

The Project Method of Teaching

SILK THROWING

PART 3

By
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INSTRUCTION PAPER

With Examination Questions

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Begin with the first line on page 1 and study every part of the lesson in its regular order. Do not skip anything. If you come to a part that you cannot understand after careful study, mark it in some way and come back to it after you have studied parts beyond it. If it still seems puzzling, write to us about it on one of our Information Blanks and tell us just what you do not understand.

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SILK THROWING

(PART 3)

HARD-SILK WINDING

INTRODUCTION

1. Purpose of Winding.—In the usual sequence of silk-throwing operations, the winding process follows the soaking and drying of the raw silk, and the rubbing of the gums, if that operation is required for the particular kind of silk being thrown. The purpose of winding is to unwind the silk thread from the skeins and wind it on bobbins, thus placing the material in a convenient form for succeeding throwing processes.

Winding is performed on a machine called a *winding frame*, or *winder*, and is a relatively simple process. The function of the winding frame is to provide a suitable means of supporting the skeins so that the silk may be unwound from them, and to support and rotate bobbins on which to wind the thread. In addition, a means is provided to cause the thread to traverse alternately from one end of the bobbin to the other, as it is wound. This movement insures the production of an evenly wound bobbin, and thus facilitates the unwinding of the thread in subsequent operations.

2. Although winding is a simple process, it requires patient and careful work, and is particularly adapted to operatives who possess both skill and speed. When silk of good quality is thrown, and when the preliminary operations of soaking and rubbing the gums are performed in an efficient manner, the work of winding is not difficult. In such cases, the

necessary attention is confined chiefly to the operations of replacing the skeins when they are unwound and the bobbins as they became filled, together with the piecing, or tying, of the comparatively few broken ends that may occur. When, however, poor silk that contains many fine ends is encountered, or when the skeins are matted and tangled, or if the soaking or rubbing of the gums has not been properly performed, the work becomes much more difficult. Under such conditions, the attendant must exercise both care and skill in winding the silk, in order that it may be wound successfully and to prevent the production of an excessive amount of waste. Great difficulty is often experienced in the winding process because of numerous breakages of the thread, because of trouble in finding the correct end of the skein, and for similar reasons.

3. Hard Silk and Soft Silk.—Winding practices vary to some extent, and certain features of silk-winding frames differ slightly in construction and dimensions, in accordance with the character of the silk to be wound. In this connection, silks may be divided into two classes—*hard silks* and *soft silks*. Hard silk is raw silk from which the natural silk gum, or sericin, has not been removed. The term, however, is also applied to thrown silks that still contain the natural gum, although these are sometimes referred to as *gum silks*. Soft silks are thrown silks, either dyed or undyed, from which the silk gum has been removed by boiling off, or degumming.

Hard-silk winders are similar to soft-silk winding frames, except that the former are somewhat wider. The difference in width is due to the fact that skeins of raw, or hard, silk are generally larger than skeins of soft silk and, hence, a hard-silk winder must be equipped with larger swifts on which to support the skeins. In addition, there are sometimes other slight differences between winders adapted to winding hard or soft silks. In this discussion, however, the treatment of winders and winding operations is confined to the winding of raw silk, incident to the throwing of the silk, and which, therefore, may be characterized as *hard-silk winding*.

the construction of the hub of the cam, whereby an adjustment of the length of the traverse may be made, is slightly different. In Fig. 2 (*a*) is an end view of the section shown in (*b*), illustrating the means adopted to provide for an adjustment of the throw of the cam. The hub of the cam g is not formed with an elliptical hole at the end farthest from the winder frame; instead, it is arranged to fit quite closely the sleeve g_4 , on which the traverse cam is mounted. The inside of the hub is cored out, so that the part that rests on the sleeve is quite narrow, as shown at g_{13} . Moreover, the cam at this point does not fit the sleeve g_4 so tightly as to preclude the possibility of tilting the cam to alter slightly the length of the

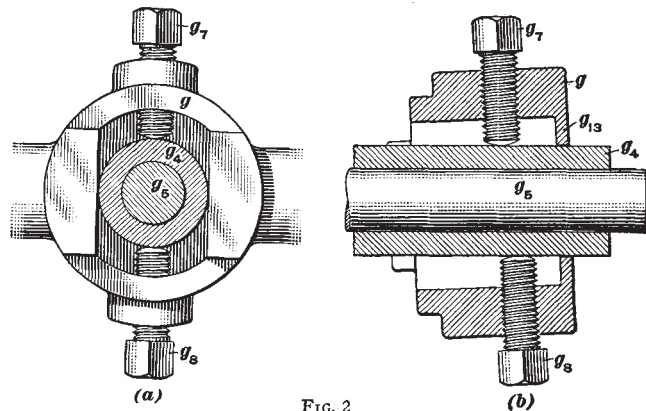


FIG. 2

traverse. The cored-out end of the hub of the cam nearest the gears and the winder frame is formed with an approximately elliptical recess. The small diameter of the ellipse closely fits the sleeve g_4 , but the large diameter of the ellipse allows some play. This construction allows the cam to be tilted on the sleeve and the length of traverse altered, the cam being adjusted for position and held securely in place on the sleeve g_4 by two setscrews g_7 and g_8 . The cam is adjusted by loosening one setscrew slightly and then tightening the other, the cam being moved slightly in either direction to increase or decrease the length of the traverse, as may be desired. In being adjusted, the cam is moved in a slight arc with the end

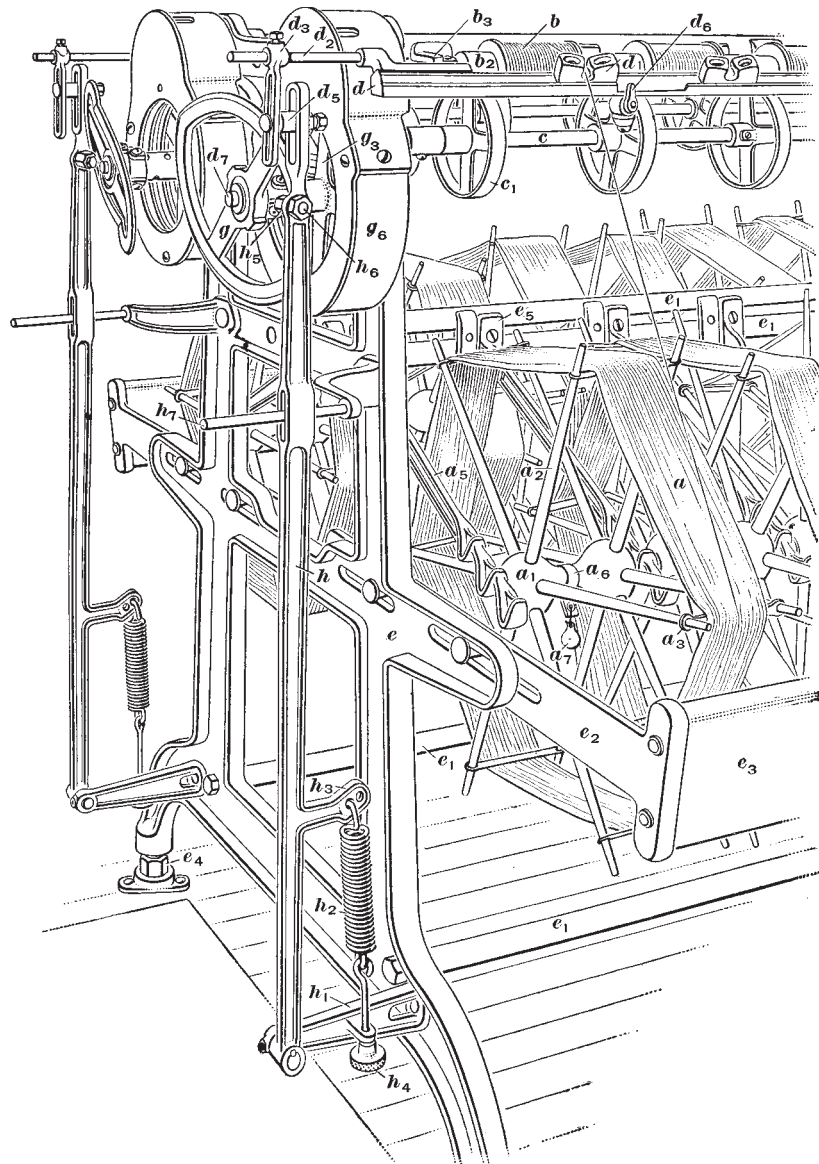


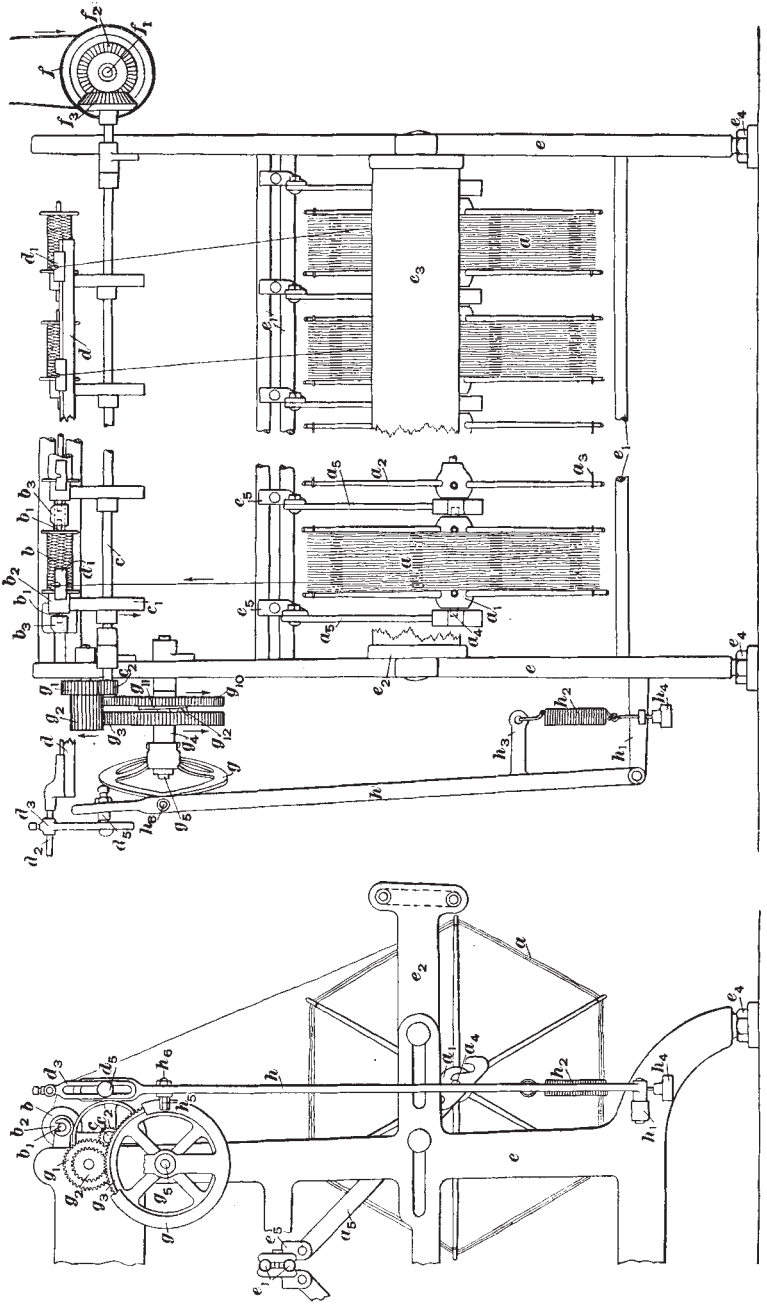
FIG. 2

typical hard-silk winder, while Fig. 2 shows the machine as seen from the opposite end and illustrates the cam end of the winder. Fig. 3 (*a*) is an end elevation and view (*b*) a front elevation of a winder, and indicate clearly the principal parts of the machine.

5. The principle involved in the operation of winding upon hard-silk winders is of extreme simplicity, although the work must be performed with a high degree of skill and with care and attention. After the skeins of silk have been soaked and properly dried, and the gums rubbed, if that operation is necessary for the particular silk that is being worked, they are brought to the winding room and issued to the various winding operatives, or winders. Sometimes the skeins of silk are brought to the winders directly from the hydroextractor, the drying operation being dispensed with, and the gum-rubbing operation, if necessary, being performed as the skeins are placed on the winding machine.

6. In any event, the winding operative takes each skein of silk *a*, Figs. 1 to 3, carefully opens and straightens it, and places the skein on a swift *a*₁. The free end of the silk, which is usually looped around the skein or tied to a lacing string, is now found. A bobbin *b* is next placed on a spindle *b*₁, the latter being equipped with a driving head *b*₂, and the end of silk from the skein wound several times around the bobbin. The end should never be tied to the bobbin, since this causes breakage of the silk when the bobbin is emptied in succeeding processes, and the broken end, when it snaps, is likely to fly and become tangled with adjoining ends. Moreover, if the ends are tied to the bobbins, the bobbins accumulate waste silk that, from time to time, must be painstakingly removed. If the waste is cut from the bobbins with a knife—a practice that cannot be commended—great care must be exercised to prevent damage to the bobbins.

7. The bobbin and spindle are next placed in the bobbin holder *b*₃, Figs. 1 to 3, and winding commences, motion being imparted to the bobbin as follows: A driving shaft *c*, sometimes known as the *spindle take-up shaft*, to which a rotary



(b)

(a)

motion is constantly imparted, carries a number of driving pulleys c_1 , known as the *spindle-drive*, or *take-up*, *pulleys*, that correspond with the number of bobbin holders on the winder. The driving head b_2 of the spindle rests on the pulley c_1 , and the latter, therefore, by frictional contact, imparts motion to the spindle and to the bobbin placed on the spindle. The rotary motion of the bobbin, of course, winds the silk on the bobbin, and causes the skein and the swift on which the skein is placed, to rotate as the silk is unwound from the skein. For this reason, the type of winder illustrated in Figs. 1 to 3 is sometimes called a *spindle take-up winder*.

8. The bobbin holder b_3 , Figs. 1 to 3, although often referred to by that designation, is, perhaps, more properly called a spindle holder, or spindle hanger, since it really holds the spindle in position, the bobbin being held and supported by the spindle. These small castings in which the ends of the spindle rest are also commonly referred to as *fingers* and, in other cases, are called *bobbin brackets*, or *spindle brackets*. The bobbin holders are slotted to hold the spindle in position with its driving head b_2 in contact with the drive pulley c_1 , and still permit the spindle to be removed easily when necessary.

In addition to deep slots that permit the driving head of the spindle to rest on the take-up drive pulley, the bobbin holder is usually provided with a shallow slot in which the left, or head, end of the spindle may be placed. If the spindle is set up on the hanger in this position, its driving head is raised from contact with the drive pulley, and the spindle and bobbin are thus rendered inoperative. The spindle is placed in this position when broken ends are being pieced up, and, in some cases, all of the spindles are placed in their inoperative positions before the winder is stopped. This latter procedure is necessary when winding some silks and with certain types of winding frames, because, when the winder is again started, the strain on the silk in starting the swifts would be too great for the thread to resist. Thus, a great many ends would be broken down when the winder was started, causing additional labor and resulting in poor work. To avoid this, the spindles are set

up on the hangers, as explained, before the machine is stopped, and after it is started again, each spindle is individually put into operation. This is accomplished by placing each spindle in its running position in the hanger with the driving head in contact with the drive pulley, and, at the same time, giving the swift a slight forward movement to lessen the strain on the thread and permit winding to be started without breaking down the end.

9. As the silk thread is wound on the bobbin, it is caused to traverse from one end, or head, of the bobbin to the other, and back again. This traversing movement causes the silk to be laid evenly on the bobbin in such a way that the threads cross each other, thus forming a hard, firm bobbin of silk that can be unwound without tangling or breaking the end. The traverse of the thread is obtained by imparting an oscillating, or back and forth, movement to a traverse bar d that carries adjustable porcelain thread guides d_1 , Figs. 1 to 3, through which the ends pass in being drawn from the skeins to the bobbins.

Winders are ordinarily so constructed that the working parts are duplicated on each side of the frame, thus permitting winding operations to be conducted on both sides of the machine.

10. Frame Construction.—The frame of a winder consists of two cast-iron end frames, or stands, e , Fig. 2, that are firmly connected by pipe ties e_1 . Between the end stands, other frames, known as middle stands, are placed about 4 feet apart. These are also made of cast iron and are of a shape similar to that of the end frames; their object is to brace and stiffen the frame so that it may firmly support the working parts. On each side of the frame, and attached to it by adjustable brackets e_2 , are wooden knee-boards e_3 . The object of the knee-boards is to protect the swifts and silk from damage such as would be likely to occur if the swifts were to come in contact with the person of the operative, and for the convenience of the operative when piecing up, or tying, broken ends, reaching for empty bobbins, or spools, or putting full spools on the spool board that is often placed on the winding frame.

11. Winders should be set level by raising or lowering the frame by means of the leveling nuts e_4 , Figs. 2 and 3. Tests for the levelness of the machines should be made at periodical intervals, and if any machines are found to be slightly out of level due to settling of the floors or other causes, proper adjustments should be made. Winders should be securely fastened to the floor by bolting them down with heavy lag-screws. To secure the driving end of the machine firmly to the floor, some makers furnish a special clamp, which usually consists of a heavy adjustable hook that is bolted to the floor, the hooked part of the clamp engaging the lower cross-bar of the end frame and holding the machine tightly so that it cannot be lifted, even if the driving belt should break and be caught.

DRIVING

12. Cone Pulleys.—The winder shown in Figs. 1 and 3 is driven by a belt from the driving shaft of the winding room. The belt transmits motion from a stepped cone pulley on this shaft to another stepped cone pulley f on the crosshead shaft f_1 of the winding frame. The driving and driven cone pulleys are usually constructed with steps having diameters of $4\frac{1}{2}$, 5, $5\frac{1}{2}$, and 6 inches, respectively. The driving pulley on the line-shaft is arranged so that its largest diameter is alined with the smallest diameter of the driven pulley f on the winding frame. This arrangement makes it possible to drive the winder at four different speeds. When the belt is running on the largest diameter of the driving cone pulley and on the smallest diameter of the driven pulley, the greatest speed is imparted to the winder. When, however, the belt transmits motion from the smallest step of the driving pulley to the largest step of the driven pulley on the winder, the frame is driven at its slowest speed. Intermediate positions of the driving belt, between these two extremes, give corresponding variations in speed. The object of driving a winder by means of stepped cone pulleys, of course, is to enable the speed of the machine to be altered quickly, and with a minimum of trouble. With this arrangement, it is unnecessary to change the size of the driving

pulley to effect a change in the speed of the machine; moreover, the length of the driving belt does not require alteration when a change of speed is desired, as the distance between the centers of any pair of steps of the driving and driven pulleys that are in line, does not vary. Some arrangement of this kind is desirable for driving winders in order that the speed of the machine may be quickly adapted to wind best the kind of silk that is being wound. If the silk winds poorly, and there is constant and excessive breakage of ends during winding, it is desirable to reduce the speed of the winder. On the other hand, if the quality of the silk is such that it winds freely, it may be desirable to increase the speed of winding and thereby increase the production of the frame.

13. Spindle Take-Up Shafts.—At each end of the cross-head shaft f_1 , Figs. 1 and 3, to which the driving pulley f is secured, are bevel gears, or miter gears f_2 , Fig. 3, that drive the spindle take-up shafts c on each side of the winder. These gears contain 36 teeth and drive bevel gears f_3 of the same size, fastened to the spindle take-up shafts. The spindle take-up shafts, therefore, are driven at the same speed as the cross-head shaft. As shown in Fig. 1, the bevel gears that drive the spindle take-up shafts, are enclosed in a housing f_4 to prevent accidents and protect the operatives from injury. The spindle take-up shafts extend the full length of the winder on each side of the machine, and the spindle driving pulleys c_1 are securely fastened to them. The spindle driving pulley is a flat-faced pulley of cast iron, usually about 4 inches in diameter, that imparts motion to the spindle by frictional contact, when the spindle is in running position, that is, when the spindle is placed in such a position that its driving head b_2 rests on the rotating driving pulley. The spindle, of course, imparts a rotary motion to the bobbin, whereby the latter is caused to wind the silk on itself, at the same time causing the swifts to rotate by means of the silk thread that is being unwound from the skein.

SPINDLES

14. Straight Spindles.—An illustration of a common type of spindle employed on a spindle take-up winder is given in Fig. 4 (a), while view (b) is a sectional view that shows clearly the essential features of its construction. The spindle consists of a round steel-rod, or gudgeon b_1 , slightly more than 6 inches in length and about $\frac{1}{4}$ inch in diameter. To the blade,

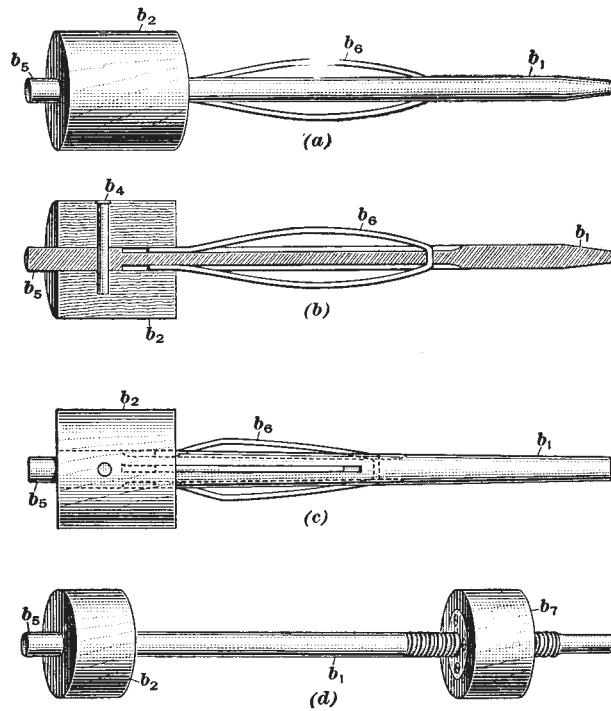
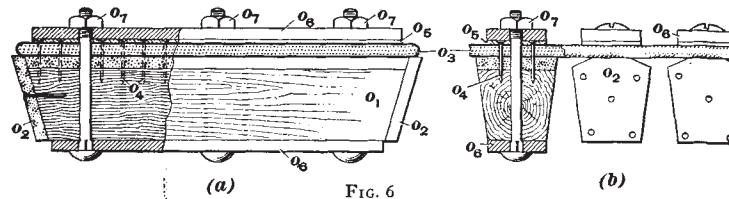


FIG. 4

or gudgeon, of the spindle, a wooden driving head b_2 , approximately $1\frac{1}{4}$ inches in diameter and with a face about $1\frac{1}{4}$ inches in width, is securely held by a driven pin b_4 . The gudgeon of the spindle projects nearly $\frac{3}{8}$ inch through the driving head, as shown at b_5 , so that the driving end of the spindle may engage with the bobbin holder of the winding frame and be supported

which has both right-hand and left-hand threads. When the screw is turned by means of the hand wheel n_1 , the ends of the shifting levers will be moved either toward each other, or apart. If they are moved toward each other, the disks l_2 and l_3 will be moved toward each other and the disks k_2 and k_3 will be moved farther apart, since the shifting levers are pivoted at m_1 . This action causes the belt o , which transmits the motion between both sets of disks, to assume a higher position between the disks l_2 and l_3 than between the disks k_2 and k_3 and thus alters the speed of the shaft k .

19. The belt o , Fig. 5, consists of a number of hardwood blocks fastened to suitable belting material. It is made endless by a splice block that joins the free ends of the belt. Details of the splice block, coupled to several ordinary blocks, are



shown in Fig. 6. In (a) is shown a side view in part section of a splice block; in (b) is shown a cross-section of the splice block and also end views of several ordinary blocks that compose the belt. The hardwood blocks o_1 are of the same size and shape, with tapered ends tipped with small pieces of leather o_2 that bear against the conical disks and form the driving surface of the belt. The blocks are fastened to the belt body o_3 by small escutcheon pins o_4 that pass through the brass strip o_5 , the belting material, and into the block. Wrought-iron plates o_6 are then placed on the belt and the under side of the block, while the entire assembly is held together by the bolts o_7 . This is the general construction of the splice block. The ordinary blocks have no bolts o , passing through them, but merely large wood screws that pass through the plate and the belt into the block; and there are no iron plates on the under sides.

for spinning with the twist inserted in the correct direction, is always assured. Sometimes, because of a lack of proper equipment, bobbins with tapered holes are wound on winders equipped with straight-spindles, the springs of the spindles being depended on to hold the bobbins in the correct position. Often, however, a bobbin that has a tapered hole will slip slightly away from the driving head of a straight spindle. This will cause the traverse of the silk thread to be incorrectly alined with the bobbin, resulting in the silk being wound too close to one head of the bobbin and too far away from the other head, thus producing a defectively wound bobbin. When tapered spindles are employed on the winders, there is less tendency for the bobbins to slip away from the spindle heads because the tapered spindles fit more closely the tapered holes of the bobbins.

It will be noted that the tapered spindle is equipped with four piano-wire springs b_6 instead of with two springs, as is customary in the case of straight spindles. This construction, of course, tends to hold the bobbins more securely in position. Four springs are also sometimes used when straight spindles are employed, but have some disadvantages in either case. Although the bobbin is firmly held in position by four springs, with but little tendency to gyrate, or wobble, it often is held so firmly that it is difficult for the operative to remove the bobbin when filled, and to replace the filled bobbin with an empty one. Slight difficulties of this nature often hamper seriously the speed of the winding operative, and decrease the production of the operative and of the machine.

16. Spindle Springs.—Bobbins are usually so constructed that the holes through them are not of uniform diameter. Instead, the barrel of the bobbin is bored to a greater diameter than the heads, in order to remove unnecessary material, reduce the weight, and cause the bobbin to fit the spindle more accurately. The piano-wire springs of the spindle are sometimes bent to special shapes designed to fit somewhat closely certain interior dimensions of the bobbin or to engage with it, and, therefore, to hold the bobbin more securely in position on the

spindle. A common method of shaping the springs is to bend them at a sharp angle at a short distance from the driving head of the spindle. The springs are bent outwards until they stand about $\frac{3}{8}$ inch from the gudgeon of the spindle. When a bobbin is forced on a spindle equipped with springs of this type, the head of the bobbin nearest the driving head of the spindle is forced over the high, or bent, parts of the springs. The springs, of course, tend to return to their normal positions and the angle at which the springs are bent causes them to force and to hold the bobbin tightly against the driving head of the spindle, in the correct position and in the center of the traverse of the thread as it is wound on the bobbin. Occasionally, the springs are so arranged that their free ends lie toward the end of the spindle farthest removed from the driving head, and the end of one of the springs is so bent as to form a catch. The entire bobbin is forced over the catch when the bobbin is placed on the spindle, the spindle being slotted to allow the catch to be depressed during this operation. When the bobbin has been forced over the catch and into its correct position, the catch springs into its normal position and securely holds the bobbin against the driving head of the spindle.

17. Screw-Nut Spindles.—Sometimes, piano-wire springs are not employed in the construction of spindles for silk winders. Instead, the end of the gudgeon of the spindle is threaded and the bobbin is held on the spindle by a thumbnut, or winged nut, that is screwed tightly against the bobbin after it is placed on the spindle. This arrangement holds the bobbin positively in the center of the traverse of the thread, but a large amount of the operatives' time is consumed in replacing filled bobbins with empty ones, since the thumbnut must be removed and replaced at each operation. Moreover, delays often are brought about by dropping the thumbnut or failing to engage it properly with the threads of the spindle when replacements must be made.

18. Double-Head Spindles.—Spindles equipped with two driving heads instead of one head, termed *double-head spindles*, are sometimes employed on silk winders. As shown in

Fig. 4 (*d*), this type of spindle has a fixed driving head b_2 of ordinary construction, except that it has a narrow face, and a removable driving head b_7 that is held in position by being screwed on the threaded end of the spindle gudgeon. The driving heads b_2 and b_7 are of the usual diameter, but the width of their faces is only about $\frac{5}{8}$ inch, or one-half of the width of the face of the driving head employed in the case of a single-head spindle. This construction enables a double-head spindle to be made of the same length as a single-head spindle. It also makes possible the use of the same size of winding bobbin on a winding frame of the same dimensions, equipped with either style of spindle. Double-head spindles are driven by two drive pulleys fastened to the spindle take-up shaft, each in the correct position to engage with the corresponding driving head of the spindle. The thread on the spindle blade b_1 for the reception of the removable driving head, is left-hand, so that the direction of rotation of the spindle drive pulley will cause the drive pulley to tend constantly to tighten the driving head against the bobbin. The bobbin, therefore, is held securely between the fixed driving head and the removable driving head, piano-wire springs being unnecessary in the case of a double-head spindle.

19. Advantages of Double-Head Spindles.—It is claimed as an advantage that double-head spindles are driven more positively than single-head spindles, and that there is not so much slippage between the driving heads of the spindles and the drive pulleys on the spindle take-up shaft. The bobbins also tend to run more smoothly on double-head spindles than on those that are equipped with only one driving head. On the other hand, the fact that the double-head spindle is driven in a more positive manner often operates to a disadvantage. In some cases, after the winder has been stopped, it is necessary to lift each bobbin and spindle into its inoperative position before starting the frame again. Each bobbin and spindle must then be separately placed in its operative position with the driving heads of the spindle in contact with the drive pulleys, thus starting the winding from each individual skein.

At the same time, it is usually necessary to give the swift a slight start to prevent the breaking of the end. All of this, of course, is made necessary by the more positive manner in which double-head spindles are driven, and which causes them to start at once to rotate at high speed when the frame is started, and before the pull of the thread has an opportunity to overcome the inertia of the swift. This naturally causes a great many ends to break down when the winder is started, unless each bobbin is started individually.

20. Advantages of Single-Head Spindles.—On the other hand, winders equipped with single-head spindles, and running on many silks, may often be started without the necessity of starting each spindle individually. The reduced friction of the single driving head allows a certain amount of slippage to take place between the driving head of the spindle and the drive pulley, thus reducing the strain put on the thread in imparting initial motion to the swift and enabling the frame to be started without breaking the ends. Moreover, the release in thread tension occasioned by the slippage of a single-head spindle often prevents breakage when the end becomes slightly tangled in the skein during the winding operation. In such a case, a double-head spindle, owing to its more positive drive, affords no release in tension and will almost invariably break the thread. A positive driving of the spindle, therefore, tends to reduce production and the efficiency of winding. When double-head spindles are employed, it frequently becomes necessary to decrease the speed of the winder if a lot of silk in which the skeins are somewhat tangled, is to be wound. Double-head spindles, like the screw-nut type, also increase the amount and difficulty of labor required in doffing full bobbins and replacing them with empty ones. In fact, it has been found by comparative tests that the length of time required to doff a certain number of bobbins is nearly three times as great when double-head or screw-nut spindles are employed as when ordinary piano-wire spring spindles are used.

21. Spindle Repairs.—Winder spindles should be kept in an excellent condition of serviceability, and when they cannot

be successfully repaired, should be replaced with new spindles. Spindle heads are sometimes cracked, in which case it is best to replace them with new heads. Loose heads may be firmly affixed again to the gudgeon of the spindle, but often replacement is the best remedy for the defect. After long use spindle heads often become worn *out of round* and, in some cases, distinctly flat places are worn on them. Defects of this nature cause the bobbins to jump and run irregularly, and prevent proper winding. Without doubt, badly worn spindle heads will greatly increase the number of breakages of the thread during winding. In many such cases, the spindles may be placed in a lathe and the driving heads turned down to a new surface. In doing this, care should be taken not to reduce the diameter of the head too much; instead, just enough material should be removed to eliminate any flat spots and to restore the concentricity of the driving head. By reducing the diameter of the driving head, of course, the speed of the spindle and, in consequence, also, the thread speed of winding, will be increased. While this increase in speed may not be desired, it is compensated for to some extent by the fact that, the smaller the diameter of the driving head, the more easily it will slip on the spindle-drive pulley. The slippage usually causes a sufficient release of tension to prevent any increase in the breakage of ends that might result through the increased speed of the thread in winding. If it is best to replace the driving head of a spindle, rather than to turn the head down, care should be taken to use replacement driving heads of good quality. Rock maple is suitable and is often employed as a material for this purpose. Care should also be taken, when inserting the pin that holds the driving head in place on the gudgeon of the spindle, to drive the pin well below the surface of the head. Otherwise, when the wood of the head wears slightly, a high place is formed that will cause the spindle and bobbin to jump and run irregularly.

22. Special care should be taken to keep the piano-wire springs of the spindles in good condition. Weak springs will not hold the bobbins close to the driving heads of the spindles

and in the center of the traverse of the thread; hence, they are a prime cause of poorly wound bobbins. The action of weak springs can often be improved by inserting a screwdriver or other similar instrument, between the spring and the gudgeon of the spindle, and bending the spring so that it will stand at a greater distance from the gudgeon. By so doing, the springs will grip the bobbin with greater tension and thus hold it securely in place. When, however, springs are badly flattened, or broken, and worn, they should be replaced. This may be easily accomplished by cutting a piece of piano wire of the correct length, passing it through the hole in the spindle, bending it to the proper shape, and inserting the ends of the wire in the grooves beneath the head of the spindle. A coil of piano wire of the correct gauge should always be kept on hand to make spring repairs. When, after long service, the ends of the spindle gudgeons are worn cone-shaped, thus causing the spindles and bobbins and vibrate excessively while running, the spindles should be discarded and replaced by new ones. Wear on the spindle gudgeons may be minimized by placing a drop of oil on the ends of each gudgeon while the spindle is in running position.

WINDER BOBBINS

23. Size and Construction.—The double-headed bobbins, or spools, on which the silk is wound are designed especially for the purpose and are accurately and substantially constructed. It is essential that they be well-made, not only to protect the silk from injury, but also to stand the wear and tear of constant hard usage. Inferior bobbins constitute a considerable item of expense, as they soon become cracked or broken, or the heads become loose, in which cases they must be replaced or repaired. On the other hand, well-made bobbins, if not subjected to abuse, will last indefinitely, often giving excellent service for years.

There are no absolute standards of either size or construction in winder bobbins, although such bobbins are of approximately the same dimensions and of somewhat similar construction. A distance of $3\frac{3}{16}$ inches between the heads seems to be

a common length for winder bobbins, but a great many are a trifle shorter or somewhat longer. The diameter of the barrel varies from $1\frac{1}{8}$ inches to $1\frac{3}{4}$ inches, and the diameter of the heads may range from 2 inches to $2\frac{3}{4}$ inches. The dimensions vary in accordance with the requirements of different mills and the preferences of individual throwsters.

24. Some winder bobbins are made entirely of wood, but many are made with wooden barrels and fiber heads. Bobbins are often made of such woods as rock maple, birch, and dogwood. Many, too, are made with maple or birch barrels and dogwood heads. The actual construction of winder bobbins varies in accordance with the ideas of the maker or of the throwster who orders them. Wooden heads are generally merely forced on the ends of the barrel and glued in position. Fiber heads are usually pressed on with great pressure and secured in various ways. Sometimes four or five screws are employed to assist in holding each head in position. In other cases a special driving screw is used, having a coarse, steep-pitched, multiple thread, so that it may be driven into place like a nail, and a slotted head, so that it may be removed by means of a screwdriver. Such a thread is especially adapted to hold securely in the end grain of the barrel.

In winder bobbins, it is especially important that there shall be between the head and the barrel of the bobbin, no crack into which the silk thread may be forced. If such a crack exists, the thread is sure to be drawn into it and be broken when the silk is being unwound from the bobbin at the succeeding operation. A crack of this character is often avoided by turning a slight shoulder on the ends of the barrel. The heads of the bobbin are recessed and the shoulder on the barrel is inserted into this recess, so that the point at which the barrel and the head meet is on the inner side of the head and not at the end of the barrel. It is, of course, impossible for the silk thread to be drawn into a crack situated in this position, even if a crack should exist. Sometimes, also, a very thin, special felt washer is inserted between the head of the bobbin and its barrel, so as to fill any possible crack that might occur.

25. Tram Winder Bobbins.—A perspective view of a typical winder bobbin employed for winding silk prior to the production of tram is given in Fig. 5 (*a*). A sectional illustration of this bobbin, showing the principal features of its construction, is given in view (*b*). The bobbin illustrated is made entirely of wood and is constructed of three pieces, the barrel and heads being turned separately and the parts being assembled and glued together. For use in connection with the throwing of tram, winder bobbins should be made as light in weight as is consistent with the required strength and durability; for, in the succeeding operation of tram throwing,

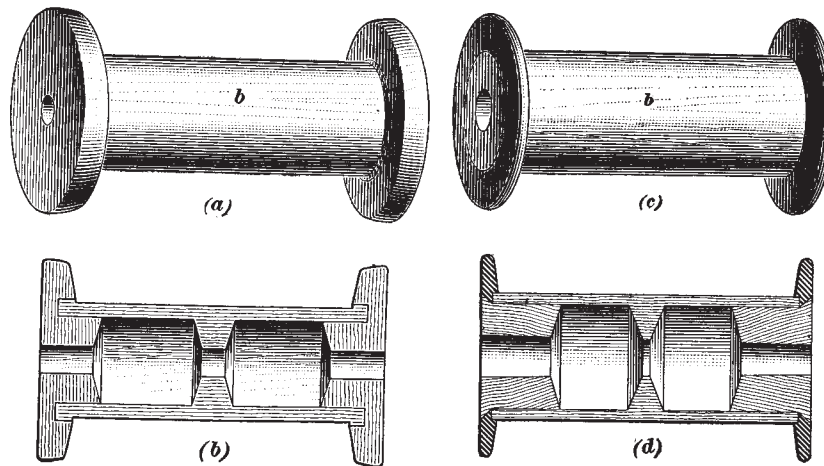


FIG. 5

namely, doubling, the winder bobbin must be placed on a stationary pin and the silk drawn from it. Since, in this operation, the bobbin must be turned solely by the pull of the silk thread while it is being unwound, a light bobbin is decidedly advantageous. Heavy bobbins or those that do not turn freely and easily on the fixed pins of the doubler, cause an excessive tension on the silk, and this tension increases the percentage of breaks during doubling. As shown in view (*b*), therefore, the barrel of the bobbin is bored, and as much of the surplus material removed as is possible without weakening the bobbin. It will be noted that this boring is done from

each end of the barrel. The portion of the wood left intact in the center of the barrel is called a *center bridge*. It forms a support that prevents the thin shell of the barrel from being easily crushed, and it also increases greatly the strength of the bobbin. Bobbins of this type of construction are called *center-bridge bobbins*. In addition to its strength, this type of bobbin has another advantage in that it has only three possible points of contact with the jack pin of the doubler, on which it is placed; the bobbin, therefore, turns more easily when being unwound. If the bobbin were constructed with a solid barrel, in accordance with early practice, a larger surface would come in contact with the pin of the doubler and, hence, more friction would be produced. This, of course, would increase the tension of the silk thread in unwinding and, especially if the bobbin or pin were covered with gummy or sticky dirt, would cause frequent breaking of the thread. In consideration of these facts, bobbins of the center-bridge type are sometimes known as *three-bearing bobbins*, although it is doubtful whether the center bearing, as such, has any great advantage.

26. To reduce further the friction of the bobbin on the jack pin of the doubler and to reduce the tension of the thread during doubling, the tram bobbin is sometimes constructed with a brass bushing, often somewhat erroneously called a *grommet*, at each end. This type of bobbin is known as the *frictionless bobbin*. No bushing is inserted in the center bridge and the bushing is not employed in winder bobbins designed for use in connection with organzine throwing. The reason for the latter fact, of course, is that when organzine is being thrown, the winder bobbin is forced on the rotating spindle of the spinner and held securely in position by friction. In this case the bobbin is not turned on a fixed pin because of the silk thread being drawn from it, and frictionless bushings would be of no advantage. Winder bobbins for tram throwing are usually made with barrels of quite large diameter, since this also reduces the tension of the thread in the doubling operation. In fact, a frictionless winder bobbin with a barrel of large diameter is perhaps best adapted to tram throwing operations.

in place on the spindle, the latter is replaced in the fingers or bobbin holders. Here it is either allowed to remain at rest or the spindle head is brought in contact with the friction wheel, causing the bobbin to revolve until the operative desires to attach the end to the bobbin, whereupon it must be stopped.

38. Beating Out Skeins.—The stock, or silk, to be wound is usually received in the winding department in canvas baskets, or on wooden poles from the drying rack. Sometimes, when the winders are working on a piecework basis, the silk is carefully weighed prior to delivery to the operative. On its receipt at the frame, the winder prepares the silk previous to placing it on the swift. This process consists of stretching, or beating out, the skein, which is done either by the aid of a stretching post or by hand. The stretching post is a smooth hardwood bar or a highly polished metal pipe, about 3 inches in diameter and about 30 inches in length. One end is securely fastened to an upright post or to the wall at a point from 4 to 6 feet from the floor, so that it will be at a suitable height for the operative. A skein is removed from the basket or rack, opened, and hung on the post. One hand is inserted in the loop of the skein, at a point directly below the post, and gradually worked downwards. If tight ends are encountered, they should be carefully worked until the operative's hand rests on the lower loop of the skein. The hand should then be given a rapid up-and-down motion, and on the completion of the downward stroke, the lower loop of the skein should be struck with considerable force. This should be continued until the threads that were slightly tangled are in good order when compared with the bulk of the threads in the skein. Instead of the hand, a small round stick is sometimes used. The stick is inserted in the loop of the skein, grasped with both hands, and given a rapid up-and-down motion, serving the same purpose as the hand. Sometimes, a stretching post is not used when beating out the skein, but both hands are inserted in the loop of the skein, brought together, and then rapidly moved away from each other until their motion is

no danger of mixing, or to prevent mixing sizes and qualities. The heads of bobbins are, for similar reasons, often marked with colored paints or chalk. Winder bobbins should be sorted, either periodically or as occasion permits. All defective bobbins should be repaired, if repairs are possible, or they should be scrapped. Cracked, warped, split, and splintered bobbins are sure to give trouble in later processes and should not be used.

SIX-ARM PIN-HUB SWIFTS

28. Construction.—The function of the swifts employed in connection with hard-silk winders is to support the skeins of silk in such a manner as to keep each skein opened and spread exactly as it was before being removed from the reel on which the skein was originally formed. This is essential in order that the silk may be unwound from the skein without entanglement. In addition, as the swift is free to rotate, the silk thread may be unwound from the skein as the thread is wound on the winder bobbin.

A type of swift very commonly used when raw silk is being wound in connection with throwing operations, is clearly illustrated in Figs. 1 to 3, the skeins *a* being mounted on the swifts. Swifts of this type are usually known as *six-arm pin-hub swifts*, but since the sticks are arranged in pairs, such swifts are sometimes referred to as *twelve-stick swifts*. As illustrated, this type consists essentially of a turned wooden hub a_1 in which equally spaced holes are bored for the swift-sticks a_2 . Six holes are bored in each end of the hub and the sticks are arranged in six parallel pairs. The sticks are of hardwood, and are slightly tapered, and smoothly finished. The holes are bored at a slight angle, so that the swift sticks of each pair diverge somewhat from the central part of the swift, and from each other.

29. Swift Strings, or Braces.—Each pair of swift sticks are connected near their outer, or free, ends by a cotton *swift string*, or *tie*, a_3 , Figs. 1 and 3, sometimes known as a *swift brace*. This string is usually of braided cotton, made either in

the form of an endless loop, or as a single string with a loop at each end, to be engaged by the swift sticks. These cotton strings are somewhat shorter than the initial distance between two opposite swift sticks; therefore, when they are placed on the swift, the sticks must be pressed together slightly to allow the loops to be slipped over their ends. When this pressure is released, the sticks tend to return to their original positions, thus tightening the strings, holding them in place taut and straight, and forming a secure and suitable support for the skein of silk. There should be no knots in the swift strings to catch and break the silk.

30. When a skein of silk is placed on the swift, the swift braces should be carefully adjusted so that all of the strings will be placed on the swift sticks at points that are equidistant from the center of the swift and so that the skein will be held in a taut and well-spread condition. The actual distance of the strings from the center of the swift will, of course, depend on the size of the skein of silk; but great care should be taken in the uniform disposition of the strings with reference to the axis of rotation of the swift, in order that the loaded swift may be evenly balanced. If the strings are unevenly placed and the skein unbalanced, the tension of the silk thread during the winding will be very uneven, owing to the irregular running of the swift. This will cause poor winding and is very likely to result in frequent breaking of the thread. However, winding operatives become highly skilled, and when placing a skein of silk on the swift, they quickly and accurately slip the strings into their correct positions. When glancing over a row of revolving swifts, any skeins that are improperly adjusted and running unbalanced can readily be noticed. Such skeins as are thus observed should receive immediate attention and the fault rectified.

31. After continued use, swift sticks often become permanently bent and lose their springiness; the strings, also, may become stretched so that they will not be held tightly in the correct position. This will often cause the strings to sag and thus form a hollow seat, or rest, for the skein of silk. The

operation of winding then has a tendency to pull the skein toward the center of the swift, thus interfering with proper winding and tending to cause entanglements and breakages. When such conditions prevail, the swift sticks or strings should be replaced. A shorter string will usually remedy the trouble, or, temporarily, the string may be twisted to shorten it, or it may be wound once around one of the swift sticks. This causes the string to become taut and the skein to be held in the correct position. Swift sticks that have become permanently bent may sometimes be removed from the hub of the swift, turned half-way around and then glued in position. Loose sticks that cannot be securely fastened again, and all cracked and broken sticks should be promptly replaced in order to avoid poor work.

32. Fiber Swift Braces.—Instead of braided cotton strings, fiber swift braces are frequently employed to connect the pairs of swift sticks and to provide a suitable support for the skein of silk on the swift. A fiber swift brace is illustrated in Fig. 2 at a_3 ; it consists essentially of a smooth narrow strip of fiber of the length required to join the two swift sticks, having an eye, or hole, at each end to engage the stick. There are several inherent advantages of the fiber swift brace that should be noted. Such braces are firm and inflexible, and have no tendency to sag, as is sometimes true of cotton strings. This feature insures at all times a perfect support for the skein of silk and enables the skein to be spread smoothly and uniformly to its full original width, thus increasing the efficiency of the winding and tendency to eliminate breakage of the silk. Breaks of the thread are also reduced to a minimum, as fiber swift braces are made very carefully with rounded edges and smooth faces. Therefore, they cause no friction on the silk and have no projections or other features to catch and hold the delicate thread. Fiber braces are easily and quickly adjusted on the swift sticks to hold the skein taut and in a balanced position, and are very durable; in fact, they are practically indestructible under conditions of proper usage, and over long periods of use, they prove economical.

33. Swift Hangers.—Swifts employed for raw silk winding are usually equipped with pin, or gudgeon, hubs and hence are known as *pin-hub swifts*. As indicated in Fig. 3 (*a*) and (*b*), steel pins, or gudgeons, a_4 , about $\frac{1}{4}$ inch in diameter, are driven into each end of the swift hub. So that the swift may rotate easily, and to support the swift securely, these pins engage with slots in cast-iron swift hangers a_5 , Figs. 1 to 3. The swift hangers are securely bolted to castings e_5 , which in turn are secured to the pipe ties e_1 . The hangers may be adjusted horizontally by sliding the castings e_5 along on the pipe ties, and may be bolted to the castings e_5 in such a position as to hold the swifts at the desired elevation. The length of swift hangers is generally about 24 inches, and they are usually provided with three sets of slots for supporting the swifts so that swifts of different sizes may be accommodated without making special adjustments.

34. Weighting Swifts.—The hub of the swift is usually turned, or shaped, with a narrow neck between the sticks and in the center of the hub. Around the center of the hub a narrow leather strap a_6 , Fig. 2, is formed into a loop, the ends being secured by an eyelet. A light weight a_7 may be hung on the leather strap a_6 with a wire hook that engages the eyelet by means of which the ends of the strap are secured. The object of this arrangement is to exert a certain amount of friction, thus steadying the motion of the swift and preventing it from overrunning. This friction arrangement also enables the required amount of tension to be kept on the thread during winding and makes it possible to produce a hard, firm bobbin.

35. The amount of weight to apply to the swifts when winding different kinds of silk, must be regulated in accordance with the size and strength of the thread, the size of the skeins and of the swifts, the speed of winding, and so forth. Ordinarily, fine raw silks are wound without weighting the swifts, and in no case should so much weight be applied as to cause an excessive tension during winding. If this is done, the silk is wound on the bobbin in a stretched condition, which sometimes injures the elasticity of the silk and often leads to

serious results in later processes of manufacture. Sometimes, however, especially if the skeins are somewhat tangled, a slight amount of friction, produced by a reasonable amount of weight, will prevent overrunning of the swifts and cause them to rotate much more steadily. Weighting of the swifts to obtain a bobbin of the desired degree of firmness is also required in some cases, it being very necessary to avoid soft-wound bobbins. Not only do soft-wound bobbins contain a smaller quantity of silk, but the thread, either in winding or in being unwound in a later process, is likely to pull into the layers of silk beneath. This is a prolific cause of breakage, and serves to emphasize the importance of producing well-wound, firm bobbins in the winding operation. No specific rule can be given for ascertaining the correct amount of weight to apply to swifts, if weighting is necessary, but a correct adjustment can usually be quickly obtained by careful observation and by the exercise of good judgment.

36. Friction-Hub Swifts.—Pin-hub swifts are almost invariably employed in the winding of raw silks incident to the throwing process. Sometimes, however, it is desired to employ winding frames to wind spun silk, cotton, or other heavy threads from skeins. When such is the case, it is often difficult to weight the swifts heavily enough to obtain the desired tension in winding; occasionally, therefore, special swifts, known as friction-hub swifts, together with suitable swift-hangers, are employed. The friction-hub swift is not constructed with steel gudgeon pins; instead, the wooden hub of the swift is extended, and a boss, or stud, about $1\frac{1}{2}$ inches in diameter is turned on each end of it. This increases greatly the friction acting against the turning of the swift, and enables heavy threads to be wound successfully with the requisite tension.

GEARED SWIFT

37. Details of Construction.—In silk winding, a type of swift known as the *geared swift*, or *screw-hub balanced swift*, is sometimes employed. As illustrated in Fig. 6, it is of the

six-arm style and of a novel construction, certain features of which are shown in the partly sectioned view given in Fig. 7. With only two important exceptions, all parts of this swift are constructed of carefully selected hardwood that has been very thoroughly kiln-dried. It is necessary to employ wood to avoid the excessive weight that would be entailed by the use of metal. The object of the peculiar construction is to obtain

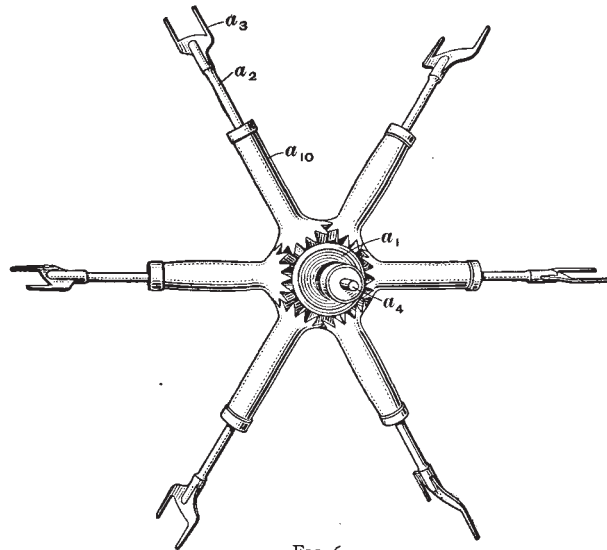


FIG. 6

perfect balance and to construct a swift that may be quickly and accurately adjusted to accommodate skeins of different diameters.

38. The tips, or braces a_3 , Figs. 6 and 7, on which the skein of silk rests, are made of fiber and, as shown in Fig. 6, are constructed with slightly convex upper edges, the object being to tend to spread the skein of silk in a natural manner and thus avoid snarls and tangles during the unwinding of the skein. The wooden tip sticks a_2 , Fig. 7, that support the tips a_3 , telescope, or slide, in arms a_8 that are rigidly fixed in the hub a_1 . A slot, or keyway, is cut in each of the rigid arms a_8 and a stud, or key, a_9 fastened to the tip stick pro-

jects through this slot and engages a coarse screw thread cut on the inside of a movable sleeve a_{10} . The tip stick and its fiber tip a_3 , on which the skein of silk rests, are always held in their proper positions, because the key a_9 passes through the slot in the rigid arm a_8 and thus holds the tip stick from turning in either direction.

The movable sleeve a_{10} is constructed at its inner end with a gear that is an integral part of the sleeve. The gear meshes with the similar gears of adjoining sleeves, all six of which are thus geared together, as shown in Fig. 6. Sleeves having right-hand threads are alternated with sleeves having left-hand threads; thus, if one sleeve is turned, the adjacent sleeves are turned in the opposite direction. When it is desired to alter the diameter of the swift, it is only necessary to turn any one sleeve in the proper direction. This will impart motion to all of the sleeves; and as the key a_9 engages the thread cut in the inside of the sleeves, the tip sticks a_2 will be forced out or drawn in. All the supports for the skein of silk are moved simultaneously by turning any one sleeve, and the diameter of the swift therefore can be adjusted almost instantaneously to fit the skein properly. Geared swifts are manufactured in three sizes. The smallest size may be adjusted so that the diameter varies from 15 to 22 inches; the swift of medium size is adjustable from a diameter of 18 inches to one of 25 inches; and the largest swift may be adjusted in diameter through a range of from 20 inches to 27 inches. The swift shown in Fig. 6 is fitted with an ordinary metal gudgeon a_4 , but it may be equipped to run on a stud, if desired.

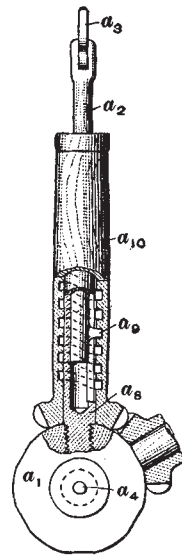


FIG. 7

39. Advantages and Disadvantages of Geared Swift.

Since it is very carefully constructed of selected wood, and the tips, or skein supports, are at all times equally distant from the axis of rotation, the geared swift is always in a per-

fectly balanced condition. This, of course, tends to prevent uneven running, or racing, of the swift, and often enables winding to be accomplished at a high speed. In addition, the uniform motion of the swift tends to produce bobbins wound with uniform tension. Because the skein is held so perfectly, it is claimed that the use of geared swifts reduces the amount of waste that is made. On the other hand, some throwsters have found that above a certain quite nominal speed, depending on the denier of the silk being thrown, the percentage of breaks during winding is likely to be increased when these swifts are employed. Geared swifts are somewhat expensive and difficult to keep in repair and are likely to be seriously damaged if they are not carefully handled. Winding operatives should exercise extreme care to avoid dropping swifts of this type, as this is a prolific cause of breakage.

40. Variation in Construction.—An older type of geared swift that may be encountered is constructed somewhat differently from the swift just described. In this type, the gears in the movable sleeves do not mesh with each other, but, instead, all of the gears mesh with a large movable gear that forms a part of the hub. By turning one sleeve, all of the other sleeves are moved in the same direction; hence, the threads of the movable sleeves are all cut in one direction, so that the skein supports will all move outwards or inwards simultaneously, as required. Right-hand threads and left-hand threads in alternate sleeves are not required in this case.

TRAVERSE MOTION

41. Purpose of Traverse Motion.—A mechanism that is of the utmost importance in connection with hard silk winding is that known as the *traverse motion*. Silk winders are equipped with this mechanism in order that the silk thread may be made to traverse continuously from one end of the bobbin to the other, and back again, during the winding of the thread on the bobbin. The traversing movement results in a firmly and evenly wound bobbin from which the thread can be

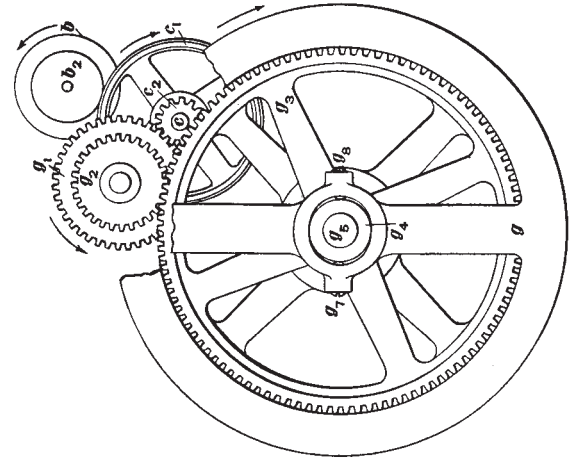
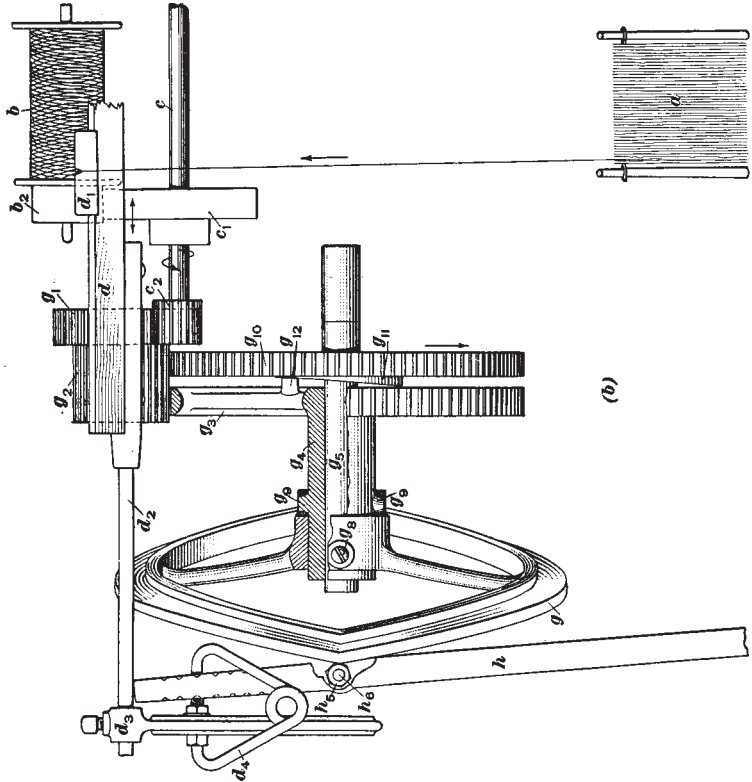


FIG. 8

unwound in subsequent processes in a satisfactory manner. If the traverse of the thread on the bobbin were not efficient, the tension of the thread during winding would cause the thread to be drawn into the silk previously wound on the bobbin, instead of being coiled in a series of distinct layers on the surface of the yarn already wound. In addition, the bobbin might be formed very irregularly and it might be impossible to produce a bobbin of the required degree of firmness. These defects, of course, would render difficult the unwinding of the thread from the bobbin and would result in an excessive number of breaks during the subsequent unwinding operation.

42. Principle of Construction.—The principles involved in the construction and operation of the traverse motion are illustrated in the views of the hard-silk winder shown in Figs. 2 and 3, while Fig. 8 illustrates the construction of the mechanism in greater detail. Fig. 3 (*a*) is an end elevation and view (*b*) is a front view of the traverse motion, while Fig. 8 (*a*) and (*b*) are end and front elevations, respectively. The threads unwound from the skeins *a* on the swifts are guided on the bobbins *b* by suitable guides, usually made of porcelain. A wooden traverse bar *d* supports as many such porcelain guides *d*₁, as there are skeins from which the silk is unwound, which is the same as the number of bobbins being wound. The guides are secured to the traverse bar in suitable positions to guide the thread on each bobbin, and a reciprocating movement is imparted to the traverse bar, so that each guide will cause the thread passing over it to traverse from one head of the bobbin to the other, and back again, as the winding of the thread proceeds. Motion is imparted to the traverse bar *d* and the guides *d*₁ by a rotating cam *g* that receives motion from the spindle drive shaft *c*. A pinion gear *c*₂, fastened to the end of the spindle drive shaft, imparts motion to the gear *g*₁, Figs. 3 and 8. The gear *g*₁ is compounded with a gear *g*₂ that drives a gear *g*₃, the latter being cast in one piece with a sleeve *g*₄ that rotates on a stationary stud *g*₅. The cam *g* is secured to the opposite end of the sleeve *g*₄. Through these connections the spindle drive shaft *c* imparts a constant

rotary motion to the cam g . The gears that constitute this driving arrangement are enclosed in a guard, or case, g_6 , Fig. 2, to protect the winding operatives and others from accident.

43. A traverse lever h , Figs. 2 and 3, is pivoted to a bracket h_1 bolted to the lower part of the frame e . A spring h_2 is attached at one end to an extended arm h_3 of the traverse lever, and at the other end is attached to the bracket h_1 , its tension being adjusted by means of the nurlled thumbnut h_4 . The spring h_2 keeps the traverse lever in contact with the cam g at all times, and tends to move the upper end of the lever toward the winding frame. As shown in Fig. 8, a cam follower h_5 , bolted to the traverse lever with a stud bolt h_6 , rests on the effective face of the cam g . As the cam rotates, therefore, the upper end of the traverse lever is forced outwards, or away from the winding frame, until such time as the toe of the cam has passed the cam follower. The spring h_2 , Figs. 2 and 3, then returns the lever to the right as the point of contact of the cam with the cam follower moves from the toe to the heel of the cam.

44. The reciprocating movement of the traverse lever is transferred to the traverse bar d , Fig. 8, in the following manner: A rod d_2 , sometimes called the *traverse-bar iron*, is bolted to the traverse bar. To the traverse-bar iron, a slotted casting d_3 is secured by a setscrew, a bent spring d_4 being bolted in the slot of the casting. The pointed ends of the spring d_4 , sometimes called the *spring clip*, engage notches, or depressions, in the traverse lever h and the spring, therefore, enables the traverse lever to transmit its movement to the traverse bar d . The object of the spring clip d_4 is to furnish a connection for the traverse lever h that will provide a suitable release in case the traverse bar, or other parts, becomes caught or jammed, and thus prevent breakage of the parts. Slight adjustments of the length of the traverse may be made by raising or lowering the spring clip in the slotted casting d_3 . If the spring clip is bolted in a lower position, the length of the traverse on the bobbin will be decreased, while raising the position of the clip will increase the length of the traverse.

45. In Figs. 2 and 3 is shown a somewhat different arrangement. It consists of a spring stud d_5 that connects the traverse lever h and the casting d_3 and operates in the same way as the spring clip d_4 , Fig. 8. The spring stud is a ball-ended stud, or pin, controlled by a coiled spring contained in a recessed casting, so that the stud will release if the free movement of the traverse motion is prevented. It may be raised or lowered in a slot in the traverse lever h to increase or decrease the length of the traverse on the bobbin. A lock-nut securely holds the spring stud in the desired position. Both the spring clip d_4 , and the spring stud d_5 , Fig. 2, allow for any slight vertical movement that may take place because of the arc described by the upper end of the traverse lever during its reciprocating movement. Although the connection of the upper end of the traverse lever h to the casting d_3 , by either the spring clip or the spring stud, tends to keep the traverse lever in its proper position, an additional arrangement for this purpose is usually provided. As shown in Fig. 2, it consists of a rod h_7 secured in a bracket bolted to the frame of the winder. The stud h_7 extends through a hole in the traverse lever but it is not fastened to the lever in any way. There is, therefore, no interference with the reciprocating movement of the traverse lever, but it is impossible for the lever to assume a position that will withdraw the cam follower h_5 from the effective face of the cam g .

46. Cam Follower.—In order to prevent the silk from piling up against the heads of the bobbin, or winding higher at the ends of the bobbins, the traverse bar d , Fig. 8, should have a very quick movement at each end of its traverse; that is, the reversal of the direction of movement should be rapid. To produce this quick change, the hardened tool-steel cam follower h_5 is made hexagonal, or six-sided, and is free to revolve on the stud h_6 by which it is attached to the traverse lever h . Because of its shape, every time the heel or the toe of the cam g passes the follower, the latter is revolved on its stud through one-sixth of a revolution, thus presenting another face to the cam. This movement takes place without hesitation,

and as the corner of the cam follower passes in contact with the cam, the traverse lever h is very quickly forced outwards and returned forwards for a short distance. While this movement is much too rapid to be perceived by the eye, it causes the traverse bar d to move the guides d_1 very quickly toward and away from the heads of the bobbins. This, of course, causes a slightly smaller amount of silk to be wound near the heads of the bobbins, and thus prevents the silk from piling up at those points. A circular cam follower could not produce this quick movement at each end of the traverse, and a certain momentary delay in the reversal of the direction of the traverse would most surely occur. The resulting bobbins would be very poorly wound at the ends, winding under would be of frequent occurrence, and subsequent operations would be greatly hampered.

While the principal reason for the hexagonal form of the cam follower is to produce a quick reversal of the traverse, this particular construction has another distinct advantage. By virtue of its rotation and presentation of successive faces to the cam, the cam follower wears very evenly, because the wear is uniformly distributed. If the follower did not rotate, it would quickly become worn at the point of contact with the cam, and frequent replacements would be necessary. To prevent the cam follower from sticking, because of lack of frequent oiling, or for other reasons, followers are sometimes arranged to turn on ball bearings.

47. Length of Traverse.—The length of the traverse is regulated in accordance with the distance between the heads of the bobbins on which the silk is wound, and is governed by the movement, or throw, of the cam g , Fig. 8, commonly spoken of as the cam throw. When wide bobbins are employed, the cam must be adjusted to impart a greater throw to the traverse bar d and guides d_1 than when bobbins having a smaller distance between the heads are used. The construction of the cam g is such that the amount of its throw and, consequently, the length of the movement of the traverse bar d , may be easily adjusted. The end view, Fig. 8 (*a*), shows that the bore of the

hub of the cam g has the form of an ellipse and that the cam is held in position by two round-ended screws g_7 and g_8 , threaded into the hub at the ends of the ellipse. The narrow diameter of the elliptical hole in the hub fits the sleeve g_4 closely. To enable the rotary motion of the sleeve to be transmitted to the cam and to furnish pivots on which the cam moves when the amount of its throw is adjusted, two bosses, or lugs, g_9 , are cast on the sleeve g_4 , as shown in Fig. 8 (*b*). These projections engage U-shaped slots in the hub of the cam. To increase the amount of cam throw and to lengthen the movement of the traverse bar d , the adjusting screw g_8 on the high, or toe, side of the cam should be loosened and the screw g_7 on the low, or heel, side of the cam should be tightened. Loosening the screw g_7 and tightening the screw g_8 will decrease the throw of the cam and shorten the movement of the traverse bar.

After the cam throw has been adjusted as closely as possible, if the traverse of the thread on the bobbins is not of exactly the right length, a fine adjustment may be made by means of the spring clip d_4 . If the spring clip is raised in the slot of the traverse connector d_3 , the length of the traverse will be slightly increased, and if lowered, the movement of the traverse bar d will be decreased to a small extent. Similar adjustments of the spring stud d_5 , Fig. 3, will produce the same results.

48. Variable Motion of Traverse Bar.—The extent of the movement of the traverse bar d , Fig. 8, imparted by the throw of the cam g alone, is about $\frac{1}{8}$ inch less than the distance between the heads of the bobbins. That is, if the distance between the heads of the spools is $3\frac{3}{16}$ inches, the cam throw should be adjusted to move the traverse bar about $3\frac{1}{16}$ inches. This small space of $\frac{1}{8}$ inch is taken care of by a variable motion that slightly moves the entire traverse from one side of the bobbin to the other, the purpose of which is to reduce slightly the amount of silk that is wound adjacent to the heads of the bobbin. The result is a much better wound bobbin than would otherwise be obtained, because the variable motion prevents the silk from winding higher at the heads, which would produce a

very badly wound bobbin, and one that would be very likely to occasion difficulty in subsequent operations. Moreover, this variable movement overcomes the tendency to wind slightly more silk at the heads of the bobbin, a condition that results because of the tendency for a slight dwell of the traverse at the point of reversing at each end of the movement.

The variable motion of the traverse is derived from the gear g_{10} , which is loose on the stud g_5 and is driven by the gear g_2 . A plate cam g_{11} having a throw of about $\frac{1}{8}$ inch is cast in one piece with the gear g_{10} and operates in conjunction with a cam follower g_{12} , cast in one piece with the gear g_3 . Both the gear g_3 and the gear g_{10} are driven from the gear g_2 , but the former contains only 112 teeth, while the latter gear has 128 teeth. The result of this arrangement is that the gear g_3 makes eight revolutions while the gear g_{10} makes seven revolutions, and hence, in this period of time, the cam follower g_{12} makes one complete revolution around the face of the cam g_{11} . It will be noted that if the gears g_3 and g_{10} contained the same number of teeth, each would make the same number of revolutions, and there would be no movement of the cam g_{11} and cam follower g_{12} relative to each other.

49. The movement of the cam follower g_{12} , Fig. 8, in running from the heel to the toe of the cam g_{11} forces the gear g_3 slightly outwards from the frame of the winder. Since both the gear g_3 and the cam g are fastened to the sleeve g_4 , the cam g also is forced outwards. This movement of the cam g is transmitted to the traverse bar d by the traverse lever h and connecting parts. The result is that the traverse bar is given a very slight additional movement. When the cam follower g_{12} is moving from the toe to the heel of the cam g_{11} , this movement is reversed and the spring h_2 , Fig. 3 (*b*), forces the traverse bar to follow the movement of the cam g and causes a slight additional movement of the traverse bar d in the opposite direction. By this mechanism the throw of the traverse is shifted very slightly from one side of the bobbin to the other, and vice versa, causing the bobbin to be filled with silk in a very even manner.

50. Setting Double Cams.—Hard-silk winders are wider than winders designed for operating on soft silk, because they require larger swifts to hold the raw-silk skeins. Hence, it is customary to equip them with two traverse-motion cams, and duplicate traverse levers and other parts, as shown in Fig. 2, so that the traverse motion on each side of the winder may operate independently of the other. The cams, traverse levers, gears, and other parts on each side of the winder are of similar construction, and each mechanism is equipped with the variable traverse motion that has been described.

When the winding frame is in operation, the traverse bars on each side of the machine should move in opposite directions, the traverse cams being accurately set to accomplish this result. If this adjustment is not made, or if the adjustment is not correct, so that the traverse bars move in the same direction for all or part of the time, the machine will run more or less irregularly, and a vibratory, or swaying, motion of the frame that will cause unnecessary wear and strain, is likely to be produced.

To set the traverse cams correctly, the cam on one side of the frame should be set so that the cam follower of the traverse lever will rest exactly on the heel of the cam. On the other side of the frame, the cam should be set so that the cam follower will be exactly at the toe of the cam. That is, the cams should be set diametrically opposite each other, or 180 degrees apart, and each traverse bar should be just at the point of reversing the direction of its motion. In setting the traverse cams, it is important to note that the cam followers of the traverse levers are each set at the same height and that they are exactly level with the center of the stud on which the traverse cam rotates. The two cam followers should be in the same horizontal plane.

51. Each of the traverse levers of the winder illustrated in Fig. 2 is equipped with a spring h_2 for reversing the movement of the traverse lever and traverse bar when the cam follower is moving from the high to the low part of the cam. In some cases, however, the traverse levers are connected by a

cross-bar to the center of which a single spring for reversing the movement of both traverse levers and both traverse bars is attached. This spring is also attached to the frame of the winder and its tension may be adjusted by a thumbnut in the usual way. When this arrangement is employed, it is particularly important to have the traverse cams set accurately so that the traverse levers and traverse bars will at no time be moving in the same direction. If this is not done, at some period in the movement of the traverse levers, when both are moving away from the frame, the spring will be unduly stretched and subjected to undue strain that may, in extreme cases, cause the spring to break. Moreover, in such cases, the tension tending to return the traverse bars will be unnecessarily variable.

52. Traverse Fingers.—Since the traverse bar *d*, Fig. 2, is very long, extending the entire length of the frame, it must be supported at intervals to hold it in the correct position and to counteract all tendency to sag. Traverse fingers *d*₆ are provided to support the traverse bar at intervals throughout the length of the winder. These fingers are really extended bobbin holders, doing double duty, in that they support both the bobbin and the traverse bar. A small roller, often made of wood, is supported by the traverse finger in such a position that the traverse bar rests on it. The rollers allow the traverse bar to move very easily, eliminating a great deal of friction and strain on the traverse motion.

53. Guides.—Every bobbin that is wound on a silk winder requires a separate guide for guiding the thread from the skein to the bobbin, so that the latter will be properly wound. The guides are attached to the traverse bars and the position of each is carefully adjusted, so that the silk will be wound uniformly between the heads of the bobbin and not too close to either head.

Guides are made of porcelain in several shapes that vary but slightly in their essential features. Guides of two slightly different shapes are shown at *d*₁, Figs. 1 and 2, while in Fig. 9 (*a*) a top view of another shape is shown. All of these guides

are formed with a central slot in which the silk thread may be easily placed and through which it runs in its passage from the skein to the bobbin. The guides are fastened to the wooden traverse bar by two screws, the holes for the screws being elongated so that a slight lateral adjustment of the guide may be made in order that it may be set exactly in the correct position. Washers should always be used under the heads of the screws to prevent breaking or chipping the porcelain guides, and, for the same reason, care should be taken not to tighten the screws too much.

54. In Fig. 9 (b) is shown a porcelain guide d_1 that is held in position on the traverse bar by two piano-wire springs, or

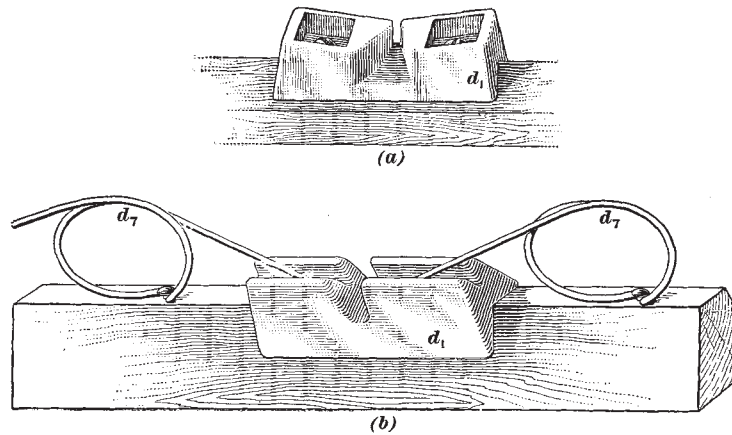


FIG. 9

bows, d_7 , instead of screws. The springs are fastened to the traverse bar by screws at one end, while their free ends rest in recesses in the guide. The guide has an L-shaped recess in its bottom and rests on the top of the traverse bar, and the springs d_7 press it firmly on the traverse bar so that it is held in position securely by means of friction. With this arrangement the position of the guide may be quickly and easily adjusted, and yet the guide is held with sufficient security in its correct position.

To prevent damage to the silk, guides for silk winding must be very smooth and very hard, since the rapidly running thread would quickly wear a groove in material that did not possess an extreme degree of hardness. For these reasons, porcelain with a hard, glazed surface is usually employed as the material in making the guides. Owing to the severe nature of the service and the constant wear at one point, the best guides will in time become cut and grooved. Worn and damaged guides should be immediately replaced, since the silk passing over them will be fuzzed or cut and the threads will be broken frequently. Fuzzed silk or silk in which the individual filaments of the thread have been broken, or the thread abraded, is damaged to such an extent that the defect cannot be rectified at any future operation, and the damage can almost always be traced to cut or worn guides.

SILK THROWING

(PART 3)

Serial 5002C

Edition 1

EXAMINATION QUESTIONS

Notice to Students.—*Study the Instruction Paper thoroughly before you attempt to answer these questions. Read each question carefully and be sure you understand it; then write the best answer you can. When your answers are completed, examine them closely and correct all the errors you can find; then mail your work to us.*

- (1) How is motion imparted to the bobbin on a winder?
- (2) Why is it customary to equip winders with stepped-cone driving pulleys?
- (3) What is the function of a swift?
- (4) Explain what is meant by the term *hard silk*.
- (5) What is the purpose of winding?
- (6) State the advantages and disadvantages of double-head spindles.
- (7) Why is it undesirable to tie the end of the silk to the winder bobbin?
- (8) How is the length of the traverse altered?
- (9) What is the object of the variable motion of the traverse?
- (10) Describe the setting of double traverse cams.

- (11) State the advantages and disadvantages of the geared swift.
- (12) Briefly describe the construction and operation of the traverse motion of a winder.
- (13) Describe the center-bridge type of winder bobbin, and state its advantages.
- (14) Briefly describe the construction of the six-arm pin-hub swift.
- (15) What are the advantages of fiber swift braces?
- (16) What is the object of the knee-boards of a winder?
- (17) Why are tapered spindles used on winders?
- (18) What is the disadvantage of the screw-nut type of spindle?
- (19) Explain how spindles are repaired.
- (20) Explain two methods adopted in the construction of winder bobbins to prevent the formation of a crack at the point where the head of the bobbin joins the barrel.

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