SCHULTE & ASSOCIATES
Building Code Consultants
3655 East 25th Street
Lawrence, KS 66046
fpeschulte@aol.com
847/312-7617

FIRE PROTECTION HISTORY-PART 214: 1899 (OPEN WELL (ATRIUM) FIRE PROTECTION)

By Richard Schulte

The third Annual Meeting of the National Fire Protection Association was held in Boston, Massachusetts in mid-June 1899. Among the various topics discussed at this meeting was the subject of "open wells" (unenclosed floor openings) in multi-story buildings. This subject was presented in a paper authored by E. U. Crosby:

"***LIGHT WELLS AND OTHER VERTICAL HAZARDS, AS FOUND IN DEPARTMENT STORES.***

PAPER BY MR. E. U. CROSBY.

Evolution of the Department Store. *Our city buildings used for display and sale of merchandise, within the recollection of many here present, were of small area, averaging perhaps 3,000 square feet. Under such conditions, the wall windows admitted sufficient daylight.*

In addition, roofs were occasionally pierced by skylights, especially if upper story was used for workroom.

As a rule, such stores were first enlarged by extension to adjoining building.

The ordinary doorways between such sections were widened and eventually all partition walls not structurally necessary were removed, resulting in a risk of large area all subject to one fire.

New lines of goods were opened up as increased floor space allowed, resulting in the department store of today.

Buildings erected purposely for department store occupancy contain no division walls of note.

Light Wells. *Stores of such area contained much floor space remote wells from wall windows and not sufficiently lighted.*

To reduce this difficulty, very large skylights were set in roofs and the floors directly beneath same removed, or not extended in the case of new buildings, resulting in an enormous vertical shaft commonly termed a " light-well."

Such shafts have not as yet been extended to basements and sub-basements but start at ground floor and each story above has open communication therewith.

Occasionally, floors are extended into shaft a few feet forming galleries at each story.

Usually the ground floor of well is used for the display of goods, and at times the galleries.

Each floor, extending back from well for great distances, is furnished with combustible counters, tables, racks and shelves piled and often festooned with tons of inflammable materials.

The wells are perhaps draped with goods and during the holiday season are the object of special attention, often being decorated with evergreen, Christmas trees, and bunting. Temporary wooden scaffoldings have been erected on the ground floor mounted with canvas scenery as for a Santa Claus tableau and in one case at least the shaft was filled with numberless cotton wads suspended from wires in imitation of a snow storm.

Aside from the original purpose of obtaining light and the incidental possibilities of architectural effect and wide display of goods, such wells have been largely used for ventilation with an attendant saving of expense and room for a specially designed ventilating system, a great relief to owner and occupant of building as scientific ventilation has been little understood or practiced.

The light well as now arranged, may be considered the greatest vertical hazard, but there are others.

Stair and Elevator Wells. *The original small store had a stairway, the growth of which has kept pace with that of the building. We now find several stairways, at least one of which is apt to assume grand proportions and extend from basement to second or third story if not to top of building. At times this is in or adjoining light well or by itself is used for spread of light and for ventilation. All such stairways are unenclosed and at times made use of for display of wares.*

The use of elevators increases yearly. Some stores have from one to two dozen. They are not enclosed, much less cut off and frequently are located with stairways.

Floors, Roofs, and Finish. *Aside from arrangement, the construction of a large majority of stores is bad. Floors and roofs are of wood joist, which, together with walls, are generally finished with wood lath and plaster, matched boards, or hard wood cabinet work.*

Concealed spaces exist under all roofs where top floor is finished with a horizontal partition to conceal unevenness of roof, made necessary for drainage. Also to a less extent, in walls and floors, the latter particularly where several buildings, floors of which have no common level, have been thrown together for a single occupancy. In many such places steel girders (uninsulated against heat) have been used to strengthen floors.

Demand for Increased Fire Protection. *How our original small store contrasts with the present octopus! For illustration, we will assume the former of 5,000 square feet floor area, the latter 50,000; 3 or 4 floors at first, now 6 to 8; a few people in former, in latter 10,000. No light wells or elevators, now freely employed. Surely great strides must be made in fire protection to at least keep pace with these changed conditions.*

Large Area. *Store managers desire large area floors unobstructed partition or curtain walls. In the first place, the appearance is better. Customer is impressed with the magnitude of store, can see for herself that there are "large sales" and may thereby be reminded of "small profits," can see why the Sunday paper calls it the biggest store in the city, state, country, world. Why it has "more people under one roof than many towns and counties." "Is a city in itself." Within her vision are many attractive articles not thought of in entering but which may be "just what she wanted." She can see hundreds of people at one glance.*

The above reasons are more than sentimental yet the most appealing argument relates to the departments. Any division of floor area by partition walls, if conforming to the departments at the start, would need alteration in a week and entire rearrangement in 3 months. This would be due to the expansion and contraction of departments and discontinuance of old and taking on of new lines which is constantly taking place but most noticeably at the change of seasons.

"Fire-proofs." *A few modern buildings of "fire-proof" construction have lately been built for these purposes and mark a distinct advance in the class which will be fully appreciated when it is known that the sufficient insulation of the steel members against heat of burning contents or exposure is a certainty.*

However, the vertical hazard has been allowed to remain untouched. No attempts are made to reduce the danger. The subject is ignored. Attention of fire protectionists diverted to other and often trivial matters.

All that is "fireproof" about such a store is that part (if any) of the structure which would not be ruined by the combustion of the contents. This, at best, would be a small per cent of the total value of contents and building. "Fire-proof" construction should not be thought of as preventing the destruction of large values until it is planned so as to hold a fire within the room where it originates.

***Foreign Stores**. It is interesting to observe the growth of departmental stores in other countries. Our correspondent advises very fully as follows. In London, they are increasing each year. Areas are limited by law. Buildings used for trade purposes and containing more than 216,000 cubic feet must be divided by parti-walls in such manner that the contents of each division shall not exceed the the above mentioned number of cubic feet. Openings (not to exceed 7 x 8 ft.) may be made in such division walls, if protected by two wrought iron doors, one fixed on either side of the wall. The height of buildings does not usually exceed 6 or 7 stories but there is no limitation other than the rights of surrounding owners to light and air. Walls are of brick and stone. Floors sometimes are of wood, but in the more modern buildings of iron and concrete. Roofs are timber framed and slated but in a few cases of iron and concrete. There are no regulations preventing floor openings which are sometimes enclosed in brick walls with iron doors and shutters, and in other instances are quite unenclosed.*

Great Britain, excluding London, has such stores to a limited extent. Heights vary and are governed partly by width of streets. Surrounding owners have rights of light and air which must not be interfered with and these effectually prevent the erection of lofty buildings. Walls are generally of massive construction. Roofs are usually timber framed and slated, while floors, as a rule, are of ordinary wood construction, but in a few of the more modern buildings are of concrete and iron. Floor openings are generally quite unenclosed.

Germany. Such stores exist. The heights and areas are very different according to the place and to the breadth of the street. Although not limited by law, there are existing special police prescriptions for construction which are different in the several places. Before such a building is erected, the allowance of the authority is to be requested, submitting to them a precise sketch with description. In general, the fire brigade authority have to give their opinion with regard to the fire hazard and have to give special prescriptions for security. As a rule, such risks are composed, beside the cellar, of three or four upper stories and the roof story. Higher buildings of this kind are not known to the writer. Height is principally based upon the width of the street and in general, it can be said that the houses, except corner premises, are never allowed to be higher than the street is broad. The several stories and walls are thoroughly massive in accordance with regulations. The roof is hard, of bricks or slates, as per prescription. The ceilings are either perfectly vaulted in stone or in stone with iron, or constructed in the so-called Klein's Gypsum planks and above it there are wooden or inlaid floors. Usually such establishments contain galleries

on some parts of the several stories through which openings, stairs and lifts extend. Such lifts extending through galleries are not enclosed, but when extending directly through the floors, they are enclosed by brick walls.

France. Departmental stores exist, except as yet they have not sold groceries, meats, etc. The two largest, viz: the "Bon Marche" and the "Louvre" have respectively 98,000 square feet and 75,000 square feet of superficial area. The others are much smaller averaging about 30,000 superficial square feet. The usual height is sunk basement, ground floor and five stories. There is no limit by law as to the extent of the warehouses. The height is regulated by the law applicable to all buildings according to the width of the streets adjacent as per table annexed.

Walls, external, always of stone; internal, generally of brick or stone. Roofs, usually ordinary tiled or slated. Floors. In one case, there are brick arched fire proof floors. In all others, the floors are of wood with iron or wood girders and rafters. There are no limitations as to floor openings. In all there are enormous well holes and numerous wooden stairs. There are also hoists through all floors. The hoists are generally open with iron guide posts. Sometimes there is an iron wire grating surrounding the hoist.

The various openings are not protected in any way.

Note:–The above answers apply more particularly to risks in Paris. The same class of risks exists also in the larger provincial towns, regarding which, we have no definite information. It may be taken for granted that in these towns, the circumstances are similar to those in Paris, except that the warehouses are much smaller and usually only 2 or 3 floors, the upper floors being occupied as dwelling houses.

Municipal regulations determining the maximum height of buildings.

Width of street.	*Feet, say*	*Maximum height of buildings allowed.*	*Feet, say*
Up to 7 m. 80	*25*	*12 meters*	*39*
From 7 m. 80 to 9 m. 74	*25-32*	*15 meters*	*49*
From 9m. 74 to 20 m.	*32-65*	*18 meters*	*59*
Above 20m.	*65*	*20 meters*	*65*

The foregoing heights are those of front walls. Attics may be added, these latter to be not under 5 meters say 16 feet and not superior to 8m. 50 (say 28 feet) in height (I. e. to ridge of roof).

Spain. There is but one building in Barcelona which tallies with London department stores, and that on a smaller scale. So far as I can ascertain, a building (to be used for any purpose) may be of unlimited superficial area and may consist of a sunk basement and a ground floor and five floors above the ground floor; but in Barcelona may not exceed 20 meters in height–say 65 feet–above the ground line. This height limit would not apply to a building standing detached in its own enclosure and if used for factory purposes. Walls are massive of brick or stone. In modern buildings floors are of iron or steel joists with brick arches springing from one joist to the other, varying in thickness from one to three courses of bricks, the spandrill filled in with concrete-rubble with flat tile or wooden floor laid on top. Roofs are of flat tiles grouted in cement or heavy fluted tiles. Some modern buildings are roofed with first a course of flat tiles resting on iron tile-laths and heavy fluted tiles on top.

Austro-Hungary. According to information received, there are neither in Vienna nor in any other great towns throughout Austro-Hungary warehouses of that description, but there are a few greater firms carrying on their business in warehouses especially constructed for their respective trades, viz: Ready-made clothes for men and women, linen shoes, hats and other dressing articles. Another, carpets and furniture stuffs. The construction of warehouses of that kind is limited to the following regulations: Area of from 750 to 1000 square metres (say 8000 to 10,000 square feet), and a height of at most four stories. A petition, together with a plan of the dwelling or warehouse to be constructed, must be sent in to the municipal board of works for examination and for alterations which are eventually to be made in connection with the security of fire and life. In the course of construction, the work will be controlled and when finished, with the plan in hand, re-examined. When in order, the consent for the use of the building will be given. In pursuance with the new regulations, no building must be higher than four stories. Floor openings 3 to 4 meters square (say 10 to 13 feet) are allowed.

Russia. Enquiries made at St. Petersburg have elicited the fact that risks of this class do not exist anywhere in Russia.

***Present Problems.** While the tide has turned as regards floor and roof construction much of even greater importance remains which demands attention in new buildings, while a majority of the existing stores have been built under the old regime, many of them to remain indefinitely due to a factor of which we will speak presently, viz.: automatic sprinkler protection.*

***Sprinklers and "Fire-proofs".** Except where automatic sprinklers and "fire-proof" construction have been employed, our department stores possess no redeeming features, are as thoroughly bad as can well be conceived, in respect to danger of life and property by fire.*

In mentioning these two features (sprinklers and construction) we wish to clearly indicate our estimation of their relative importance.

In view of the large combustible stock necessarily carried throughout a department store, a fire, unless extinguished in its early stages will destroy the entire contents of a "fire-proof" building while vertical openings exist, or, the contents of one flat, if said openings are in "cutoff" shafts and the construction developed to a point where capable of withstanding such an ordeal.

On the other hand, a high power water system discharging through a proper equipment of automatic sprinklers can be installed which will positively control a fire except there are contents allowing an explosive or extensive "flash fire," continuous concealed construction behind which the sprinklers cannot spray, or large draught spaces.

Such conditions might allow the number of sprinklers opened by the heat from fire to exceed that for which it is practical to provide pipe sizes and water supplies.

As yet, such stores have not opened departments for the sale of explosives, the display of open stock is easily restricted sufficiently to prevent "flash fires," the continuous concealed spaces can be and in many cases are done away with at the time sprinklers are installed, but the large draught spaces exist to a maximum degree by means of the vertical openings. The cross section of such a building resembles a number of sieves placed one above another.

Through these openings heat from a fire can instantly spread, operating sprinklers on all floors to a number which may overtax any system put in under past or present standards. Another argument against such openings.

We consider sprinklers to be of prime importance; "fire-proof" construction of comparatively nominal value except it will confine the fire within the flat where it originates.

Sprinklers and Hose Streams. *It is now generally conceded that after the first stages of a fire (when hand appliances may be used) sprinklers only can control a fire in these large area stores into which hose streams cannot penetrate. Hose service is essential, however, in following up the sprinklers and accomplishing the complete extinguishment. If sprinklers are of such importance they should not be handicapped, possibly rendered inefficient by faulty construction.*

Past Fires Without Sprinklers. *In a hasty examination of fire records, we find note of 10 stores of a departmental character which have of late years been destroyed by fire. Fortunately in no case did fire occur during the daytime when stores were crowded with people. None of these stores were sprinklered, while each had vertical openings which notably spread the fire. We add this list with our correspondents' remarks.*

SIEGEL COOPER & Co., CHICAGO, ILL.

Burned about 8 years ago. An old building of ordinary construction having open stairways, elevator shafts, etc., through which the fire had a clean sweep resulting in a total loss in less than an hour. Value approximately $300,000. Fire was on all floors within 8 minutes of its discovery.

FAMOUS SHOE & CLOTHING COMPANY, ST. LOUIS.

Fire of Dec. 8, 1892. Originated in show window trimmed with cotton. Caused by engineer's lighted alcohol torch, while putting in electric wires. Spread of fire very rapid, destroying contents of window, extending to the store and communicating with large light shaft in centre of store. Only the most prompt action of automatic alarm and fire department prevented a complete destruction. Loss $35,000.

BARNES HENGERRER & CO., BUFFALO, N. Y.

Fire of about twelve years ago. The quick destruction of building and contents was attributable to the fact that entire first floor was filled with light fabrics displayed on racks, etc. Of course as the elevators and stairways were not protected the fire quickly spread to the upper stories.

DUNLOP BUILDING, COLUMBUS, O.

On the night of Feb. 1, 1899, fire started in the basement near elevator shaft. The elevator was open, thus acting as a flue and causing the flames to almost instantly reach the upper stories of building, even before the department could respond. The building in question was destroyed.

Fire spread to buildings adjoining on the south and also damaged the Green Joyce building to the extent of about $10,000, stock therein to the amount of $171,000.

RUST BUILDING, COLUMBUS, O.

Fire of Feb. 1, 1898 , was caused by explosion of drugs in drug department. Fire spread through elevator, light and stair shafts. Building was of fire-proof construction, insured for $25,000. Loss about $21,000. Insurance on department store tenants must have been $125,000, on which there was a large loss paid.

THOMAS H. GROVES BUILDING, COLUMBUS, O.

Fire of July 2, 1898. In this building of ordinary construction, fire spread through light wells accomplishing a loss of $34,000 on $50,000 insurance.

J. L. HUDSON CLOTHING COMPANY, COLUMBUS, O.

Fire of Dec. 23, 1897. In this building of slow burning construction, fire communicated through large light well from a building adjoining. Loss $102,000. This fire is a good illustration of the rapid spread of flames on account of vertical openings.

C. ROSS COMPANY, LTD., OTTAWA, CAN.

Burned out Dec. 3, 1896. Fire originated in basement of building containing a light well which acted as an agent conducting fire to the top and every flat simultaneously, which then leaped the fire wall of adjoining building burning it from top to bottom, which in like manner leaped the fire wall of the Ross Company building gaining entrance through a skylight in their roof and burning it from top to bottom.

If the Ross building had not had a skylight in the roof, the chances are it could have been saved. Total loss in round numbers was $300,000.

THE ROBERT SIMPSON COMPANY, TORONTO, CAN.

March, 1895. Building was a substantial 6-story brick structure. Before the fire brigade arrived upon the scene, the fire had spread from basement to the top flat, no doubt due to the open well running straight up through the building. Total loss $350,000. The rapid spread of fire was clearly due to vertical openings.

JOHN EATON COMPANY, TORONTO, CAN.

May 20, 1897. Fire was burning on every floor, due to vertical openings, before the brigade arrived. Loss was total, $325,000.

(All the above mentioned Toronto stores had "large open wells up through the centre of the buildings, open hoists, and open stairways which contributed to the rapid spread of the fires, resulting in a total loss in each case.")

More stores would have been burned except for the automatic sprinkler which has in many unquestioned instances changed what would have otherwise been a total destruction, perhaps a conflagration, into a trifling water damage. Yet there are many stores unsprinkled, many are not properly equipped to make the control of a light well fire reasonably sure and the best of equipments may not be kept in service all the time. Neither will sprinklers prevent fires starting, smoke therefrom or resulting panic.

Past Fires Sprinklered. *We have record of over twenty fires in department stores controlled by automatic sprinklers. These also have almost invariably occurred in the night and many of them in places remote from vertical openings as in brick waste paper bins, boiler rooms, etc. One fire, however, is noteworthy in this connection, that at Bloomingdale Bros., New York, occurring at 1 A. M., Dec. 17, 1898, and warrants extended comment.*

The section in which fire started is nearly all taken up by a large light well, 40 x 35 feet extending from first floor to roof, with heavy glass skylight at top. The entire premises are equipped with a system of Grinnell glass disc sprinklers, supplied by five pressure tanks containing 15,000 gallons of water when two-thirds full and under 70 pounds pressure at tanks giving about 95 to 115 pounds at sprinklers in the building in which fire occurred. Also six gravity tanks of about 50,000 gallons total capacity. This exceptionally powerful water supply had been installed a few months previous under specifications of the New York Board of Fire Underwriters.

In the centre of the light well referred to, a platform about 8 feet square and 10 feet high had been built on the first floor, and on this stood a Christmas tree 40 to 50 feet high, decorated with the customary trinkets, etc., while from the tree to the iron columns at the different floors extended streamers of evergreen.

Should judge from the marks of the smoke that fire started somewhere between the first and second floors, and opened 2 sprinklers on the first floor, 4 on the second, 10 on the third, and 1 out of 12 at top of light well, 17 in all. Sprinklers checked fire and department extinguished it.

We would call attention to the following facts. Fire spread rapidly, due to Xmas tree, its decorations and the large open draught space. There was little open stock on the three floors in vicinity of well to which fire could quickly communicate, galleries being used for passageways, having curtain walls on three sides and restaurant on part of fourth side. Therefore, as the tree and its decorations constituted the only fire and were quickly consumed, the sprinklers had an excellent opportunity. The heat spread into the different flats in rising, opening on successive floors 2, 4 and 10 heads. Under skylight, there were 11 high test 286 ° F. sprinklers and by mistake 1 ordinary 160°F. sprinkler. Only the latter opened. Glass in skylight was not cracked and little of the paint on interior of well was blistered. These conditions, spreading fire and smoke at once to three different floors would have endangered hundreds of lives had fire occur[r]*ed 12 hours earlier, and this is the thought of chief importance.*

A secondary lesson is that under certain conditions sprinklers will control a light well fire. This does not mean that all of the present equipments in light wells can be relied upon for similar results. Many have a larger number of communicating stories with opened goods and few have such an effective water supply. The fire annihilating energy of automatic sprinklers under 75 to 100 pounds pressure, sustained no matter whether one or many heads open, should be witnessed to be appreciated.

Protection to Life of First Importance. *One might ask "Why has the construction of vertical openings been continued unquestioned?" We assume the insurance authorities after urging better methods without avail, have endeavored to make a rate to cover the hazard. The paramount danger of existing circumstances is from a humanitarian standpoint. It concerns the lives of the people and cannot have been appreciated by them or the authorities. Consider the stringent municipal theatre regulations. The chief hazard is in the stage section which is cut off from the auditorium by brick wall and asbestos curtain. The audience, but 1,500 to 3,000 in number, are not amidst piles of combustible materials, are provided with numerous exits by which all can reach the street in several minutes; certain protection is required as hose connections and fireman on duty during performance.*

Perhaps across street in same city there may be a department store of the construction so common, enormous area piled with combustible contents, with four to eight floors pierced by light wells, stair and elevator shafts, each opening into every floor, and, as a rule, poorly located in respect to each other for egress in time of fire.

Imagine a fire occurring at Xmas time in a light well, perhaps decorated as hereinbefore described.

Whether building was sprinkled or not, fire and smoke would instantaneously spread to many or all floors, crowded with perhaps ten thousand people.

Would they form in line during the subsequent half hour, wait for such elevators and file out through such stairways as might not be filled with smoke and flame or would there be one wild rush with attendant slaughter too awful to contemplate?

With a fire thus spread through such a light well and for any reason beyond control of sprinklers (if any) no fire department would avail although making use of the best water supply and apparatus existing or contemplated. Even if possible, it would be too late to save most of the inmates.

Who* [Is] *Responsible? *Conditions exist in many cities which any day may result as outlined. The needs of the property owner and insurance company have not as yet required otherwise. The people, with characteristic lack of forethought are heedless of their peril and await some awful lesson compared with which the Paris charity bazaar fire or our own hotel horrors will be as nothing.*

The Remedy. *Where people (chiefly women and children) are allowed to gather in such enormous numbers and in the midst of inflammable materials, numerous fire-proof, cut-off exits should be provided. Automatic sprinklers should be insisted upon. Open communication between floors should be prohibited as being a possible menace to sprinkler system but chiefly as they are the means of instantly conveying smoke which would cause a stampede.*

With these requirements fulfilled, there should be no knowledge of a fire except by those near where it occurred.

CONCLUSIONS.

1 (a) There should be no light well.

(The loss of illumination due to abandonment of the light well can be more than made up by a proper use of the wonderful Luxfer prism glass in wall windows helped out in especially deep or angular buildings by the modern artificial white lights.)

(b) Where such a well is allowed to exist it should be shut off from communication with each story by "wire " or " prism" glass partitions set in non-combustible frames, permanently secured in position. First story to be shut off from well by a similar horizontal partition at ceiling level. For deep wells, the arrangement of Luxfer prism glass shown on next page is suggested.

© So long as light wells are allowed to remain in violation of "a" and "b" above, they should not be used for display of goods or of any inflammable decorations. No temporary structures should be allowed therein. Where an exception is made for the display of goods on first floor counters, automatic sprinklers should be placed directly over said goods on level with ceiling of first story. These can be fitted to brass pipes in a manner quite decorative and are in addition to the sprinklers otherwise called for in well by the sprinkler regulations.

2. Stairs and elevators should be in brick shafts with spacious entryway on each floor within each shaft. A standard slide fire door should be hung at shaft side of each opening into entryway permanently secured open by a 600 degrees F. solder releasing device. This is to insure that door shall not be closed by hand in time of panic and yet will close automatically at a high temperature. There would be two or more door openings from each floor into each shaft. They would extend but part way to ceiling, thus reducing the tendency of smoke to escape in that direction. The normal draught would be toward the ventilating ducts and would be sufficient to reduce the danger of hot air and smoke explosions.

The placing of doors at shafts is open to criticism inasmuch as they might be closed while people were yet alive within the burning room. We believe this can be met by concealed sliding doors operated by an automatic device located near the floor and requiring as high a temperature at that point as would be obtained by the presence of flames.

These shafts with glazed brick, tile or mosaic walls should present a pleasing appearance and above all afford a sense of security to the customer which some day may be a feature in the popularity of a store.

3. Ventilation should be obtained by forced draught through specially constructed brick ducts with openings from same to rooms arranged to prevent passage of smoke back into rooms. We are informed that light weight (mica) check valves have for years accomplished this purpose as used in chimneys of English houses. Some such system is essential in order to obtain correct ventilation if for no other reason.

4. An effort should be made to secure suitable non-inflammable materials for trim finish and such furnishings as counters and shelves.

5. With the other requirements observed, it may not be necessary to consider the question of area. Yet "division" or even "curtain " walls are recommended. In any event, it is more essential to "stop" vertical openings with their attendant fire spreading draughts than to restrict ground area.

6. Walls, floors, roofs and partitions to be of the best "fire-proof" type which (vertical openings not being allowed) shall be capable of confining a fire within the story where it may originate.

7. Last and of the greatest importance. A complete, standard, automatic sprinkler system should be installed having supplies capable of delivering water for long periods at high pressure. This system should be kept under rigid inspection.

On it a constant burden rests for the sprinkler must ever be on duty to perform its work by day or night.

In it the greatest power lies as when the smoke is thick and men stand back, when the hose jet would pierce the window only to be scattered by the first obstruction, the sprinklers far within the building are quietly surrounding the fire and are holding it firmly in check.

By it alone does the department store of today exist for had the fires controlled by automatic sprinklers during the past seven years been combatted only by the other existing appliances, we believe the loss of values and perhaps of life would have been so materially increased as to have provoked many stringent regulations not now in force.

The information and recommendations contained in Mr. Crosby's paper presented at the Annual Meeting of the National Fire Protection Association in 1899 appears to be far ahead of its time. It is apparent that the hazard of unenclosed vertical openings was clearly recognized in the late 1800's, and the recommendations put forth bear a remarkable resemblance to the provisions for unenclosed floor openings (atriums) included in the building codes utilized in the United States today. Hence, the origins of the atrium provisions included in modern codes can be traced to as early as 1899, and, more than likely, even earlier.

It is also interesting to note the expression of concern for, what is termed, as "life safety". The hazard of unenclosed floor openings to the occupants of a building was clearly recognized in the late 1800's.

* * * * *

Source: "*Proceedings of the Third Annual* [NFPA] *Meeting*", Boston, Massachusetts, 1899.