FABRIC ANALYSIS.

(Continued from December issue.)

Testing Yarns and Fabrics for Moisture.

A most important factor with which the textile industry has to deal with, is the hygroscopic nature of all textile fibres, i.e., the property of absorbing moisture from the air without altering in external appearance, but undergoing changes in weight, volume and strength, corresponding to the amount of moisture absorbed, whereas if exposed to a dry atmosphere they do not change in any way. This tendency of taking up moisture varies with the different materials in the same atmospheric conditions and largely depends upon the humidity of the atmosphere as well as upon the extent of surface exposed, and the movement of the surrounding air.

The determination of moisture in raw materials, yarns or finished fabrics is technically called conditioning. It is one of the most important tests connected with either the raw material or the finished yarn, as it is possible to load the former with a considerable amount of unnatural moisture, which in the subsequent processes of manufacture speedily evaporates, and, by leaving them much lighter, increases the price.

Over-condition.

The fault of over-condition is a most insidious cause of loss to any mill that buys its yarn. One of our most noted mill architects and company president (I think it was Isherwood) that he liked to erect a cotton spinning mill on a clay foundation, as it was very advantageous to the conditioning cellars, and he considered a good conditioning cell is an important asset and perhaps the best investment a spinning department could make. This frank admission is very interesting from any point of view; but from a manufacturer's consideration of the question, it must call for the greatest care for its prevention. No yarn can be spun or delivered without moisture, in reason; but to pay for excess moisture at the price of yarn is suicidal policy, and its continuation leads inevitably to bankruptcy.

The moisture in the atmosphere in certain mills districts is said to be one of the reasons of the success of cotton-spinning, but even in that instance, for years many systems of further humidifying the atmosphere have been adopted in these mills. This humidity in the air is essential to the working of any textile fibre, and a yarn spun under these favorable conditions is more suitable in every way for the doubling and twisting process than a dry-spun yarn. This, if may be readily admitted, is perfectly legitimate; but it is doubtful whether that term could fairly be applied to the uses to which the watering can is devoted in certain mills. Nor perhaps is it advisable or necessary to accept as in good condition what has been done. The water or |vapor reservoir or other receptacle, previous to sending it on a precarious journey in a heavy rainstorm to the purchasing and innocent weaving or knitting mill.

It is safe to say that all this adds moisture to the yarn artificially after spinning by some process or another. During processes in the spinning mill, notwithstanding natural or artificial humidification, some moisture will be lost, and it is necessary that this natural loss should be made good. Moisture in any textile fibre is a natural constituent at any temperature below that resulting in actual incineration, and is necessary for the perfect formation of the fibre. Excess moisture in the single yarn will not be injurious to the doubling and twisting of yarns, except in so far as the excess may damage the parts of the machinery in which it comes in contact.

The Handbook of Conditioning and Testing (Manchester Chamber of Commerce) is responsible for the following:

"Of cotton, it may be said that to a limited extent a standard degree of moisture in some spinneries must be agreed between themselves upon the 8½ per cent 'regain' standard as applied to yarn. Raw cotton is not subject to any definite standard of moisture."

It is interesting to note that for instance cotton in a perfect condition contains 8½ per cent of moisture. What the term is intended to convey is that if 100 parts of absolutely dry cotton is exposed to a normal condition of the atmosphere, it will gain 8½ parts of moisture. The regain condition of the cotton will be 108½ parts; if therefore 108½ parts contains 8½ parts of moisture, 100 parts of normal conditioned cotton contain 7834 parts of moisture. The 8½ parts is termed the "regain per cent," and is the standard for cotton in any process offered for sale.

How to Test for Moisture.

For the purpose of making this test for moisture, two lots of not less than 1 lb. each are removed from the skip of the yarn as received at the mill. The apparatus used for this test consists of a circular oven; surrounding the top of the oven, fixed a pair of small weights on one end of the beam is a pan to contain the weights; at the other end of the beam is suspended, either a wire cage, if cocoons are being tested, or a reel, if the yarn is in hank, so that the material to be tested is suspended from the balance. A thermometer is placed through the lid, with the bulb in the oven, and the scale portion projects outwards to facilitate the reading of the degree.

The sample is placed in the oven and very accurately weighed, and the heat is generated either by a Bunsen burner or electricity. The temperature adopted by the Testing House for cotton is 212 deg. F. The temperature is a most vital part of the drying process, and care must be taken not to exceed this heat. At 212 deg. F. cotton is said to be quite dry, although moisture will still be contained therein, but for all practical purposes it may be regarded as being dry. Frequent readings of the thermometer are therefore very necessary.

The following points are set out in the Handbook brought out by the Manchester Chamber of Commerce Testing House:

TIME OF DRYING.

The length of time necessary to dry samples is frequently stated; for such rough methods of testing as those under consideration, three hours is sometimes recommended. With any properly constructed oven, a far shorter time than this is necessary. The time required is, however, easily calculable, and is:

\[ \text{Time} = \frac{\text{Weight of air displaced by the sample at normal temperature}}{\text{Weight of air displaced by the sample at its temperature when weighed}} \]

It will be found that the error is too small to be of importance except for the purposes of precise scientific investigation.

EFFECTS AT DIFFERENT TEMPERATURES.

A series of tests have been carried out at the Manchester Chamber of Commerce Testing House to determine the effect of drying at different temperatures. Two lots of yarn were dried for three hours at a temperature of about 160 deg. F. The loss due to moisture driven off at, and below, this temperature was ascertained by frequent weighings; the samples were then submitted to higher temperatures for further periods, and the subsequent loss recorded.

The heat rises the material being treated will commence to lose weight, and this loss of weight will continue until the yarn has been brought to a perfectly dry state. Above the reel or cage is a small pan attached to the suspending arm, and into this pan weighed is placed to compensate for the evaporating moisture. These indicate at a glance the total weight the yarn has lost.

To Ascertain Amount of Moisture.

To find the amount of moisture which the yarn contains, proceed as follows:

**Original Weight. Weight Lost.**

| 16 oz. | 100 : : 2 oz. : : x |
| 2 x 100 = 200 | : : 16 = 128 per cent |

24 per cent in loss would mean that 87.5 of cotton in absolutely dry condition, a regain of 8½ per cent from the absolutely dry cotton to a normal condition. 87.5 X 8.5 = 100 = 7.44 per cent.

87.5 absolutely dry cotton + 7.44 per cent (8½ per cent = 94.94 correct condition weight per cent and, 100 — 94.94 = 5.06 per cent excess moisture).
Water at prices varying from 25 cents to $7—ain pound is too expensive a luxury for most weaving or knitting mills. The dry process, therefore, has become most important consideration for the mill, and claims for excess moisture are the most difficult to satisfy with the spinner, as a rule. It is therefore imperative that tests of spinings should be regularly made, and in case of default no drastic measures should be adopted to prevent their recurring.

**Wool—Silk—Cotton—Flax.**

Wool in a normal condition (scoured) contains about 16 per cent of its weight of moisture, and can absorb up to 30 per cent without showing any material change, while in a high temperature, of whatever atmosphere it be, it has been known to absorb as much as 50 per cent. Woolen fabrics in a normal condition contain about 84 per cent of its weight of moisture.

Silk contains normally about 11 per cent of moisture, but is capable of absorbing up to 30 per cent.

Cotton contains normally about 83 per cent of moisture, i.e., water, as a natural constituent; if any or all of this moisture is extracted the cotton will, upon exposure to a suitable atmosphere, again absorb moisture up to the before mentioned normal percentage. Cotton may, however, easily contain twice the latter percentage without either altering in appearance or appearing unduly damp.

Flax is more hygroscopic than cotton, absorbing 12 per cent normally, with about 27 per cent as maximum.

**Union Yarns and Fabrics.**

For union yarns and mixed fabrics the amount of regain is based on the relative proportions of the materials contained in the mixture. Thus for a mixture of which, when absolutely dry, contains 75 per cent wool and 25 per cent cotton, the regain is found thus:

\[
100:75:181:15.69\%\] for the wool.
\[
100:25:81:2.12\%\] for the cotton.

Giving a total of 15.815% regain.

Dealing in the textile industry with raw materials liable to such wide fluctuations, and which may be due either to the natural condition of the atmosphere, to the temperature of the work rooms, or to fraudulent practices, shows how important it is that means should be adopted by the mill, for determining and taking into account the percentage of moisture contained in the material when bought and sold, i.e., the necessity for a standard regarding permissible moisture, raw materials, yarns, or fabrics may contain.

It will thus be readily seen, that for example, the absolute dry weight of the contents of a bale of cotton, silk, etc., is a constant and unchanged quantity (as long as no portion has been removed) whereas its actual weight varies, depending upon atmospheric or other influences.

The fact that the natural moistening of textile material is confined to no particular country or branch of the industry. It is firmly established as a natural and artificial factor in the textile trade and this is what makes it necessary for every person who buys or sells textile materials to protect himself against loss by adopting a reliable method of testing or conditioning all the material bought or sold.

Established standards for moisture in textile materials are as important for both buyer and seller as any standard for money or for weights and measures. A variation in the quantity of water in a lot of raw material or yarn has the same effect on the buyer's and seller's bank accounts as an alteration in the size of the pound or in the number of cents in a dollar would have.

**Conditioning.**

In testing for moisture, or as technically called conditioning, whether referring to the raw material, yarn or finished product, the absolute dry weight of the material is first found, then, to get the true invoice weight, the standard regain of moisture is subtracted from the dry weight to the dry weight.

This standard regain has been fixed as the result of experiments extending over many years, and is supposed to represent the amount of moisture absorbed by the various fibres under average conditions of humidity and temperature.

**Standard Regains.**

To ascertain the standard condition of a raw material, yarn or fabric, a definite quantity of either is heated until absolute dryness is attained, the same being determined by frequent weighings and continuation of the heat until no further loss takes place. The addition of the percentage of the standard regain permissible to the final weight then gives the weight in the correct condition. It is essential that the weighing be performed without removal of the material from the influence of the heat, otherwise re-absorption would imme-

diately commence, and would interfere with the correctness of the result.

A certain amount of moisture is a natural constituent of all fibres, as without it they would be harsh and wiry. With a view to determining the percentage of natural moisture, i.e., "standard regains" together with the "Equivalent losses", which the various fibres contain, a conference of experts met at Turin, in 1875, to deal with this matter, and as a result of many tests and much observation, the percentages given in the appended table were agreed upon.

<table>
<thead>
<tr>
<th>Material</th>
<th>Regain per cent</th>
<th>Normal condition</th>
<th>Loss from normal condition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tops in oil</td>
<td>12</td>
<td>15.69</td>
<td>3.09</td>
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<tr>
<td>Tops dry</td>
<td>14</td>
<td>15.48</td>
<td>2.80</td>
</tr>
<tr>
<td>Yarns</td>
<td>18</td>
<td>15.43</td>
<td>2.57</td>
</tr>
<tr>
<td>Silk</td>
<td>21</td>
<td>9.83</td>
<td>1.90</td>
</tr>
<tr>
<td>Cotton</td>
<td>85</td>
<td>19.35</td>
<td>9.12</td>
</tr>
<tr>
<td>Flax</td>
<td>12</td>
<td>12.69</td>
<td>9.71</td>
</tr>
<tr>
<td>Jute</td>
<td>13</td>
<td>10.71</td>
<td>8.80</td>
</tr>
</tbody>
</table>

(Totals to be continued.)

**Argentine Wool Exports.**

The following extract from the Review of the River Plate shows Argentina’s wool shipments to foreign countries for the past 10 seasons. The wool year here runs from October 1 to September 30. Up to 1902, the average weight of the bales ranged from 450 to 500 kilos (992 to 1,102 pounds), but since then they have been from 400 to 420 kilos (882 to 926 pounds).

**Exported to:**

<table>
<thead>
<tr>
<th>Year</th>
<th>Bales</th>
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<tbody>
<tr>
<td>1912-13</td>
<td>25,870</td>
<td>34,779</td>
<td>103,070</td>
<td>152,330</td>
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<tr>
<td>1913-14</td>
<td>5,362</td>
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<td>14,623</td>
<td>36,273</td>
<td>49,990</td>
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<tr>
<td>1915-16</td>
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<td>46,273</td>
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<td>17,500</td>
</tr>
<tr>
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**Outlook for New Season Favorable.**

According to an article in the Buenos Aires Herald, the wool season that ended on September 30 must be considered one of the most important this country has seen, as the shipments (349,622 bales) were the largest of the last five years. Two-thirds of last year's clip were acquired by the United States; France was the second best buyer. In the preceding season Italy occupied second place.

The purchases of other countries did not change much this season, although there was a falling off in the cargoes sent to neutral ports. Both Spain and Holland took much smaller quantities than in the preceding season, and the exports to "various places" amounted to only 9,222 bales, as compared with 21,305 bales in 1915-16. This decline in shipments to neutral countries was due largely to political pressure, but must be attributed in part to the extraordinarily high prices of the year, which, without doubt, caused a restriction in consumption.

The prospect for the new season is even brighter than the outlook at the beginning of last season, as the clip will amount, more or less, to the same figures, while the quality is much better, which leads many dealers to believe that prices will be even higher this year than last.