denly lose their strength and fall to pieces in the fabric, and the consensus of opinion of those who have investigated the silk fiber, after it has been made up into fabrics, is that such breaking is in all probability due to the presence of fatty acids.

Of course there are other substances besides the above mentioned that act destructively upon silk, sodium chloride (common salt) being also an enemy that must be seriously considered.

In dyeing blacks with logwood, silk soap is very frequently added to the second dye-bath, and if after dyeing, the rinsing has not been thorough, appreciable traces of soap may remain in the goods, and in such cases the use of muriatic-acid-olive-oil brightening mixture is certain to liberate free fatty acids that would in time positively injure the goods.

Water a Most Important Item.

The water problem in silk mills comes prominently in mind when soap is considered, as both go hand in hand. No silk mill can turn out a uniform article, if the quality of the water changes, which is a matter of frequent occurrence in mills depending upon a natural source of supply.

Calcareous water is not to be considered, and no silk mill should be located where such water only is to be had. Naturally soft water from granitic regions is eminently suitable, but such localities are not numerous.

The chemical treatment of water containing excessive quantities of lime or magnesia is not an easy matter in the dye house, and any attempt to correct water by the tubfull is usually without result.

The safest course to pursue by a mill using reasonably large quantities of water daily, is to install one of the softening plants and processes that are available, the result being that the dyer will always have at command a sufficient volume of water for his requirements of uniform quality, thereby relieving his mind of any consequences that would arise under other circumstances.

A soft (zero) water always leads to level shades in dyeing, especially for colors, while a hard water causes a certain loss of dyestuff, which not only tends to unevenness, but materially influences the crocking.

The process for water softening now most commonly used is that requiring very simple chemicals, known as the PERMUTIT PROCESS, resulting in an unfailing supply of Zero Water. Cases are known where so-called soft water had been used, the adoption of "Permutit" resulted in a saving of more than half the soap formerly used—to say nothing of important added savings in dyes, labor, fuel and power costs. The result is practically complete removal of the soluble impurities in the water, the same being thrown out as an insoluble precipitate, leaving the water clear and soft.

The operation of these various plants can be adjusted to such a degree of nicety, that very little attention is required, while water of uniform purity is constantly delivered.

There is no question but that the two items, **soap** and **water**, are not given the full attention in silk mills that their importance demands, and this should not be, as all the good qualities possessed by a finished fabric have a direct bearing upon the quality of both soap and water.

Points on Fabric Structures.

(Continued from May issue.)

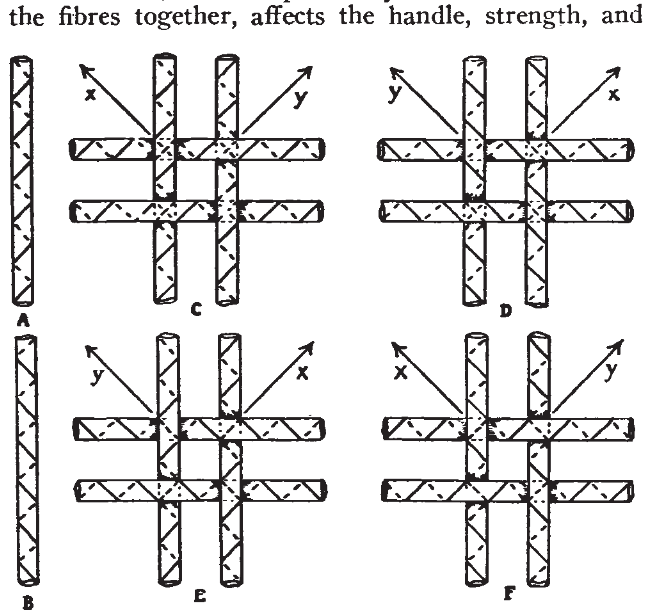
Importance of Twist.

Under the head of fabric structure it is important to consider the twist of the yarns to be used, as this has a marked effect both on the appearance and utility of the finished fabric.

A yarn made with little twist, besides being weak, leave small perforations in a fabric, and the threads are so soft that interweaving causes them to spread out and to some extent cover the interstices.

On the other hand, hard twisted yarn, while giving a strong fabric, is so wiry that it resists compression in weaving, and as the fibres are held together in the yarn, there is nothing left to cover the perforation caused by interlacings.

The twist, which is put into yarns in order to bind the fibres together, affects the handle, strength, and



wearing property of a cloth, and also has a considerable influence upon the appearance of a fabric in which any form of twill line is developed. Generally, just sufficient twist is inserted to enable the threads to withstand the strain of weaving. More turns per inch are required in fine than in thick threads, and for short than for long-fibred materials, while warp yarns are mostly harder twisted than filling yarns. The twist, while strengthening the yarn, makes it harder, and reduces its lustre; to many fabrics the necessary firmness of structure is imparted by the warp, and softness and brightness by the filling. For special purposes, yarns are twisted more or less than the normal, according to the effect required in the cloth; thus *voile* and *crepon* yarns are very hard twisted, whereas yarns for raised fabrics are twisted soft.

To show the influence of the direction of twist in the construction of a fabric, the accompanying six diagrams are given.

If the direction of the twist is to the right, as shown at *A* in the accompanying diagram, it is termed *open-band,* and if to the left, as represented in diagram *B,* it is termed *cross-band.* In cotton yarns, *A* represents warp twist (twist way) and *B* filling twist (filling way), whereas in worsted yarns, warp twist is as shown at *B,* and filling twist as shown at *A.* Single woolen yarn is almost invariably twisted as indicated at *B*. In folded yarns, the twist is mostly inserted in the opposite direction to that of the single threads, since this causes some of the twist to be taken out of the singles, and a softer folded yarn results than if the direction of the twist is the same in both twisting operations; the latter method increases the twist in the singles and tends to make the folded yarn hard.

Diagrams *C, D, E,* and *F* show the different ways in which the warp and filling threads may be placed in relation to each other, as regards the direction of the twist.

In *C,* the warp twist is as shown at *A,* and the filling twist as at *B,* the surface direction of the twist being to the right in both threads when the filling is laid at right angles to the warp.

D shows the exact opposite of *C,* the surface direction of the twist being to the left.

E shows both series of threads twisted as shown at *A,* and *F* same as at *B.*

In *C* and *D,* the direction of the twist, on the under side of the top thread, is opposite to that on the upper side of the lower thread, hence the threads do not readily bed into, but tend to stand off from each other, which assists in showing up the weave and structure of the cloth distinctly.

In *E* and *F,* on the other hand, the twist of the under side of the top thread is in the same direction as that on the upper side of the lower thread, hence in this case the conditions are favorable for the threads to bed into each other and form a compact cloth in which the weave and thread structure are not distinct.

In twill fabrics, the clearness and prominence of the twill lines are accentuated if their direction is opposite to the surface direction of the twist of the yarn. If, however, the lines of a twill are required to show indistinctly, the twill should run the same as the surface direction of the twist of the yarn.

If one yarn predominates on the surface, the twill should oppose or run with the twist of the surface threads, according to whether the effect is required to show prominently or otherwise. Thus in diagrams *C* and *D,* the arrows *X* indicate the direction in which the twill should run if the lines are required to show boldly and clearly, and the arrows *Y* if an indistinct twill effect is desired. In diagrams *E* and *F,* the arrows *X* show the proper direction for producing a bold twill, and the arrows *Y* for producing an indistinct twill if the filling predominates on the surface. If, however, the warp forms the face of the cloth in *E* and *F,* the arrows *Y* indicate the proper direction for a bold twill effect, and the arrows *X* that for an indistinct twill.

If a twill runs both to right and left in a cloth (a herring-bone twill) it shows more clearly in one direction than the other. Also, the difference in the appearance of right and left twist is sufficient to show clearly in a twill fabric in which the weave is continuous, and *shadow* effects are produced in warp-face weaves by employing both kinds of twist in the warp-threads.

Theory of Fabric Structure.

All of these facts regarding structure may be summarized as follows:

(a) Use a weave that will give the requisite weight, strength, and appearance;

(b) determine the texture for this weave;

(c) employ yarns of standard twist; and

(d) let the twist be consistent with the desired finish.

Such being the theory of cloth structure, the next step is to see wherein a practical application demands a variation from this theory and the probable reason for these differences. Of course, there are any number of causes of these variations, for every manufacturer works with his own conditions and ideas; still, in the majority of cases, the change may be made for the sake of utility, or appearance, or cost, or even all three reasons combined.

Among fabrics which vary from theoretical construction for the sake of utility may be mentioned those which in their usage demand either a low or a high texture, such as light muslins, organdies, gauze fabrics, etc., or canvas, ducking, hose cloth, etc. These fabrics have a variation in both warp, and filling from a theoretical base, but it is often desired to change the weight or strength of goods by altering the texture in only one system of threads. Among such fabrics may be mentioned certain classes of drills, cottonades, and trouserings. In changing textures for appearance, it is often desired to make certain twill lines prominent, as in denims, twilled dress goods, and trimmings; or to intensify color effects, as in some varieties of suitings and cloakings.

Then, again, we have those classes of goods in which a variation in structure causes a peculiar effect, such as in poplins, repps, cords, piqués, brilliants and satins with a highly-lustrous face.

The question of cost, both in material and construction, is the most general reason for a fabric not being made up to a theoretical standard. The fewer the ends and the picks, the greater the production and the lower the original cost. There is a demand for a cheap class of goods, especially in sheetings, checks, ginghams and shirtings, and in order to supply this demand these goods are made with as low a texture as possible, consistent with certain commercial standards of weight, tensile strength, etc. Where a fastidious trade demands any improvement, manufacturers often retain the same textures and make up for any deficiencies in weight or appearance by using some stuffing or filling, such as flour, starch, clay, flocks, etc., or else through some mechanical finishing process.

THE DYESTUFF SITUATION IN THE TEXTILE INDUSTRIES.

(Continued from May issue.)

Public Dyers and Finishers.

The various effects of the dyestuff shortage upon the cotton, wool, and silk manufacturers are combined in the case of the dyeing and finishing companies. This branch of the textile industry, which includes the dyeing and finishing processes for a wide range of products, uses large quantities of dyestuffs of a great many varieties.

The accompanying table summarizes the data for the consumption of dyestuffs and chemicals in 1913 and 1916 for 21 dyeing and finishing companies.