Sprinklers were invented by an American, Henry S. Parmalee, in 1874 to protect his piano factory.

Until the 1940s and 1950s, sprinklers were installed almost exclusively for the protection of buildings, especially warehouses and factories. Insurance savings, which could pay back the cost of the system in a few years time, were the major incentives.

Following several fires with large losses of life (Coconut Grove Nightclub, Boston, 1942 – 492 dead; LaSalle Hotel, Chicago, 1946 – 61 dead; Winecoff Hotel, Atlanta, 1946 – 119 dead) fire and building officials searched for a means to provide life safety for building occupants. They found that factories and other buildings equipped with automatic sprinklers had an amazingly good life safety record compared with similar unsprinklered buildings.

► What determines where and when sprinklers are required?

Building codes over the past two decades have increasingly called for sprinklers throughout buildings for life safety, especially buildings in which rapid evacuation of occupants is difficult or the hazard posed by contents is high.

► Why are there additional local ordinances?

Where the building codes don’t go far enough, many states and cities enact special tough sprinkler ordinances. The State of West Virginia, for example, requires sprinklers throughout all new buildings exceeding 40 feet in height. The city of Oak Brook, Illinois, requires sprinklers throughout all new buildings exceeding 1,000 square feet in area except single-family dwellings. Some communities, such as San Clemente, California, and Greenburgh, New York, require fire sprinkler protection even in new single-family homes.

► What is retrofit legislation?

In addition to requiring sprinklers throughout new buildings, some cities have encouraged sprinkler installation in existing buildings. These include New York City’s landmark Local Law 5 for high-rise office buildings, and a Chicago
ordinance requiring sprinklers throughout all nursing homes. High-rise hotels have been required to retrofit with fire sprinklers in the states of Nevada and Florida, and in the city of Honolulu, Hawaii.

Recent high-rise retrofit laws include those enacted in Atlanta in 1989 and in Philadelphia in 1991.

► What's happening outside the U.S.?
In some countries, such as Japan, automatic fire sprinkler systems are used almost exclusively for life safety protection, and are being required throughout new and existing buildings.

► How do sprinklers operate?
Automatic fire sprinklers are individually heat-activated, and tied into a network of piping with water under pressure. When the heat of a fire raises the sprinkler temperature to its operating point (usually 165°F), a solder link will melt or a liquid-filled glass bulb will shatter to open that single sprinkler, releasing water directly over the source of the heat.

► Why are sprinklers so effective?
Sprinklers operate automatically in the area of fire origin, preventing a fire from growing undetected to a dangerous size, while simultaneously sounding an alarm.

Automatic fire sprinklers keep fires small. The majority of fires in sprinklered buildings are handled by one or two sprinklers.

► Why are sprinklers important for life safety?
Sprinklers do not rely upon human factors such as familiarity with escape routes or emergency assistance. They go to work immediately to reduce the danger.

Sprinklers prevent the fast developing fires of intense heat which are capable of trapping and killing dozens of building occupants.

► What about smoke?
Smoke, a by-product of fire, is generally the cause of death to building occupants. Although smoke is produced as sprinklers extinguish a fire, such quantities of smoke are less than those which would be produced by an unsprinklered fire permitted to grow.

► Who decides design and installation procedures for sprinkler systems?
Proper design and installation of sprinkler systems is standardized nationally in a consensus standard promulgated by the National Fire Protection Association - NFPA 13.

A basic premise of proper sprinkler protection is that sprink-
lers be installed throughout all building areas. Partial sprinkler protection is a game of chance, since a fire originating in an un sprinklered area can overpower sprinklers once given a head start.

**What is the life safety record for fully sprinklered buildings?**

Aside from fire fighting and explosion fatalities, there has never been a multiple loss of life in a fully sprinklered building due to fire or smoke. Individual lives have been lost when the victim or his clothing or immediate surroundings became the source of the fire.

A National Fire Protection Association study for the years 1971-1975 found that approximately 20 lives are lost each year in this country in sprinklered buildings, as compared to approximately 8,000 per year in unsprinklered buildings. Some 68% of the lives lost in sprinklered buildings were due to explosions, and an additional 18% were due to the fact that the fire originated in an unsprinklered area of the building.

**How reliable are fire sprinklers?**

All fire protection features have a reliability factor. Walls and shafts can be breached by means of poke-throughs and building alterations. Exit doors can be blocked or locked.

Sprinklers may be the most reliable fire protection system known. Detailed fire records for Australia and New Zealand (where fire must be reported) for the years 1886 through 1968 showed that 99.76% of all fires were extinguished or controlled by the sprinklers. Fire records in this country are less dependable due to lack of full reporting, especially for small fires where the sprinklers are successful. Nevertheless, the range includes a 96.2% success record reported by the National Fire Protection Association for the years 1925 through 1969, 98.4% success record for New York city highrise buildings between 1969 and 1978, and a 98.2% success record for U.S. Department of Energy facilities between 1952 and 1980.

**How can you be sure a system will operate when needed?**

Electrical supervision of sprinkler systems to monitor valves and water flow is a major plus in assuring system reliability and effectiveness, and is required by many building codes for large and important system installations.

**Can sprinklers discharge accidentally?**

Loss records of Factory Mutual Research indicate that the probability of a sprinkler discharging accidentally due to a manufacturing defect is only 1 in 16,000,000 sprinklers per year in service.
How much does a new sprinkler system cost?
The cost of a complete sprinkler system depends on many factors, such as the building type and construction, availability of public water supply, and degree of hazard of the occupancy. For new construction, systems usually cost from $1.00 to $1.50 per square foot, less than the cost of carpeting. The major model code organizations, in releasing average costs of sprinkler systems for building permit purposes, listed the following add-on costs for new construction in 1990:

- Building Officials and Code Administrators: 93¢ to $2.00/sq. ft.
- International Conference of Building Officials: $1.50/sq. ft.
- Southern Building Code Congress: $1.50/sq. ft.

How much does retrofit cost?
Retrofit installations in existing buildings can be expected to cost somewhat more than for new construction, depending on the difficulty of installation and other factors. A general rule of thumb is to add 50%.

What are “trade-offs”?
The system cost can often be offset by insurance savings, and by specific design alternatives or “trade-offs” permitted by most building codes in view of the superior protection afforded by sprinklers. These trade-offs often include reduced fire-resistant requirements for structural components, longer exit travel distances, and larger building areas and heights.

Aren’t sprinklers ugly?
Due to advances in sprinkler technology, sprinklers look better than ever, if you can see them at all. Sprinklers can be concealed behind ceilings, out of sight until needed to extinguish a fire. Sprinklers are also available in a range of colors and sizes to blend into the background of any room.

What about water damage?
Reports of water damage due to fires in sprinklered buildings are often exaggerated due to comparisons with the small fire loss which occurs thanks to the sprinklers.
The amount of water which is put on a fire by fire department hoses in an unsprinklered building fire is nearly always tens to hundreds of times more than that which sprinklers would have discharged. During a fire, only those sprinklers closest to the fire activate, limiting the total amount of water needed. The fire damage, as reflected by insurance claims, is also many times greater.
There have been hundreds of multiple-death (three or more people killed) building fires in the United States since fire sprinklers were invented. These fires, all in unsprinklered buildings, have killed thousands of people, not to mention the property damage. A few of the more notable fires are listed here, though, unfortunately, the complete list is much longer. (Number of deaths in bold type.)

170 Rhodes Opera House
Boyetown, Pennsylvania
January 12, 1903

602 Iroquois Theatre
Chicago, Illinois
December 30, 1903

175 Lakeview Grammar School
Cologne, Ohio
March 4, 1908

145 Triangle Shirtwaist
New York, New York
March 25, 1911

77 Cleveland School
Beulah, South Carolina
May 17, 1923

38 Bond Dance Hall
West Plains, Missouri
April 13, 1928

125 Medical Clinic
Cleveland, Ohio
May 15, 1929

320 Ohio Penitentiary
Columbus, Ohio
April 21, 1930

48 Home for the Aged
Pittsburgh, Pennsylvania
July 24, 1931

32 Terminal Hotel
Atlanta, Georgia
May 16, 1936

207 Rhythm Club
Natchez, Mississippi
April 23, 1940

492 Coconut Grove Nightclub
Boston, Massachusetts
November 28, 1942

32 Forrest Park Sanitarium
Seattle, Washington
January 31, 1943

54 The Gulf Motel
Houston, Texas
September 7, 1943

61 The LaSalle Hotel
Chicago, Illinois
June 5, 1946

119 Winecraft Hotel
Atlanta, Georgia
December 7, 1946

74 St. Anthony Hospital
Effingham, Illinois
April 4, 1949

41 Mercy Hospital
Davenport, Iowa
January 7, 1950

35 Littlefield Nursing Home
Largo, Florida
March 29, 1953

72 Katie Jane Nursing Home
Warrenton, Missouri
February 17, 1957

29 Barton Hotel
Chicago, Illinois
February 12, 1955

95 Our Lady of Angels Grade School
Chicago, Illinois
December 1, 1958

20 Thomas Hotel
San Francisco, California
January 6, 1961

25 Surfside Hotel
Atlantic City, New Jersey
November 18, 1963

22 Roosevelt Hotel
Jacksonville, Florida
December 29, 1963

25 Dale's Penthouse
Restaurant
Montgomery, Alabama
February 7, 1967

13 Randolph Tavern
Mohegan Lake, New York
February 16, 1968

31 Nursing Home
Marietta, Ohio
January 9, 1970

20 Ozark Hotel
Seattle, Washington
March 20, 1970

19 Point Square Hotel
Los Angeles, California
September 13, 1970
<table>
<thead>
<tr>
<th>Number</th>
<th>Location 1</th>
<th>Location 2</th>
<th>Start Date</th>
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<tbody>
<tr>
<td>28</td>
<td>Pioneer Hotel</td>
<td>Tucson, Arizona</td>
<td>December 20, 1970</td>
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<td>15</td>
<td>Nursing Home</td>
<td>Honesdale, Pennsylvania</td>
<td>October 19, 1971</td>
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<td>32</td>
<td>Cocktail Lounge</td>
<td>New Orleans, Louisiana</td>
<td>June 24, 1973</td>
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<td>25</td>
<td>Apartment House</td>
<td>Los Angeles, California</td>
<td>November 15, 1973</td>
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<td>15</td>
<td>Galey Nursing Home</td>
<td>Wayne, Pennsylvania</td>
<td>December 4, 1973</td>
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<td>24</td>
<td>Gulliver's Discotheque</td>
<td>Port Chester, New York</td>
<td>June 30, 1974</td>
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<td>11</td>
<td>Seminole County Jail</td>
<td>Sanford, Florida</td>
<td>June 30, 1976</td>
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<td>Pathfinder Hotel</td>
<td>Fremont, Nebraska</td>
<td>January 10, 1976</td>
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<td>Winecrest Nursing Home</td>
<td>Chicago, Illinois</td>
<td>January 30, 1976</td>
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<td>25</td>
<td>Social Club</td>
<td>Bronx, New York</td>
<td>October 23, 1976</td>
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<td>16</td>
<td>Stratford Hotel</td>
<td>Breckenridge, Minnesota</td>
<td>January 28, 1977</td>
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<td>164</td>
<td>Beverly Hills Nightclub</td>
<td>Southgate, Kentucky</td>
<td>May 28, 1977</td>
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<td>42</td>
<td>Maury County Jail</td>
<td>Columbia, Tennessee</td>
<td>June 26, 1977</td>
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<td>20</td>
<td>Coates House Hotel</td>
<td>Kansas City, Missouri</td>
<td>January 28, 1978</td>
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<td>20</td>
<td>Allen Motor Inn</td>
<td>Honesdale, Pennsylvania</td>
<td>November 5, 1978</td>
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<td>Tenement</td>
<td>Newark, New Jersey</td>
<td>December 7, 1978</td>
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<td>Mental Hospital</td>
<td>Ellisville, Mississippi</td>
<td>December 29, 1978</td>
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<td>14</td>
<td>Boarding Home</td>
<td>Bradley Beach, New Jersey</td>
<td>July 26, 1980</td>
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<td>MGM Grande Hotel</td>
<td>Las Vegas, Nevada</td>
<td>November 21, 1980</td>
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<td>26</td>
<td>Stouffer's Inn</td>
<td>Harrison, New York</td>
<td>December 4, 1980</td>
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<td>31</td>
<td>Beachview Rest Home</td>
<td>Keansburg, New Jersey</td>
<td>January 9, 1981</td>
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<td>12</td>
<td>Westchase Hilton</td>
<td>Houston, Texas</td>
<td>March 7, 1982</td>
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<td>13</td>
<td>Pinter Hotel</td>
<td>Hoboken, New Jersey</td>
<td>March 6, 1982</td>
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<td>24</td>
<td>Dorothy Mae Apartment Hotel</td>
<td>Los Angeles, California</td>
<td>September 4, 1982</td>
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<td>29</td>
<td>Biloxi Jail</td>
<td>Biloxi, Mississippi</td>
<td>November 8, 1982</td>
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<td>8</td>
<td>Home for the Mentally Handicapped</td>
<td>Annandale Village, Georgia</td>
<td>August 31, 1983</td>
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<td>14</td>
<td>Elliott Chambers Rooming Home</td>
<td>Beverly, Massachusetts</td>
<td>July 4, 1984</td>
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<td>14</td>
<td>Alexander Hamilton Hotel</td>
<td>Paterson, New Jersey</td>
<td>October 18, 1984</td>
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<td>97</td>
<td>Dupont Plaza Hotel</td>
<td>San Juan, Puerto Rico</td>
<td>December 31, 1986</td>
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<td>10</td>
<td>Single Family Dwelling</td>
<td>Minnesota</td>
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<td>Hillhaven Nursing Home</td>
<td>Norfolk, Virginia</td>
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<td>16</td>
<td>John Sevier Retirement Center</td>
<td>Johnson City, Tennessee</td>
<td>December 24, 1989</td>
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<tr>
<td>87</td>
<td>Happy Land Social Club</td>
<td>Bronx, New York</td>
<td>March 25, 1990</td>
</tr>
<tr>
<td>9</td>
<td>Fontana Hotel</td>
<td>Miami, Florida</td>
<td>April 6, 1990</td>
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Established in 1914, the National Fire Sprinkler Association, Inc. (NFSA) is a non-profit trade association comprised of installers and manufacturers of fire sprinklers and related equipment and services. Professional and Subscriber memberships are also available. The NFSA provides publications, seminars, representation in codes and standards-making, market development, labor relations, and other services to its members. Headquartered in Patterson, New York, the NFSA has regional offices throughout the country.

NATIONAL FIRE SPRINKLER ASSOCIATION, INC.

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P.O. Box 1000 • Patterson, NY 12563
Telephone: 914/878-4200    FAX: 914/878-4215

To be effective, fire sprinkler systems must be installed by qualified, competent contractors. For more information, contact the NFSA, or look in the Yellow Pages under Automatic Sprinklers for the names of contractors in your area.