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FIRE PROTECTION HISTORY-PART 196: 1901 ("FIREPROOF" WOOD/U. C. CROSBY)

By Richard Schulte

The fifth Annual Meeting of the National Fire Protection Association (NFPA) was held in Chicago in June 1901. Among the various topics discussed at this meeting was the subject of "fireproof" wood. Immediately following this discussion, Uberto C. Crosby was honored for his contributions to the Association by being named the first honorary life member of the NFPA. The following is the transcript of the discussion on "fireproof" wood:

"***REPORT OF COMMITTEE ON FIRE RETARDANT TREATMENTS OF WOOD.***

H. A. Fiske, Chairman, F. E. Cabot, F. M. Griswold, C. E. Worthington, C.B. MacKinney, W. C. Robinson.

In taking up this subject your Committee would consider it advisable to divide the report into two main topics.

First. Fireproofed wood; that is, wood chemically treated internally as well as externally, so as to render the wood practically non-inflammable throughout.

Second. Fire retardant coatings for wood, such as paints and compounds of a similar nature.

I. FIREPROOFED WOOD.

On the subject of fireproofed wood, it is our aim simply to present to this Association such information as we have been able to gather regarding the various kinds of fireproofed wood now on the market, as to its general features, good or bad, processes used, tests made, and in a general way to turn over to the Association the results of our investigation in the form of a brief report.

We have taken up the subject only in its connection with the processes of recognized standing.

It would appear that there are practically but two companies which are prepared to supply the so-called fireproofed wood in quantities sufficient to meet any ordinary demand, namely, The Electric Fireproofing Co., with head office at 119 West Twenty-Third street, New York City, and The American Wood Fireproofing Co., with offices at Bowling Green building, New York City, and works at Newark, N. J. There also appears to be at least one other organization advertising as manufacturers of fireproofed wood, namely, The New York Fireproof Wood Co., 38 Park Row, New York City; but this concern is not yet prepared to supply the market.

The Electric Fireproofing Co.

Wood treated by this company has been in use and on the market for some six years. About 1895 they furnished some wood to the United States Government for use in war vessels, and they have since that time done considerable government work.

Practically all of the United States warships of recent date are furnished with wood treated by this company's process. This company has also supplied wood for several of the large fireproof buildings in New York City. Also a large amount of smaller work, including some for telegraph, telephone and electric companies.

The American Wood Fireproofing Co.

This company has had its product on the market but a comparatively short time. They have furnished fireproofed wood for the Western Electric Instrument Company's building at Newark, also some for the New York Yacht Club house. Also their wood has been used by the Ordnance Bureau at the Brooklyn Navy Yard. We understand that the contract for the U. S. S. Baltimore has been awarded to this company.

Processes.

The Electric Fireproofing Process is known as the Bachert process. The wood is placed in large steel cylinders and steam is admitted under light pressure. After a time the steam is withdrawn and a vacuum created which draws the sap and dissolved resins and gums from the wood. A solution of phosphate of ammonia and sulphate of ammonia is then introduced and varying pressures applied according to the thickness and nature of the wood to be treated, but not exceeding approximately 200 pounds to the square inch. After treatment, the wood is kiln dried for a considerable length of time.

The American Process. Wood is steamed under 10 lbs. pressure, then the sap is withdrawn by means of a vacuum as in the former process. After the sap is withdrawn, any acid remaining in the fibre is neutralized. A chemical solution is then introduced under 200 lbs. pressure. It appears that various combinations of chemicals have been used and patented by this company, including the soluble sulphates such as ammonia, sodium and zinc.

The New York Fireproofing Process is known as the "Ferrell" process. We do not know what chemicals are used in this process. There is no steaming or vacuum used. A heavy pressure (said to be even as high as 1,200 to 1,500 lbs. to the square inch) is used to force chemical solutions into the wood. Steam heat is used to aid in this process.

Tests.

A number of tests have been made on wood treated by the companies noted, with results which, we think, may be considered generally satisfactory.

Tests have been made by the United States Government, also by the New York Building Department, and by the British Fire Prevention Committee, etc. Your Committee can hardly consider these tests conclusive, as the data obtainable is meager, as the Government and the Building Department of New York publish no detailed reports of the tests.

The results of tests by the British Fire Prevention Committee as applied to wood treated by the Bachert process appear to be satisfactory.

Taking the tests as a whole, they appear to show that the wood has been so treated by at least one of these companies as to render it non-inflammable to such a satisfactory extent that there appears to be no reason to question the entire practicability of treating wood by processes as outlined so as to render it non-inflammable.

Tests have been made at the Stevens Institute of Technology and by the Ordnance Department of the United States with reference to weight, strength, etc.

One test as reported shows that the wood increases in weight from 34 pounds per cubic foot to 68[-]1/2 pounds after treatment, which again decreases to 37[-]3/8 pounds after kiln drying, that is, the final gain in weight over untreated wood is about 10 per cent.

Tests for strength show approximately as follows:

White pine shows a gain in transverse or breaking strength of 7 per cent.
Yellow pine shows a loss of transverse strength of 12.6 per cent.
Compression tests show a loss of from 6.1 to 9.2 per cent.
Tension tests show a gain of 19 to 24 per cent.

Government Tests and Approvals.

Wood fireproofed by the Electric Fireproofing Co. has been used by the United States Government some five years.

During the last year, extensive tests have been undertaken at the Boston Navy Yard. They were to determine the comparative value of wood fireproofed by the American Wood Fireproofing Co. and the Electric Fireproofing Co. We understand that none of the first-named company's wood has been used in the navy up to the present time, but as a result of these tests it appears that they have now obtained the approval of the Government and can compete with the Electric Fireproofing Co. in this line of work. No published reports of these tests are obtainable.

Tests and Approvals by the New York Building Department.

This department has made tests on wood as fireproofed by three companies, the Electric Fireproofing Co., the American Wood Fireproofing Co., and the New York Fireproof Wood Co.

In their reports, it is stated that the wood as made by the Electric Fireproofing Co. is acceptable, and that other makes of wood are not acceptable, and from such information as we have secured the reports of the tests on wood as treated by the last two companies appear to show that they did not successfully withstand the tests.

Under the building laws of New York fireproofed wood is required in all buildings over 12 stories in height, so that apparently at the present time the only wood which can be used in such buildings is that treated by the Electric Fireproofing Co.

In this connection it may be well to note that the New York Fire Insurance Exchange in its schedule of rates covering fireproof buildings gives a reduction of 5 per cent from the building rate when all woodwork is fireproofed.

Cost.

The cost of ordinary lumber not exceeding 1 inch in thickness as fireproofed by the Electric Fireproofing Co. is $50 a thousand, with an additional $15 for kiln drying, making a total of $65 per thousand.

The price of the American process is about $5 less than the above.

It is claimed that timbers as large as 12x12 can be completely treated. We have seen timbers 6 inches thick which apparently had been rendered thoroughly non-combustible, as slivers taken out of the interior would not burn. The cost of such large fireproofed pieces is much greater than noted above.

Permanence.

Tests have recently been made by the government on wood taken from the torpedo boat Winslow. This wood was fireproofed by the Electric Fireproofing process and had been on the boat five years. The report shows that pieces of the wood were subjected to various kinds of heat and flame tests, and it would appear that the wood had not in any appreciable degree regained its inflammable qualities.

Corrosion.

It is absolutely essential that wood be thoroughly dried before using. There has been some trouble from corrosion of metal in contact where fireproofed wood has been used. It would appear that wood can be treated and thoroughly dried so that if used in the ordinary dry atmosphere generally found inside of buildings in our climate, it should not give trouble from corrosion. A good coating of paint or varnish is undoubtedly a desirable feature. We understand that the United States Government had made tests of fireproofed wood first coated with kaseine or fire retardant paint and then finished with varnish paint, which treatment appears to mitigate if not overcome any trouble from corrosion.

Where trouble from corrosion has been reported, it seems to be at least probable that faulty preparation of the wood was a prominent factor, also that it may possibly in some measure be due to the use of deliquescent salts in treatment.

Finish.

Wood treated by the above fireproofing process appears to take a finish better than does untreated wood, owing to the fact that it is already filled by the fireproofing salts, and therefore, needs no other preparation to fit it for the application of paint, varnish or polish. There is some question, however, whether the finish is not more liable to blister or check than on untreated wood.

Working Fireproofed Wood.

From all that we can learn, it would appear that while wood which has been fireproofed is harder to work than untreated wood, still this difference would not seem to be any greater than that known to exist between certain soft and hard woods in common use.

Conclusion.

It appears that wood can be so treated as to render it practically and permanently non-inflammable. The expense of such treatment is large and the cost of the treated wood renders it almost prohibitive for general use.

The methods of treatment which present the most favorable results apper [appear] *to be the costlier, i. e., the better chemicals to use are more expensive than some others that are either being used or are liable to be used in such processes. This in itself is an undesirable feature on account of the tendency there will be to use cheap, objectionable and less effective chemicals. It is also evident that even in the most approved and successful of fireproofing processes, its value depends upon the thoroughness and care exercised in the treatment.*

Assuming that satisfactory processes have been or can be devised, we think it will be very difficult to guard or legislate against such undesirable features as careless or improper treatment, incomplete drying or use of objectionable chemicals, and we think that this side of the question should receive careful consideration by the Association before deciding to proceed further with this subject.

II. FIRE RETARDANT COATINGS FOR WOOD.

So far as the general aspect of this matter is concerned, we would refer to the report made to this Association two years ago by the Committee on Fire Retardant Paints.

There are at present on the market a large number of paints and similar compounds properly classed as fire retardants in comparison with such coatings as ordinary oil paints, varnishes and the like; but as there are so many compounds on the market, and in the absence of any specific and convincing tests, your Committee does not feel that it is in a position to judge between the conflicting claims of the various manufacturers.

We are, however, of the opinion that several of these compounds have considerable value as fire retardants and are deserving of careful consideration by the Association, and we would recommend that compounds of this nature be referred to the Laboratory for investigation and test.

In taking up the subject of the proper method of testing fire retardant coatings, we wish first to call attention to the fact that the basis for tests of surface fire retardants is entirely different from that under which fire doors, fire-stop partitions or similar materials should be tested. In the case of fire retardant coatings, the resistance is not expected to continue for more than a brief period, but it is expected to have sufficient quality of non-inflammability to prevent the spread of a flash fire or one of short duration over any considerable exposed surface of wood, and by excluding air from the adjacent surfaces to greatly diminish the rapidity of the spread of combustion.

In making tests on coated wood, we recommend that the following general conditions be observed:

First–Tests to be made of the action of wood protected by such a coating when subjected to a flame test of moderate intensity and moderate area approximating as nearly as possible to the intensity of the ordinary fire during its early stages.

Second–Tests to be made by burning moderate quantities of chaff or similar combustible material on horizontal surfaces to determine, if possible, whether the coatings would resist slow heat generated by the burning of a pile of dust or offal on the upper surface of a beam, timber or floor boarding.

Third–Test to be made which shall correspond as nearly as possible to the conditions likely to occur in case of fire in an establishment where there are moderate quantities of naphtha or other volatile substances which would generate a high degree of heat for a comparatively brief period.

Fourth–Tests to develop the adhesive qualities and tenacity of the coatings, that is, what conditions will cause them to flake, peel or blister, and whether they are subject to such action under the ordinary condition as found in practice.

These latter tests to include a time test, a moisture test and a heat test.

The time test to be extended over a period of at least six months, the coated wood being subjected to normal conditions during that time, and also to such alterations of ordinary heat and cold as are practicable.

Moisture Test.–Note to be taken of the hygroscopic condition of the surfaces during the previous tests; that is, whether moisture gathers upon them or otherwise; and samples of the coated wood to be subjected also to a steam bath of considerable duration to determine the effect on the coating, and whether, after drying, its effectiveness is impaired.

Heat Test–Samples of the coated wood to be subjected to conditions which would be met with in the ordinary dry kiln.

Mr. Fiske. Before this subject is taken up for discussion I should like to say a word personally. This part of the report which refers to fireproofed wood particularly the Committee did not get to work upon until rather late in the year, and we do not consider that we have made by any means an exhaustive report on the subject–we have simply endeavored to give what little information we have obtained; and I think the Committee as a whole would like to be continued in this line of work, if the Association shall see fit to continue it. The question of fireproof wood, as you can easily see, is one which cannot be dealt with in a minute. It is now in its infancy. We have had in the ordinary line of work practically no experience with it, or very little, at least, and it would seem to be a subject the study of which could be continued for some length of time, taking it up little by little and keeping track of the work of these various companies as they go on. I think that is all I have to say.

AFTERNOON SESSION.

The President. The first business before us this afternoon is the discussion of the report of the Committee on Fire Retardant Treatments of Wood. Does any gentleman wish to say anything upon this subject?

Mr. Crosby. Mr. President, I would like to call on Mr. Cabot and ask him to tell us the fairy tale which he told me the other night, not wishing to convey the idea that I believe it at all, but I would like to have you all hear it. It is his experience with fire retarding treatment of wood, and it is most remarkable, and I know it will interest you.

Mr. Cabot. I am always glad to please Mr. Crosby. The story is this. Up in Andover, Massachusetts, there was a barn, which we may represent by this piece of paper, which was somewhere 30 or 40 years old and had about outlived its usefulness. It belonged to the trustees of the Academy there. They decided to build a new barn in addition to this, and with the Secretary's permission I will take one of his envelopes to represent the new barn. It stood on a side hill, such as is found in New England alone, so far as I know, bare and thoroughly exposed to the northwest wind which prevails largely in that locality through the winter. While this barn was being built the manufacturer of one of these so-called fire-retardant paints thought he saw an opportunity to put a rather good advertising scheme through, and so he contracted with the trustees of the Academy to paint the inside of the barn, his special plea with them being that it could be washed, and as they were going to use it for a milk barn it was very important that the interior should be kept scrupulously clean.

They had begun the treating of the inside of the barn and had finished the lower floor–had not done the mow nor the whole of the roof, but had done the uprights and most of the roof timbers, including the plate, when this building was entirely destroyed by fire, nothing left of it except a little piece of one sill. There was a drive-way through the center of the building onto this floor, and the man who discovered the fire was in this section of the barn, and he had presence of mind to run over and shut the door. That door is in Boston to-day and there is about a thirty-second of an inch of the stock left. Looking at it from one side, the side which was painted with this fire retardant paint, you would say it was practically a perfect door. The fire was on one side of it and it burned until it got to that part of the wood to which the fiber carried the asbestos or magnesia or whatever mineral earth they used as a basis for the paint. The fire took off the upper end of the roof and burned the cupola off and took off the shingles and some of the boarding on this end, but the extension of the barn was there after the fire, and the chief of the fire department told me that it was no credit to him. He said, "We didn't get there until seven or eight minutes after the fire started and we had to lay seven or eight hundred feet of hose, and there wasn't much water pressure, and if it hadn't been for the paint you wouldn't have the barn."

That case I know about. The other tale I can't vouch for, but it was told me by an adjuster who went up to Wells River, where there had been a fire in the ell of a house. He said the man who took him up to the house led him in a curious roundabout way so that he approached the house from the rear. He looked at it and saw that there had been some smoke and some fire, that some of the window frames were gone and the roof was partly destroyed, but the outside of the house was practically in its original condition to all appearances. He looked at it and said, "Well, I guess we can settle this up pretty quick, there is only a partial loss." But the man said, " Hold on a minute," and he walked up to the house and stuck his pocket knife through the side of it. Upon investigation it was found that there was about a sixteenth of an inch of clean wood, which had been protected by this crystalline fire retardant paint. The whole inside of the place was burned out, but there hadn't been wind enough up to that time to blow the shell down. As soon as a wind came the whole thing fell.

Mr. Merrill. Mr. President, I have some slight changes which I would suggest in the wording of the standard, beginning with the first recommendation. I regret that I didn't have time to get these into Mr. Fiske's hands before the report was in print; I have shown them to him since then, however, and I will now ask him to accept these few amendments to the report as submitted. They change the wording a little, but do not in any way change the intent of the standard. Incorporating the amendments which I suggest, the recommendations as to the general conditions to be observed in making tests on coated wood will read as follows:

First–The action of wood protected by such a coating shall be observed when subjected to a flame test of moderate intensity and moderate area approximating as nearly as possible to the intensity of an ordinary fire during its early stages.

Second–Moderate quantities of chaff or similar combustible material shall be burned on horizontal surfaces to determine whether or not the coatings will resist slow heat generated by the burning of a pile of dust or offal on the upper surface of a beam, timber, or floor boarding.

Third–Tests shall be made corresponding as nearly as possible to the conditions likely to occur in case of fire in an establishment where there are moderate quantities of naphtha or other volatile substances which would generate a high degree of heat for a comparatively brief period.

Fourth–Tests including a time test, a moisture test and a heat test, shall be made to develop the adhesive qualities and tenacity of the coatings, that is, what conditions will cause them to flake, peel or blister, and whether they are subject to such action under the ordinary conditions found in practice.

The time test shall extend over a period of at least six months, the coated wood being subjected during that time to normal conditions, and also to such alterations of ordinary heat and cold as are practicable.

For the moisture test note shall be taken of the hydroscopic condition of the surfaces during the previous tests, that is, whether or not moisture gathers upon them. Samples of the coated wood shall also be subjected to a steam bath of considerable duration to determine its effect on the coating, and whether after drying the effectiveness of the coating is impaired.

During the heat test samples of the coated wood shall be subjected to conditions which would be met within the ordinary dry kiln.

The President. Inasmuch as the Committee makes the recommendation that it be continued, and the subject is hardly completed, I would suggest that Mr. Merrill's amendments be referred to the Committee for consideration.

Mr. Merrill. Pardon me. In [I] *understood that the Committee asked to be continued for further consideration of the question of fireproofed wood, but that these recommendations on Fire Retardant Coatings for Wood were submitted as a standard for the present.*

The President. Was that the intention, Mr. Fiske?

Mr. Fiske. Yes; that was the intention; I was simply referring to the fireproofing of wood. If the Association sees fit to do it, we should be glad to see the second portion of the report adopted; and I should like to say for the Committee, as I think I can, that we would be glad to accept these suggestions made by Mr. Merrill. A majority of the Committee is present, and unless some objection is made I think that they can stand.

The President. Will you poll your Committee to that extent?

Mr. Fiske. I have already done so, and it is satisfactory to us to accept the suggestions.

Mr. Stewart. By a report of this kind, on this question of fire retarding paints, we are naturally encouraging manufacturers to go into that line of business; and I would like to ask if the Committee has considered the relative merits of ordinary whitewash as compared with some of these patented fireproof paints?

Mr. Fiske. I think that has been pretty thoroughly discussed and considered, and as a matter of fact we know of no cheap material like whitewash which will begin to compare with such substances as we have generally designated as fire retardants. I would not consider whitewash in that class, in reality; that is, while it temporarily is a fire retardant, still, as compared with some well known fire retardant paints, it is of comparatively little value. I think we are very sure in taking that position.

Mr. Stewart. I would like to ask if the Committee has any information as to how long these patent paints will last without re-coating?

The President. I would like to refer Mr. Stewart to a report on that subject made two years ago, wasn't it, Mr. Secretary?

Mr. Crosby. Yes, sir, I think so.

The President. Two years ago or three years ago the subject of fire retardant paints was reported on by a committee, and the work of the present committee is in the nature of embodying in the shape of a standard the knowledge gained by the former committee.

Mr. Stewart. What I had in mind was this, that our experience in Chicago has shown that these paints, depending on their relative qualities, have to be replaced sooner or later; and it was a question in our minds, considering the fact that whitewash is a good deal cheaper, although it may have to be replaced oftener, whether in the long run it was not almost as good as a fireproof paint, and perhaps cheaper to the assured.

Mr. Crosby. I would like to suggest if it would not be wise for the Laboratory to make tests of these patent washes and also of whitewash, with which they can compare the patented materials? I simply suggest to them that they give us a report on whitewash.

Mr. Cabot. One serious difficulty about whitewash is that it does not stay. The fire retardant paints of which we have been talking all use a substance, which has only recently been made commercially, so far as I know, kaseine, for binding, and the base may be various mineral earths.

The President. There is no doubt in my mind there has been quite an advance made in the manufacturing of fire retardant paints. Washes made entirely without earth are now on the market, and the sticking quality of the kaseine is made use of in binding the asbestos, or whatever it may be. The washes are usually water washes, and they become quite hard and are not easily washed off or dissolved after they once set.

Mr. Anderson. Some time ago I visited a large flour mill, and the proprietor told me he didn't carry any insurance at all. He said that about four years before he had painted his entire building with a "fireproof" paint. The woodwork showed no stain whatever. I cut a piece of wood from one of the joists, about an inch and a half long and about an inch wide; I split that piece in two and threw half of it in a stove where there was a fierce fire burning, and it merely charred on the outside. The other piece I left in the office of the Inspection Bureau, and I believe they sent for some samples. The paint had been on three or four years, and, as I say, the wood showed no stain.

Mr. Eldridge. I think some recognition should be made of whitewash. There is a Government formula which was deemed so valuable in our section that we had it printed and distributed, and it is used quite extensively. I submitted a sample to Mr. Merrill and he passed upon it very favorably, and I think it ought to be mentioned with the others. It is cheap, and it seems to be quite durable.

The President. Mr. Merrills's suggestions are before the meeting. I believe Mr. Fiske for the Committee is ready to accept them.

Mr. Fiske. Yes.

The President. The motion then is that the subject of fireproofing of wood be referred back to the Committee, by request of the Committee, and that the Committee be continued.

Adopted.

The President. A motion will now be in order to adopt the report on Fire Retardant Coatings for Wood– it does not say fire retardant "paints," but fire retardant "coatings" for woods–with Mr. Merrill's amendments. Are you ready for that motion?

Mr. Stewart. I would like to hear from Mr. Merrill about that test of this Government whitewash which it is said he has made.

Mr. Merrill. I have nothing definite to report on that, Mr. President. The Government formula for whitewash is generally considered to be a very good formula for making that form of a fire retarding coating. We have no comparative tests of different forms of whitewash, or between different fire retarding coatings at the present time. We wait your pleasure in the matter of adopting standards, as we are compelled to do under your rule before we can proceed to any such tests. It is the adoption of this standard, or some standard, that we are anxious for so that we can proceed with the necessary investigations under the rules here laid down.

The President. The standard as prepared of course is simply a method of making tests, not the standard for material.

Mr. Goddard. There is nothing in the standard presented here which prevents the laboratory from testing all the whitewashes they want to. It is simply a method for testing any coating.

The President. Certainly; it is simply a method for testing any fire retarding coating for wood.

The report as amended by Mr. Merrill is adopted.

Mr. Stratton. Do I understand that this disposes of the entire report?

The President. I so understand it.

Mr. Fiske. I so understand it.

Mr. Stratton. I now move you, Mr. President, that the appointment of all committees and the assignment of all work for the coming year be referred to the incoming Executive Committee with power, as has always been done in the past.

Adopted.

Mr. Stratton. It is my very great pleasure now, Mr. President, carrrying [carrying] *out the duty imposed upon me as Chairman of the Executive Committee, to offer, as a result of the meeting which the Committee has just held, a recommendation of the Committee that Mr. U. C. Crosby be the first to be honored, under the amendment to our Articles of Association which provides for the election to honorary life membership of those who may have been distinguished in our work or who are otherwise qualified. Mr. Crosby is in every way so qualified. For many years he has been identified with this work, was prominent in it before our organzation* [organization] *was formed, and was one of the promoters of this Association and its second President. It seems peculiarly fitting that he should receive this recognition at our hands, and the Executive Committee has so voted.*

Mr. Anderson. I move that a rising vote be taken on the motion. Adopted.

The President. I declare Mr. U. C. Crosby to have been unanimously elected an honorary life member of the Association, and it will be in order for the Secretary to so advise him.

Of particular note is the use of "fireproof" wood by the United States Navy. The Navy's use of "fireproof" wood spurred the development of this, and similar types of products, and then the application spread to the construction sector of the civilian economy.

It is interesting to note that the use of "fireproof" wood was required in the construction of buildings over 12 stories in height by the building laws enacted by New York City.

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