CHAPTER VII

MATERIALS FOR CLOTHING (THREADS, YARNS AND FIBERS)

Importance. We saw in the previous chapter that the characteristics of a cloth are due to the characteristics of the yarn or thread, which in turn are due to the raw material of the yarn — the fibers. Hence, we must know the yarns, threads, and fibers.

If yarn is taken from the edge of a piece of serge and untwisted you will notice that it becomes weaker and weaker until it separates into individual lengths called fibers. In other words, yarn or thread is composed of long or short lengths called fibers of cotton, wool, silk, rayon, or linen drawn out to considerable length and then twisted. Note that the twist gives strength and that the long fibers can be drawn out longer than the short fibers.

Fibers. The fibers used for cloth come from certain plants or animals. Cotton comes from the ripened seeds of the cotton plant and varies from $\frac{1}{2}$ to $2\frac{1}{2}$ inches long. Wool comes from the back of sheep and goats and varies in length ($\frac{1}{2}$ to 8 inches) and softness, etc. Silk is given off by certain caterpillar forms called silkworms, to cover the insect while changing its physical condition, and varies from 3 inches to 4,000 feet long. Linen is obtained from the stem of the flax plant, and varies from $\frac{1}{2}$ inch to 6 inches in length. Rayon is obtained by twisting wood pulp. All these different kinds of fibers have different qualities due to length, softness, etc., that cause differences in prices of the same kind ranging from 200 to 300 per cent.

Carding and Spinning. Since the raw fibers are collected in a mass with more or less dirt, the problem of making them into yarn
requires three distinct operations: (1) Cleaning the fibers, (2) reducing the clean matted fiber into a strand about an inch in diameter, (3) reducing the thick strand to a thread of the proper size by a series of operations of drawing (pulling out) and twisting.

**Fine (Combed) Yarn.** The quality of cotton or worsted yarn, etc., may be improved by an additional operation of combing — passing the raw material through a steel comb which makes all the fibers parallel and also removes the short fibers. Combing improves the evenness, smoothness, and luster of the yarn. Hence it is used only for the better quality of cloth. Yarn may be increased in size and strength by doubling or trebling, producing what is called 2-ply or 3-ply yarn.

**Yarn and Thread.** The thread-like strand that is interlaced in weaving to make cloth is called yarn. Yarn is used in making cloth and thread in sewing. Compare a piece of thread and of yarn. Thread differs from yarn in the following points:

1. Yarn is a strand of twisted fibers.
2. Thread is ply yarn; that is, a number of yarns twisted together.
3. Thread must be smoother than yarn and sized so that the ends will not show the individual fibers and so that it can pass through the eye of the needle.
4. Thread must be stronger than yarn, hence must be made of long fibers and much twist so as to hold fabrics together.
5. Notice that the end of a piece of yarn has fibers projecting, while in thread the fibers are twisted and then smoothed by the tal low in the sizing operation so that the fibers are close together.

Yarns of different kinds can be twisted together in ply form so as to make (1) a cheaper product — cotton with wool; (2) a stronger and cheaper yarn — cotton and rayon; (3) a cooler yarn that will prevent shrinkage — cotton and wool (4) a thinner and more luxurious yarn — silk and wool.
Strength of Yarn. The strength and fineness of a yarn or thread is due to the length of the fibers and the number of turns or twists to an inch. The longer the staple the longer the yarn which can be made from a given amount of fibers. The twist varies from a few turns to a hundred per inch. The longer the fiber the more twist can be placed in the yarn without kinks or roughening. A two-ply yarn highly twisted, that is, with as many turns or twists to the inch as possible, woven closely together, will give a firm, stiff fabric that in the case of a worsted would hold its shape and be valuable for trousers or a suiting. A fabric composed of a single yarn not so tightly twisted or closely woven would be softer and adapted to women's suiting because it would drape better. On the other hand, fabrics with less twist would not be as strong, but would be easily napped, so adapted for overcoating. Worsted fabrics have a larger diversity of weave designs than woolens.

There are different types of finish or treatment given to different yarns, such as (a) lisle yarn, (b) zephyr yarn, (c) “twist” yarn, (d) novelty yarn, (e) schappe yarn, all of which have distinct artistic value and hence should be described in detail.

Lisle. Look at the lisle hosiery on the market and notice the very fine silk-like appearance of the stocking. Lisle thread or yarn is made almost exclusively from long-stapled Egyptian cotton. It is usually combed, spun, and twisted in a moist atmosphere, thus intensifying its compactness and solidity; and not infrequently it is gassed (passed over a hot plate) to remove the fuzz and give it a smooth, clean surface. The luster is then increased by the calendering process, which gives it a brilliant, lustrous finish. An especially brilliant finish is sometimes produced by treating it with tallow after dyeing. Tallow not only imparts a beautiful luster, but it also serves to increase the effect of the color and gives the yarn a soft and silky feel.

Garments knitted of lisle thread have a dry, cool feeling, and do not become soggy from perspiration as do those made from the more loosely twisted carded yarns. Each fiber of the combed thread retains its separateness, and there is no felting; consequently, the smooth threads slide and slip in their meshes and thus give
great elasticity to the whole garment, peculiarly adapting lisle to the production of high-grade underwear, gloves, and hose.

**Zephyr.** Zephyr is a name specifically used to denote a variety of soft, fine worsted yarn used for knitting, crocheting, and embroidering. It is also used as a trade name to denote textures of various kinds characterized by extreme lightness and fluffiness: as, zephyr flannel, zephyr gingham.

Zephyr is produced both in solid colors and clouded effects, and according to the size of the strands, is known as *double*, *single*, and *split*, containing, respectively, eight, four, and two strands. Double and single zephyr yarns are very slightly twisted, so that the individual strands can be divided if desired. Split zephyr is more closely twisted, and is used principally for crocheting.

**Twist** is a term applied to a thread, cord, rope or the like made of two or more strands wound one around the other. It is applied principally to silk thread used for sewing. *Buttonhole twist* is a variety of loosely twisted silk thread put up on small spools containing 10 yards; used exclusively for making buttonholes. *Machine twist* is the name originally given to three-cord silk thread for use on the sewing-machine.

**Novelty Yarn.** Examine a piece of ratine. Note the knots in the yarn. Many novelty fabrics, particularly fabrics for ladies' wear, are made from unusual and freak yarns called *novelty yarns*. These fabrics are expensive to produce because they require special twisting machines for taking single yarns and twisting them into two-ply or more, with a device for producing a loop in the yarn as it is being twisted.

There are five distinctive types of novelty yarn: spiral, spot, snarl, loop, and slub. There may be modifications of each and combinations of two or more. Every type of novelty yarn consists of two or more of the following members: A *base* or foundation end, around which the end or ends intended to create the effect or design are twisted; the *effect yarn*, the various characteristics of which constitute a design and give the threads their distinguishing titles;
and the *tie yarn*, which is used to bind the effect thread in its correct position on the base and to prevent slip. Each of these may be single or ply yarn and may be grey or colored. The effect ends are formed from rovings, soft-twisted single yarn, or ply yarn, the last named in many cases being previously twisted in a fancy manner. In general, all of these yarns are made by twisting together at uniform but different speeds. *Spot, snarl,* and *loop* yarns are made by twisting two yarns together and varying the rate of delivery of one to give the effect. The various effects, as denoted by the names, are due to the relation of the two twists and to their character. In *spot* yarn the effect yarn winds closely around the base in spots or at intervals. *Snarl* makes a twisted snarl at intervals, and *loop* gives a loop of yarn at intervals. *Slub* yarn is made by spinning or twisting roving with ordinary yarn or yarns at intervals, or making it continuous and bunching it at intervals.

**Shoddy.** Since there is not sufficient new wool cut from the sheep’s backs each year to meet the needs of the clothing trade, it is necessary to use over again old wool or rags, called *shoddy*, from old clothing.

Old rags are made into yarn by the following operations:

1. Freed from dust, 2. carefully sorted, 3. oiled so they will be soft and pliable, 4. grinding operation, which consists of tearing the rags, thread from thread and fiber from fiber, until they are reduced to a mass of wool. Then this wool may be mixed with virgin wool and made into woven yarn.

**Genuine or Reeled Silk.** As described above, silk is found on the market in two forms, (a) reeled and (b) spun silk. The reeled is better and stronger because it is made from the continuous silk of the whole cocoon held together by the gum and twist. That is, the silk is removed from the cocoon and then twisted into yarn for weaving.

As raw silk is already in the form of a continuous strand, there is no occasion for the preparatory machinery that is needed for all other textiles, where a mass of short, tangled fibers of varied lengths needs to be transformed into a continuous length of
rowng. The raw silk is doubled and twisted by a process called silk throwing.

Spun Silk. Notice the silk in pile effects of velvets and plushes and in silk thread. This is obtained from a waste silk called spun silk. Waste silks include the pierced cocoons, that is, those from which the moth has come out by making a hole and breaking the fibers in one end of the cocoon. The gum is removed from the fibers by boiling with soap, etc. After the gum is removed from the cocoons, they are opened and combed and made into yarn, the same as worsted. Since the fibers are small, they must pass through the same operations as cotton and wool in order to make a continuous thread. Imported spun silk is often called schappe silk and is used for the pile of some velvets.

Since the silk from the cocoon contains nearly 25 per cent by weight of gum, which dulls its natural luster, this gum must be removed by boiling. The fiber remaining after the boiling-off is then lustrous and brilliant, and of a light creamy white. If it is to be dyed "pure dye," the coloring is next proceeded with, and the weighting added.

Loaded or Weighted Silk. Should it be desired to increase the thickness of the silk, a process called weighting precedes the coloring. Silk has a great affinity for many substances (tin chloride, lead acetate), and when immersed in solutions of such substances will absorb and retain a considerable amount, thus adding to both its bulk and weight. By careful and scientific treatment, not only can the weight lost in boiling-off be replaced, but a large additional weight can be imparted, particularly in blacks, although all silk fabrics may be loaded.

The weighting of silk is an expensive and complicated process, but as it makes possible the production of sound, useful, and sightly qualities at much lower prices than would otherwise be possible, its use, within the dictates of prudence and the limitations of good practice, is of economic value to the consumer. Most yarn-dyed goods are weighted to some extent.

While loading silk to a limited extent may not affect the softness, luster, or color, it does affect the strength and endurance of the
fabric. Hence, it is necessary to sell and wear weighted or loaded silk fabrics quickly. Sunlight, washing, and perspiration will destroy loaded silk. Light weight, pliable, and wash silks are not as liable to be loaded as taffeta and other stiff silk fabrics.

Silk goods are always made and brought before the public with the idea that they will drape well. Weighting them was started some years ago with the advice, expressed through the press of the country, that we should confine ourselves to a certain percentage of weighting which would make weighted silks as wearable as any pure dye silks had been.

Within the last few years there has been a tendency to increase the percentage of weighting, owing to the demand of the trade. However, durability and wearability of the fabric have always been borne in mind. Weighting of silks has reached the point beyond which it cannot go, but still the trade is asking for more weight and what is more serious, an undue stiffness in these goods. This stiffness will cause the silks to crease and break when made up into dresses, and may drive women away from the silk fabrics eventually.

Other Fibers. There are other fibers such as alpaca, horsehair, and camels’ wool that are used in clothing. Mohair and alpaca are fibers obtained from goats. Both fibers are stiff and lustrous, although mohair is more so than alpaca. Because mohair is stiff, smooth, and has a luster, it is adapted for pile fabrics and those that do not require frequent cleaning. It is not adapted for soft, clinging lines and styles.

Horsehair is very stiff and is used for stiffening in the underlining of coats. Camels’ wool is very warm and light, hence it makes a fine, soft, light-weight, dressy fabric with a glossy, slightly hairy finish.

Tinsel. This term has long been used to denote a metallic substance, used in strips or threads for any purpose in which a sparkling effect is desired without much cost. Tinsel thread is produced in a great number of ornamental styles, both flat and round, and in all colors and shades, though usually in imitation of gold or silver. It is largely used in the production of novelty dress trim-
tings, braids, and cords, and for making various kinds of thread used in artistic needlework.

**Metallic Threads.** Metallic threads have always been used for decorating, particularly in rich fabrics. Fine golden threads, as well as silver-gilt threads, and silver threads and copper wire, were used in many of the so-called Cyprian gold-thread fabrics, so renowned for their beauty and permanence in the Middle Ages. These threads are now produced by covering flax or hemp threads with a gilt of fine texture.

**The Finishing of Cloth.** Cloth as it comes from the loom is in an imperfect condition for use. It must be treated in such a way as to make it attractive, and in some cases fuzzy; so as to make it feel warmer or heavier, etc. Each fabric is treated differently in order to meet certain requirements of style. The different treatments, called finishing operations, are as follows: 
(a) mending, (b) fulling, (c) bleaching, (d) napping, (e) shearing, (f) pressing, (g) sponging, (h) mercerizing, (i) gassing, (j) sizing, (k) waterproofing, (l) fireproofing, (m) embossing. No one fabric has all the finishing operations.

**Mending.** The object of darning or mending is to make repairs in the structure of the cloth by inserting the missing threads, according to the weave, by means of a needle. Notice that threads are actually woven in one direction and the other. The loose ends are left exposed as Fig. III. Then they are cut and the cloth pressed so that loose ends will not be seen.

More exact work is required in mending threadbare fabrics that call for little if any finishing than in dealing with a face-finish.
fabric, where the nap is to be raised and will cover many imperfections so that they will never be noticed in the finished cloth.

Every knot that has been tied in the threads during the manufacture of cloth must be looked for and felt for, carefully drawn to the surface of the cloth, and then clipped off with the scissors.

**Pulling.** The object of pulling is to render woolen and worsted goods stronger and firmer in body. Pulling is similar to felting, the principal object of each being to condense the fibers, thereby increasing the firmness. Certain varieties of woolens are fulled nearly one-half their original width and length. They are then dried and stretched on a machine at the finished width.

Sometimes finely cut-up wool waste is fulled into the under side of cloth in order to make it firmer. Sometimes it is used to cover up defects and make cheap fabrics of cotton and wool appear thick. Later this wool waste falls from the cloth and appears in the linings of coats and skirts.

Goods that are to be fulled are woven longer and wider to allow for the shrinking. Excess shrinking causes the cloth to feel tight and stiff, often called **bound**.

**Napping.** Look at a broadcloth and note the fuzzy surface, called the *nap*. Napping is an additional process which may be applied as a finish to any medium or heavy-weight cloth. The cloth is passed through a special machine, called a napping or raising machine, and subjected to the action of wire-covered rollers which scratch the surface and brush up portions of the fiber so as to cause it to stand out and more or less hide the interlacing of the warp and filling. The napping is facilitated by the use of specially soft-twist filling yarns. The twill weave is best for this purpose, as it permits long, regular floats which present an excellent surface from which to raise a nap.

A napped fabric, made by scratching the surface of the cloth so as to form a fibrous covering similar to that on the surface of flannel, is distinctly different from a cut-pile fabric, in which the pile is formed by extra threads which are cut so as to show projecting ends.

Sometimes the loose fibers on a slight nap like a worsted fabric are singed by passing through a gas flame. Small projecting fibers are burned. The cloth is washed to remove the odor of burned wool.
Pressing Machine. Fabrics require more or less consolidating and lustering, or "smarting up" in appearance — practically pressing — before they are forwarded to the warehouse. This is done by passing the cloth over a pressing roll heated to a high temperature. Having obtained a satisfactory luster, it is necessary to fix this by winding the cloth on rollers and allowing dry steam to pass through the piece. This fixes a permanent luster and finish and prevents shrinkage.

The gloss may be increased greatly in mohair and alpaca fabrics by excessive pressure on the cylinders. Luster may be given to cheap broadcloth by the addition of gelatine. This adulteration may be detected by wetting the inspected sample and noting whether the luster appears after the spot has dried. If the luster does not appear, gelatine has been used. If the luster appears, it means a true lustered broadcloth.

Sizing. Look at a piece of buckram and then at nainsook and note the difference in stiffness, which is due to addition to the cloth of starch, etc., called sizing. Starch dressing imparts to a fabric a stiffness and grip which improves and completes it. The finishing process also improves the appearance of the fabric, making it more saleable and at the same time enabling it to withstand shop wear.

Luster. The finishing of fabrics is really a process of beautifying and improving. Sometimes it is done by mechanical treatment alone, but in most instances, in cotton fabrics, it is done in conjunction with such materials as are suitable for developing smoothness and gloss. The degree of luster obtained depends upon: (1) The material of which the calender rolls are made, (2) the pressure to which the fabric is subjected, (3) the amount of friction between the rolls, (4) the constituents of the sizing with which the fabric has been treated.

Look at a piece of Venetian and notice its very high luster. Venetians probably have the highest luster of any cotton fabric. Since the luster depends upon (1) weave — sateen gives the highest degree of smoothness, (2) sizing, (3) pressing — smoothness of the iron and the pressure at which it is exerted, (4) mercerizing and gassing. A mercerized fabric of the sateen weave properly sized would, with the smoothest cylinder at great heat and pressure, give the highest luster.
Calendering. Cloth in large quantities is put through the calendering machine (pressing cylinders) to give it a perfectly smooth and even surface, and sometimes a superficial glaze; the common domestic smoothing iron (flat iron) may be regarded as a form of a calendering utensil. We remember that at home there are two kinds of "irons" used for pressing: (1) one heavy, dull iron, ordinarily used for ironing the wrinkles out of clothing, called a flat iron, and (2) a small, highly polished iron used under great pressure for ironing collars and cuffs in order to give them a high luster. The cloth is first passed between the cylinders of a machine two, three, or four times, according to the finish desired. The finishes, due to pressing between rollers, may be classed as dull, luster, glazed, watered or moire, and embossed. The ironing cylinder (calender) always flattens and imparts a luster to the cloth passed through it. With considerable pressure between smooth rollers a soft, silky luster is given by equal flattening of all the threads. By passing two folds of the cloth at the same time between the rollers, the threads of one make an impression upon the other, and give a wiry appearance. The iron rollers are sometimes made hollow for the purpose of admitting steam or gas in order to make them very hot to give a glaze finish. Embossing is produced by passing the cloth under heated metal rollers upon which are engraved suitable patterns, the effect of which is the reproduction of the pattern upon the surface of the cloth.

Schreinerizing. If the cloth is subject to the action of a steel roller engraved with very fine lines, called schreinerizing, there is a tendency to flatten the threads composing the fabric and impress the surface of the cloth with a close series of ridges so fine that a magnifying glass is needed to distinguish them. These lines reflect the light and give a high luster.

Mercerizing. Examine a piece of mercerized cotton. Note the luster or silk-like appearance of the fabric. The object of mercerizing is to obtain a lustrous silk-like finish; incidentally the yarn is increased in strength and in affinity for dyestuffs. The cotton is immersed for a short time — ten minutes — in a solution of caustic soda and the cloth held very tight under tension. The caustic soda appears to be absorbed by the cotton, which swells and thereby straightens out the porous twisted-ribbon form of the fiber. The
cotton tends to contract in the caustic soda, hence it is held tight so that the fiber assumes an appearance more cylindrical and hairlike. The smoother and more cylindrical the shape, the better light reflector, and therefore the more lustrous it becomes. The alkali must then be rinsed out to prevent tendering. The production of a high degree of luster depends to a considerable extent on the fineness and length of the fiber.

**Gassing.** Various attempts have been made to increase the luster of cotton cloth so it will appear like silk. The principal methods are called mercerizing and gassing.

The object of gassing or singeing is the removal of the fuzz or loose projecting fibers found on all cotton yarns after ordinary spinning and doubling. The clearing away of this fuzz from the surface of the yarn greatly improves its appearance, as the yarn looks smoother, rounder, and brighter. An incidental but important result is that the yarn, by reason of the removal of the fuzz, weighs less per yard, and is therefore raised to a higher count. Incidentally, also, gassing slightly increases the relative strength of the yarn and makes it somewhat darker in shade. In gassing, the yarn is passed one or more times through the electric hot plate, the speed being regulated so that the projecting fibers are singed off without the yarn itself catching fire.

Examine a piece of unbleached cotton cloth, often called grey cotton goods, and note the color, softness, lack of body, etc. Since cotton has a yellowish color and lacks the properties that make a fabric attractive to the eye, it is usually necessary to finish the cotton fabric after it leaves the looms before it will appeal to the consumer.

**Bleaching.** Cotton and linen are bleached in the form of yarn, thread, and cloth. This is a difficult, and in the case of linen is a long process, owing to the large amount of natural impurities present in flax fiber and the difficulty of removing or dissolving them. Although the formula for bleaching linen is similar to that for cotton, it takes a great deal longer to bleach linen, and a number of cycles — quarter-bleach, half-bleach, three-quarter-bleach, and full bleach — are employed. The fabrics are usually sold by designation quarter-bleach, half-bleach, three-quarter-bleach, and full bleach. Bleaching is now done as a rule by chemical processes,
and when chemicals are used great care must be taken as to their strength.

QUESTIONS

1. Why is it necessary to study the yarn threads and fibers?
2. (a) What is meant by the expression "carding and spinning" of the fibers? (b) Why is it important?
3. What is meant by the expression "fine combed yarn"?
4. (a) What is the difference between fine and coarse yarns? (b) How does the fineness of the yarn affect the fabric?
5. What is meant by the expression "lisle yarn"?
6. What is the difference between yarn and thread?
7. Describe the use of the term "zephyr" as applied to yarn and cloth.
8. Describe the characteristics and use of the following: (a) twist, (b) buttonhole twist, (c) machine twist.
9. Describe the characteristics and uses of novelty yarn.
10. Why does the strength depend upon twist and length of the fiber?
11. (a) How is yarn produced? (b) State the importance of twist and length of the fiber.
12. Name the principal fibers and characteristics of each.
13. How is the fineness of a yarn or thread expressed?
14. Explain the meaning of the expression "60's cotton thread six cord."
15. What is meant by the finishing of a fabric?
16. Name the principal finishing operations and state the advantage of each kind.
18. Why are fabrics usually shrunk?
19. (a) What is the difference in wearing qualities between bleached and unbleached? (b) Describe bleaching.
20. Two cotton fabrics have a luster. One has luster on both sides and the other a luster on one side. Which is the mercerized fabric?
21. What gives the high luster to a cotton Venetian?
22. Explain how a luster fabric is produced.
23. Describe the methods of finishing hosiery.
24. State the characteristics and uses of (a) mohair, (b) rayon, (c) linen.
25. (a) What is meant by loaded silk? (b) Is it a worthwhile operation to the consumer?
26. (a) What is a novelty yarn? (b) State the advantages and uses.
27. Describe the characteristics of (a) schappe silk and (b) shoddy. State the economic importance.