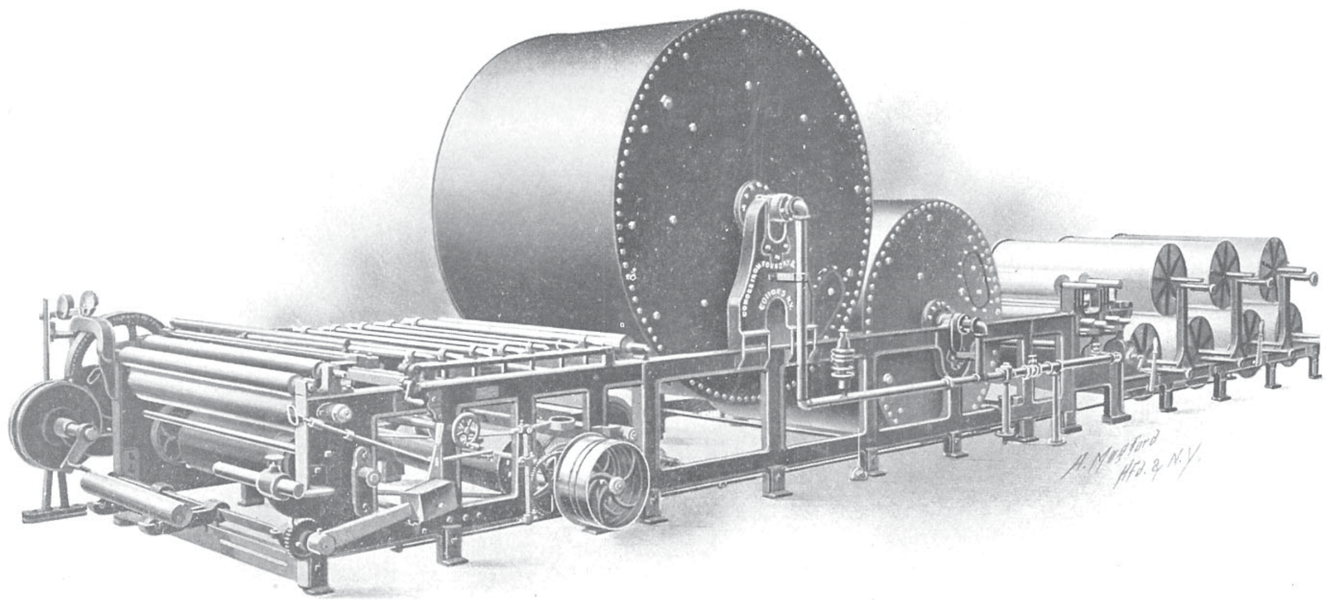


Cohoes Iron Foundry & Machine Co.

WARP PREPARATION.

It should be the aim of every overseer to excel in his occupation; but success is dependent upon certain conditions which are often difficult to maintain. These conditions may be classified in a general way under the following heads:

1. Large Production.
2. Fine quality of Production.
3. Long life of the machinery in use.
4. Low cost of maintenance.

To lose sight of any one of these, or to sacrifice the last three for the first, indicates incompetence. Intelligent management takes into consideration all four conditions and holds them for an ideal.

COTTON WARP PREPARATION.

THE SPOOLER.

This machine, as its name implies, is for the purpose of spooling the yarn as it comes from the ring spinning frame. It is shown in Fig. 1. Apparently it is a very simple machine, but it is essential that it should be thoroughly understood. It is uneconomical to run it at a speed not suited to the quality and counts of yarn in preparation. In the first place, the spools run by gravity and merely rest on the base of the spindles; also, while the speed may be correct when the yarn is being run on an almost empty spool, the increase of circumference, as the yarn is added to the spool, increases the speed of the yarn and brings an added strain upon it. This is costly, because the extra strain causes the yarn to break frequently, and the spooler-tender is able to look after only about 50 instead of 75 spindles. In addition, the constant piecing means a larger percentage of knots in the yarn than is desirable for the best results. This should be thoroughly understood at the beginning. Poor spooling results in poor warps, and no later treatment can overcome this defect. Spooler-tenders should be trained to make as small and as good knots as possible; and if attention is paid to the work at this stage there will be less trouble in the weave rooms.

Weak yarns can stand less speed than the stronger yarns, consequently the speed should be adjusted to the strength of the yarn. For example, a good 60's yarn would probably stand 800 revolutions per minute, but if the speed seemed too low when the spool was small and was increased to 850 or 900 revolutions,

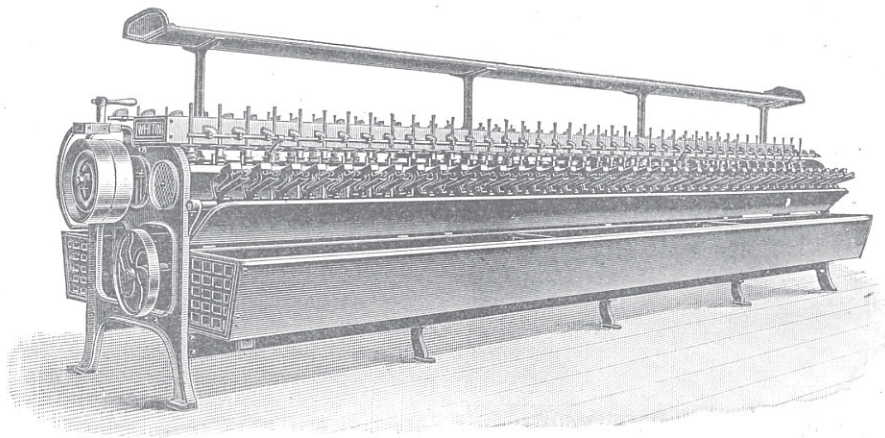


Fig. 1.

the loss would be greater than the gain because the yarn would break more frequently as the circumference of the yarn on the spool increased.

CALCULATIONS FOR SPEED.

It is customary to have the spindle run from 700 to 1,000 revolutions per minute, and the following is the method of calculation.

Multiply the revolutions of the main driving shaft by the diameter of the pulley on the same shaft, also by the diameter of the drum or tin cylinder, around which the driving bands pass: then multiply the driving pulley on the machine by the size of the whirl or whorl on the spindle, divide the first product by the second, and the result will be the speed of the spindle.

Suppose the main shaft is running at 300 revolutions per minute and the pulley on this shaft is $5\frac{1}{2}$ inches in diameter. If the drum is 6 inches in diameter, the pulley on the machine 10 inches and the whirl $1\frac{5}{16}$ inches, what is the speed of the spindles?

$$\frac{\overset{\text{Rev. of Main Driving Shaft.}}{300} \times \overset{\text{Pulley on Main Shaft.}}{5\frac{1}{2}} \times \overset{\text{Diam. of Drum.}}{6}}{\underset{\text{Diam. of Machine Pulley.}}{10} \times \underset{\text{Diameter of Whirl.}}{1\frac{5}{16}}} = 754.28 \text{ revs. per min.}$$

About $755\frac{3}{4}$ revs. per min.

To find diameter of pulley for main driving shaft, speed of whirl given, multiply revolutions of whirl by diameter of whirl and by diameter of pulley on machine and divide the product by diameter of the drum multiplied by revolutions of main shaft.

$$\frac{\overset{\text{Rev. per minute of Whirl.}}{755.72} \times \overset{\text{Diameter of Whirl.}}{1\frac{5}{16}} \times \overset{\text{Diameter of Pulley on Machine.}}{10}}{\underset{\text{Rev. per minute of Shaft.}}{300} \times \underset{\text{Diam. of Drum.}}{6}} = 5\tfrac{1}{2} \text{ in. Diam. of Pulley.}$$

Banding. There are two systems by which motion is imparted to the spindle from the drum: by a single band for

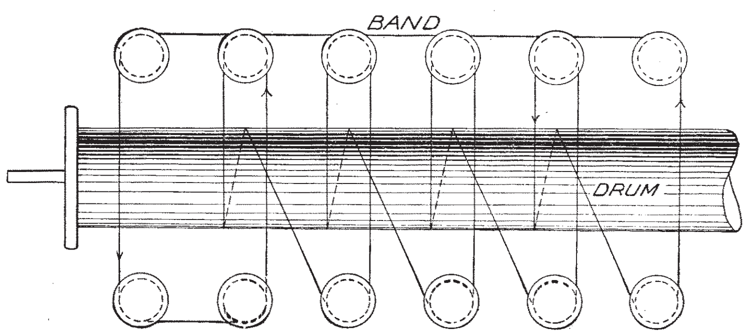


Fig. 2.

each spindle, or by connecting together four or more spindles on each side of the frame by one endless band, as shown in Fig. 2. Both systems have their advantages, but the latter is more common. One reason for this is that when a single band breaks that spindle alone is stopped, and is not readily seen. When the multiple band breaks, however, several are stopped, which attracts attention instantly. Again, the band which drives a number of spindles lasts much longer than the single band.

Building Motion. There are two distinct kinds of building motions. One builds a straight spool, the other builds a convex or rounded spool. The latter is by far the best, and is most commonly used. A convex wound spool holds more yarn than the straight wound spool, because it can be made larger in the middle without fear of the yarn being rubbed over the flanges. The

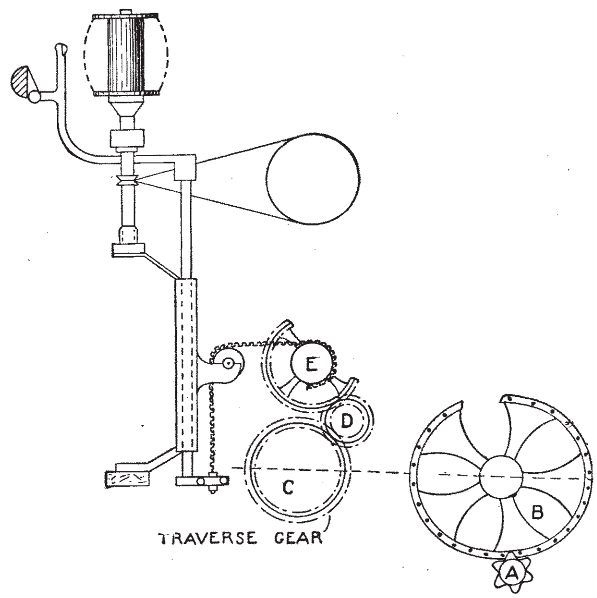
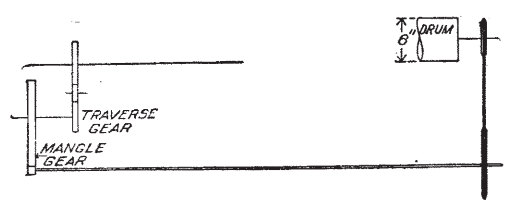


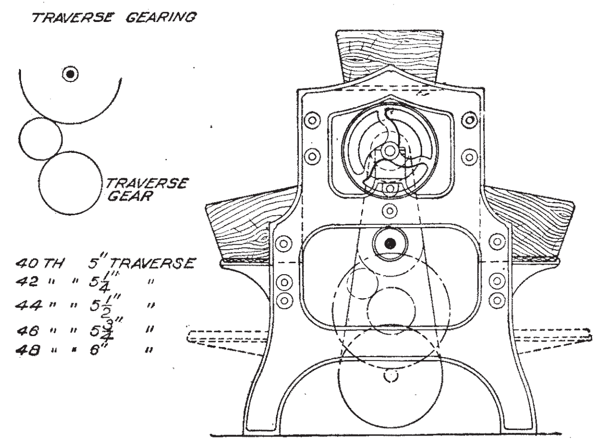
Fig. 3.



PLAN OF GEARS.

convex shape is caused by the builder rail traveling more slowly at the middle of the traverse, and in this way allowing more yarn to be placed on the spool at this point.

The building motion is as follows (see Figs. 3 and 4): A 6-tooth pinion, A, imparts motion to the mangle gear, B ; on the same shaft as the mangle gear is the traverse or change gear C. An intermediate gear D connects the traverse gear to the segment E, which is fixed on a shaft that extends from one end of the



END VIEW OF SPOOLER.

machine to the other. At different places on this shaft are small pulleys, to which are connected the chains that lift the builder rail. The mangle gear has a reciprocal motion, owing to the

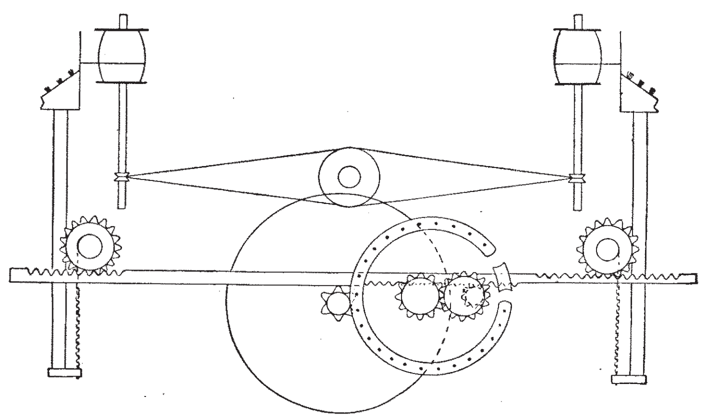


Fig. 4.

small pinion rotating on the inside as well as the outside of the gear. The mangle also has two different diameters, which cause a fast and slow motion to the builder rail, the largest diameter being at the center of the gear; this is the direct cause of the convex-shaped spool.

When calculating the speed of the traverse, two teeth must be added to the number of teeth or bars on the mangle gear, because there is a loss of one tooth as the small pinion passes round the end of the gear; and this occurs at both ends.

For example:

$$\frac{\overset{\text{Rev. of Main Driving Shaft.}}{300} \times \overset{\text{Pulley on Main Shaft.}}{5\frac{1}{2}} \times \overset{\text{Pulley on Small Machine Shaft.}}{2\frac{3}{4}} \times \overset{\text{Small Pinion.}}{6}}{\underset{\text{Pulley on Machine Shaft.}}{10} \times \underset{\text{Pulley on Small Pinion Shaft.}}{10\frac{1}{2}} \times \underset{\text{Teeth of Mangle Gear.}}{62}} = 4.18 \text{ trav. per min.}$$

Some claim that the mangle ought to be calculated as an ordinary gear, but the foregoing is the result of careful measurements.

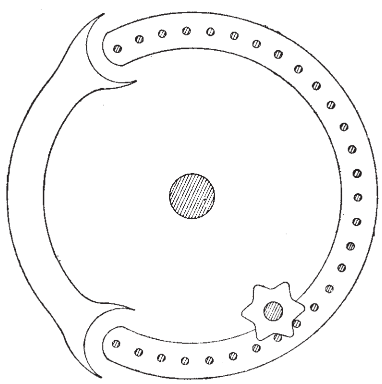


Fig. 5.

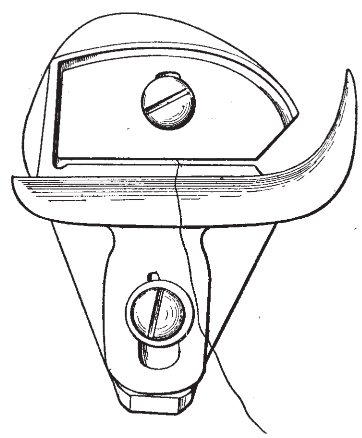


Fig. 7.

Fig. 5 shows the mangle of a straight-built bobbin, but as stated before, this motion is not of as great value as the elliptic mangle gear, on account of the greater production of the latter.

Bobbin Holder. The yarn is received from the spinning frame on a bobbin or pirn; it is then placed in the bobbin holder (shown in Fig. 6), which is in the form of a cradle or concave casting. Each cradle is supported on a rod which extends the entire length of the machine.

When setting the cradle, it should be tilted or inclined so that the yarn will have the least amount of friction; it can be readily seen that if the cradle has too steep an incline, there will be too much strain on the yarn when it is drawn from the lower end of the bobbin; and of course the opposite is the case when the cradle is too flat. The cradles should be set so that they will cause as light and equal a tension as possible. Two swinging wires are attached to the upper portion of the holder, one at each side; these prevent the bobbin from being drawn out of the cradle while the yarn is being unwound; they also add a little friction to the yarn, and prevent it from rewinding around the bobbin if the spool should stop. If weak yarn is being spooled, it is best to have the end from the pirn pass between the swinging wires instead of under them. This will take off all the friction.

Thread Guide. There are two distinct kinds of thread guide; one is made from flat steel, about $\frac{5}{32}$ inch thick, with a slot cut in the plate through which the yarn passes on to the spool.

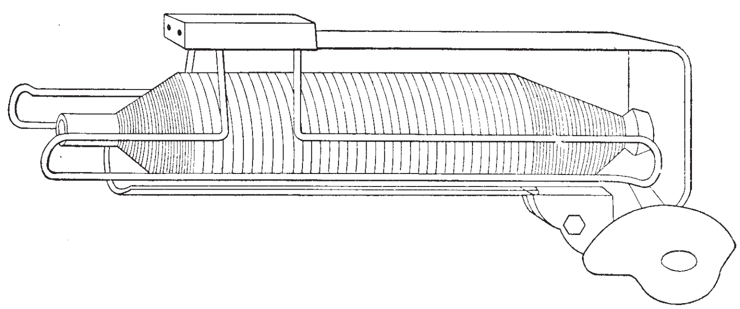


Fig. 6.

When the counts of yarn are changed, and there is a wide difference in the counts, it is necessary to change the guide, because if a fine yarn has been spooled, and a coarse yarn is desired, a guide with a larger slot is necessary; on the other hand, a smaller slot is required for finer counts. It is essential that the size of the slot conform to the size of the yarn, because the guide also performs the functions of a cleanser. If any foreign substance adheres to the yarn, or, as it sometimes happens, there are lumpy places in the yarn, it is best to have it cleansed at this point, otherwise it will remain in the warp, and cause poor cloth, or endless trouble to the weaver. So that if a coarse guide is used for fine yarns, the rough places pass through the guide and on to the spool.

The second kind of guide (shown in Fig. 7) is by far the best, and is most commonly used. There are different makes, but all embody the same principles. These are made of adjustable parts, so that they can be used for different counts of yarn. The yarn passes over a rounded lip, and under the gage plate, which is adjustable. The rounded lip on this guide is very easy on the yarn. The guides are attached to the builder rail, and guide the yarn to the spool.

Fig. 8.

In some mills the warp yarn is spun on the mule, and the yarn is received at the spooler in cop form instead of on bobbins. Where this is the case, the cop is placed on an upright spindle instead of in a bobbin holder; the thread guide is also dispensed with, and in place of this is adjusted a wooden bar which has a piece of felt attached to it. The felt cleanses the yarn, and adds friction.

If the yarn is transferred from bobbins, it is customary to have an upright spindle near one end of the machine; this is for the purpose of running off soft spun or tangled bobbins.

Production. Mills differ in the amount of production of spoolers, but the following gives a general idea of what ought to be produced under ordinary circumstances:

18 to 10 counts, 3¼ pounds to 4½ pounds per day with the spindle running 750 revolutions.

50 to 28 counts, 1½ pounds to 3 pounds per day with the spindle running 750 revolutions.

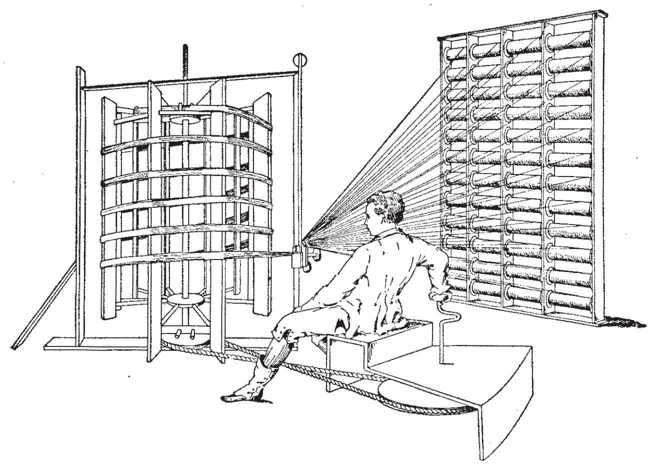
The above production would be enlarged about 1 pound for the coarser counts and about 4 ounces for the finer counts, with 825 revolutions of the spindle.

The finer the counts, the less will be the production. Not necessarily because of the more yards to the pound, but in some cases because of the added strain, and the necessary reduction in speed. It requires the production of 14 spindles on the ring spinning frame to supply one spindle on the spooler, for counts of yarn varying from 18's to 24's. 28's to 50's require from 15 to 20 spindles on the ring frame to supply one on the spooler.

One of the best inventions of recent date is the Barber and Colman knotter (see Fig. 8), by means of which more work can be accomplished than by hand; the knots are uniform, and as small as it is possible to make them.

BEAM WARPING.

The beam warper is for the purpose of making a warp for the back of the slasher; the ends of yarn, or threads from a number of spools that have been filled, are placed side by side on a beam, and when sufficient length has been run on the beam it is cut out and replaced by an empty beam, this order being followed until sufficient back warps or back beams have been made to fill up the creel at the back of the slasher.



OLD FORM OF COTTON WARPER.

Creel. The spools are placed in a creel, which may hold from 300 to 1,000. The creel is constructed in the form of a V, with the vertex nearest the machine. Down each leg of the V a number of upright bays or tiers are placed, according to the capacity of the creel; in the upright bay the spools are placed one above the other. The bays of the creel are fixed or changeable; this being determined by the amount of floor space available. If the floor space is small, changeable bays are used, and the angles of the tiers, or rows of spools, can be changed to suit the altered bays. This is necessary when the angle of the bay is changed, because as the yarn is drawn off the spool, the added tension spoils the elasticity, if it does not break it.

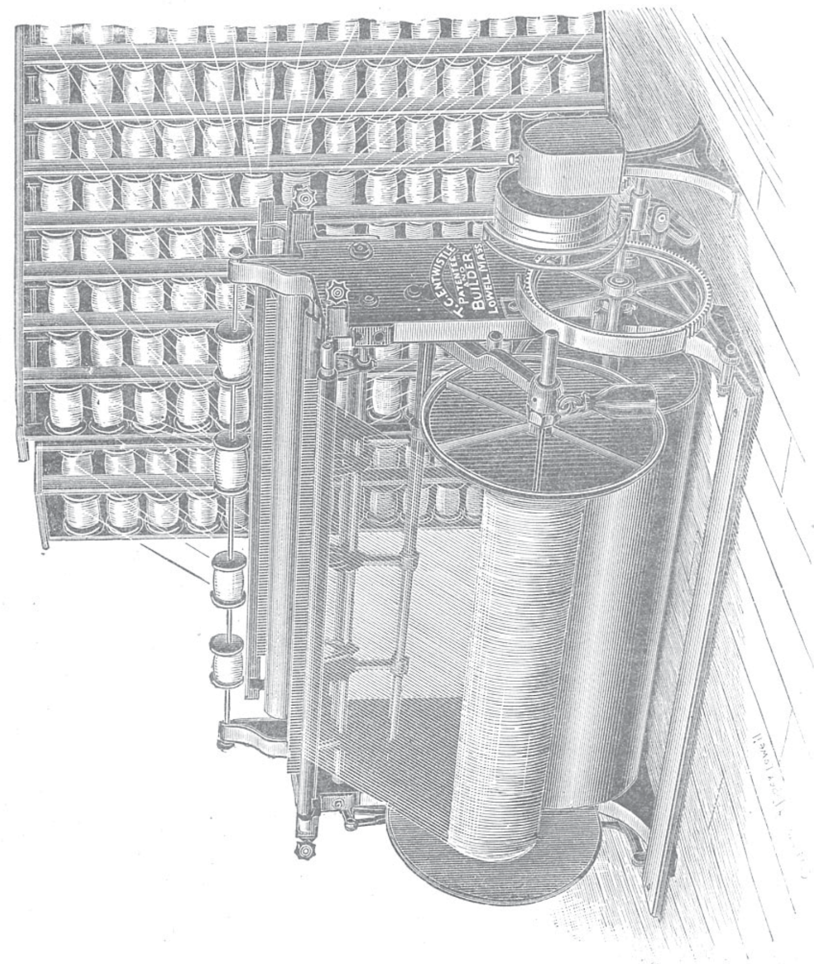


Fig. 9.

Expansion Reed. From the creel the yarn passes through an expansion reed. The purpose of this reed is to vary the width of the ends from the creel so that it will conform to the width of the beam on which it is to be placed.

Measuring Roll. From the reed the ends pass over the measuring roll and underneath the faller rod.

Faller Rod. This rod serves a twofold purpose. When the warper is stopped, the spools overrun a little, and instead of the yarn wrapping around the spool, and eventually being broken, the rod falls and keeps the yarn taut. Also, if an end breaks and the warp must be turned back, the faller rod takes up the slack yarn and prevents the ends from snarling. Some machines are constructed so that this rod is raised up instead of falling; it

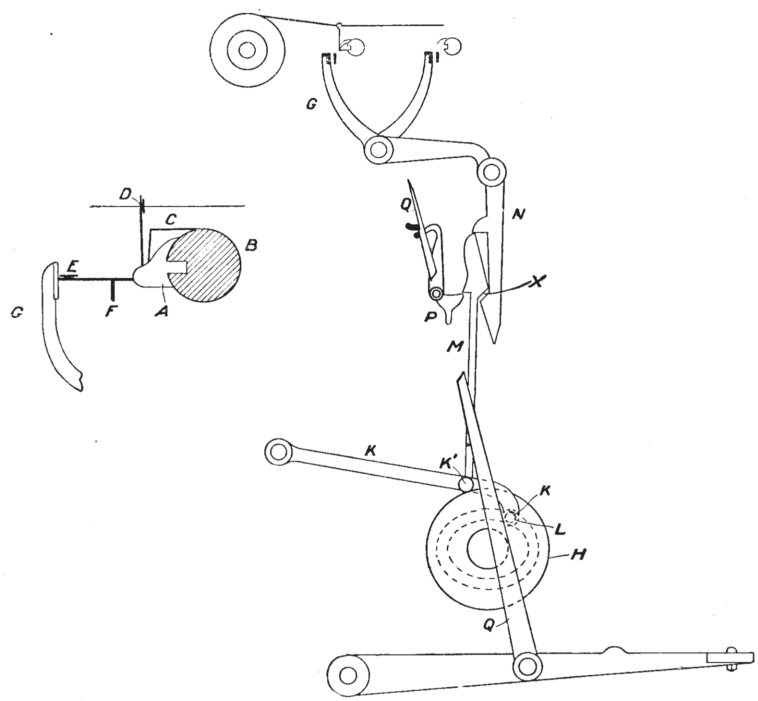


Fig. 10.

answers the same purpose. The yarn then passes over a standard rod and through the drop wires. The drop wires are actually the stop motion, and there are as many wires as there are ends in the warper; one wire for every end. Fig. 10 illustrates the entire stop motion. The detached sketch on the left shows the shape and construction of the drop-wire motion, but only one row; there being two rows in actual use, as shown in the large sketch.

A is a brass slide to which the drop wire is attached; this brass slide is placed in the slot in the tin holder. C is a strip of sheet iron attached to the tin holder, to prevent the brass slide from dropping out. When an end is passed through the loop of the drop wire and is held tight, the wire is upright, as shown in D. E shows the wire down, the end being broken. F is a flat bar which prevents the wire from dropping too low. G is a portion of an oscillating bar. There are two of these bars, one for each row of drop wires.

The motion that operates the oscillating bars is derived through a series of levers, from a shell cam, H, fixed on the outer end of the drum shaft. A small iron roller placed on the end of the lever K works in the groove of the cam at L. The upright catch rod M is connected by a stud to lever K at K'. A second upright lever, marked N, is connected to the arm of the oscillating bars; a projection on the latter rests on the top of lever M, and as M is raised by the action of the cam, it forces up N, thereby giving motion to the oscillating bars. The weight of lever N and its connecting bar keeps the projection in contact with M, when the latter is drawn down.

During the ordinary working of the machine the two beveled edges, X, are in close contact, but when a wire drops down, the end of yarn being broken, the oscillating bars are prevented from passing the usual distance, and as the cam draws down lever M the catch point on M is forced over on the catch of the shipper lever, P; this in turn will force off the shipper rod and stop the machine. When the end is tied up and the machine started, the beveled edges return to place. Q is the shipper rod, attached to a footboard, by means of which the operative starts up the machine. From the drop wires the ends pass through a second expansion comb over a rod to the beam.

Expansion Comb. The purpose of this comb is the same as the reed at the back of the machine; that is, to contract or expand the width that the ends occupy, to conform to the width of the beam on which they are placed. If the space is too wide, the ends crowd up on the sides, and when they are drawn off in the slasher the side ends become loose while the rest are tight. If the space is not wide enough, the beam is not filled up equally and the results are as poor as in the former case. Thus we see that care should be taken to have the ends pass onto the beam as evenly as possible. This difference between the reed and the comb is as follows: the reed has a cap on it to prevent the ends from coming

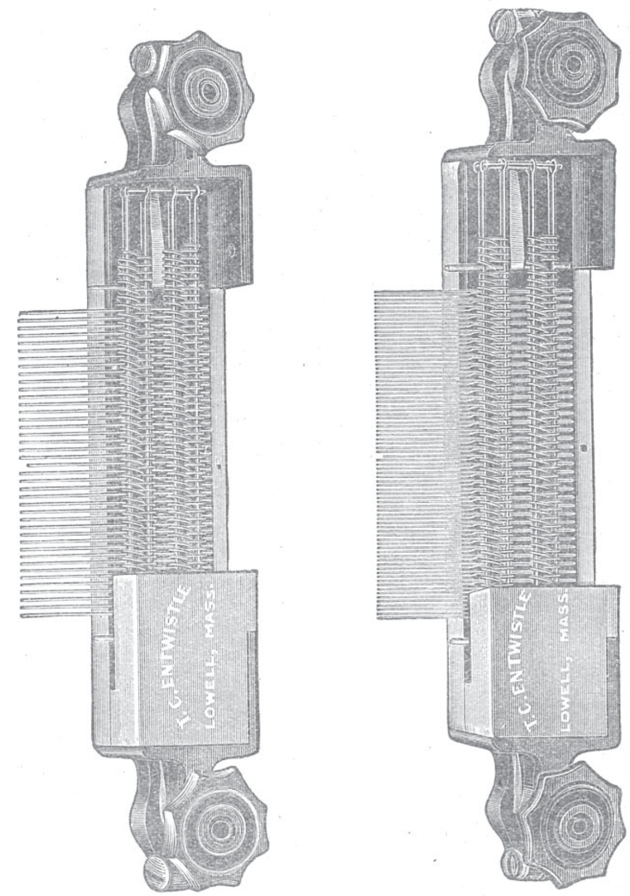


Fig. 11.

out at the top, while the comb is open, so that the end can be passed over from one dent to another. Fig. 11 shows two forms of expansion combs with varying numbers of dents to the inch.

Beam Drive. The beam is driven by friction, that is, it rests on a driving drum, which is generally twelve or eighteen inches in diameter. Owing to the beam being thus driven, the yarn is placed on it at a constant speed, no matter whether it is a large or small beam. If the drum is 36 inches in circumference, for instance, and is driven at a constant speed, it will take just as long for the drum to turn an empty beam the distance of 36 inches as it would to turn the distance of 36 inches on a full beam. So that if the beam when it is full of yarn measures 3 yards in circumference, it will take three times as long to turn the full beam as it did to turn the empty beam, when it was 36 inches in circumference. While the yarn does not travel faster as the beam increases in size, the spools on the creel travel faster as the yarn is taken off the spool; consequently there is a greater strain on

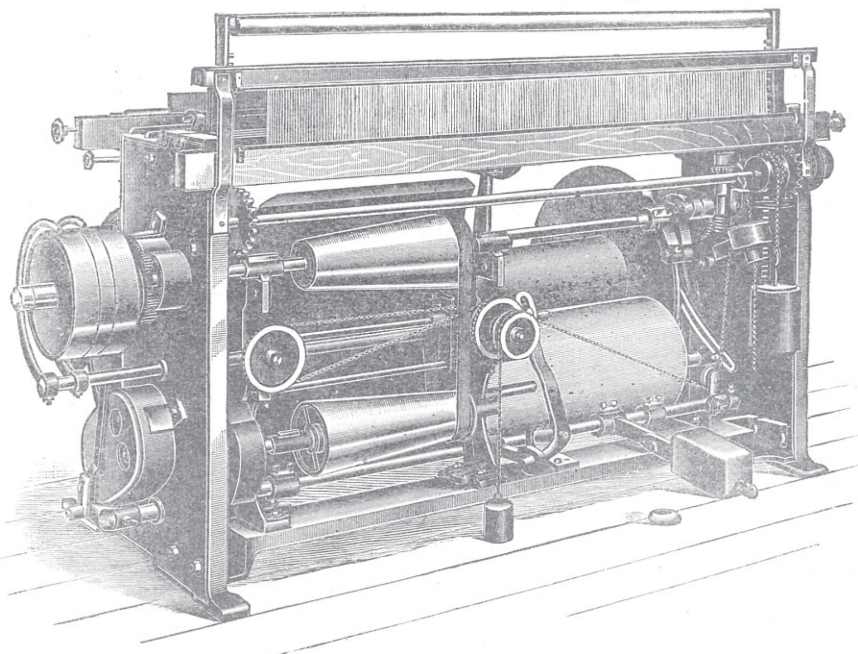


Fig. 12.

the yarn when there is less quantity on the spool. This often causes the yarn to break, which is detrimental to good weaving, inasmuch as knots in the warp yarn increase the amount of defective cloth.

Cone Drive. To overcome the difficulty of increased strain, the cone drive (shown in Fig. 12) has been added to the warper; this regulates the speed of the drum, so that as the warp increases in size and the spools decrease in size, the speed of the drum can be reduced. Though the drum travels slower at this time, the machine can travel faster when the spools are full.

It is claimed that by the use of the cone drive there is added production and better quality of warp yarn, because added tension not only breaks the yarn, but takes the elasticity from it. The loss of elasticity is a great defect.

Variable Motion. There are two distinct speeds to a warper: first, the ordinary speed at which a warper is run when all is straight and the yarn good; second, the slow speed. This change of speed is advantageous in starting up the machine; if the machine is started up at full speed, the ends are likely to break

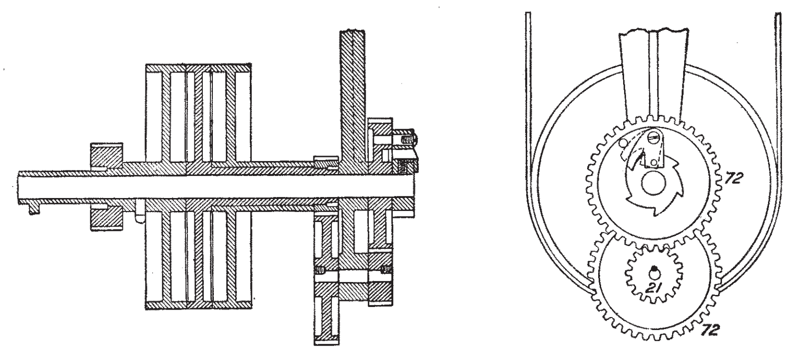


Fig. 13.

out. Also, when the faller rod is down and there is some slack yarn to be taken up, the machine should be run slowly until the yarn is tightened and the ends are traveling straight from the spool. The slow motion is obtained as follows: an additional pulley (see Fig. 13) is placed on the driving shaft, between the ordinary fast and loose pulley. This intermediate pulley has an extended sleeve attached to it. A 21-tooth gear is fixed on the sleeve, and meshes with a 72-tooth gear; on the same stud with the 72 is another 21, but attached to the 72. The second 21 imparts motion to another 72-tooth gear, which is loose on the sleeve of the slow pulley. A ratchet is fixed on the end of the driving shaft; there is also a pawl attached to the face of the last 72-tooth gear. When the belt is on the slow-motion pulley, motion is imparted to the 21 gear, which is fixed on the sleeve of the pulley, from this 21 into the 72, from this 72, through the 21 connected to it, into the second 72, and as that is turned, the pawl engages in the teeth of the ratchet, and in this way turns the driving shaft.

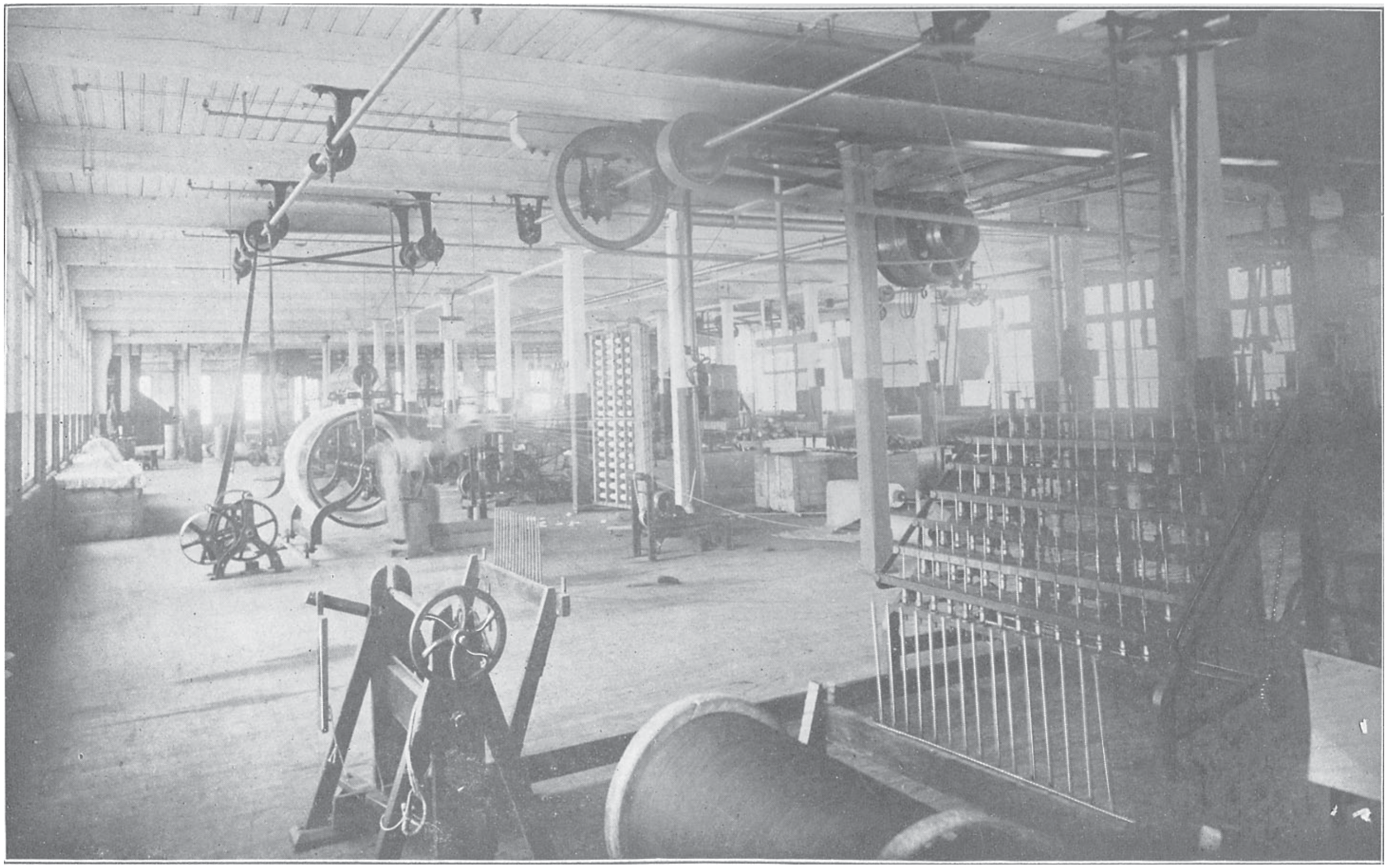
Measuring Motion. This is a combination motion for Beam and Ball warper, and the calculation for one will apply to both.

The simplest method of calculating the velocity ratio of a train of gears is to multiply the drivers together, the drivens together, divide the one in the other, and the quotient will be the answer required.

The motion is as follows: the measuring roll is 12 inches in circumference; on the end of this roll is a single worm, driving a 48 gear. Attached to this is a 16 gear, imparting motion to a carrier gear of 47 teeth; this drives a 50-tooth gear, which is the cut gear. Attached to the cut gear is a 16-tooth gear driving a 64 gear, which also has a 16 gear attached to it; this imparts motion to the leese gear, which has 80 teeth. The carrier gear is left out of the calculation.

$$\frac{48 \times \overset{\text{Cut Gear.}}{50} \times 64 \times \overset{\text{Leese Gear.}}{80}}{\underset{\text{Worm.}}{1} \times 16 \times 16 \times 16} = 3{,}000 \text{ feet} = 1{,}000 \text{ yards.}$$

The above train of gears will give 1,000 yards. The 1 represents 1 revolution of the worm, which is also 1 revolution of the measuring roll, and that being 12 inches in circumference will mean that 12 inches of yarn has been placed on the beam during 1 revolution of the worm, or 1 tooth of the first 48 gear. This train of gears will measure 3,000 feet of yarn or 1,000 yards. When the leese gear has made 1 revolution, the measuring roll has made 3,000 revolutions, and being 12 inches in circumference, 3,000 revolutions will equal 1,000 yards. The number of teeth in the cut gear A corresponds to the number of yards in a cut; therefore, if this gear contains 50 teeth, the number of yards in each cut will be 50. Three teeth on the 48 gear equal one yard: $48 \div 16 = 3$, the motion having been reduced three times before it is imparted to the cut gear; thus it is that 1 tooth on this gear means that 1 yard of yarn has passed on to the beam. B is the leese gear which determines the number of yards in a leese,



50 H. P. INDUCTION MOTOR DRIVING WINDING AND REELING MACHINERY
J. R. Montgomery Co.

or the number of yards in the whole wrap. By the substituting of the 64 gear below the cut gear the ratio will be equal to 4 to 1. Thus the number of teeth in the gear B will be 4 times greater than the number of cuts in the leese.

Example. We require 1,000 yards of yarn on the beam, and there are 50 yards in a cut, so that we shall have 20 cuts in the warp. Four times the number of cuts in the warp will be the gear; $20 \times 4 = 80$ gear.

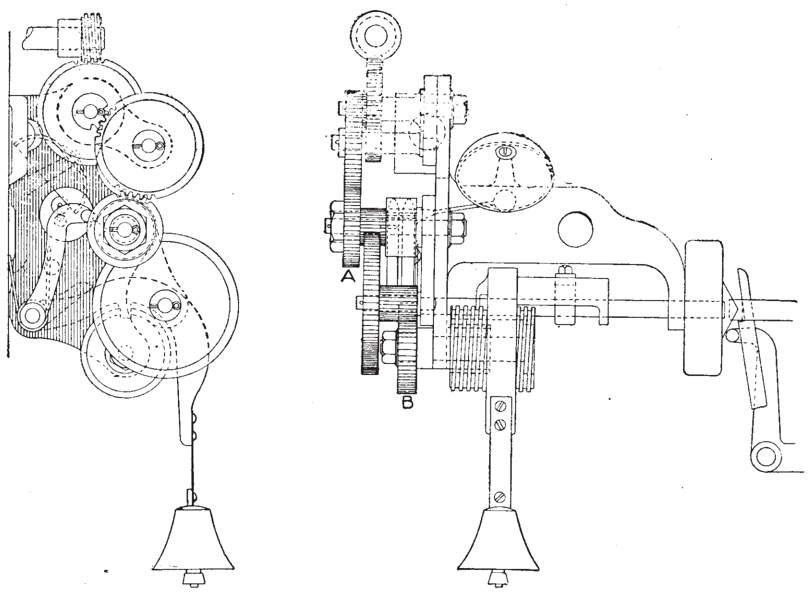


Fig. 14.

The hub of the leese gear is cut in the form of a worm, with a slot in it, and at every turn of the hub a catch point on a small lever drops in the slot. This lever is connected with the shipper rod, so that when the machine is stopped a bell is rung. If more than 1,000 yards are required, say 3,000 or 4,000, then 3 or 4 turns of the hub will give the required number of yards. The gears can be changed to give a longer length of yarn before the machine stops, and any number of yards can be placed on the beam.

It is often necessary to change both cut and leese gear when an odd number of yards are required, and the following rule will give the gears necessary for the required length:

First divide the total number of yards into wraps or leeses, that is, several turns of the hub of the leese gear, thus bringing the number of yards within the range of the motion. Having obtained the number of yards in one wrap or leese, the gears must be chosen to produce this number of yards. First find the cut gear, which must be between 20 and 80, as this is the range of gears that can be placed on the stud. Divide the number of yards in the leese by any number between 5 and 20 that will give as a result a gear between 20 and 80; the number divided by will be the number of cuts in a leese; multiply this by 4, and the result will be the number of teeth in the leese gear.

Example. Give the necessary gears for a warp of 5,760 yards.

$$\frac{5{,}760}{6 \times 16} = 60 = \text{Cut Gear.} \qquad 16 \times 4 = 64 = \text{Leese Gear.}$$

We divided the total by 6, thus giving us 6 turns of the hub and 960 yards in each wrap. We further divided the 960 by 16, which gave us a 60-cut gear, meaning 16 cuts with 60 yards in each cut; we then multiplied the number of cuts by 4, and obtained a 64-leese gear.

In the train of gears first take out the cut and the leese gears and insert the ones obtained above.

$$\frac{48 \times 60 \times 64 \times 64}{1 \times 16 \times 16 \times 16} = 2{,}880 \text{ feet} = 960 \text{ yards}$$

$$960 \times 6 = 5{,}760 \text{ yards.}$$

Example. What gears are required for a small warp of 900 yards? One wrap or leese will be sufficient.

$$\frac{48 \times 75 \times 64 \times 48}{1 \times 16 \times 16 \times 16} = 2{,}700 \text{ feet} = 900 \text{ yards.}$$

The beams that are used on the warper are back beams for the slasher, and the number of spools that are placed in the warper creel determines the number of back beams required for the slasher, and from which the warp for the loom is made. The number of ends required for the warp when ready for the loom is several times more than the number of ends that the warper creel will hold.

Example. If a warp of 2,500 ends is required, how many spools must be placed in the creel and how many back beams made for the slasher? The capacity of the creel is 530 ends. We leave out the 30 ends and run 5 back beams of 500 ends each. This is a better division than 4 beams of 530 ends each, making a total of 2,120 ends; for in order to place on a beam the remaining 380 ends, the expansion combs must be altered, the drop wires taken out, or tied up, and several other changes made. In addition, the warp in passing through the slasher would not be as even as when all the back beams were equal, for then there is one equal layer upon another. Before discussing the slasher we will explain the Long and Short Chain systems of dressing.

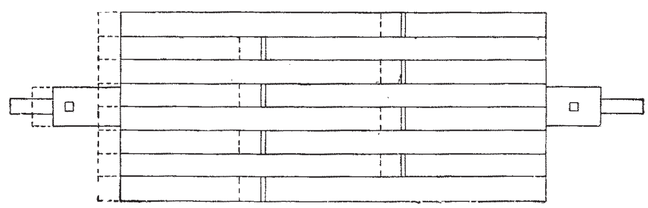


Fig. 15.

Expansion Drum. In mills where a great variety of goods is made, both as regards quality and widths, it is desirable to have a changeable drum on the warper. It saves cost in the number of warpers, and also overcomes the difficulty that often results from having the back beams too wide. We know that some do not concede this point, but in well-equipped fine mills it is not uncommon to have several widths of warpers, so that when making a warp that is narrower than usual, it is run on the narrow warper. This is a great advantage, because the straighter the yarn runs through the slasher, from creel to loom beam, the better are the side ends run on the loom beam. A little extra width should be allowed at the creel for the size to penetrate into the yarn when passing through the size box. The drum can also be used very profitably in the warping of cord warps; that is, warps used for adding a cord stripe to the cloth and also for leno cord warps.

The drum can be made of strips of wood of about 3 inches in width, 1 inch in thickness, allowing the alternate strips of each half to be a little longer than the others, so that the extended strip from one side will fit into the shorter one on the other side. (See Fig. 15.) By this arrangement these strips can be extended or narrowed to suit the width of the beam, and each half screwed on the driving shaft.

EXAMPLES FOR PRACTICE.

1. A main shaft runs 250 revolutions per minute; there is a 7-inch pulley on this shaft, and a 10-inch pulley on the machine; the drum is 6 inches in diameter, and the whirl on the spindle is $1\frac{3}{8}$ inch. What is the speed of spindle?

Ans. 763.63 revolutions.

2. A main shaft runs 270 revolutions per minute. Diameter of the drum on spooler is 6 inches, pulley on spooler 8 inches, diameter of whirl $1\frac{1}{4}$ inches. In order that the spindle shall run 972 revolutions per minute, what size pulley would be required on the main shaft?

Ans. 6-inch pulley.

3. A warp of 4,500 yards is required. The cuts are to be 50 yards in length; what gears are required to give the requisite number of yards?

Ans. $\begin{cases} \text{50 cut gear.} \\ \text{72 leese gear.} \end{cases}$

4. What are the gears required to produce a warp of 8,400 yards in length?

Ans. $\begin{cases} \text{60 cut gear.} \\ \text{80 leese gear.} \end{cases}$

COLORED WARPS.

Long Chain. Colored yarns, apart from the dye vat, must pass through an extra beaming process before they reach the slasher. In the long-chain system, instead of placing the ends on a back beam for the slasher, as described in the last process, they are drawn from the warper in the form of a ball or chain, and are then conveyed to the dye vat. After this process the chain is beamed on a long-chain beamer, the beam being carried to the slasher, where the yarn is sized and placed on the loom beam. These chains are from eight hundred to several thousand yards in length, more often the latter.

Balling Machine. This machine (Fig. 16) is similar to the beam warper up to the front expansion comb. At this point a leese reed takes the place of the comb.

Leese Reed. The leese reed wires have a hole cut in them; a thread passes through the hole and one between the wires. Thus while each alternate thread is through a hole in the wire, the rest

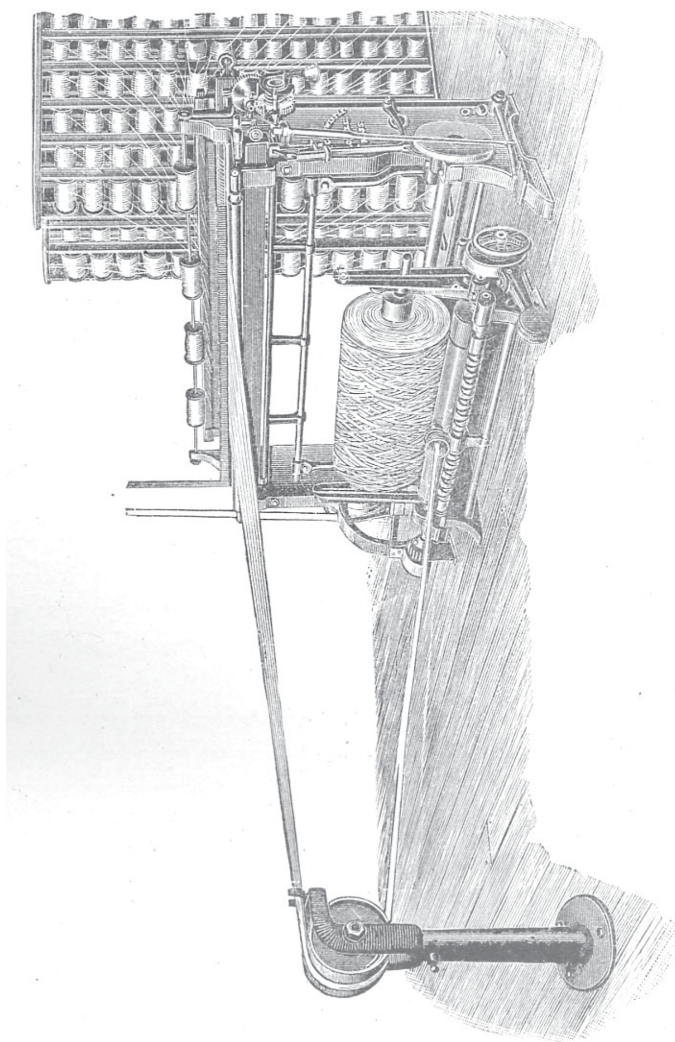


Fig. 16

are between the wires. This reed (Fig. 17) is for the purpose of placing a leese in the threads, which keeps each thread separate and prevents tangled warps. The leeses are placed in the yarn at various distances, according to the number of yards required, generally from 500 to 1,000 yards each. It is absolutely necessary that the leeses be placed in the yarn at the required distances. However, tangled warps are sometimes caused by carelessness on the part of the dyer, even if the leeses are carefully placed.

Another advantage in having the leeses in the yarn is that if a number of ends are broken during the beaming process, the threads can be pieced up in the best possible manner; when the next leese comes along, every thread can be straightened and the warp made as good and straight as when first beamed.

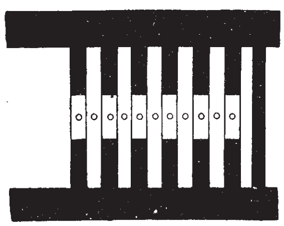


Fig. 17.

From the leese comb the yarn passes through a trumpet which acts as a condenser. This trumpet is placed on a stand that supports a pulley, around which the yarn passes. The pulley is about 10 or 12 feet from the warper, to allow the gradual condensing of the yarn into a small space before it winds around the ball. From the pulley the yarn passes back to the warper. The balling mechanism is placed where the driving drum is usually found on the beam warper. The balling mechanism is driven from the same source as the drum; the ball roller resting between the driving drums and receiving motion from them.

Traverse Guide. The yarn is guided on to the ball roller by means of a trumpet slide, whose base runs in the slot of an endless worm, with right and left thread, which guides the trumpet right to left, then left to right. Fig. 18 shows clearly the construction of the machine.

Overhead Baller. There is also the overhead baller (Fig. 19), which is considered a good machine. Less space is required for this machine than for the first one. Instead of passing straight from the machine to the condenser trumpet, the yarn passes down and under a platform, around a roller and up over the condenser pulley, then down to the beamer. This method allows the operative to stand close to the work and more easily attend to the broken ends. When the ball has attained the required length, it is taken to the dye vat. The yarn passes through the vat in chain form and is then put through the drying process. It is then ready for the beamer.

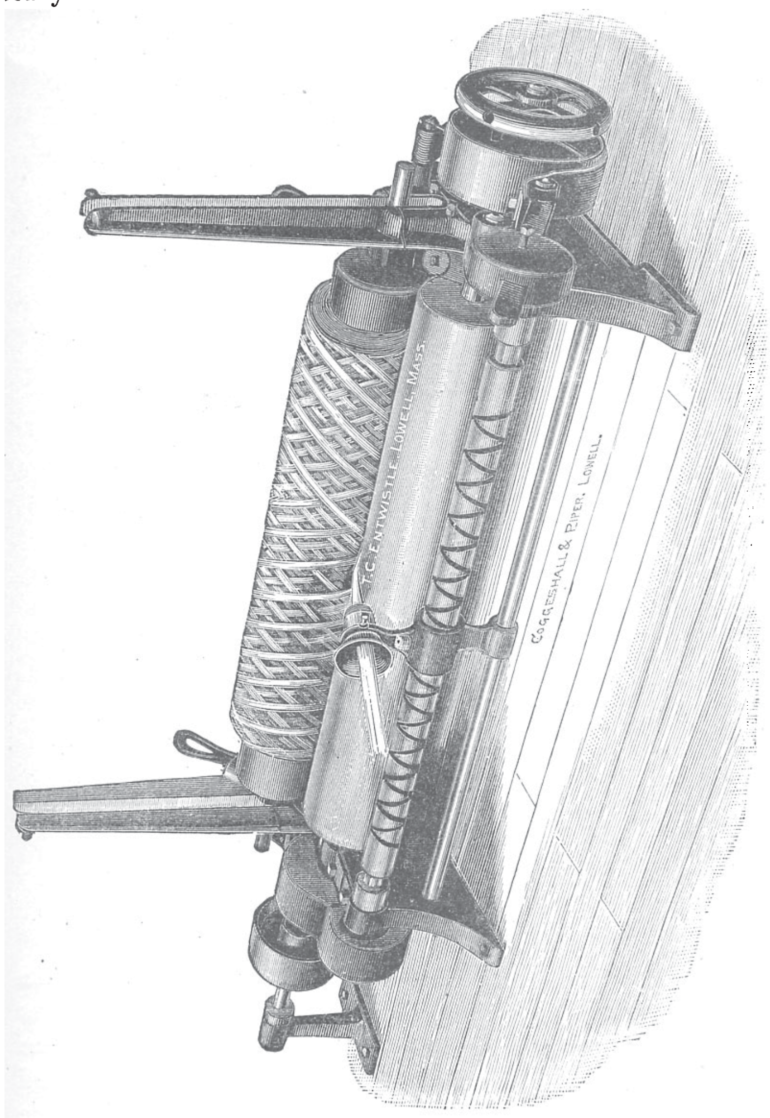


Fig. 18.

Winding Machine. In spite of all the care that a dyer can take while the chain is passing through the vat, an occasional tangled warp can scarcely be prevented. To overcome this defect the winding machine (see Fig. 20) has been invented. This wraps a cord of sufficient strength around the chain, and after the yarn has been dyed the cord is taken off. This machine has been the means of reducing tangled warps at least 50 per cent, which, in consequence, greatly improves the quality of the warp.

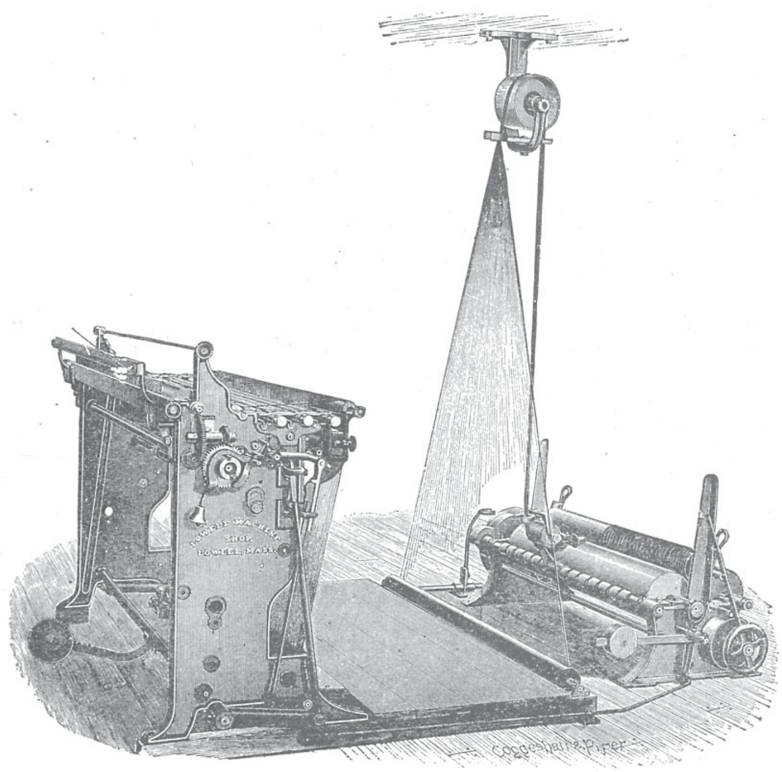


Fig. 19.

The creel of the ball warper is generally made to hold from 500 to 1,400 spools. If desired, the makers construct larger machines, but the best results are obtained by using a machine holding a medium number. These can be more readily handled in the several processes through which the chain passes, and are also more economical from the warper standpoint.

Double Screw. Chain warpers are also built with a double screw, so that two balls of a small number of ends can be made at the same time. This is shown in Fig. 21. It is especially valuable when a small number of ends of different colors are required.

The ordinary beam warper can be changed into a ball warper; the appliances necessary for constructing the ball being additional parts.

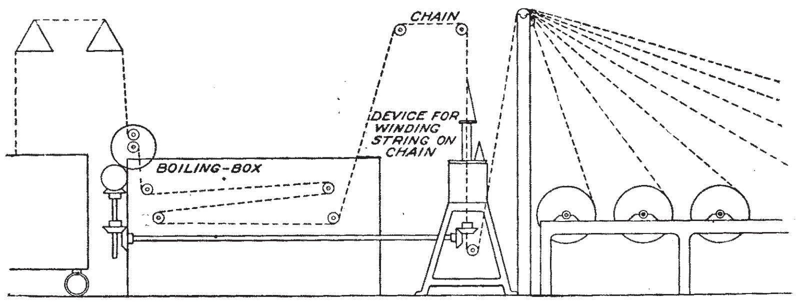


Fig. 20.

Chain Separator. This is a necessity in the colored mills, and is for the purpose of dividing a chain into several parts. For example, 100 ends are required, and there are 500 ends in the chain; the whole chain is passed through the separator, the ends required being counted off (the leese being retained in both sec-

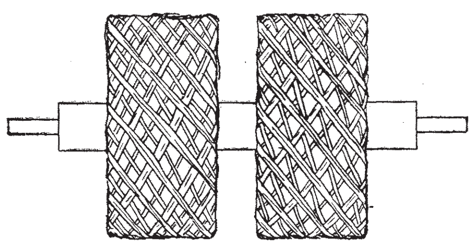


Fig. 21.

tions), after which the yarn is allowed to fall into a box provided for the purpose. It is then carried to the back of the long-chain beamer. When a mill is equipped with a chain separator, several chains having a small number of ends can be run together through the dye vats. This is desirable when the warper creels are small and the standard patterns are narrow.

Linker. For the purpose of shortening the length of a chain

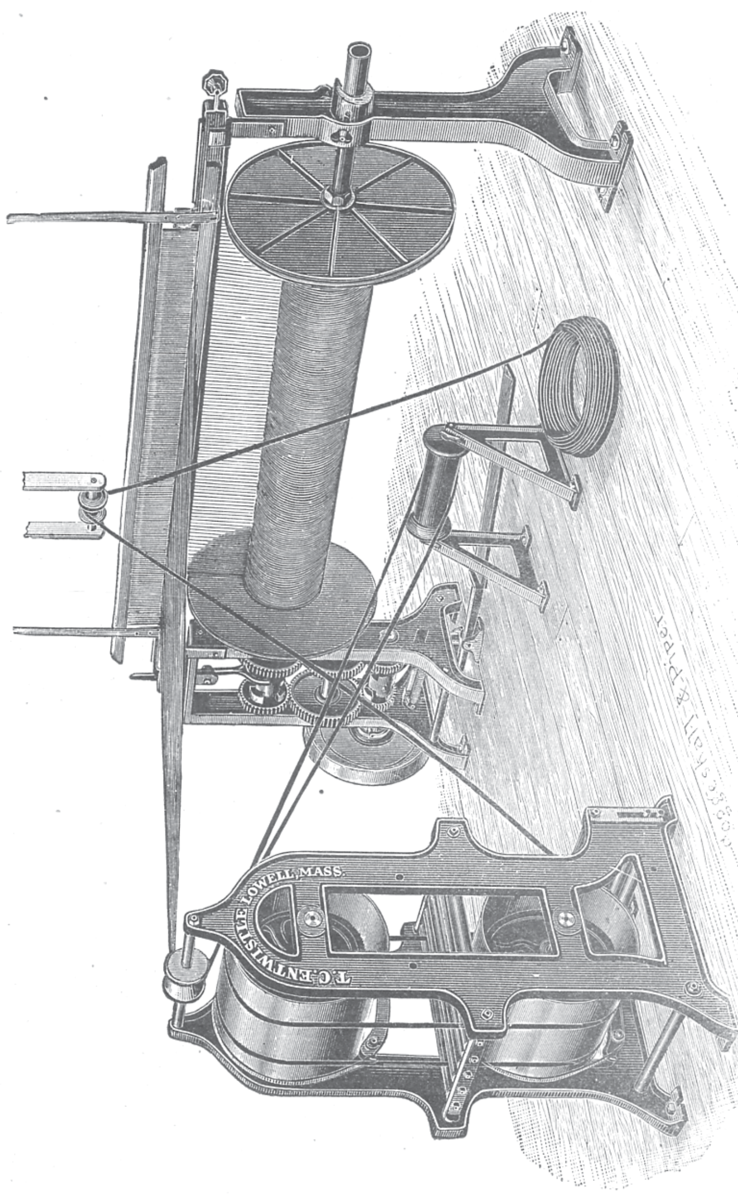


Fig. 22.

that is to be bleached, this very ingenious machine has been made. It effects a great saving, not only by preventing tangles, but by increasing the amount of yarn that can be handled in a given time.

Long-Chain Beamer. After the yarn is dyed it must be beamed on the back beams for the slasher, so that the sizing compound can be added. The ball of colored yarn is placed under a wood eyelet suspended from the ceiling. Through this eyelet the yarn passes to the bottom of the friction drums, and these, as the name implies, add friction or tension to the yarn while it is being placed on the beam. The friction on the yarn is increased by wrapping it a greater number of times around the drums. From the drums the yarn passes around a wooden roller at the foot of the beamer, then back to an iron pulley on the top of the drums and through the swinging comb, then through the expansion comb, and finally to the beam. The drums should be at least 20 feet from the beamer ; the longer the space up to a certain point the better the results. By having the drums this distance from the beamer the yarn is well opened out before it reaches the swinging comb. A long-chain beamer is shown in Fig. 22.

Expansion Comb. The purpose of the leese is now shown; the beamer tender is enabled to lay the threads side by side in the expansion comb. They must be distributed as equally as possible, for two or three extra ends in one dent make a ridge on the beam. This means added circumference to the yarn, and causes those threads to be broken or unduly strained.

Swinging Comb. After the yarn is placed in the expansion comb and widened out to fill the space equally between the beam heads, the operative applies the power to the beamer by means of a foot-board, which is connected to the friction pulley. The speed of the beamer can be varied by the changing of a clutch gear. In operating, the tender has one foot on the shipper-board, in order to apply or disconnect the power, and one hand on the swinging comb, moving the comb backward and forward. If a snarl appears in the yarn it is readily detected, for it will pull on the comb. The operative immediately stops the machine. The colored yarn beams are taken to the slasher from this machine.

The Quiller. The purpose of this machine is to transfer colored yarns from the chain to the bobbin or quill, either for the shuttle or for export. The quiller has friction drums placed about the same distance off as are those of the beamer; there is also a swinging comb. The yarn passes from the comb over guide rods to some 9 or 10 rows of bobbins, placed on upright spindles. There is also a guide or builder rail for each row of bobbins. The spindles are driven in a similar manner as are the spooler spindles, and the builder rail is controlled by a heart-shaped cam. This is a valuable machine, more especially for the heavier counts of yarn, as it builds a very perfect bobbin. (See Fig. 23.)

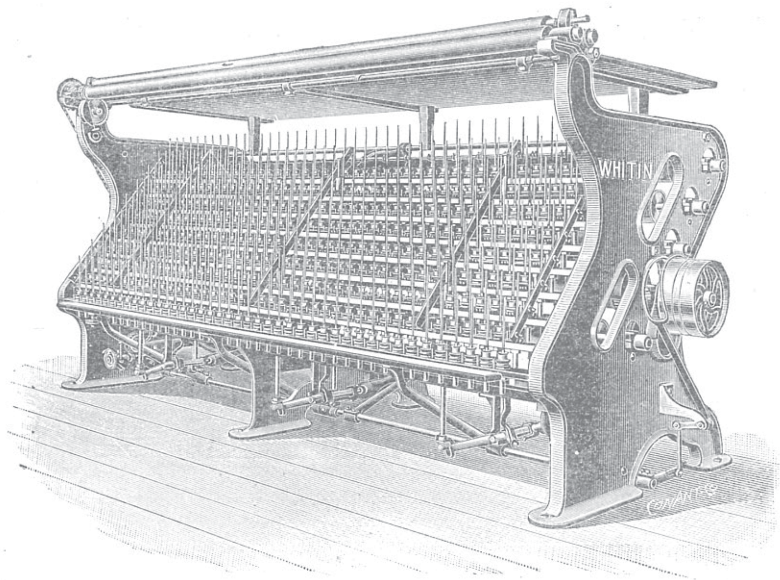


Fig. 23.

Short Chain. The difference between Long and Short chain is as follows: the short chain, varying from 400 to 800 yards in length, when received from the dye vat, is drawn through a sizing trough and sized in bulk, and then placed on the loom beam, instead of being beamed and then sized on the slasher. It is a more costly process than the long chain, and the results are not as good unless the yarn is brushed during the beaming process.

Brushing lays the fibers, and the resulting rounded yarn will then weave a nearly perfect cloth. This method is used in making fine chambrays. This is unlike the old-fashioned hand-dressing, where the beam and creel were far apart, the dresser applying cold size with long flat brushes; the yarn being brushed on both sides and wound on the beam. In the short-chain system (used for fine colored yarns, where cost is secondary) when hand brushing, the dresser draws two long hand brushes over the yarn from the beam to the creel, while the yarn is run over on the beam. The yarn passes from the ball around the friction rolls, over the split

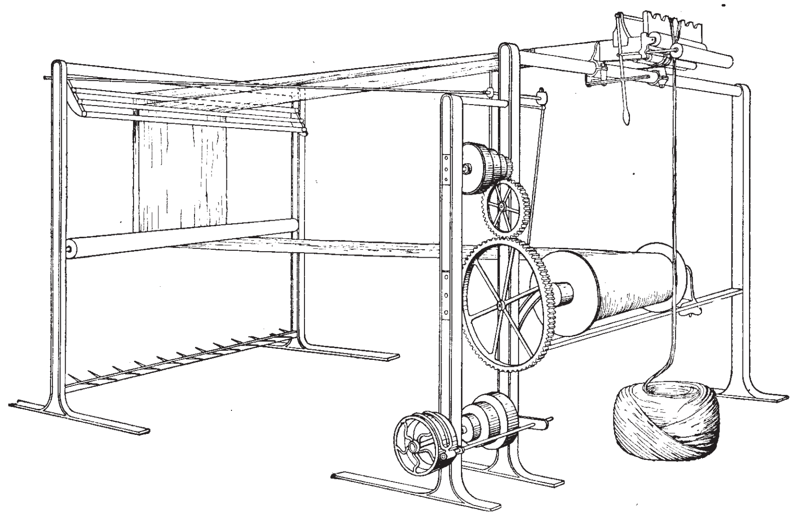


Fig. 24.

rods, through the comb on to the beam. The adding of a brush to the slasher performs the work in almost as finished a manner as hand-dressing, besides producing more warp in the same time. Fig. 24 shows a hand or short-chain dressing machine.

THE SLASHER.

In this machine the sizing compound is placed on the warp yarn, thus strengthening the yarn and laying the fibers. When sized, the yarn is better able to stand the oscillations of the reed during the weaving process. Weight may also be added to the yarn in this machine by means of the sizing compound. It is necessary to size all ordinary single yarns, but ply yarns very seldom require this unless heavily sleyed, that is, made into a fabric having a large number of threads and picks per inch. In making fine grades of goods having a large number of picks, the yarn should be stronger and greater skill displayed in sizing the warps. A point to be emphasized is that one-half the weaving is practically done in the preparing room, for no amount of skill expended afterwards will produce good results from a poorly sized warp. The weaver is often blamed for not producing quantity and quality, although the fault lies with the preparers. If the slasher tender allows his machine to stop for an undue length of time, so that the yarn is burned a little, or the size is caked on the yarn, or if he carelessly allows the size to become thin, it is impossible to expect good results from the warp. It pays to have skilled labor in a dressing room.

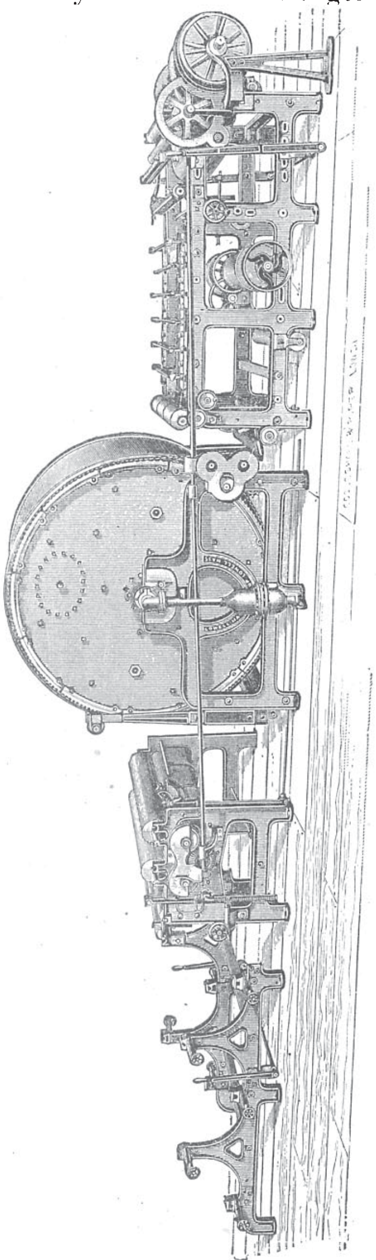


Fig. 25.

Creels. There are two kinds of creels for slashers, the upright and the horizontal. Both are for the purpose of holding the back beams. The upright creel saves floor space, as the beams are placed one above the other. The horizontal stretches out behind the machine, and the beams are placed one behind the other. The latter is considered the better, as the attendant can get at the beams more readily. Sometimes there is a slight difference in the width of back beams; when such is the case, the widest beam must of necessity be placed nearest the machine, and the narrowest farthest from the machine. If this is not done, the ends from the widest pass outside the flanges of the narrowest beam, or crowd as they pass through the squeeze rolls, thus lifting the rolls, and preventing the rest of the warp from being thoroughly squeezed. (See Figs. 26 and 27.)

Size Box. The yarn passes from the creel over an iron roller into the size box. There are two kinds of size boxes, the

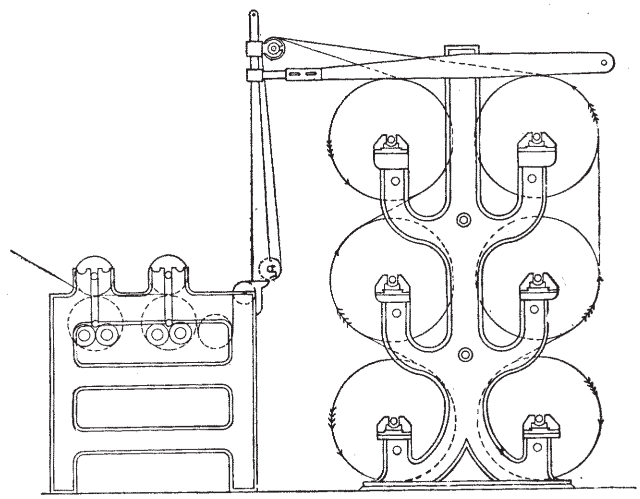


Fig. 26.

plain and jacketed. The plain box is the one in which the size is heated and boiled by means of a perforated pipe that is in the box. This pipe discharges the steam into the size.

The jacketed size box has a steam chamber under and around

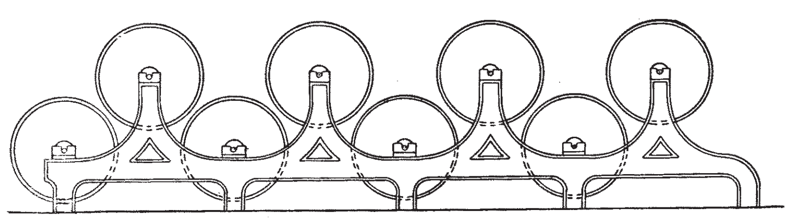


Fig. 27.

it, so that the size can be heated without steam being discharged into the mixture. This jacketed size box also has a perforated pipe inside, so that either method can be used.

Both the above systems have their advantages. It is claimed that with the jacketed vat there is no possibility of steam getting into the size and thereby weakening it. Careless slasher tenders often allow the size to become weak, thus causing soft-dressed warps. Those who prefer the perforated pipe say that so little condensed steam enters the size, it is not weakened to any injurious extent; that the size can be boiled ten or fifteen minutes

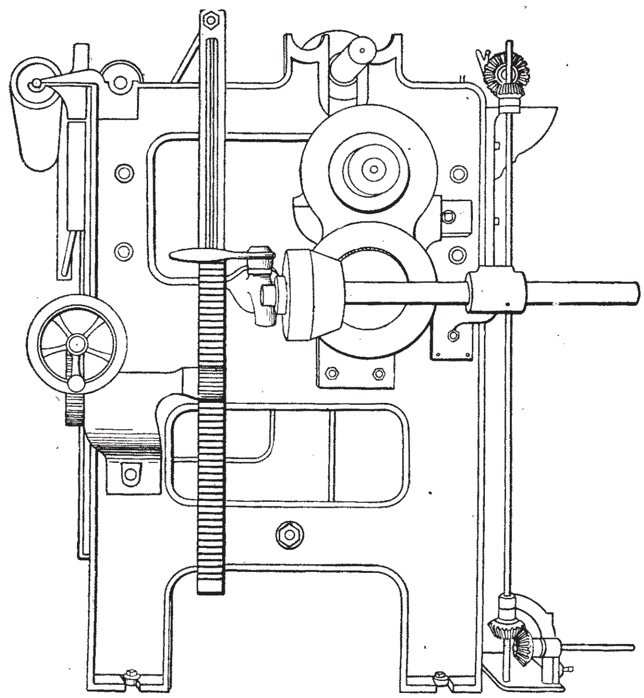
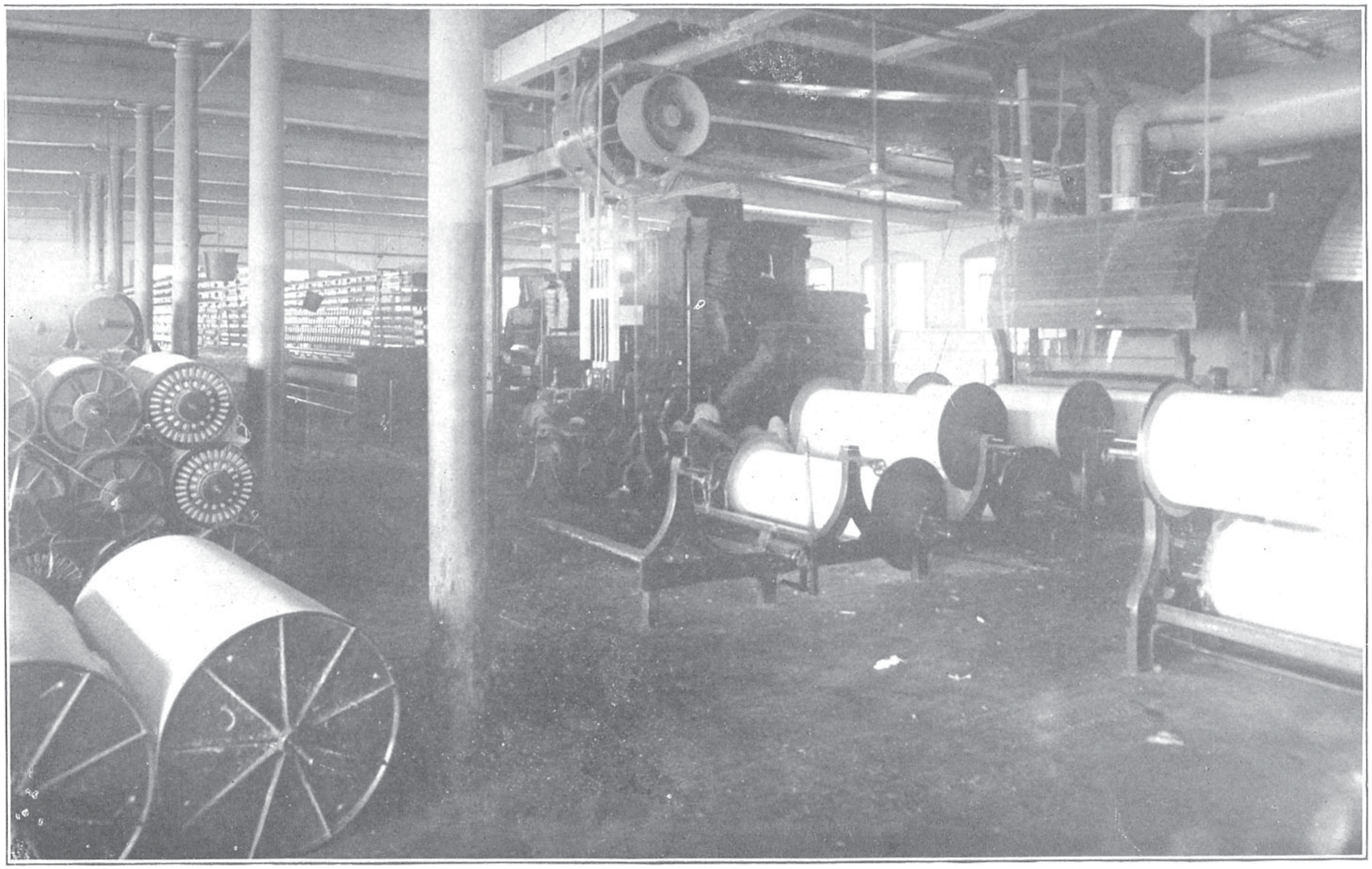


Fig. 28. (See also Fig. 38.)

quicker than with the jacketed vat, thus effecting a considerable saving; and that the size vat can be more readily cleansed. See Fig. 28.

Immersion Roller. The yarn passes under an immersion roller, which is made of copper and arranged so that it can be raised or lowered, according to the amount of size desired on the yarn. If the roller is low in the vat, thereby having more of its surface in the size, it will take longer for the yarn to pass through the size, and it will absorb more.



75 H. P. INDUCTION MOTOR DRIVING TWISTERS AND SLASHERS
Dwight Mfg. Co.

Squeeze Rolls. The yarn on leaving the size box passes through two sets of squeeze rolls. There are some instances where only one set of rolls is used, but this method does not give good results, even with fine yarn, while with coarse yarn the results are very poor. The two lower rolls of each set are copper; the roll on the top of each copper roll is solid iron. The solid rolls should be covered with an especially prepared flannel cloth, which is almost a felt. These coverings should be taken off once every week and allowed to soak in water for a day or two, from Saturday until Monday morning, for instance. Flannel cloths make the best coverings, because they allow the yarn to sink into the cloth to a slight extent, whereas cotton cloths become hard and glazed with the size, and not only tend to flatten the yarn, but cause it to be drawn through the rolls before it is thoroughly squeezed of unnecessary size. It is beneficial, also, to wash the rolls every time the machine is stopped, that is, at noontime and evening. A good way to do this is to take the regulation watering can, and pour the water on the rolls while the machine is running for the last two or three turns.

These are simple matters, but they make the slasher tender more efficient.

Two sets of squeeze rolls are advantageous because the second set act as finishers, and yield a cleaner yarn. The machine can be run at a little higher speed, because there is less chance of excessive size adhering to the yarn. The yarn will also be dryer as it reaches the loom beam, because there has been less size to dry. See Fig. 25.

Cylinders. From the squeeze rolls the yarn passes around the cylinder or cylinders. Opinions vary as to whether one cylinder or two give the best results. As the purpose of the cylinder is to dry the yarn after it has been sized, it is claimed by some that by the use of two cylinders, owing to the increased drying space, there is a better chance for this to be accomplished. For coarse counts of yarn, all the drying space that can be obtained is necessary, or the result is a damp warp, which tends to mildew if kept in stock for any length of time. There are others who prefer one large cylinder, on account of less parts to look after; but space in the mill is to a great extent the deciding point.

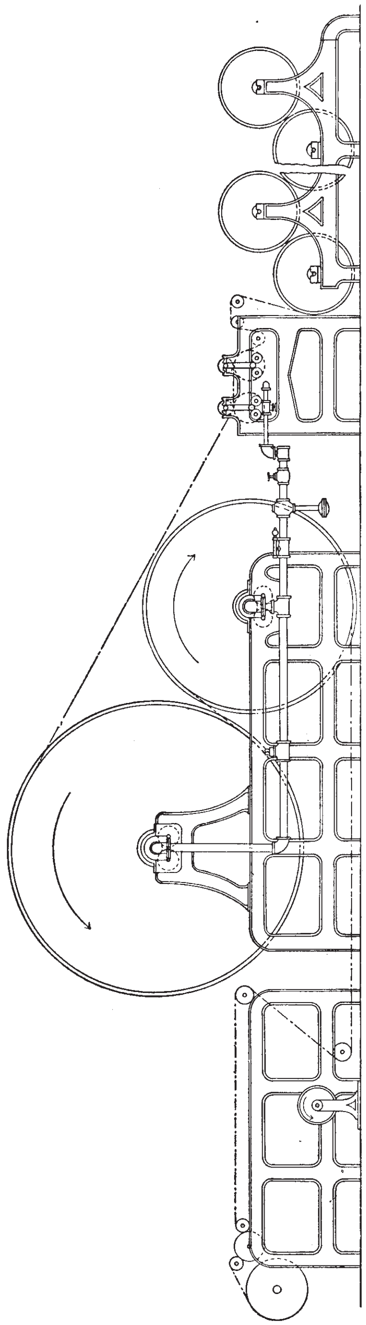


Fig. 29.

The cylinders are of various sizes, the double cylinders being 8 and 6 feet in diameter, 7 and 5 feet, 6 and 4 feet; the single cylinder from 8 to 12 feet in diameter, the width being determined by demand. For general fine work the single cylinder is usually considered better. The cylinders are heated by exhaust steam or live steam from the boiler; as both methods give good results, the cost usually decides this point. See Fig. 29.

Reducing Valve. In addition to a gage, a reducing valve is usually attached to a slasher. When the steam comes directly from the boilers it is generally necessary to reduce the pressure before entering the cylinder. The pressure in the cylinder varies from 4 to 10 pounds; 6 pounds is the average pressure used. Warps of comparatively few ends might require even less than this, owing to the small amount of dampness on the cylinder. With a heavy yarn of a greater number of ends a larger amount of steam is necessary. A greater pressure is also desirable when the yarn is heavily weighted; that is, loaded with heavy size, as will be explained later. See Fig. 31.

Steam Trap. A trap is attached to the steam outlet, and should work perfectly to prevent the loss of steam. If the slasher is run at high speed, more steam will be used to thoroughly dry the

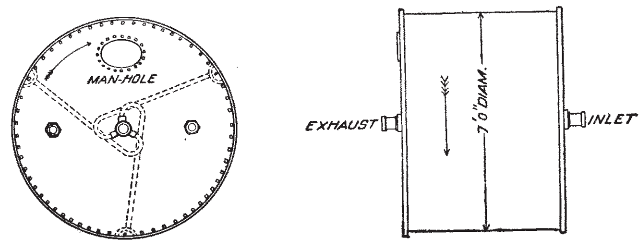


Fig. 30.

yarn than is necessary with ordinary speed. A few more yards of warp can be sized and dried if this extra steam is used, but it is not economical to gain even a warp in two or three days at the expense of greater cost. The inside of the cylinder is fitted with drip pans, which catch the condensed steam and convey it to the outlet. There are generally three of these pans fixed at equal distances apart, and extending the full width of the cylinder. They have a slight incline, and pipes in the form of the letter S running from the lower end convey the water to the outlet. (See Fig. 32.)

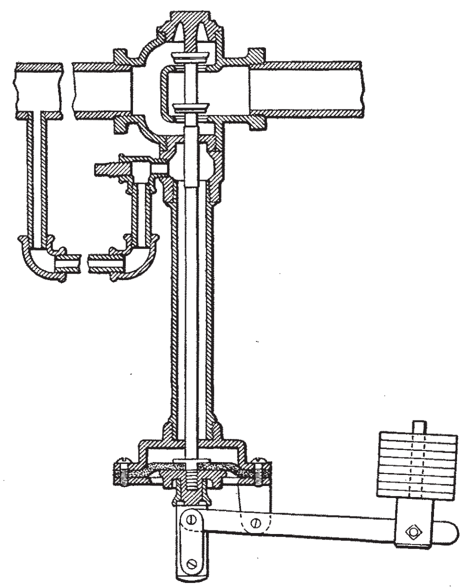


Fig. 31.

Vacuum Valve. The cylinders are also fitted with a vacuum valve, and frequently the slasher tender has serious trouble by neglecting it. Sometimes this valve becomes fouled, and the cylinder collapses; for if the valve does not allow air to enter the cylinder after the steam is shut off, a vacuum is formed and the thin copper sheeting is not capable of resisting the external pressure.

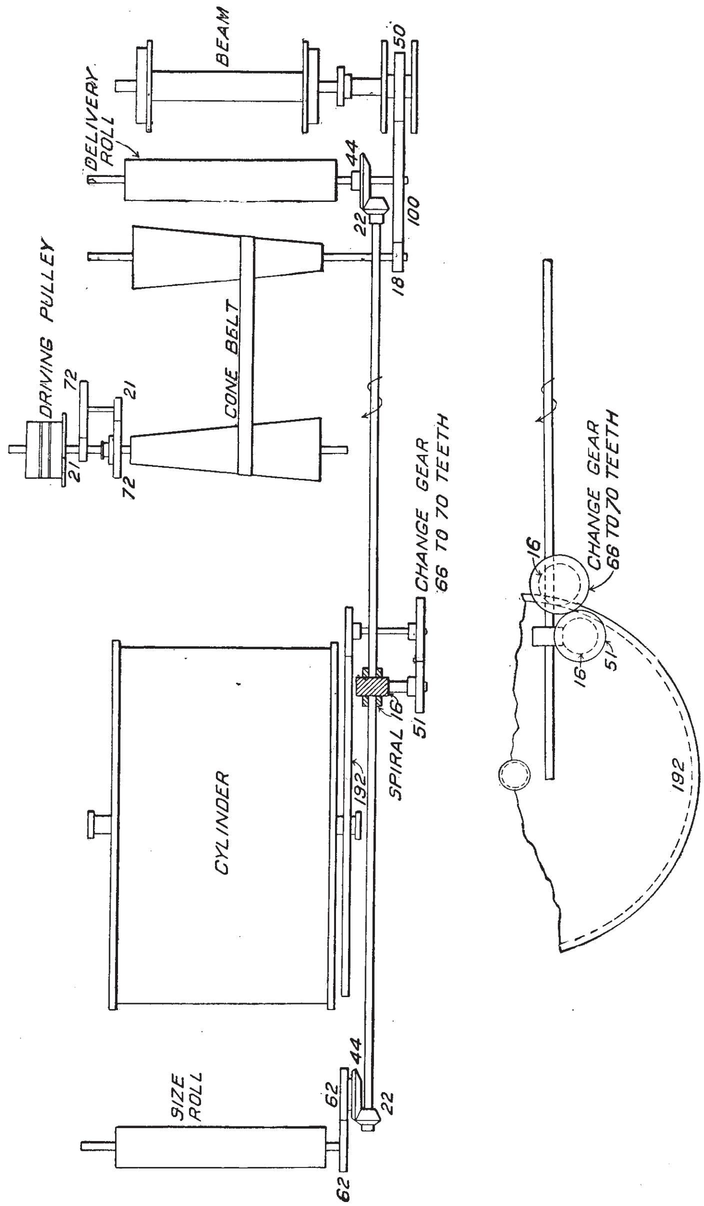

BEAM
50
DELIVERY ROLL
44
22
100
18
DRIVING PULLEY
72
21
21
72
CONE BELT
CHANGE GEAR 66 TO 70 TEETH
CYLINDER
SPIRAL 16
51
192
SIZE ROLL
62
62
44
22
16
CHANGE GEAR 66 TO 70 TEETH
16
51
192

Fig. 33.

Gear Drive. It is becoming a recognized fact that to have the best results, namely, elasticity in the yarn, and less breakage, the cylinder should be fitted with a gear drive, so that it will be driven at the same speed as the rest of the machine, but without gaining its motion from the pull of the yarn, as is common in some mills. The elasticity of the yarn should be preserved, so far

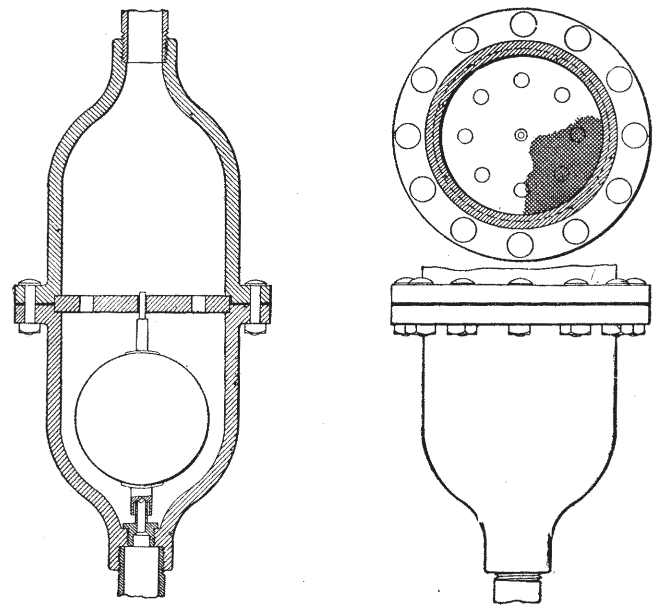


Fig. 32.

as is possible, in every process through which it passes. Yarn that has been properly handled is brighter, of greater value, and weaves better because it yields somewhat to the strain put upon it. Fig. 33.

The Fan. This is an essential feature of the slasher, and as it is a preventative of greater steam pressure it should not be lost sight of. The fan helps to dry the yarn as it passes around it, and also blows away the steam that issues from the drying yarn. Without the fan, or with it stopped, the steam follows the yarn, which is likely to be damp when it reaches the loom beam. The yarn passes from the cylinder, around the fan and up over the measuring roll, as will be explained later.

Split Rods. From the measuring roll the yarn passes around the split or separating rods. The purpose of these rods is to separate the threads before they pass on to the beam. After being sized, the ends cling together, and it is necessary to separate them, otherwise the weaver will have difficulty in weaving the warp, because of the ends clinging together. The number of rods is determined by the number of back beams, one rod less than the number of beams; thus with 6 beams 5 rods are required. The rod nearest the cylinder is the largest, and divides the ends as nearly as possible into two equal parts. A glance at the sketch, Fig. 33, will show the method of placing the tapes for the dividing rods. No. 1 is the thick rod set nearest the cylinder; No. 3 is the first thin rod on the top; No. 2, first thin rod at the bottom; No. 4, second thin rod on the bottom. The above is the order of laying in the tapes after a set has been started, No. 1 tape passing through the size box first, the rest following in the order given. This order is changed when starting up a new set of beams, as explained later. A careful slasher tender will often place the tapes in the yarn, because they keep the threads straight, and better weaving is the result. From the split rods the yarn passes through an expansion comb, over a solid iron roller, around the tension roller, over a second solid roll, and on to the beam. This

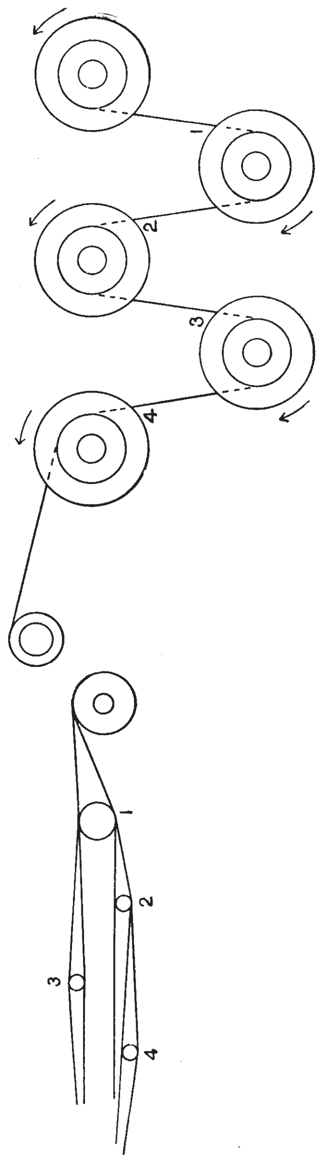


Fig. 34.

expansion comb is the same as that on the warper, and has a ratchet at the end which can be driven by a pawl from the driving shaft. If there are several cuts on the back beams after the loom beam has been filled to the edge of the flanges, instead of making a small warp, which is as expensive as a large one, in the drawing-in or twisting process, the width of the comb is gradually decreased by means of the ratchet, and the extra cuts are placed on the full beam without damage to the yarn. The extra length of warp is built up in a narrower space at every turn of the beam. This manner of disposing of warp cannot be practised if the cloth is to be made in a short time, as small warps are then run in order to fill more looms. (Fig. 34.)

Tension Roll. The tension roll, as its name implies, adds to the tension of the yarn; the larger the number of ends, the greater the tension required. The tension is obtained by wrapping layers of cloth around the roller, for by increasing the circumference the tension is increased.

Beam Drive. The beam is driven by friction, and the tender should use good judgment in the amount of friction applied. Too much friction tends to strain the yarn, and breaks many ends; while insufficient friction makes a soft beam, which is a cause of uneven cloth, the warp not weaving as well as when firmly made. The head drive is furnished with a hand wheel, so that the amount of friction can be readily changed. The amount applied is a trifle more than is actually necessary to take up the yarn delivered from the tension roll; this tends to make a tight warp without undue strain on the yarn. Failing to attend to this is often the cause of burnt yarn, also stiff or oversized warps, because the yarn is on the cylinder or in the size box too long. (See Fig. 35.)

Press Roll. Some slasher tenders allow the machine to run for a short time on a new warp before the press roll has been placed in position. This often causes a poor section of warp near the bottom of the beam. The same defect is found if the regulation of the friction is delayed too long. On account of this careless work, the warp yarn is run loosely on the beam, thus forming several soft layers. The next few layers sink into these soft layers, and owing to this, warps have had to be cut out and used for piece threads. A roll that is very valuable is known as the extending press roll. This is so arranged that it can be used for beams of several different widths, thus ensuring an even warp. When the one-piece roll is used, it often happens that it does not fit between the beam flanges, but leaves a small space on one side. If such is the case, the selvedge threads are not pressed on that side, and therefore build up higher than the rest of the yarn. Before the beam is filled, these side ends are built up to the edge of the flange, and the warp must be doffed then, or the threads may be slipped over the flange. They are then likely to become tangled and broken, and afterward the selvedge will never weave properly.

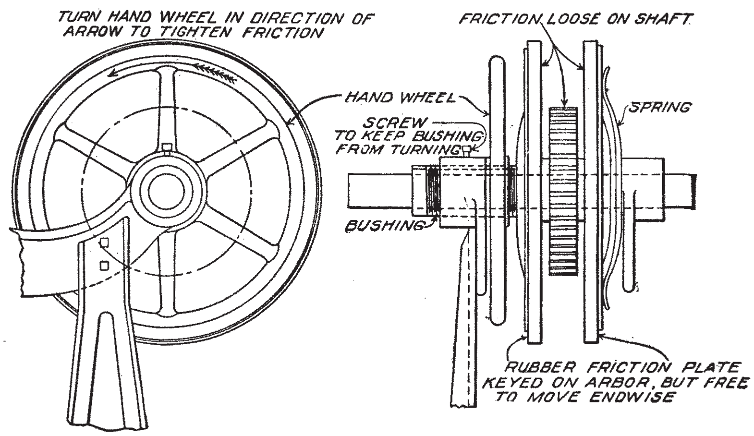


Fig. 35.

The press roll is placed below the beam and is supported on two lever arms, which can be raised or lowered to suit the beam. The weights placed on a lever connected to the supporting shaft are regulated to suit the pressure required on the press roll.

Cone Drive. In addition to the regular straight drive for the slasher, two cone pulleys are placed on the inside of the machine near the head, and the speed can be increased or diminished by means of a traveling shipper placed on a worm. The speed is gradually decreased as the warp increases in size, for if this is not attended to, the yarn travels at too great a speed through the size, and a poor warp is the result. If a very heavy warp is being sized, the speed can be reduced by means of this drive, so that the yarn has a longer time to dry as it passes around the cylinder.

Slow Motion. There is also a slow-motion drive, fixed on the same principles as that on the warper. This is generally used when putting in the split rods and also when cutting off laps. Laps are ends that have broken and wrapped around the back beams or the squeeze rolls.

Calculations for Measuring Roll and Bell Gear. In order to show the weaver where to cut the cloth when it is woven, cut marks are placed at equal distances on the yarn as it leaves the size box. A marker passes through a reservoir in which a certain color of aniline ink has been placed. This marker is connected directly with the measuring motion and the clock. The particular gear that imparts motion to the marker is called the bell gear, because it causes a bell to ring when the marker prints the colored line on the yarn. The clock connected with this motion denotes the number of cuts placed on the beam. The stud gear is on an extended stud, and between the gear and the nut on the end of the stud is a spiral spring. The spring keeps the gear in mesh with the train, but when a warp is finished and it is desired to turn the motion back on the cut marker, it can be done without turning the measuring roller, as this would tender the yarn that was around the roller. The setting of the motion is accomplished after drawing out the stud gear on the extended stud.

Rule. Multiply the circumference of the measuring roll in inches by the stud gear times the bell gear, and divide the product by 36 inches, which gives a constant number, and that number divided by the yards required will give the change gear.

Suppose the circumference of the measuring roll is 18 inches, the stud gear contains 80 teeth, bell gear 50, change gear on the end of measuring roll 40. This combination of gears gives 50 yards per cut.

To find the stud gear required to give an odd number of yards, proceed as follows: with a 40-tooth change gear each 8 teeth on the stud gear will give 5 yards, so that changing the stud gear for one with 72 or 88 teeth will give 45 or 55 yards to a cut.

Example, using the above rule to find a standard number.

$$\frac{\underset{\text{Circum. of Roll.}}{18} \times \underset{\text{Stud Gear.}}{80} \times \underset{\text{Bell Gear.}}{50}}{\underset{\text{Inches.}}{36}} = 2{,}000 = \text{Constant.}$$

$$\frac{2{,}000}{\underset{\text{Change Gear.}}{40}} = 50 \text{ yards per cut.}$$

The stud gear is often changed to get an odd number of yards, but the same rule is followed.

By changing the stud gear to 72, thus having the following train of gears, 72 stud gear, 50 bell, 18 inches circumference of roll, a standard is obtained of 1,800 yards. This standard gives a wider range than the first standard of 2,000. We can obtain 50 yards with a 36 change gear, or 36 yards with a 50 gear. Also 60 yards with a 30 gear, or 30 yards with a 60 gear. The smaller the change gear, the greater the number of yards in a cut. The larger the gear, the smaller the number of yards.

$$\frac{\underset{\text{Circum. of Roll.}}{18} \times \underset{\text{Stud Gear.}}{72} \times \underset{\text{Bell Gear.}}{50}}{\underset{\text{Inches.}}{36}} = 1{,}800 = \text{Standard Number.}$$

$$\frac{\overset{\text{Constant.}}{1{,}800}}{\underset{\text{Change Gear.}}{36}} = 50 \text{ yards per cut.}$$

Aniline inks are used for making cut marks because they retain their brilliancy and do not stain the cylinder to any great extent. (See Fig. 36.)

SIZING.

Sizing is the immersion of the yarn in a prepared size mixture. The ingredients of this mixture are boiled and placed in a size box; as the yarn is drawn through the box, the size adheres to it. This is an essential feature in warp preparation, for however good the yarn, or however carefully the preceding processes may have been carried out, poor results follow neglect in sizing. Thought must be given to the quality and quantity of the ingredients that form the size for the various kinds of yarn and the resulting fabrics. At the present time there is not as much skill required of the slasher tender as formerly in this work, because of the numerous patented mixtures. A careful overseer, however, who desires to know what he is using, will study the component parts that form a good size. This often results in economy, for local needs are best known by a wide-awake man. As already

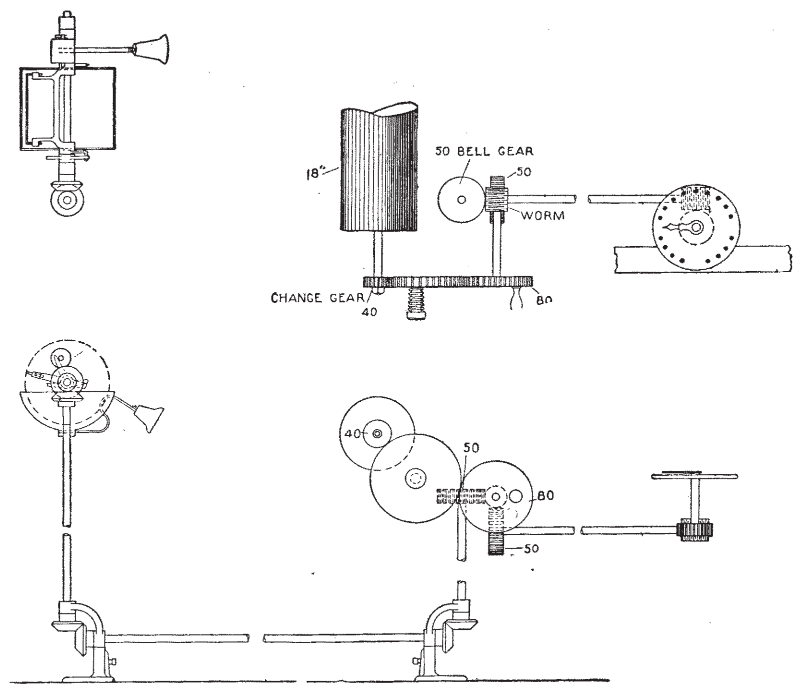


Fig. 36.

stated, single yarns must be sized in order to strengthen them. Insufficient size makes soft warps, which require very delicate treatment from the weaver, and which frequently cannot be woven; this also applies to a stiff warp, or one that has too much size on it. A slasher tender can so accustom his fingers to the feel of the yarn that he can readily tell the strength of the size. The machine should not be entirely stopped unless absolutely necessary, because stopping causes the size to cake on the yarn. This must be brushed off when the yarn is passing on to the beam.

A soft yarn results from brushing, and many ends break as they near the split rods. Unless the stiff place has been repaired by the slasher tender the weaver has great difficulty in making good cloth from this part of the warp.

In some mills the size kettle is connected to pumps, which pump the size into the vat. In some a rotary pump is constantly feeding and taking away size. Both of these features are excellent. In other places the size is in a kettle placed above the machine, and the simple opening of a faucet releases it when required. Again, in some mills the size is carried in pails from the kettle to the vat. In the latter case when pouring the size into the box, unless care is taken, lumps are sure to adhere to the yarn, with the result already described. There have been cases in which tenders who were running tablecloth warps poured the size on the squeeze rolls, without a thought or care; and as brushes were not used, great blotches of size were caked on the yarn, and some of the warps were thrown away.

The careful tender must see that the size does not get above the boiling point, for he knows that if it does the size will sputter, and little blebs or patches will appear on the yarn when it goes on the beam.

There are three distinct degrees of sizing, namely: Light, Medium and Heavy. The first is used when a solid cotton cloth is desired, especially in the finer grades. It adds a small percentage of weight to the yarn and strengthens it for the weaving process. In many cases almost all is washed out after it is woven. The second adds from 10 to 20 per cent of weight to the cloth. The third is not often used. A skilled size mixer is able to make a preparation that will deceive even experts when handling the cloth; he may readily believe that the cloth is not weighted beyond what appears to be the lightest size, when the cloth in question contains weighting ingredients to the amount of 15 per cent.

Sizing ingredients are divided into several classes.

1. Strengthening compounds
2. Softening compounds
3. Weighting compounds
4. Antiseptic

Strengthening. Potato starch or farino, dextrin or British gum, wheat flour, maize, sago, rice and tapioca. Potato starch is by far the best.

Softening. Tallow, bone grease, cocoanut oil, palm oil, Japan wax, beeswax, paraffin wax, glycerin, dulcine, Irish moss and soap.

Weighting. China clay, French chalk or silicate of magnesia, sulphate of magnesia or Epsom salts.

Antiseptic. To prevent mildew. Chloride of zinc.

Ultramarine. This blue is used for making less evident the yellow shade of the yarn; the proportion is one ounce to about five sacks of flour.

The value of a size is determined by its adhesive and strength-giving qualities.

FORMULAS.

Light Size. A good light size may be made up as follows:

40 to 50 pounds of potato starch
100 to 110 gallons of water
2 to 3 pounds of tallow
3 to 5 ounces of chloride of zinc

This would add 3 to 5 per cent in weight.

There are no patent compounds that are as good as a mixture of the separate ingredients named above, however much they may be praised. For light sizing the best ingredients should be used. The above have been used from a very early date as sizing compounds, and are now very generally used.

Medium.

100 gallons of water
120 pounds of potato starch
60 pounds of dextrin
40 pounds of Epsom salts
60 pounds of China clay
2½ pounds chloride of zinc
3 quarts bleached palm oil

The above is for the purpose of making the cloth feel heavier than it would if made from pure cotton; the cloth can also be produced at less cost.

Heavy. This formula is governed by the judgment of the overseer, and by the requirements. It is well to add a little blue to each batch of size, for it takes off the yellowish tint that would otherwise appear on the yarn. The fatty substances not only soften the yarn, but lubricate the eyes of the harnesses.

The above formulas are general, and by adding the following the weight will be increased, as indicated.

To add 10 per cent of weight:

125 gallons of water
88 pounds of cornstarch (Pearl)
1½ pounds of tallow
2 ounces of Glauber's salts
2 ounces aniline blue
1 pint turpentine
Sufficient for 216 cuts of 66 yards, 1,616 ends, 22's yarn.

To add 10 per cent weight:

52 pounds cornstarch
4 pounds dressing (Scott's size)
1 pound tallow
1½ ounces blue
1½ ounces Glauber's salts
1 pint turpentine
90 gallons water
150 cuts, 66 yards, 1,616 ends, 22's yarn.

To add 15 per cent weight:

175 gallons water
112 pounds cornstarch
1½ pounds tallow
2 ounces salts
2 ounces blue
1 pint turpentine
190 cuts, 55 yards, 1,700 ends, 16's yarn.

Turpentine is considered one of the best ingredients for preventing mice or rats from eating cloth; it is also to a small degree antiseptic.

Size Kettle. There are different makes of size kettles; the jacketed kettle is claimed to be the better, while the kettle with the perforated steam pipe has many supporters. In the latter, however, the size boils more quickly and shows less tendency to cake at the bottom of the kettle.

A size kettle is fitted with agitators, to mix up the ingredients. These agitators are constantly moving so that the size is kept free from lumps; they turn from 15 to 20 revolutions per minute. The more the size is agitated the thinner it becomes;

hence the time when the size is thoroughly boiled must be watched for. Cornstarch requires more boiling than any other ingredient, and the longer it is boiled the better it becomes.

The starch is placed in the required amount of water, and agitated for 15 minutes; when it starts to boil, the other ingredients are added. Flour requires a considerable amount of soaking before it can be profitably used, usually from seven days to three or four weeks.

Colored Yarns. For about 25 or 30 counts of yarn use 100 gallons of water, 20 pounds of potato starch, 5 to 6 pounds of stearin, 5 to 6 pounds bleached palm oil, ½ pound beeswax, ½ pound spermaceti, and 3 to 4 ounces chloride of zinc. The wax and spermaceti assist in making a smooth yarn; each alone of sufficient quantity would have a tendency to harden the yarn. The stearin, tallow and oil act as softeners.

Fig. 37.

Bleached Goods. If the yarn to be sized is to be made into a cloth that must go through a bleaching process, wax should not be added, because the bleaching powder cannot penetrate the wax, and gray spots will appear on the cloth. Use 50 pounds of starch, 2½ pounds tallow, and 100 gallons of water. Some dressers use soap, but it is not advisable, as it bubbles, and also requires some ingredient to prevent the yarn from sticking to the cylinder. The excellence of potato starch and its extensive use is due to the fact that it does not leave a harsh feeling on the cloth, or at least not to the extent that other starches do. For this reason it is given in the formulas.

If there is any tendency for the colors to bleed or run, cold size should be used, made slightly thinner than usual, to prevent the possibility of lumps adhering to the yarn. But if the colors are fast, the yarn can safely be run through hot size. Occasionally colored yarns are sized first, short-chain system, then run through the slasher over the squeeze roll at the same time that the rest of the yarn is passing through the size.

Flour is used in some mills in place of potato starch on account of its fine adhesive qualities, but it is not extensively used, because of its great tendency to attract moisture, which causes mildew. As before stated, it must be steeped in water for several days before using.

Two or more ingredients having similar properties are used in order to lessen the cost. It often happens that by using a little of a second ingredient there is a slight saving in the cost of the size, and yet a good result is obtained, because one helps the other, where alone one would probably give too much weight or softness to the yarn.

SIZING COMPOUNDS.

Vegetable. *Dextrin* possesses the same chemical composition as starch; gives a harsh feeling to the cloth.

Wheat Flour, produced from wheat, should be free from color, bad odors and acidity. When exposed in a damp place it quickly mildews; it contains a large proportion of gluten.

Potato Starch, or *Farino*, from the potato. It makes a stiff paste.

Maize, or *Corn Flour*, has great stiffening qualities; expensive, and requires additional softening.

Rice, not much used for gray cloths; gives hard feeling and is expensive.

Sago, from sago palm, gives very harsh feeling and requires but little to make size, though plenty of fatty matter to soften, particularly cocoanut oil, 1 ounce to 1 gallon of size. It soon becomes watery.

Tapioca has little starchy matter.

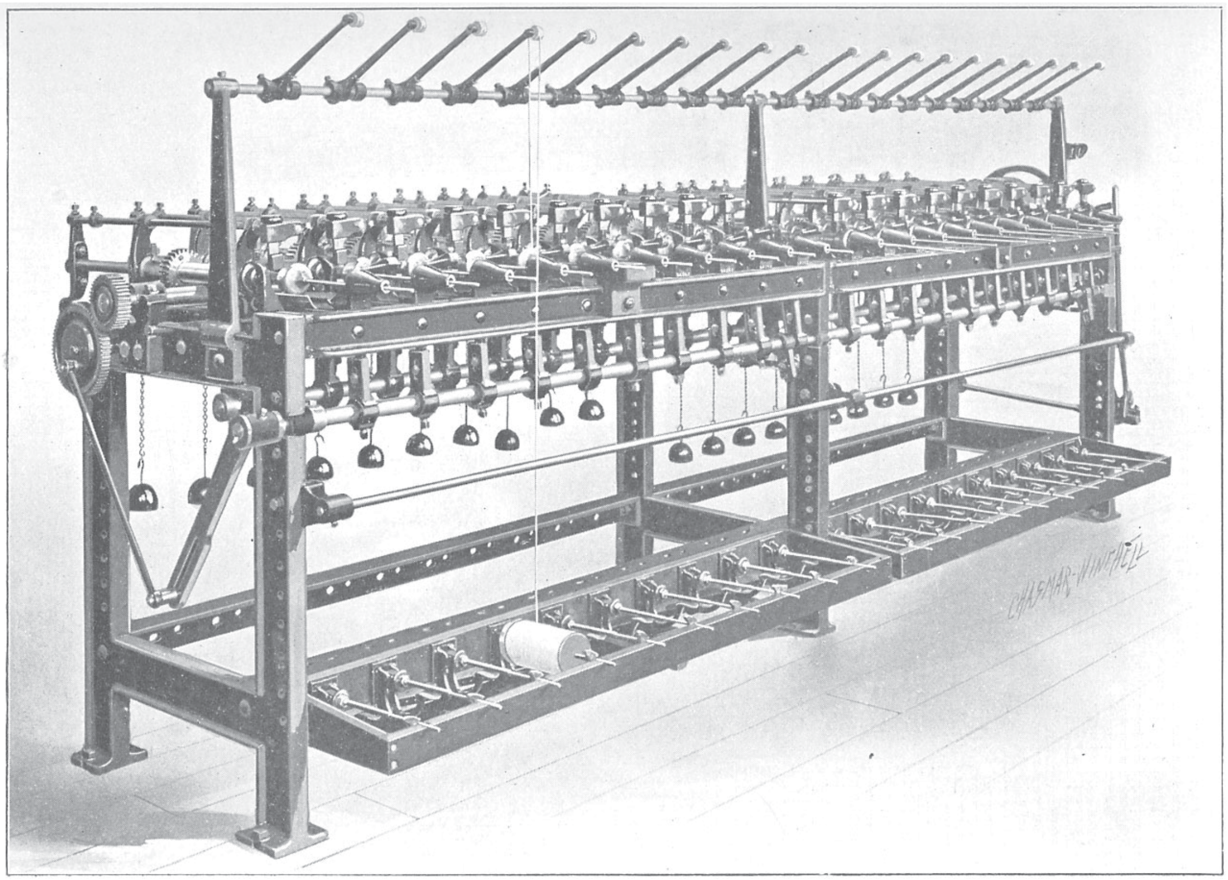
Fatty Matter. *Tallow*. Good tallow is white. Should be used in the proportion of about 8 pounds to 1 sack of flour.

Bone Grease, cheapest, but has a tendency to become rancid.

Cocoanut Oil, used principally in sago sizing; becomes rancid.

Bleached Palm Oil, next to tallow for valuable qualities; also used in sago sizing.

Castor Oil, sometimes used with tallow.



CROMPTON & KNOWLES COP WINDER

Waxes. *Japan* and *American* waxes are soft, brittle, fatty substances.

Paraffin Wax is not saponifiable by alkalies; that is, cannot afterwards be removed from the cloth during the bleaching process.

Glycerin gives a soft feeling to the cloth, especially when weighted with China clay. The quantity used should be limited, as it becomes sticky and keeps the yarn moist.

Dulcine, a mixture of glycerin, gum and Chinese wax.

Irish Moss contains a large amount of vegetable mucilage.

Soaps have a tendency to make the size lumpy.

Mineral as weight givers. *China Clay*, produced by the disintegration of feldspar; it is best when milk white.

French Chalk, or *Silicate of Magnesia*, has a tendency to discolor.

Sulphate of Magnesia, or *Epsom Salts*, the best cleanser, permeates the yarn; it also gives weight and should be pure.

Sulphate of Baryta gives a harsh, hard feeling, and is better for finishing.

Glauber Salts; same as Epsom Salts.

Chloride of Calcium, used with chloride of magnesium for adulteration; must not be used alone, as it keeps the yarn moist.

Antiseptic. *Chloride of Zinc* is the antiseptic most commonly used, and kills the mildew germs.

Chloride of Magnesium should not be used in goods that are to be calendered.

Silicate of Soda tends to make the cloth tender.

STARTING UP A NEW SET OF BEAMS.

Measure the width between the beam heads, then place the widest beam in the creel nearest the machine, and the narrowest at the back. In the meantime raise the top squeeze rolls from the bottom rolls, and also raise the immersion roll in the size box. Draw over all the yarn from the beams to the first one, tying the yarn to what has been left from the last warp. As soon as the knots are through the rolls, lower the squeeze rolls and drop the immersion roll into the size. Then take the striking comb, which is a coarse comb made especially for the work, and fix it on the edge of the size box. The comb will divide the yarn into strings or divisions of seven or eight threads each. Run this way for two or three yards, and then take off the comb. In some mills the tapes for the split rods are placed between the beams before the machine is started, the length of yarn run through the striking comb being just the length from the comb to the first tape. This method saves two or three yards of yarn. When the yarn has been run through the machine until the knots come to the split rods and expansion comb, the purpose of the striking comb is evident. The rods are taken out and the comb turned down to allow the knots to pass over. When the divided threads come

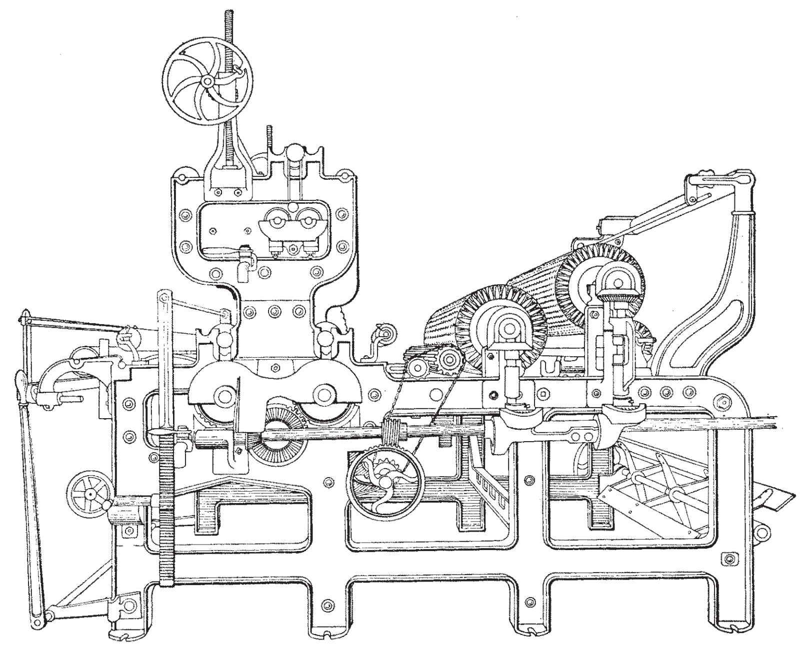


Fig. 38.

along, the comb is turned up, each division of threads being placed in one of its dents. This saves the tender the time of counting the threads that should go in each dent of the comb. If there are one or two threads more in one dent than in another they can be readily changed after the split rods are fixed. The split rods are now set where the tapes are, the first tape going over the first rod nearest the loom beam, and so on to the thick rod. After the set has been started, the opposite order of placing the tapes is used.

Now doff the last warp, secure the new beam in its place, set the clock, adjust the friction head, see that the proper quantity of size is in the box, with the immersion roll at the right depth; put on steam, set the expansion comb, and start the machine so that the yarn will be guided straight on to the beam. Now adjust the threads if there are too many in one dent.

Brushes. For fine work slashers are often fitted with brushes, which are placed between the size vat and the cylinder; clearer brushes are also set underneath the yarn. If brushes are used, the yarn produced is the nearest approach to hand-dressed warp. Brushes are an important factor when the very best results are desired. They cannot be too strongly recommended.

Leese Rods. When slashing colored goods, two leese rods in front of the expansion comb are sometimes necessary to keep the ends in the right place. This leese must be picked by hand. The usual drawing-in comb that is placed on the warp before it is doffed can be struck on the slasher, even though colored warps are being sized, the leese rods keeping the ends straight. Two size boxes are occasionally used in a colored-yarn slasher, one above the other, the top box having one set of squeeze rolls, the bottom box two sets. This method is more commonly used with a cheap dye, which has a tendency to bleed. The colored yarns are sized in the top box. The great objection to using two boxes is the slight difference in the tension on the yarn, for two sets of rolls add more tension than one set. All slashers should have a hood covering over the cylinder, and, if necessary, a fan to help in driving the steam away. The operatives do better work with this arrangement, there being less steam in the room.

The production from the slasher depends greatly upon existing conditions, so that it is almost impossible to give definite statements.

Calculations for Striped Cotton Shirtings.

Example 1.

Counts of warp yarn	50
Counts of filling yarn	50
Counts of reed	42 — 2 ends in a dent = 84 ends per inch

Width in reed practically 30 inches, including selvedges

Ends in warp	2,490	
Ends for selvedges	24	— 6 double ends on each side
Total ends	2,514	

Colors of warp yarn: Light Blue, Red and Bleached.

Filling bleached.

Order of colors for pattern:

60 Blue	
10 White	
2 Red	60 Blue per pat. $\times$ 27 = 1,620 + 60 = 1,680 Blue
2 White	24 White per pat. $\times$ 27 = 648 + 24 = 672 White
2 Red	6 Red per pat. $\times$ 27 = 162 Red
2 White	2,514
2 Red	
10 White	2,490 $\div$ 90 = 27 patterns and 60 ends over.
90 ends in each pattern.	

To obtain an equal cloth, finish with blue stripe of 60 ends, so that the stripes near the selvedge on each side will be the same. The selvedge is white, and of the same counts as the rest of the warp.

The best appearing cloths are those that have the same stripes at each side; that is, if the warp is begun with blue it should be finished with blue. However, the dresser must follow the directions of the designer.

The method of determining the number of ends for a warp is as follows:

The width of warp in reed, the counts of reed, and the number of ends in one dent being given, the width multiplied by counts of reed and by ends in one dent gives total ends in width, aside from selvedge. Having obtained the total number of ends, add the number in a pattern; divide the total number by this, which will give the number of patterns in the warp. Then add together the number of ends of each color in one pattern, and by multiplying the number thus obtained by the total number of patterns, the result will be the total number of ends of each color required for the warp. If the color and counts of yarn for the selvedge are the same as one of the stripes, add the number of selvedge threads to that color, and make the chain or spools for the warp according to further instructions. If, after dividing the total number of ends by the ends in one pattern, there is a remainder, as in Example No. 1, make those threads of the same color as the threads nearest the selvedge at the beginning of the pattern, and arrange the ends for the warp so that the extra threads will be near the opposite selvedge. This will finish both edges of the cloth with the same color. If, after dividing by the number of patterns, there is not a remainder, proceed as in Example No. 2.

Example No. 2.—A warp of the following layout is required: 30″ in reed, including selvedge; 30^s reed, 2 in a dent; 7 patterns in width, the remaining space to be made up of black selvedge ends.

Pattern	100	Red
	8	Blue
	10	Black
	4	Yellow
	6	Black
	4	White
	6	Black
	16	Green
	10	Red
	4	Black
	6	Red
	6	Yellow
	6	Red
	4	Black
	10	Red
	16	Green
	6	Black
	4	White
	6	Black
	4	Yellow
	10	Black
	8	Blue
	254	total

Red $132 \times 7 = 924$
Black $52 \times 7 = 364 + 48 = 412$
Green $32 \times 7 = 224$
Blue $16 \times 7 = 112$
Yellow $14 \times 7 = 98$
White $8 \times 7 = 56$
1,778 total in patterns
48 for selvedge, 24 each side
1,826 total in warp

If the pattern is commenced as described, it would finish with 8 blue, and a broad stripe of red on the other side of the warp; but by dividing the red stripe so that there are 50 to commence with and 50 for the finish of the pattern, the desired results are obtained; that is, a broad red stripe where two patterns are joined together, and both edges of the cloth alike. There would be the same number of ends in the pattern and warp as there would have been had the pattern been made as first written down; but if the red stripe were not divided, a number of red threads would have to be added, in order that the cloth would finish with both edges the same. Suppose the pattern to read as follows:

No. 3			No. 4		
	10	Red		3	Yellow
	4	Black		6	Red
	6	Red		4	Black
	6	Yellow		10	Red
	6	Red		16	Green
	4	Black		6	Black
	10	Red		4	White
	16	Green		6	Black
	6	Black		4	Yellow
	4	White		10	Black
	6	Black		8	Blue
	4	Yellow		100	Red
	10	Black		8	Blue
	8	Blue		10	Black
	100	Red		4	Yellow
	8	Blue		6	Black
	10	Black		4	White
	4	Yellow		6	Black
	6	Black		16	Green
	4	White		10	Red
	6	Black		4	Black
	16	Green		6	Red
				3	Yellow
	254			254	

There would be exactly the same number of patterns in the warp as in the former case, but as the rule of making an equal-sided cloth is to be followed, the number of any of the colors should be divided (the larger numbers preferred), and then the desired effect will be obtained.

Sometimes the order is given to have the main color predominate. So that No. 4 would be the order of arranging the colors to make an equal finish on both sides. This pattern will enable the student to use some of the pieces left from other patterns, as explained in pattern No. 1.

The following is the manner in which to arrange the way-chains and back-beams for this pattern:

3 chains	of 308 ends each,	Red
1 chain	of 412 ends	Black
1 chain	of 224 ends	Green
1 chain	of 98 ends	Yellow
1 chain	of 112 ends	Blue
1 chain	of 56 ends	White

When beaming these chains after they are dyed, place the red on 3 beams of 308 ends per beam, 1 beam of 412 ends for black, 1 beam of green and yellow, with the ends spaced as follows:

Y	G	Y	G	Y	G	Y	G	Y	G	Y	G	Y	G	Y	G	Y	G	Y	G	Y	G	Y	G
4	16	6	16	8	16	6	16	8	16	6	16	8	16	6	16	8	16	6	16	8	16	6	16

Y	G	Y	G	Y
8	16	6	16	4

One beam for blue and white spaced as follows:

B	W	B	W	B	W	B	W	B	W	B	W	B	W	B
8	8	16	8	16	8	16	8	16	8	16	8	16	8	8

The beams should be placed in the slasher creel according to the manner in which it is decided to run the yarn through the size box. If the top box is used for the lightest weight of yarn, then the blue and white yarn should run through the top box and the rest through the bottom box. This will be the best method, provided all past colorings that may have adhered to the box or rollers have been removed.

Arrange the beams 1st black, 2nd, 3rd, 4th red, 5th green and yellow, 6th blue and white.

There are two methods whereby the above warp can be made. First, by spacing the spools in the creel of a beam warper, and running the yarn in the form of a stripe on the back beams for the slasher. For this method the raw stock (raw cotton) must be dyed, carded and spun, or else the yarn must be dyed in skeins and transferred by means of a skein winder to spools; the spools being placed in the creel of the warper in the following manner: The ends should be divided equally, or as equally as possible, on the back beams, so that the tension on the beams can be better gaged. The creel holds 560 ends, but we do not need that number. Five back beams for the slasher consisting of 498 ends each will give us the number, with the exception of the selvedge ends, required for the warp. The selvedge ends may be placed 3 on each side, and run on 4 beams, but they must then be cut out so as not to run on the last beam. There will be 249 ends in each wing of the creel. Commence at the top spool in the first row, passing down to the bottom spool, then again starting at the top, so on until all the ends are drawn through the expansion reed.

Place the spools in the creel in the following order for the first 3 beams:

Blue	White	Red	White
12	2	2	2

Then take out the two red spools and replace with white spools for the last 2 beams. Repeat this order 27 times, then add 12 blue.

Proof. $12 + 2 + 2 + 2 = 18$; $18 \times 27 = 486$; and $486 + 12 = 498$. $498 \times 5 = 2{,}490$ ends in warp, exclusive of selvedge ends.

After the spools have been placed in the creel for the pattern, add the three selvedge spools on each side, draw the yarn through the reed, attach it to the beam and then fix the gears to give the required length. After the beams have been run, they are taken to the slasher and sized. The objection to the above method is that the yarn after being spun must be reeled to form skeins, then dyed and transferred from the skein to the spool. Or the stock must be dyed in the raw state, which means constant cleaning of the cards and other machinery to prevent the colors spoiling by intermixing. One advantage in this latter system is that there is very little trouble in the slasher, and the ends come through almost in the right places.

Second Method, Long-chain Process. The number of ends that are placed in a chain is governed by orders; if there are a number of warps required in which these colors can be used, whether of the same pattern or not, the number of ends in the chain should equal the capacity of the creel, or nearly so. But if a small number is required, the double worm and trumpet may be used, and two small balls made at the same time. Or, double the number of ends now required may be run (for the lesser number), and divide them on the dividing machine, with the prospect of using the other ends in a short time. The objection to dividing the chain is the time consumed, therefore this method is only resorted to when absolutely necessary. For instance, when a sample piece of cloth is to be made, and there are some chains of the required colors in stock, the proper number of ends are separated from the chain and transferred to the back beams.

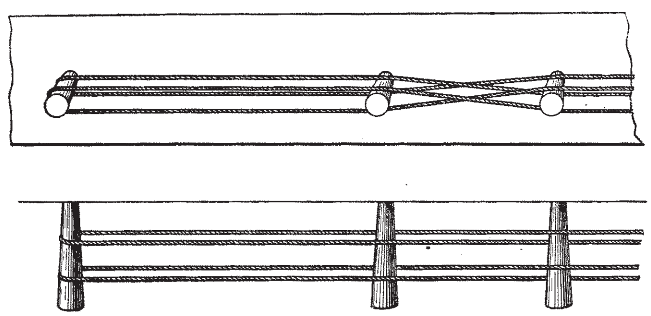
Ordinarily the pattern already given would be carried through in this manner: For the 1,680 blue run 3 chains of 560 ends each; for the white, 2 chains of 336 ends; for the red, 1 chain of 172 ends. For a larger order, make several chains of the same number of ends, and if the mill is equipped with a machine for winding a cord around the chain, wrap several of the smaller chains together, and after they are dyed, separate the several chains, beam them, and then take them to the slasher. Place the blue beams at the back, the white next, and the red beam nearest the size box. There should be no trouble in slashing this yarn, and in a good many instances there are no bad results from running all the beams through the same size box, provided the different colors are fast. If they are not fast, a separate or double size vat should be used, carrying the red through the upper box. Cold sizing, which requires great skill, might also be resorted to. Blues and some browns and other odd colors may be run successfully with whites; in fact, blues tend toward clearing whites. One size vat should be used whenever possible, even though it may cost a little more in dyeing.

One word more in regard to warping. Some overseers do not seem to realize the necessity of using up small quantities or odd lots of yarn; the result is considerable waste, for these lots are constantly accumulating and taking up valuable space in the dressing-room; furthermore, the yarn does not increase in value when kept in such a manner.

If there is an odd chain of warp in some dusty corner, it would be better to transfer the yarn to a back beam, and if a selvedge of that particular color is required, it could be placed on the back beam behind the slasher, and the required number of ends run through, separating them at the split rods. By this method the selvedge threads are obtained without the trouble and expense of using bobbins, spools, or extra ends on the other beam. Afterward this warp can be laid aside and the ends remaining on the beam left undisturbed. If, in order to make a different pattern, a few ends of another color are to be added to a stripe that is being run on the slasher, the former spare beam having enough ends of that color, it is practical and economical to use that remaining portion.

WOOLEN AND WORSTED WARP DRESSING.

It is absolutely necessary to get a correct idea of this branch of the weaving department, for if a mistake in the pattern and evenness of beaming is made here, it is almost impossible to remedy the defect. If wrong threads are used in the pattern, the right threads can be inserted when the warp goes to the loom; but those threads, whether they run from the spool or bobbin, never appear as even as the rest of the yarn; and the insertion of the extra threads cannot be called practical, for the operative's eyes must be constantly on them to prevent their coming entangled with the warp.



LEESE PINS SHOWING LEESE.

Soft beaming is undesirable at all times. The defects and subsequent losses from this process are particularly noticeable when the resulting cloth is to be piece dyed. If the threads are not beamed evenly, they weave into an uneven cloth, and when the piece is dyed it is not only rough looking but contains different shades of color. This is owing to its not having absorbed the dye equally. When a striped warp is beamed in an uneven manner, the loose threads show plainly in the woven cloth, and they often cause "seconds," or cloth of lower value. This means a loss to the mill and an investigation to fix the responsibility.

Hand-rail. In many mills the hand-rail or peg warper is used for making pattern warps or samples. This is a convenient machine, as the work is done rapidly, but by hand, as its name implies, and little waste is made. No great amount of skill is required in making a warp on the hand rail. The main points to be observed are in the picking up of the leese, taking the same thread every time the leese is made when adding a pattern to the one already on the pegs, and keeping a constant tension on the yarn as it is carried around them.

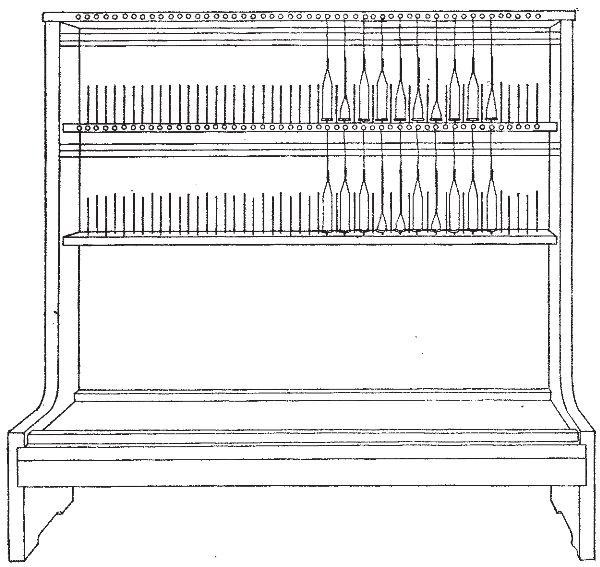


Fig. 39.

First place the bobbins in the creel (Fig. 39); the number being determined by the number of ends in a pattern.

Suppose a blanket having 500 ends in each section is to be made, one section to contain 10 patterns of 50 ends each. The following is the pattern (50 ends) to be carried out for one section (500 ends):

4 brown, 2 fawn, 1 slate, 2 brown, 1 slate, 2 fawn, 1 slate, 4 brown
1 slate, 2 fawn, 1 slate, 2 brown, 1 slate, 2 fawn, 4 brown, 4 fawn
1 slate, 1 brown, 3 fawn, 1 slate, 2 brown, 1 slate, 3 fawn, 1 brown
1 slate, 3 fawn, 20 brown threads to be added for listing

The above is a pattern for trousering, with the backing threads of brown and slate. The warp to be 12 yards in length.

Place the listing or selvedge threads on the pegs first (Fig. 40), 2 threads over and 2 under the leese pegs. Pick up the pattern, 1 thread over and 1 thread under, using the finger and thumb or a double piece of wire; always remember to keep the same order whether the first thread is placed under or over the thumb, otherwise two threads will come together when the next pattern is placed on the pegs, and will probably be drawn in on the wrong harness. After placing the threads over the leese pins, carry them around the pins set apart for the required length. Before reaching the last peg the yarn should be placed half over and half under the pegs for the footing leese. Instead of being the same as the top single leese there should be 25 ends over and 25 ends under the pegs. The footing leese indicates that there is a sufficient number of patterns on the pegs to form the required warp. From the footing leese all the yarn is passed around the last peg, and the footing leese taken again as the yarn is returned towards the single leese. This leese is also taken again, and the yarn passed around the single peg. It is best to pick the single leese just before the yarn is passed around the single peg and before the leese pegs are reached. Two patterns are now on the pegs.

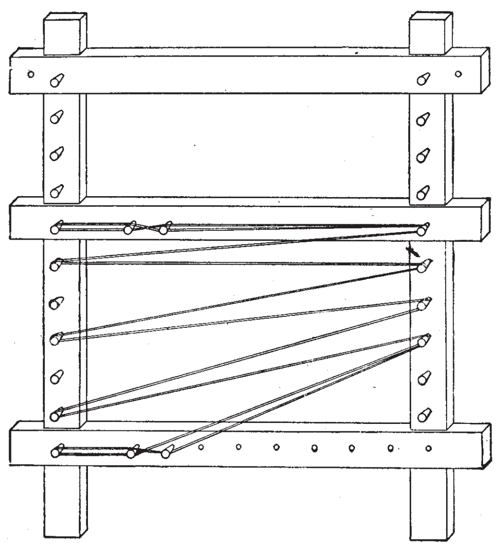


Fig. 40.

The above order should be carried out until the first section of the blanket is on the pegs, after which change the bobbins for the yarn required in the next section. After this is finished place the yarn for the third section; then add the listing threads for this side. We now have a warp of 1,500 ends in addition to the selvedges. Tie a string in the yarn in the places occupied by the leese pegs which will retain the threads in the right order, as if they were still on the pegs. The yarn is then taken to the hand-beamer.

Hand-beamer. Hand-beamers are constructed in several ways, to suit the convenience of the operator. The yarn is stretched out between the head stock (where the beam is) and the friction end. This friction can be in the form of a rope with a weight attached, the rope being connected with a rod which has been passed through the footing leese. The rope is passed over anything that is convenient.

A stand is placed to support the beam, and to which a reed or expansion comb can be attached, the threads passing through the comb and on to the beam. After the warp is stretched out, leese rods are placed in the threads to take the place of the leese string. The above method is generally used for sample blankets, and for making short warps for cloth that is not to be duplicated.

Another method of warping which is meeting with great favor, especially in worsted mills, is the use of an ordinary beam warper, used in connection with a slasher or hot-air dresser. With this system the twister or spinning-frame spools can be placed in the warper creel, and the yarn run directly on the back beam for the slasher. The pattern is arranged in the creel. There is a saving in this system, more especially in complicated patterns. The tension on the warp is more uniform, and it is also made at one time, instead of in sections, as in the machine to be described later.

POWER WARPING.

There are four distinct operations in the dressing of warps: Spooling; Picking out the pattern and tying in the same; Sizing and Drying; Reeling and Beaming.

Spooling. The yarn is spooled from bobbins on to jack spools. The jack spool is entirely unlike any cotton spool. Instead of holding only 1 thread it has a capacity of from 40 to 50, lying side by side. It is shaped something like a cotton back beam but is much smaller. For an intricate pattern the colors are sometimes spaced on the jack spools; that is, instead of having 40 ends of one color on a spool, there are sometimes several colors.

Some spools are larger than the above, and hold 50 or more ends. While apparently a simple process, a warp may be spoiled at this

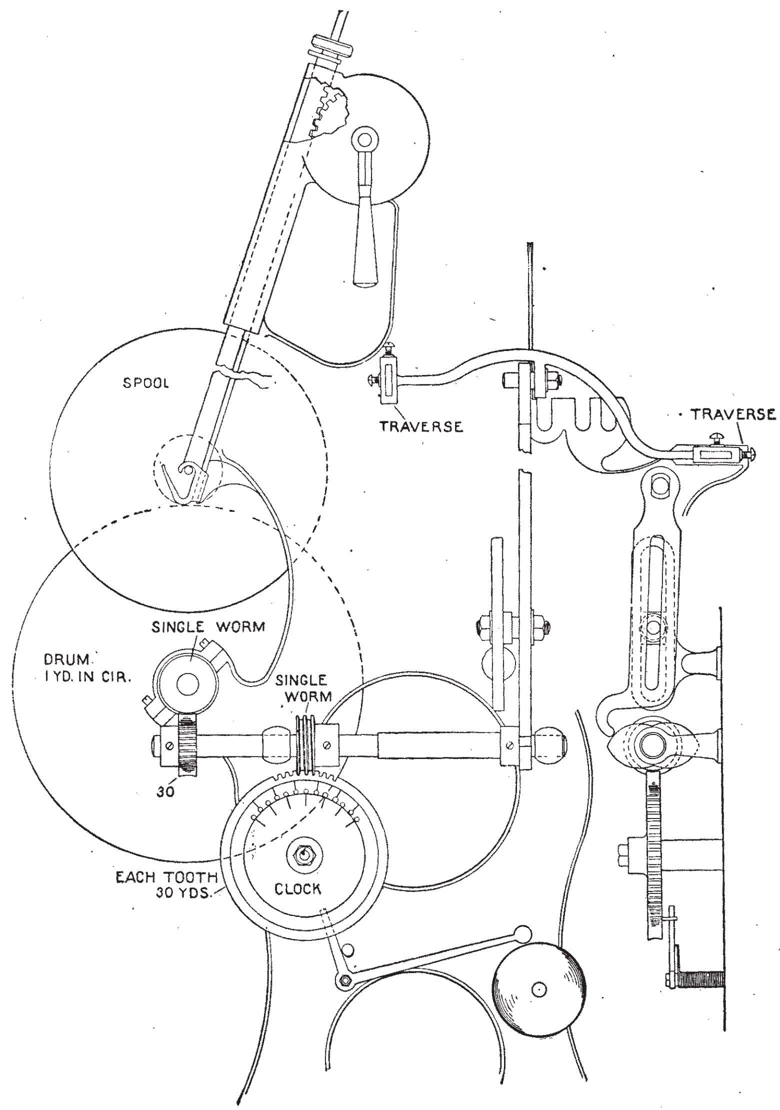


Fig. 41.

stage of preparation by the following defects: more tension on one spool than on another, loose threads, or, in short warps, insufficient length on one or more spools. This latter defect is serious, necessitating the tying in of a short length to finish the warp and thereby making 40 or more knots to the warp, and all in one place.

The drum of the spooler is generally one yard in circumference (Figs. 41 and 42). At the end of the drum shaft a single worm is fixed ; this imparts motion to a 30-tooth gear. On the same shaft as this gear is a single worm, which drives the clock or indicator ;

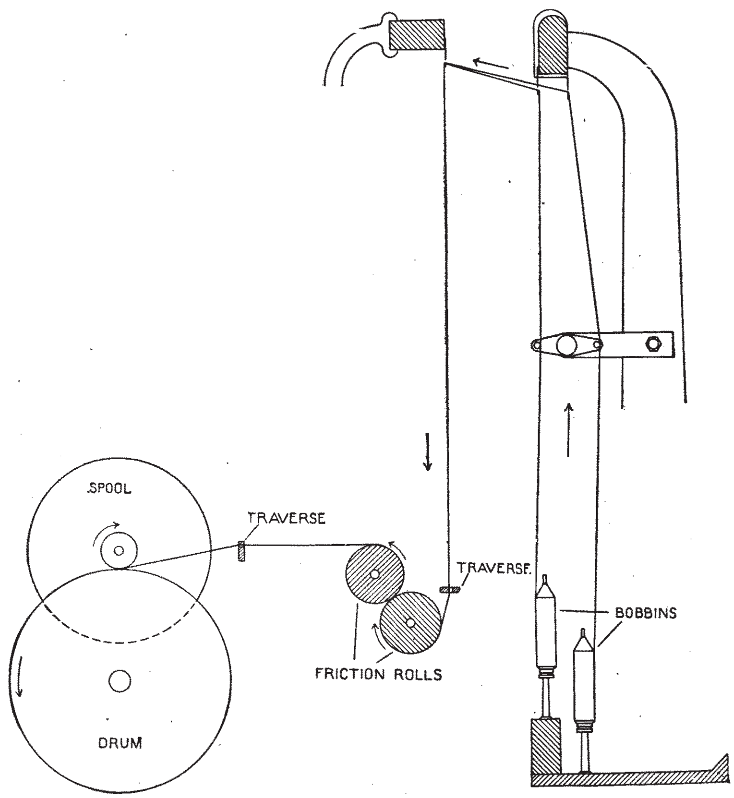


Fig. 42.

1 revolution of the drum = 1 tooth on the 30 gear; 1 revolution of the 30 gear = 1 tooth of the indicator, or 30 yards. It is better to run a trifle longer length on the spool than the yards shown on the indicator, owing to the possibility of the spool slipping when starting up.

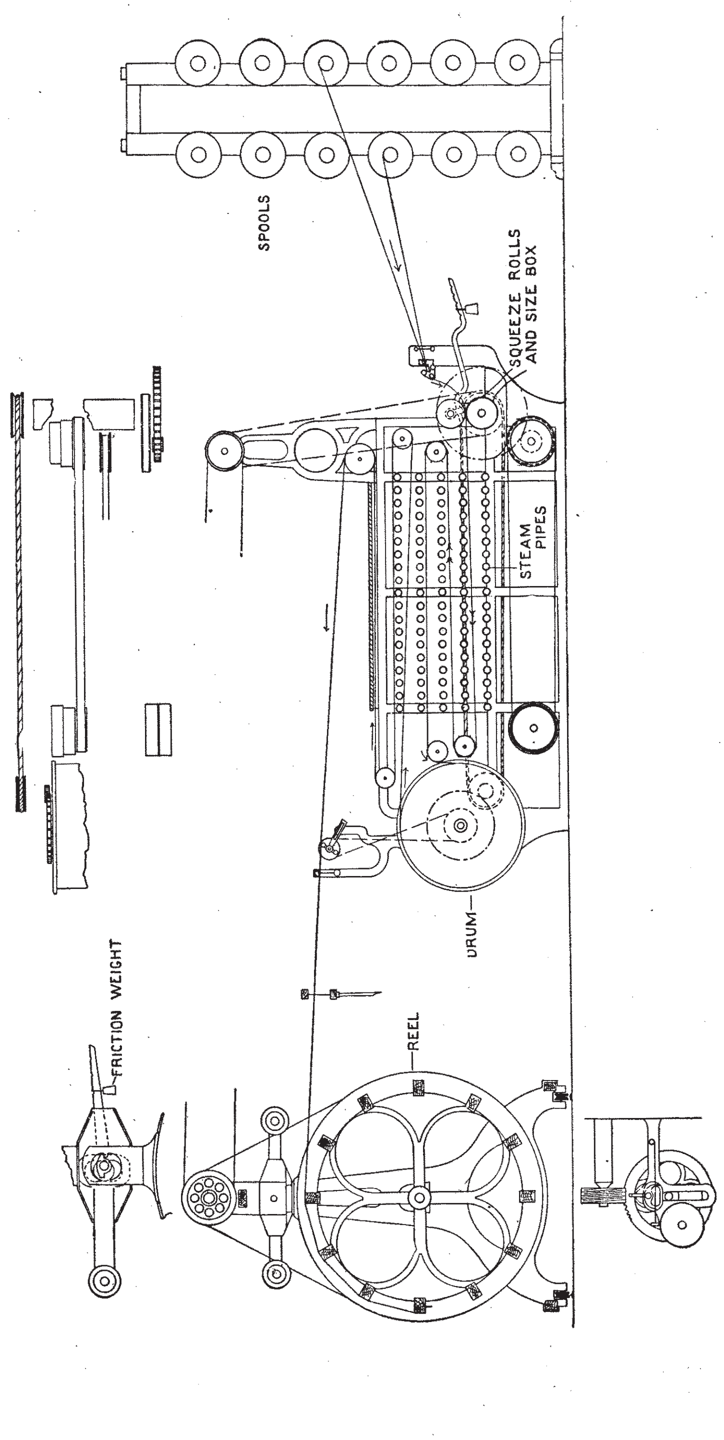
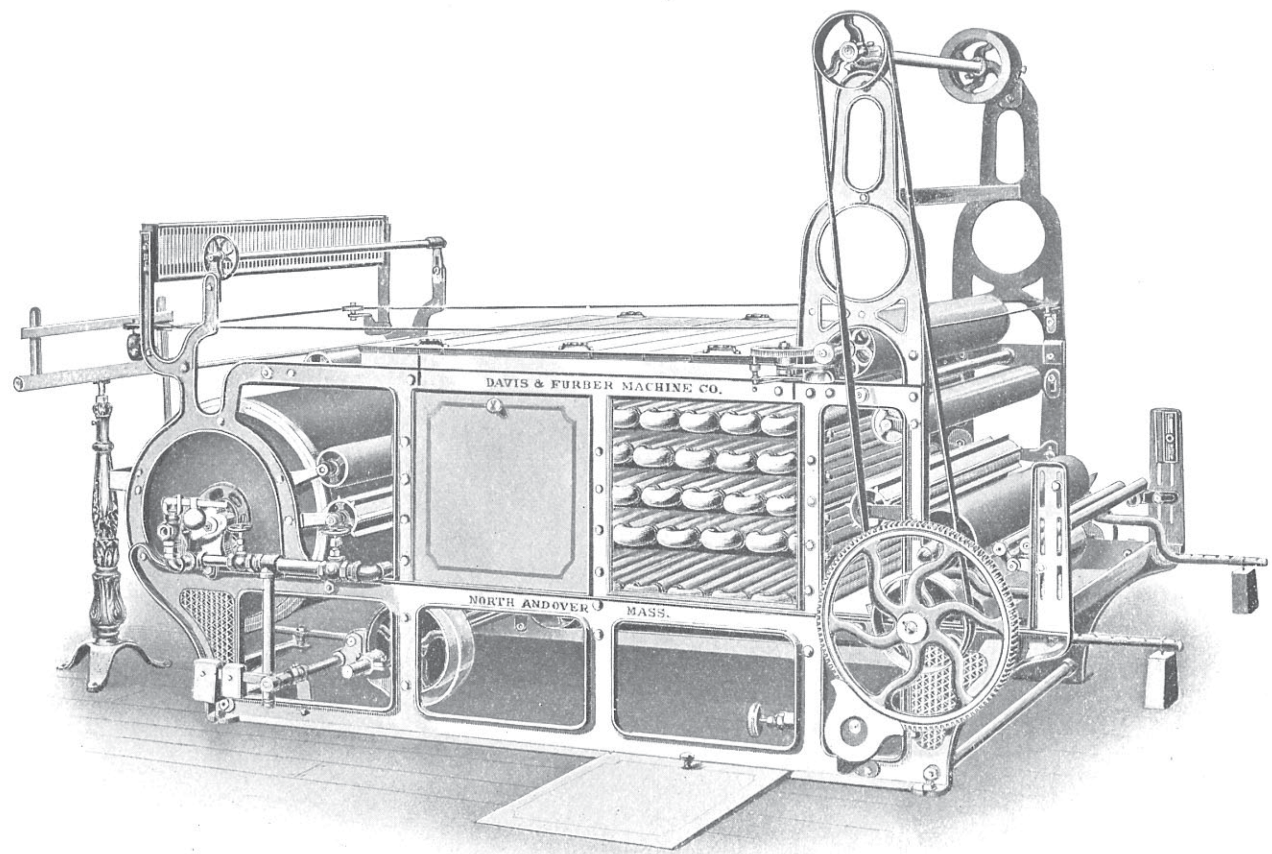

SPOOLS
SQUEEZE ROLLS
AND SIZE BOX
STEAM
PIPES
DRUM
REEL
FRICTION WEIGHT

Fig. 43.



Davis & Furber Machine Co.

Creel. The spools are placed in the creel or support behind the spooler. The creel holds 40 or 50 spools, according to the width of the spooler drum.

Steam Dresser. The purpose of the steam dresser is to immerse the yarn in a sizing compound and dry it before it reaches the reel (Fig. 43). The size gives greater strength to the warp threads and helps to lay the fibers, thereby making a smooth yarn. One of the greatest difficulties to contend with during the weaving process is the clinging together of the yarn. If this is not prevented, the long fibers are gradually worked loose by the reed, and the loose portions adhere to the ends in the form of balls or lumps, which cause the yarn to break frequently. Woolen yarns are almost always sized, but worsted yarns need only be sized when they are heavily sleyed; that is, when they have a large number of ends and picks, or when single (not two-ply) worsted warps are being used.

Sizing Compounds. For woolen yarns, 10 pounds starch, 14 pounds glue, 50 gallons of water and a little tallow.

Another compound is made up of 25 pounds of glue, 100 gallons of water and 2 pounds of tallow. In some instances Irish moss is used with a light solution of glue and tallow.

For worsted yarns, 50 gallons of water, 15 pounds starch, weak solution of Irish moss, 1 pound tallow. Another is composed of 60 gallons of water, 20 pounds of starch, 4 pounds dextrin, 2 pounds tallow.

If the creel holds 12 spools, 40 ends on each spool, or 480 ends in all, it is not necessary to have 480 ends in use; moreover, that number will not always divide equally in the number required to make the warp. Each section must be the same as another, if they are expected to join together to make one warp. For example, suppose there is one pattern and a half in one section; when the next section is laid on the reel the full pattern commences next to the half pattern in the last section, which would cause a break in the warp. If, however, equal patterns compose each section, they would join together without a break.

Occasionally when a very large pattern is to be made, for instance, a dress-goods pattern of 600 ends, one-half of the pattern could be made and placed on the reel in alternate sections, leaving one empty section between for the next half of the pattern. With this method care must be taken when the pattern is tied in, or it will not match. Great care must also be exercised with regard to the friction. Instances are frequent where one section has had a trifle less friction than another, or by some fault has been allowed to run loose on the reel; the result has been uneven and baggy cloth.

It is not uncommon to add one or more spools to the capacity of the creel, these being placed in special stands. The demands of the pattern and the skill of the dresser determine the additions.

Formation of the Pattern. A warp of 1,944 ends, 30 yards in length, is required of the following pattern: 4 black, 2 dark blue, 1 slate, 2 blue; 9 ends in a pattern, 24 black ends on each side to be added for listing.

The first thing to consider is the capacity of the creel, because on a woolen dresser a warp of 1,944 ends cannot be made in one section; however, to overcome this, several sections can be made, which added together make one warp. In making this pattern on a creel of the above capacity, proceed as follows:

There are 1,944 ends, 9 ends to a pattern. $1,944 \div 9 = 216$ patterns. $216 \div 9 = 24$. There will be 9 sections with 24 patterns in a section, and, therefore, 216 ends in a section.

The total pattern is thus divided by a number that would give a practical working quantity.

The reason for not having 432 ends in a section (as the capacity of the creel is 480) is that 9 sections give an equal number of patterns in each section, whereas if we had 48 patterns in a section, or 432 ends, there would be only $4\frac{1}{2}$ sections, which would mean the waste of a large quantity of yarn. If a full pattern is taken from the spools, and afterward half a pattern is taken from the same spools, the other threads must be discarded, which is not practical in fancy patterns. Therefore this warp on this size creel and spools should have 9 sections with 24 patterns in each section. Multiply the number of ends of each color by the patterns in a section to get the total number of ends of each color.

4 Black	$\times 24 = 96$	2 spools of 40 ends; 16 over
2 Dark Blue	$\times 24 = 48$	2 spools of 40 ends; 16 over
1 Slate	$\times 24 = 24$	1 spool of 24 ends
2 Dark Blue	$\times 24 = 48$	5 spools

Place the ends that are left from the full spool; namely, 16 black and 16 dark blue, on one spool; 1 black, 1 blue. This gives 6 spools. It is best to run the selvedge from a separate spool. As the warp is to be 30 yards in length, and there are 9 sections from the same spools, run 9 times 30 yards from each spool, and also allow several yards for waste at the end of each section for tying the pattern, drawing in the warp, and for any possibility of loss through the spool slipping while the yarn is being spooled. Twelve yards, or a little over one yard for each section, is sufficient. This gives 282 yards on each spool. An indicator is placed on the spooler to show the number of yards run through the machine.

The spools are then placed in the creel of the dresser in the following order: the two black spools at the bottom, the spaced spool next, then two blue, and the slate at the top.

Picking the Pattern. There are three ways of doing this. *First*, the more common is to have all the ends that are in the reed at the bottom; then count off the ends according to the pattern. The black spools are at the bottom, blue next, and slate next. Take up the number for the slate first. Commence at the right-hand side of the reed and count 2 ends, let them remain down, then lift 1 end, which will be for the slate, and place it over the top of the reed, count 2 for blue, 4 black, then begin with the pattern again; 2 blue, and these together will make 8 ends; lift 1 over the reed, count 8, lift 1 over the reed, and so on until the number for the slate are picked out and laid over the reed. Tie these together, and let them remain over the reed. Count the ends for the blue, 2 and 2, making 4; place them over the reed, leave 4 down for the black, pass 4 over the reed, leave 4 down for black, and so on to the end. Tie these together as before and lay them over the reed. All that remain down are for the black, but it is well to count them in order to be sure of this.

When there are 3 or 4 spools of one color, the ends are counted off in forties and bunched together, after completing the above process. For example, if there are 4 spools of black, take the first end of each of the 4 that are counted in the reed for black, and tie them together; then the second in each 4, the third and the fourth. Separate the other colors in the same manner, afterwards placing all the yarn over the reed. Then pulling down the first bunch of forties for the black, tie them to the bottom spool, then the second bunch to the second spool, and so on. But with the pattern by the first method there is no necessity to separate the ends that have been counted in the reed; take all the black threads and tie to them the ones on the spools. Commence at the bottom for the first end, and 1 from the second spool for the second end, and the black end on the spaced spool can be tied to the third in the reed. Then start on the bottom spool again, keeping them as straight as possible, passing from the bottom to the top spool however many there are. After the black ends are tied in, follow with the blue, then the slate. The ends must not be crossed any more than possible, because they will become tangled in the reed and will be broken frequently. This applies to all warps that are placed in the dresser.

It sometimes happens that the spaced spool has 2 or 3 threads of one color side by side, and 1 of another color. In order that the single thread may come in a straight line in the reed, take no notice of the single thread on the spaced spool when piecing the first bunch of ends of that color starting at the bottom spool of the same color until sufficient ends have been tied in the reed for the single thread to run straight, or as nearly straight as possible. A little thought concerning this will save endless trouble.

The Second Method requires great care and must not be interrupted until all the warp is tied in. It is not often attempted except in simple patterns, and then only by competent operatives. The ends are not counted in the reed, a bunch of them being taken and the ends on the spools tied to them, as the pattern calls for them; the one who ties them constantly glancing at the pattern paper.

The Third Method. The following is the writer's method, and one which he considers to be the safest, best and most rapid. Count the threads in the reed, and cast over the top of the reed the last end of each color; when this end is reached the operative knows that it is the last of the color being tied in. It is very convenient when there are several of one color together. After casting over the last thread in each number, take a bunch of those that are down, and tie them to the threads on the spools according to the pattern. Glance at the pattern occasionally while so doing.

This method has a decided advantage, inasmuch as it is not necessary to lean over the threads after a few have been pieced, as must be done in the first method when one spool is tied in at a time; consequently there is less risk of twisting the threads, which often causes a number of them to break as they are drawn through the reed. The operative recedes from the threads as they are pieced, and after awhile he will become expert enough to piece the threads so that even one slack end will be an exception. It also means that about an hour has been saved in the picking out of the pattern, and the operative is able to draw the ends straight through the reed without snarling, as frequently happens if they become loose or are rubbed. Some dresser tenders twist the threads together, which is a very good method after proficiency has been attained.

After the warp is tied in, it passes between flannel-covered iron squeeze rolls. The lower roll is partly immersed in the size, which is placed in the size vat. The vats are jacketed; that is, they have a steam chamber underneath them. Perforated pipe cannot be used with any degree of success when the size contains glue. From the vat the yarn passes around the steam pipes and the copper cylinder, and over the measuring roll. Iron rods and tin rollers are used to keep the yarn off the pipes. The tin rolls nearest the size vat are in skeleton form, so that the yarn will not adhere to the rolls as it passes around them.

Leese Reed. From the measuring roll the yarn passes through the leese reed. This is a blocked reed, one dent being empty and the next blocked; that is, one-third is closed at the top and a third at the bottom, leaving the remaining third open in the middle. Each alternate dent is treated in this manner. One end passes through the open dent, and one through the blocked dent. Both the pattern reed and the leese reed should be of the same count, say 10 dents to the inch.

Condenser Reed. The yarn then passes through the condenser reed, which condenses it to the width of the section on the reel. The total number of ends in a section must be equally divided in the dents of the condenser reed. If there are several more in one dent than another, they tend to crowd on the reel, with the result that they are stretched too much, or they will break constantly. Either of these faults make poor cloth.

To determine the number of ends to be placed in the condenser reed and the width of each section, proceed as follows: There are 9 sections. If the reed has 10 dents to the inch, and the warp is to be $31\frac{1}{2}$ inches in width, $31\frac{1}{2} \div 9 = 3\frac{1}{2}$ inches in each section. There are 216 ends in a section. Ten dents multiplied by $3\frac{1}{2} = 35$ dents. $216 \div 35 = 6$ and 6 ends extra; therefore, place 6 ends in each dent of the condenser, and distribute the extra 6 ends as equally as possible.

In making a warp with 238 ends in a section, and the sections $4\frac{1}{5}$ inches wide, to find the number of ends in a dent in the condenser,

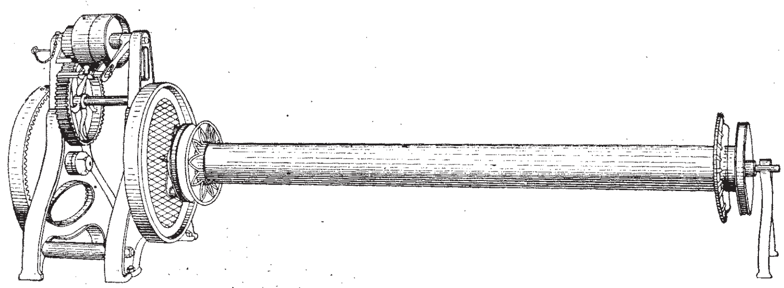
$$238 \div 42 = 5 \text{ and } 28 \text{ over.}$$

Two-thirds of 42 is 28, therefore 6 are placed in each 2 dents out of every 3, and 5 in the third; they will be distributed equally. $6 + 6 + 5 = 17$. $42 \div 3 = 14$; $17 \times 14 = 238$.

Taking the Leese. The yarn is first bunched and fastened to the pin on the reel. By the aid of two rods the leese is taken, but the manner in which this is done must be remembered, that is, whether the yarn is first pressed down or lifted up, or two threads will come together in the same leese at the end of the section. With one rod press down the yarn near the reed on the side nearest the reel. This causes the ends that are in the open dents to go below those in the blocked dents; they will form an opening, each alternate thread being at the bottom and the other threads at the top. Pass a rod through this opening, and open out the ends until there is a clear space beyond the condenser reed; now pass a cord through this space, take out the rods and lift up the yarn, so that the threads which were at the bottom will be at the top. Pass a rod through this opening, and open out the yarn as before, then pass a cord through this, and the result is a single leese. This must be followed out at the beginning of each section.

After the leese is taken, set the measuring clock. One tooth gives 18 inches, 2 teeth 1 yard, so that 60 teeth indicate 30 yards. To the first and last sections the selvedge threads are added. Start up the reel, taking care that the yarn passing through the condenser goes straight inside the section pins. When the length is run on the reel, cut off and tie the ends into a knot for the next section. Fasten the yarn to the pin on the reel, draw the reel on the track until the next section is opposite the condenser, and take the leese as before. Follow this order until finished, setting the clock at every commencement.

Reel. When the width of the section has been determined, pins are placed in the bars of the reel to correspond with that distance, so that the yarn will be laid straight on the reel, without one section overlapping another. When all the sections are placed on the reel, they constitute a warp of the number of ends required, 1,944, with the addition of the selvedges.



Beaming. Before beaming, loosen the belts around the reel, and add the friction, then tie the yarn to the leader. This is generally a piece of burlap attached to the beam. If a small quantity is tied at once, better warp is made, as the knot will be smaller. The amount of friction required must be determined by circumstances. Do not make a soft beam, and do not add too much friction, or it will strain the yarn; 7 or 8 pounds of steam are sufficient for drying purposes, and it is well to shut off the steam if the dresser is to be stopped for any length of time, or the yarn will be burned. It is also well to have separate connections for the size vat from the steam pipes, so that they can be run independently.

Press Roll. This is a recent invention for making better beamed warp; it also allows more length of yarn to be placed on the beam. It is of great value, because the beam is harder pressed, thereby preventing the layers from sticking to each other, with less possible chance of uneven cloth.