The Project Method of Teaching

SILK THROWING

PART 9

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INSTRUCTION PAPER

With Examination Questions

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ADVICE TO THE STUDENT

You learn only by thinking. Therefore, read your lesson slowly enough to think about what you read and try not to think of anything else. You cannot learn about a subject while thinking about other things. Think of the meaning of every word and every group of words. Sometimes you may need to read the text slowly several times in order to understand it and to remember the thought in it. This is what is meant by study.

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.

Pay attention to words or groups of words printed in **black-face type.** They are important. Be sure that you know what they mean and that you understand what is said about them well enough to explain them to others.

Rules are printed in *italics;* they, too, are important; you should learn to repeat them without looking at the book. With rules are usually given *Examples for Practice.* Work all of these examples according to the rules, but do not send us your work if you are able to get the right answers. If you cannot get the correct answer to an example, send us all of your work on it so that we can find your mistakes. Use one of our Information Blanks.

After you have finished studying part of a lesson, review that part; that is, study it again. Then go on with the next part. When you have finished studying an Instruction Paper, review all of it. Then answer the Examination Questions at the end of the Paper. It is not well to look at these questions until you have finished studying and reviewing the whole Paper.

Answer the Examination Questions in the same order as they are given and number your answers to agree with the question numbers. Do not write the questions. If you cannot answer a question, write us about it on an Information Blank before you send in any of your answers.

Remember that we are interested in your progress and that we will give you by correspondence all the special instruction on your Course that you may need to complete it. Remember, too, that you will get more good from your Course if you learn all that you can without asking for help.

 INTERNATIONAL CORRESPONDENCE SCHOOLS

SILK THROWING
(PART 9)

REELING, BUNDLING, AND SHIPPING

REELING

INTRODUCTION

1. Object of Reeling.—In the sequence of operations through which the raw-silk thread passes during the throwing, reeling follows the process in which the final twist is inserted in the thread; hence, the thread is delivered to the reel in bobbin form. This is the usual method of procedure with a large part of thrown silks that are reeled. After the necessary processes of yarn preparation have been completed in the throwing mill, and prior to returning the thrown yarn to the customer, the silk is usually prepared in a form that allows ease of shipment. This operation, known as reeling, is usually performed on a machine known as a *reel*, or *reeling frame*. The object of reeling is to wind a definite length of thrown yarn on a frame of a known circumference, to form a skein which may be easily removed, rolled into a small space, shipped conveniently without damage, and later opened without injuring or tangling the ends of silk.

2. Factors Determining Reeling Operation.—Although a large part of the thrown silks prepared in the mill are reeled, part of them are prepared for shipment in another manner. For this reason, a division may be made at this point in order to distinguish between the silks that are reeled and those that are not reeled in the mill. Whether or not the silk is to be reeled depends mainly on such factors as the instructions given to the throwster or the kind of yarn into which the silk was thrown; and as the kind of yarn determines the succeeding operations to which the thread is subjected, the subsequent operations must also be taken into consideration. For example, silk that is to be dyed before manufacture into an article is usually reeled into skeins. In this condition it is very easily handled in the dye bath, while the looseness of the skein allows a more rapid and even penetration of the dyestuff. Included in the classes of silks that are usually prepared in this manner are organzine, tram, and other low-twist silks. In fact, all silks that are dyed while in skein formation may be included; hence they are known as *skein-dyed silks*. After the silks have been dyed they are referred to as *soft silks*, also, since the gum is removed prior to the dyeing operation, leaving the silk soft and pliable.

The silks of the second class, or those that are not generally reeled, are known as hard twists, or crêpe. As the name implies, they have a high number of turns of twist per inch, resulting in a compact, hard thread. The high twist causes the thread to crinkle or kink after the tension is removed, and so this silk is not reeled; instead, it is wound on bobbins and shipped to the customer in that form. When prepared in this manner, the silk cannot snarl or kink, since it is tightly wound on the bobbin.

3. Other Methods of Preparation.—In addition to preparing silk in skein form and on bobbins, other methods of especial value to the customer are employed. For instance, when the yarn is thrown for a knit-goods manufacturer, it is frequently wound from the spinner bobbins directly on to a pressed-paper cone, the operation being known as *coning*. By coning in the throwing mill the silk may be employed, without any further processes, in the knitting mill. On the contrary, if the silk is shipped in skeins, it is necessary to wind it on bobbins in the knitting mill and then cone it. Hence a saving in labor and time is effected when silks are prepared by coning. It may be added that coned silks are usually employed by hosiery manufacturers.

The silk is sometimes prepared on small paper tubes known as cop tubes, or quills. These serve the same purpose as the paper cones, namely, to act as bases on which the silk may be wound. The silk prepared in this manner is ordinarily used in a silk weaving mill, as the cop, or quill, may be placed in a shuttle without further preparation and employed in the weaving of cloth.

CONSTRUCTION AND OPERATION OF REELS

4. Reel Construction.—An end view of a common type of silk reel, showing the relation of the various parts is shown in Fig. 1. A side view of one end-stand is shown in Fig. 2 (*a*), an end view of a complete end stand in (*b*), and a side view of the opposite end stand in (*c*). Corresponding parts in both illustrations are given the same reference letters. The end stands *a* are similar to those of other silk-throwing machinery and support the various parts of the reel. The main driving shafts *b* extend from one end stand to the other and are carried in the adjustable bearings b_1. Each carries a fiber-faced pulley *c* that transmits power to the pulley *d* and turns the reel fly *e*. Two driving shafts are employed in order that each reel fly may be individually driven. The fiber-faced pulley on the second shaft is located at the opposite end of the reel and so cannot be seen in the illustration; but both reel flies are driven in the same manner. The reel fly consists of four wooden arms supported on iron spiders fastened to the shaft. The circumference of the fly is a standard measurement, and so the number of yards of yarn wound on the fly may be found by counting the number of revolutions of the fly. When in motion, the thread is guided on the fly by the traverse bar *f*. In its upward passage, the thread passes through the drop wire *h*, which stops the fly when an end breaks. The fly is also stopped when a suitable yardage has been reeled on it, this being accomplished by the revolution of the count gear k_5.

5. Operation of Reel.—The bobbins are placed on the bobbin shelf a_1, Fig. 2 (a), and the thread is led upwards around the rollers i, thence through the drop wire h, over the guide f_1, and is wound on the fly e. The thread is wound in a diamond-shaped formation because of the rapid throw of the

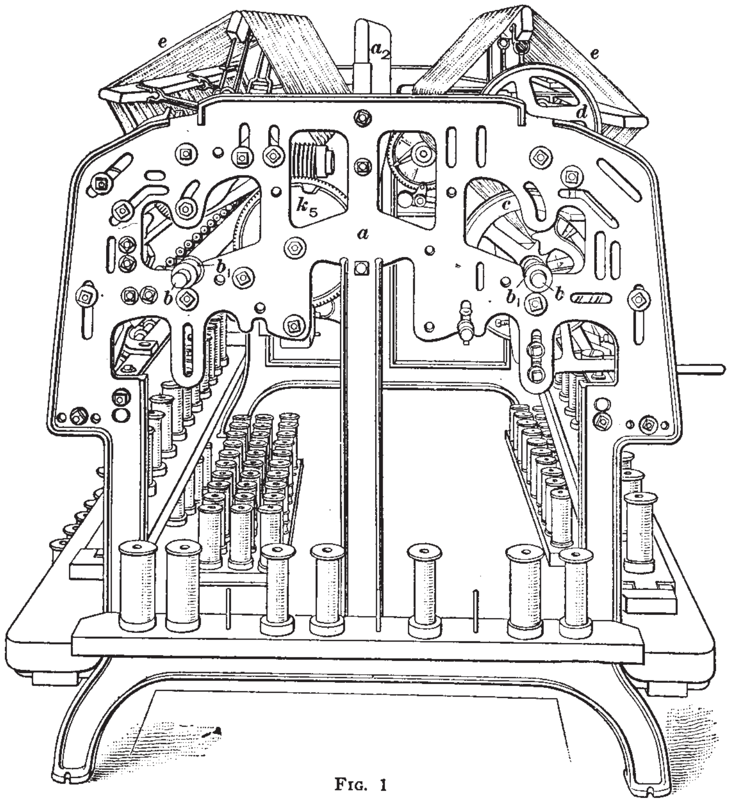

FIG. 1

traverse bar f. When an end breaks, the drop wire h falls backwards and through suitable mechanism causes the reel fly to stop.

6. Driving of Reel.—The two sides of the machine in Fig. 2 are duplicates as to construction and each has its own driving shaft b to the end of which is fixed a pulley. The two pulleys on the driving shafts are in the same plane and receive

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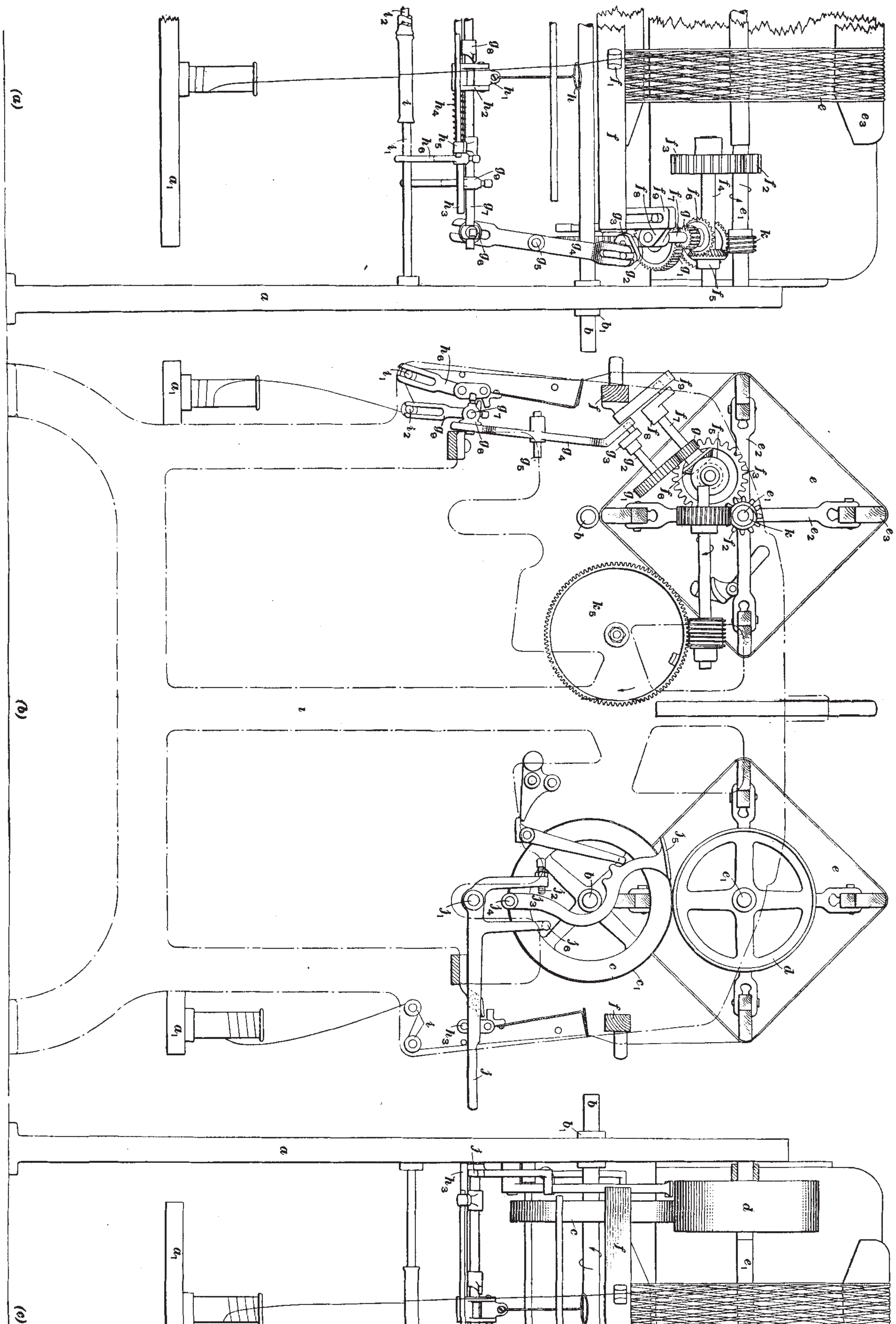


Fig. 2

Double-page spread rotated 90° to fit on page.

motion from a line shaft through a single belt so arranged that the driving shafts are rotated in opposite directions. A description of the operation of one side of the machine therefore applies equally well to the other. Near the end of the driving shaft *b* is fastened a pulley *c*, to the rim of which is riveted a band of fiber c_1. The fiber facing is carefully spliced and joined, so that its surface is truly circular. In some instances, paper or leather is used instead of fiber; but the object in any case is to provide a friction surface for driving the cast-iron pulley *d* on the fly shaft e_1 with as little slippage as possible.

7. Motion is transmitted from the fiber-faced pulley *c*, Fig. 2, to the iron pulley *d* and thence to the other parts of the reel. It is very important that the facing of the pulley *c* be smooth and circular. Countersunk rivets are used, so that there will be no ridges to cause the pulley *d* to jump during its rotation. Leather as a facing is much softer than fiber, wears more rapidly, and is likely to have flat spots formed on it. The effect of these would be to cause uneven running of the pulley *d*, just as would be caused by careless joining of the ends of the facing. A fault of this kind, causing uneven running of the fly, should be remedied at once.

8. Reel Fly.—The reel fly *e*, Fig. 2, on which the silk thread is wound, is located between the end stands and is supported by a shaft e_1 that extends the length of the machine and rotates in substantial adjustable bearings. The bearing next to the pulley *d* is so located to allow the pulley to rest on the fiber-faced driving pulley, while the bearing at the opposite end of the shaft allows the gears at that end to mesh with the gears they drive. The bearings are so constructed that the reel fly may readily be removed from the machine, when necessary.

Fastened to the fly shaft are three spiders e_2 usually made of malleable iron, and spaced at equal distances. Each spider has four spokes that stand at right angles to the fly shaft and support the arms e_3 at their outer ends. The arms are of wood, usually straight-grained maple, and are thoroughly sandpapered and finished after the reel fly is assembled. While the reel is in service in the mill, the arms are frequently sandpapered and oiled with neats-foot oil, as the operation of steaming sometimes raises the grain of the wood and causes the arms to become rough. It is customary to design the arms as light as possible, but they are always made large enough to withstand the strain placed upon them by the contraction of the skein after the steaming operation. Since twelve skeins are usually wound on the fly simultaneously, the pressure due to contraction of the silk is considerable when heavy silks are reeled into large skeins.

9. The details of construction of the fly are shown in Fig. 3. Three of the spokes of each spider are cast in one

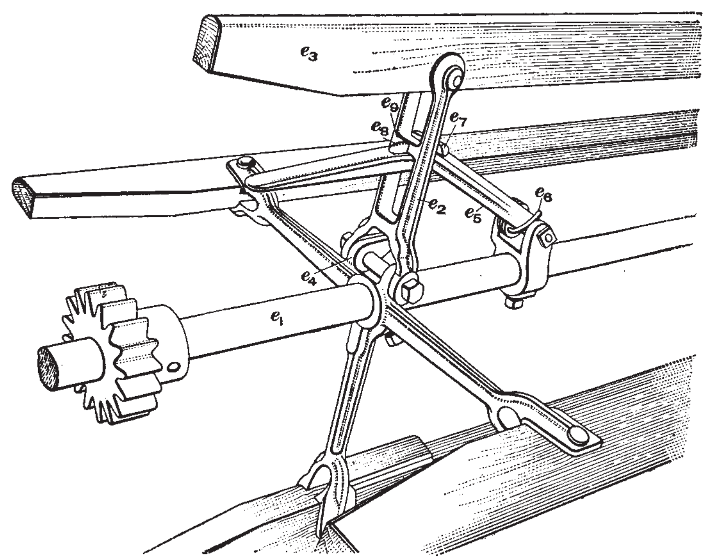


FIG. 3

piece with the hub and are fastened to the shaft e_1, by a set-screw. The fourth spoke e_2 is connected to lugs e_4 on the hub and may be swung on a pin that passes through the lugs. The outer ends of the three rigid spokes are firmly riveted to three of the wooden arms e_3, but the movable spoke e_2 is connected to its arm e_3 by a pin on which the arm may turn. When the fly is running, the collapsible arm e_3 and its attached spoke e_2 are kept in proper position by a catch e_5. The inner end of the catch is pinned to a collar that is fastened to the shaft e_1 by a setscrew and a spring e_6 tends to force the free end of the catch outwards. Two lugs e_7 and e_8 are cast on the catch and the bar e_9 on the slotted spoke e_2 fits between these lugs. The movable spoke and its attached fly are thus held in proper position while the machine is running.

10. The thread is reeled on the fly, Fig. 2, under a slight tension, and additional tension results from contraction of the silk after steaming; consequently, it would be difficult to remove the skeins if the fly were wholly rigid. But, by reason of the collapsible construction just described,the reeled skeins may easily be removed. The outer end of the catch e_5 is pressed inwards toward the shaft, which will remove the lug e_8 from in front of the bar e_9. At the same time the lug e_7 will press against the spoke e_2 and swing it to the left, thus carrying the movable arm e_3 to the left, also. The pressure due to the tension of the silk in the skeins will assist in forcing the movable arm toward the shaft. When the arm and its attached spokes have thus been collapsed, the skeins will hang loosely on the remaining three arms of the fly, from which they may easily be removed. When the arm e_3 is swung outwards to its normal position, the bar e_9 drops between the lugs e_7 and e_8 and the catch springs into place, as shown.

11. The reel flies illustrated in Fig. 2 have four arms each, which is the usual construction; but they are also made with six arms when so desired by the purchaser. With the four-arm fly the operation of lacing the skeins may be done more easily than with the six-arm fly, as the arms are not so close together; also, four equally spaced lacing strings may be placed in each skein. With the six-arm fly there is less space between the arms, and, usually only three lacing strings are placed in each skein. Regardless of the number of arms, it is very important that the balance of the fly be as nearly perfect as possible; for, if the fly is unbalanced, it will not run smoothly, and will tend to vibrate.

12. In removing the reel fly from the reeling frame it is lifted bodily and then carried away from the frame. The weight to be lifted is considerable, as the reel carries the cast-iron pulley *d*, Fig. 2 (*b*) and (*c*), at one end of the fly shaft, in addition to the gear f_2 and the worm *k* at the other end. To reduce the weight of the entire assembly, the reel fly is sometimes made with a tubular steel shaft e_1. It may also be fitted with a *clutch coupling* at the end that carries the pulley *d*. In that case, the pulley *d* is located as shown in the illustration. It is mounted on a shaft that extends a short distance through the pulley on the side toward the reel fly and carries one half of the coupling. It always remains in this position and is not removed from the machine. The other half of the coupling is carried by the fly shaft and meshes with the first half when in the running position. The reel fly is then merely lifted from the machine and the coupling readily disengages, allowing the fly to be carried away while the heavy pulley remains on the machine. The flies are separated by a wooden board a_2, known as a wind board, or wind shield, that prevents the draft caused by one reel fly from affecting the other fly. It is simply dropped into vertical grooves cast in the end stands.

13. Traverse Motion.—The traverse motion on the reel performs the same functions as on other silk-throwing machinery in which the thread is wound on some form of container. On the reel, however, the traverse bar is given a very rapid back-and-forth motion, in order to produce a cross-winding effect. At one time, the silk was wound on the reel fly without any definite and rapid back-and-forth guidance thus producing a skein with one thread wound more or less directly on another. In a later operation in which the reeled skein was unwound and placed on a bobbin, extreme difficulty was experienced in finding broken ends and in clearing tangles and snarls. To overcome these difficulties the thread is guided on the reel fly with a rapid traverse and the number of throws of the traverse bar is definitely fixed with relation to the revolutions of the reel fly. Hence, in winding, the thread is guided on the fly in such a way as to cause well-defined diamond-shaped openings to be formed and so that succeeding layers of thread always cross those already wound. As shown in Fig. 2 (*a*) and (*c*), the threads are wound on the reel fly with diamond-shaped openings. This style of reeling is known as *Grant reeling*. It is sometimes referred to as *cross-reeling* since the threads cross each other; however, in some methods of cross-reeling the speed of the traverse bar does not have a definite relation to that of the reel fly, hence the diamond-shaped openings characteristic of Grant-reeled silks are not produced.

14. The wooden traverse bar f, Fig. 2 (*a*) and (*b*), is supported by fingers, not shown, that hold the bar upright and keep it in position while it is in motion. Into it are screwed the thread guides f_1, spaced according to the number of skeins to be reeled on each fly. Two general types of thread guides are used, although many different forms are derived from them. The type shown in Fig. 4 is a common form of porcelain guide, the screw being firmly imbedded in the part that forms the guide. Two hooks overlap across the opening through which the thread passes and prevent the thread from pulling out. The thread is inserted by being turned at an angle and pushed down between the overlapping hooks. If a guide is broken during the operation of the reel, it may quickly be unscrewed from the bar and replaced by a new one. Another type of guide frequently used is the pigtail type, made of heavy wire carefully enameled. It is less likely to break than the porcelain type.

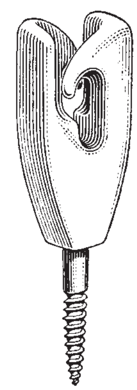


FIG. 4

15. Reciprocating motion is imparted to the traverse bar f, Fig. 2 (*a*) and (*b*), from the fly shaft e_1. A 13-tooth gear f_2 on the fly shaft meshes with a 24-tooth gear f_3 on the short shaft f_4. Motion from the shaft f_4 is transmitted through the miter gears f_5 and f_6 to the shaft f_7 that carries the crank f_8 At the outer end of the crank is a pin that fits in the slot of

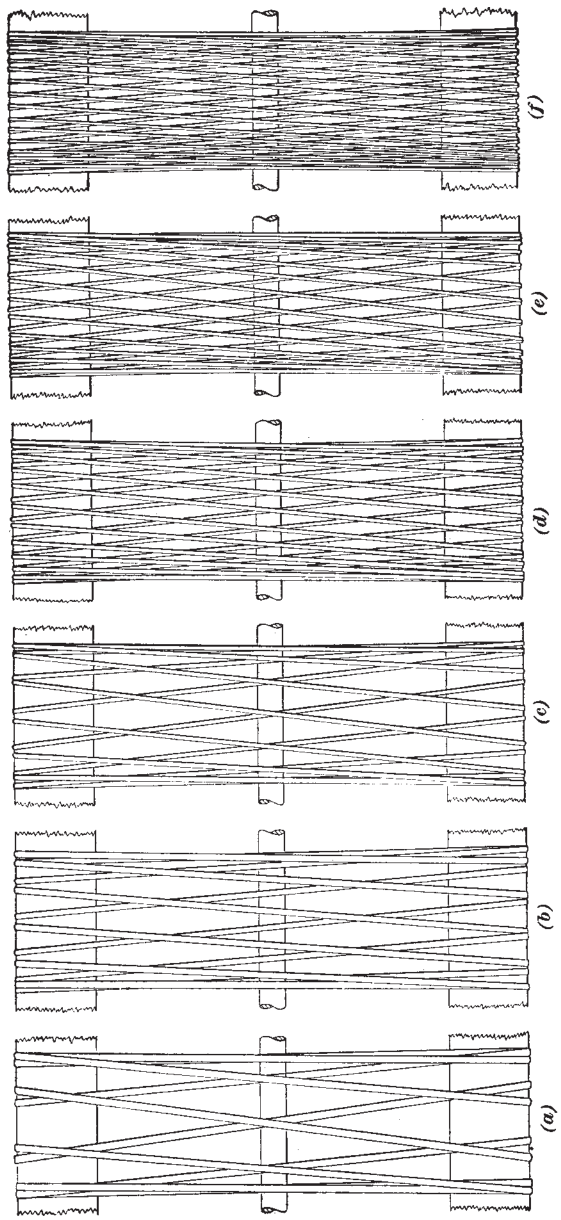


FIG. 5

a casting f_9 firmly fastened to the traverse bar. The shaft f_7 turning at the same speed as the shaft f_4, gives the traverse bar a to-and-fro movement, the pin on the crank sliding up and down in the slot as the crank turns. Thus, as the traverse motion is derived from the fly shaft, the relation between the reel fly and the traverse bar is very important in obtaining the correct diamond-shaped winding of the skeins.

16. As the reel fly turns at a constant speed, a change in the number of diamonds in the skein is made by altering the number of throws of the traverse bar, which may be done by changing the relative sizes of the gears f_2 and f_3, Fig. 2 (*a*) and (*b*), through which the crank f_8 is driven from the fly shaft. These gears are so fastened to their shafts that they may readily be removed. Various formations produced by different sets of gears are shown in Fig. 5. That in (*a*) has three diamonds in the width of the skein; (*b*) and (*c*) have four diamonds each; (*d*) has eight, (*e*) has ten, and (*f*) has twelve. Skeins are most commonly reeled with eight, ten, or twelve diamonds.

TABLE I

CHANGE GEARS FOR DIFFERENT NUMBERS OF DIAMONDS

Style of Skein Fig. 5	Sizes of Change Gears in Fig. 2	
	Gear f_2	Gear f_3
(*a*)	15	24
(*b*)	10	24
(*c*)	14	24
(*d*)	11	24
(*e*)	13	24
(*f*)	14	37

17. The numbers of teeth in the gears f_2 and f_3, Fig. 2, required to produce the different numbers of diamonds in the windings shown in Fig. 5 are given in Table I. The letters in the first column designate the different styles of skeins shown in Fig. 5 (*a*) to (*f*), and the second and third columns give the numbers of teeth in the gears f_2 and f_3, respectively, in Fig. 2, to produce the corresponding skeins. Thus, to produce a skein with eight diamonds, as shown in Fig. 5 (*d*), it would be necessary, according to the fourth line of Table I, to use an 11-tooth gear f_2, Fig. 2, and a 24-tooth gear f_3.

18. Automatic Stop-Motion.—Since the object of the reel is to wind on a reel fly a number of skeins, each containing a definite number of yards, it is equipped with a stop-motion that stops the reel fly when an end breaks. The principle on which the stop-motion is constructed is similar to that employed on the doubler. As each end passes from the supply bobbin to the reel fly, it is threaded through a drop wire that is held erect by the tension of the thread while it is running. The instant an end breaks, its drop wire falls backwards, causes the fly pulley to be lifted off the fiber-faced drive pulley, and stops the reel fly.

The stop-motion is operated through gearing from the fly shaft. A spur gear g, Fig. 2 (a) and (b), is fixed on the crankshaft f_7 and transmits motion to a larger gear g_1 on a parallel shaft g_2. A pin at the end of the crank g_3 on this shaft works in a slot machined in the arm g_4, which is pivoted at g_5. The lower end of the arm g_4 is also slotted and fits over a pin in the bracket g_6 fastened to the rod g_7. This rod extends the entire length of the reel and carries the knock-off dogs g_8 spaced at regular intervals.

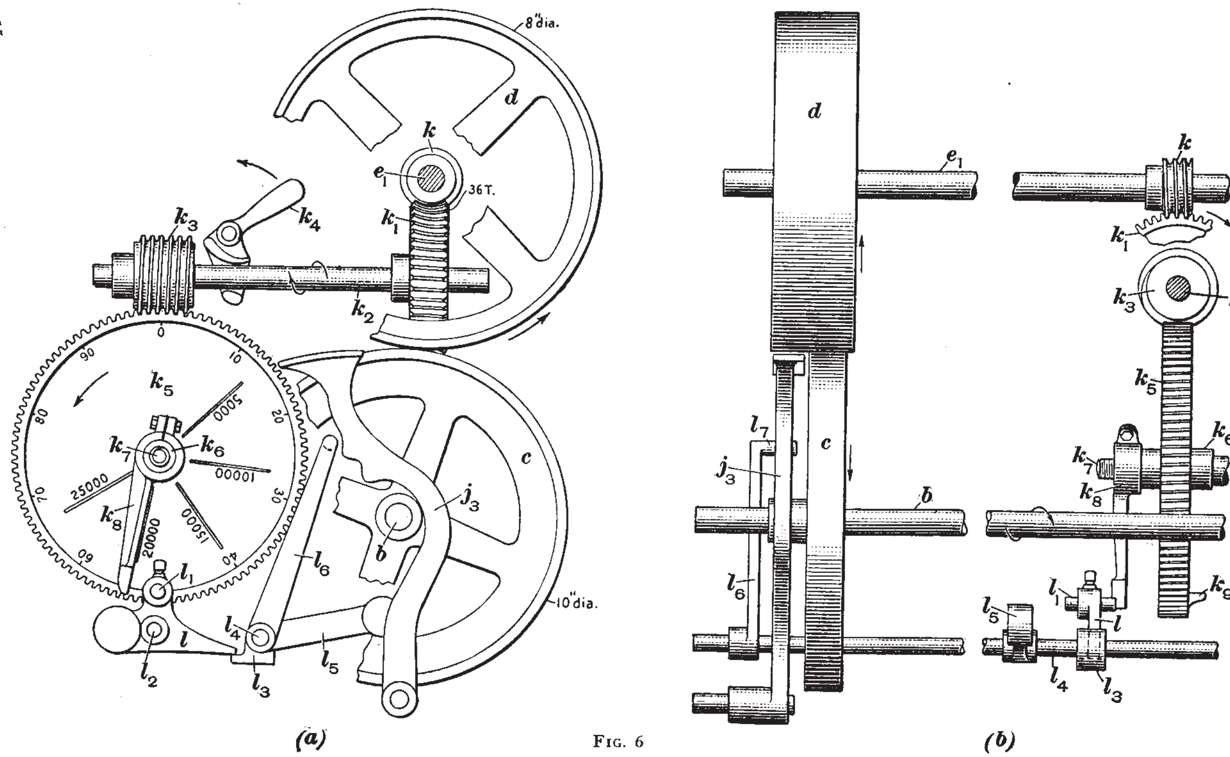
19. The drop wires consist of wires bent to the shape shown at h, Fig. 2; however they may be made with large procelain eyes that present smooth surfaces, to the threads and prevent cutting. The drop wires should be inspected from time to time, as cut wires will damage the silk. The drop wires are attached by setscrews to feet h_1 pivoted on pins held in brackets h_2. The brackets are fastened to the rod h_3, which extends practically the length of the machine and is free to move laterally; however, it is retained in the running position by the pressure of the compression spring h_4 which is located between a drop-wire bracket and the rod support h_5. Because of this spring, the position assumed by the drop wires while the frame is in operation will be as shown in the illustration. The rod h_3 cannot turn because the forked end of the arm h_6 fastened to the rod fits over the rod i_1, which extends from one end stand to the other, and supports the porcelain roller guides i. A second rod i_2 directly behind the rod i_1 supports a second row of porcelain roller guides and fits in the slotted arm g_9 on the rod g_7, thus preventing the latter from turning but allowing it to move endwise.

20. On the rod h_3, Fig. 2 (*b*) and (*c*), rests a lever j that is pivoted at j_1 and provided with two vertical arms. A setscrew j_2 at the end of one arm may be set closer to the brake lever j_3 or farther from it as desired. The brake lever swings on the pin j_4 and carries the curved shoe j_5 at its upper end. When the lever j is dropped, the setscrew j_2 will strike the brake j_3 and throw the shoe j_5 under the pulley d of the revolving reel fly, causing the latter to stop. When the fly is to be started, the handle j is raised, and the upper end of the arm j_6 then presses against the brake lever and forces the curved shoe out from under the pulley d. This allows the pulley to come in contact with the fiber-faced drive pulley g_1 and start the reel fly. While the reel is in operation, the turning of the crank g_3, Fig. 2 (*a*), imparts a reciprocating motion to the rod g_7 through the arm g_4, and so the rod g_7 and the knock-off dogs g_8 will constantly move to and fro. If an end should break as it passes from the bobbin on the bobbin shelf a_1 to the skein, the drop wire that it supports will immediately fall backwards. When this occurs, the extension of the drop-wire foot h_1, will also fall backwards and stand in the path of the knock-off dog. The knock-off dog, on coming in contact with the drop-wire foot, will carry it along, moving the rod h_3 supporting the drop-wire bracket. As the rod h_3 extends to the opposite end stand and supports the handle j, its movement toward the right will allow the handle j view (*b*) to drop, which will cause the brake j_3 to be forced under the fly pulley d, raising it and stopping the reel. Sometimes the brake j_3 is not forced under the pulley d quickly enough, in which case the reel fly revolves slightly after the end has broken. To make the brake act more rapidly, the setscrew j_2 should be moved toward the lever j_3 and then locked in position by the locknut.

YARDAGE CLOCK

21. Yardage Clock.—The reel is fitted with a device that stops the rotation of the reel fly as soon as the required yardage has been wound on the fly. This mechanism is known by various names, as, the *yardage clock*, *counting wheel*, *count gear*, or *count knock-off*. It may be adjusted to stop the fly at a predetermined yardage, the number of yards to be placed in the skein being dependent on the instructions given to the throwster, or the class of yarn that is being reeled. In Fig. 6 (*a*) and (*b*) is shown a detailed view of the yardage clock and its driving mechanism, while the relative positions of the parts may be seen in Fig. 2. It is driven from the reel fly shaft e_1 by a worm k between the end stand and the gear f_2 that drives the traverse motion and the stop-motion. The worm k, shown in detail in Fig. 6 (*a*) and (*b*), meshes with a 36-tooth worm-gear k_1 on a short shaft k_2 that extends toward the center of the reel and carries at its other end, the worm k_3. The shaft k_2 is supported in a movable hanger, not shown in the illustration, and may be raised or lowered by moving the handle k_4. By moving the handle in the direction shown by the arrow, the shaft is raised, thus disengaging the worm k_3 from the count gear k_5 so that the latter may be set as desired.

22. The count gear k_5, Fig. 6 (*a*) and (*b*), has 100 teeth, and, for convenience in setting it to obtain a desired yardage, one side of the gear is cast with raised bars adjoining which are marked the different yardages that may be obtained; also, the teeth are marked off in groups of ten, so that the number of teeth to be considered may be found quickly. The hub k_6 is threaded on the inside so as to fit on the stud k_7 bolted to the end stand. The pitch of the threads is such that the count gear will move $\frac{1}{8}$ inch away from the end stand for each revolution of the gear. The gear hub also carries an adjustable pointer k_8, which is set to knock off or stop the fly when a given yardage has been reeled. The count knock-off l is located directly below the count gear and carries the



8"dia.
36T.
10"dia.
d
c
k
e1
k1
k2
k3
k4
k5
k6
k7
k8
k9
j3
b
l
l1
l2
l3
l4
l5
l6
l7
0
10
20
30
40
60
70
80
90
5000
10000
15000
20000
25000
(a)
(b)

Fig. 6

knock-off bar l_1, which is held in place by a set screw, so that it may be adjusted readily. The knock-off l is pivoted on a short shaft l_2 attached to one end stand, and its toe rests on the lug l_3. This lug is attached to a shaft l_4 that is underneath and slightly to the rear of the fiber-faced pulley c. The shaft l_4 carries the balance weight l_5 and the catch arm l_6 at its outer end. The catch arm is located near the brake j_3 and in such a position that the projection l_7 will strike the brake when the shaft l_4 is turned forwards.

When the machine is in operation, the count gear k_5 turns slowly, carrying the pointer k_8 around with it. When the pointer strikes the count knock-off bar l_1, it swings the count knock-off on the short shaft l_2 and releases the lug l_3. The weighted arm l_5 then turns the shaft l_4 and swings the catch arm l_6 forwards against the brake lever j_3, thus forcing the brake shoe under the pulley d and stopping the reel fly.

23. Setting Yardage Clock.—Prior to starting the reel it is necessary to set the yardage clock to knock-off at a predetermined yardage fixed by the specifications given to the throwster; or, if no instructions have been given, the silk is reeled into skeins of such yardages as are generally considered correct for the class of thrown yarn. The circumference of the reel fly and the gearing are such that the count gear k_5, Fig. 6, will move one tooth after approximately 44 yards of silk have been wound on the fly; or, for one complete revolution of the count gear, 4,400 yards of silk are wound on the fly, since the gear has 100 teeth. To set the pointer to knock-off at yardages less than 4,400 yards, the clamp holding the pointer should be loosened, the pointer pressed against the count gear, and set to the proper tooth, which is found by calculation and counted off on the gear. The clamp is then tightened to hold the pointer in place. The worm k_3 is next disengaged from the count gear by shifting the handle k_4, and the count gear is turned to the right until the lug k_9 strikes a block bolted to the end stand. It is then known that the counting wheel is at the zero position, and the handle k_4 may be moved back, allowing the worm k_3 and the count gear to mesh. When the clock is set in this manner, the zero marked on the count gear will be at the bottom, or in the lowest position.

24. The method of setting the yardage clock to allow the reeling of higher yardages is similar to that just described. With the higher yardages it is convenient to employ a yardage table, such as that in Table II, whereby the number of teeth of the count gear that must pass a given point may be found without calculations. For example, suppose that it is desired to reel 15,000 yards of silk in the skeins before the reel fly is

TABLE II

YARDAGE TABLE

Number of Yards in Skein	Number of Teeth of Count Gear	Number of Yards in Skein	Number of Teeth of Count Gear
500	11½	10,000	227½
1,000	23	10,500	239
2,000	45½	15,000	341
2,500	57	20,000	454½
3,000	68	21,000	477½
4,000	91	22,500	511½
5,000	114	25,000	568½
6,000	136½	30,000	682
7,500	170½		

stopped. Table II shows that 341 teeth of the count gear must pass the knock-off bar before the pointer strikes the bar. As the count gear contains 100 teeth, it must make three complete revolutions plus 41 teeth before the pointer strikes the knock-off bar. The pointer is set at the 15,000-yard mark, which corresponds to the forty-first tooth, the setscrew holding the knock-off bar is loosened, and the bar is moved away from the count gear. With the lug k_9 against the block on the end stand, so that the gear is in the zero position, the pointer will be 41 teeth away from the knock-off bar, so that 41 teeth must pass the knock-off bar before the pointer reaches it. At the end of another complete revolution, 141 teeth will have passed the bar, and it will be found that the count gear has moved slightly more than $\frac{1}{8}$ inch along the stud that supports it. At the end of another revolution, as the pointer reaches the bar, 241 teeth will have passed the bar and the count gear will be slightly more than $\frac{1}{4}$ inch from its initial position. Since it is necessary for the gear to make only one more revolution in order that 341 teeth may pass the bar, the knock-off bar should be so adjusted that the pointer will just clear the bar in making its second revolution. Then the pointer in moving outwards during the third revolution will strike the knock-off bar and stop the reel fly, and this will occur when 341 teeth have passed the bar.

25. Sometimes the yardage clock has a cord attached to the hub, with a weight suspended from the lower end, keeping the cord taut. As the count gear revolves, it winds the cord on the hub and gradually raises the weight from the floor. When the correct yardage has been wound, the reel is stopped in the usual way. Then, on resetting the clock, it is only necessary to lift the worm out of mesh with the count gear, whereupon the weight will immediately return to its original position, causing the count gear to return to zero. Care should be taken to observe that the count gear does not rebound when its lug strikes the block on the end stand. The reeler should be positive that the lug on the gear is against the block before the worm is again meshed with the count gear. If the latter is not in the zero position when the worm is meshed with it, the skeins will not contain the required yardage and they will be classed as short skeins.

CALCULATIONS

26. Speed.—The calculations in connection with reels are very simple and may be divided into speed and production calculations, as there are no twist calculations to be made. Of the speed calculations, probably the most important is the speed of the main drive shaft and the speed of the reel fly.

EXAMPLE 1.—If an individual motor carrying a 4-inch pulley and making 720 revolutions per minute drives an 8-inch pulley on the main drive shaft, what is the speed of the drive shaft?

SOLUTION.—The speed of the main drive shaft is

$$\frac{720 \times 4}{8} = 360 \text{ r.p.m.} \quad \text{Ans.}$$

EXAMPLE 2.—A fiber-faced pulley 10 inches in diameter, mounted on the main drive shaft, makes 360 revolutions per minute and drives by frictional contact an 8-inch pulley mounted on the fly shaft. Find the speed of the fly shaft.

SOLUTION.—The speed of the fly shaft is

$$\frac{360 \times 10}{8} = 450 \text{ r.p.m.} \quad \text{Ans.}$$

27. Production.—The production of a silk reeling frame depends on a number of conditions. For instance the lots of silk may be of different qualities, so that part may run well with little or no trouble while the remainder may run very poorly, resulting in many stoppages. The theoretical production should be calculated and a suitable deduction made for stoppages.

Rule.—*To find the production, in pounds per reel fly per day, divide the product of the number of skeins per fly, the circumference of the fly in inches, the number of revolutions per minute of the fly, the number of minutes in an hour, and the number of hours of operation per day by the product of the number of inches in 1 yard and the number of yards in 1 pound of the thrown thread.*

EXAMPLE.—How many pounds per day of a 2-thread 13/15-denier organzine (159,448 yards per pound) will be produced if a reel fly having a 44-inch circumference and supporting 12 skeins makes 450 revolutions per minute, considering 10 hours as the daily working period?

SOLUTION.—The production per day is

$$\frac{12 \times 44 \times 450 \times 60 \times 10}{36 \times 159{,}448} = 24.835 \text{ lb.} \quad \text{Ans.}$$

28. The production found in the solution of the example in the preceding article is the production of the reel if it is in constant motion; however, this is impossible, as the fly is stopped frequently due to the breakage of ends, running out of bobbins, and replacing of flies that have been filled. These conditions, together with the skill of the reeler, vary to a considerable extent, and so it is impossible to give a definite percentage of allowance for stoppages. But, for illustrative purposes, 15 per cent. may be assumed, which may also be considered an average allowance under normal conditions.

EXAMPLE.—If the production of a reel fly, based on continuous running, is 24.835 pounds; what is the actual production if the fly is stopped 15 per cent. of the total running time?

SOLUTION.—If the loss due to stoppages is 15 per cent., or .15, the actual production is $1.00-.15=.85$ times the theoretical production, or

$$24.835\times.85=21.109 \text{ lb. Ans.}$$

29. Frequently it is desirable to calculate the time required to reel a certain yardage of silk of a known size, and from this, the number of flies that can be produced per day may be found. The following rule may be applied:

Rule.—*To find the time required to reel a given yardage, divide the product of the number of yards per skein and the number of inches in a yard by the product of the number of revolutions per minute of the fly and the circumference of the fly in inches, and increase the result by an amount equal to the percentage of stoppage.*

EXAMPLE.—Find the time required to reel 20,000-yard skeins if the circumference of the fly is 44 inches and its speed is 450 revolutions per minute, allowing 15 per cent. for stoppages.

SOLUTION.—Apply the rule, and

$$\frac{20{,}000\times36}{450\times44}=36.363 \text{ min.}$$

This length of time must be increased, since it represents only 100 per cent. minus 15 per cent., or 85 per cent. (.85) of the total time required. Hence, the total time required is

$$36.363\div.85=42.78 \text{ min. Ans.}$$

If reeling requires 42.78 minutes per fly, the number of flies per day may be found by dividing the number of minutes per working day by the number of minutes required per reel fly. Thus, in a 10-hour day there are $10\times60=600$ minutes. If one reel fly requires 42.78 minutes, the number of flies per

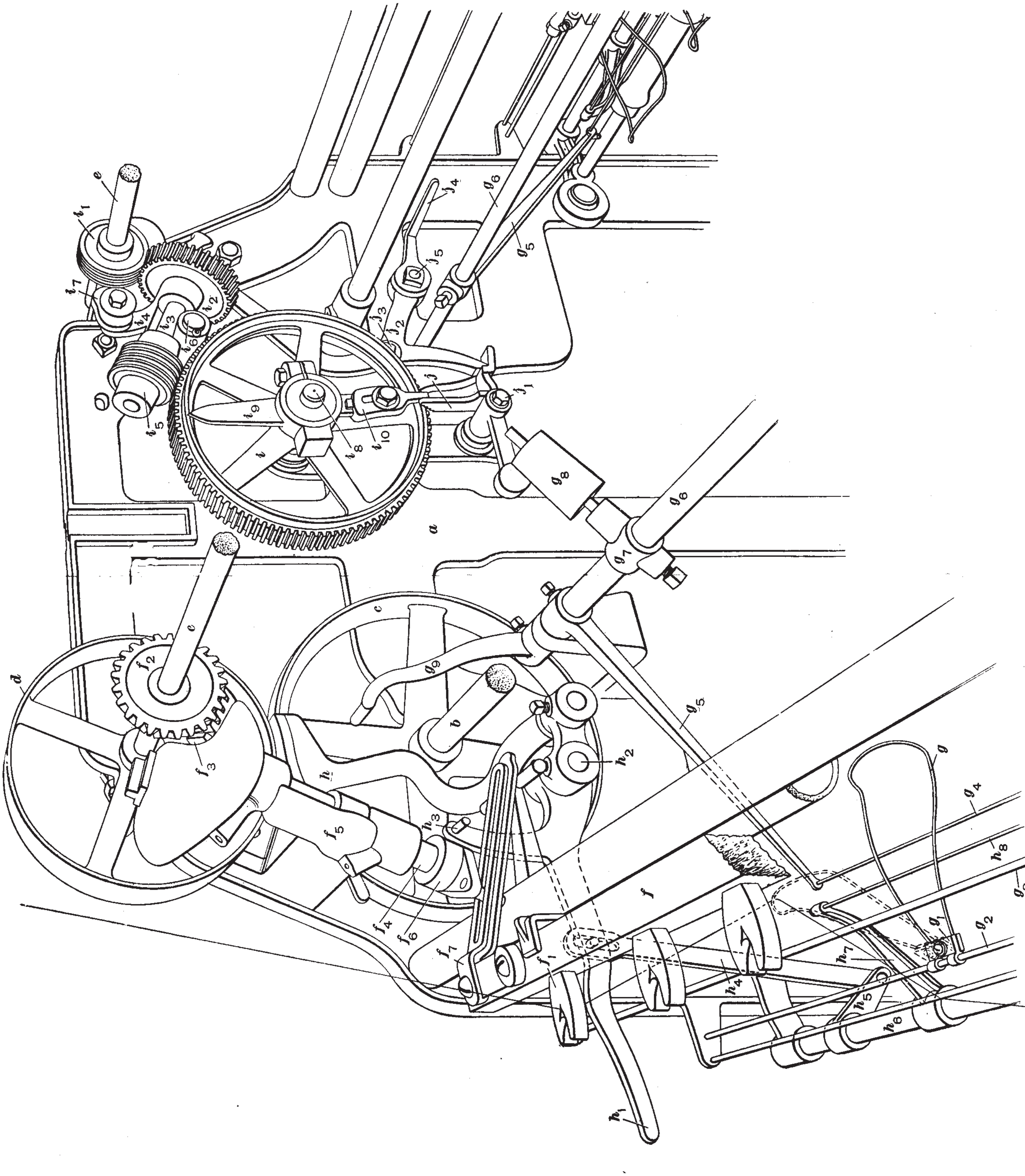


FIG. 7

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day will be $600 \div 42.78 = 14$, practically. It may be added that the allowance for stoppage for daily production may be greater than 15 per cent., as reel flies may not always be available to replace those removed from the machine; also, the time required for inserting lacing strings may vary according to the skill of the operative.

VARIATIONS IN CONSTRUCTION

30. Traverse Motion.—Although the reels used in silk-throwing mills are similar in general construction, their details are often different. The type of reel just described is employed to a large extent; but the reel that is now to be described is also used by a large number of throwsters. As both reels have many parts alike, it will be unnecessary to repeat descriptions of those details here, but rather to deal with the variations in construction. A reel having certain differences in details is shown in Fig. 7. The endstand a supports the main driving shaft b, on which is the pulley c that imparts motion to the pulley d by frictional contact. The pulley d is fastened to the reel fly shaft e, of which only a part is shown. The wooden traverse bar f supports the porcelain guides f_1 and receives motion from the fly shaft. On the reel fly shaft e is a bevel gear f_2 that meshes with a larger bevel gear f_3 mounted on a shaft f_4 that extends downwards through the hanger f_5. The hanger is bolted to the end stand and contains oil holes through which the shaft bearings are lubricated. Fastened to the lower end of the shaft f_4 is a crank f_6, at the end of which is a pin that fits in the slot in the casting f_7. This casting is screwed to the traverse bar, and the turning of the shaft f_4 thus imparts a reciprocating motion to the traverse bar.

31. Whenever the number of diamonds in the skein must be altered, it is necessary to change the number of throws per minute of the traverse bar, which is done by substituting gears of different sizes for the bevel gears f_2 and f_3, Fig. 7. These gears perform the same functions as the spur gears

f_2 and f_3, Fig. 2, and all previous explanations pertaining to the combinations required to obtain the various crossings in the skeins may be applied to this reel.

It may be added, however, that as the fly shaft may move slightly to one side, or as, because of the wear resulting from continuous use, the gears may become improperly meshed, it is well to observe closely the meshing of the gears. Should the bevel gears be somewhat out of mesh they will wear much more rapidly. They may be readjusted by loosening the setscrews holding them and bringing them together until they are in the correct relation.

32. Stop-Motion.—The stop-motion that stops the reel fly when an end breaks, on the reel shown in Fig. 7, is different from the stop-motion in Fig. 2. The drop wire g, Fig. 7, is a large loop of wire that is firmly held in a bracket g_1 supported on a rod g_2 held in brackets attached to the end stands. The dotted lines indicate the position of the drop wire when the thread is intact, passing from the bobbin upwards through the drop wire and porcelain guide. In this position the drop wire is in contact with the front rest g_3, whereas, should the end break, the drop wire will assume the position shown by solid lines, in which case it will rest on the heavy wire g_4 supported by two arms g_5 that are fastened to the shaft g_6. This shaft is supported by hangers attached to the end stands and carries an arm g_7 on which is an adjustable counterweight g_8 that may be set to balance the weight of the wire g_4. At the end of the shaft g_6 is an arm g_9 that, when swung forwards, strikes the brake h and brings the reel fly to a stop.

33. When an end breaks and the reel fly stops, the tension is removed from the threads passing to the fly and all the drop wires fall backwards to the position indicated by solid lines in Fig. 7. After the end from the bobbin has been passed upwards through the drop wire and tied to the end on the fly, the fly is started in the following manner: The handle h_1 is raised, and as it is pivoted at h_2, the pin h_3 attached to its upper branch will strike the brake h and force the brake shoe from under the pulley d, thus allowing the latter to come in contact with the revolving driving pulley c. In starting the fly a certain amount of strain is placed on the threads, because each end must lift its drop wire into the running position. To relieve the strain and to aid in bringing the drop wires to their normal position, the handle h_1 carries a pin that engages with a slot in one end of the bar h_4. The other end of the bar is pinned to an arm h_5 attached to the shaft h_6, on which are two arms like h_7 that support a wire h_8.

34. When the machine is running or at rest the wire h_8, Fig. 7, is in the position shown. As a drop wire falls backwards, due to a broken end, it first comes in contact with the wire g_4, which is depressed, causing the fly to stop, as already described. The remaining drop wires then fall backwards and strike the wire h_8, since the wire g_4 has been depressed. In starting the fly, the starting handle h_1 is raised, pulling the bar h_4 upwards and causing the shaft h_6 to turn, thus swinging the arm h_7 and the wire h_8 upwards. This movement raises all the drop wires resting against the wire h_8, and at the same time the pin h_3 forces the brake h from under the pulley d and starts the fly. After the fly is in motion, the handle h_1 is returned to the position shown, and the wire h_8 simultaneously returns to its normal position. The wire g_4 is above the wire h_8, so that it may intercept a falling drop wire.

35. Counting Wheel.—The yardage clock, or counting wheel, shown at i, Fig. 7, is driven from the fly shaft e. The worm i_1 on the fly shaft, meshes with a worm-gear i_2 on one end of a short shaft i_3 carried by the hanger i_4. The other end of the shaft i_3 carries a worm i_5 that meshes with the counting wheel i. Thus, when the reel is in operation, motion is transmitted through the worms and worm-gears from the shaft e to the counting wheel. The hanger i_4 that carries the shaft i_3 is mounted on a pin i_6 fastened to the end stand. At its upper side it is formed into a curved arm to which is bolted an adjustable steel plate i_7 that rests against the fly shaft e. The purpose of this arm and its attached plate is to prevent the worm i_5 from being accidentally thrown out of mesh with the counting wheel i when only a part of the required yardage has been reeled. So long as the reel fly is in position, its shaft *e* will be in contact with the plate i_7 and the hanger i_4 will be prevented from swinging on its pin. But, as soon as the reel fly and its shaft are removed, the bracket i_4 will be swung on its pin i_6 by the weight of the worm-gear i_2 and the worm i_5 will be disengaged from the counting wheel.

36. The counting wheel *i*, Fig. 7, has 100 teeth, groups of ten being marked by numbers stamped on a narrow rim. The hub is threaded and is screwed on the threaded stud i_8 attached to the end stand, and so the wheel moves farther away from the end stand at each revolution. Clamped to the hub is the pointer i_9, the end of which is opposite the narrow rim on which the numbers of teeth are stamped. Opposite the pointer is an extension to which is bolted the knock-off finger i_{10}. The extension is graduated, so that the knock-off finger may be set accurately to strike the latch *j* when the desired yardage has been reeled. The latch consists of three arms cast in one piece with a hub that fits on the pin j_1 fastened to the end stand. The latch has the position shown when the reel is in operation. Its vertical arm is formed into a series of steps. One horizontal arm forms a counterbalance and the other carries a shoulder against which the end of the lever j_2 bears. This lever is often called the *signal*, because the operative may determine, by noting its position, whether the stoppage of the reel has been caused by a broken end or by the reeling of the required yardage. It is pivoted on a stud j_3 and its outer end j_4 is adjustable by means of the bolt j_5. The counting wheel is so set that, when the required yardage is reeled, the knock-off finger i_{10} carried by the wheel will strike the vertical arm of the latch *j*. The latch will turn on its stud and release the signal j_2, which will allow the arm j_4 to fall down against the arm g_5 and so turn the shaft g_6. As may be seen at the left, turning of the shaft g_6 swings the arm g_9 against the brake *h* and stops the reel fly.

37. Setting Counting Wheel.—The counting wheel *i*, Fig. 7, contains 100 teeth, and when a reel fly 44 inches in circumference is used, the wheel moves one tooth for every

50 yards wound on the fly. Therefore, one complete revolution of the wheel represents the winding of 5,000 yards of silk on the fly. When it is desired to reel skeins of 5,000 yards or a multiple thereof, the pointer i_9 is first set at zero, which is done by loosening the clamp, turning the tip of the pointer to the zero mark on the rim, and then tightening the bolt of the clamp. Next, the knock-off finger i_{10} is adjusted. On one side of the extension holding the knock-off finger are four graduations numbered 1, 2, 3, and 4, reading inwards from the rim of the gear toward the hub. These marks indicate correct positions of the knock-off finger for reeling 5,000, 10,000 15,000, and 20,000 yards, respectively. Suppose that 15,000 yards is to be reeled. With the pointer set at zero on the rim, the knock-off finger is adjusted to the third mark, corresponding to 15,000 yards. The signal is then raised until its vertical arm rests against the shoulder on the horizontal arm of the latch j. The counting wheel must next be turned, or run back, until the lug on the wheel strikes a lug on the end stand. Then the fly may be replaced and set in motion. As the counting wheel revolves once, the knock-off finger will clear the first step of the latch, and a similar result will occur at the second revolution; but at the third revolution, corresponding to the reeling of 15,000 yards, the knock-off finger will strike the latch and stop the fly, as previously described.

38. If the yardage to be reeled is not an exact multiple of 5,000 yards, certain additional steps are required in setting the counting wheel, Fig. 7. Suppose for example that the length of skeins to be reeled is 18,500 yards. It is seen at once that this is 3,500 yards greater than 15,000 yards, because $18,500 - 15,000 = 3,500$. To reel 15,000 yards, the counting wheel is set as previously described; but, to account for the additional 3,500 yards, it is necessary to move the pointer so as to allow $3,500 \div 50 = 70$ teeth more to pass the latch, because a movement of one tooth of the counting wheel corresponds to 50 yards on the fly. So, after the wheel has been set for 15,000 yards, in the manner already described, the pointer is loosened and moved around to the 70 mark on the rim, and the clamp is then tightened. The knock-off finger will then trip the latch when 18,500 yards have been reeled. It is important that the pointer be firmly held to the hub, so that no slippage may occur.

39. Other Types of Reels.—The reels that have been described are those most frequently found in silk-throwing mills, but other types differing slightly in design are sometimes employed. Among these may be found the reel in which the supply bobbins are above the reel fly. In this case the reel fly is somewhat lower than on the reels previously described, and the traverse bar is located above it. The thread in passing from the supply bobbins is led upwards over a bar, and then down toward the fly, on which it is guided by the traverse bar. The advantage of this type of reel is that the operative may tend it with less strain than on the ordinary type, as it is unnecessary to stoop over to tie ends. For this reason, it is claimed, operatives work more efficiently and produce better work.

40. Another type of machine that may be classed as a reel, but that is a twisting frame and a reel combined, is commonly known as a *reel mill*. At one time it was employed to a considerable extent but gradually declined in popularity. However, it is still being built and is sometimes employed for twisting heavy artificial silks and tram. It consists of the essential parts of both the twister and the reel. The lower part has two rows of belt-driven spindles identical with those on an ordinary twister. Instead of take-up rolls, however, two reel flies are placed above the spindles, the lower fly taking up the thread from the spindles on one side of the frame, and the upper fly that from the spindles on the opposite side. The thread from the bobbins on the spindles is guided on the reel fly by the motion given to the traverse bar.

41. The reel mill has a vertical drive shaft from which motion is imparted to the spindles and the reel flies. The combination of gears is such as to cause the fly to take up the silk at the proper speed, so that the required twist will be inserted in the thread. Change gears are used and may easily be altered in order to alter the twist. Each reel fly has a counting wheel that stops it when the required yardage has been wound.

Probably the most important reason for the growing decline in the use of the reel mill is that operatives on this machine must be very skilful. For example, when an end breaks, the operative must find the end on the bobbin and also on the reel fly and tie them together while the fly is in motion. This rapid tying of ends is necessary; for, should the reel fly be stopped when an end breaks, the ends that are intact would be twisted very tightly, which is undesirable. Moreover, should one or several ends break, and the operative fail to observe the fault, the yardage in some skeins would be less than in the remaining skeins, and it would be impossible to obtain so nearly uniform a yardage as with reels equipped with stop-motions. The reel mill usually has 12 spindles on each side, making a total of 24 spindles. The lower reel fly takes up from the spindles in one side and the other reel fly from the spindles on the opposite side.

CARE AND MANAGEMENT OF REELS

42. Importance of Careful Reeling.—The process of reeling is very important in the throwing mill, and so it should be performed by operatives that are thoroughly competent. Carelessness in performing this operation reduces the quality of the product and thus offsets all the care that may have been taken in preceding departments. Even though the thrown yarn is clean, uniformly twisted, and so on, if it is carelessly reeled, so that it unwinds poorly in a following operation it is judged as being of poor quality. Therefore, since the quality of the product can be materially increased or decreased in reeling, this operation should be performed by skilful reelers working under careful supervision, in order that the standards of the mill may be upheld.

43. Details of Operation.—The first duty in preparing the reel for operation is to adjust the counting wheel and set the yardage clock as previously described. The reel fly is then lifted into position in the reel and inspected to see that the collapsible arm is securely fastened. The bobbins containing the silk are placed on the bobbin shelf and the silk is pulled upwards over the head of each bobbin. If the silk as received in the reeling department is wound on iron-head steaming shafts, a reel cap, or bobbin cap as it is also called, should be put on the bobbin on the bobbin shelf. A reel cap is a smooth circular iron casting of slightly larger diameter than the head of the bobbin. When in place it extends approximately $\frac{1}{2}$ inch beyond the edge of the bobbin head and prevents the thread from being damaged by contact with a scratched bobbin head. It is not used when the silk is received on fiber-head bobbins. This is true with the bobbin used on the combination machine, as it has one fiber head that is kept absolutely smooth.

44. The bobbin shelf a_1, Fig. 2, is adjustable upwards and downwards. Its construction varies according to the type of bobbin that is employed. The reels illustrated are equipped for reeling the silk from combination-machine bobbins, or from ordinary fiber-head second-time spinner bobbins, which have holes through their centers. So, it is necessary to drive a number of wires or spindles into the shelf to hold the bobbins in position. When reeling from iron-head steaming shafts, the shelf is drilled with small holes to receive the gudgeons that extend from the heads. The holes are 4 inches apart which is the proper spacing when it is desired to place twelve skeins on a reel fly. In passing upwards from the bobbin the thread is guided over porcelain rollers to obtain the desired tension. When a light tension is required, the thread passes from the bobbin around the back and top of the rear roller, then down under the front roller and upwards toward the fly, as illustrated. If greater tension is required, the thread is led upwards over the front roller, down and beneath the back roller, up over the top of the back roller, thence down under the front roller and up to the reel fly. When viewed from the end of the machine, the course of the thread around the rollers would resemble a figure 8 laid on its side.

45. The ends are tied to one arm of the reel fly with loose knots, and each is deposited in the guide attached to the traverse bar. After all ends have been prepared in this manner, the reel fly may be started by lifting the starting handle. While raising the starting handle, operatives frequently grasp the fly and move it briskly in the direction it is to rotate. By thus starting the reel fly wear on the fiber-faced driving pulley is reduced. After the reel fly is in motion, it should continue to run until the required yardage has been wound on it, or until it is stopped because of a broken end or a bobbin that runs out and must be replaced. When the fly stops, the reason should be promptly discovered and the fault remedied. Broken ends should be quickly tied, which is usually accomplished as follows: The supply bobbin is lifted from the shelf and the broken end is found in the usual manner. Several yards of silk are pulled from the bobbin to assure the removal of the defective thread. If this is not done, the end is likely to break immediately after the fly is started. When the end on the bobbin has been found, a small bunch of silk is made by wrapping it around the fingers, in order to pass it around the rollers and through the drop wire more easily. for it is a great deal easier to grasp a bunch of silk between the fingers than it is to grasp a single end. When the end has been wrapped properly around the procelain rollers and passed through the drop wire, the broken end in the skein is next found.

46. Finding the broken end in the skein is very easy and is not unlike finding the end on a bobbin. Because of the crossings, the thread has no opportunity to pull down into the skein and cause excessive waste in finding the end. The end, generally, will be found to be hanging loose from the skein, and to it the end from the bobbin is tied. Sometimes the end adheres to the skein; but it may be found by brushing the skein with a moistened finger, in the direction in which it was running. When the end is found, it should be tied to the end from the bobbin and the reel fly started in the usual way. After the required yardage has been wound and the yardage clock stops the reel fly, the skeins are prepared so that the fly may be removed and sent to the succeeding department where the final operations are completed. The inside end of the skein that is tied to the fly arm is broken and drawn toward the edge of the skein. The end from the bobbin, on the outside of the skein, is drawn toward the same edge and both ends are crossed and looped around the entire skein or else through one diamond, after which they are tied in a knot. This operation of looping and tying the ends of the skein is known as *banding off*. When a skein is properly banded off, the ends may be found very easily in a later operation. Although this method of banding off is commonly used, variations are often found; however, it is best to adopt one method and band off in exactly the same manner all thrown silks leaving the throwing mill.

47. Sometimes, when reeling heavy silks, especially artificial silk in corded effects, the wiry nature of the thread causes it to unwind from the bobbin very rapidly, thus tending to balloon and strike the ends from adjoining bobbins. In that case the breakage of ends is likely to be great, and to prevent it, many throwsters equip their reels in a special manner. A very thin piece of wood or heavy cardboard about 6 inches wide and of the correct length is cut to fit between the bobbin shelf and the rods holding the porcelain rollers. This is then tied, or otherwise secured in an upright position, so that it acts as a shield and prevents the thread of one bobbin from striking other threads.

48. Length of Skeins.—The length of the skeins wound on the fly is usually specified by the customer, especially when the yarn is of the novelty class and not considered a staple thrown silk. Specifications are not always given when staple thrown yarns are produced, and the throwster reels the silk into skeins of the proper size for that type of thread. In order to give a certain uniformity of skein lengths, this contingency is covered in Article VI of the Rules and Regulations

Governing Commission Throwing of Silk in the United States of America, approved by the Silk Association of America, which reads as follows:

"In the absence of any stated length of skeins, the following will apply.

2-thread organzine	20,000 yards
3-thread organzine	10,000 yards
2-thread tram	15,000 yards
3-thread tram	10,000 yards
4-thread tram	7,500 yards
5-thread tram	5,000 yards

"The above lengths will apply on thrown silk made from 13/15 and/or 14/16 denier, European, Japan, Canton, and China Filatures silks only. On all other grades of thrown silk delivered in skeins, the length is optional with the throwster unless stipulated in contract."

49. Poorly Reeled Skeins.—Of the various defects that are most frequently produced in silk reeling, poorly reeled skeins may be considered first. This term includes all skeins that are badly reeled, whatever the cause. When such skeins are later placed on swifts in order to unwind the yarn and prepare it for subsequent operations, the thread usually unwinds very poorly, becomes snarled, and breaks frequently. A large part of this trouble is avoided if the skeins are reeled with a good clean diamond having clear crossings.

Poorly reeled skeins may be traced to worn parts of the machine or to the carelessness of operatives. The gears that drive the traverse bar may become worn, or the pin in the slotted casting attached to the traverse bar may wear and thus develop an extraordinary amount of lost motion. Either condition decreases the ability of the reel to produce clearly crossed skeins. The bearings of the fly shaft may become worn excessively and allow the fly to slap back and forth, resulting in poorly wound skeins.

It also happens, at times, that after a broken end has been tied and the fly is started in motion, the operative fails to drop the end in its guide on the traverse bar. The thread then will not be given a back-and-forth motion but will wind on the skein in practically one place, and produce in the skein a section devoid of any crossing. Should the silk be unwound from a swift on a winding frame in a future operation, difficulties are sure to arise when an end breaks in the section of the skein that has no crossings.

50. Improper tension on the thread will also cause the formation of a poor skein. It is usual to have as little tension as is consistent with good work. When the tension is too light, however, the skeins are likely to be loose, and then they tangle easily. Conversely, if the tension is too great, the edges of the skein will be very hard and tight and the silk from the upper layers will tend to push or squeeze the silk outwards from the lower layers. When a skein of this type is removed from the reel it does not hang straight but is somewhat bulged, from which it receives the term *baggy skein*. The tension on the thread depends on the number of times the thread is wrapped around the porcelain rollers.

It sometimes happens, when tying ends, that the thread is placed in the wrong guide, and consequently the silk is wound on the wrong skein. When this is discovered, the ends should be broken and the faulty skeins reeled again. When this is not done, but the thread is dropped into the correct guide and the reeling continued until the fly stops, threads from one skein will be wound with threads from another skein, producing the defect known as *crossed ends*. When such skeins are removed from the fly, the ends will be broken, and consequently in later operations, an increased number of delays are inevitable.

51. Short Skeins.—Short skeins are produced when either the yardage clock is improperly set or the stop-motion fails to operate when an end breaks. When setting the yardage clock, it is very important that the counting wheel be returned to its starting position. It should be turned until the operative is positive that the lug on the back of the wheel is in contact with the block bolted to the end stand. After the gear has been turned to this position, the worm may be engaged with the counting wheel. Moreover, great care should be taken that all parts of the knock-off mechanism are tight and that no obstructions of any kind are present to disengage the worm from the counting wheel.

When short skeins are caused by the failure of the stop-motion to act, it will be necessary to inspect the working of each drop wire. It sometimes happens that the brackets holding the wires become jammed so that the wire fails to fall backwards; or, the wire may become bent, so that it is held upright and cannot fall. Any such fault should be discovered and promptly eliminated. The dogs on the shaft g_7, Fig. 2, sometimes become loose and fail to make good contact with the drop-wire bracket on the rod h_3 consequently the latter is not pushed far enough to one side to allow the starting handle to fall. In like manner, the weight g_8, Fig. 7, may be improperly adjusted, preventing the drop wire from tripping the rod g_4 and causing the reel to stop. Periodical inspection of all parts of the reel will aid in reducing defects in skeins.

52. Bruised Ends.—Very often the reel caps used in reeling from iron-head steaming shafts are scratched or nicked, and catch or break the silk as it passes up toward the fly. When such caps are discovered, they should be laid aside and polished at an opportune time. Smoothing and polishing may be done by placing the cap in a lathe or on a spindle on an ordinary spinning frame. While it is revolving at high speed, a fine abrasive is applied until the cap is smooth and free from any rough places that may catch the thread.

In addition to the reel caps, the drop wires and traverse guides should be carefully examined. Should they be cut, they are likely to scratch and bruise the silk causing a defect similar to that caused by a rough reel cap. It is a very difficult problem, at times, to locate the source of scratched silk. That defect is difficult to discover in the throwing mill, but is readily seen after the gum is removed from the silk. For example, when reeling 2-thread organzine, one of the two threads is sometimes slightly bruised but does not break, while the remaining end is uninjured. This, of course, is unnoticed when the thrown silk is inspected in the throwing mill; but when it is being warped or woven in the weaving mill, or passes through the needles of the knitting machine, or through any other operation in which the thread is subjected to friction, the defect is soon found. In each case, the friction on the thread as it passes through the machine breaks the bruised end and pushes it along the intact single and results in the formation of lumps. If the thread does not break, it will be necessary to break the end, remove the lump and tie the thread. Ends that break in this manner are referred to as *split ends*.

53. Adjustments.—There are very few adjustments to be made on a reeling frame; for, after it is set up and in operation changes are seldom made. At times, however, it may be necessary to alter the traverse so that a different number of diamonds will appear in the skein, which is done by changing the gear on the fly shaft and the gear it drives. The slotted casting on the traverse bar and the crankpin that meshes with it should be occasionally examined. If found to be worn so as to allow a large amount of lost motion, these parts should be replaced with new ones. Skeins with poor and indistinct diamonds may sometimes be traced to lost motion in these parts which allows the traverse bar to move a greater distance.

The drop wires should be examined from time to time and carefully tested to see that they fall backwards when an end breaks. Moreover, it should be observed that the wire is not bent; otherwise, the loop of the drop wire will come in contact with a part of the reel and remain upright even after the end has broken.

It may be necessary, from time to time, to re-adjust the reel fly bearings after the reel has been in use for some time. This is easily done, all that is necessary being to loosen the bolt holding the bearing, raise the bearing until it is in the correct position and then tighten the bolt.

54. Oiling of Reel.—Like any other machine that operates at high speed, the reel requires periodical oiling in order to give satisfactory service. Only a few parts require oiling since the number of bearings is very small. The reel-fly bearings should always have an adequate supply of oil in order that they will not wear rapidly. Similarly, the slotted casting on the traverse bar and the pin engaging with it should be well lubricated, because these parts are subjected to considerable wear. The remaining parts of the reel, while not as important as those mentioned, should be oiled frequently in order that the number of worn parts will be reduced and the length of service increased.

55. Size, Speed, and Power.—Of the various reels that are employed in a silk throwing mill, the dimensions of a common type may be given as follows: Length, 5 feet 7 inches; width, 3 feet 8 inches; and height, 4 feet. These are the dimensions for a reel containing two flies, and the entire unit is known as a section; hence, it would also be referred to as a 1-section reel. Reels are built with different numbers of sections, as 2, 3, or 4; these would have 4, 6, or 8 flies respectively. The width and height of the reel would be the same but the length would vary, a 2-section reel measuring about 10 feet 9 inches; or 3-section reel about 15 feet 11 inches, and a 4-section reel about 21 feet.

The speed of a reel is usually expressed by the number of revolutions per minute of the reel fly. This, of course, is variable and depends on the conditions under which the reel is operated and on the design of the reel. The range of speeds at which the fly is operated is from 300 to 500 revolutions per minute, while the average speeds are from 400 to 480 revolutions per minute. When the speed is too great, there is a tendency to produce too many broken ends. By decreasing the speed the breaks are reduced and the thread is reeled more smoothly.

The power required to drive the reel is greater at high speeds than at moderate speeds. At a speed of about 450 revolutions per minute, it will be necessary to allow about $\frac{1}{4}$ horsepower for each reel fly; thus, a 4-section reel having eight flies would require about 2 horsepower.

SETTING TWIST

56. Method of Setting Twist.—In the sequence of operations followed in the manufacture of tram and organzine, the twist is usually set in the thread while it is on the reel fly. The twist is set so that, after the skein is removed from the reel fly and the tension is removed, the thread will not kink or curl but will remain straight. In this operation the silk is usually subjected to a steam bath. The silk becomes damp because of the moisture in the steam, and the heat of the steam, in conjunction with the moisture, causes it to be softened. After steaming for a short time, the silk is removed from the bath and allowed to dry. Naturally, since the silk is heated, it will dry very rapidly. In drying, the silk is held taut by the reel fly and the twist is set in the thread so that there is no subsequent tendency to kink.

57. Steam Box.—The compartment in which the silk is steamed is usually a large wooden box built comparatively steam-tight. The inside of the box is sometimes lined with heavily galvanized iron; however, this is not necessary, as the tongued-and-grooved boards usually employed in building it furnish a tight compartment. One side of the steam box is fitted with a door, through which the flies may be readily placed and removed. The door has a catch so that it may be securely closed when desired. The inside of the steam box is fitted with supports fastened to opposite sides. The supports have small notches cut in them so that when the flies are entered in the box horizontally, they will be spaced without touching. A number of supports are provided so that several tiers of flies may be entered in the box at one time. When a small steam box is used,it is sometimes constructed with several horizontal brackets that are fastened to the rear of the box and extend toward the front. These brackets are located near the top of the box and are arranged so the shafts of the reel flies may pass between them. Then, when the flies are entered in the box vertically, the pulleys at the ends of the shafts will rest on the brackets and the flies will be suspended in this position. A steam pipe fitted with a shut-off valve on the outside of the box allows the steam to be readily turned off or on as desired.

58. In operation, the reel flies containing the silk are placed in the steam box, the door is closed, and the steam is turned on. The silk is allowed to remain in the box until it is thoroughly steamed, the time required depending on several conditions. For instance, the size of the skein has an effect on the time, as a large heavy skein will not be steamed as quickly as a small, light skein. Again, the number of turns of twist in the thread must be considered, as the penetration of steam in a soft twisted thread will be more rapid than in a thread that is hard twisted. The steam pressure would also be taken into account if the steam box were capable of withstanding high pressures; but if the box is constructed of wood, only low pressures are employed.

In view of the preceding conditions, it may be said that the period of steaming ordinary tram silks should range from 15 seconds to 1 minute. This should be sufficient for a loose twisted yarn like tram. Organzine, on the other hand, is twisted harder, and requires longer steaming. Moreover, as the thread is twisted in the single, penetration by the steam will be more difficult. For this reason, organzine is steamed from 30 seconds to 4 minutes depending on the conditions previously explained. When steaming organzine on bobbins, the silk should be steamed from 2 to 10 minutes. Crêpes and hard twists, while they are steamed, are treated in a different manner, as will be explained later.

LACING EQUIPMENT AND METHODS

59. Purpose of Lacing.—After the thread has been reeled into skeins and steamed, as previously described, strings or cords must be passed through the diamonds in the skeins, in a definite manner, before the skeins are removed from the fly. This operation is known as lacing, and its object is to hold the skeins and prevent the derangement and entanglement of the ends in processes through which the silk may pass while in skein form. It permits the skein to be unfolded and easily placed on a swift and properly spread out in a following operation in which the silk is again wound on a bobbin. When the skein is properly laced, it may be pulled apart and treated with surprising roughness, after which it may be beaten out by the operative and will assume its original shape.

60. Reel Stand.—After the reel fly containing the silk has been removed from the steaming box, it is placed in a suitable support that holds it while the lacing strings are inserted in the skeins. The support is known as a *reel stand*, *stripping buck*, or *stripping horse*. A part of a double stripping buck is shown in Fig. 8. The center support a is firmly screwed

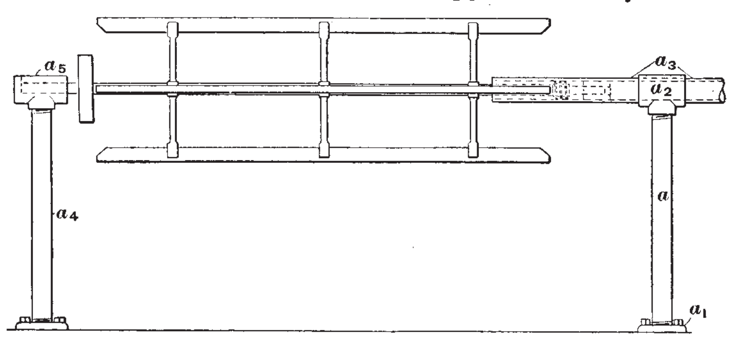

FIG. 8

into a flange a_1, bolted to the floor and at its upper end carries a tee a_2 into which are screwed two lengths of iron pipe a_3 that extend about 22 inches on each side of the support. Another support a_4 carries a special cast-iron cap a_5 that is open at the top and the inner end, so as to permit the shaft of the reel fly to be dropped into it and removed from it in the same manner as with the detachable bearing on the reel. The other portion of the stand is like that just described, but is located on the opposite side of the center support a. It holds a second reel fly. Thus, the center support serves to hold one end of each fly shaft. The single stripping buck consists of two uprights, one like a_4 while the other is like a excepting that an elbow is used instead of the tee a_2. One section of pipe

a_3 is fitted into the elbow, permitting the end of the reel fly shaft to be placed therein. The uprights are placed at such a distance from each other as to support the shaft of one reel fly.

When the shaft of the reel fly is to be placed in the stand, the end carrying the worm that drives the yardage clock is pushed into the open end of the pipe a_3 far enough to allow the end supporting the pulley to drop into the bearing in the cap a_5. The fly may then be revolved in either direction.

61. Lacing Operation.—The reel fly in place in the stripping buck is turned until a part of the skein between two arms is horizontal, or, preferably, slightly inclined toward the lacer, who is the operative that performs the lacing operation. The lacer usually carries a bunch of lacing strings across one shoulder, from which each string may conveniently be drawn as it is needed. In performing the lacing operation, the lacer takes a string, lays it across the top of the skein parallel to the fly shaft, passes one hand underneath the skein, grasps the lower end of the string, and draws both ends to the left until the parts above and below the skein are of equal lengths. The loop at the middle of the string will then be against the right-hand edge of the skein. The width of the skein is divided into four or five parts and the lacing is begun at the first division, or opening, nearest the right-hand edge. The lacer pushes a forefinger down through that opening, grasps the under end of the string, and pulls it up through the skein, and next pushes the upper end of the string down through the same opening. Thus the two parts of the string cross in the first opening. At the next opening the operation is repeated. The end of string that is beneath is drawn up through the second opening and the end above is pushed down through it. The same operation is performed at the third opening, and so on until the other edge of the skein is reached, at which point the free ends of the string are tied in a knot. The lacing string thus forms a continuous series of figure 8's from one edge of the skein to the other, because each half of the string is alternately above and below the sections of skein separated by the diamond-shaped openings.

62. The lacer usually works from both sides of the skein; that is, one hand threads the string from the inside toward the outside, while the other hand works from the outside toward the inside. Lacing in this manner is considered better practice than using the hands alternately, first on the outside and then on the inside, as in the latter case, some time is lost in changing the position of the hands each time the string is drawn through an opening. The string should be drawn through the openings with a wrist movement. Many lacers move the entire arm from the shoulder, but this is more tiresome and not quite so fast.

Frequently, after lacing rapidly for a considerable time, the lacer's fingers become sore because of the friction in passing through the skein. This is particularly the case in lacing skeins with close diamonds, as the openings are small. To make lacing easier when skeins are reeled in this manner, the catch arm of the reel fly is lowered so as to release the collapsible arm, which reduces the tautness of the skeins and allows the lacer to work with greater freedom; however, the collapsible arm should not be lowered too far as this would cause the skeins to lose all their tension and become tangled very easily.

63. The lacer usually works from one end of the fly to the other; that is, after one lace is placed in the first skein, a lace is placed in the second skein, and so on until all the skeins on one side are laced. The fly is then given a quarter-turn, if it is a 4-arm fly, and the new side is laced in the same way as the first. After this is completed, the third side is laced, and finally the fourth. Thus, when a 4-arm fly is employed, four lacing strings are usually placed in each skein. A 6-arm fly divides the skeins into six parts, but it is more convenient to insert only three laces, which are inserted in alternate spaces between the arms.

Skeins are commonly laced in such a way that the width of the skein is divided into five equal parts. Skeins that are divided in this manner hold their shape better and do not tangle so readily as skeins that are laced in fewer openings. Sometimes, however, the throwster is given special instructions as to the number of divisions to make in the width of the skein. Organzine is sometimes laced in seven parts; that is, the lacing string is placed through six diamonds in the skein. Tram is usually laced like organzine, although special orders may direct otherwise. For instance, some manufacturers desire 6-thread tram and higher to be laced in five parts in the following manner: The lacing string is passed through the first and second diamonds from one edge, then two or more center diamonds are skipped, and the lace is again passed through the two diamonds near the opposite edge. When lacing is done in this manner, the edges of the skein at the point of lacing are firm and the center of the skein is loose. Hosiery tram and tussah tram are often laced in this manner.

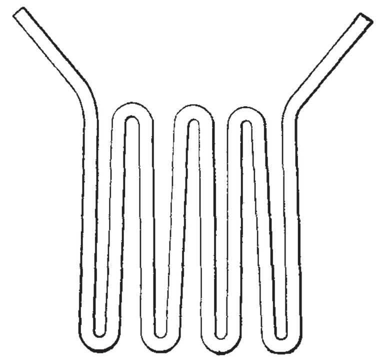

Fig. 9

64. Lacing Comb.—Sometimes, when the lacer's fingers become sore because of tight skeins, or if the diamonds are indistinct, a lacing comb is employed to facilitate the lacing operation. A common type of lacing comb is illustrated in Fig. 9. It consists of a heavy, smooth steel wire bent to form coarse teeth, as shown. There are usually four teeth in such a comb, so that when it is inserted in the skein it separates the skein into five parts. Lacing with the aid of a comb is accomplished as follows: The teeth of the comb are inserted through the diamonds from the upper side of the skein, and the comb is worked up and down through the skein several times to enlarge the diamonds. With the comb still in position the lacing strings are inserted, and after the string has been knotted the comb is removed. Lacing with the aid of a comb produces a better grade of lacing than that done with the fingers only. But less time is required to produce an efficient lacer without the use of the comb than with it.

65. Lacing Needle.—A lacing needle may be used with a lacing comb or when the lacer's fingers are sore. One type is illustrated in Fig. 10, in which (*a*) is a top view and (*b*) is a side view. The lacing needle is made of smooth steel wire, with one end formed into a small knob and bent somewhat like a large, very coarse, right-hand screw thread with about three-fourths of a turn. The other end of the needle is flattened and contains an eye to receive the lacing string. The lacing string is put through the eye and the point of the needle is inserted in the first diamond that has been enlarged by the lacing comb. The needle is then given a right-hand twist and at the same time it is pushed toward the opposite edge of the skein, so that the point is caused to pass upwards through the second opening. By repeating this operation the needle passes through the proper openings made by the comb

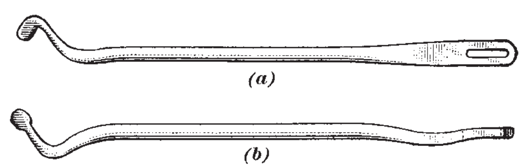

FIG. 10

until the skein is laced once across. The direction of the needle is then reversed and moved through the openings as described, returning to the starting point. Thus one lacing string is inserted in the skein. Great care should be taken, when lacing with a needle, to see that all the silk is under the needle at all times. If a quantity of silk is not included in the lacing but lies outside the string, it may be easily tangled or broken.

In finished lacing the two parts of the string should lie side by side across the skein, or in parallel planes. They should not be twisted around each other in the diamond shaped openings. Sometimes the parts of the string are twisted producing what is referred to as *crossed lacing*. A skein that has the lacing strings free and not crossed, so that they may be drawn apart, is referred to as containing *open lacings*. Open lacings are desirable because they allow the skein to spread out more easily

66. Lacing String.—The lacing string, also known as a *lacing cord*, or merely *lacing cotton*, is usually made of cotton, although spun silk is used at times. The string used is usually a 3/20s or 3/24s cotton yarn twisted loosely, but with enough turns to give the required strength. The object of loose twisting is to prevent the yarn from forming into kinks or snarl either after the lacing is completed or during the boiling off or dyeing operation. A kinky lacing string is difficult to remove from the skein at a later operation.

Lacing string is usually delivered to the throwster in the form of a ball from which the strings are cut to correct length. The string should be long enough to pass through the skein and after the knot is tied at the end, the loop should be large enough to allow the skein to spread out without cramping. Strings that are too short should be avoided as they cramp the skein and prevent the dye liquor from circulating as readily as in one that is laced with strings of the proper length. Strings that are too long are a disadvantage, for they often become entangled with the threads in the skein or in other skeins. A good length is 16 inches, which will allow the skein to spread properly after the knot is tied.

When skeins are laced with spun silk, the cost of reeling is naturally increased but silk laces are used only, in special cases, as when reeling a grenadine twist, which is a high-twist organ. In this instance the rough cotton lace is likely to catch in the thread. Spun silk is smooth and may be withdrawn from the skein without catching threads or causing tangling.

67. Stripping of Reel.—After all the laces have been inserted, the skeins are removed from the fly, this operation being known as *stripping the reel*. If the catch arm has not previously been released to make lacing easier, it should be released and the collapsible arm completely lowered. The lacer should now gather one half of the skeins that are on the fly and nearest to the center upright of the stripping buck, and slide them from the fly on to the pipe fitted into the tee. The group of skeins, still on the pipe, should be given a slight twist of only a turn or two in order to hold them together. The remaining skeins should be removed from the reel in a similar manner and twisted as described, but it should be remembered that the twist is merely to hold the several skeins together and is removed when they are received in the next department. After the skeins have been removed from the fly the collapsible arm should be raised into position, and the fly returned to the reel.

68. Sometimes, after the skeins are laced, the fly is removed from the stripping buck and held on its end, the shaft resting in a wooden bracket on the floor. After the catch arm is released and the arm has collapsed, the skeins are allowed to fall to the floor. The fly is then returned to the reel while the skeins are gathered from the floor and hung on a pin until ready for the following operation. This method of removing the skeins is not regarded as good, as it results in unnecessary tangles and causes many broken ends. If the skeins are slid on to the horizontal iron pipe, it is absolutely necessary that the pipe be kept smooth. When iron pipes are employed, they should be rubbed with a very fine abrasive from time to time in order to maintain the necessary smoothness. Frequently, the pipes become rusty from the perspiration of the lacer's hands or the moisture in the air. When this occurs, the pipe should be cleaned. To prevent the formation of rust, many operatives wipe the pipes with oily rags at the end of the working period. On arriving at the mill in the morning, the oil may be wiped from the pipe, leaving it clean and shiny.

HARD TWIST PROCEDURE

STEAMING

69. In the manufacture of hard twists or crêpes, the method of procedure after the thread leaves the last-time spinner is different from that in the manufacture of tram or organzine. The thread is not reeled and steamed while on the fly, but is steamed on bobbins, because of the kinky nature of this class of yarn. When completing the insertion of twist while on the last-time spinner, the thread is taken up on iron-head steaming shafts or maple rolls, either being capable of withstanding the subsequent steaming operation. As the bobbins are filled with silk they are placed on bobbin boards or racks. Bobbin boards are used when the bobbins have holes through them and require loose-pin gudgeons as maple rolls, whereas the bobbin rack is used in connection with the iron-head steaming shafts having fixed gudgeons.

The bobbins, on either bobbin boards or racks, are delivered to the department in which the steam box is located. The racks are placed on a small truck, the entire lot to be steamed is wheeled into the steam box, the door is securely closed, and the valve is turned to admit the steam. Since crêpe threads have a high twist, the filaments of silk of the ply threads are firmly bound together producing a hard, dense thread that is quite impervious to steam. Furthermore, as the thread is wound on a bobbin, layer on layer, it is difficult for the steam to penetrate the silk that is wound next to the barrel. Therefore, crêpes are always steamed longer in order to obtain the proper penetration.

70. While different throwsters subject the silk to the steam bath for various lengths of time, it has been found that steaming for short intervals, alternating with periods of cooling, gives more satisfactory results than steaming for one long period. For instance, the silk is placed in the steam box and steamed for 10 minutes, at the end of which time the steam is shut off, the doors opened, and the silk allowed to cool. After cooling for 10 minutes the doors of the steam box are closed and the steam is admitted for another 10 minutes, at the end of which period, the steam is again shut off and the silk is allowed to cool for 10 minutes. This is followed by a third and last steaming of 10 minutes, after which the truck is wheeled from the steam box and the silk is allowed to cool and dry thoroughly. In drying it contracts, thus causing the twist to set, as previously explained.

After the silk has been properly steamed the kinky nature of the thread should be removed. To test this, 4 or 5 feet of thread should be pulled from a bobbin and the ends brought together, allowing the middle to sag. If the thread remains straight and free from kinks or curls it may be considered properly steamed. This simple test is frequently applied to crêpe thread in order to determine whether the silk has been properly processed or not.

REDRAWING

71. Purpose of Redrawing.—After hard-twist silk has been steamed, it is removed from the steaming shaft and transferred to a shipping bobbin, the operation being known as redrawing. The object of redrawing is to remove the silk from the throwster's steaming shaft and wind it on the shipping bobbin furnished by the customer.

72. Redraw Frames.—The machine by which the silk is transferred from the steaming shaft to the shipping bobbin is known as a redraw frame. Its construction and size are identical with those of the doubler, except that the drop wires and the stop-motion are omitted, and so a detailed description of it is unnecessary. It is usually equipped with jack-pins when the thread is to be redrawn from maple rolls, as the latter may be easily placed on the jack-pins. However, when iron-head steaming shafts are employed, a special bracket is required to hold the shaft. This bracket, which is attached to the upper side of the rail supporting the pin rails, consists of a **U**-shaped iron slightly wider between the uprights than the width of the bobbin. Each upright has a small slot of sufficient size to receive the gudgeon that is permanently attached to the shaft. When the shaft is in position in the hanger, it is free to revolve, and because of its weight, no tension need be given to the thread.

73. As the redraw frame is generally operated at a higher speed than the doubler, it is sometimes necessary to apply some tension to the thread when unwinding from rolls. This is true when redrawing from all bobbins other than iron heads, because the bobbins have a tendency to overrun. The difficulty is overcome, more or less, by arranging the bobbins in the following manner: The filled bobbins as received from the spinner are placed on the second pin of each pin rail and empty bobbins are placed on the top pin. The thread from a full bobbin is now guided toward the empty bobbin on an adjoining row, wrapped once around that bobbin, and thence, lead to the take-up bobbin of the redraw frame. In its upward passage, the thread passes over a porcelain guide attached to the traverse bar, the motion of which distributes the thread on the bobbin.

74. Thread Cleaners.—Since hard twisted threads often have kinks, slugs, waste, and so on, which are very undesirable, a device known as a thread cleaner is often employed on the redraw frame to remove any loose thread or fuzz that cling to the thread, and prevent slugs and large knots from passing to the take-up bobbin. It is located at a point between the supply bobbin and the take-up bobbin. Of the various thread cleaners on the market, a type that is employed to a large extent is illustrated in Fig. 11. An angle bracket a contains a groove in which fits a hardened steel plate a_1 that is firmly held to the bracket by the thumbscrew a_2. A base a_3 supports the bracket and the two porcelain guides a_4. A deep **V** in the plate terminates in a narrow slit, and the porcelain guides are so located as to cause the silk to pass from one to the other without chafing against the edges of the slit in the steel plate. The manner in which the thread is guided affects the method of mounting the cleaner. If the thread, on leaving the cleaner, is moved from side to side by a traverse bar, the porcelain guides must be used on the cleaner, to prevent the thread from being chafed by the edges of the slit; but if the thread moves in a straight line, with no side-to-side movement, the bracket a

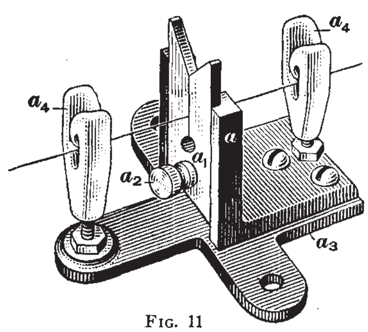

FIG. 11

and the attached plate a_1 may be removed from the base and used without the porcelain guides.

75. The slit in the plate of the cleaner, Fig. 11, cannot be thrown out of adjustment by the operative. It frequently happens that, when a bad lot of silk is run and a great number of ends continually break, the operative enlarges the slit in order to cause the silk to run better and cause less work. As the plates are not adjustable, three are usually supplied with each cleaner, the slots being of different sizes to suit different sizes of silk. The plate may be removed by loosening the thumb-screw, and may then be replaced by another, as desired. In selecting a plate, it should be remembered that each time the thread breaks it must be tied with a knot; and so a plate should be selected containing a slit that will remove only the gross irregularities, while those of the size of a knot may pass through unhindered.

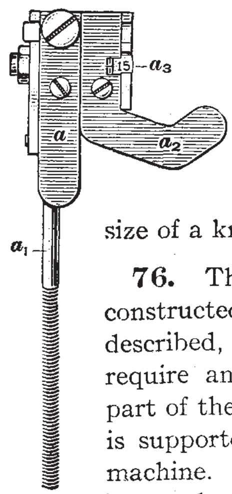

Fig. 12

76. The thread cleaner illustrated in Fig. 12 is constructed on a different principle from that just described, as it is an adjustable type and does not require any substitution of parts. The stationary part of the cleaner, to which the guide a is attached, is supported on a threaded stud a_1 fastened to the machine. Another guide a_2, known as the *speed guide*, is attached to the movable part of the cleaner, its shape being such as to guide the thread into the slit between the guides a and a_2. The thread may be dropped against the under side of the guide a_2, whereupon it will move along the inclined face and fall into the slit. While running through the slit, the thread is prevented from coming in contact with the body of the cleaner by a small porcelain roller located on the under side of the cleaner. The roller cannot be seen in the illustration, as it is hidden by the guides. Adjustment is made by altering the distance between the guides a and a_2 by turning the micrometer screw a_3. A special key that fits only the micrometer screw is supplied with each cleaner. When adjustment is to be made, the key is inserted and the screw is turned in the proper direction to cause the speed guide a_2 to move away from the guide a or toward it, as required. When the correct adjustment has been obtained, the key is removed and retained by the foreman or some responsible person, thus preventing operatives from tampering with the cleaner and altering its adjustment.

77. Shipping Bobbins.—The shipping bobbins used as take-up bobbins on the redraw frame are usually constructed of wood and are shaped like the bobbins employed in the various throwing operations. Sometimes, however, they are made with slightly larger heads and smaller barrels, so that a larger amount of silk may be placed on them. Because of the rough handling that such bobbins receive, the heads often become broken after the bobbins are filled with silk, causing them to be very difficult to unwind; also, the heads are sometimes forced from the barrel when the glue fails to hold, and this causes a considerable amount of waste, as the entire bobbin is rendered useless. For this reason, fiber head bobbins are often employed in order to eliminate breakage and unnecessary waste. Besides the fiber-head bobbin, a light weight all metal bobbin has been produced that does not splinter or crack and will not warp. Its heads are very thin, and so a greater amount of silk may be wound on it than on the ordinary all-wood type.

SILK THROWING

(PART 9)

Serial 5002A | 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) What is the object of reeling?

(2) If the brake is not forced under the pulley *d*, Fig. 2, quickly enough to stop the fly immediately when an end breaks, what adjustment should be made to insure quicker action?

(3) Explain how to equip a reel to prevent ballooning ends from striking each other and breaking.

(4) Describe the method of reeling known as Grant reeling.

(5) Why is a band of fiber usually riveted to the rim of the pulley *c*, Fig. 2?

(6) Explain how a skein of reeled silk is banded off.

(7) (*a*) What is a reel cap? (*b*) Why are reel caps used?

(8) What is the purpose of the adjustable steel plate i_7, Fig. 7, that rests against the fly shaft *e*?

(9) If the lacer's fingers become sore while lacing skeins reeled with close diamonds, what should be done to make this operation easier?

(10) Explain why crêpe threads on bobbins are steamed longer than threads wound on reel flies?

(11) State how to alter a reel so as to change the number of diamonds in the skeins.

(12) What is the purpose of lacing?

(13) Why is the twist set in thrown silks?

(14) Explain how to strip the skeins from a reel fly.

(15) Describe the effects on the skein if the thread is reeled either too loose or too tight.

(16) When is redrawing necessary and what is its object?

(17) State two reasons why short skeins are produced when reeling silks.

(18) Why are thread cleaners employed on a redrawing frame?

(19) If 15 per cent. is allowed for stoppages, what is the production in pounds per 10-hour day, reeling 5-thread 13/15-denier tram (63,779 yards per pound) on a 12-skein reel fly 44 inches in circumference, that rotates 350 revolutions per minute? Ans. 41.047 lb.

(20) (*a*) The circumference of a reel fly is 44 inches and its speed is 360 revolutions per minute. If the yardage clock is adjusted to knock off at 10,000 yards, how many minutes will it take to reel one set of skeins, or fly, not considering stops. (*b*) Allowing 15 per cent. for stops, how many flies will be produced in 9 hours?

Ans. {(*a*) 22.727 min.
(*b*) 20 flies, practically.

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