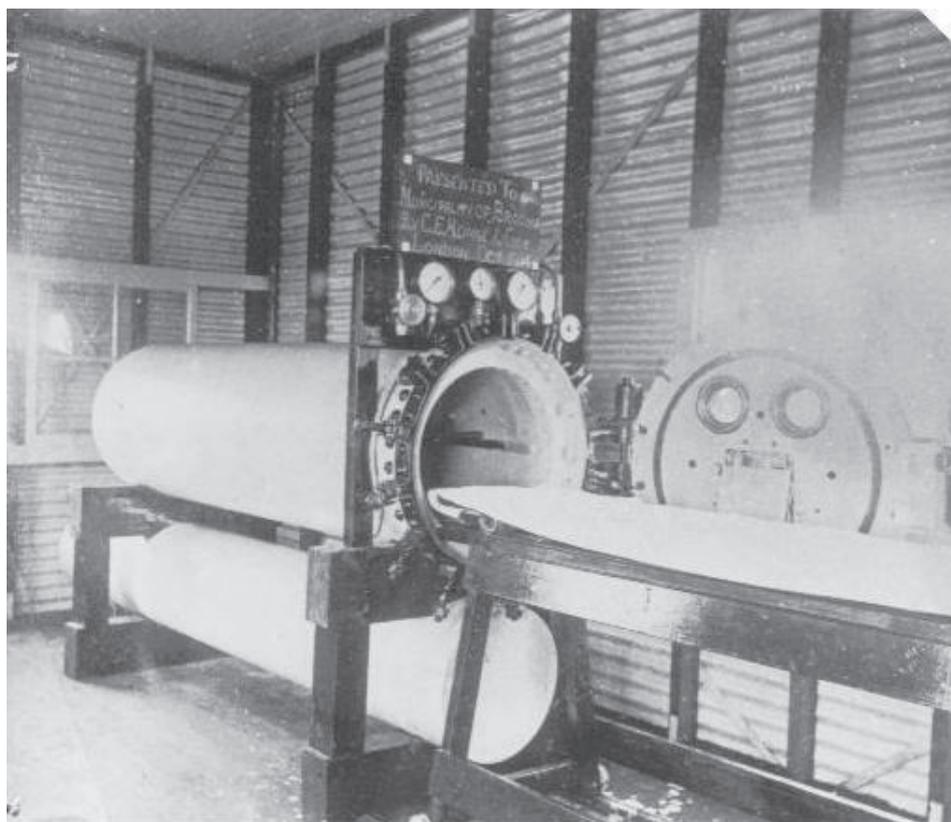
British Patent N° 29,625. Diving - apparatus. Sprang, F.H., 87, Grange Road, Bermondsey, London. (Classes 68 (ii), 81 (ii), and 123 (i).) Courtesy of Patents Information Unit, Leeds City Council, England



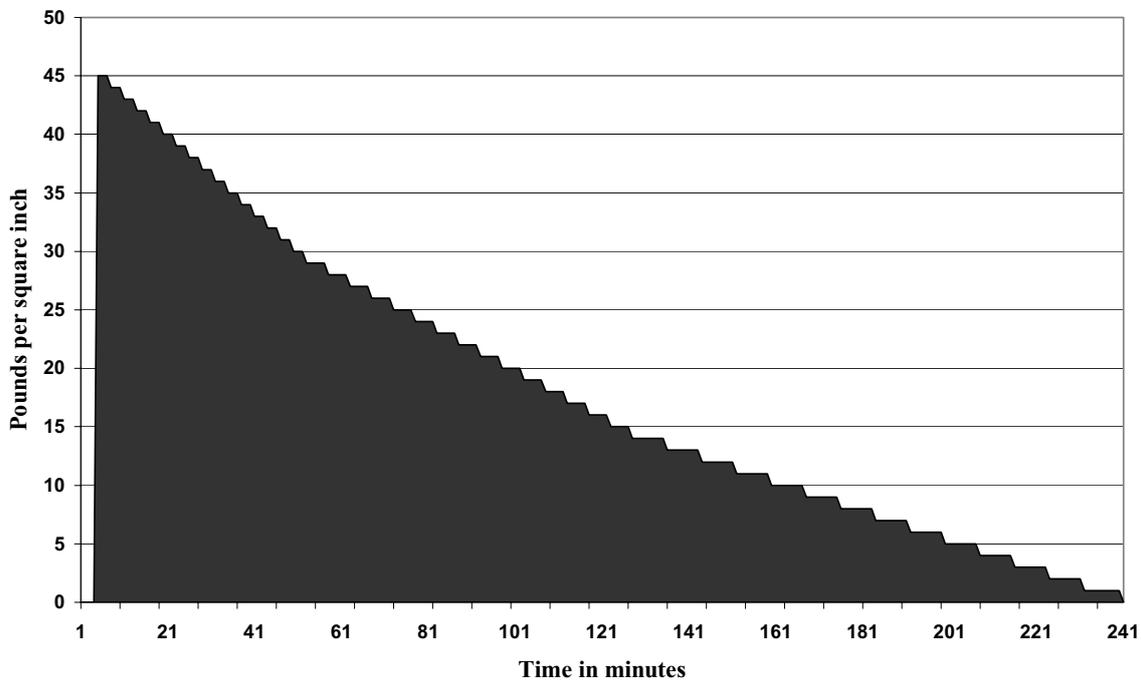
**Figure 2.**  
**Broome recompression chamber. Photo courtesy of Broome Historical Society**



**Figure 3.**  
**Broome recompression chamber. Photo courtesy of Broome Historical Society**



**Figure 4.**  
**Treatment table used for recompression chamber, Broome 1915**



**Figure 5.**  
**RCC in Bedford Park 1990 showing deterioration. The Continental Hotel can be seen in top right-hand corner.**  
**Photo courtesy of Dr Harry Oxe**



on the 19<sup>th</sup> and immediately taken to the chamber. Treatment commenced in the presence of Drs Smythe Yule and Y Harada, the Mayor, councillors, Major Wood, other representative townspeople and a number of divers. It is intended to attach a telephone to the chamber, so that conversation may be carried on with the patient while he is being treated. An electric light will also be installed to help treatment at night. Both doctors examined the patient, and declared him paralysed from the hips down, no feeling existing in any of those parts".<sup>1</sup>

### Treatment table

A treatment table was supplied with the RCC, designed by Mr Sprang and Lieut. G. Damant from the Royal Navy.<sup>1</sup> Mr Sprang was quoted as saying:

*"Doubtless you, long ago, read the report of the admiralty upon diving, and saw therein the prominent part that Lieut. Damant took in all test and trials, both underwater and in compression chambers."*<sup>22</sup>

*"Mr V. B. Knott [CE Heinke & Co engineer trained at their London Factory<sup>15</sup>] then took charge of the plant and diver, wheeled the patient into the chamber on a travelling stretcher designed by Mr Knott. The door being securely closed, air was turned on to 45 lbs per inch and staging proceeded with from that point to zero. Great care was taken as the effectiveness of the process depends upon the success of the experiment.*

*The staging was: 45 lbs to 30 lbs - 1lb every 3 minutes, 30lbs to 15lbs - 1lb every 5 minutes, 15lbs to zero - 1lb every 8 minutes, the total time for treatment was 240 minutes."*<sup>1</sup> (Figure 4)

*"...A large number of people were present to witness the release of the diver at 7.30. He came out smiling, and stated feeling had returned to the paralysed partes. He was able to stand upon his feet. Within two days he was able to walk without the aid of a stick and it is confidently anticipated he will be able to return to work early next week."*<sup>1</sup>

Most divers were treated with a single treatment but several with severe spinal DCS were treated twice with the same table but showed little improvement.<sup>10</sup>

Records reveal nine divers died in 1912. Around this time, the introduction of engine-driven air compressors allowed greater depths to be reached.<sup>4,5,8,9,11</sup> The death rate of divers increased to 29 in 1913 and 33 in 1914.<sup>11,12</sup> In 1915, 21 divers died and nine divers were treated in the RCC. In 1916, 19 divers died and nine divers were treated.<sup>11,12</sup>

### Pearling industry, 1914 to present

At the outbreak of World War One in 1914 there were about 300 pearl luggers based at Broome and the population was over 3,000. Within a few months, however, the fleet numbers had halved as men enlisted and the war in Europe severely

Figure 6.  
RCC and author, Broome Historical Society Museum, May 2003



curtailed the MOP market. After World War One, the price of MOP shell collapsed until the industry found new markets in America, where more than 50 per cent of all shell harvested went during the 1920s and 1930s. This recovery lasted until the 'Great Depression' of 1929. After the outbreak of World War Two only 73 luggers remained. Workers were once again scarce because of the heavy reliance on Japanese pearl divers, who were now interned in prisoner-of-war camps or had returned to Japan, and enlistment of most of the pearling industry's labour pool. By the early 1950s, the MOP shell industry made a recovery but, by then, the invention and marketing of the plastic button reduced demand for the MOP shell. As an industry, MOP shell harvesting was virtually abandoned.<sup>4,5,8,9</sup> Now, however, the town of Broome is once again thriving, this time with tourism and the cultured pearl industry.<sup>8</sup>

### The RCC's final years

Records of how long the chamber was used have been difficult to source. The chamber and its corrugated shed were moved to Broome District Hospital in 1925.<sup>25</sup> There is a reference to the chamber being used in 1954.<sup>2</sup> In the early 1970s, a local man interested in Broome's pearl diving history was told of the chamber. After a long search he found it dumped at the Broome rubbish tip.<sup>8</sup> The chamber was rescued and put on display in Bedford Park, along with other relics of Broome's history (Figure 5). It was located in close proximity to where it was originally used nearly 60 years before. Nearby, an engine also on display bears the inscription "This motor operated the decompression chamber donated by Heinke & Co of London, used in the treatment of divers' paralysis".

By 1990, the chamber was showing significant signs of deterioration, and the Broome Historical Society requested the Maritime Museum in Fremantle undertake restoration work. In December 1991 the renovated chamber was returned to be displayed at the Broome Historical Society Museum along with other memorabilia of Broome's remarkable history (Figure 6).<sup>12</sup>

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