FABRIC ANALYSIS.

(Continued from October issue.)

Ascertaining Materials Used in Construction of Fabrics.

To determine the raw materials of which any yarn or fabric under consideration is composed, there are two methods to follow, *viz:* physical and chemical tests.

Physical Tests.

These tests are based upon the structure and consequent appearance and feel of the various fibres, and may be considered under three divisions, viz: (*a*) practical knowledge, (*b*) by means of the microscope and (*c*) by burning.

In the mill, men who handle yarns and fabrics daily, year after year, to a certain extent can by feel readily distinguish of what materials the same are composed. However, even the most experienced man will sometimes be in doubt and have to resort to one or the other physical or chemical test, to convince himself if his judgment is correct, more so will this be the case if dealing with yarns or fabrics composed of two or more kinds of raw materials used in their construction.

The microscope will in most instances reveal the constituent parts of a yarn or fabric, whether pure or mixed.

Textile fibres of commerce belong to two distinct varieties: (*a*) animal fibres, (*b*) vegetable fibres.

Of these, the first variety comprises (1) wool, hair and fur, each having formed the covering of an animal, and (2) silk, as spun by the silkworm at its entry into the chrysalis.

With reference to vegetable fibres, the first place belongs to cotton, the next to flax jute, ramie, etc. Besides these two chief varieties, a third, artificial silk may come under consideration.

The Microscope.

By means of it, yarns or fibres can be examined under a lens either by bringing them within or beyond focal length; in the first instance obtaining an enlarged picture on the side next the object, whereas in the other case, the enlarged picture is formed in an inverted position on the opposite side of the lens. To obtain high magnifying power, these two conditions are combined in the compound microscope, which consists in its main parts of a tube some six or seven inches in length, closed at the upper end by a large glass lens (of greater focal length—placed nearest the eye, hence termed *eye piece*) and at the lower end by a smaller glass lens (of smaller focal length—placed nearest the fibres to be examined, hence *object piece*), both pieces being capable of vertical movement. This tube is blackened on the inside to exclude extraneous light. The total magnifying power of a microscope is thus the sum of the powers of the *object piece* and the *eye piece*. The tube carrying the two pieces for adjustment in the regular microscope, is raised or lowered by a rack and pinion motion, while in connection with a high class microscope, an extra, *i. e.*, fine adjustment, is afterwards made by the micrometer screw, as provided to such microscopes.

On the stand of the microscope we find fixed an arrangement for supporting the stage (pierced with a small circular aperture for the passage of the reflected light), as well as a small circular concave reflector, movable in any direction.

The most important quality of a good microscope is, that its lenses produce a well defined, clear picture, distinctly showing every detail of structure in the object under examination.

The best source of illumination for carrying on investigation by means of the microscope is diffused daylight, with a sky evenly covered with a white veil of clouds. In connection with artificial light, a glass bulb, filled with a dark blue solution of ammoniacal copper oxide, interposed between the source of light and the condenser, will be found of advantage.

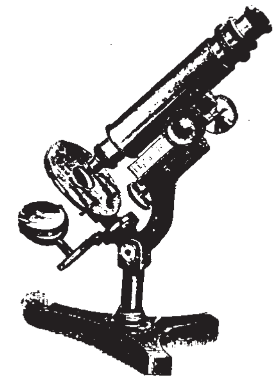
When dealing with wool fibres an important factor is that the illumination used for the examination of the structure of the scales, the cortex or the medulla (if present) should be entirely modified when it is desired to observe the disposal of the coloring matter in the cortex. In the first case the light is suitably restricted by means of the iris diaphragm with which the microscope used for this work is fitted out, while in the latter case the diaphragm is thrown completely open, and as much light as possible from some uniform source is directed through the fibres. All appearance of scales, medulla, etc., will now disappear, and only the faintest profile of the fibres remain visible, however, the pigment disposal, in the peculiar characteristic manner of lines and irregular congeries of dots, etc., will stand out as clearly as possible.

As mentioned before, no method of artificial illumination is so satisfactory for this work as diffused daylight, though the more conspicuous forms of fibre coloration can, in default of this, be seen by interposing a sheet of ground or whitened glass between the mirror and the source of artificial light, of which the ordinary mantle used with gas (or better, with a petroleum lamp) is, perhaps, the most suitable.

Where the pigment is nearly obsolete or where comparison has to be made with dyed wool fibres of such faint brownish and yellowish tints as may be employed with a view to resemble natural (colored) wool fibres, artificial light cannot be satisfactorily employed.

If these precautions are observed, the essential differences between dyed and natural (colored) fibres can be quickly determined, although fabrics are seldom met with in which the normal shades of most can be so closely imitated so as not to be detected at once by the naked eye.

Any dyed fibre, unless of so faint a tint as to appear colorless under the microscope, will show a complete uniformity of coloring throughout, from edge to edge; whereas the distribution of the pigments in the cortex of natural brown fibres occupy definite restricted areas, as mentioned before. The method of such disposal, however, varies largely in different classes of animal fibres, and often affords a means of distinguishing one kind of fibre from another.



MICROSCOPE.

When a material, such as that used for the natural undyed underwear is examined, it will be seen that the admission of the small proportion of brownish and yellowish fibres introduced in the mixing process into the bulk of the white fibres produces an irregular appearance of small patches of color, so that to imitate this, it would not do to employ a uniformly dyed yarn, but specifically dyed fibres, of the colors of sheep's wool, must be introduced in the same fashion. It is here that the microscope can be of infallible service in detecting the dyed fibres by revealing the differences before mentioned, between the pigment disposal of the natural fibre, and the uniform, clear, unbroken transparent color of the dyed fibre.

It is even possible in some cases where natural brown fibres have been dyed, should the latter not have rendered the fibre too opaque, to see coexistent in the same fibre the lines and areas of pigment showing through the clear and uniform dyed color.

A precaution may here be noted against classing as *dyed*, such fibres that for one reason or the other have become artificially colored, such as may have been stained by the sheep's urine or fæcal matter; however such fibres rarely are present in large numbers. Their color is weak and irregular in distribution, their scaly structure usually more or less impaired, so that the analyst can generally without difficulty discount their presence.

Water is the usual medium in which wool fibres can be microscopically examined. The scaly structure of the fibre can be well seen by oblique illumination, by throwing the iris diaphragm out of the optical axis of the instrument. The fibres then have a striking silvery appearance, the projecting edges of the scales catching the light, and the cylindrical nature of the fibres being clearly shown.

Much of what has been said about the wool fibre is also applicable to the examination of vegetable fibres, though in many cases the use of higher powers may be required.

For ascertaining the difference of certain fibres, *i. e.*, silk and artificial silk, the microscopical appearance of cross-sections will often be found of use. In making such cross-sections paraffin wax of fairly high melting-point is the most suitable medium. A bundle of the fibres is straightened, as far as possible, immersed in the wax at a temperature a little above its melting-point, and the mass then twisted between the finger and thumb until a solid rod is obtained.

Cross-sections may easily be cut from this by means of a microtone, or with a sharp razor with a little practice.