9 Fancy Yarn Production

The earlier chapters dealt with the production of yarns where the objective is to provide as regular and as parallel as possible an arrangement of fibers twisted together to form a continuous length of uniform thickness. Slubs, neps, thin places, and so on are noted as faults and imperfections and are viewed as degrading features of yarn quality. A great deal of care and effort is taken to minimize their occurrence by preventing or removing these features wherever possible. In fancy yarn production, these features are deliberately introduced into the yarn, along with color, to give visually and texturally attractive differences to fabrics. Some yarns that might be called fancy yarns have only color changes as distinctive features, obtained by a number of techniques such as twisting together different colored yarns, spinning irregularly blended dyed fibers or printed slivers, and irregularly printing already spun yarns. The production of such yarns will not be considered here, since the processes described in Chapters 2 and 3 are generally used to make them. In this chapter, the fancy yarns that are of interest are the ones that may be said to have, besides color changes, a specially structured profile and therefore conform to the following definition:

Definition: A fancy yarn is a yarn that is made with a distinctive irregular profile or a construction that differs from basic single and folded yarns, the objective of which is to enhance the aesthetics of the end product with respect to visual and textural properties.

Fancy yarns essentially give fashion touches to a fabric, and they have therefore a broad range of end uses — although not as wide as basic yarns. A significant market segment for fancy yarns is ladies' outwear. Occasionally, they are used in men's jackets, knitwear, and ties. Hand knitting is a popular end use, mainly for ladies' and children's knitwear. Fashion designers use fancy yarns as a means to diversify style. Therefore, furnishing is also an important market area, particularly in curtains and blinds, wall coverings, and upholstery.

Technically, producing fancy yarns is about creating distinctive features and combinations of these features. With the depth of available technology, the range is restricted only by imagination and commercial acceptance. This chapter gives a classification of the various structured effects and a description of the basic principles for producing such yarn features, as well as of the production machines employed.

9.1 CLASSIFICATION OF FANCY YARNS

Figure 9.1 gives examples of the many fancy yarn types that are commercially used. The list is not comprehensive, but it shows some of the more popular effects.

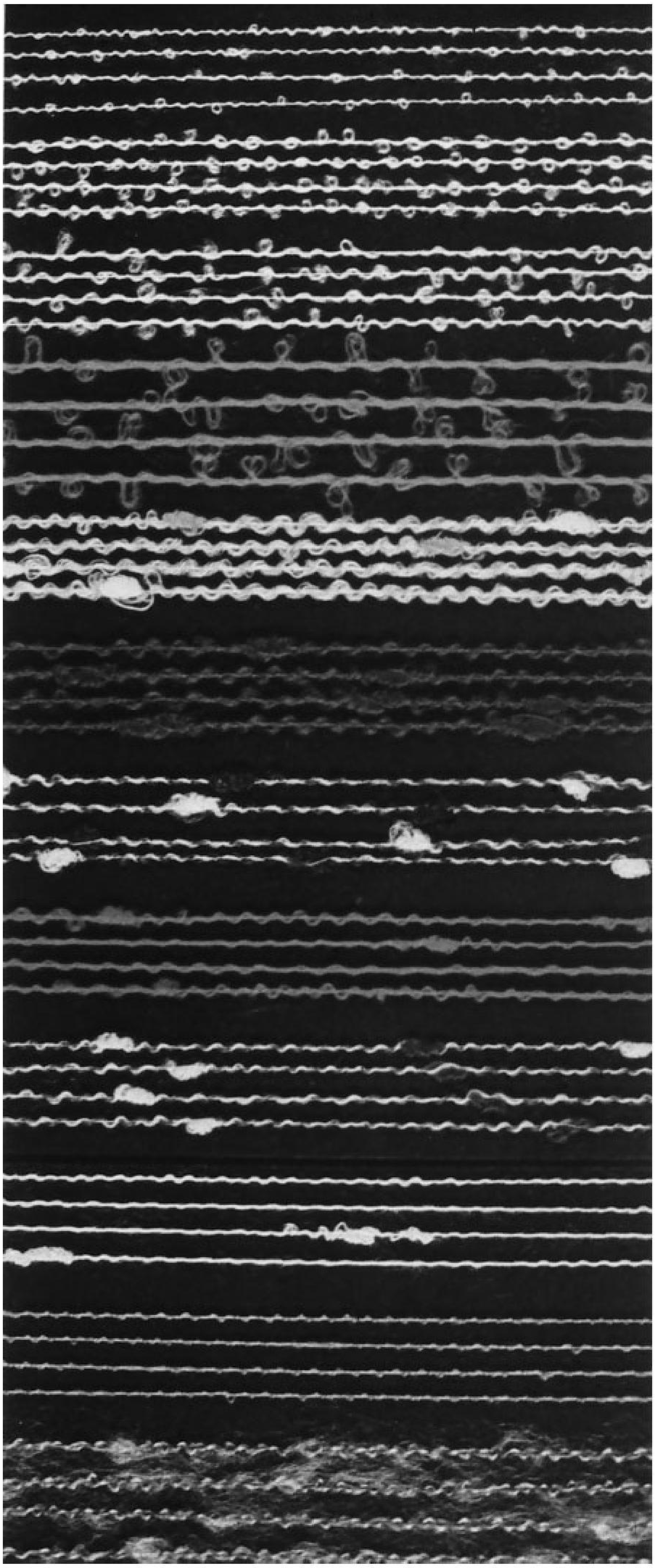


FIGURE 9.1 **(See color insert following page 266.)** Examples of effect twist fancy yarns. (Courtesy of Saurer–Allma GmbH.)

Various names are used to describe the different yarn effects. However, a careful study would show that many of the effects are variations on the eight basic profiles given in Table 9.1. These yarn effects can be made by plying a number of yarns together or, with modified spinning techniques, most can be spun from sliver or roving.

TABLE 9.1
Fancy Yarn Effects

Basic yarn profile	Effect variations
Spiral	Mock spiral, mouliné, jaspé
Gimp	Frisé, caterpillar, ondé
Slub	Ground slub, injected slub, injected flame (also called tear-off flame)
Knop	Knot, nep, noppé, button, reverse caterpillar, flake
Loop	Bouclé, frotté, prong, mock-spun chenille
Cover	Twisted flame
Chenille	Woven chenille, plied chenille
Snarl	

Several classifications for fancy yarns have been attempted.[1–3] The one given here is a further development of these and is based on the different types of yarn features, termed *effects*, and on the methods of their manufacture.

Table 9.2 gives a classification for fancy yarns, which also indicates the two production methods employed. Yarn-produced effects are based on twisting or doubling yarns together to create the fancy yarn effect from already spun yarns. This is the conventional method for producing fancy yarns. Spun-effect yarns are fancy yarns spun directly from fibers fed to the spinning system.

TABLE 9.2
Classification of Fancy Yarns

Fancy yarn classification			
Yarn (produced) effects		Spun yarn effects	
Regular effects	Controlled discontinuous effects	Regular effects	Controlled discontinuous effects
Spiral	Reverse caterpillar	Spiral	Button
Mouliné	Neps	Mouliné	Slub
Loop	Knots	Loop	Caterpillar
Bouclé	Knop	Bouclé	Combinations
Frotté	Slub	Gimp	
Gimp		Ondé	
Ondé		Chenille	
Snarl			
Cover			
Chenille			

As shown in the table, fancy yarns may be divided into regular and randomized effects. Regular effects are where the features appear uniformly along the yarn length. Some features, if made to appear at regular intervals along the yarn length, would cause pattern faults in the end fabric. Therefore, they have to be randomly spaced and are termed *randomized effects.* Both methods of yarn production can be used for regular and randomized effects.

9.2 BASIC PRINCIPLES

Let us now consider the basic principles for producing structured effects, with regard to the conventional method. The spun-effects method is based on similar principles. A suitable way to start is to refer to the general structure of a fancy yarn. Most consist of two or more of the following components as illustrated in Figure 9.2:

- A ground or core component
- An effect component
- A binder

The names of the components indicate the purpose of each in the final yarn structure. It is evident from Figure 9.2 that, to obtain a structured effect, a longer length of effect component, relative to ground components, must be present to form the required feature or effect. The buckling and twisting of the effect component onto ground components produce the aesthetic effect, and the twisting of the binder around the assembly locks the feature in place. The basic principle is therefore to feed the ground and effect components at different speeds into a twisting element, with the latter having the higher rate of feed, and then to reverse-twist the assembly with a binding component. The percentage ratio of the speeds of the effect component to the ground component is called the *overfeed* and, as we shall see later, this is an important factor in constructing various effects.

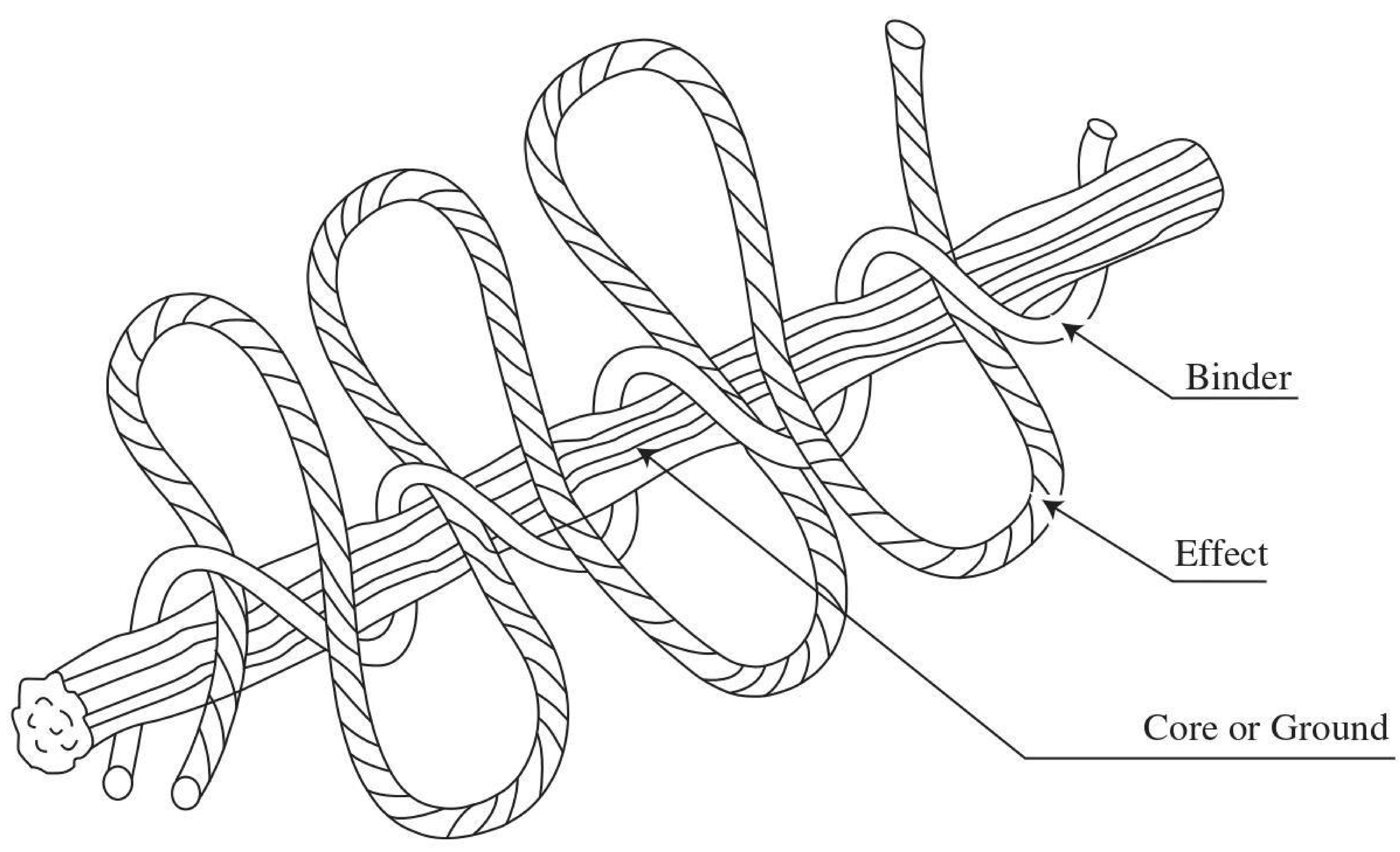


FIGURE 9.2 Basic components of a twist effect or spun fancy yarn.

The exceptions to the above general structure for fancy yarns are spiral yarns and ground slub, flake, and nep spun yarns. For the spiral effect, the basic principle is to feed two yarns of significantly differing counts and twist levels to a ply-twisting device so that, when twisted together, the finer yarn appears to spiral around the coarser yarn. The yarns are usually of different twist directions, and the ply twist direction is the same as the finer yarn. Although the ply twist is of a much lower level than the component yarns, the action of plying will remove some twist from the coarser yarn, thereby increasing its bulk to give a greater contrast with the finer yarn.

The basic principle of producing ground slub effects is based on roller drafting. The ground slub, as the term implies, is part of the base yarn. As the sliver or roving is being drafted to produce the count of the base yarn, the drafting process is deliberately and randomly interrupted to cause the appearance of short, thick places at random intervals in the final yarn. Flake and nep spun effects are also produced as part of the base yarn. In Chapters 2 and 3, the occurrence of neps in the preparatory processes was discussed. Carding was presented as an important stage in the process sequence at which neps could be removed or produced. For the production of flake and nep effects, tightly entangled minituftlets are deliberately scattered, during carding, onto the swift of a woolen card.[4–5] They may be of different colors to obtain a distinctive contrast with the host fiber. If deposited onto the swift between the licker-in and the carding zone, the minituftlets will be partially opened to appear as flakes. If introduced after the carding zone but before the cylinder/doffer setting line, the minituftlets are rolled tighter to form neps. The resulting slubbings are then spun in the conventional way.

9.3 PRODUCTION METHODS

As indicated in Table 9.2, fancy yarns that conform to the general structure are produced either by plying techniques, where the various components are in the form of yarns, or by spinning, where the effect component can be a ribbon of fibers, a yarn, or a combination of both.

It should be evident from the description of the basic principles of constructing fancy yarn profiles that different ply-twisting and spinning techniques can be used. Figure 9.3 gives a list of available production methods. For completeness, the brushing process is included. Essentially, this is where a staple yarn is brought into contact with a rotating cylinder fitted with flexible card clothing, and the direction of rotation enables a "back-of-tooth" action to partially pull out fibers and provide a hairy yarn surface. Since the purpose is only to produce hairy yarns and not to construct definite features, no further consideration will be given to the brushing technique.

9.3.1 Plying Techniques for the Production of Fancy Yarns

Plying is the conventional method for producing fancy yarns. There are two stages to the process.

1. The profile twisting stage, involving the ground and effect components
2. The binding stage, where the binder is introduced to stabilize the profile

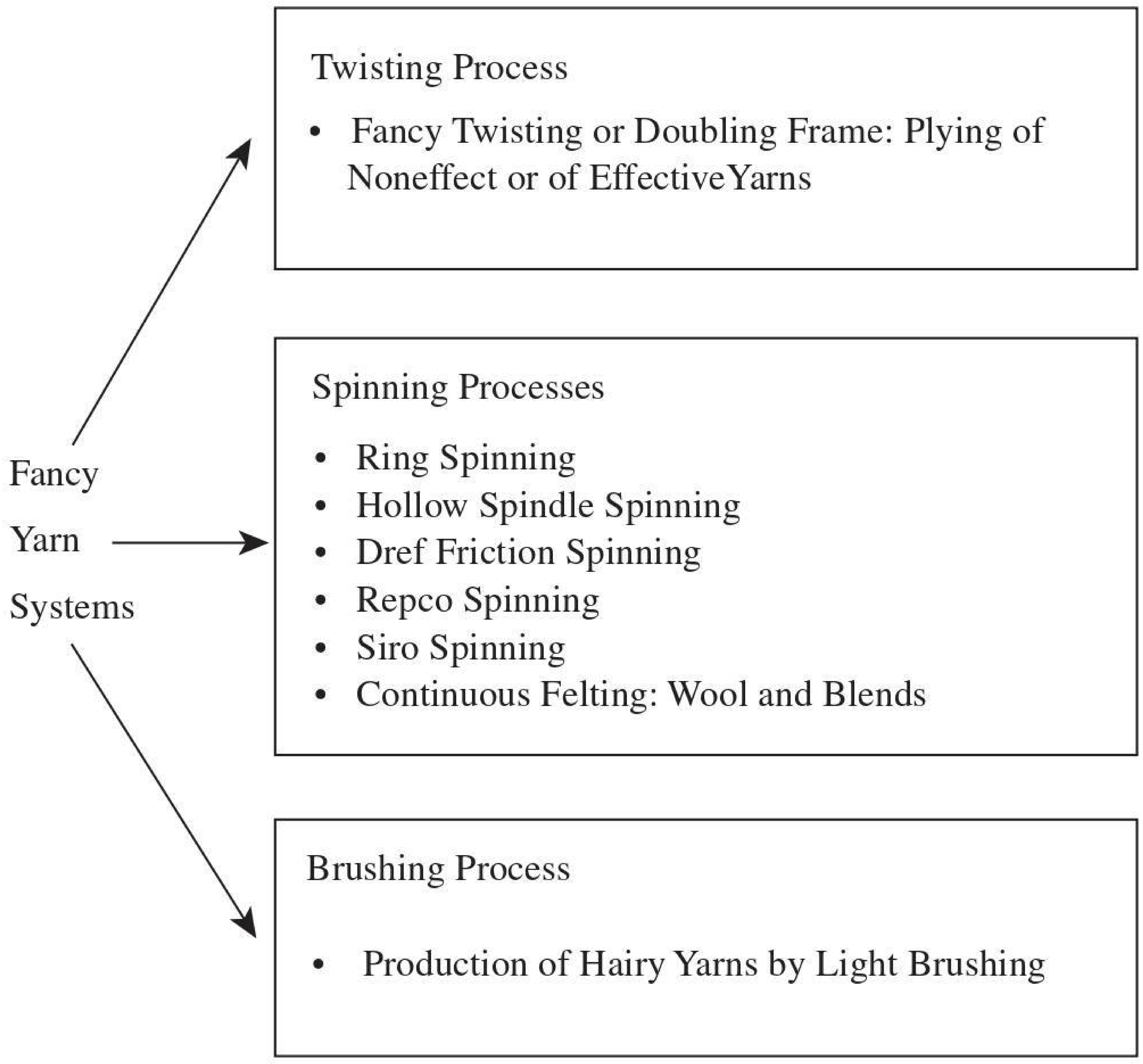


FIGURE 9.3 Fancy yarn manufacturing systems.

9.3.1.1 The Profile Twisting Stage

Specially made ring twisting machines are employed, particularly for the first stage, where threading of the component yarns is important to obtaining the required profile. Figure 9.4 shows that the yarns are fed to the ring and traveler twisting device by a minimum of two sets of rollers. The back rollers, G, control the rate of feed of the ground components, and the front rollers, E, control the effect component. The production rate and twist insertion are calculated using the surface speed of G. The E rollers must not interfere with the controlled running of the ground yarns. To ensure this, either a substantially higher count of yarn is used, its thickness preventing nipping of the ground yarns by E, or grooves are cut into the periphery of the top E roller. As explained earlier, the length of effect yarn needed to form a desired profile is obtained by the percentage overfeed; therefore, the speed of E must be greater than G. When producing regular effect yarns, both sets of rollers run at constant speeds. The rollers are usually computer controlled so that, to produce randomized-effect yarns, the E rollers can be rapidly slowed to the same speed as G and then accelerated to their original speed to give random intervals between repeats of the profile. Speed control of the rollers also enables construction of a yarn with different profiles.

The threading arrangement illustrated in Figure 9.4 can be used for most of the basic eight profiles, with the exception of the knop, cover, and chenille effects. Figure 9.5 shows threading arrangements needed for the knop and cover profiles. One of the two may be used to form, for example, a knop profile and, in both cases, only one ground component is necessary; both yarns are fed forward at the same

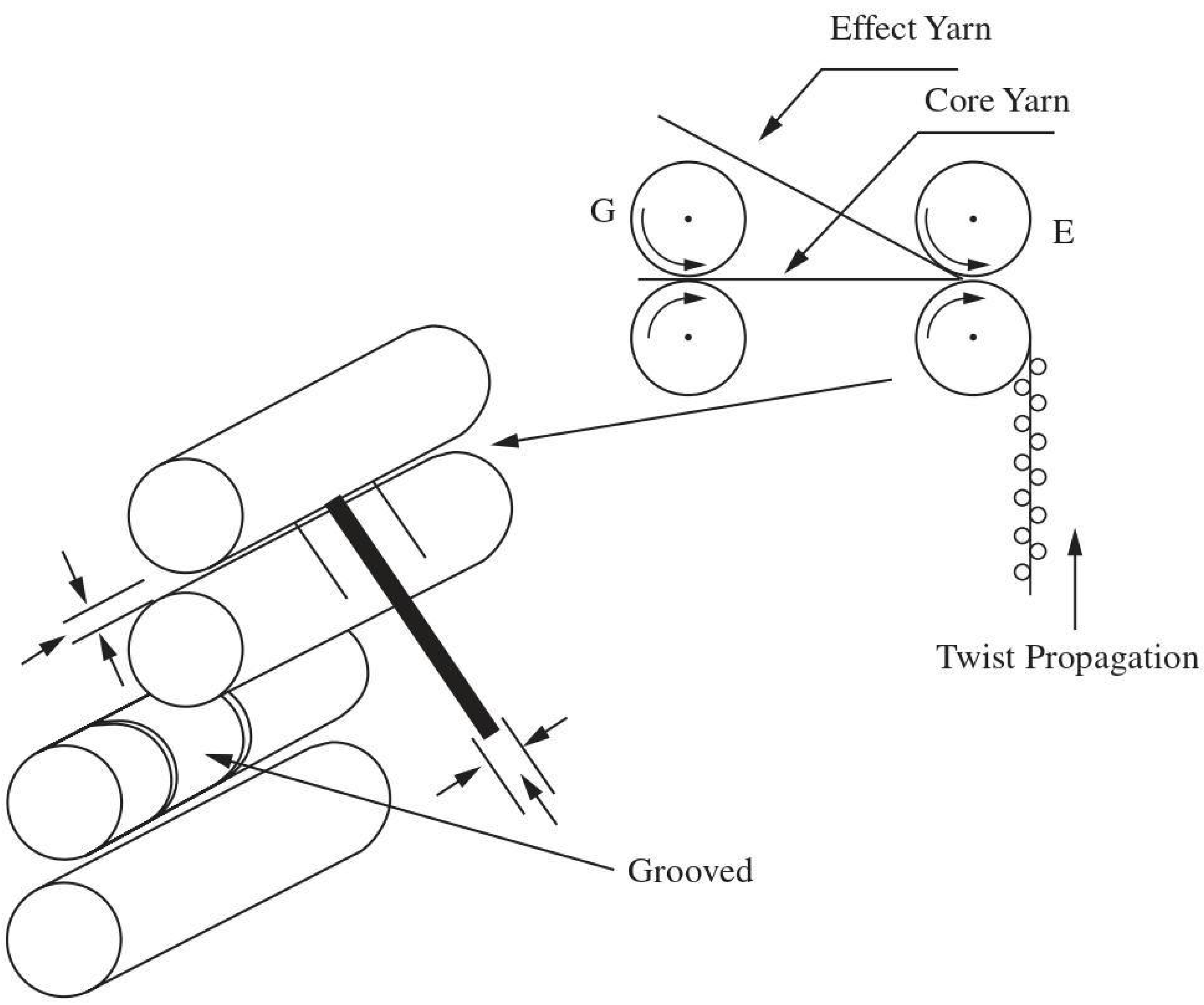


FIGURE 9.4 Threading arrangement for profile twisting stage.

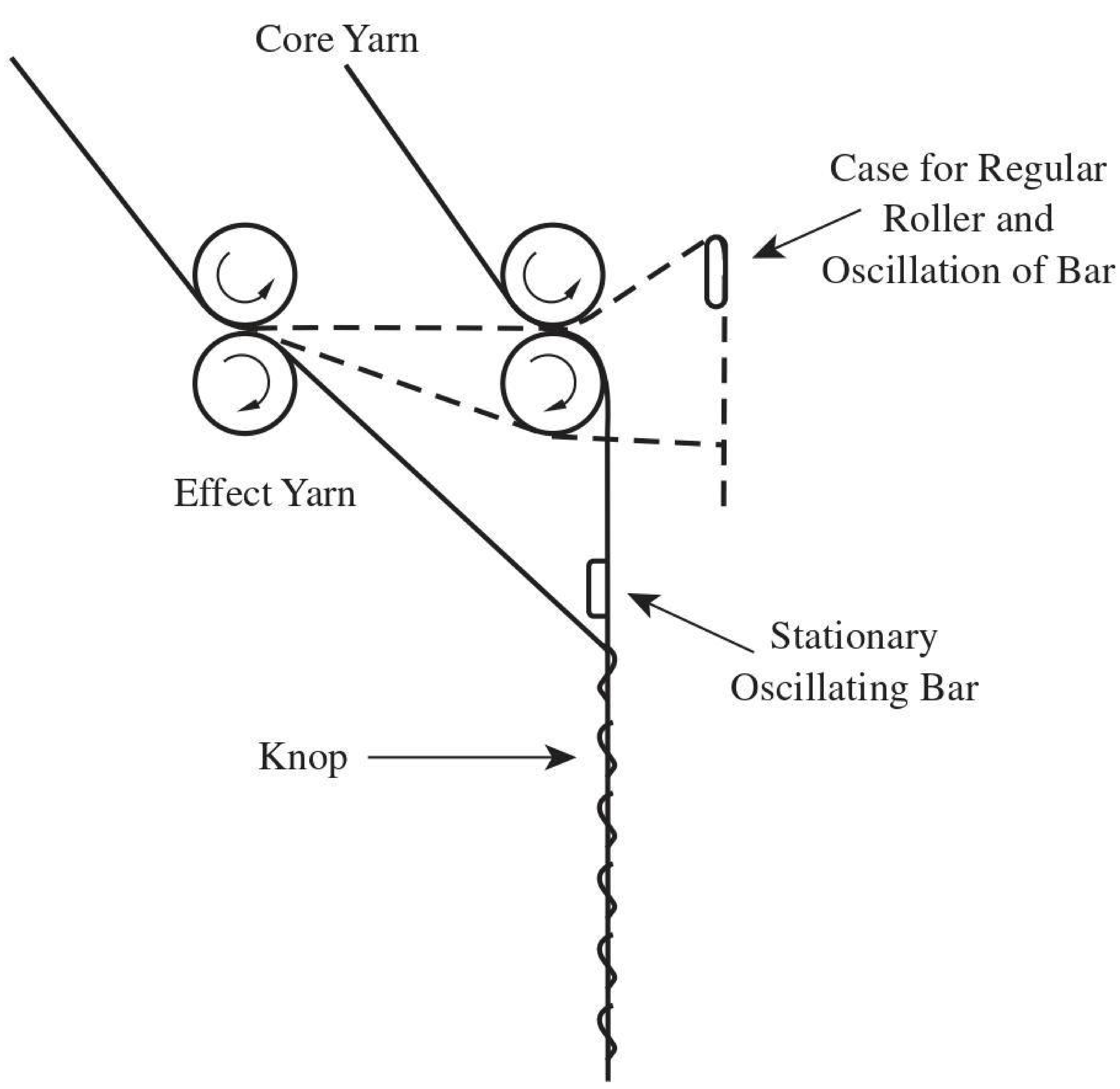


FIGURE 9.5 Threading arrangement for single or two–color knop.

speed. The G rollers can be then made to stop for a very short period at irregular intervals while the E rollers are still feeding the effect yarn into the twisting zone. At the last twist point where the yarns cross, the extra length of the effect yarn will wrap tightly around the ground yarn to produce the knop profile. It is important that, when wrapping occurs, the effect yarn meets the ground yarn at a steep angle (i.e., at almost a right angle). To assist this occurrence, a rectangular metal bar — termed a *spacer bar* — is positioned to separate the two yarns. When both yarns are running, the ply twist propagates up to the spacer bar, the last twist point being just below the bar. When the ground yarn stops and twisting continues, the effect yarn will be forced to meet the ground yarn at a steep angle for wrapping.

The second approach in forming the knop profile is to have both yarns constantly running with a small overfeed of the effect component. The spacer bar is made to oscillate up and down to continuously alter the distance of travel of the effect component. When in the up position, the extra length of the effect component, caused by the overfeed, is accommodated by the increased path length. As the oscillating bar moves to the down position, this length becomes tightly wrapped around the ground component to form the knop.

9.3.1.2 The Binding Stage

This is a reverse-twist stage. If the profile twist is of Z direction, the binding twist is usually S direction so as to obtain a balanced yarn (see Chapter 6). The profile yarn is commonly twisted with a filament yarn, the latter having a slight overfeed of 102 to 105%. The filament yarn, therefore, wraps or binds the profile yarn; hence the reference to it as the *binding component.*

9.3.1.3 The Plied Chenille Profile

The plying process used for constructing the chenille profile is a special case and has to be considered separately from the above descriptions of plied effect yarns. Imitation chenille can be produced by the wrap spinning method but with respect to plied chenille; Figure 9.6 illustrates the plying process.

As shown, rotating steel belts guide two ground yarns through a wrapping zone. There, four small bobbins on which the profile yarns are wound circulate around the steel belts and thereby wrap the profile yarns around the belts. The belts are spaced a small distance apart — sufficient for a sharp blade to be located between them. The motion of the steel belts causes the wrapping layers of the profile yarns to be cut by the blade. Two binding yarns are brought into contact with the cut yarn sections and are plied with the ground yarns. The ply twist locks the cut sections between the ground and the binding yarns, forming two fancy yarns in which the cut yarns appear as a cut pile. The two fancy yarns are termed *cut-chenille yarns.*

9.3.2 Spinning Techniques for the Production of Fancy Yarns

The spinning techniques listed in Figure 9.3 have already been described in Chapter 6. Here, we will consider how they are utilized in the production of fancy yarns.

It should be clear from the general principles that ground slub profiles can be made on a conventional ring-spinning system if the drafting system is modified to cause random thick places. Computer control of the drafting rollers is one option, which also has the added benefit that slub sizes can be varied. Cheaper alternatives

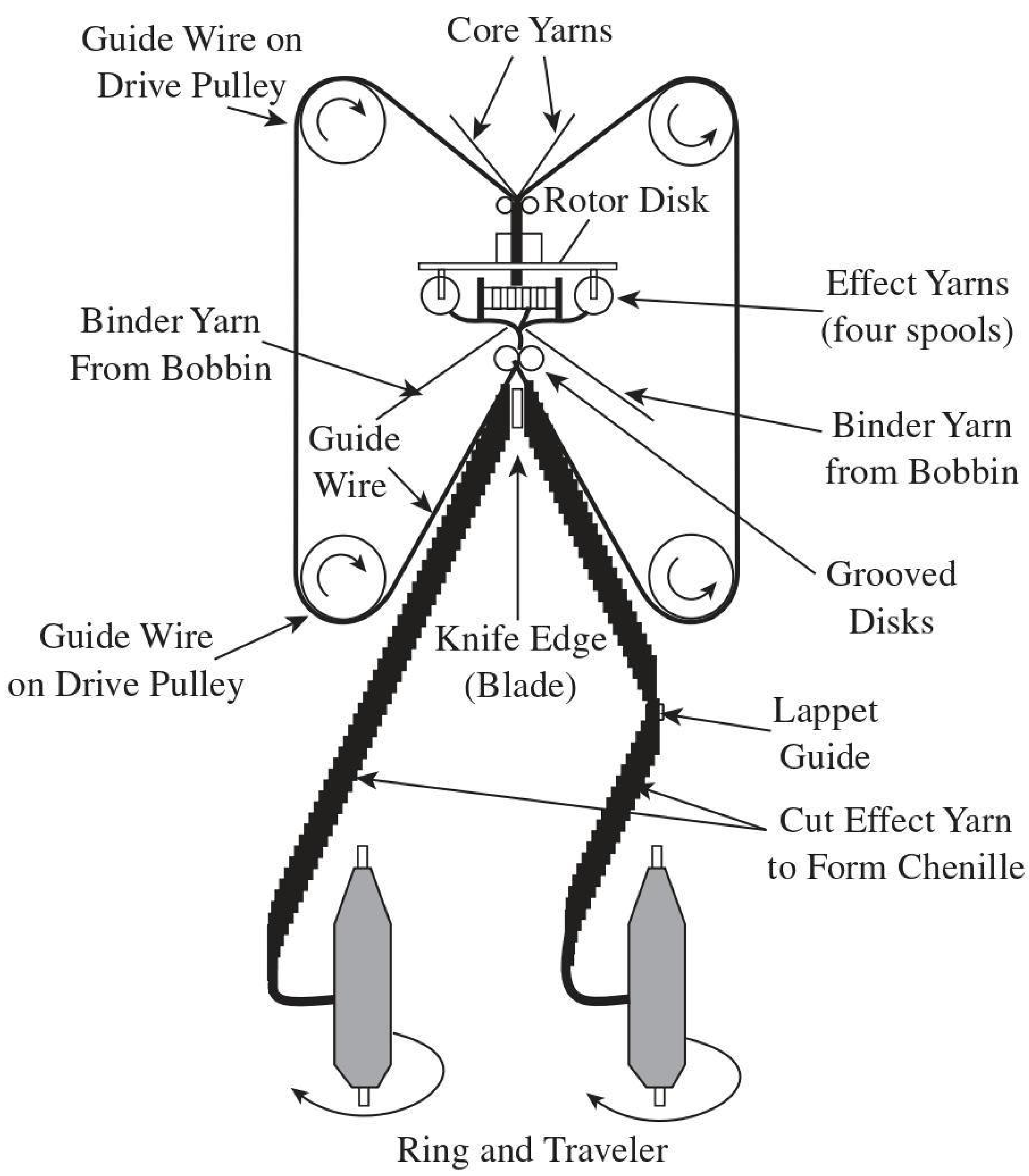


FIGURE 9.6 Production of chenille effect fancy yarn by yarn plying process.

are modification to the mechanical drives of the drafting system and the presence of a high percentage of short fibers in the material being spun.

From the descriptions given in Chapter 6, it can be seen that, by feeding either different colored fibers or different fiber types, or by including a filament yarn and using differential dyeing, the Siro and Repco systems may be employed to produce mock spiral yarns.

Flak and nep yarns can be spun from appropriately carded slubbings using the woolen spinning or the continuous felting process. However, if slivers rather than slubbings are made, using, say, a semi-worsted card, then the Dref-2 friction spinning system can be used to produce flake- and nep-effect yarns. Similar yarns have been produced with salvage waste from weaving fed along side normal carded sliver to the Dref-2 machine.[6] Loop profiles (largely bouclé) can be also produced with this spinning system. The ground and profile yarns are made to run along the nip line of the friction rollers with only the ground yarns kept under tension. The suction at the nip line causes the profile yarn to buckle into a sinusoidal shape along its length. The friction rollers twist the components together, causing the undulations of the profile yarn to further deform and become small loops. Individual fibers from a light feed to the opening roller are simultaneously being deposited onto the friction rollers and twisted around the ground and profile components, thereby binding the loops in place.

A slub-injection device can be mounted above the friction rollers, as shown in Figure 9.7, to introduce color effects in the yarn, producing an injected flame yarn. Basically, the device consists of two pairs of drafting rollers with a tapered tube

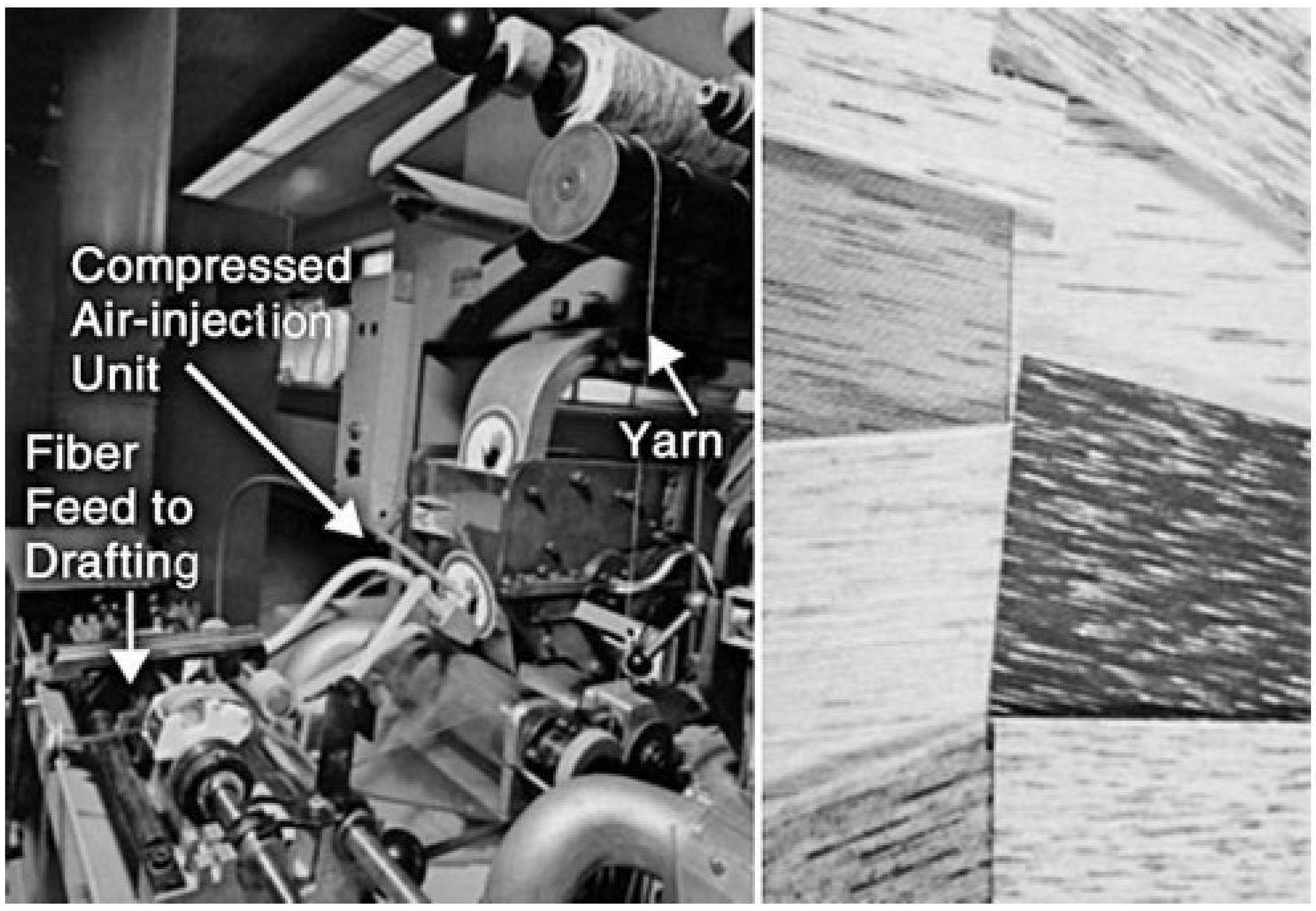


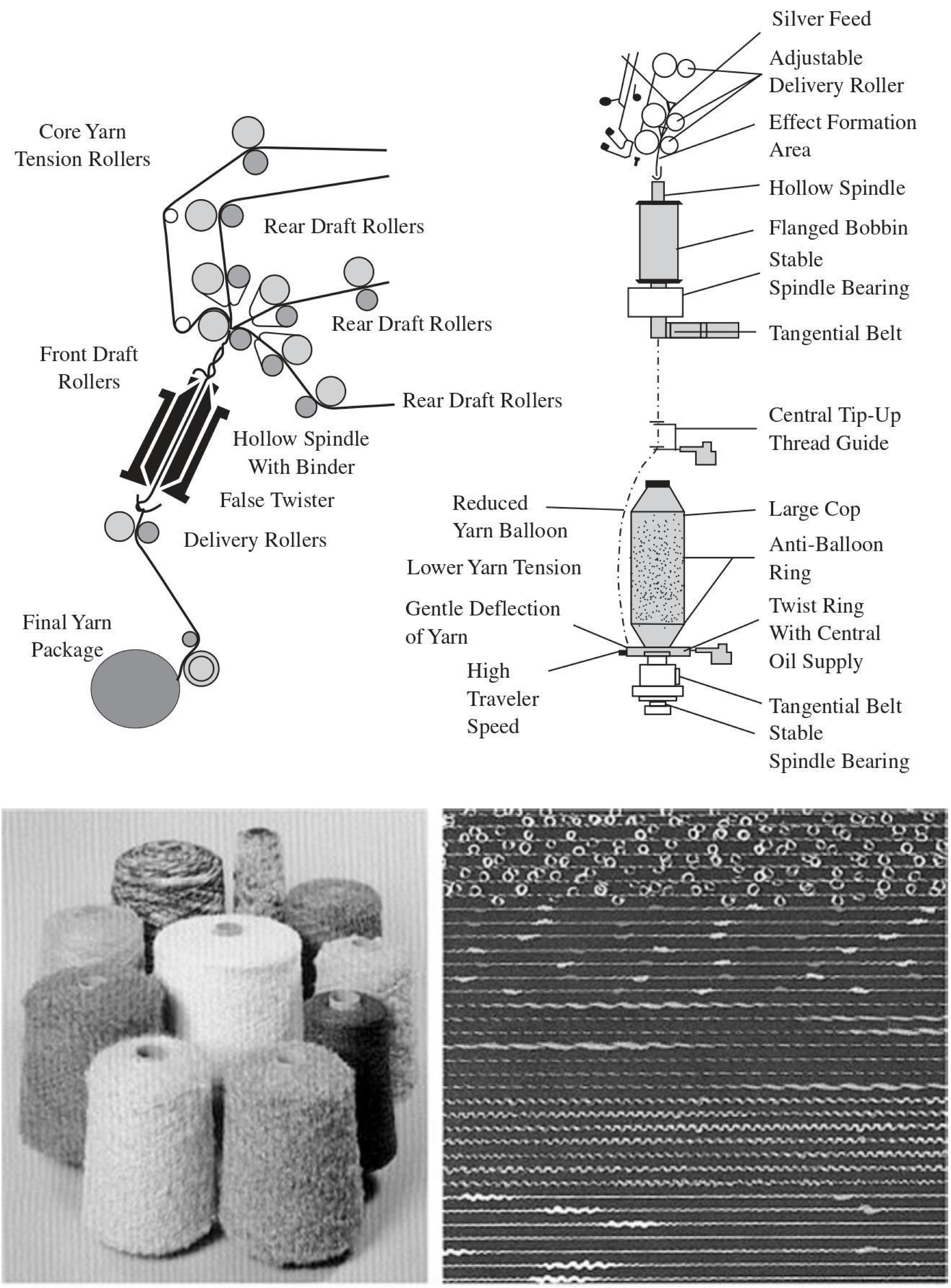
FIGURE 9.7 **(See color insert.)** Dref spinning of injected slub–effect yarns. (Courtesy of Fehrer AG.).

fitted at the exit of drafting unit. Compressed air passing through the tube removes small tufts from the fiber ribbon leaving the front drafting rollers and injects them into the nip line of the rollers during friction spinning.

The above spinning processes are restricted in the range of fancy yarns they can produce and are therefore rarely used in the fancy market area. The most popular spinning technique that has been specially developed for the production of fancy yarns is hollow-spindle wrap spinning (see Chapter 6).

As Figure 9.8 shows, the basic system for plain yarns can be modified to have a main drafting unit with a grooved top-front roller, an added pair of feed rollers for controlling the speed of the ground component yarns, and two additional drafting units to produce multicolor slub injection or mock cover yarns. Similar to the plying system, the tread line of the ground component yarns passes from feed rollers and through the grooves of the top-front drafting roller. The profile component is usually in the form of a drafted fiber ribbon attenuated from a sliver or roving to the required count by the main drafting system and fed into the twisting zone at the percentage overfeed necessary for the desired profile. Yarns can be also used as the profile component, in which case they are fed only through the nip of the drafting-system front rollers. Both the profile and ground components are threaded together down the hollow spindle, around the false-twist device, and through the nip of the delivery rollers to the package-winding unit. As in the plain-yarn system, a filament from a pirn mounted on the hollow spindle is also threaded around the false twister. The false twist action of the rotating spindle twists the two components together to form the profile, and simultaneously the filament wraps the yarns to hold the profile in place.

To produce slub effects, a sliver or roving can be fed to the nip of the front drafting rollers. The injection unit consists of a pair of roller-driven aprons, which guide the sliver or roving into the front drafting zone of the main effect component just behind the front rollers. The control system is programmed to stop the aprons



Source: William Tatham Ltd. *Source:* Saurer-Allma GmbH

FIGURE 9.8 **(See color insert.)** Hollow-spindle fancy yarn-spinning system.

when the front rollers nip the injected fibers, with the result that fiber tufts are pulled into the main effect component and spun into the final yarn.

Figure 9.8 also shows that the hollow spindle, without the false twister, can be combined with a ring and traveler to produce yarns that look very similar to the conventional process but are produced more economically. The false-twist action is replaced by real twist from the ring and traveler.

Using the hollow spindle/false-twister technique, the effect component in the final yarn has no twist. Hence, the fancy yarn is bulky and also may be hairy. The profile is therefore not as well defined as a conventionally made profile, where the constituent yarns are pretwisted. By combining the hollow spindle with the ring and traveler, real twist propagates through to the front drafting rollers, and the effect component becomes twisted and has a well defined profile.

Like the Dref-2 process, the hollow-spindle technique combines the profile twisting and binding stages into one process and. as explained in Chapter 6, the separation of twisting and winding actions enables faster production speeds and larger package sizes to be wound. Therefore, there are obvious economic advantages over the conventional plying process. In contrast to the friction spinning technique, hollow-spindle wrap spinning has the flexibility to produce most of the eight profiles of Table 6.1.

9.4 DESIGN AND CONSTRUCTION OF THE BASIC PROFILES

Our consideration of the design and construction of the eight basic profiles will be restricted to the plying and hollow-spindle spinning techniques, as these are the most commonly used processes. From the above descriptions of these techniques, it can be seen that threading up of the various components is critical to construction of the basic profile. The following factors are also of importance and should be given careful consideration in the design and construction of the profiles:

- *Fiber fineness and length.* Essentially, it is the bending rigidity of the fiber that is strictly of importance. Coarse, long fibers tend to give the best loop definition but, for bouclé or small loops, finer fibers are more effective.
- *Count and twist level and direction of component yarns.* Count and twist are principal factors influencing yarn bulk, which in turn can enhance any contrast of color differences between the various components of a fancy yarn.

9.4.1 Spiral

This is usually made with the plying technique. Typically, two single yarns of appreciably differing thickness and twist level and direction are plied together with a slight overfeed of the coarser yarn. Typically, a bulky woolen yarn of around 300 tex with 120-t/m Z-twist would be ply twisted with a 47-tex, 600 to 800 t/m S-twisted cotton yarn, dyed a darker color (see Figure 9.9). The ply twist would be in the S direction and may be a quarter to a third the twist level of the woolen yarn, depending on the required visual contrast and handle.

A *mock spiral* can be produced in which both yarns have the same twist direction but are plied with the reverse direction of twist. The spiral effect is much less pronounced, because twist is removed from both yarns during the plying action, and the surface fibers of the finer yarn become slightly intermingled with the coarser yarn, thereby diminishing the visual contrast.

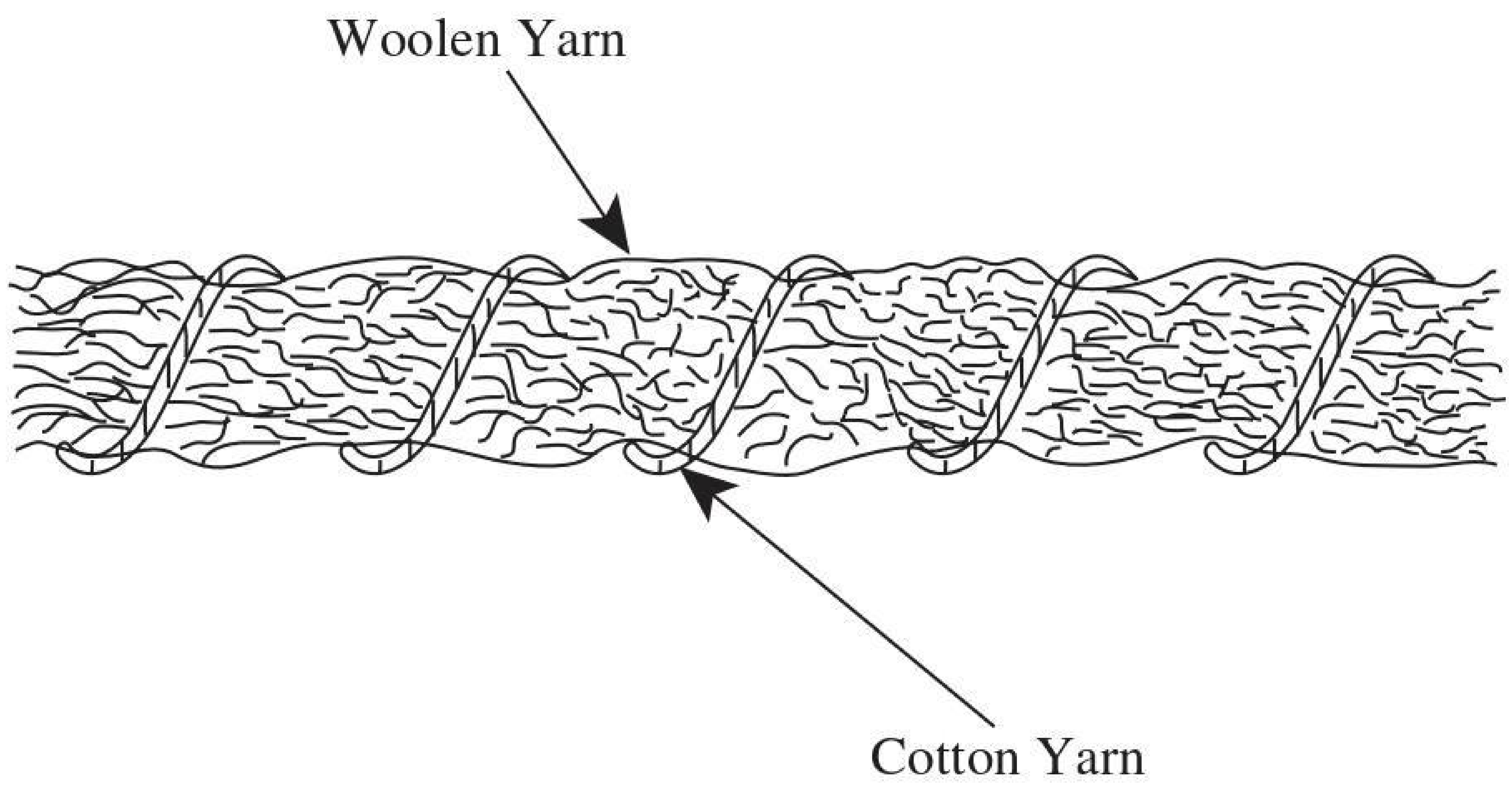


FIGURE 9.9 Illustration of spiral yarn structure.

9.4.2 Gimp

Both the plying technique and the hollow-spindle process can be used to make this yarn (see Figure 9.10). It is produced in a wide range of yarn counts and fiber types, and, with the plying technique, most yarn types (i.e., woolen, worsted, carded ring-spun, filament, etc.) can be used.

Using the hollow-spindle process will require two ground yarns on which the drafted ribbon can be made to buckle into the form of a wavy shape, e.g., a sinewave, using an overfeed within the range of 120 to 200%. The greater the overfeed, the larger the amplitude of the waveform. The propagation of twist from the false-twist device plies the ground yarns around the undulations to retain the profile, which is then locked by a wrapping filament yarn. Typically, two 2/50-tex semi-worsted acrylic yarns may be used for the ground component. The profile component would be an acrylic sliver of 60 mm 3.3-dtex fibers drafted to a count of up to 300, and the binder a 20-dtex multifilament yarn. The binding twist would be within the range of 200 to 300 t/m.

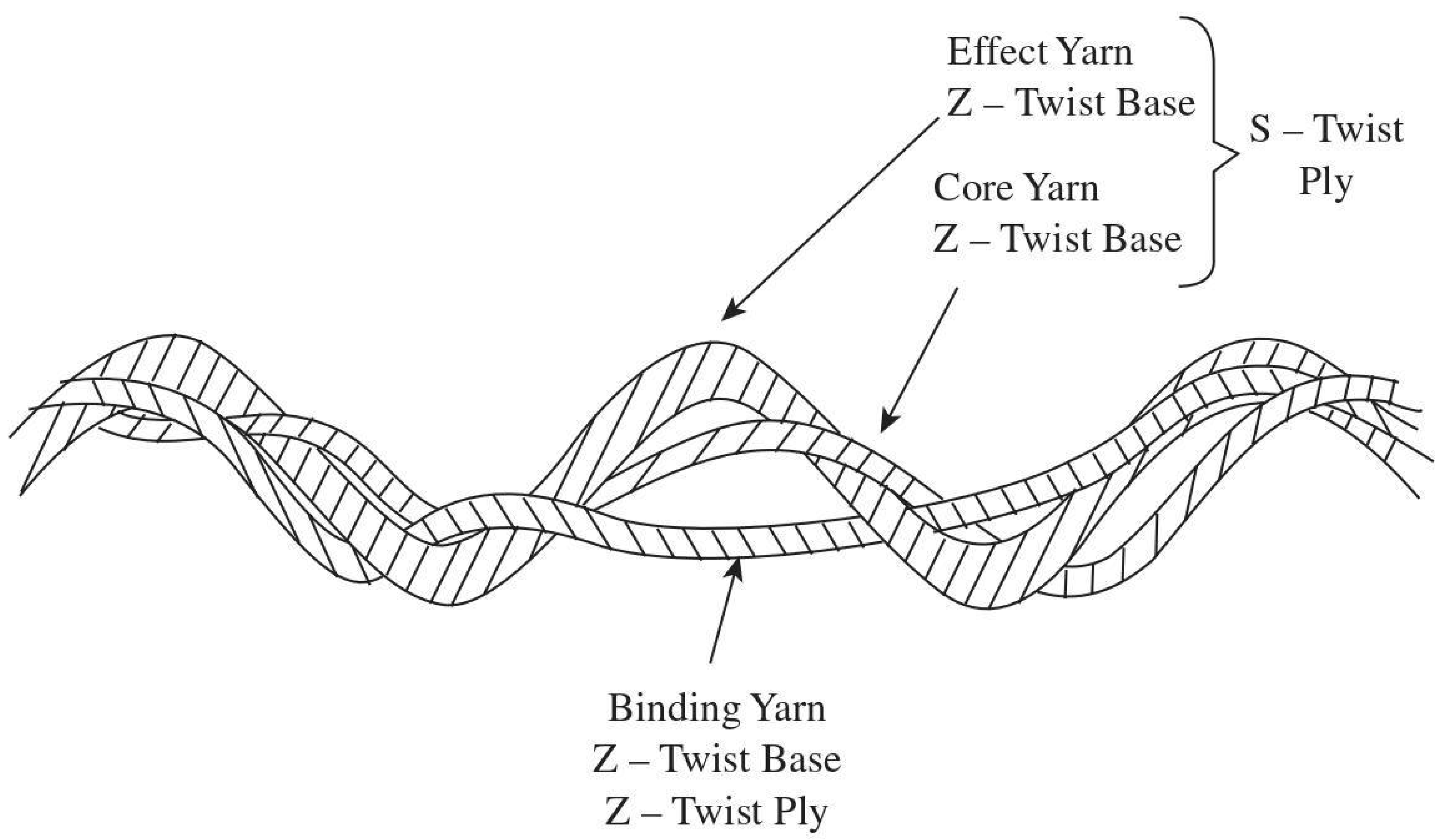


FIGURE 9.10 Structure of gimp effect yarn.

With the conventional technique, yarns of similar counts to the above or finer may be used. The profile component could be a woolen spun wool yarn with an overfeed of 120 to 150%, and the ground components could be two worsted yarns. These would be plied together with 400 to 500 t/m S-twist. For the reverse twisting stage, a single 2/40-tex worsted yarn would act as the binder and 180 to 200 t/m Z-twist used as the binding twist.

9.4.3 Loop

The threading arrangement of the component yarns to form loops is similar to that for the gimp. Three other factors, however, must also be given careful consideration when constructing loop profiles. They are (1) the type of fiber or yarn used to form the loop, (2) the level twist applied in forming the loop, and (3) the percentage of overfeed employed at the profile stage.

To construct a series of loops, the profile component must have suitable stiffness to deform into a circular shape during overfeeding and twisting with the two ground yarns. The stiffness is also important in retaining the loop shape after the binding twist stage. In spinning, it is the fiber rigidity and staple length that are of importance. In the plying process, in addition to fiber rigidity and length, the twist of the profile component yarn is a key factor. The longer the fiber, the better the loop formation when the profile is made by spinning. In the case of the plying process, longer fibers and a suitable level of twist produce a profile yarn component with low hairiness but high lustre, and this combination aids the visual definition of the loop. The twist of the profile component yarn, however, must not be at a level that will cause snarling during a high-percentage overfeed. The usual practice is to have just sufficient twist to enable the yarn to withstand the tensions involved in the threading arrangement and to unwind from the supply package, typically 240 to 320 t/m, depending on count — the coarser the count, the lower the twist.

Mohair is a popular fiber used for the profile component in the spinning process. With the plying technique, Z-twisted, wool worsted yarns and mohair yarns, typically of 70 to 100 tex, are often used. The ground and binding components may be 40- to 50-tex worsted, semi-worsted, or short staple yarns of natural or synthetic fibers.

At the profile stage, the overfeed is within the range of 150 to 300%, and the applied twist is within 100 to 1000 t/m in the S-direction. A high overfeed (250 to 300%) and low twist level (150 to 500 t/m) will produce large loops (see Figure 9.11), whereas an overfeed of 150 to 250% with twist levels of 500 to 1000 t/m will produce a profusion of small loops to give a bouclé yarn (see Figure 9.1).

9.4.4 Snarl

This type of fancy yarn is generally produced with the plying process. The profile component has to be a highly twisted yarn; typically, it is a short staple cotton or synthetic fiber singles yarn of 25 tex with 25% greater twist level than normally used for a conventional singles yarn. The percentage overfeed is similar for the loop profile. The ground and binding components would be of a coarser count yarn, around 2/40 to 2/50 tex. The ground and profile components should have opposite

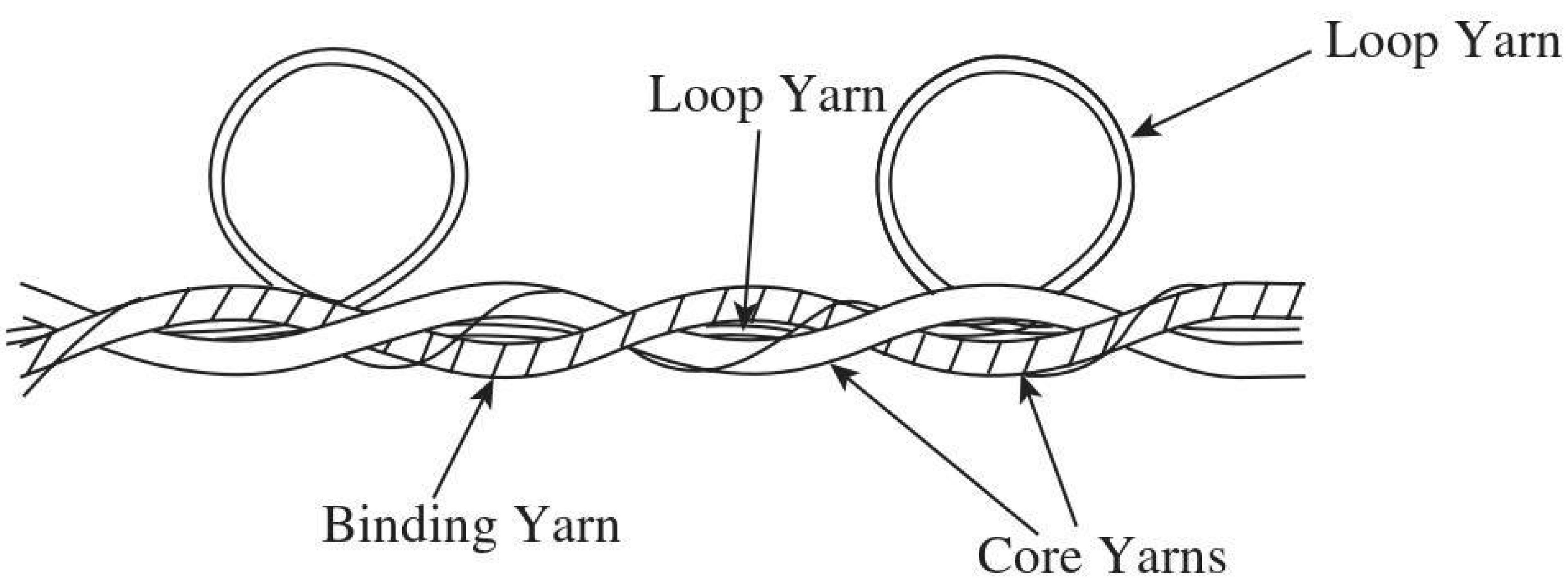


FIGURE 9.11 Effect loop yarn structure.

twist directions, the former S and the latter Z. At the profile stage, S-twist of 500 to 600 t/m would then be used in plying the yarns together; this adds further twist to the ground component so that the snarl shape is conspicuous against the ground yarns (see Figure 9.12). The binding twist is usually on the order of 320 t/m.

9.4.5 Knop

The knop (see Figure 9.13) can be constructed by the spinning or the plying system using an overfeed of 150 to 200%, but the profile is visually not as well defined in the spinning as in the plying process, because a drafted fiber ribbon is used as the profile component. The earlier description of how a knop can be formed in the plying

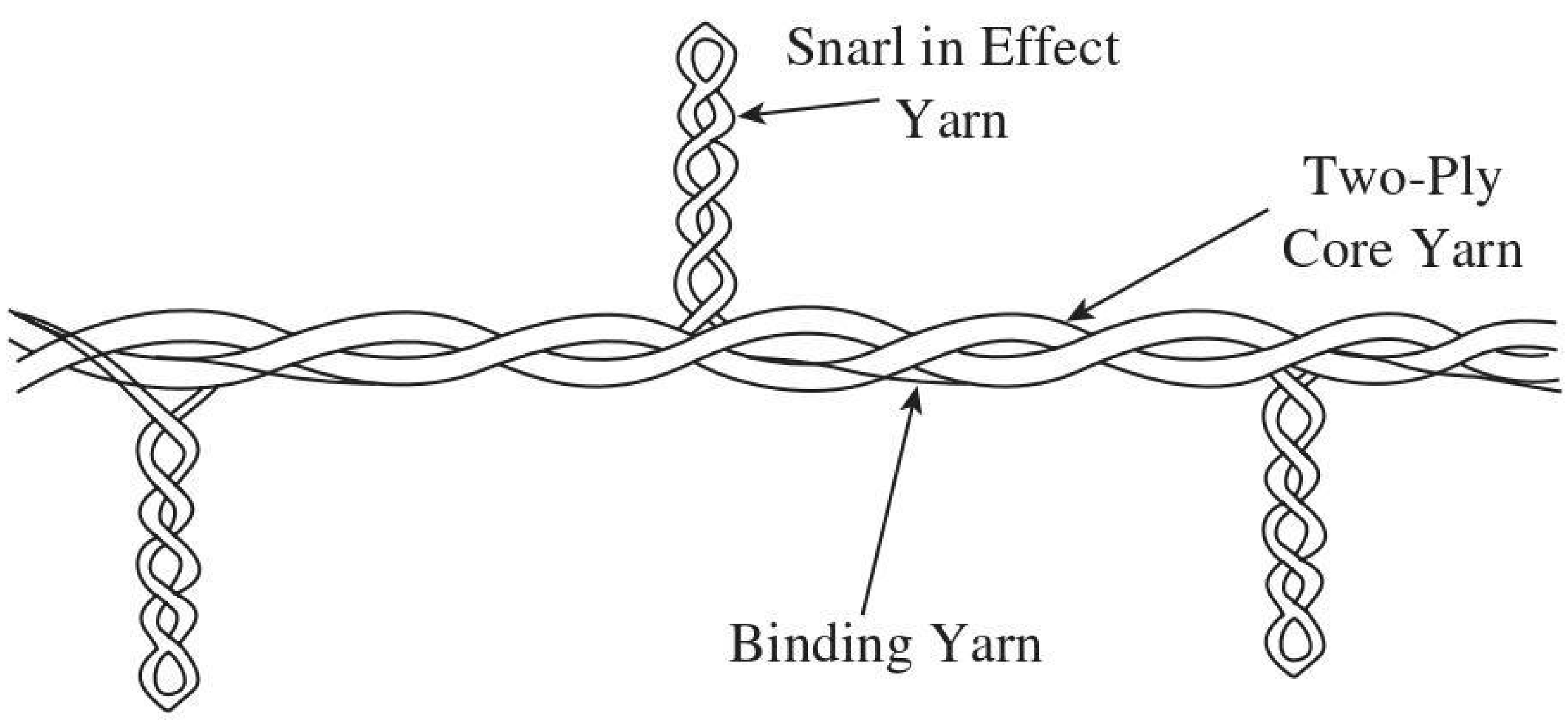


FIGURE 9.12 Structure of snarl effect yarn.

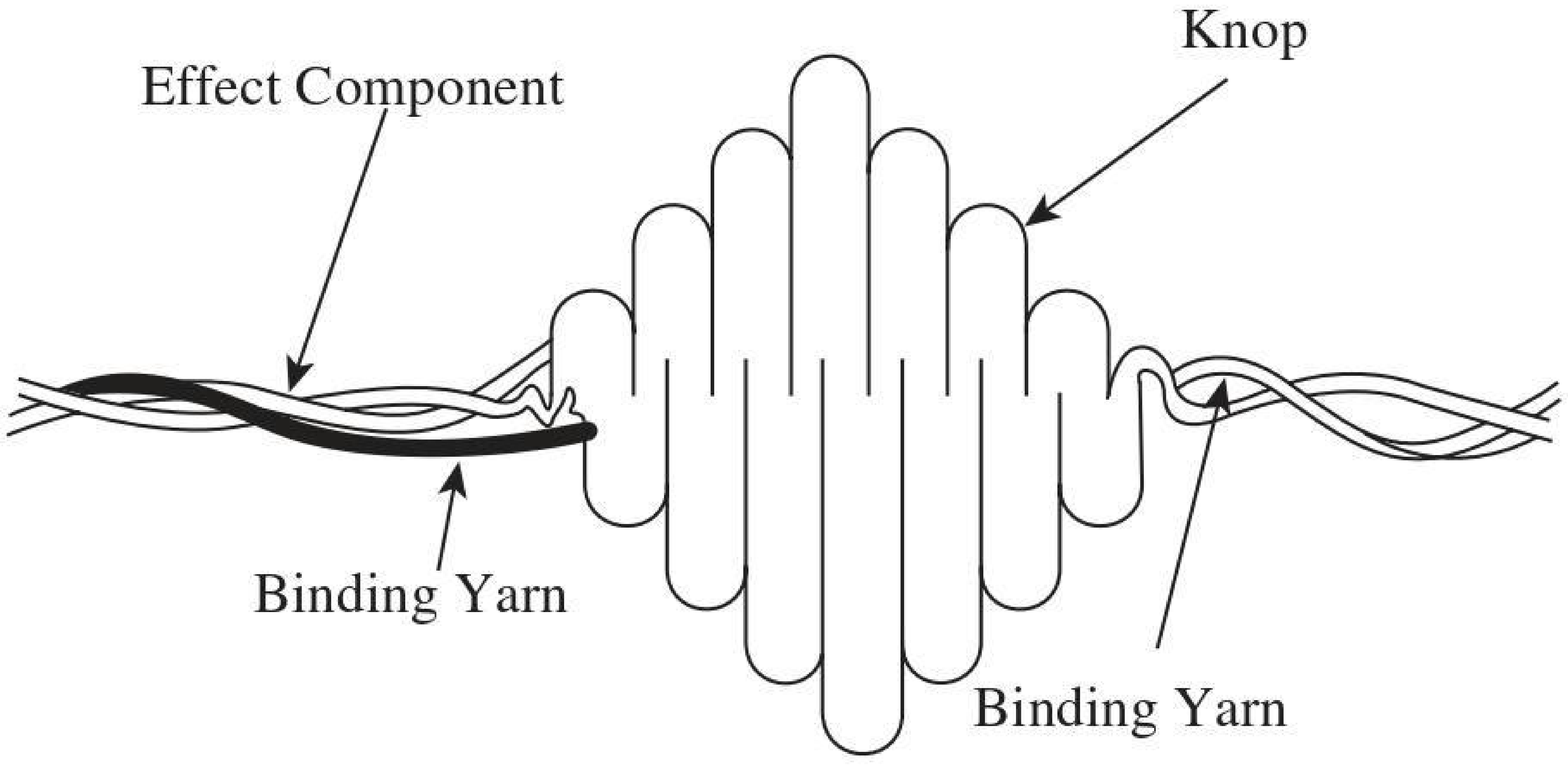


FIGURE 9.13 Effect knop yarn structure.

process concerns a single-color knop. Alternately stopping and overfeeding the two yarns would produce a two-color knop, and the addition of another pair of rollers could be used to produce a three-colored knop. Generally, with a single knop, the profile component is of a coarser count, e.g., 150 tex compared with 2/50 tex for the ground component and 80 tex for the binder. If two- and three-color knops are to be constructed, the yarns are of similar counts. In the plying technique, S-twist of around 700 to 1000 t/m may be used with binding twists of 200 to 250 t/m; if higher twist levels are used, the binding component can be omitted. With spinning, the wrap levels used are equivalent to the lower end of the quoted twist range.

9.4.6 Cover

Strictly cover yarns are made by the plying process. The threading arrangement is identical to the knop, where the two pairs rollers controlling the yarns are made to stop and start as required. However, instead of stopping, each pair of rollers will, in turn, slow to a speed that allows the other yarn to wrap around that fed by the slowed rollers. The wrapping coils bunch closely to completely cover a length of the slowly moving yarn. The level of twist required is usually high, of the order of 1600 t/m. This wrapping action is made to alternate between the two yarns, which are of different colors. As illustrated in Figure 9.14, the resulting fancy yarn would have alternating sections of color. The length of each colored section should vary so as to avoid patterning defects in the end fabric. The overfeed of the yarns can be within 200 to 250%; each yarn may have different values of percentage overfeed. The yarns are normally of similar count, e.g., 80 to 100 tex, and the binder is of a finer count — 50 tex. The binding twist is within 300–400 t/m.

A mock cover yarn can be produced with the hollow-spindle system. Here, the two- or three-roller drafting systems can intermittently feed different-colored drafted ribbons onto the ground yarns to produce a repeating sequence of two or three different color lengths having a small gimp profile.

9.4.7 Slub

The production of ground and injected slub yarns was considered earlier. The emphasis was mainly on modification of the conventional ring-spinning system for

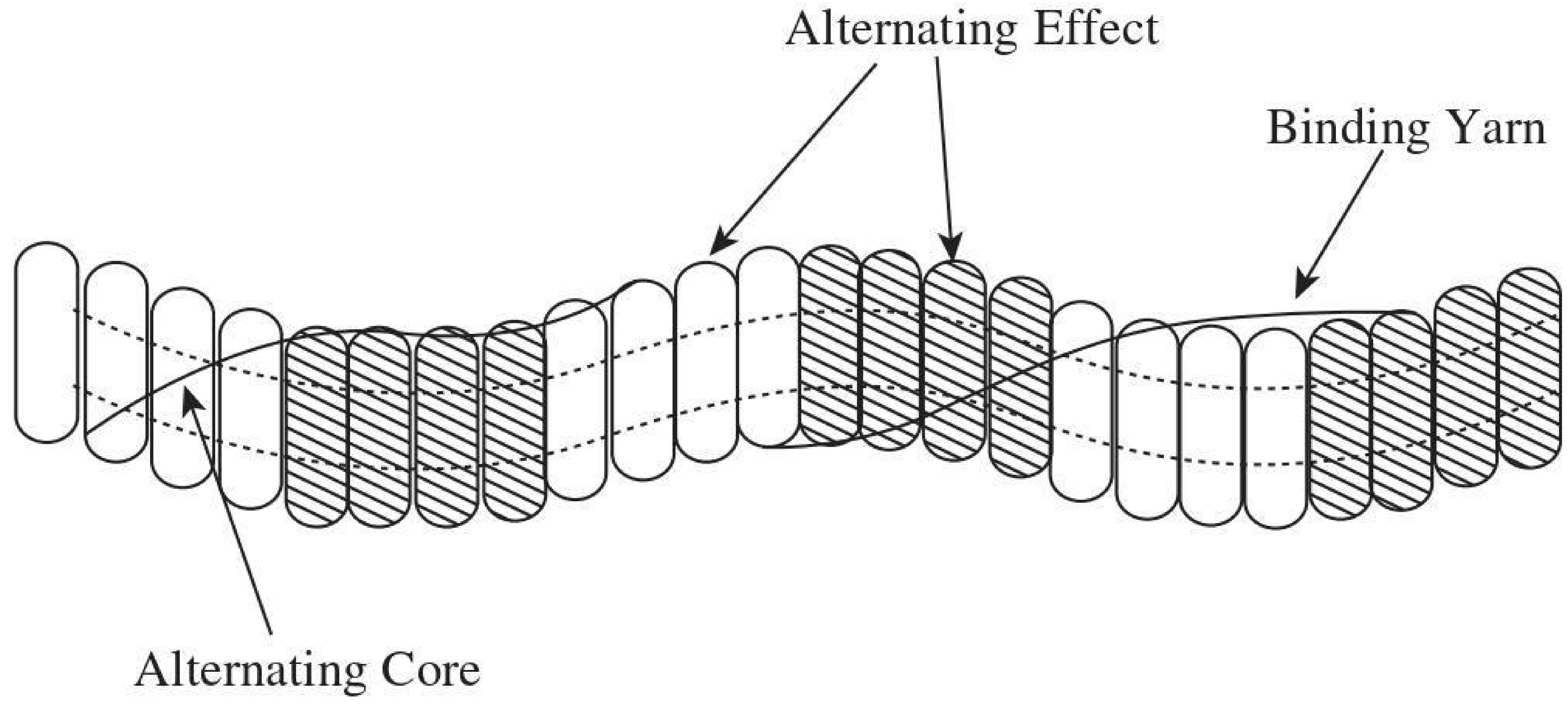


FIGURE 9.14 Structure of cover effect yarn.

producing ground slub yarns or on the hollow-spindle system for both ground and injected slubs where single- and multi-drafting units are used. Injected slub yarns (see Figure 9.15) can be made, however, with the plying process. In this case, a roving replaces a yarn as the profile component, and the rollers feeding the roving periodically stop and start according to required slub length and spacing. The slub thickness is determined by the roving count. As an example, a 600-tex roving of 1.7-dtex acrylic fibers may be fed without overfeed onto two 2/30-tex ground yarns made from the same fiber but dyed a different color. The slub lengths formed by periodic stopping of the roving feed would be twisted with the ground yarns using 650 t/m; the opposite twist direction to that of the ground yarns (i.e., the ply twist) is used, as this would enable the slub to be better embedded between the ground yarns. A singles 34-tex acrylic yarn may be then applied as the binder with a twist level of 250 t/m.

9.4.8 Chenille

The chenille profile was originally made by leno weaving (see Figure 9.16), where typically cotton yarns of 60 tex would be used as warp and the staple spun rayon yarns of 150 tex as weft. Two weft yarns (two picks) are placed between each

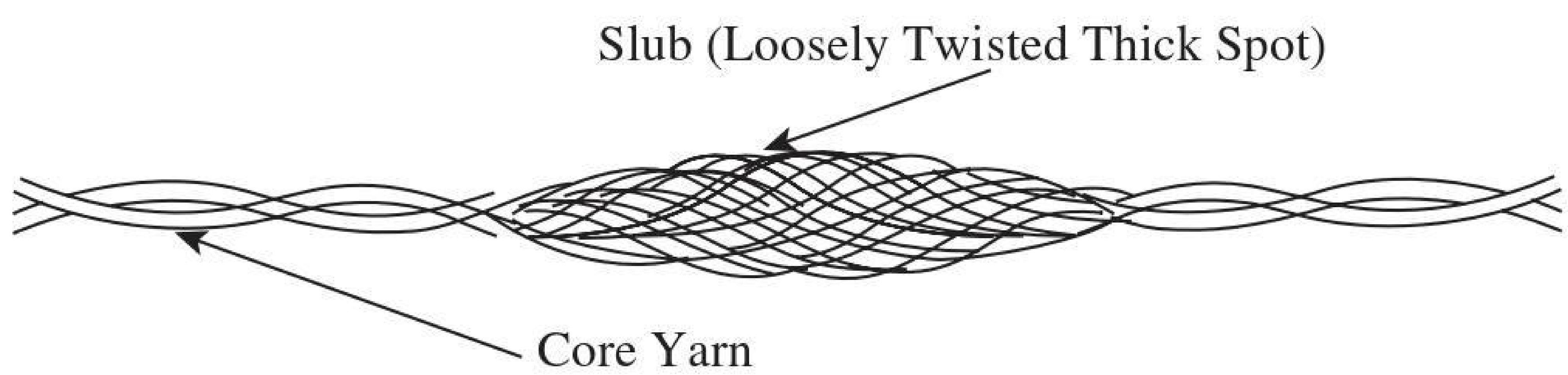


FIGURE 9.15 Structure of injected slub-effect yarn.

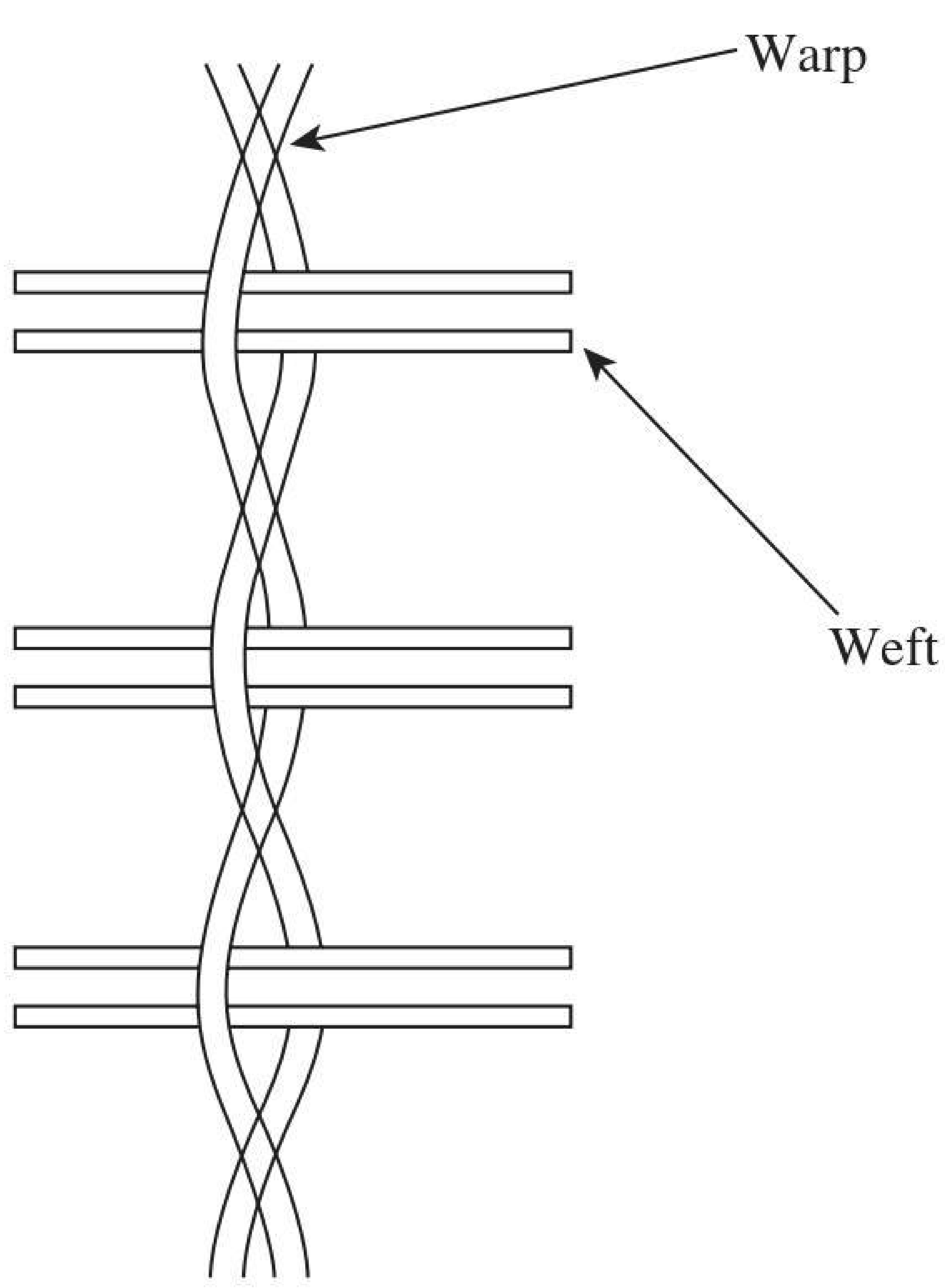


FIGURE 9.16 Traditional chenille-effect yarn structure.

crossing of the warp yarns. After weaving, the weft length extending between the warp yarns is cut to produce the pile effect. This process is clearly time consuming and has been replaced by the spinning process described earlier for cut chenille yarns.

A mock chenille effect can be obtained with either the hollow-spindle or the plying process using settings for the production of a profusion of very small loops. Two such loop yarns are then wrapped or plied together, giving a mock chenille profile.

9.4.9 Combination of Profiles

Computer control of the drafting rollers or the rollers feeding the profile yarn enables the superposition of most of the eight to be achieved, giving added fancy effects. The profiles unlikely to form combinations in this way are the snarl, cover, and chenille. However, plying together a number of fancy yarns also makes many combinations, and this approach covers all profiles.

9.5 ANALYSIS OF FANCY YARNS

Although yarn CAD systems have been a subject of study[7] for use in fancy yarn design and production, a still common practice is to analyze a fancy yarn design to determine how it was made, i.e., reverse engineering. Generally, it can be readily determined if a fancy yarn has been spun on a hollow-spindle system or produced by the conventional plying technique, since the former will show the binding component wrapped around the profile and ground components, whereas the latter would show a twisted configuration. Fancy yarns produced on the Dref-2 system will have staple fibers as the binding components, wrapped around the other components. A cut chenille yarn can also be easily identified from the appearance of the pile and the way it is attached to the ground and binding components. Detailed analysis is usually required only with plied fancy yarns, although, with obvious modification, the steps taken are applicable to spun yarns.

As an example of the analysis of plied fancy yarn, let us consider the simple case of a loop profile. We would wish to determine levels of twist and overfeed used at profile and binding stages, and then the fiber type, yarn structure, count and twist levels used to make each component yarn. Ultimately, we will require the mass of the constituent yarns per kilogram of the loop yarn.

After measuring the count of the loop yarn, C_f, a number of 10-cm lengths are untwisted to obtain the following calculated average values per meter of loop yarn: the binding twist T_b, the profile twist, T_p, and the lengths of each component; L_b (binder), L_p (profile yarn), and L_g (ground yarns). L_{pg} is the measured length of yarn after the binder is removed and represents the plied yarn from the profile twisting stage. Subsequently, the twist in each component can be measured and the structure determined by looking at each yarn under a microscope (see Chapter 6). From measuring the mass of component lengths, the respective counts in tex can be calculated: C_b (count of binder), C_p (profile yarn), and C_g (ground yarns).

The number of kilometers per kilogram of loop yarn will given by $10^3/C_f$. Thus, the number of kilometers of each component in a kilogram of loop yarn would be

$L_b 10^3/C_f$, $L_p 10^3/C_f$, and $L_g 10^3/C_f$. The mass fraction of each component contributing to a kilogram of the loop yarn would be $C_b\ L_b/C_f$, $C_p\ L_p/C_f$, and $2C_g\ L_g/C_f$. The percentage overfeed at the profile and binding stages are given by L_p/L_g and L_b/L_{pg}. Once these values are known, the machine settings for the respective feed rollers and the ring spindle speeds can be made to produce the loop yarn.

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