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W. Greenwood

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This information caused him to look into the matter more closely, in consequence of which he ordered enamelled ring bobbins sufficient to enable all yarns spun to drain or dry for 24 hours after immersion. His experience taught him that five minutes' immersion was not sufficient, that 15 minutes stained the yarn, and that 10 minutes gave satisfactory results.

The success of this method of conditioning seemed to arise in consequence of the operation being conducted whilst the yarn was tightly held on the ring bobbin, and resulted in the curl being effectively taken out of the yarn, which, it was found, reduced the breakages in bleaching and dyeing to a minimum. In addition to this, strength was added to the yarn, which was retained after the moisture had evaporated.

The enamelled bobbin, however, in time suffers grievously, causing the spinner no end of trouble. One of the least troubles is that, by constant conditioning, the weight of the empty bobbin is increased, in some cases by five grammes per bobbin, which, in a 50,000 spindle mill, is equal to 550 lbs. weight to be revolved from 5,000 to 10,000 revolutions per minute.

Mr. Greenwood, who follows me, will explain the different methods of conditioning in vogue, and I will conclude by saying that the reprehensible method adopted by some spinners, of adding magnesium chloride to water used for conditioning, seems to be dying out. The reason of this, in my opinion, is in consequence of the educational action of this Institute by its papers on the use of magnesium chloride for sizing. (See Mr. F. Whowell's paper read on April 28th, 1911; the observations by Messrs. T. W. Fox, J. Huebner, and E. Knecht, p. 27, Vol. III., No. 1, in the *Textile Institute Journal*.)

I desire also to recall attention to the report on "Moisture in Raw Cotton and Yarn," p. 61, Vol. III., No. 1, May, 1912, *Textile Institute Journal*.

METHODS OF CONDITIONING YARN, Etc.

By W. GREENWOOD.

THE material that generally goes through the process of conditioning, and with which we are most familiar, is cotton yarn. The systematic conditioning of raw cotton is a matter with which we do not come into contact, but the effect is a source of considerable interest and very often of great annoyance and difficulty. The matted, caky, evil-smelling bales sometimes delivered to us are not only the cause of a great loss in putting through the machinery, from a financial point of view, but the danger arising from the unevenness and inequality of condition in the resultant yarn is probably much more serious than the loss in the first case. In one, you do know exactly where your loss begins and ends, but in the second case you never know what the end of the trouble may be. American bales seem to have been put through a system of conditioning in the bale during the ginning process, and even if this has not been very scientifically done, it is very often done thoroughly and over-efficiently done, as we find to our cost. When we know that raw cotton has been tested by the Chamber of Commerce

Testing House to contain from 25 per cent to 30 per cent of excess moisture, it is putting a big strain on the endurance of a spinner when he is faced with a very serious complaint from a manufacturer owing to his yarn containing actually $\frac{1}{2}$ per cent over standard allowance.

We were indebted to Mr. Howarth, of the Fine Spinners' Association, for a very interesting description of the manner in which Egyptian cotton was treated for conditioning purposes. Some of you will remember, in the lecture by Mr. Howarth to the British Mill Managers, some time ago, how the natives were shown to be busily engaged transferring the waters of the Nile in a very homely but efficient manner to the valuable cotton on its banks. This method of conditioning the raw cotton proves to us that whatever evils there may be in the system they have not been created by the inventive genius of the present or past few generations of men engaged in the cotton trade.

The first system of conditioning yarn known to the writer—and, I think, the best one that has ever been adopted—was the one in vogue about thirty years ago, but which has been gradually given up owing to the amount of capital required for the process and the difficulty of giving quick delivery to the consumer when the method is adopted. The system was to put the yarn in cops from the mules into doffing skips and ticket the sets with the date spun, and then put them in large cellars provided for the purpose with sufficient accommodation to take fourteen days' production. The floor of the cellar was arranged to carry water and was made with several rows of bricks, on end, so as to avoid the direct contact of the bottom of the skips with the moisture on the floor. The skips were covered with sheets of tissue paper and the conditioning process was accelerated now and then by a little of the gentle rain from heaven nicely showered on to the yarn by means of a specially-arranged degging can.

There is a story told of an old spinner who was met by his friend when returning from the mill on Sunday noon, instead of from church, and who said he had been attending to this particular part of the business, because it was of such importance that he could not trust anybody else to do it. I well remember that we had strict orders not to pack any yarn until it was ten to fourteen days old, and this rule was only broken in cases of extreme urgency.

Although this method was very cumbersome, inconvenient, and costly, it was probably the most efficient method of conditioning yarn that has ever been adopted. The ever-present moisture being in touch for such a length of time and the absence of light from the cellar brought back the yarn to the condition of the raw cotton in a very even manner, and complaints from this system were almost unknown. It was with the idea of cheapening the cost of conditioning that new and quicker methods were adopted. The reason for this alteration can be understood when we figure out the cost of storing the production of a mill, at present prices, for fourteen days. In many mills, the extra capital involved would be from £10,000 up to £40,000, meaning a very considerable item in the requirements of a business.

One of the new methods tried, and which has been adopted very considerably, was that known as Pearson's. This system was the placing of the cops in layers between wet cloths or blankets, leaving them in that state until the following day, and then packing them into skips from the conditioning machines. This system is also used very extensively in ring spinning concerns where the yarn is conditioned

on the ring bobbin. It has several advantages; the yarn is very quickly changed from the hot, dry condition of the spinning rooms into a reasonable state for delivery; it is very convenient for packing, and each parcel or set of cops gets a uniform share of condition, and is more even and regular in its quality and appearance than would otherwise be the case.

I remember a case many years ago where a complaint was made in reference to the yarn of one of the best spinners in the cotton trade. The representative came over to see the yarn, admitted the fault, and promised to replace the yarn as quickly as possible. The buyer was in urgent need of the yarn, and offered to forego 5 per cent of weight if the spinner would get the yarn off the same day. On no con-

MODERN YARN CONDITIONING MACHINE.

sideration would the spinner do this, but insisted on the yarn being put through the usual treatment at his own mill. I do not think that for one moment the question of loss in weight or otherwise influenced his decision.

Another method is the placing of yarn in chambers specially prepared and then steaming it. This system makes the appearance of the yarn very much better indeed, but it is very costly to work and does not repay the spinner for his outlay by the gain over the dry condition of the yarn when received from the spinning rooms. There are certain classes of yarn, notably yarns of a fancy character, which can only be got to the appearance desired by this treatment. The use of this

method, however, is very cumbersome and extremely unhealthy for those who have to carry the yarn to and from the chambers, and I do not think its use has been extended in recent years.

A system of conditioning on winding frames has been adopted where the threads, in winding from the bobbin or cop to the warpers' bobbins, were allowed to run over a roller partially immersed in water. This had many objectionable features, amongst which were the following: Rapid depreciation of the machinery owing to contact with the water; the tendency of the small pieces of leaf and dirt, which would usually be cleared from the yarn, to adhere to it and go forward on to the large bobbin, and be the means of causing considerable difficulty in the after-processes; and the liability to increase the drag, unduly, in winding, owing to excess moisture, and the consequent breaking of ends and multiplying of the number of knots in the yarn sent for beaming, warping, &c. So far as one can get to know this system is not much in use at the present time.

Conditioning on the warping mill, as mentioned by Mr. Lye, has been quite common, but I do not think this idea gives the uniformity in conditioning which is essential if good and satisfactory results are to be obtained. The primitive way of putting moisture into yarn by means of a hose worked by hand cannot by any means be described as a scientific way of dealing with a very important and necessary process in which regularity is one of the most important features.

The conditioning of yarn on the beaming frame is a system which has been adopted very extensively. As a method of adding weight there is no doubt it is fairly satisfactory, but for other reasons it is questionable whether this method is very satisfactory. The difficulty in getting uniformity in condition is very great, and the danger of causing complaints in the running off of the beams in the slashing frame is also very great. Sometimes, one side of the beam will get more moisture than the other, and this causes a difference in the diameter of the beam on either side, with a tendency to cause slack or tight sides as the case may be.

In a general way, it has been proved more satisfactory to condition yarn immediately after the spinning process, as this gives the yarn additional strength for the after-processes of winding, reeling, beaming, warping, &c. The three systems for doing this are: The one where the skips are put into a cage and the yarn conditioned whilst in the skips. I think this system originated in Germany, but is now made by a British firm. Another system is the one mentioned by Mr. Lye, where the skips with the yarn in, are totally immersed in water, and which does a considerable amount of damage to the skips and bobbins in the process. The third is one where the yarn is emptied out of the skips, put through a conditioner, and then put back into skips at the front end of the machine. This method saves the skips very materially. A sketch of this arrangement is shown, and it appears to me a very sensible way of treating the yarn.

In conclusion, I wish to say that I am in entire agreement with Mr. Lye about the importance of letting more daylight into this important subject. Spinners should be willing to sell yarn on a standard test for moisture, with an allowance of 1 per cent either way. If yarn is proved to contain more than 1 per cent over the standard, the spinner should make an allowance; if less than 1 per cent under the standard, then allowance should be made to the spinner. It will be much better for

all concerned if this important question could be dealt with in a businesslike way and in the sensible manner which its importance demands.

INTRODUCTION AND DISCUSSION.

The foregoing papers were submitted at a meeting of the Lancashire Section, held at the Institute on the evening of 28th November, 1916, Mr. T. Fletcher Robinson (Chairman) presiding.

The CHAIRMAN said he was sure they were all delighted with the papers. It was most important that a fully recognised standard should be provided.

Mr. R. LIVSEY said the $8\frac{1}{2}$ regain had been fairly well adopted. It was not general, but many firms bought and sold in conformity with that standard.

Mr. J. H. LESTER said Mr. Livsey was quite correct as to the $8\frac{1}{2}$ regain so far as yarn was concerned. There was only one actual decision in law. Some years ago, Judge Bradbury laid it down that $8\frac{1}{2}$ must be the standard unless expressly departed from. That standard having been adopted as between spinner and manufacturer, it rested with the spinner to see that the standard was set up and enforced as between himself and the cotton merchant. If he did not do so, it was his own look-out. The Liverpool Cotton Association was a strong body, and it would be difficult to move them. But the whole conditions were unscientific. If a complaint were made as to moisture in cotton, a number of gentlemen appointed by the Association visited the mill and pretended, by feeling, to say how much excess moisture should be allowed to the spinner. Small claims were disregarded. There was no reference to real tests. Decisions had been ridiculous in relation to the actual conditions of the cotton. What was needed was the introduction of a definite weight of moisture into a definite weight of yarn. He could not agree with the suggestion to allow of a depreciation of the standard by the recognition of a margin of 1 per cent either way. In the wood pulp trade, the difficulty was overcome, no case lying against the seller in the event of the material not departing by more than a half per cent from the standard. In the case of deficiency of moisture, of course, the buyer made no claim. In cases of excess of moisture, however, the claim would be based upon the $8\frac{1}{2}$ standard exactly and with no allowance. He did not quite agree with the suggestion as to the reasonableness of replacing the amount of moisture taken out of cotton in the process of spinning. If the cotton bought chanced to contain from 10 to 12 per cent, that would be no justification for again bringing it up to 10 or 12 per cent. The standard was of very great consequence. It was extraordinary that the trade went on exploiting cotton artificially damped; and the amount of the damping was probably increasing, on the average. Until some standard was laid down and enforced the average imported cotton would continue to increase in moisture.

Mr. H. P. GREG said he imagined two standards were desirable. In fixing standards, regard should be paid to what was considered the best amount of moisture for the fibre in the particular transaction involved. He thought that in raw cotton the standard regain might be 5 per

cent and in the yarn $8\frac{1}{2}$. The question was as to how they were to obtain the $8\frac{1}{2}$ regain. He considered that all the methods mentioned were either unscientific or unsatisfactory. It seemed to him that they should strive to get the moisture into the rooms, so that the cotton in going through the processes of manufacture would come out with $8\frac{1}{2}$ per cent regain. In the card room, for instance, the work could be done very much better with a certain amount of moisture present. If more satisfactory means of humidification inside the mills could be established, this would be more satisfactory than systems of conditioning. The difficulty was in getting humidity in the mill. He had experimented to a certain extent, and considered that pulverised water was the best means of admitting moisture into a mill. The difficulty about pulverised water was that it was distributed in comparatively heavy doses at few points in the room. If some means could be found of diffusing it properly, the problem might be solved. In America the Cramer system was largely adopted, and the system automatically regulated the amount of water pulverised according to the temperature of the room.

Dr. W. LAWRENCE BALLS said as regarded the original content of water in the raw cotton, Mr. Greenwood mentioned damping by the Egyptian native, but it did not matter to the spinner how much water—within reason—a fraudulent grower put into his cotton after picking, since when it came to the ginning-factory the water content diminished. One matter had been investigated by Mr. F. Hughes, a former colleague of the speaker. The cotton in the roller-gin had to pass over a roller which developed quite a high temperature. No matter what the water content might have been at the commencement—short of being sodden—it was brought down here to $2\frac{1}{2}$ per cent, speaking from memory. Before the cotton had got to the floor, as it was in so thin a layer, its humidity had risen to, say, 4 per cent. The bearing of all this was upon the 5 per cent standard. He thought the normal amount of moisture of cotton passing through the ginneries in the normal way was in the neighbourhood of 6 per cent—perhaps a shade over. Of course, more was added afterwards, and this the ginneries claimed to be necessary in order that the cotton might be properly pressed. Egypt was a very dry country and the cotton was thirsty. It would therefore seem to be difficult to hold to a 5 per cent standard for other countries at any rate.

Mr. SCOTT TAGGART said there was lack of scientific basis in the consideration of regain in yarn. Standards had been mentioned, but a practical question arose—What was the condition of the cotton as it passed through the various stages so far as moisture was concerned? Suppose they had a mill and they knew raw cotton contained, say, $8\frac{1}{2}$ per cent of moisture. It passed through the mill and they were able to say how much yarn had been turned out. But was there any other loss in moisture? Had they any details to enable them to form a clear idea of what loss had actually taken place in the way of moisture? A series of carefully-conducted experiments on a large scale was needed in order to ascertain what was actually taken out other than moisture. The difficulty of getting details prevented the realisation of standards. The papers submitted did not provide details to enable the formation of reliable opinion. There was nothing definite, and the statements made were too general.

Mr. GREENWOOD said both himself and Mr. Lye started out with the idea that their own efforts would not be of great interest. Yet they hoped to arouse interest in the subject and provoke useful discussion. He agreed with Mr. Livsey as to recognition of the $8\frac{1}{2}$ regain standard, but it was by no means universal. There was considerable difficulty in getting spinners of yarn to sell on this basis. He could not agree with the suggested 5 per cent for raw cotton. He believed the $8\frac{1}{2}$ was right, but did not think we should ever get a definite standard in raw cotton so long as we in this country bore so small a share in control of supply of raw cotton. It was desirable in regard to this question of the condensing of yarn to get away from the point of view that it was something to be hidden; it was something that needed to be brought into the open. He mentioned the 1 per cent allowance for business reasons. No scientist, however clever, could arrange the output of a mill so that the standard would be one thing. The idea was to cover frivolous complaints.

The CHAIRMAN said that a fully-recognised standard would enable equitable bargaining.

Mr. LESTER said science and practice must go hand in hand. They were of equal importance. For the scientific or the practical man to attempt to put each other in his place was a great mistake.

Mr. GREENWOOD said he even recognised that the scientific man would have to be more and more called upon, but he objected to some of the criticism of the scientist who did not know the practical difficulties.