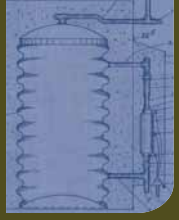
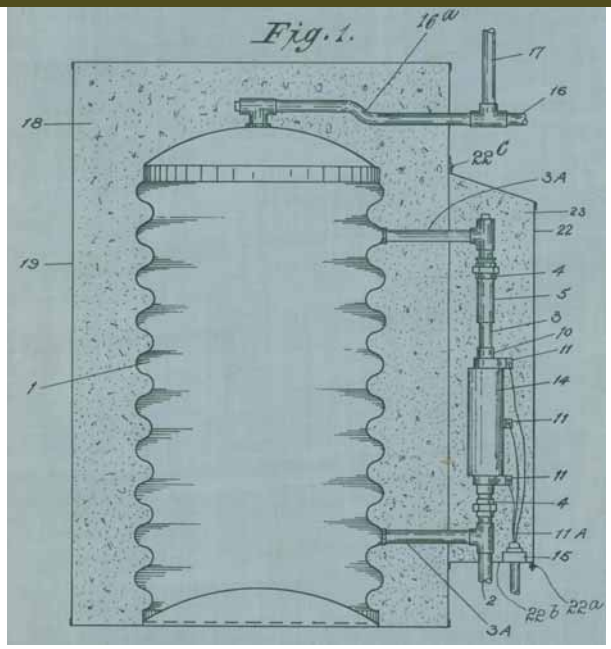


by Nigel Isaacs, BRANZ Principal Scientist

Hot water plugs into the mains

Today we expect to have ready supplies of hot water but this has only been available in most New Zealand homes for less than 100 years.



Patent drawing of Lloyd Mandeno's 1923 improved electrical water heater. From Archives New Zealand/Te Rua Mahara o te Kāwanatanga Wellington Office (Archives reference: ABPJ 7396 W3835 Box 258 P51131).

Continuous hot water needs continuous cold water and an energy supply. Although the main New Zealand cities had piped water from the 1860s, it was not until the early 1900s that it reached the suburbs, relieving the drudgery of fetching water from a nearby well or stream. Until then, heating water followed the traditions of thousands of years – it was batch-produced by solid-fuel heating of a pot on the fire, a 'copper', a stove attachment or a stand-alone chip-heater. Even today, 'wet-backs' (a unique New Zealand term for a water heater based on a nearby fire or stove, and a derogatory term for an illegal immigrant in the southern US) are in 15% of homes supplying about 5% of our hot water.

By the late 1870s most large, and many small, towns had manufactured or 'town' gas. The 'geyser' could fume away above the bath or sink if both town gas and running water were available. Even then its use does not appear to have been widespread. Apart from the smell of burnt gas, there was always the possible excitement of an explosion if the gas initially failed to light.

Although Reefton had the Southern Hemisphere's first public supply of electricity in 1886, it was not until the 1910s that electricity was widely available throughout the country.

Stored hot water

Electric hot-water heating dates back to 1915, when Lloyd Mandeno (then the Tauranga Borough engineer, but later a major force in New Zealand electricity development) developed the world's first storage hot-water heater for use in the world's first all-electric house.

He made the hot-water container of heavy-gauge corrugated galvanised iron and fitted two elements (350 W and 500 W). This sat in a larger container, around which he packed a 6-inch-thick (15 cm) layer of screened pumice for insulation, before placing it under the roof above the ceiling, with short drops of concealed pipe leading to the sink and the bathroom.

The fatal flaw in the cylinder design only became obvious after a couple of years – the galvanised iron corroded through. The solution, a copper cylinder, remains the basis for the low-pressure electric hot-water cylinder still used in most New Zealand homes.

On 25 October 1923 Mandeno patented the first electric hot-water cylinder, as illustrated in the patent document shown above. It had some interesting points:

- there was no separate thermostat, the heated water lifted a small disk inside pipe 5, letting hot water into the storage tank to be replaced by cold water from lower in the tank
- the external element in its case (14) could be automatically descaled by a chain or disk attached to the release disk, and presumably replaced without removing the cylinder from the system (the heating wires were insulated by asbestos and mica – both naturally occurring electrical insulants)
- pumice or other appropriate material insulated the tank (18)
- the corrugated tank and bottom dome (1) were stronger than flat material.

Patents earlier than 1910 show neither tank insulation nor tank corrugations.

Electric water heating takes over

The impact of the electric hot-water cylinder was major. A mere 23 years after the patent, 32% of the nation's total electric power use was going into hot water (today only 8%).

Cylinder volumes and heating elements remained small for many years. The 1940s recommendation of a 30 gallon (135 litre) cylinder with a 1 kW element may have been satisfactory for daily baths, but fails to meet the shower needs of modern households. In the 2005 BRANZ HEEP sample, 94% of households used showers as the main method of bathing, up from 41% of households in 1971/72. This places very different demands on the hot-water system.

Still, Mandeno's legacy remains. The 2001 Census reported 77% of New Zealand homes still have an electric hot-water cylinder, the highest proportion in the developed world.