



# ONE HUNDRED YEARS OF DRY FIRE EXTINGUISHER EQUIPMENT

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## Abstract

In the early 19<sup>th</sup> century, the level of Hungarian industry lagged behind that of developed states. As a result of rapid development, by the end of the 19<sup>th</sup> century and the first decades of the 20<sup>th</sup> century, the domestic technical and natural sciences showcased significant successes through the outstanding activities of the defining industrialists and engineers of the era.

The rapid urbanization posed new challenges in the operation of large cities, ensuring security, and fire protection. Responses to these challenges could only be provided by professionals who were excellently prepared with both technical and firefighting knowledge, such as Kornél Szilvay, who dedicated his entire life to improving the efficiency of firefighting.

**Keywords:** *Kornél Szilvay, dry extinguishing, water damage-free extinguishing of fire.*

## 1. The beginning of a firefighter's career

Kornél Szilvay was born on July 25, 1890, in Budapest, as the child of Antal Szilvay and Anna Greff. After completing his four years in elementary school, his interest turned towards the technical field. He continued his studies at the predecessor of the present-day Óbuda University, the Budapest Hungarian Royal State Upper Industrial School. Following the successful completion of the preparatory class, he obtained his certification in the mechanical engineering department after three years.

During his studies, the director of the Upper Industrial School, Károly Hegedűs, initiated the expansion of the students' firefighting knowledge with the school authorities. A "firefighting training course" was organized, and „it was approved by the high decree of the minister, as stated in the document number 105.684./IV. B. from 1908”. [1]

By completing the specialized course, Kornél Szilvay committed himself for life to the cause of firefighting and fire protection. After his studies, he began his career at the Schlick Factory in Budapest, where his father also worked. He became

a factory firefighter and joined the Budapest Volunteer Fire Association in the same year. From 2012, he served as a section commander, and from 2013, he performed assistant officer duties and handled storage tasks. Recognizing the significant role of reliable firefighting equipment and procedures alongside the personal preparedness and courage of firefighters, he consciously started modernizing them to increase the efficiency of firefighting. On February 1, 1914, he entered the service of Budapest as a professional firefighter.

## 2. The Patent of the Dry Fire Extinguishing Apparatus

In the early 1920s, Szilvay shifted his focus to replacing water-based firefighting techniques based on water application, aiming to reduce or avoid water damage. A hundred years ago, on December 29, 1923, as a result of his experiments related to dry firefighting, he patented the principle of gas and powder extinguishing firefighting apparatus. The patent description summarized the essence of the innovation as follows: "The essence of the method according to the invention

lies in first cooling the exhaust gases of an internal combustion engine, then compressing them to the necessary pressure with the help of a compressor, and finally blowing the extinguishing powder, known from the powder container, to the location of the fire with the thus compressed gases." [2]

The operational principle is recorded in the description as follows (Figure 1): „In the attached drawing, a schematic representation of a firefighting device operating according to this method is provided. (1) indicates the powder container from which a (2) conveyor screw transports the extinguishing powder to the (3) nozzle. (4) denotes an internal combustion engine, and its exhaust gases exit through the (5) tube. At (6) on the (5) tube, it converges into a (7) tubular cooler, where the exhaust gases are cooled as they pass through, leaving the cooler through the (8) tube after being cooled. The (8) tube converges into a (9) rotary compressor, which is driven by the (10) shaft of the (4) engine; the same shaft also drives the (2) conveyor screw with the help of the (11) belt drive. The (9) compressor compresses the gases sucked in from the (8) tube to the required pressure and delivers them to the (3) nozzle through the (12) casing, where the pressurized gas blows the supplied extinguishing powder into the (13) hose attachment, to which the hose required for firefighting can be connected in a known manner.” [2]

The production of the experimental apparatus began in 1926. The first dry firefighting vehicle, equipped with a 60 HP internal combustion engine, built on a chassis with a load capacity of 5 tons, and featuring a compressor capable of transmitting 6 m<sup>3</sup>/min of extinguishing gas, was manufactured at the MÁVAG Locomotive and Machine Factory. It had a 2 m<sup>3</sup> wooden powder container initially, but as the wooden container proved ineffective, further experiments continued with a steel storage vessel (Figure 2).

In the preparation of the prototype, the constructor was István Horthy from Nagybánya; he was the former head of one of the design departments at MÁVAG. The first dry firefighting vehicle was presented and handed over during a demonstration on December 27, 1927, at the barracks of the Budapest Fire Department (Figure 3).

On January 22, 1928, Prime Minister Count István Bethlen observed Szilvay's newly employed powder extinguisher in action during firefighting. A few days later, Dr. Ferenc Ripka, the Mayor of Budapest, witnessed the operating equipment during a practical exercise, and on both occasions, it functioned excellently.

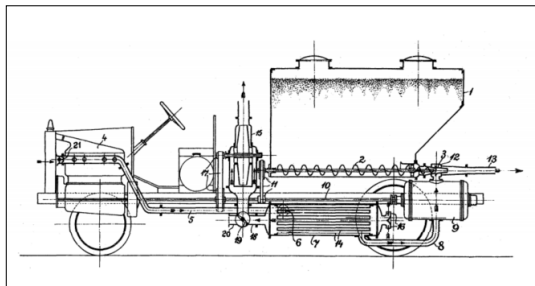


Fig. 1. The conceptual outline of the dry fire extinguishing apparatus from the patent description's accompanying drawings [2]



Fig. 2. The production of the experimental dry firefighting equipment [3]



Fig. 3. Presentation of the horizontal cylindrical dry fire extinguisher at the Kun Street barracks [4]

The first practical deployment of the dry firefighting machine took place on March 1, 1928, in Budapest, during a fire at the art studio of painter Miklós Mihalovits. According to the report in *Esti Kurir*, "...Chief Officer Szilvay decided not to attempt to extinguish the fire with water, which would soak the ceiling and destroy the paintings, but with a new type of firefighting device, his invention. This extinguishing device uses powder and a gas mixture. The chief officer personally put



**Fig. 4.** A group of professional firefighters from the capital, Szilvay second from the right with an uncovered head [5]

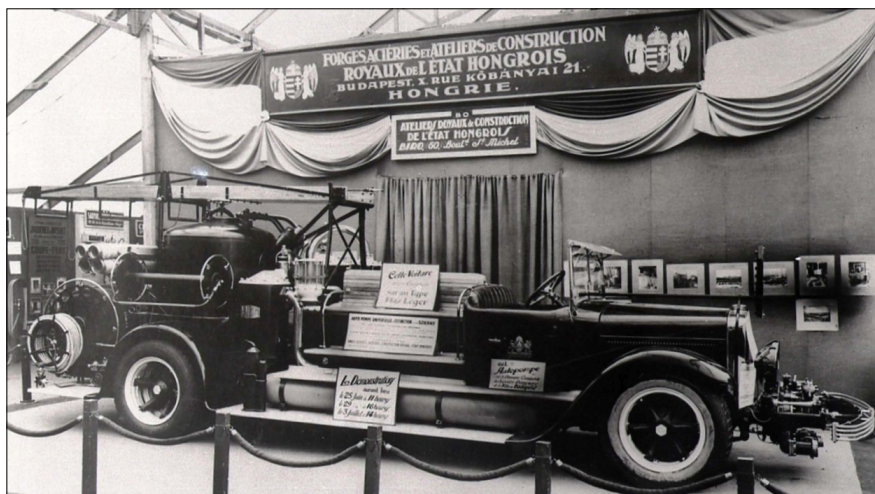
this device into operation, marking its first appearance. The result perfectly justifies the hopes placed in the device because within twenty minutes, they managed to localize the extensive fire without any harm to the accumulated artistic objects.” [6]

The highest international recognition came at the Paris International Firefighting Exhibition,

where, according to contemporary reports, “Szilvay Kornél, the chief firefighter from Budapest, attracted great attention with his invention, the dry firefighting machine.” (Figure 5) „At the exhibition opening, the Hungarian invention was presented to the French Minister of the Interior, Tardieu.” [7]

At the exhibition, the dry extinguisher presented on the Mávag-Mercedes-Benz chassis was capable of extinguishing with neutral gas, powder, water, and water mist, carbon dioxide snow and foam, as well being suitable for combined extinguishing with powder, gas, and water mist. The equipment, referred to in professional circles as a “universal extinguisher,” was equipped with a vertical cylinder powder container instead of the previous horizontal one.

In early July, President Paul Doumer of the French Republic also visited the Hungarian section of the Paris Firefighter Exhibition, where a perfected dry extinguisher was showcased. “In response to his inquiries, brave Chief Engineer István Horthy of Nagybánya provided detailed explanations.” At the request of a colonel from the Paris Fire Department, a firefighting demonstration was also held. “In the demonstration house of the exhibition, cables saturated with high and low voltage electricity were laid down and then ignited. Engineer István Horthy and the Parisian firefighters at his disposal began extinguishing the fire... they quickly suppressed the burning telephone cables. The Parisian fire officers, as well as foreign firefighters who witnessed the firefighting work, expressed their utmost admiration...” reported the *Magyarság* newspaper on July 14, 1931. [9] The new equipment aroused the interest of not only



**Fig. 5.** The Szilvay-designed dry firefighting machine at the Paris International Firefighting Exhibition [8]



French and Austrian experts but also American and Canadian firefighters.

In 1929, the dry extinguisher was used in 20 cases to carry out significant firefighting operations in Budapest without causing substantial water damage. Experience showed that dry extinguishing proved to be most successful in extinguishing fires that occurred in enclosed spaces (out of 20 fire incidents, 14 were business or warehouse fires). It often happened that when entering a closed space, such as breaking through the shutters of a shop, fresh air rushed in, causing the fire to flare up and engulf the surroundings in flames. Recognizing this, Szilvay implemented small openings for introducing the extinguishing agent without breaking the closure, which allowed the introduction of the extinguishing gas without destroying the closure and without the inflow of fresh air.

With the widespread use of electricity, fire incidents involving electrical equipment and distribution units became increasingly common, where traditional water-based firefighting methods were not applicable. On June 16, 1932, at the Kárpát Street site of the Hungarian Transdanubian Electricity Company in Budapest, a 20,000 KVA oil-cooled transformer caught fire. *"The fire of the outdoor transformer was successfully extinguished with a powder jet without the need to power down the two adjacent transformers."* [10]

Szilvay further developed the procedure for extinguishing fires in enclosed-space transformers as well. His patents extensively discussed the introduction openings, which effectively enabled the extinguishing of fires in closed spaces containing transformers and switchgear. The inventor's patents for effectively extinguishing fires in closed spaces included the following:

- Procedure and apparatus for extinguishing fires by dry means (January 24, 1932).
- Apparatus for extinguishing fires occurring in rooms (November 29, 1934).
- Dry extinguishing apparatus (December 4, 1934).
- Dry extinguishing apparatus for fires in large rooms and method for maintaining the dry extinguisher (January 15, 1941).
- Apparatus for extinguishing fires in enclosed spaces (May 9, 1942).

The experiences showed that *"the vehicle engine often does not provide a sufficient quantity and quality of gas without carbon dioxide, because the engine is not sufficiently loaded; moreover, the gas quantity required to extinguish large fires cannot even be produced by the engines in use, even under full load. To overcome these disadvantages, according to the invention, a compressor is driven by the engine, which compresses clean air and pushes it into an oil burner, from which the resulting combustion products can be used for extinguishing..."* - wrote the inventor in his patent registered on December 4, 1934, titled *"Dry extinguishing apparatus"*. [12]

Despite the continuous modernization of the dry extinguishing system, the quantity of exhaust gases from internal combustion engines at the time proved insufficient for extinguishing fires in large-sized spaces.

Szilvay's further developments aimed to increase the amount of gas emitted per minute. The opportunity to design a device capable of producing 100 m<sup>3</sup> of extinguishing gas per minute arose at the Ganz és Társa a Villamossági Gép-, Vagon- és Hajógyár Rt. using the Jendrassik-type gas turbine. The mechanical equipment was completed in 1951, followed by the superstructure in 1953, and then the trial operation began. However, due to Szilvay's death on September 8, 1957, the process was interrupted.

### 3. Reminiscing

Throughout his career, Kornél Szilvay deemed it important to actively participate in firefighting efforts. For 35 years, he responded to fire incidents, with one occurring approximately every 17<sup>th</sup> hour of his service. With a high level of professionalism and selflessness, he fulfilled his duties as both a firefighter and an innovator.

In his 1982 article, retired Lieutenant Colonel Rezső Tarján, a mechanical engineer and former firefighter, praised Szilvay's role, stating, *"As a firefighter officer, he estimated that he led firefight-*

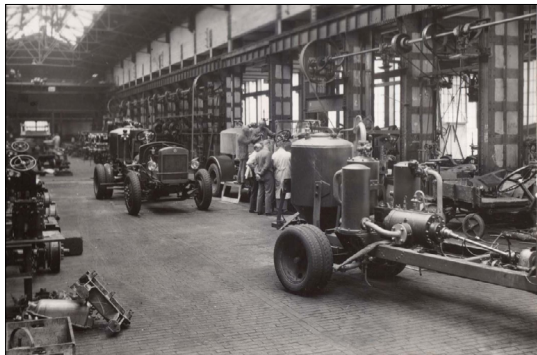


Fig. 6. The installation of stationary tank dry extinguishers at Mávag between 1939 and 1940 [11]



Fig. 7. The Kornél Szilvay Commemorative Coin by HNB [14]

ing efforts in about sixteen thousand fires. For instance, he directed the extinguishing of the Basilica dome fire on June 20, 1947. He took proactive measures to protect the valuable frescoes, and despite the large quantity of water used during the fire-fighting, there was no flooding or water damage. Using a 400 liters per minute small motor pump, he drained water accumulated in the recesses of the dome pillars and used the streams to protect the Basilica's valuable parts from burning." [13]

On February 1, 1955, he announced his final patent titled "Dry Extinguishing Procedure", making him the holder of 39 patents, the majority of which were directly aimed at improving firefighting efficiency.

In recognition of his life and professional career, President Árpád Göncz posthumously promoted him to the rank of Lieutenant General in 1993. In May 1994, a plaque was unveiled in honor of Kornél Szilvay, the firefighter-inventor, at the headquarters of the Budapest Fire Department. The Central Fire Protection Department of the Mechanical Engineering Scientific Society established the Kornél Szilvay Memorial Medal in 1995.

In 2015, on the occasion of his 125th birthday anniversary, the Hungarian National Bank issued a commemorative coin with a face value of 2000 HUF under the name "Kornél Szilvay." (7. ábra).

In 2022, the Bánki Donát Faculty of Mechanical and Safety Engineering at Óbuda University launched the "Kornél Szilvay Fire Protection Conference" series in honor of the outstanding student of its predecessor institution. This initiative is part of the Hungarian Science Festival event series. [15]

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