SIEMENS

Technical Article

Industry Sector
Building Technologies Division

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The 100th anniversary: Siemens was among the first to provide innovative fire safety solutions

First innovative extinguishing systems from Siemens in 1910

As far back as a hundred years ago, Siemens installed one of the first automated CO_2-based extinguishing systems. The fundamental concept behind fixed extinguishing systems remains applicable even today: fire detection and extinguishing technologies are interlinked. These technologies have been continually under development, with Siemens continuing to taking a leading market position.

Back in 1910, Siemens & Halske AG first introduced an extinguishing system that was far ahead of its time. This set a standard valid even today: the use of carbon dioxide (CO_2) as an extinguishing agent instead of water, in combination with reliable fire detection technology. Carbon dioxide extinguishes fires effectively using oxygen displacement (inerting), leaves no residues and has poor electric conductive properties. For this reason, CO_2 does not cause any damage to machines and systems.

Collaboration with the company FEG Salzkotten formed a cornerstone in the development of this system. Since 1897, FEG (“Fabrik explosionssicherer Gefäße”) had been involved in the manufacture of petroleum canisters and expanded its line of business to tank farms for flammable liquids in short time. FEG held a number of important patents in the area of explosion protection and fire extinguishing technologies, including patent 223.863 filed in 1907 for a “device to produce gases that extinguish fires, especially in shipping spaces”. Such a system eventually came to form the subject of the collaboration with Siemens.

Based on a collaboration agreement dated July 1, 1910, FEG supplied CO_2-based extinguishing equipment, while Siemens was responsible for the customized design of systems, electrical components and sales. Siemens brought these systems to market in the very same year.

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Bimetal effect activates detectors

The overall system included several fire detectors, the extinguishing equipment, and various display and control devices as needed. Each fire detector contained two contacting metal strips made of different materials. Upon achievement of a temperature that was configurable between 40 °C and 90 °C, one of the metal strips bends (bimetal effect), causing the contact to open. This interrupts the flow of current thereby activating the detector. A second control element ensures that a special alarm sounds in the event of a line break or power failure without the extinguishing system being activated.

Alternatively, differential detectors can be used as fire detectors which are activated only if there is a rapid rise in temperature. These are used primarily in spaces with strong temperature fluctuations (during the year), since they operate independent of ambient temperature. In case of fire, the detector sends a signal to the control panel, which activates various circuit breakers. As a result, the extinguishing system is activated and the fire alarm also sounds. An automatic notification can also be routed to the fire department.

A special feature of the extinguishing system developed by Siemens partner FEG was that CO_2 was not stored in a finished state but produced only in the event of alarm. A container made of galvanized steel and filled a third with potash solution (potassium carbonate) was used for this purpose. The upper portion of the container contained a rotating wrought-iron drum filled with sulfuric acid held vertical in the position of rest with the help of a magnetic locking device. In case of alarm, the inner container tipped over causing both liquids to mix. Depending on the filling quantity, the chemical reaction produced 5,000 to 15,000 liters of CO_2 within 45-60 seconds which was conducted to the area to be extinguished by force of the excess pressure generated.

Numerous control and alarm options

Several other features were added. For example, pushbuttons were added to enable electrical activation manually. In addition, the system could be configured so that no extinguishing gas was produced if there was a person in the area. This was achieved through the use of a door contact that cut off the activating magnets if anyone entered the area. Other features included the pre-alarm, mechanical activation using a hand wire pull and an automatically controlled door, window or flap closer.

These extinguishing systems were successfully tested in a number of instances: at the *Königliches Materialprüfungsamt* (Royal Materials Testing Office) in Berlin, in the Hanover and Kiel Fire Directorates, as well as on a navy ship. An archived account reports “outstanding results […], since an extraordinarily rapid extinguishing process sets in for both smoldering as well as open fires.”

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Between 1912 and 1920, some companies planned and/or implemented projects using this system. For example, Scheller & Cie at Dietikon in the Zurich region installed a system in 1912 presumably to protect a gasoline depot having a capacity of 250,000 liters from fire.
Another project was implemented in 1918 by Gutehoffungshütte AG at Oberhausen-Sterkade, one of the largest machine construction companies at the time in Germany.
An extinguishing system with six flooding zones with automated selector valves was installed in six transformer cells, with the system designed such that only cells affected by fire and their two adjacent cells were flooded with CO_2 when needed. Starting1914, three other projects were planned on behalf of the *Oberdirektion für Wasser- und Straßenbau (*Chief Department for Water and Road Works), Karlsruhe. The switching stations in the Forbach (Murgwerk), Karlsruhe and Rheinau power plants were to be equipped with automated extinguishing systems. It is noteworthy that the Chief Department opted for this innovative solution even at that time. However, war-induced budget cuts precluded implementation.
The automated CO_2-based extinguishing system was unable to make further inroads at the time despite its up-to-date technologies. Fixed extinguishing systems were just as uncommon as extinguishing processes using inert gases such as CO_2, and were received with caution. For this reason, other extinguishing methods for local fire protection continued to remain dominant at the time.

Siemens with innovative extinguishing systems

Seen from today's vantage point, it is much easier to appreciate how path-breaking the automated CO_2-based systems of that time were. Present-day Sinorix extinguishing systems work with natural or chemical extinguishing agents, as gas/water-combined or water mist systems. Insofar as inert gases are concerned, a choice was made to go with nitrogen (N_2) and argon (Ar) or carbon dioxide (CO_2). As was the case earlier, extinguishing is effected by reducing the oxygen content in the air. Thus Siemens opted a hundred years ago for an extinguishing process that meets the standards for fire safety technology still today – for example when protecting data centers, telecommunications systems or technical and machine rooms against fire.
The move to fixed extinguishing systems was visionary at the time and has proved to be the correct approach over the years, especially since manual fire extinguishers are unable to fully meet the demanding requirements for fire protection. Therefore, the detection of fire using intelligent fire detectors is usual for automated extinguishing systems. This practice does not restrict itself to the local production of CO_2 today. Instead, easy-to-use extinguishing agent cylinders are installed.
Today, Siemens offers intelligent Sinorix extinguishing solutions for a variety of applications and risks of fire. In all cases, fires are detected early and extinguished fast and reliably. Siemens provides support right from risk assessment system design, commissioning to maintenance. Two

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extinguishing systems, namely Sinorix CDT and Sinorix H_2O Gas, make it amply clear that Siemens continues to be the innovative forerunner in this sector even today.
Sinorix CDT (Constant Discharge Technology) enables efficient extinguishing without pressure peaks. Through the patented and VdS (VdS Schadenverhütung GmbH – damage prevention – is part of the Association of German Insurers) approved valve technology, nitrogen is introduced into the flooding zone at constant pressure during flooding. This allows the piping network to be dimensioned smaller than it is the case for standard extinguishing systems and overpressure flaps can be reduced by up to 70%. Sinorix CDT is therefore particularly well suited for interior rooms where large overpressure flaps are very difficult to realize due to structural circumstances. Sinorix CDT is currently the only VdS-approved system with constant gas discharge. Another innovative solution is Sinorix H_2O Gas. The combination of nitrogen and water offers decisive advantages. While nitrogen reduces the oxygen concentration, the water mist reduces the temperature – the fire is reliably extinguished with re-ignition effectively prevented. Sinorix H_2O Gas is therefore particularly well suited for smoldering and deep-seated fires that can break out in closed facilities. Typical application areas are archives, libraries or turbines. Sinorix H_2O Gas is the first and currently only VdS approved gas/water-combined extinguishing system for room protection.
At the Security Trade Fair 2008 in Essen, a jury of experts, consisting of safety experts from industry as well as public authorities and representatives of the trade press awarded the “Security Innovation Award 2008” in the “Fire Protection” category to the Sinorix H_2O Gas solution

BOX

Siemens & Halske installs the first fire detector network in 1851

For artillery lieutenant Werner Siemens and mechanic Johann Georg Halske, advanced technologies for fire protection were already a prime focus of their company Telegraphenbauanstalt Siemens & Halske which they co-founded in Berlin in 1847. The company installed the first fire protection system in the world in the German capital back in 1851. Triggerable spring motors with daisy printwheels were used to transmit Morse thus linking 37 firehouses to the central system.
Automated extinguishing systems were unknown at the time. It was first in 1874 that US American Henry S. Parmalee invented the sprinkler, but this was not initially implemented in practice. At the time, fire protection employed the classic fire engine approach used by fire brigades. It was only in 1906 that the Association of Private Fire Insurance Companies in Germany enacted regulations for the construction of sprinkler systems. Up until that time, water and in scattered cases CO_2 were almost exclusively used as extinguishing agents.

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CAPTIONS

100_Ext_1.jpg

At the Fire Brigade Exposition in Berlin in 1901, Siemens & Halske introduced an electrically driven fire engine.

100_Ext_2.jpg

Fire insurance companies soon recognized the enormous value of fire detectors. Starting 1913, insurance premium discounts were offered for the use of fire detectors.

100_Ext_3.jpg

The maximum temperature detector based on the bi-metal principle was activated when a specific temperature was reached.

100_Ext_4.jpg

Extinguisher equipment from 1910 for the production of CO2: Housing (4) Frame (6) Pipe (8) Lid (10) Acid tank, (38) Release device.

100_Ext_5.jpg

The newssheet from Siemens & Halske announcing and describing the CO2-based extinguishing system in 1910.

100_Ext_6.jpg

A diagram of the complete fire safety system installation.

100_Ext_7.jpg

Sinorix H2O Gas is particularly well suited to smoldering and deep-seated fires in closed facilities. It is the first and currently only VdS approved combination gas/water extinguishing system for the protection of rooms.

100_Ext_8.jpg

Extinguishing agents are no longer produced on-site today. Instead, easy-to-use containers of extinguishing agents are installed.

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Industry Automation, Industry Solutions, Mobility und Osram. With around 207,000 employees worldwide (September 30), Siemens Industry achieved in fiscal year 2009 total sales of approximately €35 billion. www.siemens.com/industry

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