



The Development of Breathing Apparatus

By Paul Hashagen

Early American firefighters had to face not only fire and the effects of heat with little or no water supply, but also the debilitating effects of smoke with nothing at all to protect them. As was the case for firemen all over the world, they could not effectively operate under the heavy smoke conditions encountered during structure fires.

Fire service folklore recounts the practice of firemen growing long beards to help them breathe heavy smoke. The theory was a fireman would dip his whiskers in a pail of water, then clinch his wet beard between his teeth and breath through his mouth, using the wet beard as a filter.

As a practical answer to overcoming the difficulties of breathing smoke, many seemingly strange and unusual inventions were tried. One of the earliest recorded attempts was in France, where the "Apparatus Aldini" was tested in 1825. This was a thick mask of asbestos worn over the head. Another mask made of woven iron wire was placed over the first. The device provided a small margin of heat protection, provided the wearer was able to maintain the air space between the two masks and not allow the iron mask to touch the inner mask. It is believed this mask provided the wearer only the small amount of trapped air within for breathing.

The functionality of the mask left much to be desired, but the scientific testing by Aldini was ground breaking. He conducted tests of his apparatus under actual fire conditions. This was the start of serious efforts to protect firefighters from smoke as they operated at fires. Many strange and unusual-looking devices were invented, manufactured and tried on the fireground with a wide range of results and effectiveness.

Two years before Aldini's device was in use, a patent was issued to Charles Anthony Deane for a smoke and diving apparatus. This system consisted of a closed helmet, flexible air tubes and a pump. The air was directed across the glasses in the front of the helmet to clear breathing condensation. This apparatus was apparently used with some success by firefighters in London and Paris.

In 1824, a miner named John Roberts came up with a "smoke respirator," or hood, that would allow a person "to enter a dense smoke condition without any danger." Various types of filter masks were developed and used by firemen in Europe and the United States. In 1861, an inventor named Bradbrooke devised a "smoke and noxious vapour respirator" designed to allow a person to "enter a building however dense the smoke or vapour might be without injury."

James Braidwood, the Superintendent of the London Fire Brigade, invented another type of hose mask at about the same time. To supply air and protect the firefighter from smoke, a tube was connected to an air pump attached to the engine outside the fire building. A stout leather dress and hood were worn to protect the wearer from heat and flames. Thickly glazed eye holes were provided in the hood. To furnish light a powerful reflecting lantern was worn on the chest. A shrill whistle was attached to the hood for emergency communications.

Braidwood tested his invention under severe conditions during experimental fires in the vaults of the Fire Brigade Headquarters in Watling Street. The system was used to rescue three small children from a burning house on Fetter Lane. Numerous men and women were also reportedly saved at other fires by men so equipped.

In 1863, a patent was granted to A. Lacour for his invention, the "improved respiring apparatus." This was actually a self-contained breathing apparatus of sorts and consisted of an airtight bag made of two thicknesses of canvas, separated by a lining of India rubber. The device was carried on the fireman's back and held in place by two shoulder straps and a belt around the waist. The bag was filled with pure air inflated with a pair of bellows, and came in different sizes for air durations of 10 to 30 minutes.

From the upper part of the bag two India rubber tubes were connected to a mouthpiece that was held in place by biting down with the teeth. Corks were placed in the mouthpiece when the bag was being filled through a faucet at the bottom of the bag. The corks were then removed when the wearer was ready to begin breathing the stored air. It came with a pair of goggles to protect the eyes from smoke, a rubber clamp for the nose and an air whistle that could be pressed by hand to signal. Tests made by various fire departments, including New York City, Brooklyn and even the U.S. Navy, proved the device worked to some degree.

In the 1870s, fire departments were buying and using "Neally's Smoke Excluding Mask." This filter-type mask had a small bag of water that was suspended by a neck strap. Connected to the water bag were two sponge filters that were kept wet when the bag was squeezed. Air was drawn through the filters to the mouthpiece in the face mask. This "most perfect apparatus" was marketed to fire departments for \$15.

A portable breathing apparatus designed for work in mines was introduced at a competition being held in the Belgium Academy of Science in 1853. These oxygen rebreathers continued to be improved slowly by a number of people. Bernhard Draeger designed a closed-circuit rebreather in 1903. These units were used for many years in many major fire departments in Europe and America.

The first successful American self-contained breathing apparatus was the Gibbs. Experiments with this unit began in 1915 and by 1918 they were being manufactured by Edison Laboratories in Orange, NJ.

In 1920, filter masks took a big step forward when Johns Hopkins University and the University of California completed their research on a gas mask designed to be used in a carbon monoxide-filled atmosphere. Their efforts produced a catalyst called Hopcalite that did not absorb or remove the carbon monoxide, but rather oxidized (burned) it and formed the relatively harmless carbon dioxide. This was one of the most important benefits science had given firefighters to that time.

Toward the end of World War II, Scott Aviation was manufacturing breathing equipment that allowed air crews to operate at extreme altitudes. One story goes that a number of Scott engineers watched a smoky fire being fought in a nearby building. They were amazed that the firemen had to operate in such a severe smoke condition and they decided to see if they could adapt their equipment to suit firefighting. Working with the Boston and New York City fire departments, Scott introduced the AirPac in late 1945 after a year of field testing.

This basic design was modified and improved as wartime invention gave way to space technology. NASA and its space program became a new testing ground that directly improved work on the fireground. Modern firefighters now have more air, with less weight and a lower profile. Numerous manufacturers currently offer strong, lightweight air cylinders and breathing apparatus with integrated personal alarms and radio systems.

Firefighters have come a long way from breathing through their wet whiskers, or sounding the shrill whistle attached to their leather hood.