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A History Of Sprinkler Development

In 1874 the world's first practical Automatic Sprinkler system was installed in the piano factory of Henry S Parmelee

at

New Haven Connecticut in the USA

Parmelee was not the first to invent an automatic sprinkler system

Despite the extensive development work that took place in the US between 1872 and 1918

the early inventors of automatic fire extinguishing systems were British

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1723

The earliest reference to an automatic fire extinguishing device is to be found in Patent No.458 granted on 12th November 1723 to Ambrose Godfrey, a chemist who lived in Covent Garden, London

The device consisted of a cask filled with water, chemical dry powder or a liquid of Godfrey's invention. Also in the cask was a tin box containing a gunpowder charge with a fuse extending outside the cask. The intrepid fire-fighter had to light the fuse, advance close enough to the fire to hurl the cask into it and then beat a hasty retreat before the gunpowder exploded. The subsequent blast and scattering of the liquid or powder were intended to extinguish it

Godfrey went to great lengths to promote the device, even building two timber houses and giving fire extinguishing demonstrations in them to many interested people, including members of the Royal Society. Improbable as it may seem; the device appears to have been reasonably effective on at least one occasion. An article in Bradley's Weekly Messenger on 17th November 1729 refers to its efficiency in extinguishing a fire in London

1763

Patent No.796 was granted on 24th November 1763 to John Green, a watchmaker of St. Martins Court, London for an automatic fire alarm. This was not a fire extinguishing device but could be considered a forerunner of the modern fire alarm system. It consisted of a clock type mechanism that was set in motion by a falling weight released when a cord stretched across the ceiling was burnt through by fire. No records exist of it actually being used

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1797

A system that foreshadowed the present day fire hydrant and hose reel system installed by Sir Samuel Bentham, Inspector General of Naval Works in Buildings at Portsmouth Dockyard. The system consisted of a gravity water supply tank on the roof connected to a pipework system feeding hydrants throughout the building. A similar system was later installed in the London and South Western Railway Company's locomotive works at Nine Elms. The installation was still in position when the building was demolished during the Second World War

1806

A further development was recorded in 1806 when John Carey, a Doctor at Law who lived in Camden Street, London was granted Patent No.2963 for a number of devices to extinguish fires in various types of buildings

The most interesting of these was an early version of the present day deluge system. It consisted of a water tank in the roof with pipes running to a number of lever operated valves positioned at ceiling level in the areas to be protected. Each valve was fitted with a large rose to spray water over the floor

Under normal conditions the valves would be held closed by means of cords stretched across each room at ceiling level. In the event of fire flames would burn through the cord, releasing the elevated operating lever of the valve in that room, and allowing water to discharge onto the floor. It was also proposed that in some instances the outlet rose should be replaced with a leather hose for manual use

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1809

Colonel William Congreve, also the inventor of the military rocket, who lived in Cecil Street, Westminster, patented a refined sprinkler system, Patent No.3201. This system utilised wires and pulleys, in addition to strings or cords, the wires carried fusible links about the size of a half-crown consisting of two thin metal plates held by fusible metal comprised of bismuth, lead and tin in the proportions of eight, five and three respectively, with a melting point of 190ð¦£134;ü¯³pan>

Also described in the patent document is a means of releasing the weights by the expansion of mercury

Drawings illustrate sprinkler devices, including perforated false ceilings, perforated piping at high levels around rooms, and devices with extended and flattened apertures to spray out into the room from near the ceiling, in a similar manner to sidewall sprinklers. A wide coverage sprinkler device mounted in the centre of a room was similar in design to a present day lawn sprinkler. In large rooms, compartmentation was suggested, each with its own fuse link, valves and showers, thus the extent of the remedy shall be limited to the extent of the evil

1812

Carey's system does not appear to have been widely used, if at all, but a much improved system was installed at the Theatre Royal, Drury Lane, London in 1812. This later system was designed by William Congreve. The system was the subject of Patent No.3606 dated 30th December 1812. It was also described in some detail by the architect Benjamin Wyatt in a publication Observations on the design of the Theatre Royal, Drury Lane, as executed in the year 1812

The system comprised an underground cylindrical reservoir containing 400 hogsheads (95 cubic metres) of water pressurised with air from an air pump to a pressure of six atmospheres (6 bar). Water was supplied to the reservoir by a 250mm underground cast iron main fed by the York Buildings Waterworks System in the Adelphi. From the reservoir a further 250mm main supplied water to the theatre building where it was distributed through a series of manually operated valves to small bore branch pipes perforated with three rows of 13mm diameter holes

The valves controlling the system were manually operated and it was intended only to discharge water on to the affected area, not over the whole building. To ensure a standby water supply, agreement was reached with the Waterworks that upon receipt of an alarm signal they would start their 75hp steam engine driven pump to discharge water into the underground reservoir within twenty minutes

This system was the first practical sprinkler system using a high pressure water supply to be installed in a commercial building. Congreve's Patent also shows a number of different types of nozzle including a short revolving perforated pipe and large roses

1835

The Factory Mutual was founded in the United States

1852

William MacBay of Woolwich was granted Patent No.505 for a fire extinguishing system for both buildings and ships that in some respects resembled the modern automatic sprinkler system

His invention comprised a pipe system with branches terminating in outlet nozzles sealed by caps of gutta percha, lead or fusible metal, in all areas to be protected. It was proposed to supply the system with water from either gravity tanks or from towns' mains. The fusible caps when melted by heat from a fire would allow water to flow through the nozzles

It was also suggested that the system should be fitted with a plugged connection through an external wall to enable the fire brigade to pump water into the system. This appears to be the earliest reference to the present day Fire Brigade Breeching Connection used extensively in the US but which has not found favour in the UK owing to the risk of polluting towns' main supplies by connection to non-potable water sources. A further proposal in the MacBay patent was to use carbonic acid gas and steam as an extinguishing agent, but no details of this method were given and it does not appear to have been practically demonstrated

Meanwhile in the US, the perforated pipe system had been introduced from the UK, the first recorded installation being in 1852 in a plant belonging to the proprietors of the Locks and Canals on the Merrimac River at Lowell, Massachusetts. The early systems were installed to protect the roofs of the mill buildings only and were later extended to include the picker, carding and spinning rooms of the textile mills

1855

James Smith, a Liverpool Baker, was granted Patent No.2375 for a system employing gutta percha or fusible metal lines running through areas to be protected and attached to an alarm mechanism on a weight operated

valve controlling the water supply to a system of perforated pipes. It was proposed to plug the perforations with gutta percha that would melt in the event of a fire and release water only in the affected area

This system was very similar to the earlier inventions of Carey 1806 and Congreve 1812, and it suffered from the same defects

a. Stretching of the cords resulting in false alarms

b. Leakage from the water valves

c. Failure of the valves to open when needed

1859

The Locks and Canals Company in the US was requiring perforated pipe installations in all hazardous areas and certain inaccessible rooms in their mills

1861

While the perforated pipe system was being developed in the US further patents were granted in the UK. The first being Patent No.1714 granted to Lewis Roughton, a London Civil engineer, This was for a system similar to that patented by MacBay nine years earlier, and consisted of a fixed pipe system with sprinklers sealed by fusible metal or wax, and arranged so that they could be operated by hand as well as automatically by heat from a fire

Unlike earlier patentees, Roughton described his sprinkler or pendent valve box in some detail and submitted a drawing with the patent application

The sprinkler body would have been made from cast iron with female threaded ends; the outlet being sealed by a mushroom headed valve. The valve had a number of holes drilled in it, sealed with fusible metal. Water was discharged either, by the melting of the fusible seal at approximately 38ð¦£131; allowing water to pass through the holes, or by lifting the valve bodily by means of a threaded spindle passing through the top of the body. The sprinkler was also fitted with a very primitive deflector in the form of a rose fitted over the outlet

There is no record of the system being used and its major defect was the fusible element that was located inside the body in contact with the cold water. Under these conditions it is highly unlikely that the sprinkler would have operated automatically

1862

The recent introduction of American Petroleum into the UK was causing great concern amongst the leading Fire Insurance companies. An example of the regulation, which was found to be necessary for the safe storage of this product, is reproduced here

1863

In July 1863 Roger Dawson was granted a provisional patent No.1869 for a manually operated sprinkler system supplied from gravity tank. The information given in the patent application is very scant and the system appeared to offer little improvement over existing perforated pipe systems

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1864

Within a year of Dawson being granted his patent, the first automatic sprinkler operating in a manner familiar today appeared on the scene, although by comparison with modern products it is somewhat cumbersome and crude. It was invented by Major A Stewart Harrison of the First Engineer Volunteers, London. He never patented the device, and there is no evidence of the system being used, but it showed a marked advance in sprinkler technology and was in fact superior to a number of devices that followed it, both in the UK and the US

The sprinkler consisted of a 76mm diameter hollow brass casing shaped like a flattened sphere, pierced by a large number of 1.5mm diameter countersunk holes spaced at between 3mm and 19mm apart. At its upper end the sphere contracted to a 25mm diameter outlet threaded externally to enable it to be screwed into the outlet of a pipe

Inside the threaded outlet was a water valve comprising a cup shaped piece of soft rubber that because of its shape tended to seal more tightly as the water pressure increased. The inside surface of the outlet was tinned in order to prevent the rubber valve from sticking. The valve was held in place by a spindle that extended down through the sphere and through a wooden block on the underside, to a shouldered bush at its lower extremity. Here it was held in position and under compression by low melting point solder. The wooden block insulated the solder joint from the large mass of metal forming the sphere and thus made the sprinkler more sensitive to heat. When the solder melted, both the valve and spindle were pushed down by the water pressure and water was discharged in all directions through the perforations in the sphere

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Harrison intended that his sprinklers should be spaced between 1.8m and 3.0m apart depending upon the combustibility of the area covered. He also proposed to supply the system with water from an elevated tank and to include an alarm valve actuated by the water flow when a sprinkler operated

The four principal features of this sprinkler that made it so superior were -

a. The cup shaped rubber valve tightened under pressure and therefore did not leak under high water pressure

b. The solder forming the fusible element was effectively insulated from the body of the sprinkler making it more heat sensitive

c. The water valve had to slide a short distance before any water could be discharged thus tending to prevent water from reaching and cooling the solder joint before it had fully parted, and thereby preventing the valve from fully opening

d. Low melting point solder under compression rather than in tension or shear; was used for the fusible element. This was important, as this type of solder is not able to withstand large tensile or shear loads for long periods

The only serious defects were the water distribution because of blockage of the holes and leakage past the valve due to hardening of the rubber seal. Harrison proposed to overcome these by changing the seating or the complete sprinkler, a solution that would not be acceptable today

In the UK, the Tariff Insurance Companies established the Fire Offices' Committee as a central technical organisation. Although the Fire Offices' Committee had been in existence for at least 40 years, as the central

authority to which the District Committees of the Fire Insurance companies reported

1865

The Locks and Canals Company hydraulics engineer, James B Francis carried out a series of experiments to determine the best size and location of perforations, the optimum sizes of feed pipes and branch lines, and the best location for the pipes. These experiments were reported in the Journal of the Franklin Institute in April 1865

In the Francis system the pipes were fitted close to the ceiling, running across the mill in the centre of each bay formed by the supporting structure. The branch pipes were perforated with 2.5mm diameter holes, 225mm apart alternately on opposite sides of the pipe at a point a little above the centre line. To reduce friction losses the pipework was graded so that the cross-sectional area at any point was approximately twice the aggregate area of the perforations. With an inlet pressure of 1.4 bar the system would discharge sufficient water to cover the floor to a depth of approximately 2mm within one minute

One of the earliest contractors to install perforated pipe systems in the US was the Providence Steam and Gas Pipe Company of Providence, Rhode Island, whose president Frederick Grinnell, later achieved fame as the inventor of the Grinnell sprinkler. They commenced installing the Francis system during the late 1860's and subsequently introduced an improved version in which the perforations were spaced at 152.4mm apart at angles 60ð¦£141;Å to the horizontal centre line of the pipe

It was also during this period that the Factory Mutual companies developed a perforated pipe system using wrought iron pipes with 2.1mm diameter holes spaced 76.1mm apart alternately on the top of the pipe at the

vertical

1868 - 69

An eight page document sent with the letter dated 22nd May 1868, and approved at the General Meeting of Offices' on 5th June 1968, became, after the suggestions of the District Committees had been dealt with, on 7th June 1869 the Rules of the Fire Offices' Committee.

The Rules at this time did not as yet incorporate requirements for Sprinklers

The issue of these Rules finally established the Fire Offices' Committee's role

1872

Whilst manually operated perforated pipe systems were being installed; interest was being shown in the US in the development of automatic systems.

In 1872 Philip W Pratt of Abington, Massachusetts took out a patent for a device that consisted of two revolving perforated hollow arms. Water was supplied under pressure through a normally closed valve that was released by the melting of a fuse in a system of cords

Also in 1872, John Souther of Boston, Massachusetts advocated the use of a steam extinguishing system through perforated brass pipes. The steam valve was to be opened by the expansion of the pipe or by the burning of cords. A steam whistle was incorporated to give an alarm

Both these systems suffered from defects similar to those of Carey, Congreve and Smith, that of stretching of the cords and valves jamming in the closed position

At about this time, many textile mill owners were finding it difficult to obtain insurance cover because of the large losses from fires in the combustible mill buildings that were in many cases 45m to 75m long and five or six storeys high

To overcome the problem a number of the more enlightened owners grouped together to form mutual insurance companies similar to the Factory Mutual System. It was these mutual insurance companies that encouraged the development of the automatic sprinkler system

Following the disastrous fires in Chicago in 1871 and Boston in 1872, insurance rates began to rise steeply. One Connecticut industrialist objected to this and was determined to take action. He was Henry S Parmelee who owned a piano factory in New Haven, and he began to look for a device that would operate automatically but only discharge water in the locality of the fire, thus minimising water damage

1873

Charles E Buell of New Haven introduced a sprinkler that although crude was the first to use the principle of water discharging from an open nozzle and being distributed by a splash plate or deflector. This sprinkler was of the sensitive type, and like the Harrison sprinkler was superior to many that followed it

1874

Parmelee took out his first patent in 1874. This was for a complicated device comprising a perforated head containing a valve that was held closed against water

pressure by a spring. The spring was held in position by two eyes made from low melting point material. The eyes were protected from water discharged from adjacent sprinklers by a shield or hood

In addition to the main valve, the sprinkler incorporated an auxiliary valve in the main supply pipe that shut off the water supply to the sprinkler so that when it first operated it was supplied only by a small auxiliary pipe. The dropping of a piston that was normally held up by the water pressure in the small pipe then automatically opened the auxiliary valve. This sprinkler was of the 'sensitive' or non-water joint type. It does not appear to have been put to practical use commercially

His next version, in 1874 was the famous Parmelee Sprinkler No.1 that was actually installed in his piano factory

This sprinkler was of a radically different design from his first model and consisted of a rose type distributor and a valve that was held in place by a spindle resting against a lever. One end of the lever was pivoted on the sprinkler frame and the other end was attached to the body casting by a spring and fusible link.

When the link melted the water pressure acting on the inlet side of the valve forced the spindle upward. The lever also pivoted upward thus allowing the valve to open and water to discharge through the rose

Parmelee later modified the design in which the valve was held in place with a wooden strut bearing at the upper end against a fusible washer

1875

His fourth model was one of the simplest sprinklers ever produced, but in some ways it was a retrograde step as it was of the non-sensitive or water joint type. It consisted of a casting fitted with a rose type distributor over which was soldered a brass cap. The inlet was internally threaded and it was designed to be screwed onto a short pipe nipple

There was no valve and the whole of the sprinkler was filled with water that was retained by the cap. When the heat from a fire melted the solder retaining the cap, it fell away and water was discharged through the rose

Because the soldered joint was in contact with the water considerable heat was required to melt it. Nevertheless, this sprinkler was put onto the market in 1875 following successful demonstrations to mill owners, insurers, businessmen and the press

The first installations outside Parmelee's own piano factory were at the Fall River Mills of Colonel Thomas Borden, a leader in the New England Manufacturers Mutual Association, and at the works of M Seward & Son, New Haven. These were installed by Fosket Bishop & Co. piping contractors of New Haven

Parmelee himself approved the designs and developed the so-called tree piping system comprising main feed pipes 6m apart and branch lines of 20mm diameter pipe 1.5m long 3m apart along the main feed pipes so that the sprinklers were at 3m centres, Each one covered 9m^2. The feed pipe was gradually increased in size at the points where the branch lines connected back towards the main riser so that it was possible for all sprinklers to operate simultaneously

J R Brown and William A Foskett took out a patent for an elbow type sprinkler sealed by a soldered disc, but was never used. They also produced an improved sprinkler later in the same year in which the valve was held in place by a spindle bearing against a cap soldered to the body casting with a spring to assist in opening the valve. Although used to a limited extent it proved unreliable

Hazekiah Conant of Pawtucket, Rhode Island patented a crude device operated by a cord that burnt through in the event of a fire. This sprinkler weighed 1.35kg and was one of the largest sprinklers ever produced. Some of these were installed in the works of Conant Thread Company but were so unreliable that they were never used elsewhere

1878

Parmelee modified his sprinkler by replacing the rose distributor with a revolving slotted turbine thus improving the distribution and reducing the risk of blockage. This sprinkler became known as the Parmelee No.4

It was further modified in the same year by Frederick Grinnell who increased its sensitivity by hollowing out the base thus reducing the area of solder contact with the water. This sprinkler the Parmelee No.5 had an externally threaded water inlet designed for screwing into a 15mm pipefitting. It was erected in the upright position above the line of piping and operated at a temperature of 71ð¦£131;ü¯³pan>

In 1878 Parmelee made arrangements with Frederick Grinnell of the Providence Steam and Gas Pipe Company to sell and install the sprinklers. This they did until 1882 when Grinnell introduced his own much improved sprinkler

During this period some 200,000 Parmelee sprinklers were installed mostly in New England mills

Nineteen fires between 1877 and 1881 were listed as being successfully extinguished by Parmelee sprinkler systems

Also in 1878 Joseph A Miller of Providence patented a sprinkler that was actuated by the expansion of rods and oil in a closed container, and could be considered to be the first attempt at producing an On-Off sprinkler

1879

Charles Barnes of Cincinnati developed a Harrison type sprinkler and an improved version in 1881

John W Bishop of New Haven patented a sprinkler with a sliding valve

1880

Frederick Grinnell patented his first automatic sprinkler that in many respects was similar to the Harrison sprinkler of 1864 but it was never installed on a commercial basis and a further two years were to elapse before the true forerunner of the present day sprinkler appeared

1881

A M Burritt of Waterbury, Connecticut patented a rose type sprinkler similar to the Parmelee No.3, and produced further modified versions in 1882 and 1883. Patents were also granted to A Whiting and A C Harris both of Chelsea, Massachusetts and to J R Brown of Bridgeport, Connecticut for sprinklers that were used with varying

degrees of success along the east coast of America

In the UK the Parmelee sprinkler, the first one to be recognised by the insurance offices, was installed in the Edinburgh Rubber Works

1882

It was in this year that Grinnell patented the now famous No.1 sprinkler that was a radical departure from all previous designs

It comprised a gunmetal frame with a 15mm male threaded water inlet. Instead of terminating in a nozzle the inlet opened into a chamber that was closed by a thin orifice or diaphragm made from brass plate with an 11mm hole in the centre. To support the diaphragm and prevent it from collapsing when the sprinkler was not under pressure and also to impart a spring action to the levers supporting the valve, a stiff spring plate was inserted immediately underneath it

The edges of the hole in the centre of the diaphragm were bent over to form a seat ring approximately 3mm wide. The valve was a lead disc inserted into the depression formed in the centre of the deflector plate and held in position against compound levers.

The uppermost lever that supported the valve was held at one end by a notch in the frame and at the other end by a second lever. This in turn was hooked under a notch in the opposite side of the frame and soldered at its lower end to the frame by fusible solder reinforced by a shaped piece of wire

One of the best features of this sprinkler was the diaphragm discharge arrangement that ensured that increased water pressure tightened the valve instead of causing it to leak, a feature that it had in common with the earlier Harrison sprinkler

After only a few weeks of production changes were made to the design and the Grinnell type A was introduced

The major changes were an increase in the number of teeth on the deflector plate from 20 to 24, and the use of a key to strengthen the solder joint

The first Grinnell sprinkler system in the UK was installed in the cotton spinning mill of John Stones and Company, Astley Bridge, Bolton, Lancashire

1883

C I Delmage of Woonsocket, Rhode Island patented a sprinkler covered by a glass ball that was smashed by a spring operated hammer released by a fusible link

Further changes were made to the Grinnell sprinkler when the diaphragm orifice was increased to 12.7mm diameter but still retaining the lead valve disc and 3mm wide seat ring

C J H Woodbury working for Factory Mutual began a study of automatic sprinkler performance and practice

1884

Assisted by F E Cabot of the Boston Board of Fire Underwriters, Woodbury produced a report that was a major landmark in the history of sprinkler development

resulting in Factory Mutual setting up their own testing laboratory in 1886, and the Stock Insurance Companies Underwriters Laboratories, ten years later in 1894

Grinnell introduced the type B sprinkler that was basically the same as the type A except that the valve disc was of tin instead of lead and the seat ring was increased in width to 5.76mm

F H Prentice of Boston, Massachusetts patented an On-Off sprinkler that depended on the expansion of ether within a sealed container. A number of these devices were manufactured by the Draper Company

1885

John Wormald of the Mutual Fire Insurance Corporation Ltd., Manchester, England wrote the first ***Rules for the installation of Sprinkler Systems***

The publication ***Engineering*** *carried a series of articles dedicated to sprinkler systems, amongst which were reports of tests carried out on various types then available. The Grinnell sprinkler was reported as being superior to the Parmelee and was used as a yardstick by which other systems were judged*

1886

E H Ashcroft of Lyn, Massachusetts patented a sprinkler with four outlets playing onto bell shaped deflectors

Grinnell introduced the type C sprinkler with the seat ring width reduced to 1.92mm. Also in December of this year Grinnell introduced his first upright sprinkler. This was the standard type C sprinkler with a perforated deflector plate instead of a slotted one

In February, the first sprinkler system was installed in Australia in the bedding factory of Laycock, Son & Nettleton, South Melbourne, Victoria by Mather & Platt Ltd using the Grinnell system. On 21st December the system controlled its first fire

1887

Mutual Fire Insurance Corporation Ltd., Manchester, England published the first ***Rules for the installation of Sprinkler Systems*** *in March 1887*

Rules similar to those prepared by John Wormald were issued in the US by the Factory Improvement Committee of the New England Fire Insurance Exchange

1888

The final version of Grinnell's original design the type D appeared. In this version babbitt metal was used for the valve disc and the seat ring width was increased to 2.88mm. In addition the valve disc recess in the deflector was reduced from 22.26mm to 15.9mm diameter

Thus over a period of six years the first modern sprinkler was developed into its final form. It rapidly became the standard sprinkler used throughout the US where Grinnell's own company, the Providence Steam and Gas Pipe Company of Providence, Rhode Island, installed it

The first alarm valve made in the UK was introduced by R. Dowson and J. Taylor of Bolton, Lancashire

This valve was known as the English Alarm Valve and was patented in the US by Grinnell and manufactured by the Providence Steam and Gas Pipe Company, later to become the General Fire Extinguisher Company and subsequently the Grinnell Corporation. This alarm valve

incorporated an annular groove as a means of providing an alarm port for connection to an alarm gong whereas other valves of the time used auxiliary valves or levers to provide an alarm

*The third revision of the Mutual Assurance Corporation's rules was issued as the first **Rules of the Fire Offices' Committee** in September 1888. These rules were not published until 1892*

1889

Mather & Platt Ltd installed the first sprinkler system in New Zealand in the Northern Roller Milling Company, Auckland that subsequently dealt with many fires

Mather & Platt's agents in Australia and New Zealand were Russell & Wormald. The Wormald partner being the brother of John Wormald

The first sprinkler testing facilities were set up in Brown Street and St. Ann Street in Manchester by an Experts Sub-Sub-Committee with members drawn from the Fire Insurance Offices. The facilities at Brown Street were situated in a cellar and employed a gas-heated oven for temperature tests, and at St. Ann Street another cellar was used for water distribution tests

1891

A glass valve replaced the valve disc in the Grinnell sprinkler

During the following years a number of sprinklers were invented and developed both in the US and the UK

A sprinkler of particular note was the Simplex introduced by Dowson & Taylor of Bolton. This sprinkler

incorporated a central tube with the deflector fixed to the lower end and the upper sealed end provided a valve seal in the inlet orifice. The central tube was soldered to an outer fixed tube that allowed the deflector to fall to its operating position when the solder melted

John Taylor of this partnership later joining Mather & Platt Ltd to develop their sprinkler equipment

1892

The Fire Offices' Committee published the first edition of the ***Rules for the Installation of Automatic Sprinklers***

1895

In the US, an attempt to regularise the situation caused by various organisations issuing their own rules, representatives of twenty stock insurance companies met in New York to standardise their rules. A draft set of rules was adopted the following year

1896

The National Fire Protection Association was formed and the draft sprinkler rules became the first edition of what has now become ***NFPA Code 13 Installation of Sprinkler Systems***

1899

From this date virtually all sprinklers being developed were incorporating deflectors fixed to the upper end of the frame or yoke, and employing soldered struts in a variety of forms placed between the upper end of the yoke and the valve. The valves were made from a variety of copper based materials or glass

1903

Grinnell introduced a radical new design in the type A that would today be regarded as an example of minimalism. The sprinkler utilised a three piece soldered linkage directly acting on a glass valve and fixed by an adjusting screw that provided a means of pre-loading the valve seating

1906

The first valve testing facility was opened in East Stanley Street in Salford, and sprinkler testing was transferred to this site

1908

The Experts Sub-Sub-Committee work developed rapidly, and a separate department was established as the Appliances Department

1911

In Australia the partnership of Russell & Wormald became the company of Wormald Brothers

1922

The Grinnell Silica Bulb sprinkler later known as the Quartz Bulb sprinkler, was introduced to avoid corrosion problems that occurred with the soldered strut type

The glass bulb containing a red coloured spirit held the valve closed, and the volume of spirit in the bulb determined the temperature at which it ruptured when exposed to the heat from a fire. The arrangement of the bulb within the sprinkler frame did not allow for

adjustment to ensure leak tightness

1925

A modified version of the glass bulb sprinkler was introduced by both Mather & Platt and Grinnell, which incorporated the bulb mounting method that most subsequent sprinkler designs have adopted

The barrel or cylindrical bulb is held between a hollow cone and a valve cap. An adjusting screw located in the top of the sprinkler frame enables the loading on the cone and bulb to be transmitted directly to the valve ensuring a leak tight seat

The Appliances Department's work was transferred from Salford to the Technical Institute in Cheetham Hill, Manchester. The facilities at this location enabled sprinklers , fire extinguishers, fire-doors and shutters to be tested

1930

The increasing margins of safety incorporated into successive revisions of more appropriate level of protection for light hazard occupancies. In 1930 a standard for Class B systems was introduced to cater for this lower hazard classification. The systems for normal hazards were then known as Class A standard

1931

The Globe Automatic Sprinkler Company introduced the Saveall, with a low-fusing chemical element

In this sprinkler the strut incorporates a small cylinder containing the chemical, that rests upon a piston-shaped piece of metal holding in place the other component parts

of the strut assembly that are slightly off-centre. At the rated temperature the chemical liquefies and is forced out of the cylinder, allowing the strut to collapse and the valve to be opened by water pressure

1932

Development that had started in 1928 by Dr S H Barclay of Mather & Platt Ltd culminated in the introduction of the Mulsifyre system in the UK, and in the US by Grinnell in 1934. This system was the precursor of today's High Velocity Waterspray Systems

The original nozzles were derived from multi-jet distributors and incorporated a deflector. Later types used one of three main methods of spray production, namely conical or helical deflectors, the impingement of two jets or a combination of straight and spiral jets

1933

The Grinnell Quartzoid sprinkler was introduced. This sprinkler incorporated a new body design and was known as the type C. The design of this sprinkler could be considered to be modern in appearance

1935

*The **Fire Offices' Committee Rules for Automatic Sprinkler Installations 25th edition** was published*

The Testing Station at Elstree was opened, and all the work previously carried out at Manchester was transferred

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1940

Following a wide-ranging report ***NFPA Code 13*** *was completely revised and re-issued. The introduction of Light, Ordinary and High hazard classifications were one of a number of important changes, which left the UK design codes in the backwaters for almost another 30 years*

Whilst the colour of the original glass bulb sprinkler was red, soldered strut sprinklers were uncoloured until the colour coding of sprinklers was introduced in the US in 1940

The FOC did not publish the colour coding of sprinklers until 1968, and the selected colours for soldered strut sprinklers matched neither US practice nor that used for glass bulb sprinklers

1945

The ***Fire Offices' Committee Rules for Automatic Sprinkler Installations 25th edition*** *was published*

1946

The NFPA introduced a ***Sprinklers shall not be re-used*** *policy. Under special circumstances other sprinkler equipment could be re-used after complete overhaul by the original manufacturer, and issued with a certificate of guarantee and conformity*

1950

The ***Fire Offices' Committee Rules for Automatic Sprinkler Installations 26th edition*** *was published*

1952

The British Standards Institution published ***CP402.201 1952 Code of practice for Sprinkler Systems*** *listing the FOC rules as the main reference standard*

1953

Following extensive research by Factory Mutual, the spray sprinkler was introduced in the US; the deflector of this sprinkler produced a near hemispherical discharge pattern with less ceiling wetting and greater uniformity of droplet size. This sprinkler became the standard replacing the conventional pattern sprinkler

NFPA Code 13 *was again revised to incorporate revised design criteria particularly in response to the introduction of the spray sprinkler. In order to improve the discharge from terminal sprinklers and reduce clogging, 20mm pipe was no longer accepted for feeding sprinklers*

1960

In the UK, the demise of the textile industry and conversion of mill buildings to warehousing, and the increasing production and storage of foam plastics and rubber, outstripped the capabilities of the standard sprinkler system, and ushered the introduction of larger bore sprinkler systems with improved water supplies

The ***Fire Offices' Committee Rules for Automatic Sprinkler Installations 28th edition*** *was published*

The close relationship between the FOC pipe sizes as late as 1967, and the original Grinnell pipe sizes of 1878, indicates how far behind the UK design codes had slipped before drastic measures to correct the situation were finally

implemented in late 1968

The following table illustrates the changing pattern of sprinkler system pipe sizes between 1878 and the present day

1962

A study of the available water supplies on existing sprinkler systems was initiated by the Fire Offices' Committee, and led to the preparation of a completely new set of sprinkler rules

1968

In December, the twenty ninth and what was to be the final edition of the Fire Offices' Committee Rules was published, introducing the concept of designing systems appropriate to the fire hazard including hydraulic calculation, and system testing and maintenance

In the UK the use of spray sprinklers was accepted where wetting of structural steel at roof level was not required

1970

Factory Mutual Research developed the concept and use of Large Drop sprinklers for storage risks

1973

Extended coverage sprinklers were introduced in the US, and acceptance incorporated in NFPA Code 13 subject to approval testing and listing

Grinnell introduced the first approved On-Off sprinkler. The on-off feature comprising a snap-action bi-metallic disc that operates a pilot valve on a reaching the

operating temperature. This causes a pressure reduction that then opens the main orifice and allows water to discharge. A reduction in temperature causes a reverse action

1975

The British Automatic Sprinkler Association BASA was founded to more closely focus the interests of the Sprinkler Installation companies, away from the British Fire Protection Systems Association BFPSA, with their predominantly Fire Detection, Gas and Foam Systems interests

1979

BS5306 Part 2: 1979 Code of practice for fire extinguishing installations and equipment in premises (sprinkler systems) was published, its main reference being to the **28th edition FOC rules**. This document superseded **CP402.201 1952**

1985

The first approved Large Drop sprinkler was introduced by the Viking Corporation. This was a development of the earlier High Challenge sprinkler

With the formation of the Loss Prevention Council, which incorporates the FPA and LPCB, responsibility for the UK sprinkler design codes passed from the Fire Offices' Committee

1987

NFPA Code 13 confirmed Extended Coverage Sprinklers as suitable for Ordinary Hazard

1989

Early suppression fast response sprinklers were introduced after extensive fire testing by Factory Mutual. They were developed from work done on large drop sprinklers and provide a practical engineered solution for high hazard storage risks. The prime objective of ESFR protection is extinguishment, not just fire control as is the case with conventional sprinkler protection

The systems provide specific protection to high piled storage risks up to 9.2 metres in height without intermediate level sprinklers. Adherence to a strict design standard is necessary to ensure that the appropriate protection is provided

Life safety systems were introduced with the publication of ***LPC Technical Bulletin 29-1***

1990

Work commenced on the preparation of ***CEN Comité European de Normalisation standards for sprinkler systems****, with the test requirements for sprinkler system components being the first standards to be published*

A European Sprinkler Standard was proposed, the work being processed through CEN. In accordance with agreed procedures the basis for new standards was centred around existing national standards where they existed. Commercial standards such as those produced by insurance bodies could not be accepted. At the time there was no existing national standards for sprinkler design codes in any of the European countries, only reference to insurance standards viz. CEA, LPC, VdS, etc.

In an attempt to ensure the UK codes were used as the core document ***BS5306 Part 2: 1990*** *was rushed through*

the drafting and comment stage and published in June 1990, just prior to the CEN deadline for document acceptance of July 1990

*This document was essentially a major revision of the **29th edition FOC/LPC rules**, including particular reference to maintenance and reliability of sprinkler systems and their water supplies. This publication overcame the problems associated with the previous standard referencing the **28th edition FOC rules** for over twenty years after the **29th edition FOC/LPC rules** had been published*

The speed at which the standard had been rushed through draft and comment stage was evident in the number of errors which found after publication. Since the document was now in process within CEN no changes could be made to the standard

*The **Loss Prevention Council's Rules for Automatic Sprinkler Installations** was published adopting **BS5306 Part 2** as the core document, with Technical Bulletins detailing the additional and alternative requirements of the Fire Insurance Companies, and a list of the errors and corrections present in the standard*

The development and approval of Fast/Quick response sprinklers was gaining pace

1995

***LPC TB 20:1994:1** was issued by the LPC in respect of sprinkler selection. This document detailed criteria for the selection and use of sprinklers including quick response types, but was unfortunately based on inappropriate and non-comparative test results, and highlighted the continued use of different testing methods for different sprinkler types leading to confusion and conjecture as to their actual relative response and performance under fire*

conditions

1996

The first ESFR sprinkler was approved by the LPCB

Low and high pressure Water Mist Systems are under intensive development and draft standards are being written. These systems are mainly for use in localised applications in generally small enclosed spaces

1997

*The LPC publish **TB25 1997 1** for ESFR system design*

1999

*The LPC publish **TB26 1999 1** for general changes of commodity classification and protection of high piled storage hazards for the British Standard*

2000

The LPC publish TB27 2000 1 to TB33 2000 1. These technical bulletins detailed the protection for a variety of high hazard applications and commodities not specifically stated in the British Standard

TB33 2000 1 amended the British Standard table for accepted pipe and fitting materials that can b used for sprinklers systems

2003

*The LPC publish **TB26 2003 1** Sprinkler protection of schools*

*The LPC publish **TB26 2003 1** This technical bulletin*

covered the use of a new type of extended coverage sprinklers that could provide extended protection for Ordinary Hazard Group III sprinkler systems

2003

The new EN12845 European Standards for Automatic Sprinkler Installations are released by the Comité Européen de Normalisation (CEN). The Standards are translated into English and are released in the UK as the BSEN12845 2003 Standards for Fixed fire fighting systems - Automatic sprinkler systems - Design, installation and maintenance.

The new design standard incorporates many of the design requirements stated in the existing LPC TB's, written in the form of Annexes. Although the new document's core is based on BS5306 part 2, there are fundamental changes of design requirements throughout the document. The document has been restructured and is very easy to understand when compared BS5306 part 2.

The LPC release a series of technical bulletins to supplements the European Standard and provide additional guidance. The new TB's also cover innovative products, which are not to be found in the new standard.

2004

BSI issues a further version of the BSEN12845 standard. This version has many of the errors in the 2003 version corrected.

2006

The British Standard Institute changes the status of BS5306 part 2 to "Current as Obsolescent". Essentially this means the document has been superseded by BSEN12845

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2004 for the design of new sprinkler systems, extensions and alterations, however it remains current for the service and maintenance of existing sprinkler systems designed and installed using BS5306 part 2.

This history has of necessity been brief and this fascinating story has many untold chapters

Nevertheless, we hope our attempt to summarise the important events and developments in this vital field of engineering has been both informative and entertaining

and the future?

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