The Early History of Arrester Disconnectors

By Jonathan Woodworth

The Sentinel

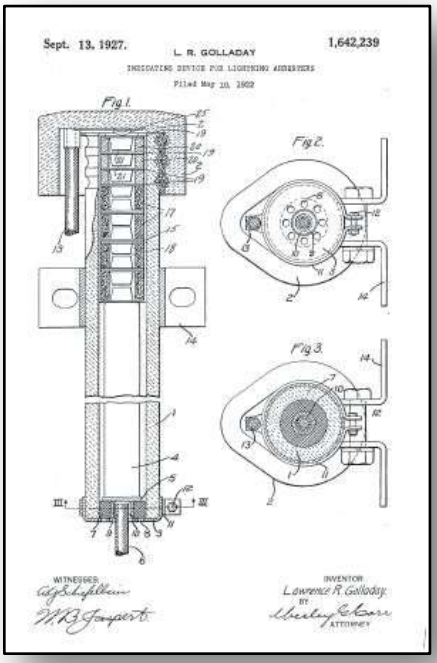
In modern day arresters the Ground Lead Disconnector is routinely misunderstood and its value to power system reliability is vastly underestimated.

At some point in time, all electrical equipment has an end-of-life-event (EOLE). Sometimes the event is as benign as being removed and replaced with a newer device, but sometimes it is with a thunderous and potentially destructive power fault event. For distribution surge arresters, this thunderous EOLE can lead to either a short or long term system outage. It is during this event that the arrester disconnector becomes a major player in system reliability.

During an EOLE the arrester disconnector that has remained dormant in a sense for the entire life of the arrester is called upon to operate one and only one time to protect the power system from a potentially long term outage. This remarkable sentinel of the power system stands guard over the arrester for its entire life, and in the end, it has the last word. It senses the fault, and immediately it activates and separates the arrester ground lead from the arrester and successfully avoids the undesirable sustained outage.

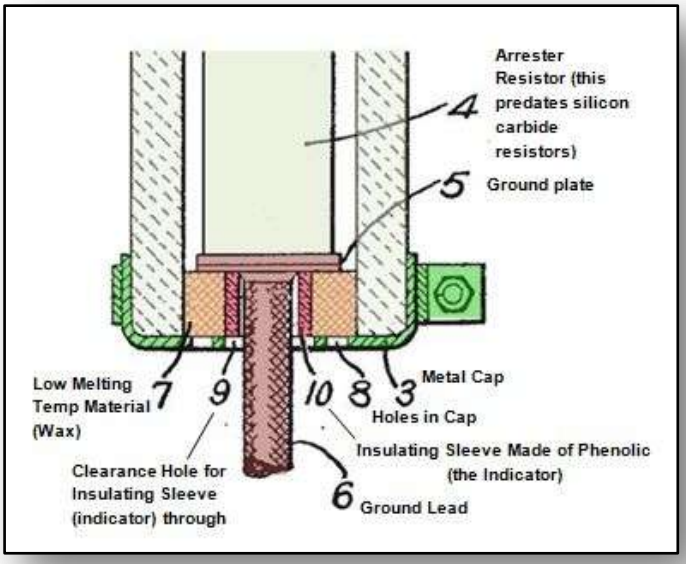
A Precursor: The Arrester Indicator

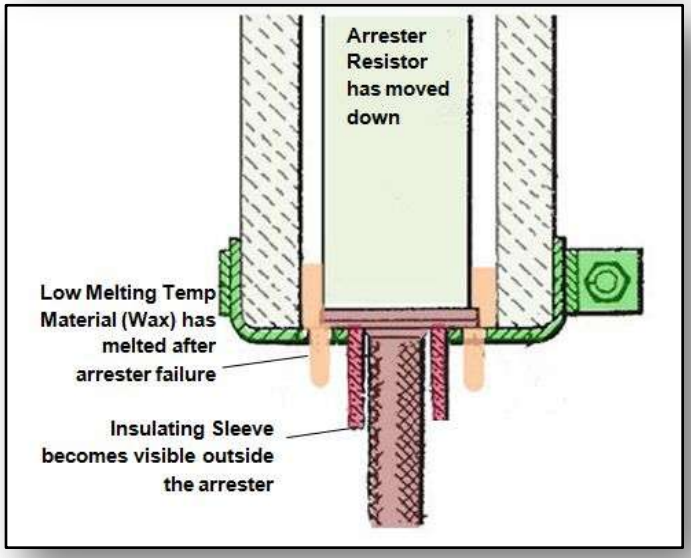
The arrester indicator was a precursor to the modern day disconnector. On May 10th, 1922 Lawrence Rice Golladay filed for a patent for an arrester indicator. Note it was not called an interrupter or disconnector because it was not meant to be either. At this juncture of the distribution arrester life line their goal was to find the failed arrester. Obviously the inability to visually determine if an arrester had failed or not when installed was an issue.



First Failed Arrester Indicator Patent (Filed 1922)

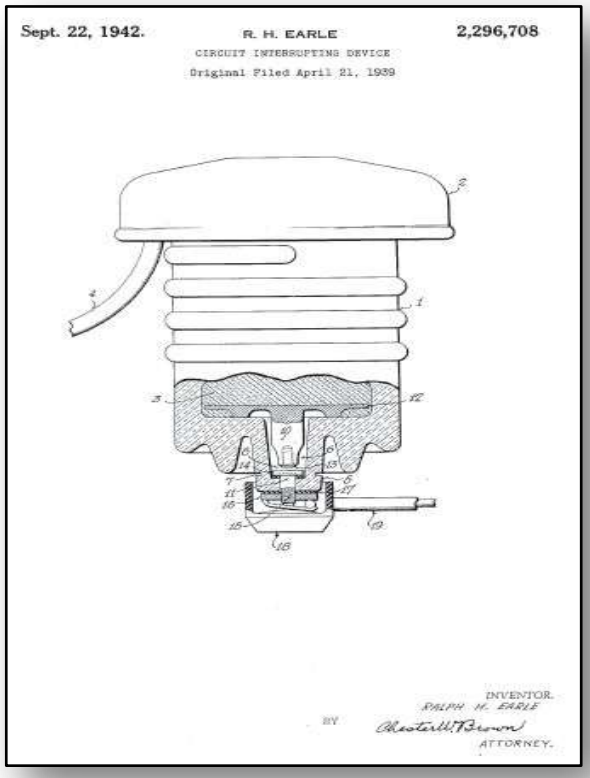
In patent 1,642,239 Golladay introduced the concept of using the arrester resistor to melt a low temperature material allowing an insulating sleeve to protrude out of the bottom of the arrester.





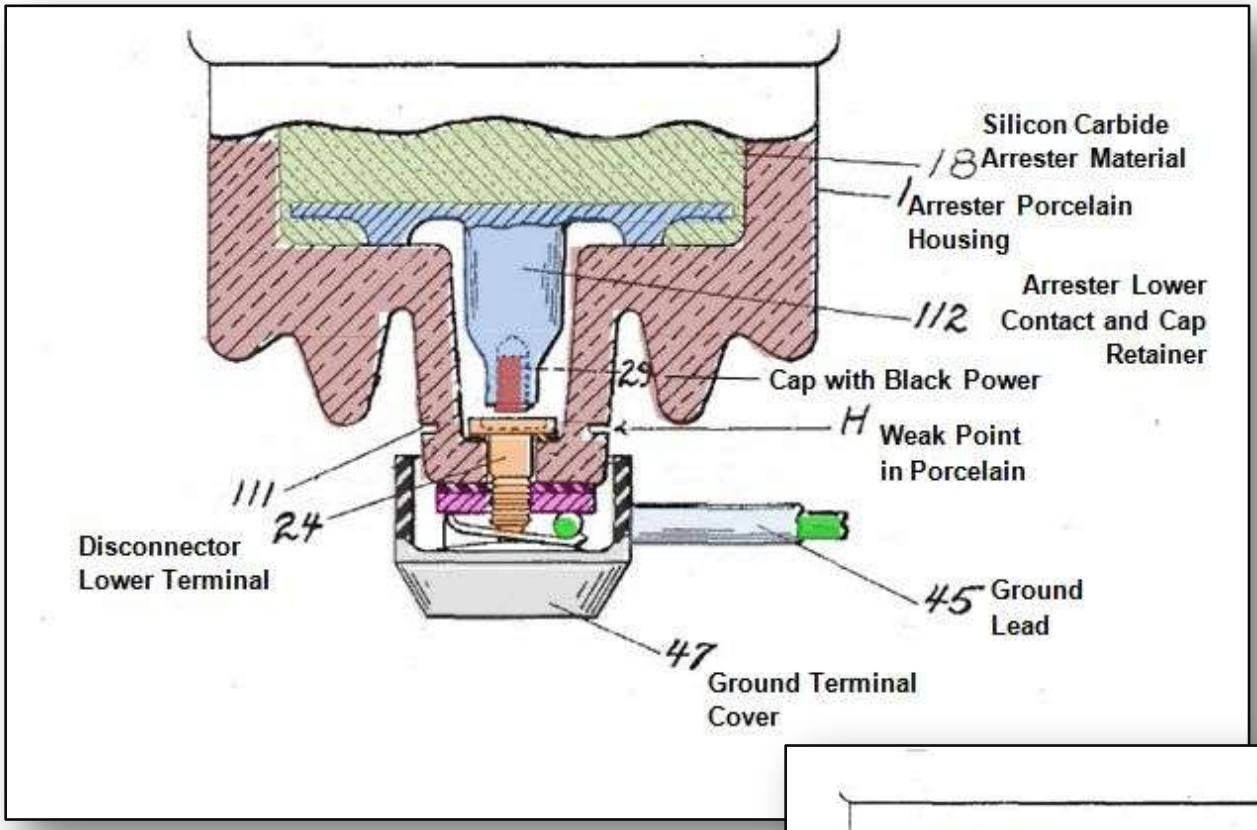
The Arrester Disconnector

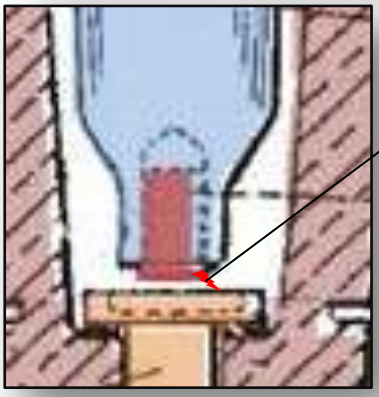
The concept of the arrester ground lead disconnector as we know it today can be traced back to April 22, 1939 when Ralph H Earle applied for a patent. Ralph was at that time a fuse and arrester design engineer for the Line Material Company in Milwaukee Wisconsin. Having expertise in both fuses and arresters was an obvious advantage. His concept was patented in 1942. The concept of using an explosive charge to separate the ground lead is still


Sept. 22, 1942. R. H. EARLE 2,296,708
CIRCUIT INTERRUPTING DEVICE
Original Filed April 21, 1939
INVENTOR.
RALPH H. EARLE
BY
ATTORNEY.

First Failed Arrester Disconnector Patent (Filed 1939)

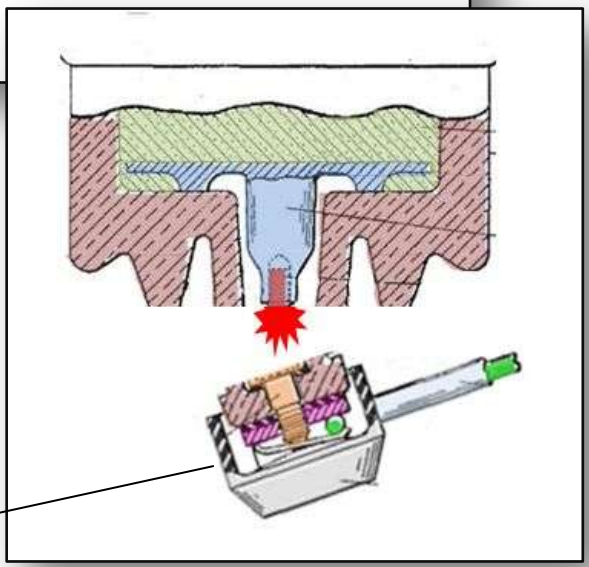
in use today, 70 year after it was first introduced. This is a testament to the quality and uniqueness of this concept for it to have survived this long.





Theory of Operation

When an arrester fails, a high energy arc is created between Cap (29) and bottom terminal (24). The heat from the arc ignites the cap which leads to fracture of the porcelain at the weak point. The blast moves the ground lead away from the arrester.



The title of this 1939 patent was Automatic Current-Interrupting Device. In 1939 the available fault currents on distribution systems was not more than a few thousand amps. This is the reason this device could interrupt fault current then and not today. Even today, the common models of ground lead disconnectors that use an explosive material to separate the ground lead can interrupt currents below a few thousand amps, but not system currents of 4000 amps or more.

By 2009, the ground lead disconnectors no longer include porcelain, and most of them have gap bypass resistors to accommodate arrester leakage currents. The bypass resistors were not needed in 1939 since no arresters had internal leakage current at that time.

The Engineers behind the Devices

Lawrence Rice Golladay only remained in the arrester business for a few more years. He was part of one of the largest and most patented arrester teams ever assembled at Westinghouse. In late 1930, he left Westinghouse and started with the Union Switch and Signal Co. He worked there until at least 1957 in the year of his last patent application. While there he patented An FM transmitter and a Train Detecting Device. He was a prolific inventor with his first application in 1922 and his last in 1957 covering a span of 35 years.

Ralph Earle had started his career at Allis Chalmers working on transformers where he was granted his first patent in 1926. About the same time that Golladay was leaving Westinghouse, Earle moved to the Line Material Company. He remained an active inventor for Line Material until 1959 for a span of 31 years.

So there it is, the early years of arrester disconnectors. Hope you enjoyed reading it as much as I did researching and writing it.

Jonathan Woodworth Jan 17, 2009