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 power (which all fibres used, possess) 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 in a dry atmosphere they will lose moisture and decrease in weight. 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 temperature and barometric pressure. The time which lapses before an exposed raw material, yarn or fabric, responds to changed condition of the atmosphere is termed *time-lag,* and is governed by several factors, such as the bulk of sample, 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 them 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 promoters remarked a few years ago (in an after-dinner speech) that he liked to erect a cotton spinning mill on a good clay foundation, as it was very advantageous to the conditioning cellar, and he considered a good conditioning cellar an important asset and perhaps the best dividend-earning department of the spinning mill. 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 energy in its repression. No yarns can be spun or doubled without moisture, in reason; but to pay for excess moisture at the price of yarn is a suicidal policy, and its continuation leads inevitably to bankruptcy.

The moisture of the atmosphere in certain mill districts is said to be one of the reasons for the success of cotton-spinning, but even in that instance, for years many systems of further humidifying the atmosphere have been adopted in these spinning 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 processes than a dry-spun yarn. This, it 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 single yarn that has been half-drowned in the mill 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 firms add 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 working. 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 with 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 applies, since some spinners and manufacturers have 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 erroneous to say 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 normal condition of the cotton will be 108½ parts; if therefore 108½ parts contains 8½ parts of moisture, 100 parts of normal conditioned cotton contain 7.834 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; surmounting the top of the oven, is fixed a pair of scales. On one extremity of the beam is a pan to contain the weights; at the other end of the beam is suspended, either a wire cage, if cops are being tested, or a reel, if the yarn is in hank, so that the material to be tested hangs within the oven; and the balance of the scale is in equilibrium. 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 degrees.

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 should be ample, so long as the sample does not exceed one or two pounds. There are serious objections to extending the time of drying; for instance, the *increase* of weight known to follow the protracted heating of fibres. The weighing should be conducted within the hot atmosphere of the oven; weighing of the sample after leaving the oven is anything but reliable, making exact results a matter of chance. If the sample be weighed immediately after removal from the oven, it causes an upward current of air at that side of the balance, thus giving an accurate weight; and if left to cool before weighing, it will absorb moisture from the air and become too heavy.

Error Due to Weighing Hot.

It is true that a very small error results from weighing the sample in the hot state as compared with weighing when cold, quite apart from absorption of moisture or the setting up of air currents. This error is, however, easily calculable, and is: (weight of air displaced by the sample at normal temperature) minus (weight of air displaced by the sample at its temperature when weighed). It will be found that the error is too small to be worth consideration 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 with a view to ascertaining 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.

As 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 weights are 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
$2 \times 100 = 200 \div 16 = 12\frac{1}{2}$ per cent.

12½ per cent in loss leaves 100 — 12½ = 87.5 of cotton in absolutely dry condition, a regain of 8½ per cent from the absolutely dry cotton to a normal condition.

$87.5 \times 8.5 \div 100 = 7.44$ 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.– a pound is too expensive a luxury for most weaving or knitting mills. The condition of the yarn received is a most important consideration for the mill, and claims for excess moisture are the most difficult to settle with the spinner, as a rule. It is therefore imperative that tests of spinnings should be regularly made, and in case of default most 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, with the atmosphere at the point of saturation, it has been known to absorb as much as 50 per cent. Woolen Yarns in a normal condition contain about 18¼ 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 8½ 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 feeling 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, which, when absolutely dry, contains 75 per cent wool and 25 per cent cotton, the regain is found thus:

100 : 75 :: 18¼ : 13.69 % for the wool.
100 : 25 :: 8½ : 2.125 % 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 on atmospheric or other influences.

The artificial, like 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 are established standards 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 must be added 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 continuance 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 immediately 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.

Material.	Regain.	Loss from normal condition.
Wool Scoured	16 per cent	13.79 per cent
" Tops in oil	19 "	15.96 "
" Tops dry	18¼ "	15.43 "
" Noils	14 "	12.28 "
" Yarns	18¼ "	15.43 "
Silk	11 "	9.91 "
Cotton	8½ "	7.83 "
Flax	12 "	10.71 "
Jute	13¾ "	12.09 "
Hemp	12 "	10.71 "

(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:	1912-13 *Bales.*	1913-14 *Bales.*	1914-15 *Bales.*	1915-16 *Bales.*	1916-17 *Bales.*
United States	25,876	34,779	103,070	152,330	225,467
Austria: Trieste..	5,362	6,881	.....	.....	.....
Belgium: Antwerp	30,668	36,723	.....	.....	.....
France:					
Bordeaux	642	367	33,265	14,879	24,347
Dunkirk	64,765	72,551	100	1	.....
Havre	4,287	7,384	1,793	11,501	9,577
Marseille	338	1,573	12,472	6,903	3,581
Germany:					
Bremen	10,175	19,021	.....	.....	.....
Hamburg	93,082	66,172	.....	.....	.....
Mulhouse	3,149	1,931	.....	.....	.....
Italy: Genoa.....	6,093	6,120	47,672	41,491	32,286
Netherlands	2,637	2,678	9,637	11,697	7,517
Spain: Barcelona.	186	30	8,169	7,002	3,637
United Kingdom..	63,274	43,255	77,319	32,098	33,988
Other Countries..	399	6,141	11,020	21,305	9,222
Total	310,933	305,606	304,517	299,207	349,622

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.