Leclanche dry cell diagram

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LeclanchéGeorges Leclanché1866?,,??

The Leclanch? cell is a battery invented and patented by the French scientist Georges Leclanch? in 1866.[1][2][3] The battery contained a conducting solution (electrolyte) of ammonium chloride, a cathode (positive terminal) of carbon, a depolarizer of manganese dioxide (oxidizer), and an anode (negative terminal) of zinc (reductant).[4][5] The chemistry of this cell was later successfully adapted to manufacture a dry cell.

In 1866, Georges Leclanch? invented a battery that consisted of a zinc anode and a manganese dioxide cathode wrapped in a porous material, dipped in a jar of ammonium chloride solution. The manganese dioxide cathode had a little carbon mixed into it as well, which improved conductivity and absorption.[6] It provided a voltage of 1.4 volts.[7] This cell achieved very quick success in telegraphy, signalling and electric bell work.

The dry cell form was used to power early telephones--usually from an adjacent wooden box affixed to the wall--before telephones could draw power from the telephone line itself. The Leclanch? cell could not provide a sustained current for very long; in lengthy conversations, the battery would run down, rendering the conversation inaudible.[8] This is because certain chemical reactions in the cell increase its internal resistance and, thus, lower its voltage. These reactions reverse themselves when the battery is left idle, making it good for many short periods of use with idle time between them, but not long periods of use.[9]

The original form of the cell used a porous pot. This gave it a relatively high internal resistance, and various modifications were made to reduce the resistance. These included the "Agglomerate block cell" and the "Sack cell". Leclanch? first, and Carl Gassner later, both strived to transform the original wet cell into a more portable and more efficient dry cell.

The redox reaction in a Leclanch? cell involves the two following half-reactions:

As the current travels around the circuit, when the electrons enter the cathode (carbon rod), they combine with manganese dioxide (MnO2) and water (H2O), which react with each other to produce manganese oxide (Mn2O3) and negatively charged hydroxide ions. This is accompanied by a secondary acid-base reaction in which the hydroxide ions (OH-) accept a proton (H+) from the ammonium ions present in the ammonium chloride electrolyte to produce molecules of ammonia and water.[10]

or if one also considers the hydration of the Mn2O3(s) sesquioxide into Mn(III) oxy-hydroxide:

Alternately, the reduction reaction of Mn(IV) can proceed further, forming Mn(II) hydroxide.

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The electromotive force (e.m.f.) produced by a Leclanche cell is 1.4 volts, with a resistance of several ohms where a porous pot is used.[7] It saw extensive usage in telegraphy, signaling, electric bells and similar applications where intermittent current was required and it was desirable that a battery should require little maintenance.

The Leclanch? battery wet cell was the forerunner of the modern zinc-carbon battery (a dry cell). The addition of zinc chloride to the electrolyte paste raises the e.m.f. to 1.5 volts. Later developments dispensed with the ammonium chloride completely, giving a cell that can endure more sustained discharge without its internal resistance rising as quickly (the zinc chloride cell).

A Leclanche cell is a battery invented by Georges Lechlanche, which contains an electrolytic solution, a cathode and an anode. The evolved version of this cell is known as the dry cell. It was an immediate commercial success due to its low cost of production and availability.