

YARNS

(PART 2)

YARNS FROM ANIMAL FIBERS

WOOLEN AND WORSTED YARNS

1. Wool, by which is understood the fleece of the sheep, is spun into two classes of yarns, namely, *woolen* and *worsted* yarns, the distinction between the two being in the disposition of the individual fibers in the thread. Strictly speaking, both are wool yarns, but it is the custom to divide them into these two main classifications for commercial purposes, because of the difference in their structure, appearance, method of manufacture, and uses.

A **woolen yarn** is a thread spun from sheep's wool in which the individual fibers are mixed and crossed in various directions so that the surface of the thread presents a rough, although uniform, appearance, but lacking in luster. A **worsted yarn** is also a thread composed of wool, but the individual fibers lie smoothly and in the direction of the thread and are parallel to one another. The surface of worsted yarn is comparatively smooth and generally has a well-defined luster.

No distinction is made between woolen and worsted yarns merely because of the length of the wool fiber used in their construction, although a somewhat longer fiber is generally used in the manufacture of worsted yarns, which are free from the very short fibers often found mixed with the longer

ones in woolen yarns. Strictly speaking, the distinction between woolen and worsted yarns should be made under the head of yarns as classified according to the method of manufacture, since worsted yarn is produced by an entirely different system from that used in the manufacture of woolen yarn.

RAW MATERIAL FOR WOOLEN AND WORSTED YARNS

2. Of all animal fibers that are used in the production of yarn for textile purposes, the fleece of the domesticated sheep is by far the most important—so much so that the general interpretation of the word *wool*, unless otherwise qualified, is that of the wool of the sheep, although in its true sense the word wool is applicable to the fleece of some other animals. The sheep belongs to the scientific classification of *Ovis*, which is divided into a large number of species. Wool is produced in many parts of the world, chiefly in the United States, Australia, South America, and Europe.

Wools are often divided in a general way in America into two classes—domestic and foreign, or imported, wools. Foreign wools are sometimes divided according to the continent on which they are raised, as, for instance, South American wools, Asiatic wools, Australian wools, etc. They are also sometimes divided according to the country from which they come, as Russian wools, China wools, etc., and sometimes according to the ports from which they are shipped, as Buenos Ayres, Port Phillip, etc. Wool exported from Buenos Ayres is frequently called River Plata wool, from the fact that Buenos Ayres is situated at the mouth of the River Plata (Rio de la Plata). Another classification is that of the Cape wools from South Africa.

Domestic wools are usually designated by the state in which they are grown, as Ohio, Pennsylvania, West Virginia, Texas wools, etc. The wool from the large group of territories, or former territories, is known as territory wool, and includes North and South Dakota, Montana, Wyoming, Colorado, New Mexico, Arizona, Utah, Nevada, Idaho, Washington, Oregon, and California wools.

Wools are often divided according to the use to which they are to be put, as, for instance, clothing wools for woollen yarns, combing wools for braid, luster, and carpet yarns; fine combing wools for the fine and medium worsted yarns, etc.; also according to the breed of the sheep, as Saxony, merino, cross-bred, etc. Sometimes two or more divisions are grouped, as, for instance, Australian merino, Ohio, Pennsylvania, or West Virginia cross-breds. The cross-breds are further subdivided according to the amount of merino blood in the cross-bred sheep, as, for instance, $\frac{3}{8}$ -blood, $\frac{1}{4}$ -blood, $\frac{1}{2}$ -blood, etc.; also as XXX, which means a first cross of a merino with a Saxony, XX, which is the full-blooded merino, and X, which is the quality of a $\frac{3}{4}$ -blood merino and $\frac{1}{4}$ -blood common sheep. The term *delaine* is sometimes used in connection with wools, and while it is a term of somewhat loose application, its general significance is a wool of superior quality, from a sheep containing merino blood. Raw wools are also classified according to the condition or age of the sheep, whether washed or not, and in many other ways, but as this Section is intended to deal only with yarns and the extent to which the classes of wool affect the naming of yarns made from them, these will be ignored; in fact, many of the classifications of raw wools disappear when classifying the yarns.

3. Worsted Yarns Classified According to Raw Material.—The nomenclature depending on the country of origin or the shipping point of the raw wool is not extended to the yarns made from such wool, except in the case of Australian, which is a distinction given to certain kinds of worsted yarn, and American and Canadian when applied to braid yarns that are spun from long and coarse, or *braid*, wools, either of American or Canadian origin. Yarns, however, are classified to some extent according to the breed of the sheep from which the raw wool has been taken, and from these sources are derived such yarn classifications as yarns from $\frac{1}{4}$ -blood, from $\frac{3}{8}$ -blood, from $\frac{1}{2}$ -blood, and merinos, in the worsted-yarn trade. There is a worsted merino yarn,

however, that is made by blending a combed wool and a combed cotton in suitable proportions.

It is only worsted yarns that are classified according to the names of the wool from which they are made. Woolen yarns are spun to a large extent from wools that it is not necessary to classify according to their breed or origin, and commercial woolen yarns in many cases contain only a percentage of wool, so that such classifications are not applied to these yarns to any appreciable extent, except in certain cases; for instance, the term *merino yarn* is applied to certain so-called woolen yarns, which, however, should not be construed to mean that these yarns are made exclusively from the wool of the merino sheep.

All common and $\frac{1}{4}$ -blood worsted yarns are spun into numbers below 20s; the $\frac{3}{8}$ -blood and $\frac{1}{2}$ -blood yarns range from 20s to 40s; the delaine worsted yarns, from 40s to 50s; while the Australian worsted yarns are the finest, ranging from 40s to 70s. The Canadian braid yarns are made from 20s to 40s.

The difference between yarns made from different wools is chiefly in the fineness of the thread. Yarns from the wool of sheep with a large proportion of merino blood are the finest numbers, with the exception of yarns from Saxony wools.

4. Woolen Yarns Classified According to Raw Material.—Woolen yarns spun on the straight woolen system may be roughly divided into three classes: (1) pure woolen yarns, (2) shoddy yarns, and (3) part-wool yarns.

1. *Pure woolen yarns* are composed of the wool of the sheep only, and in general are yarns of fine quality, and used in the highest-grade fabrics. They are not made to nearly so great an extent at present as formerly, and it may be stated that the bulk of the so-called woolen yarns now made are either shoddy or part-wool yarns.

2. *Shoddy yarns* are all wool but are made from a mixture, in the raw stock, of new wool and shoddy, new wool and mungo, new wool and extract, or new wool and some of the various hairs that are occasionally used for textile purposes. Shoddy, mungo, and extract are sometimes manufactured

into very coarse yarns, but are more frequently used with new wool as mixture yarns.

Shoddy is the wool fiber obtained from soft woolen rags, such as flannels, stockings, and knit goods, which have not been milled or felted. While shoddy is pure wool, it loses much of its characteristic wool nature in the manufacture and tearing apart again to regain the fiber. In the process of obtaining shoddy, the woolen rags are ground up or torn into a fibrous state, which necessarily breaks the fiber until it is only a fraction of its original length. The loss in length of the fiber and the destruction of the uniform and regular structure characteristic of new wool makes shoddy fit only for mixing with new wool in the production of the lower qualities of goods.

Mungo is the recovered fiber of hard-spun and felted woolen and worsted goods. Owing to the hard milling that these goods undergo, mungo is inferior to shoddy. There are two varieties of mungos, the better quality being obtained from the new rags that accumulate in tailor shops as clippings, and the poorer quality from worn broad-cloths, suitings, etc.

Extract is the recovered wool fiber obtained from worn or waste cloth that contained cotton or other vegetable fibers as well as wool. The vegetable fibers are first removed by a chemical process known as carbonization, and the wool fibers afterwards worked up into a fibrous state in a similar manner to shoddy and mungo.

3. *Part-wool yarns* are made from a blend of wool and cotton, wool and silk noils, or wool and some other fiber, and while forming a very large class of yarns often called wool and sold as such, are really only part wool, such as are called in German half-wool (*halb wolle*) yarns. Merino yarns form one variety of such yarns; they are spun on the woolen principle from a blend of wool and cotton, and resemble woolen yarn. Different percentages of wool and cotton are used for merino yarns; for instance, 40 per cent. wool and 60 per cent. cotton, usually written 40-60; 50 per cent. wool and 50 per cent. cotton, written 50-50; 60 per cent. wool and

40 per cent. cotton, written 60-40; and 70 per cent. wool and 30 per cent. cotton, written 70-30.

Vigogne yarns is a name given to a class of yarn formerly made like merinos but with a very small proportion of wool, generally only from 3 to 10 per cent. The name was probably originally adopted in order to give the impression that the yarn was made from the wool of the vicugna goat, which makes a very desirable yarn, but vigogne yarns do not contain any vicugna wool; the small percentage of wool used is that of the sheep, cotton being the other constituent of the yarn.

5. A more convenient classification of woolen yarns than under the three foregoing headings would be to consider all woolen yarns other than those from pure, new wool—such as wool-and-shoddy and wool-and-cotton yarns—as **mixture yarns**; this is sometimes done, but it leads to complications, since the term mixture yarns, when used in connection with woolen yarn, also includes those of pure wool produced by mixing colored wools, and thus may refer to a yarn of any one of the three classes previously mentioned. For instance, yarns may be made from mixtures of different colors of wool, and also from mixtures of wool and cotton, wool and shoddy, wool and mungo, wool and extract, or wool and silk, either of one color or of different colors, all of which are sometimes spoken of under the general head of mixture yarns. Woolen mixes of this kind are very common, the mixing being made early in the process of manufacture, before the stock is carded. Gray-mixture yarns, for example, are obtained by mixing black and white wool together in such a proportion as to give a gray of the desired shade.

**WOOLEN YARNS CLASSIFIED ACCORDING TO THE
METHODS OF MANUFACTURE**

6. Single yarns made from sheep's wool when divided according to the different methods of their production consist of: (1) woolen yarns made by the ordinary woolen process, (2) woolen yarns made on the Belgian system, and (3) woolen yarns made on the Saxon system.

7. Ordinary Woolen Process.—Most woolen yarns are of the first class, and are produced by spinning the yarn directly from the spool made at the card. The web of wool at the card is divided, by ring doffers, into ribbons, which are condensed into rovings by rub aprons or rub rolls. These rovings are then wound on the jack-spools from which they are spun at the mule.

The range of numbers of woolen yarns of this class is from $\frac{1}{2}$ -run to 10-run for ordinary commercial purposes, which approximately corresponds to from $2\frac{1}{2}$ -cut to 50-cut in the Philadelphia, or cut, system of numbering. In isolated cases, woolen yarns are spun finer than 10-run, but these yarns do not usually come on the market, being generally used by the mills producing them.

8. The Belgian System.—The only difference between common woolen yarns and woolen yarns made on the Belgian system is in the means of producing the roving at the card; in this system the Belgian condenser, or Bollette steel-tape condenser, is used to divide the web into the separate rovings required for spinning. The yarns are often sold under the name of Belgian-system woolen yarns, although they do not greatly differ from ordinary woolen yarns spun from the same stock and under the same general conditions.

9. The Saxon System.—The difference between yarn spun on the Saxon system and other yarns is also in the method of making the rovings at the card. For yarns made on this system, the web is divided by narrow leather belts, the rovings being afterwards condensed by rub rolls or aprons, or both.

10. Woolen yarn can easily be distinguished from worsted yarn by the rough, oozy appearance of the former, the fibers projecting from its surface, and by the comparative weakness of its thread.

It is more difficult to determine, by an examination of the yarn, to which system a woolen yarn belongs—ordinary, Belgian, or Saxon—since all three classes of yarns have a general resemblance and each can be made from various

grades of wool or various mixtures of wool and other materials. Woolen yarns belong to the condensed and spindle-drawn class of yarns as distinct from the roller-drawn yarns. All woolen yarns are carded and mule-spun. When examined in the condition in which they leave the spinning machine, they are generally on wooden bobbins, but may be on paper tubes.

WOOLEN YARNS CLASSIFIED ACCORDING TO FORMS IN WHICH PUT UP

11. Among the forms in which woolen yarns are found are *bobbins*, *dresser spools*, *beam warps*, *conical* and *parallel tubes*, and *cops*.

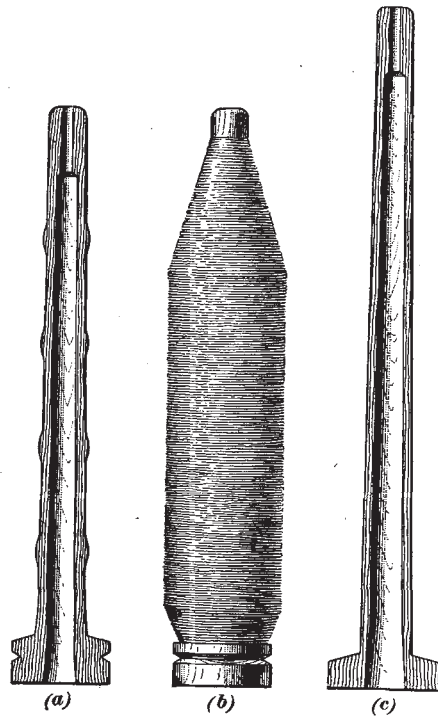


FIG. 1

the more common type being similar to (a), but having a corrugated surface and no groove at the bottom. Another

12. **Bobbins.**—The bobbin, by which is meant the spinning bobbin, is the form in which most single woolen yarns are put up as they leave the spinning mule. Two styles of bobbins are used, as shown in Fig. 1; (a) is a section through a regular woolen filling bobbin empty, and (b), a bobbin filled with yarn. The yarn is laid on the bobbin with a short traverse, commencing near the base, and extending to the nose, from which the yarn is unwound in the shuttle. The woolen warp spinning bobbins are of two styles, the

style, which has a smooth surface, is shown at (*c*); this bobbin is often used for knitting yarn as well as warp yarn. The warp yarn is built up on this bobbin with a short traverse gradually rising until the nose of the bobbin is reached, and the yarn is unwound from the nose at the spooler.

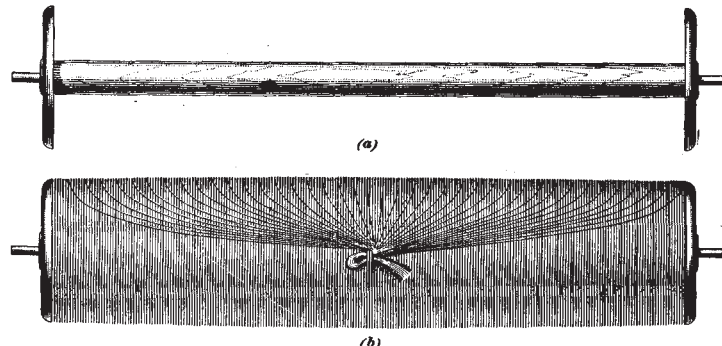


FIG. 2

13. Spools.—The spool on which woollen warp yarn is put up is shown in Fig. 2, (*a*) being an empty and (*b*) a full spool; it is a long double-headed bobbin about $2\frac{1}{8}$ inches in diameter at the barrel and with a distance of 40 or 48 inches

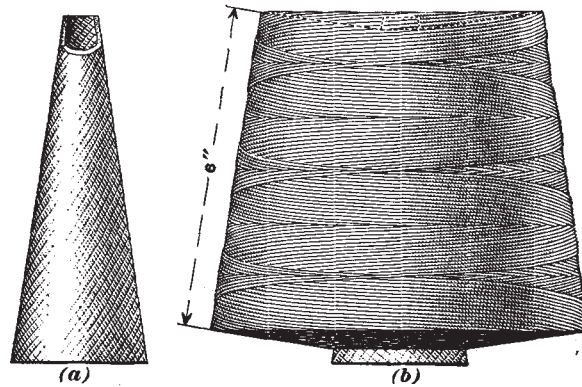


FIG. 3

between the heads. A large number of ends are wound on this spool, usually 40 or 48, which are given only a slight traverse during the winding, so that the spool really consists

of a number of ends wound side by side. Other names for this spool are *jack-spool* and *dresser spool*.

14. Beam warps are the form in which woolen yarn is finally put up for use at the loom in weaving, but as yarn is not often sold in this form, no description is necessary.

15. Cones and Tubes.—Woolen yarns are often supplied on conical tubes for knitting purposes and, less frequently, are put up on parallel tubes. The coned form is shown in Fig. 3 and the parallel tube in Fig. 4, (a) representing the empty tube, and (b) one filled with yarn, in each case.

16. Cops.—Woolen yarns are sold in the cop in either of

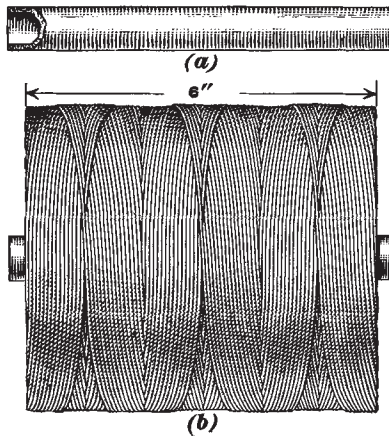


FIG. 4

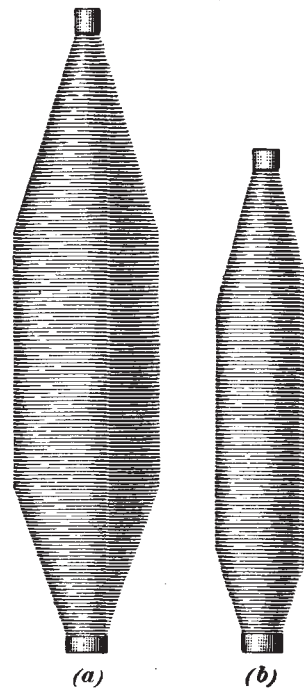


FIG. 5

two forms: (1) mule cops and (2) carpet cops. Merino yarns are often spun at the mule on a paper tube sufficiently long to project through the cop at each end. These cops are larger in diameter than the regular woolen spinning bobbin and are used for convenience in transporting yarns to knitting mills. A common style of merino cop is shown in Fig. 5 (a), while a smaller mule cop of filling yarn

produced in some branches of the so-called woolen industry, especially in the vigogne-yarn and imitation vigogne-yarn trade, is shown in Fig. 5 (*b*). This is also built on a paper tube. The carpet cop, which is wound on a special machine, is shown in Fig. 6, and is entirely different from the mule cop. It is held in the shuttle by means of an elastic strap and woven from the inside of the cop, commencing at the bottom.

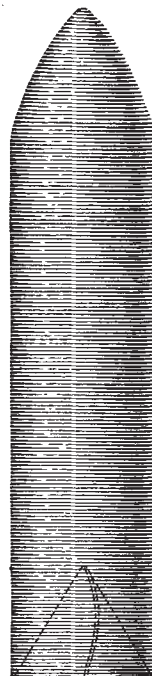


FIG. 6

WOOLEN YARNS CLASSIFIED ACCORDING TO THEIR USE

17. Woolen yarns, in common with most yarns, are spun mainly for weaving, in two varieties—warp and filling. A considerable quantity of woolen yarn is also spun for knitting purposes, chiefly in the merino yarns, which are supplied on cops or on cones. Woolen yarns are also used for filling in cheaper qualities of carpets, in which case they are usually supplied on cops. Woolen carpet yarns are sometimes sold in skeins, and are made from 40 yards per ounce to 200 yards per ounce, the most common weights being from 40 to 120 yards per ounce. The comparative lack of strength and the rough surface of woolen yarns render them unsuitable for many purposes for which cotton and worsted yarns are produced; in general, it may be stated that the use of woolen yarns is confined chiefly to weaving and knitting purposes.

WORSTED YARNS CLASSIFIED ACCORDING TO METHOD OF MANUFACTURE

18. The usual sequence of operations in the preparation of worsted yarn aims at the manufacture of a thread that shall be smooth and uniform in appearance, with the fibers arranged in parallel spirals and all short fibers eliminated. To obtain this result a combination of processes selected from

the following is used: scouring, carding, doubling, back washing, combing, preparing, gilling, drawing, roving, and spinning. Thus a number of varieties of worsted yarns are produced, according to the processes selected and the style of machine adopted for each process. The same processes cannot be used for handling all kinds of wools, as they vary in length of staple and in other characteristics; nor can the effects desired in worsted yarns for special purposes always be obtained by one method only. The differences in the sequences of processes are chiefly as follows: (1) whether the carding process is used or not (in case it is not, preparing is substituted); (2) whether the comb is used or not, and if used, the style of comb; (3) the method of spinning, whether on the cap spinning frame, ring spinning frame, flyer spinning frame, or mule.

In a general way, worsted yarns may be divided according to the operations previous to spinning into four classes: (1) prepared yarns, (2) yarns made on the Bradford system, (3) yarns made on the French system, and (4) uncombed worsted yarns. They may also be divided according to the method of spinning without regard to the previous handling of the stock into: (1) cap-spun yarn, (2) flyer-spun yarn, (3) ring-spun yarn, and (4) mule-spun yarn.

19. Prepared Worsted Yarns.—In case yarns are to be made from wools that are too long to be put through the card, especially English wools, American or Canadian braid wools, and luster wools, they are prepared for combing by what is known as a preparing set of gill boxes, and are afterwards combed, drawn, and spun, without being subjected to a carding process, thus distinguishing them from other worsted yarns. Although they are here spoken of as prepared yarns, this name is not often used commercially; they are more generally described with reference to their appearance or their future use, such as luster yarns, braid yarns, or carpet yarns.

Prepared yarns are made from coarse, long-stapled, lustrous wool, and have a distinctive appearance on account of their

luster. This quality is not especially given to the yarn by the preparing process, but is a natural feature of the long and coarse wools from which these yarns are made. Prepared yarns may vary from low to medium numbers, but are made largely in coarse, high-grade, carpet yarns and braid yarns; they may run as high as number 40s, and from that downwards as coarse as is desired.

20. Worsted Yarns Made on the Bradford System.

The term **Bradford system** applies to the ordinary process of producing worsted yarns. It derives its name from the system widely used in the Bradford district of England, and for this reason is sometimes called the *English system*. The wool for yarns made on the Bradford system is both carded and combed; it then passes through the ordinary processes of drawing, and may be either cap-spun, flyer-spun, or ring-spun. The term Bradford system applies more to the series of drawing and spinning processes after the combing than to the methods of carding and combing.

Worsted yarn spun on the Bradford system is smooth and uniform in appearance, the fibers being laid parallel to each other in the direction of the thread; the yarn generally exhibits a well-defined luster and is strong and elastic. The luster is not so great as in the case of the prepared yarns, which affords one means of distinguishing the Bradford-system yarns from the prepared yarns.

Bradford-system worsted yarns may also be subdivided into several classes, depending on the method of spinning the thread—whether on a cap spinning frame, a flyer spinning frame, or a ring spinning frame. The bulk of the yarn spun on the Bradford system is spun on a cap spinning frame, since the production of this machine is greater than that of the flyer spinning frame. Cap-spun yarn, however, is much more apt to exhibit a *beard* than flyer-spun yarn, that is, have numerous projecting fibers. Flyer-spun yarn is smoother, softer, has less twist, and is more even than cap-spun yarn. Ring spinning is not yet on a commercial basis, although there is some ring-spun yarn made. The

bulk of worsted yarn is spun on the Bradford system in numbers ranging from 12s to 60s.

21. Yarns Made on the French System.—The French system of manufacturing worsted yarns—generally called **French spinning**—differs from the Bradford, or English, system to a considerable extent in the drawing processes as well as in the spinning. It derives its name from the fact that it was largely developed in France, and the machinery for it made in one of the former French provinces (now a part of Germany); the yarns themselves are spoken of as **French-spun worsteds**. In this system, nearly every drawing process employs a peculiarly constructed roll, called a *porcupine*, filled with sharp needles for separating and straightening the individual fibers of the sliver, whereas in the Bradford system traveling bars, called *fallers*, set with needles are employed. French-spun yarns are spun on a mule in the form of a cop built up on a long, thin, paper tube. They can thus be distinguished from worsted yarns spun on other systems by the form of the tube on which they are spun, since the yarns made on other systems are either on wooden bobbins or paper tubes of large diameter. French-spun yarns are made to a considerable extent in America. Yarn spun on this system is softer, more bulky, and more elastic than worsted spun on other principles and generally has less twist per inch. The stock used for French spinning is either X, XX, delaine, or Australian, and the yarns are made in various numbers from 20s to 80s, according to the stock used. It is not necessary, however, to use only long-stapled wool in their production, since comparatively short fibers can be worked up in this way. This yarn is particularly suitable for the production of soft, fine, worsted goods, especially ladies' dress goods, and also makes excellent knitting yarn.

22. Uncombed Worsted Yarns.—Uncombed worsted yarns are prepared by a sequence of processes from which the combing is omitted; they are carded, drawn, and spun somewhat similar to the Bradford-system yarns. Owing to the omission of the combing process, they are more uneven

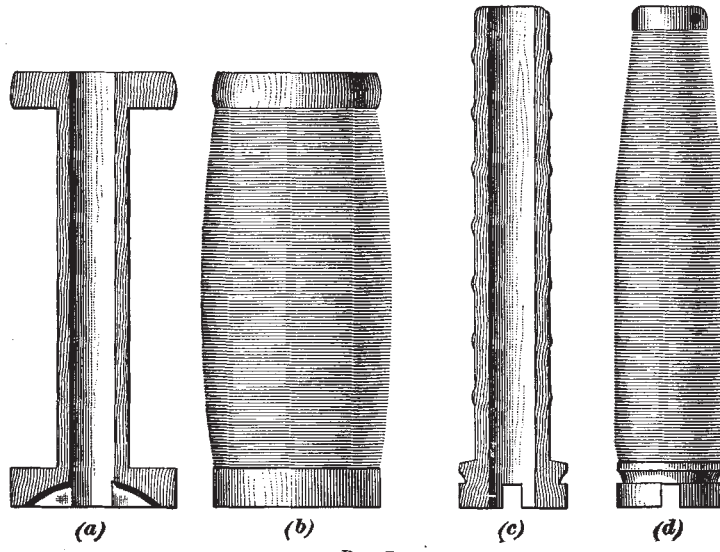


FIG. 7

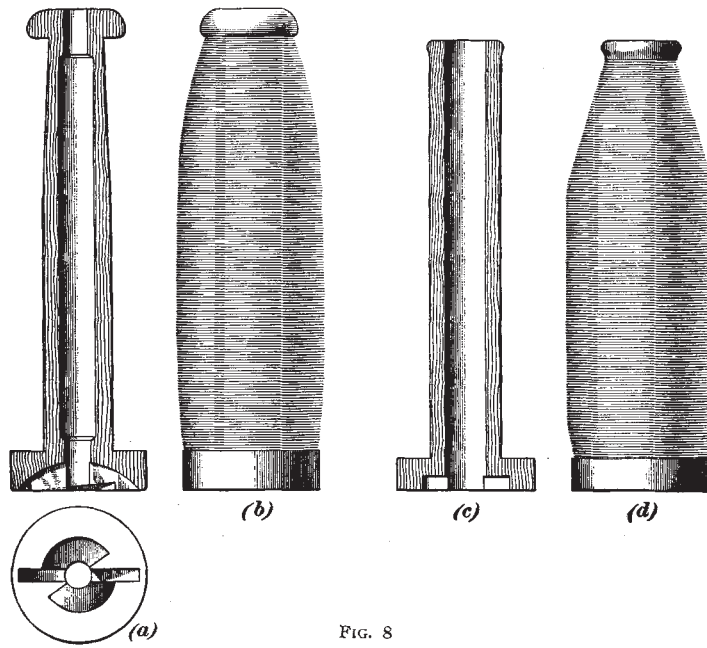


FIG. 8

and irregular than the ordinary types of worsted yarns and bear more resemblance to a woolen yarn than does a true worsted. Uncombed worsted yarn contains short fibers, which in an ordinary worsted yarn would have been removed in the combing process. Strictly speaking, such a yarn ought not to be classified with either worsted or woolen yarns, since, in the usual acceptation of the definition, worsted yarn is always a combed yarn and woolen never a roller-drawn yarn; for convenience, however, these yarns are classed with the worsted yarns, although they are sometimes given the distinguishing name of *half-worsted* or *semi-worsted*. They are spun in coarse numbers and can be distinguished from other worsted yarns by their lack of luster and smoothness, and are generally used in the carpet trade.

23. Worsted Mixture Yarn.—Fancy mixtures of different-colored fibers are frequently made in worsted yarns, especially for knitting purposes. In making worsted mixtures, the blending takes place later in the series of processes than in the case of woolen mixtures, it generally being done after the combing. The word mixture in connection with worsted yarns has the same meaning as in connection with woolen yarns; namely, a blend of different colors, unless specially qualified as a worsted-and-cotton mixture; this latter, however, is seldom made.

**WORSTED YARNS CLASSIFIED ACCORDING TO FORMS
IN WHICH PUT UP**

24. Worsted yarns are put up on *bobbins*, *cops*, *spools*, *cones*, *tubes*, *warp beams*, and in *skeins*.

25. Bobbins.—By a **worsted bobbin** is generally meant a *spinning bobbin* on which the yarn has been spun, or a *twister bobbin* on which the yarn has been wound after being doubled to make a two-, or more, ply yarn. The spinning bobbin may be either a double-headed bobbin, as shown in Fig. 7, in section at (*a*) and filled with yarn at (*b*); or a single-headed, as shown in Fig. 7, in section at (*c*) and filled with yarn at (*d*). The double-headed bobbin

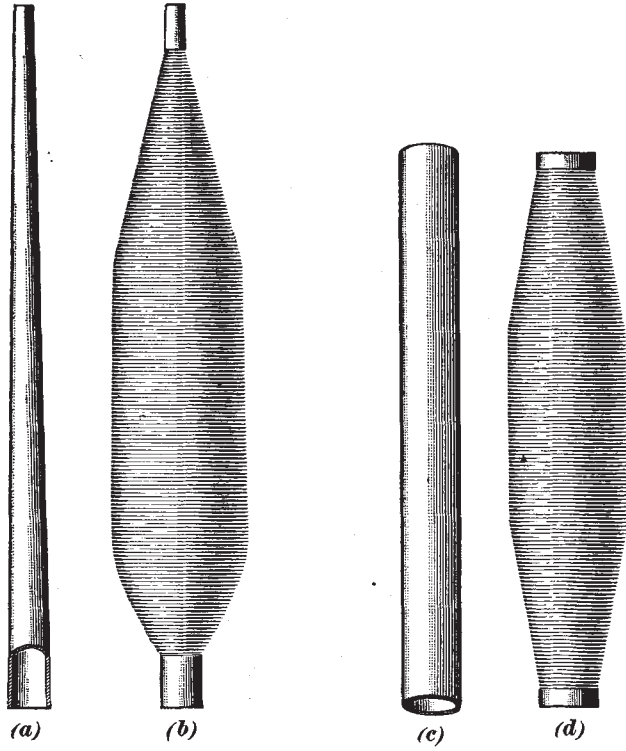


FIG. 9

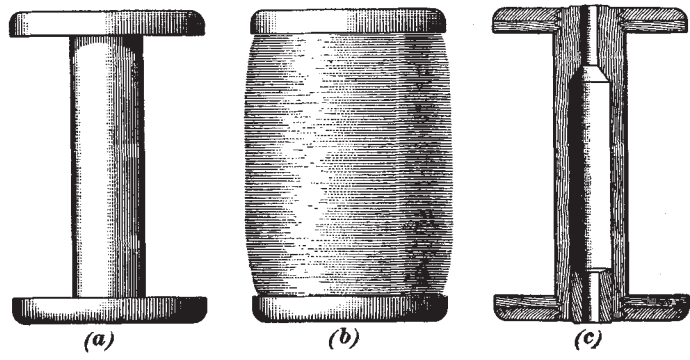


FIG. 10

is customarily used for warp, while the single-headed bobbin is filled with filling yarn and used in a shuttle.

Twister bobbins may be either double-headed, as shown in Fig. 8, in section at (a) and filled with yarn at (b); or single-headed, as shown in Fig. 8, in section at (c) and filled with yarn at (d).

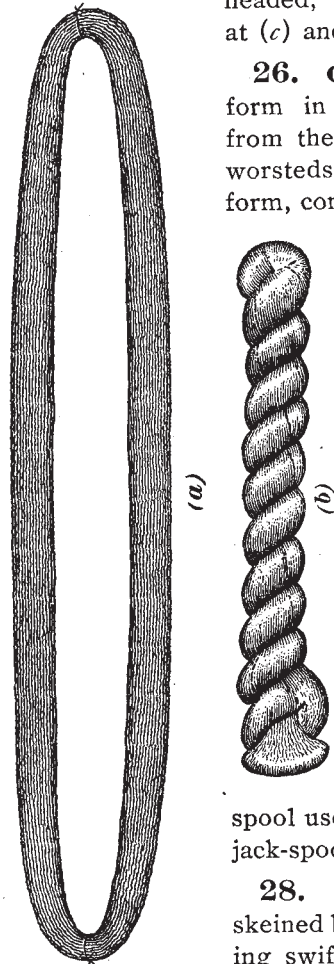


FIG. 11

26. Cops.—A worsted cop is the form in which single yarn is delivered from the mule in the case of mule-spun worsteds. It is built up in a cylindrical form, coned at each end, on a long, thin, paper tube, shown empty in Fig. 9 (a) and filled in view (b). Shorter tubes of larger diameter used for frame spinning are shown empty in Fig. 9 (c) and filled in view (d). These are sometimes called *cannettes*.

27. Spools.—Worsted yarn is spooled in two forms; the spool, shown in Fig. 10, is similar to the regular cotton-warper spool and is used to form a convenient method of transporting worsted yarn for sale, since from this spool the yarn can be conveniently made into a warp; the other form of spool used for worsted yarn is the regular jack-spool or dresser spool, shown in Fig. 2.

28. Skeins.—Worsted yarns are skeined by being wound around the revolving swift of a reel; the skein when completed resembles the illustration in Fig. 11 (a). This is twisted several times and doubled upon itself, when the excess twist causes it to form into a firm roll, similar to Fig. 11 (b),

suitable for packing and transportation. The circumference of a skein of worsted is generally 72 inches, although other dimensions can be arranged. The length, except when otherwise specified, should be understood as 1 hank, or 560 yards. Worsted yarns are generally put up into skeins for dyeing purposes, one form known as the Balmoral skein being intended for random dyeing, that is, dyeing several colors in one skein.

29. Parallel and conical tubes are used to a considerable extent in the worsted trade. Knitting yarns are often coned.

30. Beam Warps.—The information given regarding woolen beam warps is applicable to worsted.

WORSTED YARNS CLASSIFIED ACCORDING TO THEIR USE

31. Worsted yarns, as well as woolen yarns, are spun mainly for weaving, in two varieties—warp and filling. Considerable quantities of worsted yarns are also used for knitting purposes, including the so-called worsted merino yarn made of combed cotton and combed wool; knitting yarns are supplied in cop, cone, or skein. Worsted yarns are used very extensively for carpet making, especially for the higher-grade carpets; the worsted appears on the face of the various styles of carpets, both as cut and uncut pile, while the backing is often of cotton, linen, or some other vegetable fiber. Worsted carpet yarns are put up in skeins. They are generally made on the straight, prepared system and may be said to be coarse yarns, below, say, 16s. Rug and fringe yarns are usually made of worsted, in coarse numbers, and are often 3-ply skein yarns, although they are made 2-, 3-, or 4-ply as required. Worsted yarn is also made in limited quantities into harness thread, sewing thread, seaming thread, etc.

WOOLEN AND WORSTED PLY YARNS

32. The foregoing descriptions of woolen and worsted yarns apply to single yarns, but any woolen or worsted yarn can be made into ply yarn; in fact, it is very common to

make worsted into ply yarns, more so than is the case with woolen yarns, except those for fancy double-and-twists. The term ply is not so frequently applied to woolen yarn as is the name double-and-twist, which indicates that two threads are doubled and twisted together at the same time. In worsted yarns, especially those made on the Bradford system, the process of doubling is fairly common also, as 2-ply yarn is generally used for worsted warps.

**WOOLEN AND WORSTED YARNS CLASSIFIED ACCORDING
TO SIZE**

33. The expressions coarse, medium, and fine yarns are occasionally applied to both woolen and worsted yarns, but it must be understood that when these terms are used no definite size of yarn is referred to, since the terms are necessarily somewhat vague and indefinite; considerable leeway must therefore be allowed. For instance, a woolen yarn that a mill running on coarse cheviots and tweeds would consider fine would be thought a very coarse yarn in a mill running on fine dress goods or flannels; or in the case of worsted yarn, a yarn might be considered as fine in a carpet mill and as coarse in a fancy-dress-goods mill. Striking a general average, however, it may be stated that woolen yarns up to 4-run, or about 21-cut, are considered as coarse yarns, while those from 4- to 8-run, or from about 21- to about 43-cut, are considered as medium, although in many woolen mills an 8-run yarn is considered very fine. Woolen yarns above 8-run, or about 43-cut, are in almost every instance considered as fine yarns. Worsted yarns may be considered as coarse when spun into counts below 16s, while medium worsted yarns include those from 16s to 40s. Any worsted yarn above 40s will almost always be considered as a fine yarn.

YARNS PRODUCED FROM HAIR

34. Mohair yarns are produced from the fleece of the Angora goat, which is a fine, silky fiber closely resembling wool in its spinning properties. The source of supply formerly was Asia Minor, and considerable mohair is still obtained from there, but of late years the Angora goat has been introduced into the United States, France, and Spain, and Angora wool, or mohair, is now obtained from these countries. The principal characteristics of mohair are its luster and resistance to crushing, so that fabrics made from it cannot readily be creased. The fiber varies in length from 4 to 10 inches, the general length being about 5 or 6 inches; it is pure white, fine, curly, as well as lustrous. No classification of mohair yarns dependent on the source or origin of the material is customary, nor are they classified according to the method of their preparation or treatment after spinning, as in almost all cases they are made on the worsted principle. When delivered in the form in which it is spun, mohair yarn is on paper tubes or bobbins; it is also delivered on 6-inch warper spools or on dresser spools, and both in single and ply yarns. Its use is chiefly for weaving purposes, especially for dress goods, plushes, and part-silk goods. The luster and tendency to curl make it a suitable material from which to make certain novelty yarns, especially loop, or bouclé, yarn. Mohair yarns are produced in various numbers, up to as high as 36s.

35. Alpaca yarns are those produced from the fleece of the alpaca sheep, which from the fact of its resemblance both to a camel and a sheep is sometimes called the camel-sheep. The fleeces of the llama and guanaco, although not true alpaca, are often classed and used with alpaca. Alpaca is either white, red, brown, or black, is as long as 6 or 8 inches, somewhat fine, and generally spun alone into yarns intended for use in dress goods. The manufacture of this yarn is a small industry and is conducted on similar lines to the worsted- and mohair-yarn industry.

36. Vicugna yarns are now seldom manufactured; the true vicugna yarn is made from the fleece of an animal belonging to the camel-sheep variety, and is very lustrous, extremely fine and soft, and reddish brown in color, if undyed. This yarn should not be confused with vigogne and imitation vigogne.

37. Cashmere, or Tibet, Yarns.—Cashmere yarns are those spun from the hair of the Cashmere goat; this is an exceedingly soft, silky fiber, and when pure is of considerable value. The manufacture of these yarns is so small an industry as to be of no commercial importance.

38. Other animal fibers are camel hair, cow hair, and the fur of various animals, domesticated and otherwise. These are not generally used alone for spinning into yarn, but are used for adulterating woolen yarns.

39. Horsehair is not generally spun into yarn, but the mane and tail hairs are used alone as filling and sometimes as warp for such fabrics as coverings for the seats of chairs, for strainers, etc.

SILK YARNS

CLASSIFICATION BY RAW MATERIAL

40. The most valuable yarns known in the textile trade are silk yarns, the appearance of which is sufficiently familiar to render an extended description unnecessary. The features that give silk yarn its value are an intense luster, great strength in proportion to its size, as well as softness, elasticity, and durability to such an extent as cannot be found in any other material. Silk yarns are very suitable for dyeing, giving brilliant shades in all colors, and fabrics of silk have a rustling property, or *scroop*, not common to any other material.

41. Cultivated and Wild Silk.—All silks may be divided in two main classes: (1) cultivated silk, sometimes known as mulberry silk, and (2) wild silk, often called Tussah silk, although this is only one variety of wild silk. Silk yarns may therefore be classified according to the kind

of silk used in their manufacture, as: (1) yarns from cultivated silks, and (2) yarns from wild silk. The cultivated silk is produced by the caterpillar of the *Bombyx mori*, the silk moth. Wild silk is produced principally by the caterpillar of the Tussah moth (*Antheræa mylitta*), although other varieties are produced from other moths, such as Eria silk, Fagara silk, Murga silk, Atlas silk, Yama Mai, and others.

Yarns produced from cultivated and wild silks, if undyed, are readily distinguished by the color. Cultivated silks in the natural state are a bright yellow, while by scouring, various shades from yellow to pure white are produced, according to the amount of coloring matter removed from the raw silk. The wild silks are always of a dark color, in some cases approaching a brown. The cultivated silks also are superior in luster, softness, and elasticity to the wild silks.

42. Classification of Silk Yarns According to the Country of Origin.—The countries from which the largest supplies of silk are obtained are China, Japan, Italy, France, Austria, Spain, and the United States. The production is greatest in China. In describing raw silk, the name of the country or district in which it is produced is used to a large extent, as is also the name of the port from which it was shipped; thus, there are Japanese silks, China silks, Italian silks, etc., with subdivisions such as Tsatlee and Canton silks, which are varieties of China silk. Owing to the fact that all cultivated silks bear a decided resemblance to one another and that after they are scoured and made into a thread the difference is not sufficiently great to retain the geographical name that was used to describe the raw material, such a classification of silk yarns is not made to any extent; they are classified rather according to the method of preparation or treatment of the yarn.

**CLASSIFICATION ACCORDING TO METHOD OF
PREPARATION**

43. The essential differences in silk yarns, from both wild and cultivated silks, are due more to the differences in their manufacture than to anything else. This determines a

primary classification depending on the treatment of the raw stock, one class, called *thrown silk*, consisting of yarns that are produced by the processes of reeling and throwing, and the other, called *spun silk*, consisting of yarns spun from waste raw silk. Thrown silk may be further divided according to the number of silk fibers combined to form one thread and the method of twisting adopted in producing this thread, or according to the extent of the scouring to which the silk has been subjected.

44. Thrown Silk.—A fiber taken from one silk cocoon consists of two single filaments held together by a gummy matter and is of great length, from 300 to 1,000 yards of good silk being obtained in a continuous thread from one cocoon. There is a much greater length than this on the cocoon, but it is not possible to obtain it in a continuous thread; the waste is used for spun silk. It is not customary, however, to take the individual fiber as a basis of preparation for making a silk thread, but to unwind several of these at one time, varying in number, from five to eighteen, to form one loose, even strand, termed a **single**. The process of obtaining these singles is known as *reeling*; this gives the name *reel silk*, often applied to thrown silk. The number of fibers composing the strand is not the same at all points, since, as the individual fiber varies in thickness, at some parts more filaments are used than at others, in order to produce a single that shall be even throughout its length. By the process known as *throwing* these singles are made into two classes of yarn: (1) **organzine** and (2) **tram**. These are used in largest quantities for weaving purposes, the organzine being used chiefly for warps and the tram for filling. The most perfect cocoons are selected for the manufacture of organzine, which is produced by first taking several singles, twisting each in the same direction, and then twisting these singles together in the opposite direction. Tram silk is made from less perfect cocoons with a smaller number of ends and less twist. In addition to tram and organzine, other yarns are also made from silk, such as embroidery, French,

sewing, knitting, and machine twists, which differ chiefly in the number of strands used to make the final thread and the method of twisting them.

Neither trams nor organzines are all silk; about 30 or 40 per cent. is the gummy matter that holds together the two filaments forming the real silk. The amount of scouring, or boiling off, to remove this foreign matter determines four classifications: (1) hard silk, the term applied to silk after it has been reeled from the cocoon and before it has undergone any boiling-off process; (2) *écru* silk, which is silk that has been boiled sufficiently to remove about one-twentieth of the gum; (3) *souple* silk, which has been boiled sufficiently to remove about one-sixth of the gum; and (4) boiled-off silk, from which the gum has been completely removed. In both *écru* and *souple* silk, sufficient boiling is introduced to produce the luster characteristic of silk, although they differ in regard to the amount of gum removed. The first class is the darkest yellow and least pliable of silks, while the fourth class is the lightest in color and has the characteristic luster to the greatest degree. The other two classes are situated between these, both as to luster and color.

45. Spun Silk.—The thrown silks, such as the tram, organzine, and others, are often called *spun silks*, but this use of the term is erroneous; **spun silks** should be applied only to silks that are actually spun, and this is not the case with thrown silks, which are simply reeled and afterwards passed through a twisting process or processes. There are two grades of spun silk: *schappe* and *bourette*. **Schappe**, sometimes called *chappe*, *florette*, or *filoselle* silk, is made from silk waste from the fibrous portion of the cocoons that it is not possible or desirable to unwind in order to produce tram or organzine. The manufacture of these yarns includes the processes that break up the long silk fibers into short lengths, which are spun by a series of processes bearing some resemblance to those required in the manufacture of woolen and waste cotton yarns.

The waste made at schappe-spinning processes is again worked up into a still coarser yarn, which is known as **bourette silk**.

Tram and organzine silks bear considerable resemblance to each other in their appearance; the examination of either of these yarns shows continuous fibers that can readily be separated from the thread. Schappe silks show a more solid construction of thread, resembling a cotton or worsted yarn more than the tram and organzine silks; bourette yarns are coarse, lumpy, uneven threads.

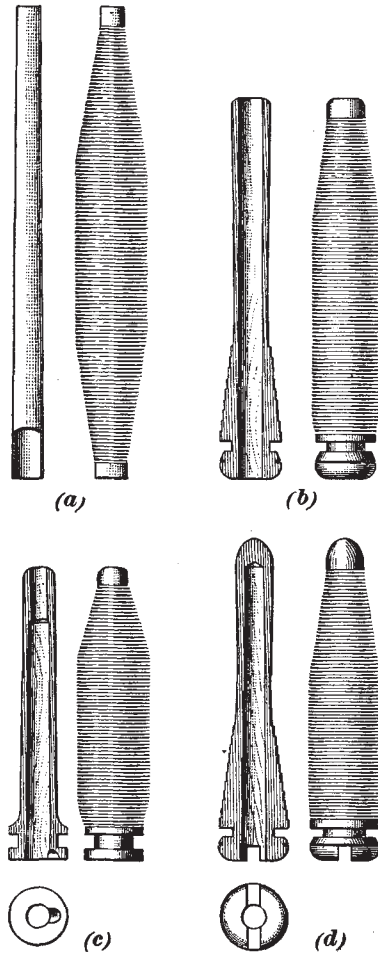


FIG. 12

**SILK YARNS CLASSIFIED
ACCORDING TO FORMS
IN WHICH PUT UP**

46. Silk yarns are found in *cops*, *spools*, *skeins*, *quills*, *cones*, *tubes*, and in *warps*.

47. **Cops**, usually known as **pin cops**, are wound on through paper tubes and are of a small size suitable for the shuttle, as shown in Fig. 12 (a).

48. **Spools** are the usual construction of double-headed bobbins and are used at various processes in the spinning, doubling, or winding of the yarn.

49. Silk **skeins** are formed in the ordinary way, so as to produce a continuous coil of thread.

50. The quill, or filling, bobbin for silk is small compared with that for other yarns; various kinds are shown in Fig. 12 (*b*), (*c*), and (*d*).

51. Parallel and Conical Tubes.—Silk yarn is sometimes put up in parallel and conical tubes.

52. Warps.—Silk yarn is, of course, made into warps for weaving purposes, but this form is not one in which silk is usually bought and sold, so that in this connection nothing need be said regarding them.

USES OF SILK

53. The uses of silk are chiefly: (1) for weaving, organzine being used as warp and tram as filling; (2) for the making of sewing, embroidery, and other threads that in the silk trade are generally known as twists; and (3) as knitting yarn for high-grade hosiery and underwear.

YARNS FROM MINERAL FIBERS

54. Asbestos yarns are the principal yarns produced from mineral fibers. Asbestos, which is a mineral found in the United States, Canada, Italy, and other countries, consists of a mass of short fibers that are separable into filaments of as great a length as 2 inches. These it is possible to spin into yarn that may be woven into cloth. Asbestos yarn is usually coarse and of a whitish or grayish appearance. It is incombustible, which is its chief value, and for this reason is used for making yarns and fabrics that must stand intense heat.

55. Wire Yarns.—Although hardly a suitable name, the term wire yarns is intended to cover very finely drawn wires and ply strands made from wires. The metals chiefly used for this purpose are gold, silver, gold- or silver-plated copper, iron, copper, and brass. The chief use of such metallic wires in the textile industries is in the very finely drawn and rolled gold and silver threads for ornamental

purposes, which are usually put up on small spools and commonly called *tinsel*; iron, steel, brass, and copper wire is woven into screens and wire cloth for various purposes.

56. Glass Yarns.—Glass has occasionally been used for thread making. When softened by heat it can be drawn out into very fine threads from which it is possible to make yarns that under certain circumstances can be incorporated with yarns of vegetable or animal fibers. The production of glass yarns, however, is of no commercial importance.

YARNS WITH SPECIAL CHARACTERISTICS

CLASSIFICATION ACCORDING TO TREATMENT AFTER SPINNING AND TWISTING

CONVERTED YARNS

57. There are a number of processes through which single yarns may pass after the spinning: (1) several threads may be combined either as ordinary ply yarn or in some form of novelty yarn, the result of which is a complete change in construction; (2) the yarn, either single or ply, may be operated on so as to change the form in which it was originally put up to a form ready for the market or for some succeeding process, without, however, in any way changing its appearance or construction; (3) the yarn may be passed through one of the various converting processes, thus changing its appearance definitely and decidedly, but leaving its construction unaltered; to be so treated the yarn may be taken in the condition in which it leaves the spinning machine, but more frequently it is converted after having passed through some winding or form-changing process. It is entirely outside the scope of this Section to fully describe any of the various converting processes for yarn, as it is the purpose of this Section to describe only the differences in the threads as they are found to exist; therefore, only a brief

definition will be given as to how to distinguish between yarns that have and have not been processed, or between yarns that have gone through different processes.

58. Dyed yarns are those that have passed through processes that impart color to them. They may have passed through only one process, for giving what is known as a one-bath or one-dip color, succeeded, of course, by drying, or they may have passed through several processes, for the purpose of first scouring, washing, or bleaching, then mordanting, and afterwards dyeing and drying. Dyeing is performed on practically every variety of yarn made from vegetable or animal fiber, whether cotton, wool, silk, flax, linen, or jute. Yarns made from mineral fibers are not dyed. The term dyed yarns is a general one that may be made more definite by classifying yarns as *skein-dyed*, *warp-dyed*, *cop-dyed*, *sliver-dyed*, *raw-stock-dyed*, *slub-dyed*, etc., according to the period in the process of manufacture at which the dyeing was done. **Skein-dyed** yarn, sometimes called *hank-dyed*, is yarn that has been skeined before being dyed. **Warp-dyed** yarn, sometimes called *ball-dyed*, or *chain-dyed*, is yarn that has been put up in the form of a warp before being dyed. **Cop-dyed** yarn is yarn that has been dyed in the same form in which it leaves the spinning mule by placing it on perforated tubes and forcing dye liquor through a number of these tubes. **Stock-dyed** yarn, spoken of as *raw-stock-dyed* yarn, or in the case of cotton as *raw-cotton-dyed* yarn, is yarn in which the fiber is dyed in the raw state—in the case of wool, immediately after scouring, and in the case of cotton, immediately after the opening process. **Sliver-dyed** yarn refers to cotton that has been dyed in the form of a card sliver. **Top-dyed**, or **slub-** or **slubbing-dyed**, refers to worsted that has been dyed in the form of a top, or slubbing.

59. Dyed and weighted yarns comprise those that have purposely had their weight increased during the dyeing process; they are usually silk yarns.

60. Bleached Yarns.—Bleaching yarns is a process or combination of processes necessary to give a white, or as

nearly as possible a white, appearance to yarns. Bleaching is generally performed on cotton, linen, or other vegetable yarns, while wool, silk, and other animal fibers do not readily lend themselves to any process of producing an absolutely white thread, beyond that of washing or scouring off the foreign substances adhering to their surface, although processes of obtaining a yellowish white in the cloth are not unknown. This is sometimes done in the yarn, in which case it is bleached, usually with sulphurous acid either in a liquid or gaseous form, generally the latter. Woolen and worsted yarns are also bleached when delicate colors are to be dyed. The process is sometimes called *stoving* when woolens are bleached with the sulphurous-acid gas.

Cotton is subjected to various kinds of bleaching processes, known as *quarter bleach*, *half bleach*, *three-quarter bleach*, or *full bleach*; the last, which gives the whitest appearance, is especially applied to Egyptian cottons to remove the brown tint natural to that cotton fiber. In speaking of bleached cotton yarns it is advisable to use the word *bleached* and also state whether quarter, half, three-quarter, or full bleach is meant. The name *white* cotton yarns is not always sufficient to indicate bleached yarns, as white is sometimes applied to cotton to indicate yarns in the natural state spun from white cottons, such as American or sea-island, as distinguished from yarns in a natural state spun from brown cotton, such as Egyptian, Peruvian, and certain kinds of Indian and Central American cottons.

The flax fiber in the form of linen yarn lends itself to bleaching, although it is a more difficult process than that of bleaching cotton yarns. Bleached linen yarns are spoken of when only partially bleached as *half white*, or *cream color*; when bleached to a higher degree, as *three-quarter white*; and when completely bleached, as far as is commercially customary, as *full white*.

61. Scoured Yarns.—In the manufacture of woolen and worsted yarns, raw wool is always subjected to a preliminary scouring, or washing, process to remove the dirt

and the natural grease, or yolk, with which the wool is impregnated, but this is separate and distinct from the scouring process as applied to yarns. During the manufacture of the yarns various oils and emulsions are applied to aid in the working of the stock and preserve the fiber from injury. In the case of woolen yarns this oil or emulsion is not removed when the yarns are put on the market for sale; that is, it may be stated that woolen yarns are practically always sold in a greasy condition, or *in the grease*. Worsted, however, is frequently subjected to a scouring, or, as it is called, a *back-washing*, process after carding or combing, for the purpose of removing any artificial impurities that may be in the stock and rendering it as nearly white as possible. This scouring, or back-washing, process is merely a treatment with warm water and soap or other detergents, and is in reality simply a washing process. Worsted yarns are also frequently sold without being back-washed, but in this case they are not nearly so white, and in fact at the best they possess only a yellowish shade.

Certain varieties of silk are scoured, or, as it is termed, *boiled off*, in order to remove the gum found on the raw silk, and in this process they lose from 15 to 30 per cent. of weight. They are spoken of as *stripped*, or *boiled-off*, silks. Milder processes that do not completely strip the fiber but rather tend to bleach both the fiber and the gum attached to it are known as *scouring*.

62. Mercerized Yarn.—**Mercerizing** is a process applied only to cotton yarns, and consists of a treatment, while under tension, with a solution of caustic soda that gives a silky luster to the thread. These yarns are usually either bleached, dyed, or bleached and then dyed. Unless otherwise stated, mercerized yarns are generally understood to be mercerized in the skein, although it is done in the warp form. This class of yarns is almost always 2-ply, as there is a risk of stretching a single yarn and making it uneven or damaging it in the process of mercerizing. As this process requires that the yarn shall stand

considerable strain and yet the effect produced be that of a soft, pliable, elastic yarn resembling silk, it is necessary that the yarn should be strong and yet soft spun. For this purpose very good cottons are used, even for coarse and medium numbers of yarns, Peelers, Egyptian, and sea-island often being the stock selected; thus, although the turns per inch are few in proportion to the counts, a strong yarn is obtained.

63. Printed yarns are those that have been passed through a printing machine, and may be either warp-printed or skein-printed. The effect of the printing process is to impress short dabs or long blotches of color on the threads, the intervals being left white or the original color of the skein or warp. Either one, two, three, or four colors may be imprinted on the yarn, thus giving it a mottled appearance, which is accentuated when the yarn is interwoven with other yarns, and thus produces a speckled effect on the fabric.

It is cotton yarn that is usually used for printing purposes, although any yarns having a moderately smooth surface, such as linen, jute, silk, etc., may be used. Woolen and worsted yarns, owing to the nature of the thread, do not receive such a clear and satisfactory impression of the printing rolls as a comparatively smooth yarn like cotton. Before printing, yarns must be reeled into skeins or made into warps.

64. Glazed and Polished Yarns.—Polished yarns, or, as they are sometimes called, glazed yarns, or glazed and polished yarns, are those that have been passed through a process of applying a dressing material to the yarn and then brushing it until a high glossy polish is attained. Polishing is chiefly used in giving to sewing thread what is known as a *bright finish*. Polished yarns are often dyed yarns. The polishing process is a mechanical one, which distinguishes it from the method of obtaining a luster on cotton yarns by mercerizing—an entirely different process that depends on chemical action.

65. Gassed, or Genapped, Yarns.—All yarns have, to a greater or less extent, loose ends of fibers projecting from their surface. These are found to the least extent in yarns made by the multidrawing system and to the greatest extent in those that are made by the condensing, or woolen, principle of yarn preparation.

In yarns made from sheep's wool, it is found to the least extent in worsted yarns, and to the greatest extent in the ordinary woolen yarns. In woolen yarns, imitation vigogne yarns, and those of a similar character, the oozy construction and projection of loose ends of fibers is desirable and serves a definite object, but for certain purposes in the combed yarns it is undesirable and creates defects in the fabrics manufactured from them; for instance, in the making of certain kinds of laces and curtains from fine, combed-cotton yarns, the projecting fibers prevent that clear definition and sharp outline of the pattern that is desired. This oozy construction is also a disadvantage in such yarns as harness or heald yarns manufactured from worsted yarns. For this reason some cotton and worsted yarns are treated in a gassing machine, in which each thread is passed through a gas flame very rapidly, thus causing the projecting fibers to be singed off. The passage of the yarn is so rapid that the heat does not destroy or damage the thread. In the case of worsted and other yarns of animal origin, the process is called *genapping*, and gassed worsted yarns are called *genapped* yarns; for other yarns the terms *gassing* and *gassed yarns* are used.

Yarns that have been gassed or genapped are slightly brown, and the ends of the fibers are discolored. This is not detrimental if the yarns have previously been dyed a dark color, but otherwise it is desirable to pass them through some process that removes this defect; for instance, in making lace yarns it is better to gas them before the bleaching process, and in worsted yarns genapping is advantageously followed by a process of scouring or dyeing.

66. Prepared Yarns.—**Preparing** is the name usually applied to a process of coating yarns of vegetable origin

with wax or grease, sometimes accompanied by a compressing process.

67. Processed yarns is a vague name given to yarns that have passed through some private or patented process for producing some special effect or change in the yarn. It is generally a modification of mercerizing or polishing.

68. This classification of converted yarns, while by no means complete, comprises the leading processes by which yarns may be changed after spinning or twisting. While these processes cannot be considered as a part of the regular yarn preparation in a textile mill, in many mills they are classed as such.

This list is not intended to include any processes that merely change the form in which the yarn is collected or arranged or that change the structure of the thread itself.

CONDITIONING YARNS

69. Conditioning, or damping, yarns is accomplished by various means and for different reasons. Fibrous materials, after being exposed in the various processes to the heated atmosphere of a textile mill, lose a certain percentage of the moisture that they contained in the raw state. Most yarns, if allowed to stand in the open air or in some storehouse where they can come in contact with the atmosphere, will regain a portion of this moisture and return to a normal condition.

For various reasons, however, it is sometimes considered desirable to cause the yarn to absorb an abnormal amount of moisture. If the yarn is produced for sale, this is frequently the result of a desire on the part of the seller to have the yarn weigh as much as possible within reasonable limits, although the precaution must be taken not to damp it to such an extent as would cause it to lose its excess moisture during transportation or would cause mildew, discoloration, or decay. Another reason for damping yarn is to cause the strands or twist put in the thread to become fixed, so that

when the yarn is unwound it will not immediately run into snarls, as is sometimes the case with very dry yarns, especially in fine numbers or when excessively twisted in any counts.

Still another reason, if the yarn is for filling, is to enable the picks to be driven closer to one another in beating up in the loom in the case of fabrics that are very heavily picked and in which dry threads of filling would not lie sufficiently close together to enable the necessary number of picks per inch to be inserted; damping also prevents the filling from kinking.

70. This capacity for absorbing moisture, which is known as the *hygroscopic* property, is not so great in the case of cotton as in that of some other materials; cotton will, however, easily absorb 5 per cent. of moisture if removed from the hot spinning rooms of a mill and placed for sufficient time in a cool, moist atmosphere, and, under suitable conditions, can be caused to absorb still more moisture.

The hygroscopic property of woolen and worsted yarns is much greater than that of yarns spun from any other materials. If the yarn is stored in a dry atmosphere it will contain from 5 to 10 per cent. of moisture, but if stored for some time in a damp atmosphere will readily absorb from 10 to 25 per cent. additional moisture. This, of course, produces great variations in the weight of a given amount of yarn and should be an important factor in the purchase or sale of all yarns, although less attention is given to this matter in America than in England and on the continent of Europe, where conditioning houses are established for the express purpose of determining the exact percentage of moisture, not only in yarns but also in raw wools and stock in a partially manufactured condition.

Silk yarns also possess a marked hygroscopic property, but not to so great an extent as woolen and worsted yarns.

71. Conditioned yarn is either damped or steamed. A customary method of conditioning cotton yarn, especially in Europe, is to place it in a suitably constructed basement, the

floor of which is absolutely level and made water-tight with clay or concrete. On this water-tight floor porous bricks are laid in rows, with slight spaces between the rows, so as to provide continuous channels along which water may flow. The basement is then flooded to about one-half of the depth of the bricks, fresh water being admitted at one end of the room and an overflow provided at the other. The yarn is placed in baskets and allowed to stand on the bricks for several days.

Another method is to pack the yarn in a frame between moist woollen cloths, a layer of yarn being placed on a cloth and covered with another cloth, and then a second layer of yarn, and so on. In this way, by being allowed to stand overnight, it will absorb almost as much moisture as it would in a week by the first method.

It is usually filling yarn that is steamed. This is accomplished by means of a steam chest, into which is carried a steam pipe having an outlet within. The chest is so constructed that it will contain a number of boxes, which are perforated with holes to admit the steam. The yarn is placed in these boxes and when a sufficient number of the boxes have been placed in the steam chest, the door is tightly closed and steam admitted for several minutes, after which the yarn is removed.

VARIETIES OF REGULAR YARN RESULTING FROM COLORING

SINGLE YARNS

72. Yarns, either single or ply, may be modified in appearance during the spinning or twisting process by the introduction of color, so that they cannot be described as natural yarns in the sense of indicating the natural color of the yarn, nor, in the case of cotton yarns, are the words gray or brown applicable to them, in the sense in which those terms are applied to yarn and cloth made from cotton in the natural color. In single yarns, the varieties generally found

are *solids*, *mixes*, *intermittents*, *randoms*, and *mock twists*. In ply yarns, the varieties found are known as *twists*.

73. **Solids** are yarns spun from one color only of fibers that have been dyed in the raw stock or at some early process of yarn preparation; for instance, in the sliver, in the case of cotton, or in the top, in the case of worsted yarns. Another name for solids is *self-color*, or *selfs*, to indicate that they are made from one color. In dyeing the raw material in this way, it is almost impossible to have all fibers dyed exactly alike, but the later processes of yarn manufacture so blend the fibers as to eradicate any irregularity in shade. These yarns are made principally in cotton, and for filling, the object being to spin the yarn in a form ready for the shuttle of the loom, and thus avoid the reeling and back-winding processes that would be necessary if it were dyed in the skein or warp, and the quilling processes necessary if it were dyed in the long chain.

74. **Mixes** are those yarns made by blending fibers of a natural color with dyed fibers of the same material, or by blending two or more colors of dyed fibers. This is done at one of the earlier processes in the manufacture of the yarn, so that the fibers become thoroughly blended, and the effect is a delicately tinted or mottled appearance that cannot be obtained by dyeing the yarn after spinning. Innumerable combinations may be made: such as black and white; brown and white; blue, black, and white; brown and yellow. Light shades are made by using a large proportion of white or natural fibers with a slight proportion of colored, while darker shades are produced by increasing the proportion of the dyed fibers, or using fibers that have been dyed different shades. Various names are given to these yarns, such as *mixes*, or *fancy mixtures*; the English name is *mixture yarns*, and the French name *mélange*. The different shades producible are so numerous that very few of them are named, but they are generally indicated by a shade number. A few shades, however, are so commonly used that trade names have been given to them, although in this case the same

name is sometimes found to have a different meaning in different districts, while two or more names are sometimes given to the same yarn.

In cotton yarns, one class of these fancy yarns are those known as *silvers*, which are combinations of black and white in light shades, making a silver gray, and blue and white in light shades, making a silver blue. These silvers are sometimes called *steels*. Another shade in common use is what is known as *Jaeger* in America and Germany, or *natural* in England. It is a light combination of brown and white, sometimes with a few black fibers in it, in imitation of the natural shade of some varieties of sheep wool commonly found in Jaeger garments. *Heather mixes* are other popular shades composed of browns, blacks, and other dark colors combined with purple fibers, sometimes three or four colors being used to make one mix. In woolen and worsted yarns, common mixes are known as *gray mixes*, which are combinations of black and white in various proportions, and *Oxfords*, which are dark grays made with a very small percentage of white, and so on.

Mixes are made in cotton, wool, worsted, mohair, schappe silk, and other materials, and are used principally for woven dress goods and for knitted fabrics, especially underwear. The information given as to the forms in which yarns are put up applies to the various mixture yarns.

75. Random yarns are those that have been skeined and one-half of the skein dyed by dipping it half way into dye liquor and after drying it dyeing the other half another color; or one-third of the skein may be dyed one color, another third of the skein a second color, and the remainder of the skein left a natural color. Many other random effects may be produced in a similar manner.

76. Intermittent yarns are those composed of two or more colors of fibers, usually of white yarn with a slight percentage of colored fiber, this fiber being placed in the yarn in streaks. Where the streaky color occurs, the yarn is very slightly thicker than the other portion of the thread;

but as it has been drawn out after the insertion of the colored streaks, this variation in size has been reduced so as to be hardly discernible. The streaks of color give a distinct mottled effect in the yarn, and also in the cloth or knit goods made therefrom.

The name intermittent yarn is commonly applied to these yarns in Europe, but in America they are sometimes called random yarns. Strictly speaking, they are not random yarns, for the true random yarn is one that is produced on an ordinary single or ply thread by an irregularity in dyeing. Intermittent yarns are found in cotton, woolen, worsted, or mohair. They are sometimes used as filling for weaving, but more frequently for knit goods, especially underwear.

77. Mock-Twist Yarns.—An imitation twist may be made at the spinning machine by putting up two ends of different colored roving and spinning them into one thread. Thus, for example, if a black end and a white end are run together, it will make a black-and-white mock twist. The English name for mock twist is *mock grandrelle*.

PLY YARNS

78. Twists.—In American textile manufacturing the word *twist* applies to a ply yarn composed of two or more differently colored yarns. For example, a single black yarn twisted with a single white yarn will make a black-and-white twist in 2-ply. A brown thread, black thread, and yellow thread will make a brown-black-and-yellow twist in 3-ply. In cases where a subdued tone is desired in a fabric or where a mottled effect is necessary, it is customary to use a twist yarn. For example, by twisting a brilliant color with a dark one, a softer color is produced than by using a solid thread of one bright color. Twists are made in cotton, woolen, worsted, mohair, silk, and other yarns, and sometimes each of the constituent threads of the twist is of a different material. The name *double-and-twist* is often applied to 2-ply twists made in woolen or worsted.

79. It will be noticed that in the manufacture of these solids, mixes, and twists the construction of the yarn itself is just the same as in the case of an ordinary yarn, the different appearance being obtained not by a change in the structure but by the introduction of color.

NOVELTY YARNS

80. A class of yarn that is made in very great variety but in relatively small quantity, even in the aggregate, as compared with ordinary yarns, is that classification known as *novelty yarns* or *fancy yarns*, the latter being the name usually given to them in England. These yarns are made in cotton, wool, worsted, mohair, and silk, but seldom, if ever, in other materials. In some cases, a certain variety of these yarns will be found in all of these materials; others, owing to their construction, can be made in only one or two of the materials that are suitable for use, while many are a combination of two or more fibrous substances.

A **novelty yarn** may be defined as one that differs in construction from an ordinary single or ply yarn. Novelty yarns do not include those that differ in appearance merely on account of their having been passed through a bleaching, dyeing, printing, scouring, mercerizing, polishing, or similar process, for such processes do not change the structure of the thread; yet dyed, bleached, mercerized, or printed yarns are often used as one or more of the constituent threads of a novelty yarn, although this is not sufficient to produce the novelty yarn. There must be some difference in the structure of the resultant thread from the regular type of single or ply yarn common in the material from which the novelty yarn is made. Thus it will be seen that a number of effects in single and ply yarns cannot be considered as novelty yarns, even though the appearance of a thread bears a marked difference from the ordinary yarn; for instance, a mock twist is a single yarn and has the appearance of two spirals forming a thread, and a cotton or woollen mix has a distinct *mélange* appearance, although the construction of the

thread is that of the ordinary type; a twist made of two colored threads twisted together is still an ordinary type of ply yarn so far as its construction is concerned, so that neither ordinary solids, mixes, nor twist yarns can be considered as novelties.

81. The production of novelty yarns varies at different times, depending on current styles or fashions in goods. A certain type of yarn may be in vogue for one or two seasons and then not be much used for several years, another taking its place. Such yarns are principally used for woven goods, and occasionally for knit goods, to produce novel or extraordinary effects. When used for cloth they may form the body of the fabric or may be incorporated only in a very small proportion; for example, when one thread is inserted at intervals throughout the fabric. Novelty yarns are generally made in coarse numbers, owing to the fact that their construction, in most cases, prevents the formation of a fine yarn; for this reason, and also because the threads are in many cases uneven and often composed of two or more materials, the ordinary methods of indicating the counts of yarns are often discarded, and instead the size is indicated by the number of yards in a pound or other given weight.

As there is no uniformity in the naming of novelty yarns, it is not possible to give for each kind one name that is generally applied to it in all branches of the textile trade in America and Europe. Most novelty yarns are of domestic manufacture, although formerly imported, which again leads to confusion in naming them. For this and other reasons, most manufacturers of and dealers in novelty yarns sell them by number instead of by name. It is not intended to describe the manufacture of novelty yarns, as that is outside the scope of this Section; also, owing to the fact that they are made by only a few firms, and often by secret or patented processes, there is very little information available on the subject. It is intended, however, to describe the appearance of the yarns sufficiently for their identification so that the differences between them may be understood.

Novelty yarns may be divided into *single novelty yarns* and *ply novelty yarns*. Among the single novelty yarns are *flake yarns*, *knickerbocker yarns*, *mock knickerbocker twists*, and *crêpe*, or *extra-hard*, yarns.

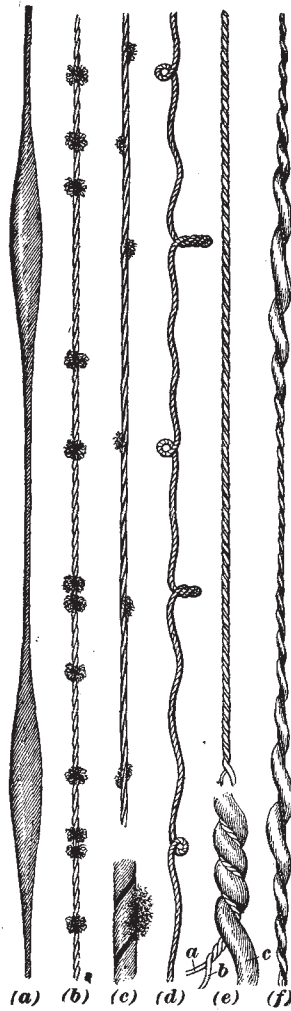


FIG. 13

of the thread; and all fibers form a constituent part of the thread.

SINGLE NOVELTY YARNS

82. **Single flake yarns**, as shown in Fig. 13 (a), are uniformly uneven single yarns, in which thick and thin places alternate regularly, the larger portions gradually tapering off to a thin thread, which enlarges again to a thick place. As the twist, given the yarn during the spinning process, has a tendency to affect the thinner places of the yarn more than the thicker ones, a great many more turns to the inch are found in the thin portion of a single flake yarn than in the thick portion.

Single flake yarns can only be made from fibers that are relatively short, of even length, and lend themselves to being drawn with accuracy; thus, the most common flake yarns are those made of cotton or wool, or sometimes a combination of wool and silk. In the true single flake yarn the flakes are evenly spaced throughout the length of the thread; the fibers are parallel to one another, lying in the direction of the length

83. Knickerbocker yarns, or more briefly **knicker yarns**, Fig. 13 (*b*), are single yarns with which are intertwined relatively bulky pieces of the same material that, however, are not so large as to unduly weaken the yarn or prevent its being used for weaving purposes. These extra pieces are spoken of variously as *neps*, *motes*, *specks*, *nubs*, or *knickers*, and the yarn itself is sometimes called *speck yarn*, or *nub yarn*. The English name is *knicker yarn*. Sometimes this yarn is called *flake yarn*, but it is not a true flake thread, as the excrescences are not evenly spaced and are additions to the ground thread. They can be picked off from the thread and still leave a single yarn. They differ from true flake yarns also in the fact that the knickers are composed of balls of fibers crossed in all directions. Knickerbocker yarns may be made of materials in their natural state, that is, the yarn undyed and the ground thread and the knicker composed of the same material. They are sometimes made with the knicker of one color and the ground thread of another; sometimes they are bleached, dyed, or printed after being spun, so that a large number of styles are produced. The best grades are those that are so constructed as to show knickers at close intervals on as fine a ground thread as possible; these are the grades that more frequently are called nub yarns.

84. Knickerbocker mock twists are shown in Fig. 13 (*c*), the lower part showing a short piece of yarn enlarged. This yarn has the appearance of a twist yarn with the knicker effect showing on one portion of the twist. Each constituent part forms a spiral, with the nubs projecting from one of the spirals at more remote intervals than in the case of ordinary knickers. Knicker mock twists are always made in at least two colors, each spiral being a different color. Another variety of these yarns has knickers on both the spirals, thus giving an opportunity for the use of four colors if desired, that is, one spiral of a certain color carries knickers of another color, while the other spiral is of a third color with the knickers of a fourth color; yet

the completed yarn is only a single yarn. Both knickerbocker yarns and knickerbocker mock twists are made in cotton, wool, and silk, or combinations of these materials.

85. Crêpe, or extra-hard, yarns, Fig. 13 (*d*), are single yarns in which an excessive amount of twist has been inserted, the yarn being allowed to contract during the twisting process; this forms numerous snarls, or kinks, thus giving to fabrics woven from it not only a rough appearance but a sharp, prickly sensation to the touch. Such yarns are chiefly made in cotton.

PLY NOVELTY YARNS

86. By using two or more threads in producing a novelty yarn there is a much wider range for the production of novel effects. An opportunity is given in ply yarns of introducing two or more threads of different colors, of different sizes, or of different materials, which in itself provides for endless combinations, more especially when one of the single yarns is not of the ordinary construction. The ordinary types of ply novelty yarns are *corkscrew yarns*; *bead yarns*; *gimp yarns*; *spiral yarns*; *ply flake yarns*; *2-ply flake yarns*; *slub, or bunch, yarns*; *ply crêpe yarns*; and *twist corkscrew yarns*. The more complicated varieties are *knotted, or bourette, yarns*; *knotted, or bourette, twists*; *loop, or bouclé, yarns*; *diamond twists*; and *tinsel yarns*, as well as combinations of any two or more novelty yarns, or of novelty yarns with ordinary single or ply yarns, the combination being made by twisting them together.

87. Corkscrew Yarns.—The simplest way of making a **corkscrew yarn** is to double a thick and a thin single yarn together, each of the single yarns being twisted in the same direction, and the ply yarn, of course, twisted in the opposite direction. The tendency is for one yarn to be wound around the other yarn in such a way as to produce the corkscrew appearance that gives the name to the yarn. These yarns are made in cotton, worsted, mohair, or almost any material.

88. Bead Yarns.—A more pronounced corkscrew yarn, sometimes called the **bead yarn**, Fig. 13 (*e*), is produced by twisting together a fine 2-ply yarn and a coarse single yarn, usually of the same material. The lower part of (*e*) shows a portion of the yarn enlarged to show its construction more clearly. The two single yarns of the 2-ply yarn and the single coarse yarn are, originally, twisted in one direction, say to the right. The 2-ply yarn is twisted in the opposite direction, say to the left. Thus, the two threads that form the bead yarn are twisted in opposite directions. When these two are twisted together, the ply yarn becomes harder twisted and shortens, while the single yarn has the twist taken out of it and lengthens, thus becoming more open and oozy and giving a more pronounced corkscrew effect, sometimes spoken of as a *bead effect*, or *waved effect*. By a suitable number of twists per inch in the ordinary yarns and in the bead yarns, many different effects can be produced; the final twisting is sometimes carried to such an extent as to actually untwist the single yarn and commence twisting it again in the opposite direction to that of the original twist. This method of producing novelty yarns can be applied to either cotton, worsted, mohair, silk, or combinations of these, and lends itself to the application of color by the selection of different-colored threads.

These bead yarns should not be confused with yarns on which glass beads are threaded or imitation beads placed.

89. Spiral yarns are constructed in the same way as bead yarns, but consist of built-up threads made from several ends of ply yarns, being finally twisted from one fine end and one coarse end. One style of spiral yarn consists of two ends of coarse 2-ply and one end of thick single yarn twisted together; this makes a heavy ply thread, which is then twisted with a thin end of 2-ply yarn, thus producing a heavy, strong, spiral thread. By the use of color, considerable ornament can be applied to these threads. They are made in cotton, worsted, mohair, or combinations of these materials.

Bead and spiral yarns are made in many other combinations of single yarns and ply threads, or combinations of ply threads.

90. Gimp yarns is a name given to bead and spiral yarns.

91. Ply Flake Yarns.—Several varieties of ply flake yarn are made, either by combining: (1) a single flake yarn and an ordinary single, (2) a single flake yarn and an ordinary ply yarn, (3) two single flake yarns, or (4) a ply flake yarn and an ordinary 2-ply yarn. A combination of a single flake yarn and an ordinary ply yarn is shown in Fig. 13 (*f*). The thin thread is a common 2-ply yarn of regular construction throughout its length and is twisted in the opposite direction to the single flake yarn. When the two are twisted together, the ply yarn becomes harder and shorter, while the flake yarn becomes softer and longer, thus giving a pronounced bead effect near the flake. The ply flake yarn made from two single flake yarns is somewhat similar in appearance, but has not the strength of the ply flake yarn made from one single flake and the 2-ply thread. By making a flake yarn in this manner the flake is softer and more pronounced, as compared with the single flake yarn, while the ground thread gives the necessary strength to enable it to be woven. Flake yarns are more commonly made ply than single, and the customary interpretation of the term flake yarn is that of a ply flake yarn.

Ply flake yarns can be made in cotton, wool, silk, and other materials or any combinations of these materials, and of course lend themselves to the use of color in many ways.

92. Two-Ply Flakes.—Two ply flake yarns can be twisted together so that the thick part of one of the flake yarns comes against the thick part of the other flake yarn, thus making a thread with the flake part accentuated and composed of two distinct colors when each of the single flake yarns is of a different color. Such a yarn is shown in Fig. 14 (*a*). The name *cloud yarn* is applied to these various types of ply flake yarns.

93. Bunch Yarns.—Very effective novelty yarns can be made by inserting at regular intervals in the ground threads of ply yarn of one color, *slubs* of the same material but

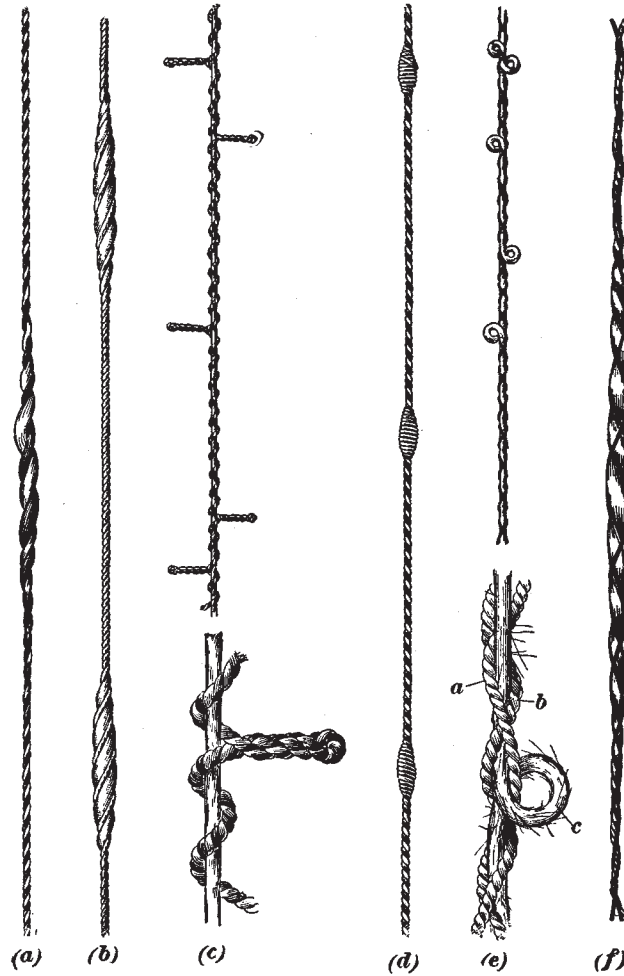


FIG. 14

of another color; *slubs* are small bunches of untwisted or loosely twisted yarn, as shown in Fig. 14 (b), which

represents a small piece of **bunch, or slub, yarn**. This bears some resemblance to a flake yarn, but when closely examined it will be seen that each slub is absolutely separated from the next slub, being connected by the ply yarn only. More effective forms of slub yarns are produced by using two different colors alternating with each other, for instance, first a red slub, then a black one, next a red one, etc.; or each slub may be of two colors.

Bunch yarns are made with a cotton ground thread and cotton slubs, cotton ground thread and woolen slubs, worsted or mohair ground thread and woolen or silk slubs, and with other materials, while color is very largely introduced in their manufacture. In some branches of the trade and in various districts, bunch yarns are called *slub yarns* or *flake yarns*, while the name *cloud yarns* is also applied to them.

94. Ply crêpe yarns, Fig. 14 (*c*), are produced in various ways: (1) by doubling an ordinary single yarn with a single crêpe, or hard-twist yarn; (2) by doubling a ply yarn with a single crêpe yarn; or (3) by first making an extra-hard ply crêpe yarn and doubling this with an ordinary 2-ply yarn. All of these may be of the same or different colors.

95. Twist Corkscrew Yarns.—An effective corkscrew yarn is made by using either a mock twist or a real twist for the thick thread of the corkscrew and a one-color thread for the thin one.

96. Knotted, or bourette, yarns, Fig. 14 (*d*), comprise one of the most common types of novelty ply yarns and are produced by, and exhibit the effect of, one thread wound around a ground thread a large number of times until a pronounced knot, or button, of thread is formed; then for a certain distance the ordinary construction of a ply-yarn twist is maintained until the next button is reached. These yarns are generally called *knotted*, or *knop*, yarns, although the names *nub yarns* and *bug yarns* are sometimes given to them in America, while when made from worsted and silk or mohair and silk, they are generally called *bourette yarns*. The ground thread is a ply yarn of one color, the knotting

thread usually a single yarn of another color, and the ground thread and knotting thread are twisted in opposite directions.

Knotted yarns can be made with the knops, knots, or nubs either closely or widely spaced, but the spacing is even throughout the length of the thread. The knots can be made in two colors, both differing from the color of the ground thread and the knots alternating in color; thus, a red and a white knot can be made to alternate on a black ground, in which case the ply yarn between the knots would be a red-white-and-black twist.

Knotted yarns are sometimes confused with knickerbocker yarns, but there is a considerable difference between them; knickerbocker yarns are always single yarns and knop yarns are always ply yarns. The term *nub yarn* is sometimes applied to a single yarn resembling a knickerbocker yarn but made more carefully and of better quality, so as to imitate a knotted yarn to some extent.

97. Knotted, or Bourette, Twists.—After a knotted yarn has been made, it is quite common to twist it with a yarn similar to the color of the ground thread in the knotted yarn, so as to make what is known as a **knotted twist**, or a **bourette twist**. This strengthens the thread and aids in passing the knot through the harness and reed of the loom in weaving. The word bourette in this connection should not be confused with bourette silk yarn, which is a different variety.

98. Loop yarns, sometimes called **curl yarns** or, when made in mohair or worsted, **bouclé yarns**, consist usually of three threads—two ground threads, which are the shortest, corresponding almost to the length of the completed yarn, and one loop thread, which forms a complete curl at intervals, the ground threads binding the loops. A loop yarn is shown in Fig. 14 (*e*), the ground threads being marked *a* and *b* and the loop thread *c*. The extra length of loop thread forming complete curls, or loops, on the surface of the yarn, makes it one of the most striking varieties of novelty yarns, especially when made of suitable combinations of color.

Loop yarns may be made: (1) with all three threads of one color, (2) with binding threads of one color and the loop of another color, and (3) with each thread of a different color. Loop yarns are most commonly made in mohair and worsted, and to some extent in cotton, but a cotton fiber does not lend itself to the formation of so distinct a loop as does mohair or worsted.

99. Diamond twists are made by using binding threads laid in opposite directions around a ground thread. A diamond twist on a flake ground is shown in Fig. 14 (*f*).

100. Tinsel yarns, sometimes spoken of as **brilliant yarns**, are combinations of an ordinary yarn and flattened metallic wire; the metals used for producing the extremely thin ribbon of metal are gold, silver, copper plated with gold, or copper plated with silver. Tinsel yarns are commonly made of a 2-ply worsted or silk ground thread, around which the tinsel or metallic wire is either closely or loosely twisted. Two of these threads are commonly doubled together. **Tinsel cords** are made on the corkscrew-yarn principle, using a metallic thread as the fine end.

101. Combinations of Novelty Yarns.—The combinations of novelty yarns are usually found in the form of twists, some of the varieties being as follows: (1) knotted twists, in which a knotted yarn is twisted with either an ordinary single or a ply yarn; (2) knot-and-loop twists, in which a knotted yarn is twisted with a loop yarn; and (3) knot-and-twist yarns, in which a knotted yarn is twisted with a common twist. Other combinations are produced by making a loop yarn in which the binding thread is a knickerbocker yarn, or in which the ground thread is a knot yarn. Many other combinations are also used.

102. When it is taken into consideration that any one of the varieties of novelty yarns made may be varied in size, that most of them may be varied in color or combinations of colors by the use of an unlimited number of shades, that in the case of those exhibiting a structure of thread that varies

at intervals, the distance between these variations may be changed or the size of the thickened part may be extended in length or in thickness, that combinations may be made of two or more types of novelty yarns or of a plain yarn and a novelty yarn, and that in case of the simpler types they may be printed, dyed, or bleached after being spun, it will be realized that the possibility of producing novelties in yarns is unlimited.

It is said that 15,000 different designs, or styles, of novelty yarn have been made, any one of which is liable to come into use again at any time, according to the prevailing fashions in fabrics. These many different designs result chiefly from difference in coloring and combination of materials, since the number of distinct types of novelty yarns is comparatively small. Novelty yarns as a rule are made of relatively heavy weight—as low as 100 yards to the pound and from this upwards to as high as 3,000 or 4,000 yards to the pound. It is possible, however, to make certain types of novelty yarns in much finer numbers—up to as fine as 15,000 yards to the pound. Many kinds of novelty yarns are used in extremely small quantities, only one thread appearing at intervals in the fabric in some cases. This causes the trade in novelty yarns to be of a retail character, since a few pounds of a certain style is often sufficient for the buyers' requirements.

YARNS

(PART 2)

EXAMINATION QUESTIONS

- (1) What is meant by prepared worsted yarns?
- (2) What is a ready means of determining the difference between yarn made from cultivated silk and from wild silk?
- (3) What are meant by the terms half white, three-quarters white, and full white, and are these terms usually applied to yarns of animal, vegetable, or mineral origin?
- (4) How would you distinguish between a bouclé and a bourette yarn?
- (5) How would you distinguish yarn made of raw-stock mixes of different colors from self-colored yarns?
- (6) (a) In what form does woolen yarn generally leave the mule? (b) Is filling yarn ready for the shuttle of the loom when in this form?
- (7) How is a mock twist made in single cotton yarns?
- (8) What is the difference between a woolen and a worsted yarn?
- (9) Describe a spool in the sense in which the word is used in connection with woolen warp yarns.
- (10) Name and define the varieties of silk produced by different degrees of scouring or boiling off.
- (11) What is asbestos, and what quality makes it especially useful for certain purposes?

- (12) What class of yarns is often weighted in connection with the dyeing process?
- (13) (a) What is a flake yarn? (b) Mention and briefly describe two different kinds of flake yarn.
- (14) Define: (a) woolen merino yarn; (b) shoddy yarn.
- (15) What is meant by a silk single?
- (16) What is the meaning of such expressions as $\frac{1}{4}$ -blood, $\frac{1}{2}$ -blood, etc., when used in connection with yarns?
- (17) From what material are mercerized yarns made?
- (18) When a woolen merino yarn is spoken of as 60-40 what does it mean?
- (19) Describe a knickerbocker yarn.
- (20) Define: (a) printed yarns; (b) polished yarns; (c) gassed yarns.
- (21) On what system of spinning are the majority of worsted yarns made?
- (22) Explain the meaning of the word twist as applied to a certain variety, or varieties, of cotton, woolen, and worsted yarn in America.
- (23) From what animal is mohair obtained and what are the principal uses of mohair yarns?
- (24) Define the terms: (a) warp-dyed, (b) cop-dyed, and (c) skein-dyed, as applied to yarns.
- (25) (a) What is bourette silk yarn? (b) Give a definition of another kind of yarn called bourette.