

Publications of the

BRITISH FIRE PREVENTION COMMITTEE.—No. 6.

Edited by Edwin O. Sachs.

COTTON FIRES & COTTON BALES.

A Paper

BY

R. H. SCOTTER, C.E.

WITH

Illustrations.

LONDON, 1898.

ISSUED AT THE OFFICES OF
THE BRITISH FIRE PREVENTION COMMITTEE
1, WATERLOO PLACE, PALL MALL.

One Shilling.



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OF THE
BRITISH FIRE PREVENTION COMMITTEE.

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No. 3.—THE PARIS BAZAAR FIRE.
No. 4.—THEATRE EXITS.
No. 5.—THE NEW YORK FIRE DEPARTMENT.
No. 6.—COTTON FIRES AND COTTON BALES.

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OBJECTS :

The main objects of the Committee are :—

To direct attention to the urgent need for increased protection of life and property from fire by the adoption of preventive measures.

To use its influence in every direction towards minimising the possibilities and dangers of fire.

To bring together those scientifically interested in the subject of Fire Prevention.

To arrange periodical meetings for the discussion of practical questions bearing on the same.

To establish a reading-room, library and collections for purposes of research, and for supplying recent and authentic information on the subject of Fire Prevention.

To publish from time to time papers specially prepared for the Committee, together with records, extracts, and translations.

To undertake such independent investigations and tests of materials, methods and appliances as may be considered advisable.

The Committee does not hold itself in any way responsible for the opinions expressed, or methods advocated, by members and others who kindly contribute to these publications.

Comments on the opinions expressed in these papers, or further information on the subjects under consideration, are cordially invited by the Executive, at whose discretion they will be circulated among the members of the Committee.

NOTE.

THOUGH general rules may be laid down for the protection of warehouses from fire as far as their construction is concerned, there is no doubt that for the storage of particular goods, specific measures are essential. Thus, the cotton warehouse requires peculiar care as regards subdivision of risks, the position of windows facing south, ventilation, and many other matters which tend to prevent self-ignition on the one hand and the rapid spread of fire on the other.

But frequently it is impossible to obtain a practical minimum of risk by attending to questions of structure and equipment only. We have to go further and consider whether the goods are packed in a safe manner, and whether without disturbing the ordinary course of business and without incurring undue expenditure, the risk involved by using unsuitable forms of package or by careless handling can be reduced without inconvenience to the trade.

Now, it has been long recognised that, as far as cotton warehouses are concerned, one of the primary dangers is to be found in the actual packing of cotton. And as the cotton warehouse is one of those buildings that has been most liable to destruction by fire, it has been thought advisable here to give a hearing to those who argue that a better form of bale would do much both towards reducing the risk of outbreak and the risk of a fire spreading when once alight. In the paper before the Committee, we find strong advocacy of what is termed the "round" or "cylindrical" bale as compared with the far clumsier and certainly more dangerous "turtle-backed" bale which is now commonly in use. As to the greater practicability of this new bale from a fireman's point of view, I think there can be little

doubt; but it rests entirely with those associated with the cotton trade, to decide whether the use of this bale does not involve some extra expenditure or inconvenience. There is no doubt that the old bale tends in every way to facilitate an outbreak of fire and its spread, and though it will be seen that the energetic measures in force at Liverpool since the cotton fire epidemic of 1892 and 1893 have tended to lessen materially the number of conflagrations, it yet remains a fact that when an outbreak takes a hold of a cotton warehouse where the "turtle-backed" bale is used, the destruction of property is not only very rapid but also very complete.

Should there be no practical nor economic reason against the introduction of a different bale for the purposes of Liverpool and other centres interested, I certainly hold that the old bale should be done away with, to make room for a safer form of cotton package. It might be well if any conservatism or mere prejudice against the innovation were overcome by some enforcement of its adoption within a certain number of years. It may not, however, be politic for local authorities to define the form of cotton package in the same way as definitions are made in respect to explosives or highly inflammable liquids; yet where the public authorities leave such matters optional, any substantial rebate afforded by the insurance companies on a particular form of package should certainly induce a voluntary modification of what is at present a most dangerous and clumsy form for consigning a very valuable article of commerce.

EDWIN O. SACHS.

London,

April 25th, 1898.

Cotton Fires and Cotton Bales.

IN order to appreciate the importance of adequate fire preventative measures in cotton warehouses, it is necessary to point out the enormous extent of the cotton trade in Liverpool. In the early days of the growth of the cotton manufacture, Manchester, South-East Lancashire, and North Cheshire seemed marked out by Nature as its ideal situation. An abundance of running water, a damp climate, and the presence of an industrial community assisted among other causes to make Manchester what it is to-day. Now at least three quarters in value of the raw cotton imported for use in South Lancashire comes from the United States of America, and of this amount all but a very small proportion passes through Liverpool. Liverpool, it must be remembered, is a port of transit, as owing to various causes it is not possible to manufacture the cotton there. It is, however, warehoused for some time pending delivery to the mills inland. In 1896, the total weight of cotton imported into the United Kingdom was 15,668,900 cwt. valued at £36,272,039; of this amount 12,446,000 cwt. valued at £27,965,000 came into the country from the United States. The total imported into Liverpool amounted to 13,384,000 cwt. This arrived from the following countries, America, 2,900,688 bales; Brazil, 72,096 bales; Egypt, 398,954 bales; West Indies, 46,560 bales; East Indies, 58,126 bales.

It generally happens that a considerably greater quantity is imported than can be disposed of to the manufacturers, as for instance, at one time, March 24th, 1898, it was estimated that 1,175,439 bales were stored in Liverpool warehouses, 1,073,535 of which were bales of American cotton. This gives some idea of the warehouse accommodation necessary, and also some idea of the value of the "risks" involved.

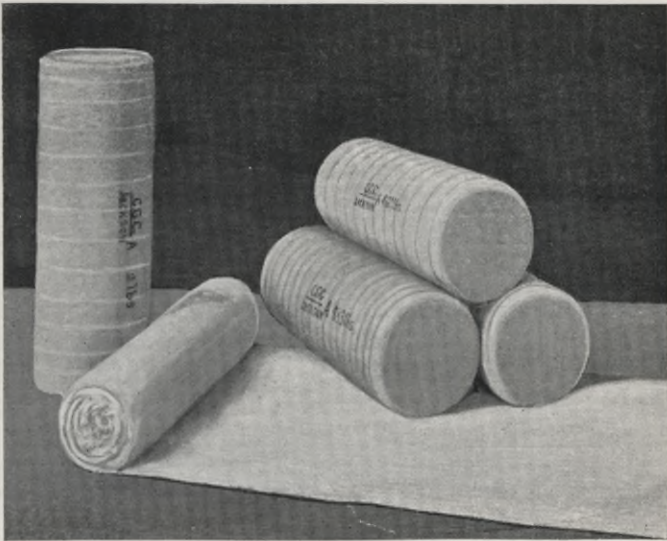
A few years ago, 1891-2 Liverpool seemed to be suffering from an epidemic of Cotton Fires: on one day, June 13th, 1892, no less than three serious fires happened and the Fire Brigade was kept continuously at work for twenty-seven hours. The cause of most of these fires could, however, not be discovered. In 1892-3 matters eventually became so serious and the destruction of property so enormous, that the Salvage Association offered substantial rewards for evidence regarding the origin of any outbreak, more particularly as to the carelessness (if any) of employes. These rewards resulted in it being proved that a great number of Cotton Fires were the result actually of carelessness on the part of warehousemen. A hot pipe, a match thrown away unextinguished, or sparks from a lighted tobacco pipe, have no doubt been the immediate cause of much of the loss. It was seen that one of the first remedies would have to be the appointment of several special Fire Inspectors, and the rigid application of the rules as to smoking, open lights, etc., with the enforcement of which they were entrusted. The benefits of this action may be seen from the following figures, showing the number of Cotton Fires occurring in Liverpool. The decrease of fires after 1892-93 is most marked.

Before Action was taken. After Action was taken.

1890-1893.			1894-97.		
1890 ...	...	14	1894 ...	...	10
1891 ...	...	13	1895 ...	...	3
1892 ...	...	32	1896 ...	...	4
1893 ...	...	18	1897 ...	...	6

It is also interesting to note the value of property at risk at actual fires since 1893. Taken roughly, the value of buildings and contents at stake was as follows:—

	Stock.	Buildings.
1893 ...	£771,625 ...	... £54,892
1894 ...	194,845 ...	... 22,556
1895 ...	28,600 ...	... 3,866
1896 ...	97,850 ...	... 11,155
1897 ...	88,776 ...	... 17,500



THE "ROUND" BALE.

Setting aside the actual cause of fire by open light self-combustion or otherwise, the spread of an outbreak is primarily due to insufficient packing and inadequate compression.

Now it is a remarkable fact that nearly all the damage by Cotton Fires in Liverpool only affects American Cotton, though the aggregate of bales from other countries is quite one-fifth of the total quantity shipped to that port. Egyptian and Indian Cottons are very seldom

affected in the great Liverpool conflagrations. This is largely due to the fact that the latter classes of bales are more securely and densely packed before being shipped to Europe, and to my mind no really successful attempt can ever be made to lessen the extent of a Cotton Fire while raw Cotton is packed in the United States in the present unsuitable manner in bales of the "turtle-backed" description. The old American bale is produced in a compress which masses together under a sudden pressure of 2,000 tons per bale, cotton fibre, sand, and unfortunately any amount of foreign matter which dishonest or careless packers may see fit to introduce. During the process it is impossible to exclude an appreciable quantity of air. This air and the foreign substances already mentioned as present in the bale together constitute, on a rise of temperature, two sources of concealed danger against which ordinary preventive measures are applied in vain. Added to these dangers from within, there is also the danger of the inefficient outer covering, as the bales are generally only sewn up in coarse jute. This jute is in itself highly inflammable, but it also allows the Cotton to get through, with the result that the outer surface of a bale is fluffy and only too easily catches fire. Again, the size, weight and shape of these bales necessitate many processes during transportation which considerably add to the risk of fire. In loading and unloading a free use of hooks is made and these are responsible for the ragged condition in which bales arrive at the warehouse or mill. It is this extra raggedness which again assists the spread of flames.

Anyone who may have witnessed the commencement of a Cotton Fire and seen the lightning rapidity with which the fire spreads along the warehouse floor will appreciate the great danger from these ragged ends.

The "waste" occasioned by the ragged bales makes the floors literally a tinder line, and with even the most careful of sweepers the floors cannot be kept clean where the "turtle-back" bale is used.

Recognising the great necessity there is for a different system of packing cotton if we are to take steps towards preventing Cotton fires in the future, I shall try to briefly describe how the new style of bale is made which is at present attracting the attention of the Cotton world, and the makers of which claim that its adoption will materially reduce the risk from fire to which cotton is at present exposed.

This so-called "round," or more properly speaking the "cylindrical" bale is produced by a new Hydraulic Press. The cotton coming from a gin, just touches the underside of the condenser wheel or drum and is immediately deposited between the two aprons of a bat former; the air and dust pass out through the meshes of a wire cloth above. The two aprons of the bat former carry the cotton down, gradually compressing it, and the bat then passes between a compression roll and a stationary roll. A solid bat of cotton is thus formed which again passes on to a bale now being formed between the two main compression rolls. The pressure on the bale is produced by an hydraulic cylinder and as the bale increases in size, it regulates automatically the pressure required. By an ingenious contrivance the pressure can be regulated up to a maximum of 200 lbs. per square inch.

The standard "round" bale produced is cylindrical, weighs 425 lbs., is 4 feet long, 2 feet in diameter, and its density is about 35 lbs. per cubic foot, or 50 per cent. more dense than a best compressed bale on the old system, although the average pressure exerted in making the "round" bale is only about 10 tons, as compared with 2,400 tons in making the "compress" bale.

As the tendency of modern fire prevention methods is to reduce, rather than increase, the storing capacity of each separate room in the warehouse, this advantage as to bulk is important. The Liverpool Fire Prevention Act grants the maximum of 4,000 sup. feet for warehouses, 6,000 feet for sheds of two floors, and 7,000 square feet for ground floor sheds only. As an example

of what may be done in packing these bales in a small space I may mention that in December, 1896, the largest single truck load of cotton ever carried was conveyed by the Illinois Central Railway in a box truck, the bales being made on the "round" bale system. It consisted of 160 bales and weighed 68,628 lbs.

Now the principal feature of this bale in relation to fire prevention is that it is claimed to be both fire-and-water-proof. It is formed in a short space of time and not left about the yard to pick up dirt, sand or wet; it contains no compressed air; it is much better packed and secured, and is not only less liable to self-ignition, but should the warehouse or shed in which it may be stored be attacked by fire we have ample proof from theory, from experiment, and from practical experience, that this form of bale resists the attack of fire admirably. Various experiments have been made in placing a "turtle-back" and a "round" bale on the same fire. In favour of the former it may be said that should a fire have worked its way into a bale before it is discovered a dash at the bands with a hatchet will release the cotton and allow water to be thrown on the burning spot. On the other hand the "round" bale would have to be unwound in a similar contingency. But it must be remembered that it is denied that a fire can penetrate a "round" bale, and if a non-inflammable covering be used in the packing, no doubt this risk will be reduced to a minimum.

An interesting experiment was made last year in Liverpool, where a cylindrical bale and an ordinary bale were both exposed to the same fire. After half an hour the fire was extinguished and the bales rolled off. The old bale fell off with bands complete, but the new bale became unrolled in the process of removing it from the furnace and the cotton blazed up. However, only a small portion was found to be alight, and this was extinguished in a few seconds, while the cotton in the old bale was still burning next morning. Prior

to the test the old bale weighed 410 lbs., of this, 261 lbs. of sound cotton was obtained after the fire, showing a loss of 36.3 per cent., while the "round" bale, which weighed 504 lbs., lost 22.2 per cent. or 112 lbs. by damage from the fire.

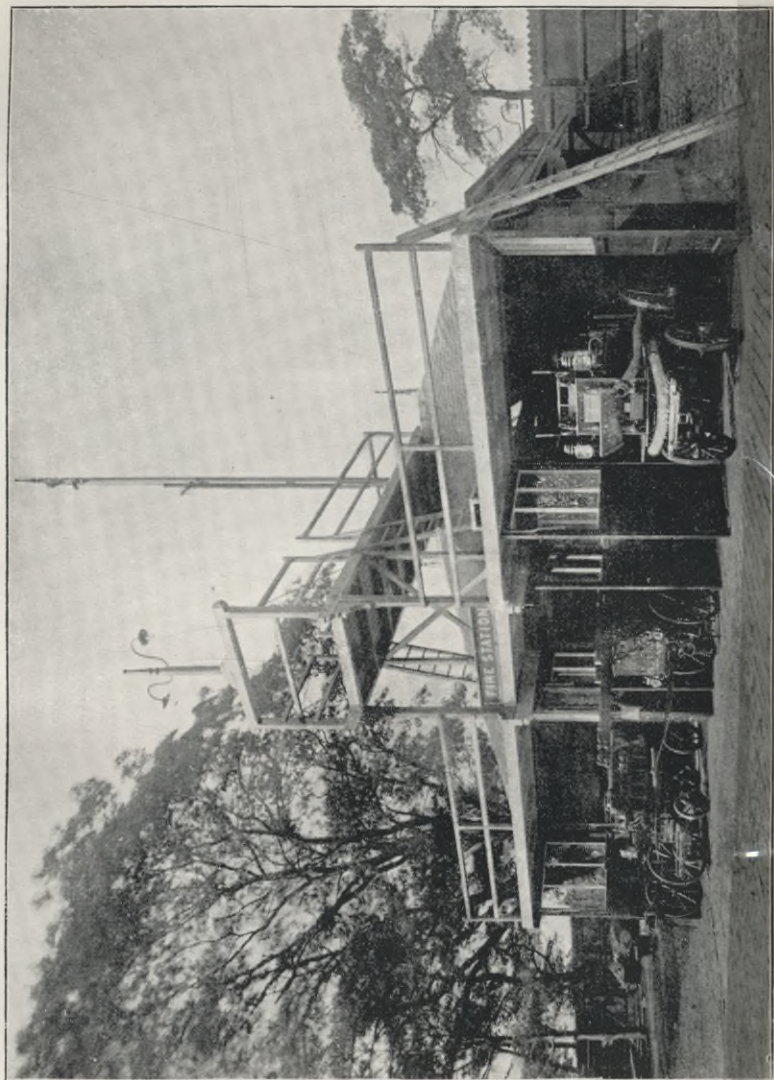
This shows in favour of the new system and taking into account the greater density of the cotton, and under recent improvements the non-combustibility of the Hessian cloth, chemically treated, with which it is suggested all cylindrical bales should be encased, the latter have a decided advantage in the matter of fire prevention.

But leaving experiments which have been carried out in the interests of Insurance Offices, both in this country and America (with the result that the offices have reduced the premium on round bales by one-half), I will just mention a fire which occurred in the Rock River Cotton Co.'s works at Janesville, Wisconsin, in July last year. The official report says "the main building with machinery became a total loss. The Cotton, some 40 round bales, which was lying where the fire was the hottest and could not be reached until after the building was entirely burned out, was entirely saved. When found, only the covering was gone and about an inch of cotton scorched, the rest of the cotton perfectly dry, white and wholly uninjured. The bales with ends cut, opened as well as if they had never been burned. The water had not penetrated any at all." This latter statement is, perhaps, of primary importance, for it is well known how often more damage is done to the cotton by water than by actual fire. To repeat, I hold that the spread of a cotton fire can only be limited by giving more attention to the packing of bales, which not only governs the extent of the spread, but the extent of the salvage after the fire. As the expense of improved bales is often argued, I would only add that, as a matter of fact, what with the easier portorage, reduced insurance rates and other economies which the new bales allow

for growers, shippers and merchants alike, their introduction means a material saving to all concerned, quite independent of the lesser risk, which should count for something, considering the inconvenience generally caused by fire loss, no matter how well goods may be covered by insurance.

In conclusion I would give a short list of some of the most disastrous Liverpool cotton fires in recent years. The figures indicating the losses are of course only taken approximately:

1883	April 21st	Lancelots Hey	£100,000
1884	May 17th	Chapel Street	£100,000
1886	Oct. 25th	Hornby Dock	£70,000
1886	Oct. 31st	Wellington Dock	£35,000
1887	Nov. 10th	Hornby Dock	£35,000
1888	July 26th	Sandon Dock Shed	£70,000
1888	Sept. 5th	Bootle	£40,000
1889	July 19th	Grundy Street	£70,000
1889	Aug. 10th	Bootle	£25,000
1890	July 29th	Dacre Street	2,500 bales
1891	May 12th	Formby Street	£40,000
1891	Oct. 21st	Toronto Street	£90,000
1892	Jan. 18th	Vulcan Street	3,800 bales
1892	June 13th	Huskisson	3,000 bales
1892	June 13th	Bath Street	£100,000
1892	June 13th	Brook Street	£20,000
1892	Dec. 17th	Burrells	£40,000
1893	Mar. 26th	Studholme Street	£18,000
1894	Feb. 10th	Effingham Street	4,600 bales
1894	Aug. 4th	Atlanta Road	£40,000
1895	May 22nd	Irland Road	£40,000



FIRE STATION AT THE STANDISH COMPANY'S WORKS.