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FIRE PROTECTION HISTORY-PART 138: 1907 (COTTON FIRE PROTECTION)

By Richard Schulte

A little over a century ago, coal was our principal source of energy and lighting was still provided by burning gas and oil in lamps. The fire apparatus used in our major cities, such as New York, Chicago, Philadelphia and St. Louis were horse-drawn “steamers”, pumps powered by coal-fired steam boilers. Tall buildings at that time were ten stories in height.

Major disasters such as the Iroquois Theater Fire in late December 1903, the Great Baltimore Fire in February 1904, the Great Toronto Fire in April 1904 and the San Francisco Earthquake and Fire in April 1906 seemed to be almost commonplace events. And these fires were followed by the Collinwood School Fire in March 1908, the Union Stockyards Fire in December 1910, the Triangle Shirtwaist Factory Fire in March 1911, the sinking of the Titanic in April 1912 and the beginning of the Great War in 1914.

Part of what makes the history of fire protection of so fascinating (at least to me) is also learning about some of the events which shaped America in which the fire protection field developed. In the first decade of the 1900's, as in previous decades both before and after the Civil War, cotton was still a major export crop. Hence, a presentation on cotton made at the eleventh Annual Meeting of the National Fire Protection Association in 1907 was of much interest at the meeting, but today is just more of a background on life in America at that time.

> “*The President: The next subject on the program is "The Cotton Bale as Source of Loss by Fire " by Mr. Benjamin Richards.*
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> ***THE COTTON BALE AS A SOURCE OF LOSS BY FIRE.***
>
> *By*
>
> *MR. BENJAMIN RICHARDS*
> *Associate Member, Boston, Mass.*
>
> *I desire to present to this Association a brief review of the deplorable conditions affecting the fire losses in raw cotton and to point out such facts as are available to aid in suggesting improvements which will reduce the excessive yearly fire tax on our valuable cotton crop.*

Although I have given this subject some study for the past three years I have as yet been unable to discover a single point in favor of the present American compressed bale. All who have anything to do with the handling of the cotton crop unite in declaring that our cotton bale is a disgrace to American commerce. Mr. S. S. Dale, Editor of the Textile World Record, in reporting the International Cotton Congress at Manchester, England, to the New England Cotton Manufacturers' Association, stated that at the Congress "the English, French and German vocabularies were ransacked in vain for words strong enough to denounce the American bale." He states that few of the bales arrive in Manchester intact, varying from "one tie off to none on," and the contents are usually bulging out and scattering about wherever the bale is moved. James R. MacColl, President of the National Association of the Cotton Manufacturers, in referring to the present cotton bale in an address at the recent semi-annual conference of the association, said: "Who can estimate the millions of dollars that are annually thrown away by unnecessary fire losses, insurance, freight charges, waste, labor in manufacturing and inferior cloth as results of the poor manipulation of the raw material (cotton) before it reaches the mill." Consul Diederich, in reporting the International Cotton Congress at Bremen in June, 1906; at which twelve countries were represented, states that the American bale was the chief topic of discussion, and described the bales as landing, "in European ports in filthy and deplorable condition with a superfluity of heavy burlap dangling about them all tattered and torn."

No other product of American industry is packed and shipped in such a slovenly manner as is our cotton crop. This valuable fibre is enclosed in partly old, second-hand, loosely-woven jute rags, bound with almost enough steel hoops to hold the bale together until its destination is reached, and then gradually torn to pieces by hooks of teamsters, by jack-screws used in squeezing the bales into holds of vessels and by general rough handling as it passes along its journey. It causes loss to all through whose hands it passes and is not only a source of waste in itself but a source of danger to its neighbor. Its covering is so incomplete that we have become accustomed to its usual faculty of losing weight and spreading fire during its transportation. The amount of loose cotton which drops from the bales is so great that on the arrival of a cargo of American cotton it is a regular custom to divide the loose cotton among the consignees, this waste being so extensive that, were this not done, a serious loss would be entailed. Large quantities of loose cotton are stolen from warehouses and wharves, and in Liverpool a small army of people gain their support by collecting this cotton from about the wharves and shipping platforms. This is practiced to some extent in New York. There is also an enormous waste caused by our cotton bale in high cost of storage and transportation on account of the unnecessary bulk, the high cost of insurance in transit, the added cost of re-weighing frequently on account of losses in weight and losses by the manufacturer through soiled and wet cotton caused by lack of sufficient covering. As these matters, though of great importance, do not come within the province of fire prevention they will not be further discussed, but we will confine our remarks to the losses by fire due to improper baling, which is the greatest loss of them all.

FIRE RECORD.

Most of us are familiar with the great losses resulting from cotton fires in and near New York. The four and one-half million dollar fire in the summer of 1900 at the Hoboken docks was a direct result of our slovenly cotton bale. Also, the three large fires within as many weeks at the Staten Island cotton stores in June, 1906, finally resulting in the abandonment of these stores by the New York Cotton Exchange on account of difficulty in obtaining proper insurance. Without exception, there is no greater fire loss sustained today on any merchandise, whether oils, naphtha, celluloid, gunpowder or dynamite, while in transit between producers and consumers, as there is on the cotton crop of the United States. For the nineteen years preceding 1903, the fire losses on raw cotton alone, not including cotton in gin houses or mills nor the damage to the building in which the cotton was stored, amounted to over twenty-one millions of dollars. If we add to this the fire losses on cotton at the farm, in the gin houses and in the storehouses at the cotton mills, the enormous waste by fire in cotton can be appreciated. The last bulletin of the Census Bureau reports 25,760 bales destroyed by fire for the year ending August 31, 1906, these bales representing a value of a little under one and one-half millions of dollars.

CAUSES.

In the compilation of the causes of cotton fires, the fires caused by exposure from other fires were omitted, yet, as will be shown later, this loss is greater than in most other goods, owing to the readiness with which fire catches on the cotton because of poor baling. Excluding exposure fires, the Statistics show the remarkable fact that practically 70 per cent of the fires in cotton while between the gin houses and the cotton mills were caused by sparks alone. Of the fires within warehouses 16 per cent were credited to spontaneous combustion and 30 per cent to unknown causes. Judging from a study of cotton fires, we can safely assume that a large proportion of these spontaneous combustion and unknown fires also originated in sparks. I should say that no less than 75 per cent of all cotton fires are caused by sparks. The remaining fires are from ordinary causes, such as occur in other property, and are about equally divided between incendiary, smoking and matches. Cotton growers, buyers and handlers are sacrificing over a million dollars a year to the shiftlessness and slovenly work of those responsible for our compressed American cotton bales. This bale is put out in a worse condition today than it was at the time of the Civil War.

The readiness with which cotton falls a prey to sparks is well known by those familiar with the manner of handling cotton. These bales, with their protruding highly inflammable contents, are piled along the platforms of the railroad without covers, where sparks from the passing locomotives shower upon them. The truckmen lounge about the bales smoking and often dropping matches which later make their presence known on shipboard or in the storehouses or picker rooms of the mills. The cotton often is loaded onto flatcars and rolled over the Southland and later to the great shipping ports, behind a locomotive, sometimes wood fired, belching forth sparks which rain steadily upon the unprotected cotton. Arriving at the wharf it meets more sparks, matches and smokers, and if this is not enough, upon its arrival in New York it is carried about the harbor on ferries unprotected against the sparks which fall about from the passing tugs and steamboats. Indeed, sparks are attacking the cotton from the time it is gathered until it is in the machines of the cotton mill.

THE PRESENT BALE.

The manner of baling American cotton is the prime cause of the great fire loss from sparks. Almost any other product of the farm or factory is better able to withstand the exposure by sparks. Cotton is temporarily baled at the gin house, being there compressed only to the density of about twelve pounds to the cubic foot, the bale being about five feet long by four feet wide by 28 inches thick. When these bales reach the large shipping markets they are further compressed in order to save space in cars and vessels. The bale is placed in the compress and pressed to a thickness of about 12 inches. Pieces of bagging are added, the object often being to bring the bale up to weight as much as to cover it. After that the bales are shortened, additional ties being added if necessary. The usual standard bale is about 54x27x16 inches, with seven or eight steel bands. The manner of compression gives the bale a flat shape but as soon as pressure is removed the bale expands to about 16 inches thick, giving a density varying around 22 pounds per cubic foot. Between the compress and the mill the bale undergoes a continual and gradual expansion, tending to an oval shape. I recently observed some bales which arrived in Boston that were nearly in the form of a complete circle in cross section. The faulty custom of compressing the bale so that the faces of the press are on the larger side instead of on one of the narrow surfaces is the greatest defect. The bale is bound to expand to a more or less cylindrical shape as the pressure is not equal in all directions but is exerted in the direction used in compression. This continual movement causes air to be sucked into the bale as the density becomes less, the action continuing practically throughout the life of the bale, being often greatly enhanced by the breakage of some of the bands. This sponge-like characteristic accounts for the ready absorption of sparks by the bales. A spark falling on the bale follows one of the air passages thus formed and burrows into the bale where it may smoulder for weeks, there finding enough air to support combustion and remain undiscovered, possibly not bursting into flame until the cotton is well out to sea in the hold of a steamer or on its journey in the freight car. Often the fire is not discovered until the bale has been placed in a cotton storehouse at a northern mill. We would put this one feature as the greatest objection to the present bale. Were it compressed so that it would retain the shape with which it left the compress a major portion of the trouble would be avoided.

The covering used on bales is seldom of a continuous piece and it is very coarsely woven. Moreover, it is torn in transit and cut by samplers, leaving the cotton exposed, which makes cotton in storage especially subject to flash fires. However, even with the present covering, the cotton would be fairly well protected were it not for the expansive action of the bale just described which increases any weakness or damage in the present covering. A correction of this fault, together with that of insufficient covering and banding, would eliminate a great proportion of the losses and prevent the rapid spread of fire over the bales which so often opens an excessive number of sprinklers at fires in our sprinklered cotton storehouses.

Experiments show that superiority in resisting damage by fire and water is somewhat proportional to the density of the bale. Several tests have been made bringing out this point. In a report in 1902 of the special Committee on cotton baling appointed by this Association, the following results were obtained on the salvage of cotton after being tested by fire:

	Density in lbs. per sq. foot.	Average per cent of salvage.
American Compressed	22	65.3
Gin bale	12	47.5
Cylindrical (American)	43	71.5
Lowry	38	49.3

The relatively poor results shown by the Lowry bale was due to the peculiar construction of the bale and had no relation to the density, therefore it should be eliminated from consideration. The other figures show that by simply increasing the density about 3[-]½ times the loss at a fire would be reduced by about 50 per cent. In an immersion test where each bale was put under water for forty-eight hours, the gin bale absorbed 200 per cent of water, the compressed bale over 162 per cent, while the cylindrical bale of the American Compress Co., with its greater density, absorbed but about 35 per cent of water. Approximately similar results were obtained by tests made at an earlier date by the Factory Mutual Insurance Companies. These tests were confined entirely to bales produced in the United States, therefore the good results which we could anticipate from a test of the highly compressed Egyptian and Indian bales are not available. The American compressed bale used in these tests had a density of 22 pounds per cubic foot, whereas these bales when they arrive at a northern mill run about 16 to 18 pounds per cubic foot and many of them as low as 12 pounds. Therefore the salvage at mill fires is likely to be very close to that shown by the gin bale in the test, or say 50 per cent. The losses, of course, will be less where there are the best facilities for handling or utilizing the damaged cotton.

SUPERIORITY OF FOREIGN BALED COTTON.

In order to appreciate that there is no excuse for the poor condition of American cotton bales, we have but to turn to the bales produced in Egypt and India. Inherent fires in these bales are practically unknown. The Egyptian bale is about 22x31x51 inches and weighs about 820 pounds, giving the great density of 40.4 pounds (average) per cubic foot or nearly twice that of the American compressed bale. It is entirely covered with finely woven burlap and securely held by eleven strong steel straps, which are fastened by small cast iron buttons. Of course, the bales have one or two small holes which are made in sampling the cotton, but the density is so great that the damage is but slight in pulling the samples. The bale is not subject to a flash fire and when accidentally dropped overboard in loading vessels the bales are said to be withdrawn from the water and sent along with the rest without danger of the consumer making claim for wet cotton. Moreover, in compressing these bales the pressure is applied to the side having the lesser area, so that there is but little tendency for the expansion to increase after the bale has left the compress, and we do not find it taking on the oval form as does our American bale, nor do the sample holes enlarge and throw off loose cotton. These bales can be packed in a storehouse, so that the whole density of the piles will be approximately 31 pounds per cubic foot against 14 pounds, which is about the limit of our bales. It will be seen, therefore, that in the cost of erecting storehouses alone there will be a saving of about one-half by simply compressing our cotton to a density similar to that practiced in Egypt.

The Indian bale is even more dense than the Egyptian, running 42 to 55 pounds per cubic foot, and it is said that this bale will give a ringing sound when struck with a hammer. The bale is well covered with burlap and bound by a single steel band, which runs spirally around the bale. A representative of a Liverpool compress manufacturing company recently said, in discussing Indian bales: "No instance of a cotton fire on board ship or in a warehouse has been known with this Indian pressed bale, whereas, fires are of constant occurrence in the American bales." Mr. Robert P. Skinner, Consul-General at Marseilles, in his late report on Indian cotton, states: "A foreman on the docks with whom I discussed this question (spark fires) told me that a lighted match might be thrown upon an Indian bale without much fear that the bale itself would be damaged, and that the workingmen who are in the habit of smoking a great deal were under no special instructions as regards sparks and matches when handling Indian cotton. On the other hand, when American cotton arrived the most minute precautions were necessary to prevent accidents." We can assume that, were our American cotton baled in a similar manner to these Egyptian or Indian bales, our fire losses would nearly approach that experienced by these bales.

Should the bales be compressed to a density of about 40 pounds the manufacturers would be put to a little more trouble than they are at present as they would have to pay more attention to their opening processes in order to thoroughly shake out the cotton. There would probably be no damage to properly ginned fibre by this great compression. The high speed at which the saw gins of the South are now run produces more or less damage to cotton and great compression might increase this damage to cotton poorly ginned. A remedy lies in correcting the evils in ginning. Any slight disadvantages will be compensated for a hundredfold by the advantages gained by greater compression owing to the elimination to a great extent of the many losses already mentioned.

RECENT MOVEMENTS TOWARD IMPROVEMENTS.

We have already given a brief record of the general complaint from various sources regarding the poor manner of baling the American cotton crop.

Up to a year or so ago the farmer had little interest in his crop, as it was usually owned by his creditors even before it was raised. The farmer was in debt for clothing, food, rent and often for the cottonseed itself to the full value of his future crop, which at the end of the year he would sell to cancel his indebtedness, and then proceed to go in debt again in anticipation of the next year's crop. It was but natural that the grower took little interest in the care of his cotton or the manner in which it was marketed. Recently, however, the price has been so favorable that the farmer to his great surprise has found that he could go back home with not only his debts paid but a little extra money in his pocket, which he could call his own. As a result, the farmer has begun to appreciate the real value of his crop and desires to make it worth as much as possible. The South, with old-time energy, seems to be rising to the occasion and by forming Growers' and Handlers' Associations those interested are gradually getting matters into their own hands, and are asking what they can do to improve the conditions. They justly claim that the price of cotton should be kept up in order that they may make a fair profit and be able to withdraw the women from the fields and send their children to school. The manufacturers have not been slow to point out the present evil conditions which they claim should be improved if a high price is to be maintained. At the first conference of Growers and Manufacturers held at Washington a year

ago a committee was appointed, of which Mr. Charles H. Fish of Dover was chairman, to report on the needed improvements in cotton baling. Their recommendations covered the main faults affecting the spinners but did not go into the matter of fire prevention. They suggest bales of standard dimensions, new burlap or cotton canvas covering, ten ties with Egyptian style of buckle, and that all cotton be sold by net weight. A committee was appointed to further consider the matter and report at the Conference to be held next October. It is fair to say for the growers that many of them do not know what a good bale of cotton looks like; and it has been recommended to Mr. James R. MacColl, president of the coming Conference, that he obtain some Egyptian and Indian bales to place in the assembly room, in order that the growers may appreciate the great inferiority of their bales. The growers also expect to handle a large proportion of the cotton themselves through warehousing associations, thereby doing away to a great extent with the speculating carried on in the New York cotton market. Thus by keeping in touch with the consumers, they will be enabled to keep informed regarding their complaints and a general improvement of conditions should be expected.

I therefore would say that it is a proper time for the Underwriters through this Association to put in a word in favor of improving the bales, as they are interested to an extent fully as great as that of the growers and manufacturers. This Association gives much time and attention to devices and materials to prevent fires and to stop their spreading. As one of the objects of the Association is to promote the science of fire protection, it does not appear that it will be at all out of place if the work be extended to cover causes of heavy losses through the improper marketing and handling of highly combustible or dangerous goods. Many owners of cotton warehouses have at much expense equipped their buildings with automatic sprinklers. Yet we may cover the cotton with sprinklers and store it in fireproof buildings but it will not prevent fire and loss in the valuable cotton itself; moreover, such protection cannot affect the great proportion of cotton which for one-half of the year is in transit. The Underwriters, having an interest in the bale throughout its life, can be justified in demanding a reduction of the hazard. Indeed, a prominent manufacturer recently expressed in a textile paper great surprise that the Underwriters had not extended their control over this matter. As most of us know, the New York Insurance Exchange has recently taken action in requiring improvements affecting insurance of cotton in New York warehouses and these regulations are in the right direction but, of course, are necessarily limited. They have asked for improvements in the warehouses covering the storage of workmen's clothing, use of pipes, matches, etc., prohibiting smoking, requiring gatekeeper, watchman and watch clocks. They also require that loose cotton be cared for and that bales be stored so that sample holes are not exposed. I have been wondering since reading this last rule how it can be complied with in the North, as I find our bales there are all hole. I would suggest if the matter be considered worthy of attention that the following general lines of improvements be considered and suggestions submitted to the various cotton congresses.

1. Underwriters should realize the great difference in losses between foreign and American baled cotton. Statistics show that Egyptian cotton is a more favorable insurance proposition than are grey print clothes in bales. Rating organizations should differentiate favorably for Egyptian or Indian cotton against the American compressed bale. Inspectors should point out the differences in hazard between the classes of cotton and demand the isolation of that which is improperly baled.

2. American compressed cotton as at present baled, when piled in mill yards, on platforms or when in transit, should be properly protected against sparks.

3. A density of 40 pounds per cubic foot should be required in the bale.

4. The shape should be similar to the Egyptian bale with the pressure applied at the compress to the side with the lesser area.

5. A complete covering of closely woven burlap or cotton canvas should be required.

6. There should be a larger number of ties with improved buckles.

There should be, in fact, the equivalent of a "National Standard" cotton bale, one that, in contrast to our present bale, will be fairly safe from loss by fire and, as well, a credit to American industry.

April 22, 1907.

BENJ. RICHARDS,
93 Water Street, Boston.

Mr. Richards: I should like to qualify that because it may be possible to adopt the Indian method, which has no buckle at all. [Applause.]

The President: You have heard Mr. Richards' interesting paper. Are there any remarks thereon?

Mr. Crosby: I think we all are impressed with the manner in which this paper has been treated. This whole country is very much interested in the subject of the cotton bale. I have no doubt, if not immediately, in due course, the procedure laid down here for the settlement of these conditions will meet the recognition that it deserves, and I would like to move a vote of thanks to Mr. Richards for this very excellent paper.

Mr. Merrill: I second the motion.

The President: It is moved and seconded that a vote of thanks of this Association be tendered to Mr. Richards for his admirable paper on "The Cotton Bale as a Source of Loss by Fire."

The question was put by the President and declared unanimously carried.

Mr. Phillips: Mr. President, I would like to move that the paper be printed in the minutes of the transactions of this meeting and that the suggestions be referred to the Executive Committee with the idea that they arrive at some means, if possible, of trying to improve the conditions.

The motion was duly seconded.

The President: Mr. Phillips moves that the paper be received and printed in the proceedings and that the suggestions be referred to the incoming Executive Committee with power.

The question was put and declared carried unanimously.

Mr. Richards: Mr. President, I expected that Mr. McCall [MacColl] *would have been able to attend this meeting, but he is not here. I am sure he would gladly co-operate with any committee, as the manufacturers' associations are trying for the same objects.*"

From a modern fire protection standpoint, there seems to be little of interest in Mr. Richards' presentation on cotton and cotton bales, however, from the responses to his presentation, it is clear that there was much interest in cotton a century ago.

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Source: "*Proceedings of the Eleventh Annual* [NFPA] *Meeting*", New York, New York, 1907.