PRACTICAL LOOM FIXING

(Second Edition)

By
THOMAS NELSON
Director Textile Department, North Carolina State College of Agriculture and Engineering
Raleigh, N. C.

PREFACE, SECOND EDITION

The reception of the first edition of Practical Loom Fixing has been gratifying. It is hoped that this, the second edition, will be as favorably received.

THOMAS NELSON.

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CHAPTER I

Plain Looms

For fabrics, such as sheetings, print cloths, lawns, mulls and other fabrics that are woven on two harness shafts, the plain loom is used. This loom has the shedding cams on the bottom shaft in the loom and only fabrics that are made with two harness shafts can be made on same. When fabrics such as drills, denims, hickory stripes or twill goods have to be made, the same loom can be used with the addition of an auxiliary shaft to carry the shedding cams, the cams being driven from the bottom shaft in the loom.

Plain looms are divided into two classes, viz., regular plain looms and automatic looms. The foundation for all plain looms is practically the same, the only essential difference being the automatic attachment for transferring bobbins or shuttles. The various movements of a loom are usually divided into two divisions, principal and auxiliary movements, the principal movements being considered as the shedding, picking and beating up movements. All the movements must work in unison with each other if the best results are to be obtained from the loom. The movements may be itemized as follows: 1, shedding motion; 2, picking motion; 3, beating up the filling; 4, let-off motion; 5, take-up motion; 6, filling stop motion; 7, warp stop motion; 8, protector motion. In addition to these there is the tape selvage motion, used on twill and sateen goods; temples, lease rods.

Shedding Motion

Fig. 1 is a sketch of a shedding motion for plain fabrics, also lay cap, reed, lay and lay sword of the beating-up motion. The ends for a plain fabric are drawn through the harness from back to front, beginning from the right hand side. As one harness is raised and the other lowered, the ends are opened and make what is known as the "shed," through which the shuttle travels with the filling, hence the motion to obtain this separating of the ends is known as the shedding motion.

Names of Parts.—A, is the harness roll on which are the collars B. B. Each collar is of two sizes, one being about one-eighth to one-fourth of an inch larger than the other. C, the harness straps connecting collar to harness D. E, jack stick; F, jack strap connecting harness to treadle G. H, treadle ball; I, shedding cams; K, fulcrum of treadles.

Setting Shedding Motion

When starting up a new warp there are two conditions which it is absolutely necessary to consider, otherwise a shed of sufficient size for the shuttle to pass through cannot be obtained. These two conditions are first, collar on harness roll; second, the shedding cams. The collar is of two distinct sizes, one being larger than the other. The shedding cams also are of two sizes, one being larger than the other. Each collar must be arranged so that the strap on largest part will be connected to back harness and the shedding cams must be set so that the largest cam will also operate the back harness.

If either of these two conditions are not strictly carried out, the shed for one pick will be larger than the shed for the next pick. The reasons for this connecting of the harness to the harness roll and treadles can more readily be explained on reference to Fig. 1. The shed is formed from the fell of cloth (fell of cloth is last pick of filling put in cloth), the harness and lease rods. The back harness being farther away from

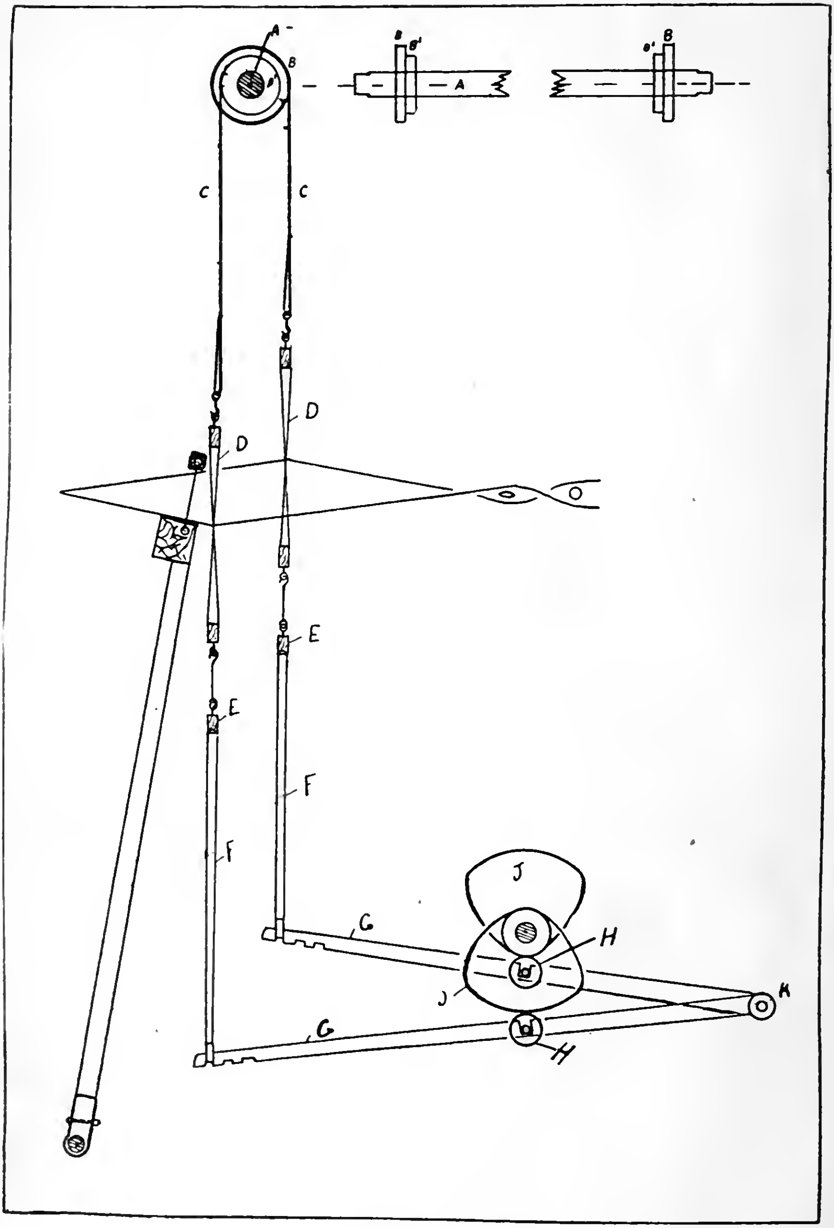


Figure 1

the fell of cloth has to travel a greater distance than the front harness in order to make the same size of shed for the shuttle to pass through,

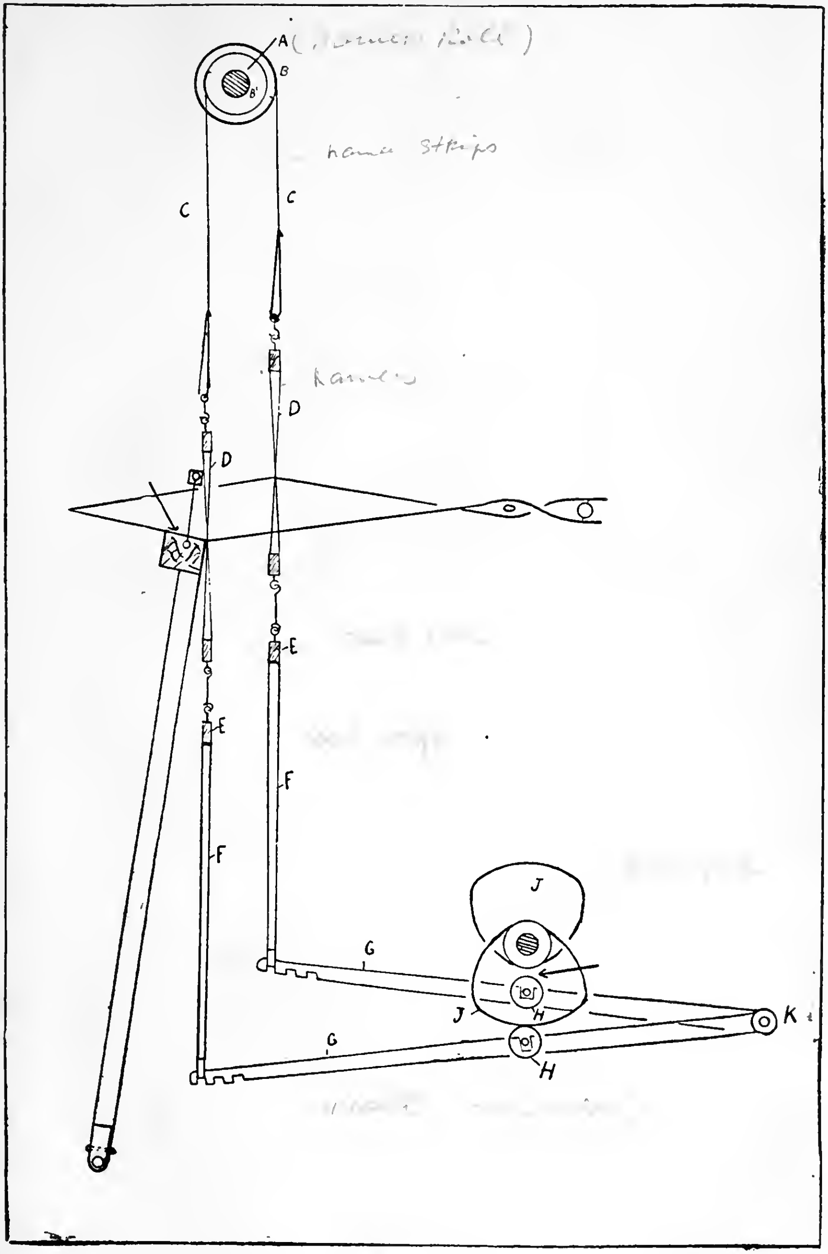


Figure 2

consequently that harness is connected to the largest cam. Also the back harness being connected to the treadle nearer the fulcrum, it is necessary that the treadle move a greater distance to compensate for this. The front harness, not having to move as far, is therefore, operated by the smallest shedding cam.

With the harness roll and the shedding cams in their correct positions and the harness connected up, all parts of the shedding motion should be level when the harness are crossing each other.

When the cams are level, the treadles should also be level and the treadle balls in contact with the cams, the harness should be level and the harness roll should be level. Not only should the front and back harness be level but the ends of the harness should also be level, that is, one end should not be lower than the other. The harness roll should be level so that when the harness are open, the straps will not lap under each other.

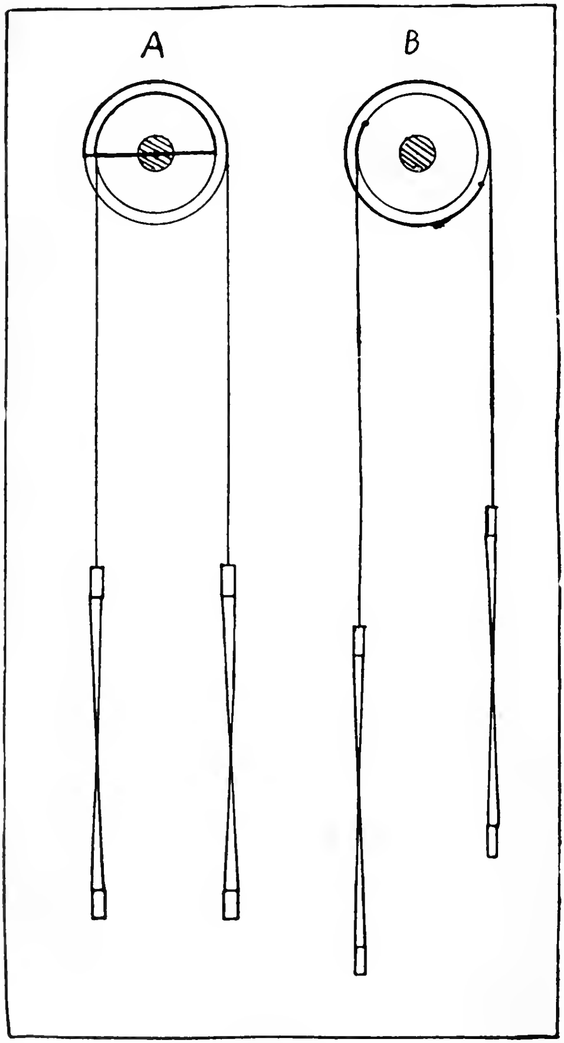


Figure 3

Fig. 1, on page 10, illustrates a good setting of the shedding motion. It will be noticed that the harness straps operate perfectly on the collar, there not being any underlapping of the straps. The front harness is just low enough to prevent chafing of the ends by the forward and backward movement of the lay and the treadle balls are in contact with the shedding cams.

Fig. 2, on page 11, illustrates a very faulty setting of the shedding motion. The harness roll has been set correctly as will be seen by the straps, but the front harness is too low, the yarn bearing heavily on the race board, indicated by arrow. The treadle ball on treadle operating back harness is not in contact with the shedding cam—indicated by arrow. The lay is shown as being up against the harness. The consequent result of such a setting as this is as follows: The ends resting too heavily on race board will chafe or "button," that is, small lumps or buttons will be made on the ends through the rubbing of the race board against the ends when the lay is moving backwards and forwards with the result that it is practically impossible to obtain a perfect fabric as the ends will be continually breaking out. The treadle ball should be in contact with the shedding cam for the whole of the revolution of cam so that the harness will have an easy movement. With the treadle ball as illustrated, the cam

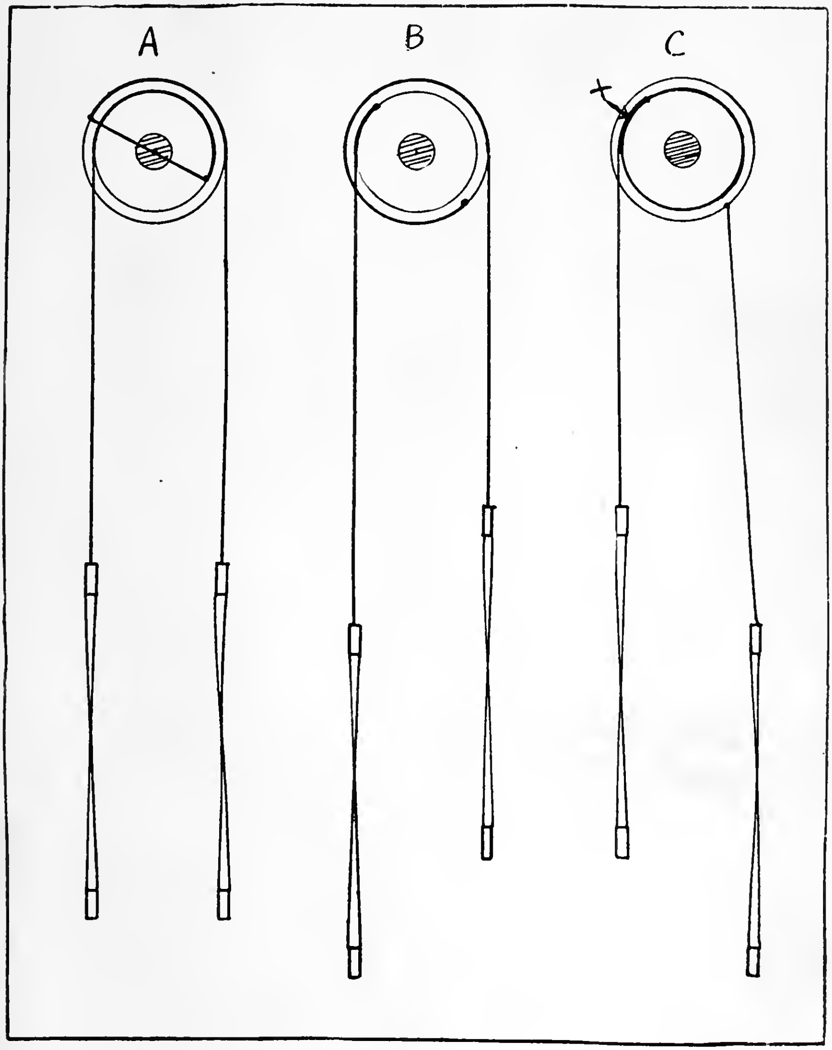


Figure 4

will strike the ball and this in turn will cause the harness eyes on that shaft to come suddenly in contact with the ends causing many to break out and will also have a tendency to cut the harness eyes and otherwise wear out the harness, thereby producing faulty cloth and increasing the cost of manufacturing the cloth.

The front harness should never be set too close to the lay. If the lay strikes the harness, the harness twine will be cut wherever the lay comes in contact with it. Not only at these points will the harness twine be cut, but the lay, in striking the harness, will force it back and when

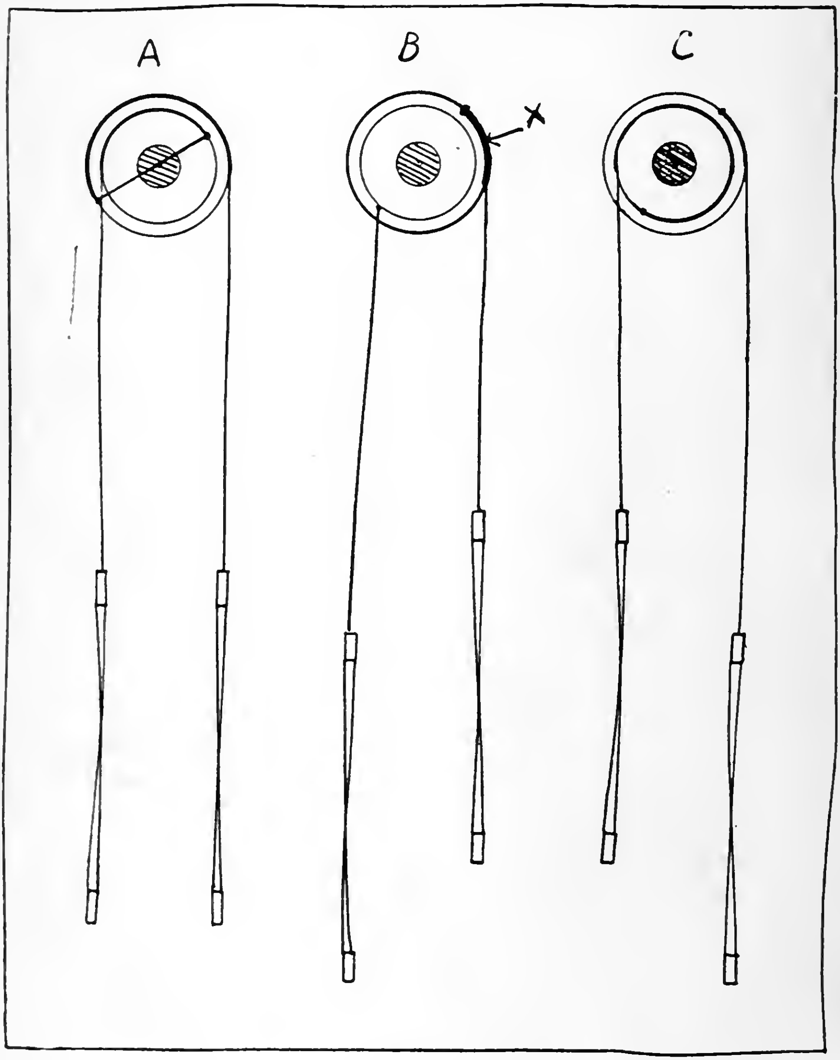


Figure 5

the harness is at the bottom and is knocked back by the lay, the top of the eyes are very easily cut. This is because the ends are tight and cut into the top of the eye and especially if the yarn is hard sized.

Setting Harness Roll

At A, Fig. 3 (page 12), is illustrated the correct method of setting the harness roll when the harness is level. This is indicated by the heavy line passing through center of roll and showing that the harness strap screws are directly opposite to each other. B shows the harness open with the back harness strap wrapped around the collar and the front harness strap unwound from the collar. This gives the easiest working of the roll and harness because each harness shaft is raised and lowered its required distance without either of the straps lapping under.

Fig. 4 (page 13) illustrates a very faulty setting of the harness roll and one which is very often seen. A illustrates the setting of harness roll with the harness level. This is indicated by the line drawn through the roll from one harness strap screw to the other. B shows the result of the setting when the front harness is lowered and the back harness raised. The back harness strap is not wrapped around the collar sufficiently, neither is the front harness strap sufficiently wound from the collar. This, of itself and on this pick, does not have any unfavorable results, but, on the next pick, illustrated at C, when the back harness is lowered the result of this setting is very readily seen. On this pick, the front harness strap laps under itself, indicated by a X, and this raises the front harness higher than it should. Not only this, but the harness is given a sudden jerk which strains the yarn and when fine yarns are used this is often the cause of breaking out the ends and making uneven cloth. This jerky motion is also very detrimental to the harness and causes them to wear out sooner. The sketch also illustrates the strain that is put on the back harness strap and the harness itself. The stretching of the harness causing the harness eyes to be pulled tight is often the means of cutting the ends in the eyes, as well as cutting the eyes themselves. The life of this harness is considerably reduced.

Fig. 5 (page 14) illustrates the setting of harness roll directly opposite to Fig. 4 as line through harness roll indicates. The same unfavorable results will occur as in previous setting of roll. In addition to these defects, there is also the possibility of another defect appearing which in its results is worse than the foregoing. It will be noticed at B that the front harness and harness straps is stretched tight on this pick.

If also on this pick, the lay should knock against the front harness, the top of the eyes would be cut because the ends which are drawn through the harness are tight and they would act as a knife on the top of harness eyes. Especially will this be the result if the harness twine is a little too fine for the goods being made, as sometimes happens, especially when the warp is drawn through the harness by the drawing in machine, as this requires a spiral spring through the harness in order to keep each eye separate, therefore a finer twine has to be used. Again, many looms are constructed with too little space between the lay and the loom arch and it is very difficult to keep the lay from striking the harness. In some cases this can be remedied by using a deeper harness. In any and every case, the harness should be set so that the lay will not strike them during weaving, as this causes a large expense to the mill as well as a loss in production for the weaver. The back harness is raised too high and receives a sudden jerk when the straps lap under, as illustrated at X in B. At C, the straps do not have any bad effect on the weaving, the bad effects resulting from B.

Summarized, the setting of the shedding motion should be as follows:

1. Have harness roll level, harness strap screws opposite each other.
2. Have harness level, both front to back and side to side.
3. Have treadles level.
4. Have shedding cams level.
5. Have treadle balls set against the cams so as to be in contact with the cams for the full revolution.

6. Have harness set so that the lay will not strike against the front harness.

7. Have harness set so that when shed is open, the yarn will not

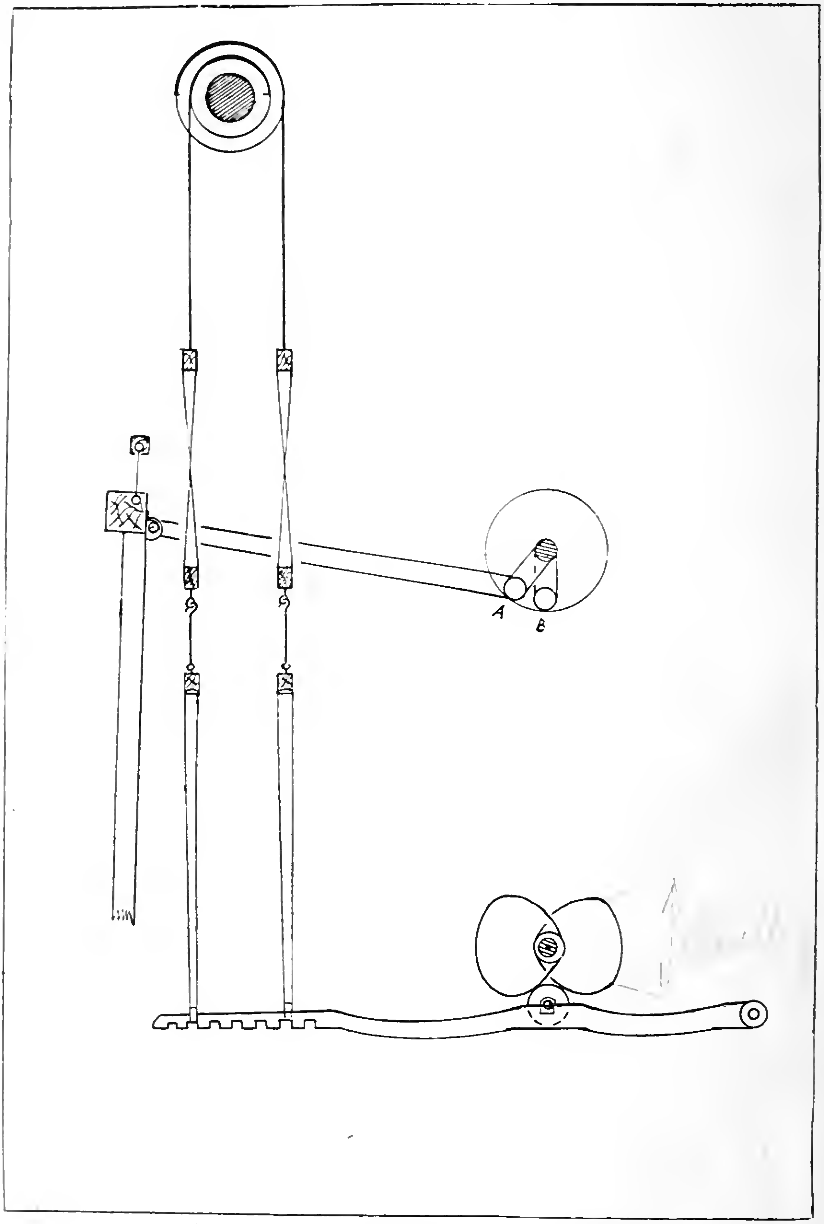


Figure 6

rest on the race plate, neither be too high off the race plate. It is only necessary for the yarn to just touch the race plate.

Timing of Shedding Motion

A shedding motion can be set on three different timings as follows: late, medium, early. The medium and early timings are most generally used. For medium timing have harness level with crank between bottom and front center, illustrated in Fig. 6 at A. For early timing have harness level with crank on bottom center, illustrated in Fig. 6, at B. Many loom fixers measure the distance of the reed from fell of cloth and then set the harness level. For uniformity, this method is not as preferable as timing by the position of crank on crank shaft. There is a difference in the results obtained in certain fabrics with these two timings. On fabrics that do not have an excessive number of picks per inch the medium timing is very often used but on fabrics requiring a large number of picks per inch, the early timing is preferable. In plain goods, such as 80x80, the only way in which this number of picks can be put in the cloth is by early timing. When this timing is used, the ends have crossed the last pick of filling put in the cloth and holds it in place so that the reed has only to beat this one pick firmly into position.

CHAPTER II

Measurements for Size of Shed

When a shedding cam has to be constructed it is necessary to ascertain the stroke of cam required to raise and lower the harness the required distance. With the cams already on loom, the size of shed these cams will give can very readily be obtained. When making these calculations it must be remembered that there is always some loss caused by

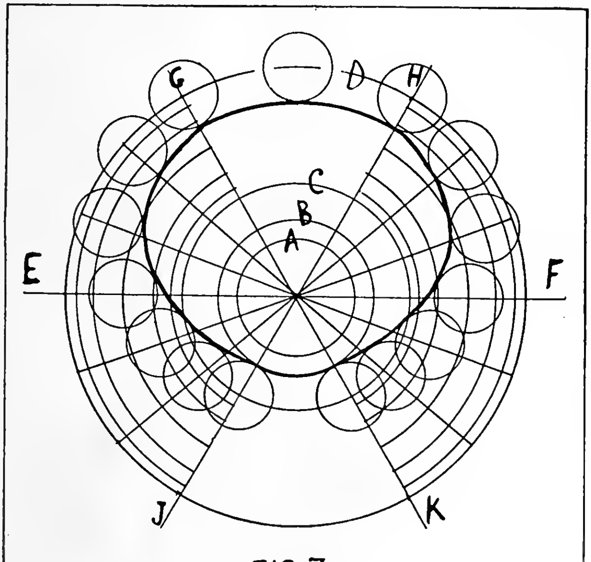


FIG. 7

the stretching of the straps, the method of connecting the various parts and the setting of the motion. This loss amounts on an average to about three-quarters of an inch.

Take for example the following measurements of a shedding motion. Length of treadle from fulcrum to point of connection with front harness 22 inches. Distance from fulcrum to treadle ball, 14 inches. Stroke of cam, 3 inches. Distance of front harness from fell of cloth, 7½ inches. Distance of front of shuttle to fell of cloth, 3½ inches. What will be the size of shed? $22 \times 3 \div 14 = 4.714$ inches, distance through which front harness moves. $4.714 \times 3.5 \div 7.5 = 2.2$ inches size of shed. $2.2 - .75 = 1.45$ inches actual size of shed, after allowing three-quarters of an inch for stretching of straps and lost motion. A shuttle about 1⅜ deep would be used for this size of shed.

Shedding Cams

In plain goods, two shedding cams are used and one is always larger than the other. The largest cam always operates the back harness because this harness is farther away from the fell of cloth and has to

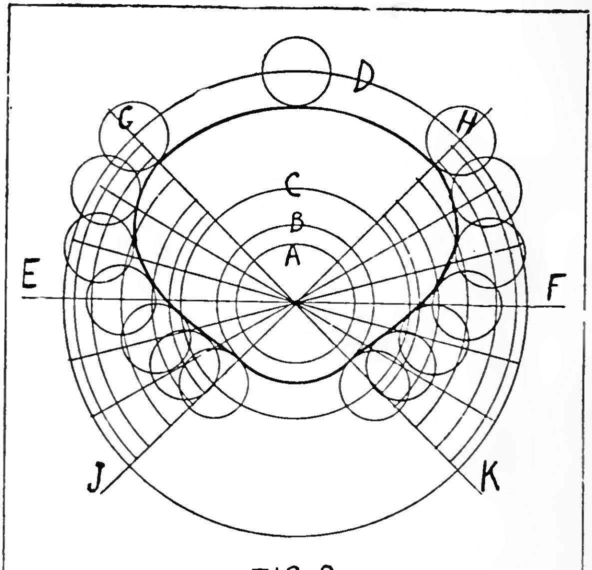


FIG. 8

travel a greater distance in order to make the same size of shed as the front harness. The back harness is also connected nearer the fulcrum and for these reasons a larger cam is required. On twill and sateen goods, the cam that operates the front harness is the smallest, with an increase in size of each cam that operates the second, third, fourth and fifth harness, respectively.

All shedding cams have a certain amount of pause or dwell, that is, each harness when full open is stationary a certain length of time to allow the shuttle to pass through the shed. This is often called the dwell of the cams, and has a certain relation to the time occupied by one revolution of crank shaft.

The shedding cams for plain goods may be classed under three heads: First, one-third dwell cam; second, one-half dwell cam; third, two-thirds dwell cam. The term dwell, refers to the portion of a revolution of crank shaft that the harness dwells or is stationary. The one-third dwell cam can only be used on narrow looms, because of the short time the harness remains open for the shuttle to pass through.

When tender or poor yarns have to be woven this dwell cam may be used. A smaller shuttle has often to be used so as to get clear through the shed on time.

The one-half dwell cam is the best practical cam that can be used. The harness are open for one-half revolution of crank shaft, which gives sufficient time for the shuttle to get clear through the shed, and one-half revolution for the harness to change. This cam is frequently used on narrow looms, always on medium width looms and often on wide looms.

The two-third dwell cam, when used, is only used on extra wide looms, which requires extra time for the shuttle to pass through the shed from one shuttle box to the other. The harness are open for two-thirds revolution of crank shaft, but this only leaves one-third revolution in which to change the harness, consequently a sudden movement is

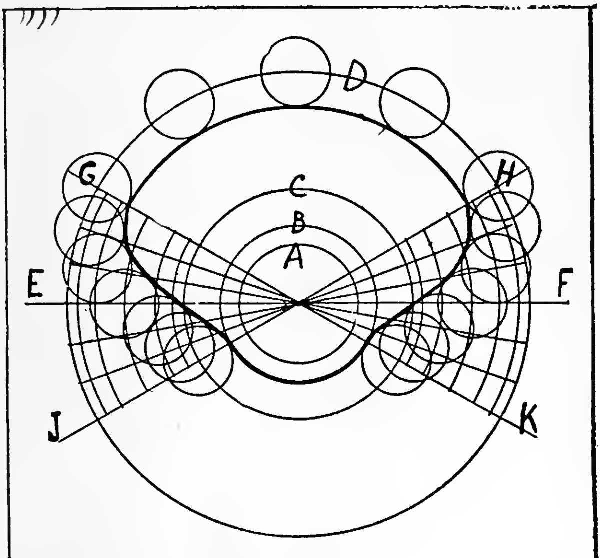


FIG. 9.

given to the harness which has a tendency to strain the yarn and also tends to quickly wear out the harness. Soft or tender yarns cannot be woven with this cam, because of the sudden changing of the harness.

Construction of Cams

Cams should be constructed so that the harness will be raised or lowered without any jumping or jerking motion. The easier the harness can be moved up and down, the better will be the weaving. In constructing a cam, are should be taken so that there will not be any depressions in same or the treadle ball will have a tendency to lock or bind, especially with a small ball.

The following illustrations are given to show in a clear way the principle on which cams for plain weaves are constructed. Three cams are given, each having the same measurement, but with different dwells: Fig. 7 (page 17) having one-third dwell, Fig. 8 (page 18) one-half dwell, Fig. 9 two-thirds dwell.

To make plain goods, two cams are necessary as pattern repeats on two picks, but only one cam need be illustrated, as this will show the principle. Measurements: diameter of pick cam shaft, 1½ inches; diameter of cam hub, ½ inch; stroke of cam, 3 inches; diameter of treadle ball, 2 inches; dwell ½ revolution of crank shaft.

To construct cam: One, describe circle A, which equals diameter of shaft; two, describe circle B, which equals hub or inner throw of cam; three, describe circle C, which equals the radius and center of treadle ball, with ball in contact with inner throw of cam; four, describe circle D, which equals the radius and center of treadle ball, with ball in contact with outer throw of cam; five, divide circles into as many parts as there are picks in pattern. This is shown by line E F; six, mark off dwell on each half of circles, illustrated by G, H, I, K; seven, divide space between G I and H K into six equal parts; eight, divide the space between circles C and D in six unequal parts, having smallest on outside and largest in center; nine, begin at one side with bottom corner of unequal parts, and on each of the corners describe circle as made by treadle ball. This will finish on outer circle on that side at H. On opposite side begin on outer circle, at G, and finish on inner circle. Ten, make outline of cam by curved line touching extremities of treadle ball.

CHAPTER III

Picking Motion

This is one of the most important motions on the loom. It is this motion that causes so much power to be required to drive the loom.

Description of Picking Motion

Unless all parts are adjusted and set correctly, there will be a considerable waste in supplies such as breaking of picker sticks, lug straps, shuttles, etc., as well as a loss of production caused by loom having to stop to replace broken parts. Especially will this be the case when too much "pick" is used. It is the aim of all good loom fixers to reduce the "pick" required to drive the shuttle across the lay to its lowest amount for in this way the loom runs with the smallest amount of attention from the fixer.

The picking motion on a cotton loom is generally known as the "cone" or "ball" pick and is illustrated at Fig. 10 (page 21). The pick cam A is fixed in the pick cam shaft in the loom. Above the cam the cone B is connected to the picking shaft C, the shaft being held to the side of the loom by two pick shaft boxes. The picking arm D extends downward from the picking shaft and to this shaft is connected the lug straps.

It will be noticed that the picking cone is not set directly over the center of the picking cam. With this arrangement the picking cam comes in contact with the cone forcing it upward, whereas if the cone had been directly over the center of picking cam, the cam would have a tendency to drive the picking shaft forward against the pick shaft box.

A point to be noticed in regard to this picking cam is the shape. This shape of cam gives a gradual development of power or force behind the shuttle, or in other words, a gradual increase in speed is given to the shuttle from the beginning of pick until the shuttle leaves the picker. This principle of driving the shuttle is much preferable to a sudden blow.

The shape of the pick point also deserves consideration. If the pick point F is too hollow there is a tendency to lock or bind the cone which gives a jump to the motion and occasionally tends to break the picking shaft. With the pick point too narrow and straight a soft pick is the result, causing the loom to bang off.

Some picking cams have a circular base with a large pick point. These cams are generally keyed on the shaft, and adjustment in timing of pick can be made by moving the pick point backward or forward.

On a new loom the pick point should be flush with the outer end of picking cone. On a loom that has been in operation for a number of years it is sometimes necessary to move the cam nearer the side of the loom in order to obtain the power required. The picking shaft should be set so that the picking cone will drop on the cam immediately after picking and travel around the cam until it is picked again. If the shaft is not set correctly, the cone does not drop immediately and in some cases only comes in contact with the cam just previous to picking, causing a weak pick. Care should be taken in setting the picking shaft so as

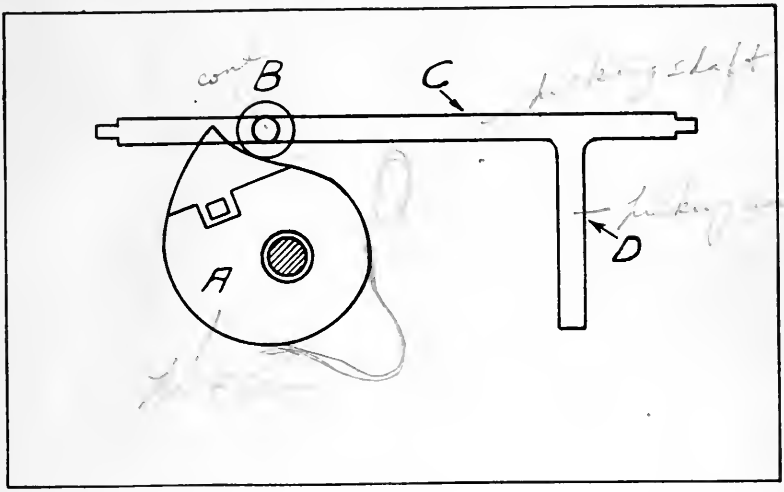


Figure 10

to have the cone full into the pick point and also have the end of pick point full against the cone for unless this is done much of the power is lost. The dropping of the picking cone in the same place after each pick eventually has its effect on the picking cam, with the result that the cam is badly worn at that point. This can often be remedied by the use of a casting made to correspond with the outside of the cam which covers the worn part and this has removed the necessity of replacing the whole cam. Considerable saving has been effected by this because of the time saved that previously was required to replace the cam; also a saving in the cost of the cam. In addition to this, the adding of the casting to this particular point on the picking cam has made the cam more rigid at that point and also heavier, consequently a firmer blow is given to the picking cone.

Parallel Motion

Fig. II (page 22), illustrates this motion. A, picker stick. B, parallel or shoe. C, parallel tongue. D, parallel stand. E, plug. This is one of the most important parts of the picking motion. The object of this motion is to enable the picker to travel parallel the full length of the stroke. The parallel stand, fastened to the rocker shaft, is level but the parallel is so constructed that the picker will travel parallel with the bottom of shuttle box. The shape of the parallel is obtained by using the picker as a center and the distance from picker to end of parallel as a radius. The parallel should be set to work full and free on the parallel stand, and should not work to one side or the small projection on top will soon be worn away or broken off with the result that the parallel will move about when picking and this will have a tendency to throw the shuttle out. The plug, which is inserted in the picking stand, must have the face perfectly true or this will cause the parallel to run crooked and shuttle will be thrown out. During picking, the parallel tongue forms a tapering contact with plug and guides the picker stick. Without the parallel motion it would be impossible to run a loom because it is absolutely necessary to have the picker travel straight in the shuttle box. If picker had to make an arc of a circle or in other words a curve from back to

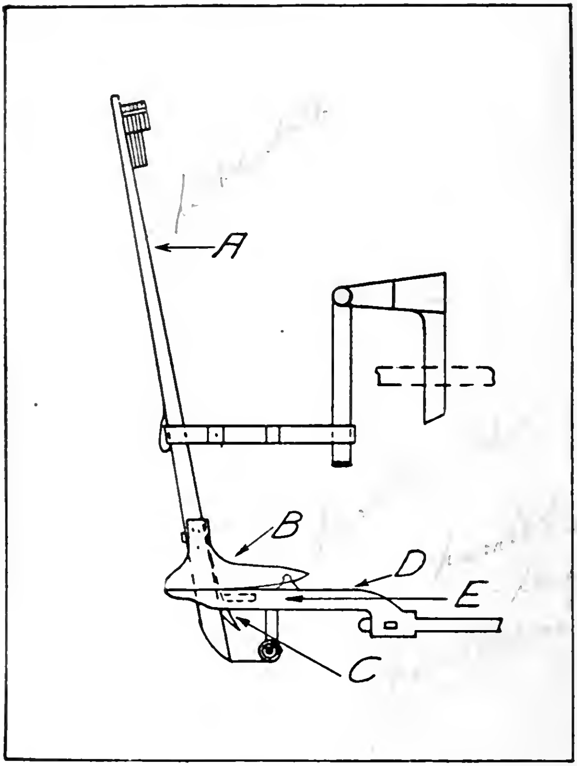


Figure 11

front end of box, the shuttle could not be driven across the lay. It is to dispense with this curve that the parallel motion is used.

Timing of Picking Motion

The shuttle should begin to move when crank is on top center. The motion is set on this timing because the shed is open to receive the shuttle, also the shuttle will have time to travel through the shed before shed begins to close.

If the picking is set earlier than this the shuttle will have to force its way into the shed and this will chafe the yarn and break out the selvages. Another objection to picking before crank reaches top center is that ridges or furrows are made on the back of shuttle; this will also cause the shuttle to rattle in the box. The reason for ridges being made on back of shuttle is as follows. The lay on top center travels at its highest speed and as the crank moves toward the back center the speed is considerably reduced. The shuttle is therefore being delivered when lay is at its highest speed, but the speed of shuttle decreases as it passes through the shed. The speed of the lay also decreases and this allows the shuttle to keep close to the reed and get clear through the shed and into the opposite box on time. If shuttle is picked before crank reaches top center the lay will not have attained its highest speed and as the shuttle is passing across the lay there will be a tendency for the reed to leave the shuttle behind and in this way cause ridges at the back.

CHAPTER IV

Setting Lug Straps

These straps should be set to avoid extremes in power. To illustrate. A stronger pick is made by lowering the stirrup strap on picker stick or by lowering the dog on picking arm, or the arm itself. A weaker pick is made by raising the stirrup strap on picker stick or by raising the dog on picking arm, or the arm itself. The desired result is obtained by

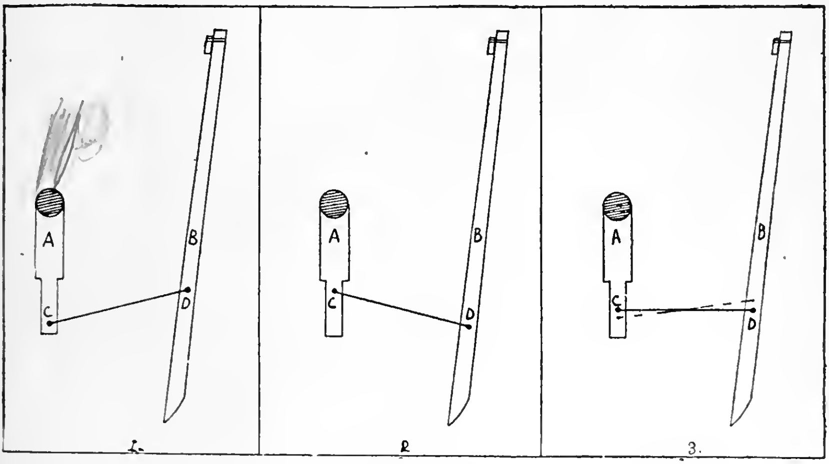


Figure 12

manipulating the dog on picking arm and stirrup strap on picker stick, but extremes should not be used, that is, the strongest pick on one and the weakest pick on the other.

To more clearly illustrate this point Fig. 12 is given. Three different settings between the picking arm and picker stick are shown. A represents the picking arm. B represents the picker stick. The connections are shown between C on picking arm and D on picker stick, the line representing the lug straps. At section marked I, the lug strap is at its lowest point on the picking arm and at its highest point on the picker stick. The best results will not be obtained from this. There will be extra power on the picking arm, but it will be lost on account of the lug strap being high on the picker stick. This fixing will also cause trouble to the fixer as the screw that holds the stirrup strap, which in turn holds up the lug strap, will either break or be continually coming out. Section marked 2 is just the opposite to that marked 1, and is probably more unsatisfactory, because of the power being applied to the weakest point first. There will also be a tendency for the lug strap to jump up on the picker stick. The most satisfactory setting from every standpoint is given in section 3. In this case the lug straps are set level with the medium power on both picking arm and picker stick. It is not always possible to set the lug straps absolutely level but it is advisable to do so when possible and to conform to practical results. In any case it is much easier to change from a weak to a stronger pick or from a strong to a weaker pick. This is illustrated by the dotted line which shows that for a weaker pick the lug strap can be raised on picker stick, while for a stronger pick the lug strap can be lowered on picking arm and still not have that undesirable extremes of power.

The lug straps and picking cams should be so set in relation to each other that there will not be too much play between the lug strap and the picker stick, as this causes lost motion and weak picks. To illustrate. First, lug strap on one side of loom is set to have about three-eighths of an inch play between outside lug straps and picker stick. Second, lug strap on opposite side of loom is set to have about one inch play between outside lug strap and picker stick. With the pick on correct time the picker stick on each side will begin to move when crank is on top center, on their respective picks. There will be a tendency for more weak picks with the second setting than with the first for the following reasons:

In first setting, only three-eighths of an inch had to be taken up before lug strap came in contact with picker stick. In second setting, one inch had to be taken up before lug strap came in contact with picker stick. This means that in the first setting, the pick point on picking cam will be just beginning to raise the cone on picking shaft and this will bring the lug strap against the picker stick and the full force of the pick point can be used to drive the shuttle across the lay. In the second setting, the pick point on picking cam will have forced up the cone a certain distance before the lug strap is brought in contact with the picker stick, thus reducing the force of the blow because much of the initial movement has been lost. To remedy this, the lug strap will have to be shortened as on opposite side and the pick cam set later to correspond, taking care that the picker stick and shuttle begin to move when crank is on top center.

There are a number of different kinds of lug straps used. These are made from wood; single, folded and stitched leather; ticking, reinforced canvass, etc. A single leather lug strap soon wears out and is expensive. Folded and stitched leather makes a very good strap as does the moulded and formed ticking strap and the improved reinforced canvass strap.

CHAPTER V

Setting the Pickers

The majority of pickers used are made of strips of leather cemented together. When these pickers are used it is advisable to fasten the strips together more securely by three fine wire nails, one at the top of picker and the other two at the bottom as illustrated at Fig. 13-A. By doing this the strips do not break apart and the pickers last longer. The loop which holds the picker to the picker stick should be of the correct size so that the picker can be securely fastened to the picker stick.

In setting the picker to the picker stick, the stick will have to be at the back end of the box. The picker when fastened to the stick should not come in contact with box plate at the bottom of box. When picker stick is at the back end of box it is not straight, but at a certain angle so that when fastening the picker to the picker pick, if care is not taken, it will press hard against the box plate. It is advisable to cut the picker to fit. This is illustrated at Figs. 13-B, 13-C. Fig. 13-B shows picker on picker stick with the stick straight in box. If picker is cut at dotted line it will fit on picker stick, as shown at Fig. 13-C. No part will be in contact with box plate when picker stick is at back of box.

When picker is in correct position the shuttle should be pushed full in the box against the picker so that an impression will be made in face of picker. At this point, a small round hole should be cut. If this hole is

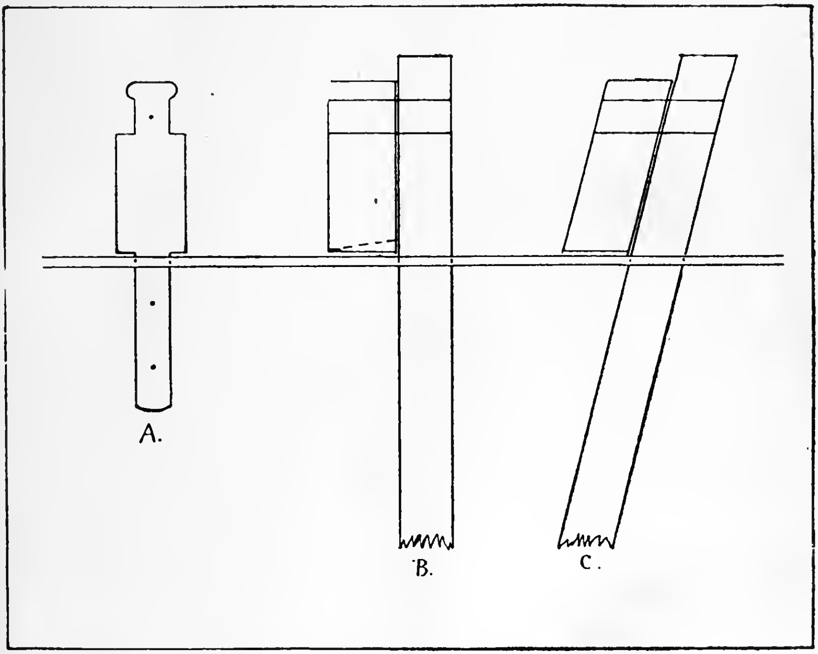


Figure 13

not made, the shuttle is apt to strike in different places, but by making the hole, shuttle will strike true and be delivered better. Excellent results are obtained if the hole is cut from one-sixteenth to one-eighth of an inch higher, that is, the center of hole to be made that distance higher than the impression made by the shuttle tip. Under no circumstances must the hole be made lower than the impression made by the shuttle tip or the shuttle will continually be flying out.

It is advisable, when a new picker is being put on the picker stick, to notice whether the parallel is adjusted correctly or not. Sometimes the picker is too low when shuttle is being delivered and this will certainly throw the shuttle out. When this occurs, the elevation of the parallel will have to be changed. On some looms, an adjusting nut is provided for this purpose, but where this is not provided, the picker can be elevated at delivery by inserting a piece of leather between the top of parallel tongue and picker stick, or between tongue and parallel. If the picker is too high at delivery, a piece of leather inserted between picker stick and bottom of parallel tongue will reduce the elevation.

Saving Pickers

Leather pickers usually consist of strips of leather glued together. A saving in pickers can be made by keeping all the old pieces of leather and picking out the best pieces. A new picker can be split in two pieces and an equal number of old pieces of leather cut the same shape as new picker can be made. These can be glued together and three fine wire nails put in the picker as indicated at A, Fig. 13. If the mill has drop box looms, the old rawhide pickers can be used. The picker can be softened so that the part through which the spindle passes can be made pliable. This can then be flattened out and the piece cut to the same shape as the leather picker and nailed to the regular picker leather. A good method is to have a layer of leather, then a layer of rawhide with leather behind. In making these pickers, it is of course necessary to keep them the same thickness as the regular pickers.

Setting Picker Stick

Three methods of setting the picker stick are illustrated at A, B, C, in Fig. 14. R is to represent back end of shuttle box. At A, the picker stick has returned almost to the back end of box. The bottom of picker stick is set about level with the spiral spring to which the picker stick is connected through the heel strap. There is a direct pull of the spring to the bottom of the picker stick, which makes it easy to pull the picker stick to the back end of the box after picking. The spring should not be too strong, only sufficient strength being required to pull the picker stick back to its original position. If the spring is too strong, the pick will have to be made stronger to overcome the extra resistance of the spring, which is a waste of power. At B, the picker stick has been raised from one to two inches higher than A, which allows the picker stick to stay in the shuttle box from two to three inches from the back end of box. At C, the picker stick occupies the same position as at A, that is, the bottom of picker stick is level with the spiral spring, but the heel strap has been connected between the parallel tongue and the picker stick. This keeps the picker stick from three to four inches from the back end of shuttle box.

When the picker stick is set as at B and C, it acts as a shuttle check and is used for this purpose. Both these settings are used by fixers. The objection to the setting at C is that the picker stick is kept too far into the box.

In both cases, extra pick is required on the shuttle to drive the picker stick to the back end of the shuttle box, but especially is this the case with setting as at C.

CHAPTER VI

Binders

Fig. 15 (page 28) illustrates various shapes of binders used on cotton looms. A represents what is known as a gradual tapered binder. This is used on drop boxes and also other boxes, and is made of malleable iron so that the shape can be altered to suit various circumstances, such as different sizes of shuttles. This binder, however, is usually so shaped that there will be a gradual taper on same and the shuttle will be gradually checked as it gets into the box. Also, this binder should grip the shuttle about half way, or near the center of shuttle.

The binder should not be bent to grip the shuttle near back end or there will be a tendency for the shuttle to be driven crooked across the lay. This is due to the fact that the pressure being on the back end of shuttle will release the shuttle too soon and the shuttle will not be guided straight out of the box. If shuttle is released too soon with this shape of binder, the dagger will rub against the frog in passing under it, and will also cause the loom to bang off. This can be seen on examination of the dagger, for the point of dagger will show the effect of rubbing against the frog.

B also illustrates a gradual tapered binder on a wood base. The adjusting nut is to allow adjustments to be made according to the width of shuttle and clearance of dagger from frog. With gradual tapered binders, gradual tapered shuttles should be used, that is, shuttles that taper gradually from the shuttle tip backwards and do not have any shoulder on back of shuttle. Such shape is shown at A and B.

With this shape of binder and shuttle the picker stick is pulled almost to the back end of the box after picking, this setting of the picker stick being illustrated at Fig. 14-A. It is only necessary to put a piece of

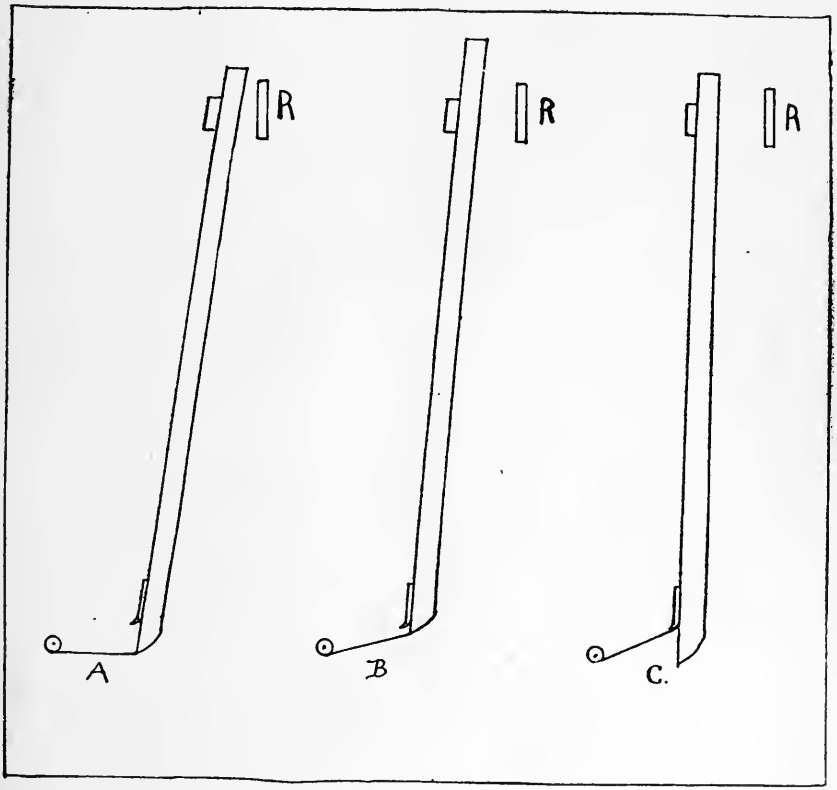


Figure 14

leather at the back end of box between end of box and picker stick. What is generally understood as a shuttle check is not used with this shape of binder and shuttle. When shuttle enters the box, the speed is gradually reduced until it gets to the back end of the box where it is held in position for the next pick. There is, however, a small check finger fastened to the protector rod, which in a way controls the binder so as to keep the shuttle in position when full into the box. This finger is fastened to the protector rod with the opposite end under the lay sole. When the shuttle is almost full into the box, this finger should be set against the lay sole and in this way the shuttle is held in position. Illustrated Fig. 21, Page 38.

C illustrates a wood binder, and when made as with full lines, would be known as a shoulder or blunt binder. This shape is usually used on the back of shuttle box with a side protector. The shape of shuttle used can be as solid lines which represents a shouldered shuttle, that is, the back of shuttle extends nearer the tips of shuttle than does the front of shuttle, in other words, there is a gradual taper on front of shuttle to the end of tip but not at the back. The shape can be also gradually tapered, as indicated by dotted lines. Many fixers, however, prefer the shouldered shuttle for this binder. The dotted line on binder illustrates a method of using the wood binder on front of shuttle box and having practically a gradually tapered binder.

D illustrates a blunt or shoulder binder, on front of box with center protector. This binder is made of cast iron and the shape cannot be

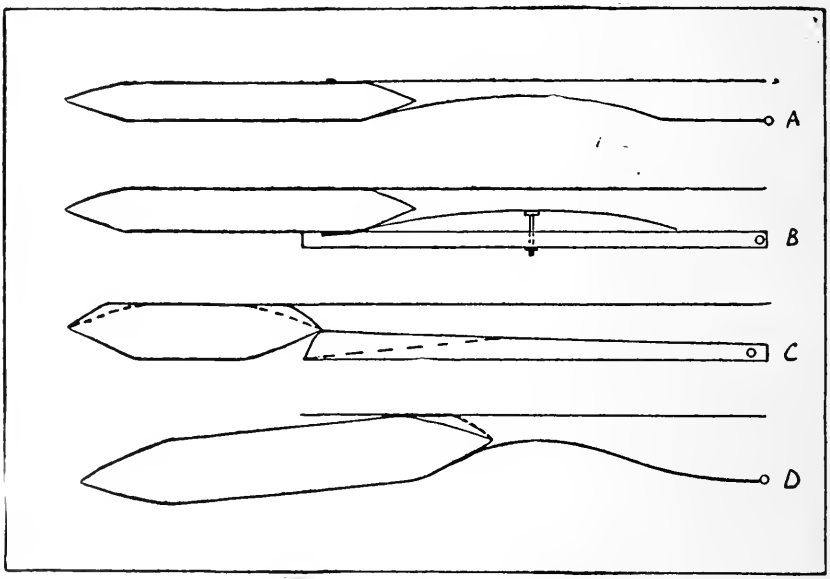


Figure 15

changed. A shoulder shuttle can only be used successfully with this binder. If the gradual tapered shuttle is used with this binder, it will not pass straight into the shuttle box; also, when shuttle is leaving the shuttle box the front end of shuttle will be forced away from the reed, and shuttle will run crooked across the lay and will also have a tendency to fly out. This is clearly illustrated in sketch. One end of shuttle is in contact with the binder, which forces back that end because there is nothing to prevent it and this causes the other end to be forced out as will be seen. If, however, a shoulder shuttle had been used, as indicated by dotted lines, the binder could not have forced back the end of shuttle and it would be delivered straight from the box.

Summarizing the above, it can be stated thus: On looms with gradual tapered binders, gradual tapered shuttles can be used. On looms with shoulder or blunt binders, shouldered shuttles can be used. Front binders, with few exceptions are generally gradually tapered. Front binders have the center protector; back binders have the side protector. On fine goods, the gradual tapered binder and shuttle is preferred. If the shoulder shuttle was used, it would be too hard on the selvage ends.

Relation of Picker Stick to Binder

As stated previously, with gradual tapered binders, the picker stick returns to the back end of shuttle box after each pick. The checking of the shuttle after it enters the box is done by the binder and then held in position by the small finger fastened on protector rod and under the lay sole.

With the shoulder binder, the picker stick remains in the shuttle box two or three inches and acts as a check on the shuttle. Fig. 14-B is the setting of picker stick. When this shape of binder is used, it is necessary to use a shuttle check, or have the shuttle box very tight. It is not advisable to have the shuttle box too tight, as this wears out the shuttle and increases the supply bill. The necessity for having to use a shuttle check with this kind of binder is as follows: The shuttle, as it passes from one shuttle box to the other, travels rapidly. As the shuttle enters the box, it comes suddenly in contact with the shoulder of the binder and this sudden contact causes the protector finger to rebound slightly, or in other words, to release the binder for the moment, and shuttle shoots into the box. If the picker was at the back end of box under these conditions, the shuttle would rebound and it is to prevent this rebound and to bring the shuttle to a stop gradually, that the check is used.

CHAPTER VII

Beating Up

The third principal movement in weaving is "beating up the filling." Fig. 16 (Page 30), A and B illustrates this motion. The names of the parts are as follows: Reed cap G; reed H; lay sole K, on top of which is fastened a steel race plate or a wood race board; lay sword L which is fastened to rocker shaft M; connecting pin N which connects the crank arm from crank to lay. Measurement of sketches, 28 inches lay sword, from center of rocker shaft to connecting pin; 12-inch crank arm; crank 3 inches radius. The figures are reduced in size proportionately. The sketch A illustrates the general setting of the crank and connecting pin in relation to each other. Sometimes the setting is as illustrated at B. When the lay is vertical, the reed in full against the cloth. Sometimes in beating up, the lay is a little forward of the vertical. Very seldom is the lay behind a vertical line when filling is being beaten into the cloth.

The curved line illustrates how the connecting pin moves. The circle illustrates the crank making its revolution. The radius of the crank being 3 inches, the diameter of the circle as described by crank will be 6 inches. The lay, which is at the fell of the cloth, or up against the cloth when crank is on front center, will be pulled back 6 inches by the crank. This distance is illustrated by connecting pin on lay, having moved from N to S in the curved line. When crank is on front center, the crank arm will be at N X; when crank is on back center, the crank arm will be at S, Y. The intermediate points of connecting pin between N and S, show the various positions of the lay with corresponding positions of the crank. For example, with connecting pin at N, from M to N, the crank will be on front center. M, O, will be position of connecting pin when crank is at O. M P will be position of connecting pin when crank is at P. M R, will be position of connecting pin when crank is at R. M S, will be position of connecting pin when crank is at Y or back center.

Two points will be noticed. First, the distance through which the connecting pin travels, has been divided into four equal parts. Second, the distance through which the crank travels has been divided into irregular parts, each part being in exactly its correct position. The distance from O, connecting pin, to O, crank circle, is exactly the same distance as from P to P, and R to R, and S to Y. From this it will be seen that the lay does not have a regular movement but has what is known as an eccentric movement.

Connecting pin moves from N to O, while crank moves from X to O. Connecting pin moves from O to P, while crank moves from O to P and

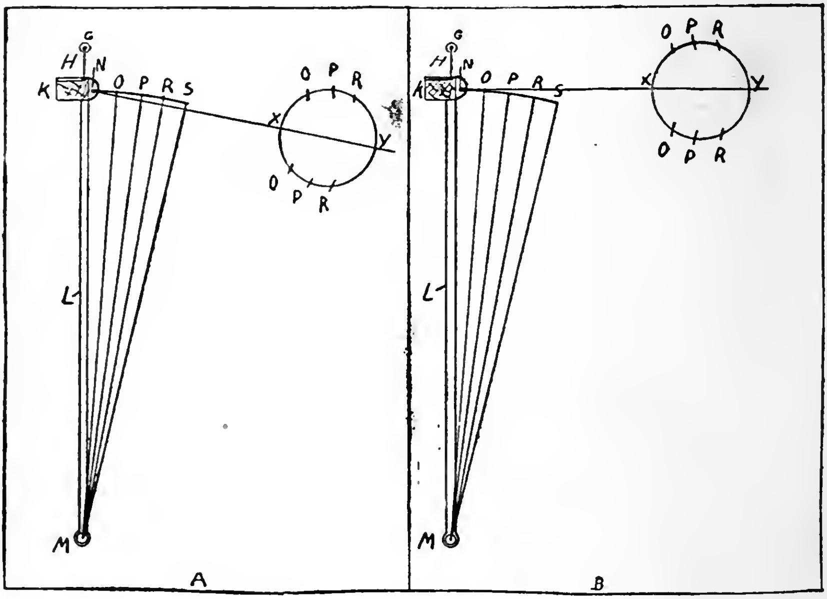


Figure 16

so on through the movements. The lay, therefore, travels the fastest between points O and R, and slowest between R and R, while crank is passing round back center.

A comparison of A and B will show that A has more eccentricity than B, which will therefore give a firmer beat up to the filling. The eccentricity is caused by the connecting pin being higher or lower than the crank shaft, or the shaft being higher or lower than the connecting pin. In B the crank arm is in a straight line when crank is on front center. In A the crank arm is on a plane or a straight line when crank is on top center. It is this relation of the connecting pin to the crank that causes the eccentricity.

The eccentricity of the lay allows the shuttle time to get across the lay from one shuttle box to the other. If a change had to be made on a loom from fine goods to coarse goods it would be advisable, if possible, to increase the eccentricity of the lay because of the firmer beat up of the filling which would be obtained, and the corresponding increase in time allowed for the shuttle to pass through the shed.

Effect of Pick on the Eccentricity of the Lay

This heading is given because it is sometimes thought that the pick has some effect on the making of the eccentricity of the lay. This is not so as the pick does not have any such effect. If there is extra strong pick on the loom; or if the shuttle is too tight in the shuttle box there will be a slight retard when crank is on top center, because this is the timing of picking motion. This retard can be felt by placing the hand on the lay cap but it is not in any way the cause of the eccentricity. This is merely poor loom fixing and should be remedied at once.

CHAPTER VIII

Take-Up Motion

When the number of picks per inch in cloth has to be changed, the only thing to be done is to put a new change or pick gear on the take-up motion, hence calculations for this motion are seldom made. There are one or two points about this motion that are not as clearly understood as they ought to be. For the purpose of making these points clear we will divide the take-up motions as follows:

1. When motion is driven from bottom shaft and one tooth in change gear is equal to two picks put in the cloth.

2. When motion is driven from crank shaft or lay sword and one tooth in change gear is equal to one pick put in cloth.

3. When motion is driven from bottom shaft and calculation has to be made for change gear.

Fig. 17 illustrates a train of gears driven from the bottom shaft in loom. One tooth in change gear will be equal to two picks in cloth. A is the ratchet gear of 100 teeth; B, take-up gear of 17 teeth on same stud. This gear meshes directly into change gear C, of 24 teeth, which is on the sleeve of pick sleeve gear D, with 21 teeth. This gear transmits motion to the tin roll gear E of 50 teeth. The circumference of tin roll is 14¼ inches.

In take up calculations, the circumference of tin roll must always be taken into consideration and not the diameter of roll. The driven gears are multiplied together for a dividend and the drivers together with the circumference of the tin roll for a divisor. Result of driven gears divided by result of drivers will give a number, which multiplied by 2 will give the picks per inch.

The multiplier 2 is used because the motion is driven from bottom shaft and one tooth in change gear is equal to two picks.

$$\frac{100 \times 24 \times 50}{17 \times 21 \times 14.25} = 23.58 \times 2 = 47.16.$$

The change gear, it will be noticed, is 24 teeth, so that there will be 48 picks per inch in cloth. The calculation only shows 47.16 picks per inch, but as there is always a certain amount of slipping of cloth and contraction after cloth is taken off the loom and as this is variously estimated at from 1½ to 2 per cent, the picks will be right for the change gear.

In all take-up motion calculations, the ratchet gear is a driven gear and the circumference of tin roll is considered as a driver.

Somewhat the same arrangement of gears is used when the motion is driven from crank shaft or lay sword as given in 2. In this case the change gear is generally the ratchet gear. The following gears are used on one of these motions. Ratchet gear (change) 46 teeth, take-up gear 12 teeth, gear fixed on sleeve 34 teeth, sleeve gear 12 teeth, cloth roll gear 60 teeth, circumference of tin roll 14⅜ inches.

$$\frac{46 \times 34 \times 60}{12 \times 12 \times 14.375} = 45.33$$

The take-up gear has 46 teeth, for that number of picks per inch in cloth. The calculation allows a little under that but when allowance is made for slippage and contraction of cloth from loom there will be 46 picks per inch in cloth.

Fig. 18 illustrates the train of gears when motion is imparted as

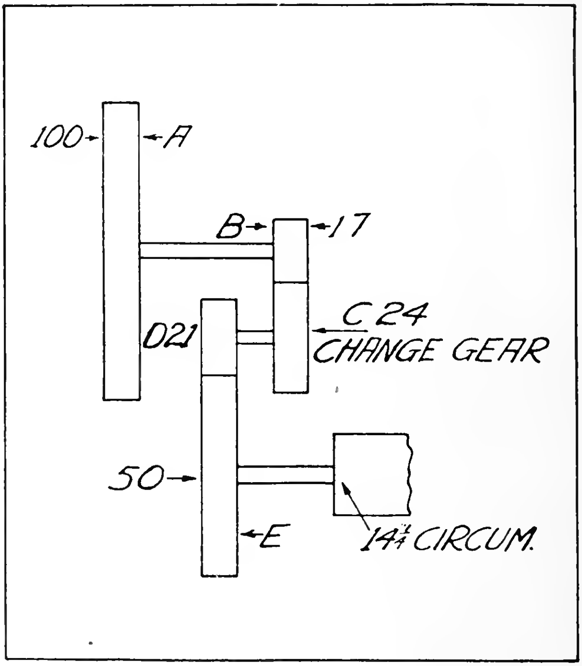


Figure 17

stated at 3. These gears require a calculation to show the number of picks per inch put in the cloth as the change gear does not indicate the number of picks per inch. To save time, a list of gears should be made showing the number of picks each gear will give. Sometimes the calculation is made by proportion, using the gear on loom with the picks in cloth and ascertaining what gear will be required for another number of picks. This, however, is not very satisfactory, because it is not always possible to get the exact change gear.

With the train of gears in illustration, what change gear can be used for 64 picks per inch? In this calculation the picks per inch are substituted for change gear. The answer is multiplied by 2, because the motion is driven from bottom shaft.

$$\frac{110\times68}{64\times12.25}=9.54\times2=19 \text{ change gear.}$$

Influence of Tin Roll on Picks Per Inch

The size of tin roll has a decided influence on the number of picks per inch. Any variation in the size of roll will have a corresponding variation in the picks per inch. This is a point that should be carefully

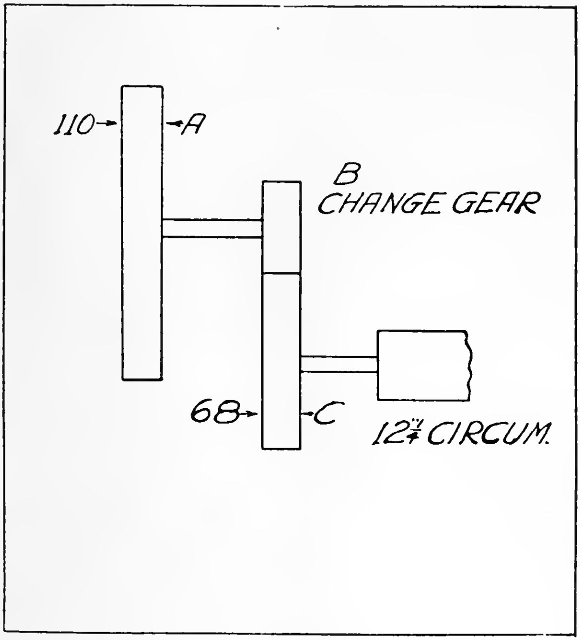


Figure 18

watched, especially when old tin rolls have to be re-covered. In recovering tin rolls, the old perforated tin should always be taken off before putting on the new tin. If this is not done, the new tin covering being put over the old, will increase the diameter of the roll and this will cause the cloth to be pulled down faster, with the result that a less number of picks will be put in cloth than is called for by the change gear.

If the circumference of tin roll is increased in any other way, the change gear and the picks per inch in cloth will not correspond. When sand rolls are used, and at one time they were more in use than at present, the surface would gradually rub and wear off. When re-covering with this "sand," which is a combination of grit, small particles of glass, etc., the circumference will be made too large if care is not taken when doing the work.

When re-covering an old sand roll with perforated tin, all the old sand must be cleaned off the roll, otherwise an uneven surface will be left and this will show clearly in cloth by making it uneven.

Perforated tin is now used almost exclusively for cotton goods, but on the finer grades of goods extreme care is required in selection of this so as not to damage the cloth when winding on the cloth roll.

Setting Take-Up Pawl

On plain goods the take-up pawl should be set to turn the ratchet gear when the harness are level. At this point the yarn and cloth has the least strain on them. The most strain is on the yarn when harness shafts are wide open and if the take-up motion operates at this time an additional strain is put on the yarn.

CHAPTER IX

Gear Let-Off Motion

Fig. 19 illustrates a gear let-off motion. This motion is used extensively on plain looms. The motion is controlled by the vibration of whip roll and the connecting rod from lay sword. There are different makes of gear let-off motions, but all have the same governing principles. The parts of the motion given are as follows: A clutch lever A connects a spring rod B to the whip roll. On the spring rod are two springs, a long one and a short one. An upright lever C works on a stud fixed to the side of the loom. The top of the lever is on the short end of the spring rod and is held between the spring and the collar. To the bottom of the lever is fastened a round iron rod D that is connected to the pawl lever E at F, the connection being shown in small sketch in corner. The connection F is directly behind the vertical shaft G, on which the pawl lever moves. On the end of pawl lever a small pawl H is fixed and this pawl turns the ratchet J. A small spring keeps the pawl in contact with the ratchet. The vertical shaft G carries a worm K which, when the shaft revolves turns the worm gear L. This worm gear is fastened to a small shaft which carries on its opposite end a small pinion gear and this pinion gear being meshed with gear on loom beam flange transmits motion to the loom beam. The rod M is connected to the lay sword which works free through collar set screwed on pawl lever rod D.

Setting the Motion

Have the whip roll set a little higher than the harness eyes, with clutch lever A as near vertical as possible. The large spring on spring rod B should have sufficient pressure on it to keep the yarn tight. The pressure on this spring will be determined by the amount of yarn on beam. The small spring should not be too close or tight and is governed by the strength of the top spring. This small spring counterbalances the oscillation of the whip roll and the rebound of the top spring. When the harness shafts are level, the upright lever C should be vertical and the pawl should be on the outside of the ratchet as shown in large sketch. When the harness are opening the whip roll is forced down and through the spring rod B a slight forward movement is given the upright lever C.

This causes the pawl H to pass over the required number of teeth on the ratchet gear and also brings the collar on pawl lever rod almost in contact with the small collar on rod M, which is connected to lay sword. In beating up, the rod M will pull the pawl lever rod D forward and the ratchet will be turned. The small collar on rod M can be set to come in contact with collar on pawl lever rod D according to requirements, but a good setting is to have the reed about one inch from the fell of cloth with collars in contact with each other.

Every part of the motion must work freely. If there is any binding in any part of the motion uneven cloth will almost certainly result. When

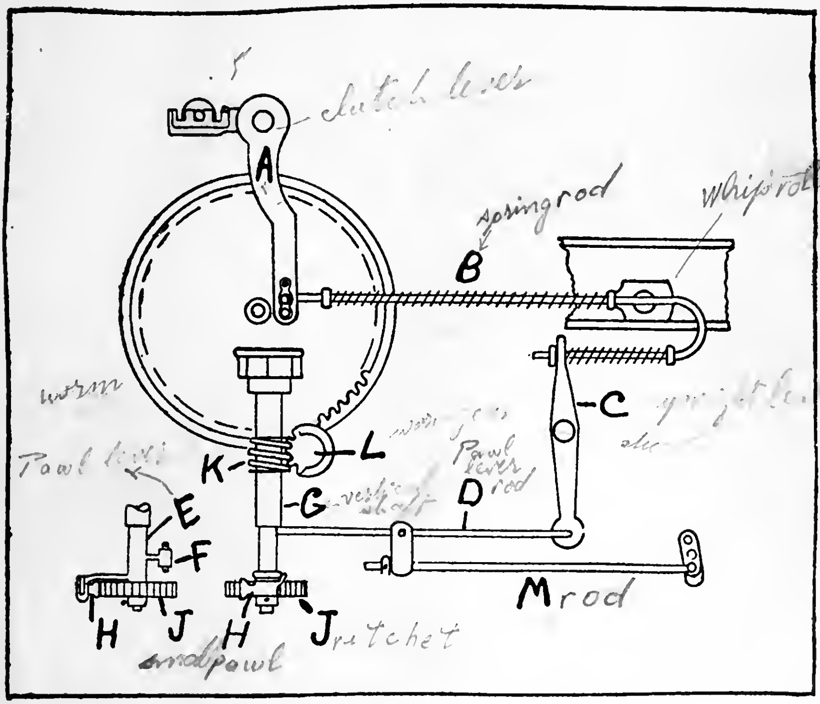


Figure 19

thin cloths are being made, there should not be too much motion of the whip roll as the extreme movement is likely to cause thin places in the cloth. When a full warp is put in the loom the long spring on spring rod is tightened by moving the collar. This reduces the vibration of whip roll and in turn reduces the number of teeth passed over by the pawl on the ratchet gear. This reduces the speed of the loom beam in letting off the yarn but not the amount of yarn let off because of the circumference of the yarn on the beam. As the yarn is woven off the loom beam, the circumference of the yarn on beam is reduced. therefore the loom beam has to travel faster to let off the amount of yarn taken up in weaving. The tension on the large spring must be reduced periodically so as to maintain the full width of the goods in the loom. If this is not done the cloth will be pulled out too long and will be too narrow.

Friction Let-Off

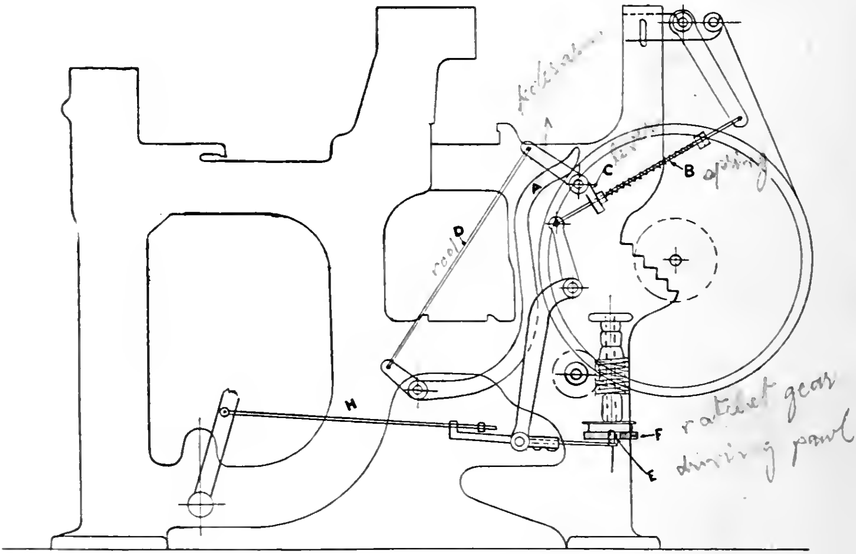
The commonest friction let-off is a rope passed around the drum of the beam head and attached to a weight lever under the loom beam. Sufficient weight is required on the lever to keep the yarn tight. As the beam is reduced in size, some of the weight is taken off. In damp weather, when rope is used it becomes sticky and the yarn is not let off evenly. When this occurs, the rope and beam head should be cleaned thoroughly, and black lead or powdered graphite should be applied in small quantity and this will allow the yarn to be let off evenly. Sometimes French chalk or Talc powder is used but this is not as good as black lead.

The rope should be kept clean at all times and oil should not be allowed to drop on either the rope or beam head, as this will soon make the rope sticky and cause uneven cloth to be made. The best results from the rope friction seem to be obtained when a hemp rope is used as it is less likely to become sticky.

Many mills are using chains for friction instead of rope. These chains are not affected by changes in atmospheric conditions, that is, if the room should be damp owing to a change from dry to damp weather, or an extra amount of moisture being put in the room, there will not be any visible effect on the chain let off. This is an advantage over the rope let off. These chains, however, require great care or the beam head will soon become grooved.

POSITIVE LET OFF MOTION

Figure 20 illustrates a positive let off motion. This motion automatically regulates the amount of yarn delivered as the beam gets



POSITIVE LET-OFF
Fig 20

smaller, or is reduced in size. The yarn is let off the beam by the driving pawl E in the same way as in the Gear Let Off Motion. The number of teeth in ratchet gear F over which the driving pawl E moves is determined by the position of Feeler Arm A and the tension on spring B.

Illustration shows a full beam. Feeler Arm A is resting on the yarn and in this position causes lever C through rod D to compress the spring B. Movement is imparted to the let off motion by the vibration of whip roll during weaving, the amount of vibration determining the number of teeth in ratchet gear over which the driving pawl moves thus regulating the speed of the loom beam.

With a full warp it is only necessary for the driving pawl E to pass over one or two teeth in the ratchet gear F to deliver the required amount of yarn. As the beam is reduced in size, the spring expands and permits more vibration of whip roll which in turn causes the driving pawl E to pass over more teeth in the ratchet gear F and this turns the loom beam faster thus delivering the correct amount of yarn.

CHAPTER X

Filling Stop Motion

This motion is illustrated in Fig. 21 and is an alternate stop motion, that is, the fork is raised out of the way of the elbow lever on every second pick. The purpose of the motion is to stop the loom when filling

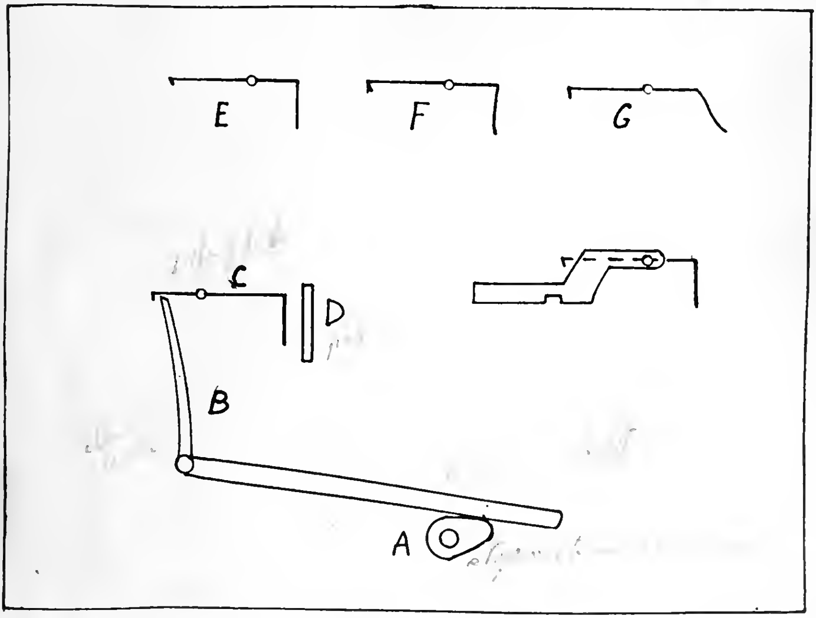


Figure 21

runs out or is broken and in order to operate successfully, the various parts must be set and adjusted correctly. A stop motion cam A is set-screwed on the pick cam shaft in the loom. This cam is made in different shapes, an eccentric cam often being used. The elbow lever B, is of two parts, one extending over the cam and the other end extending upwards under the filling fork. C is the filling fork, D the grate which is in line with the reed and back of box. At right hand side of illustration a fork and fork slide is shown.

When the loom is running, the filling is carried by the shuttle directly in front of the grate and between the grate and the fork. As the lay comes forward, the filling will raise the fork out of the way of the elbow lever and loom will continue to run. When filling is broken the fork passes through the grate, and the elbow lever, in moving outwards comes in contact with the catch on end of fork. This forces back the filling fork slide and at the same time forces back the shipper handle and loom is stopped.

Setting the Fork

In setting the fork, care must be taken that the prongs of the fork pass clear into or through the grate and must not come in contact at all with the grate but must work clear so that when filling breaks, the catch on the fork will remain over the elbow lever. Excessive movement of the fork should be avoided and the fork should be set so as not to pass too far through the grate, as this not only gives excessive movement but causes strain on the filling. The prongs of the fork should not be too long, or when fork is raised the bottom of the prongs will come in contact with the lay sole and this often causes loom to stop.

Shape of Fork

The prongs of the fork can be made any desired shape. These shapes are given in Fig. 21 at E, F and G. The shape given at E and F are two of the best that can be used. E has the straight prong, F the slightly concave prong. The filling is subjected to the smallest possible amount of strain and it is not necessary to have them pass very far through the

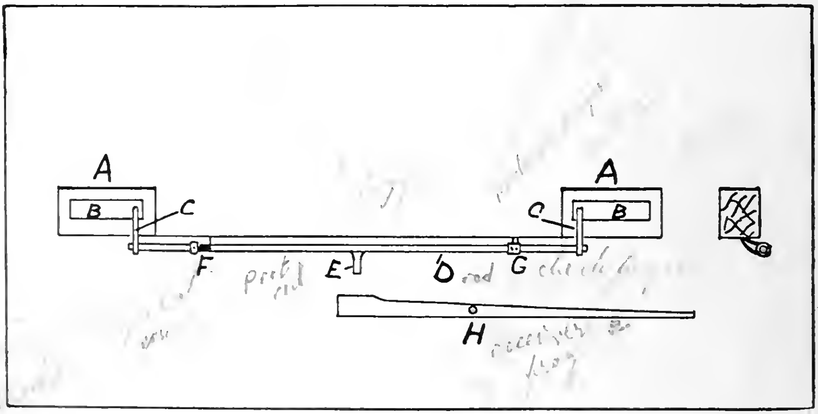


Figure 22

grate in order to raise the catch on end of fork the required distance out of the way of the elbow lever. The shape at G is not very desirable and is not as easily regulated as the other shapes. The filling is more likely to slip on the fork and more pressure is required to raise the catch on the end of fork the required distance. In all cases the prongs of the fork should be of sufficient length to reach below the level of race plate and into groove that is cut into the lay sole at the required point.

Timing of Stop Motion

Have shuttle in box at stop motion side with crank in front center or just a trifle past front center. Push fork slide as far forward as it will go. At this point, the stop motion cam should be set to raise the elbow lever so that the end will be just passing under the catch on fork.

Thin Place Preventer

On almost all cotton looms there is a thin place preventer. These are constructed differently but the object is the same on all, namely, to raise the catch on take-up gears when filling breaks which prevents the gears from drawing down the cloth for those picks where no filling is inserted. On looms with tight and loose pulleys the thin place preventor is of much value as the lay usually turns over for two, three or four picks before coming to a stop. On these picks the ratchet gear on take-up motion is kept from being turned and the cloth is not pulled down. The loom can generally be started up without turning back the take-up gears if the preventor motion is working correctly. Often, the passing of the hand across the cloth before starting up the loom is sufficient to prevent a thin place. The motion is operated in all cases from the filling fork slide so that as this slide is pulled back when filling is broken, the motion operates.

Protector Motion

There are two kinds of protector motions on looms, namely, center protector and side protector. The purpose of the protector motion is to prevent smashes. If the shuttle should not get into the shuttle box the loom will bang off and if shuttle is in the shed a smash will be prevented.

Fig. 22 illustrates a center protector. The center protector has only one dagger which is in the center of protector rod. The binder in shuttle box is always on the front of box. In illustration, A represents shuttle boxes; B, the binders; C, protector fingers; D, protector rod; E, dagger; F, spiral spring on protector rod; G, check finger; H, the frog or receiver. The frog is held under breast beam, one end being behind the shipper handle.

The spring on protector rod is to keep the protector fingers in contact with the binders. The spring should not be too light, only sufficient tension being required to keep the protector fingers in position. The spring, however, is sometimes used as a means of checking the shuttle but it is not advisable to do this. When the shuttle is in the box, the binder is forced out and in turn forces out the protector finger and the dagger on protector rod passes under the frog or receiver. When shuttle is not in the box, the dagger strikes the frog and knocks off the shipper handle, stopping the loom.

The small sketch on right hand side shows the check finger in contact with the bottom of lay sole. This check finger is only used on front binders and which are generally gradual tapered. The setting of this finger is to have the shuttle almost full into the box with the binder and protector finger pushed out almost as far as they will go and at that point the end of finger should be set against the bottom of lay sole. This will check and hold the shuttle in the box. The check finger must not be set to hold the shuttle too tight in the box but just enough to keep the shuttle in place and also to prevent rebounding of shuttle in box. If the finger is set to hold the shuttle too tight, more power will be required to drive the shuttle; the shuttle will also wear out sooner. By the use of the check finger, the picker stick can be set to the back of box after picking.

Warp stop on p 63

Fig. 23 illustrates the side protector. A side protector is always operated from a back binder. The finger shows the protector motion on shipper handle side and the connection of frog with brake. The frog A has the knock-off finger B fastened to it and which is directly behind the shipper handle C. D is the dagger which is fastened to the protector rod; E the protector finger fastened to protector rod. The protector rod is suspended in small bearings under the lay sole. When the dagger comes in contact with the steel receiver F in the frog, the shipper handle is knocked out of position, the belt is pushed on the loose pulley, and the brake G is pulled in contact with the wheel on tight pulley H, thus stopping the loom.

With this protector motion, two frogs are generally used. The one operating on shipper handle side is an active frog, the one on opposite side of loom is an inactive frog. These two frogs are exactly the same but the inactive frog merely receives part of the strain when loom bangs off. The daggers are set so that the one on shipper handle side will come

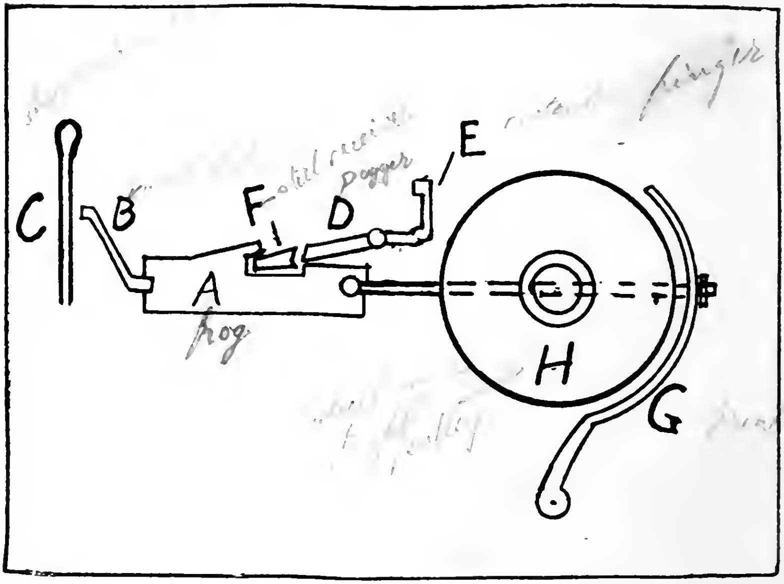


Figure 23

in contact with the frog before the dagger on the opposite side. If these conditions should be reversed, that is, if the dagger on inactive frog should be in contact with frog before the active dagger, a smash will result, sooner or later.

Setting Protector Fingers

The protector fingers which are fastened to the protector rod must be set so that when shuttle is in the box the dagger will clear the frog. Also, when shuttle is not in the box, the fingers should be set so that the dagger will strike squarely in the frog. If the dagger strikes too high, the binder has to be set closer in the box so as to have the dagger move a greater distance, thus requiring more power as well as putting increased pressure on the shuttle.

The frog should be placed in the position it will be when loom is running. The dagger should be full into the groove in frog. At this position, the protector fingers should be set full against the binders. In setting, care must be taken not to have any lost motion between finger and binder, also that the dagger strikes full into the frog.

CHAPTER XI

Cover or Face on Cloth

The subject of cover or face on cloth is one that should have full attention given to it. Judging from the way much of the plain cloth is woven, it would appear as though face on goods is of very little value. Cover or face is of value and fabrics possessing this feature, which costs practically nothing to put on, is very often the deciding factor in many sales. Not only is this feature the deciding factor in making the sale, but a better price is often paid for the goods.

There are three requisites for putting face on cloth. First, setting of whip roll. Second, soft twisted filling. Third, timing of shedding cams. First. The setting of whip roll is one of the first details which must be attended to. It is surprising how often this little thing is neglected. What ought to be done in every mill on the same class of goods, whether goods have to be covered or not, is to have one position of the whip roll.

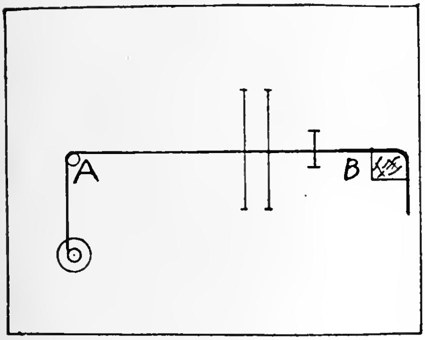


Fig. 24

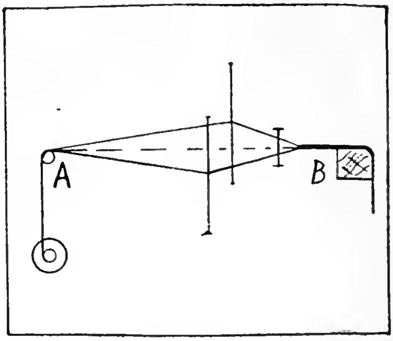


Fig. 25

When the correct position has been found for either reedy or covered cloth, the whip roll on all looms should be set the same and the result will be uniform in every piece produced.

Setting for Reedy Cloth or Without Cover

Fig. 24 illustrates the setting of whip roll and harness to produce cloth in loom without any face or cover on it. With the harness level, that is, crossing each other, the warp yarn forms a straight line from the whip roll A to the breast beam B. Fig. 25 illustrates the harness shafts open, the dotted line representing the warp line as in Fig. 24.

It will be noticed that there is an even tension on the yarn both at the top and bottom. As the ends in a plain cloth are drawn through the reed two in a dent, every two ends will be worked together as a unit, and the reed wire separating every two ends and beating the filling into the cloth will keep each two ends together and leave an empty space between. Each two ends being opened and held together at even tension must of necessity run together. The warp and filling is divided evenly on the face and back of cloth.

Setting for Covered Cloth

Fig. 26 illustrates the position of whip roll to put face or cover on cloth. It will be noticed that the only change that has been made between Fig. 24 and Fig. 26 is that the whip roll A is set higher in Fig. 26 than in Fig. 24. This, however, is one of the vital points in putting face on goods. Fig. 27 illustrates the harness shafts open with this setting, the dotted line illustrating the warp line as in Fig. 25. The harness shafts have been raised and lowered the same distance as in Fig. 25. but it will be noticed in this Fig. that the bottom of the warp is much tighter than the top half. This is because the line that is formed by the warp drawn through the raised harness shaft is not as high above the warp line as the warp drawn through the lowered harness is below the warp line. In other words, when a harness shaft is raised, the yarn that is drawn through that shaft does not have the same tension on it that the yarn does that passes through the harness shaft that is lowered. The effect of this on the yarn and cloth is as follows: When the harness shafts

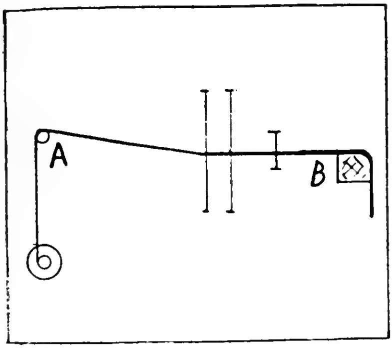


Fig. 26

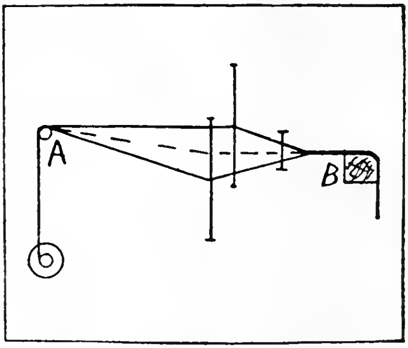


Fig. 27

are open and the reed is beating the filling into the cloth, the ends in the top part of the shed will be looser than the ends in the bottom part, consequently the loose ends will spread out and in between the tight ends and the marks of the reed will not be seen.

Also, remembering that the bottom half of the warp is tighter than the upper half, the filling will be forced on the face of the cloth and it is the filling that makes the "face" on cloth. In some cases, the cloth is raised at the breast beam by placing a strip of wood either on top of breast beam or in front and allowing the end of wood to extend over the top of breast beam. When this is done, the warp line will be higher both at the breast beam and whip roll than at the harness shafts when shafts are level. Care must be taken that the cloth is not raised too high or the ends of the upper half of the shed will be too loose. This will also occur if the whip roll is too high.

Second. To obtain the best face or cover, the filling should be soft twisted. It will readily be seen that the softer and more loosely twisted filling that can be used, the better will be the face or cover since the filling is forced on the face of cloth and it is the filling that gives the cover.

Third. The timing of shedding cams has a decided influence on the face of cloth. There are three different timings of cams, namely, late, medium, early. Each setting is suitable for special kinds of cloth, but when considering the regular plain sheeting and prints, the medium or early timing should be used. The medium timing of motion is to have crank between bottom and front center with the harness shafts level. Early timing of motion is to have crank on bottom center with the harness shafts level.

With the early timing, the shuttle will have passed through the shed and laid in the pick of filling, the harness shafts will have crossed the picks and be almost full open when the reed is beating the filling into the cloth. With the whip roll set at Fig. 27 the filling will be forced on the face of cloth because the bottom half of the warp is tighter than the upper half and also because the ends, being opened, will allow the filling to be beaten into the cloth easier.

Many fixers time the position of the shedding cams by the distance of reed from fell of cloth with the harness shafts level. A medium timing of motion will be when reed is about one inch from fell of cloth with harness shafts level; an early timing of motion will be when reed is about two inches from fell of cloth.

Cost of Adding "Face" or Cover to Cloth

It has been previously stated that it costs practically nothing to add face to cloth as the following shows:

First. It costs nothing to raise the whip roll, for the fixer can do this in his regular work. When the correct position has been ascertained, a measuring stick can be made and all the whip rolls set to this standard. As the raising of whip roll puts additional strain on the bottom part of the shed, the yarn will have to be carefully sized so as to retain all its strength, but this can be done by a judicious mixing of sizing ingredients. The whip roll must not be set too high or the yarn at the bottom part of the shed will have too much tension on it and the ends will be liable to break. Also, the yarn at the top part of the shed will be too loose and this will have a tendency to throw out the shuttle.

Care is therefore required in getting the correct position for the whip roll. Sufficient face or cover can generally be put on cloth by adjusting the whip roll, though occasionally a strip of wood has to be added to the breast beam. This will be added expense but the results obtained will more than compensate for this.

Second. The making of soft twisted filling will probably cost a little more because of the extra breaking of the ends on the spinning frame. These breakages should not be too many unless the filling is extra soft twisted, in which case there will be more ends down on the spinning frame and more stoppages on the loom than there will be when the regular filling is used.

The regular filling twist is usually correct and an excellent face or cover can be obtained when other things are in proportion.

Third. It certainly does not cost anything to set the shedding cams early in preference to setting them late.

Summary

To sum up in a concise form the following points are given which, if followed, will give good results.

For Cloth Without Face or Cover

Have harness shafts level. Crank between bottom and front center. Set whip roll so that "warp line" will be in a straight line from whip roll to breast beam.

For Cloth With Face or Cover

Have harness shaft level. Crank on bottom center. Set whip roll so that "warp line" will be above a straight line from whip roll to breast beam, the line being lower at the harness shafts. In other words, raise the whip roll. In some special cases put a strip of wood on the breast beam.

CHAPTER XII

Temples

Temples are for the purpose of keeping the fell of cloth as wide as the yarn in the reed. If temples were not used, the selvages would not weave. Fig. 28 illustrates a left hand temple with plate. This is a single roll temple, some temples having double rolls. Temples are made for all kinds of work, both fine and coarse and in different widths to suit the cloth being made.

The rolls should always work freely, if they do not, the pins in the roll will make small holes in the cloth if fine cloth is being made. The pins will also pluck the filling and make a poor looking cloth. The rolls should be kept clean as ends frequently wrap around them. This keeps the pins from holding the cloth out firmly and allowing it to slip. Waste also accumulates at the ends of the roll and this keeps the roll from turning. It is sometimes necessary to take out the rolls to clean and oil and in replacing same, care is necessary.

On some fine goods, the finest pins used in rolls will sometimes make temple marks. To remedy this, the rolls should be covered with fine

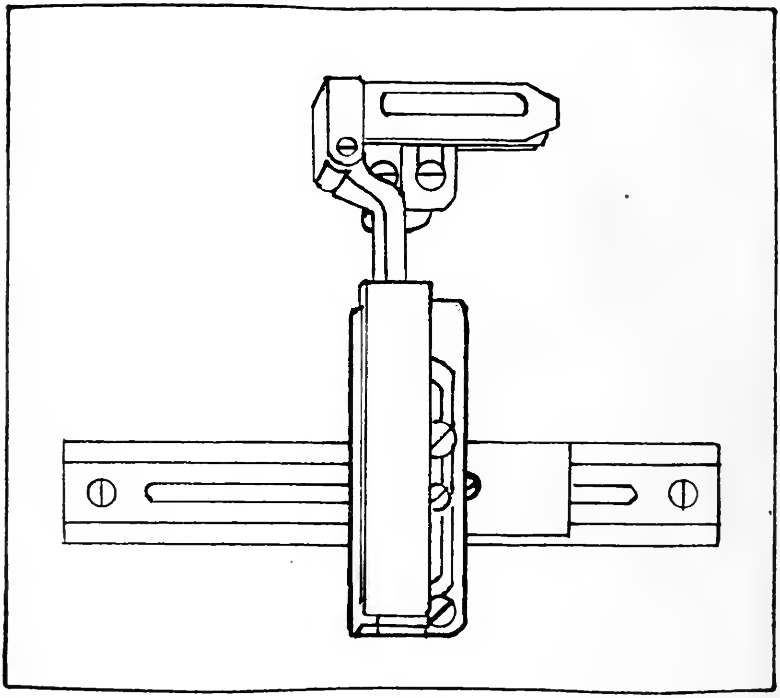


Figure 28

tissue paper until only the points of pins show through the paper and this is enough to hold the cloth the full width. Sometimes filling is wound round the roll but this is not as good as tissue paper. Rough and bent pins cause temple marks, plucking of filling in cloth as it passes through the temple. and holes are often made in cloth by these defective pins.

Setting the Temple

The plate of temple should be fixed securely to the breast beam. The trough of the temple should be just high enough for the lay sole to pass under. The selvage of cloth should be full into the temple. When the reed is about one-eighth of an inch from the fell of cloth the lay sole should be in contact with the heel plate on temple.

Fig. 29 illustrates the lay almost in contact with the heel plate of temple A. With the heel plate set so as to have the lay sole come in contact at this point, a slight forward movement is given to the temple. This releases the selvage at this point and the strain on them is slightly reduced. There should not be too much movement of the temple.

Lease Rods

These rods are for the purpose of separating the yarn and obtaining, as the name indicates, a "lease." This use of lease rods enables the weaver to readily find the place if an end should be broken; the ends can

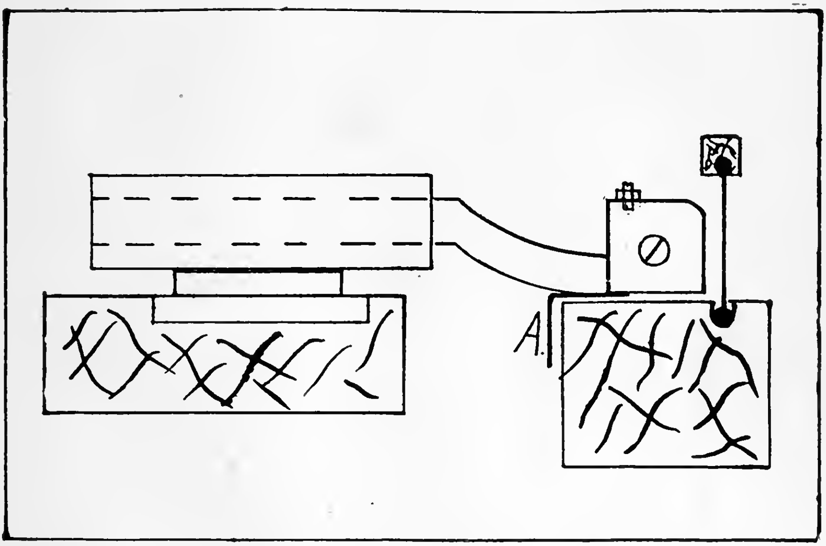


Figure 29

also be kept straight, which is of great service, especially when colored yarns are used. A clearer "shed" is obtained by the use of them and they also keep the ends from becoming tangled. A soft wood, with surface insufficiently protected, should not be used as the continued drawing of the ends over the rods soon cuts little ridges or furrows in them. This is a source of constant trouble and expense, as the ends getting in the ridges are continually breaking out, especially on fine yarns. Such rods have then to be sandpapered frequently so as to keep them smooth.

To overcome this difficulty, a lease rod made from either basswood or white birch, thoroughly seasoned and kiln-dried, then enameled with a special enamel designed and made for this purpose, and the enamel carbonized and thoroughly baked on the rods for successive coats under high heat for hours, produces a hard, glazed surface, over which the ends run as smoothly as over glass. So made they wear for many years.

Lease rods are of different shapes and sizes. The largest rod, which is a round one, is always inserted in the yarn first, and is the back rod. The back harness is raised and the front harness lowered when the rod is inserted in the yarn. When the front rod, which is oval, is inserted, the front harness is raised and the back harness lowered. The reason for inserting the rods in warp in this order is as follows: When the back harness is lowered and the front harness raised the shed is formed at a point between the rods and the fell of cloth. The added thickness of the back rod is sufficient to put the necessary tension on the yarn to make a clear shed because the front harness is near the fell of cloth. When the front harness is lowered and the back harness raised, the shed is formed from the front rod and the fell of cloth. The back harness has to travel a greater distance than the front harness to make the same size of shed for the shuttle to pass through because it is farther away from the fell of the cloth, therefore more tension is required on the ends drawn through that harness so as to make a clear shed. This additional tension is obtained by having the ends under the front lease rod which is sufficient to equalize the distance between the harness and fell of cloth. A small oval rod is therefore necessary for front rod as the larger the rod the farther the yarn has to bend.

Shuttles

On single box work the usual custom is to have two shuttles to one loom so that when one is at work the other is threaded up ready for use. When more than one shuttle is used on the same loom they should all be the same size, shape and weight. The shuttle box is set for one size of shuttle and there should not be any variation in size otherwise there will be more or less trouble with loom banging. The weight of shuttles should be as near the same as it is possible to get them. The shape of shuttle should be the same on all shuttles used. With a gradual tapered binder, the best shape of shuttle to use is one that is tapered to the shuttle tip, with the tip in center of shuttle. A shoulder shuttle should only be used with a shoulder or blunt binder and the shoulder on shuttle should not be too deep.

More and better production can be obtained from the loom by the use of a correctly designed shuttle. The shuttles should be made of the best material and perfectly constructed. With poor material the shuttles soon become ridgy on the back, splinter and soon wear out. The result is a loss in production caused by ends breaking out, smashes, etc.

Care of shuttles is an important part of weaving, especially on fine goods. Shuttles are, however, very often neglected with the result that ends are continually breaking out. All rough places should be made smooth by being sandpapered and all sharp edges should be eliminated.

Shuttles should be handled carefully and should not be dropped on the floor. This causes the tips to be blunted and flattened. It is impossible to have good weaving when the shuttle tips are flat or blunted. When the tips are in this condition any loose ends are caught by the tip and broken out. The tip strikes the loose ends, breaking them and carrying them through the shed. The blunted tip can readily be detected when this occurs because the broken ends are carried in the direction this tip is traveling.

All blunt tips should be sharpened. They should be perfectly round and to a sharp point, for only in this way can the best results be obtained. In sharpening care should be taken so as not to have the shuttle tip flat as this will cut out the ends.

CHAPTER XIII

Auxiliary Shaft for Twill Goods

When a mill is equipped for weaving plain goods only, the shedding cams are put on the pick cam shaft. If it is intended to also weave twill or sateen goods on these looms a small auxiliary shaft is added to the loom. This shaft is driven from the pick cam shaft at varying speeds according to the twill that is being made on the loom. If a three harness drill is being made the auxiliary shaft has to be driven so that one revolution of the shaft will be equal to three picks, or if a four-harness drill is being made, one revolution will be equal to four picks. Fig. 30 shows the connection between the pick cam shaft and the auxiliary shaft. A, represents crank shaft. B, represents pick cam shaft. Different sizes of gears are put on the shaft as will be seen and the meshing of either of these gears will drive the auxiliary shaft at a different speed, according to the number of cams being used. A fixed gear is usually set on the auxiliary shaft. When plain goods have to be made the gear on pick cam shaft will have to be the same size as the gear on auxiliary shaft, since auxiliary shaft has to travel the same speed as the pick cam shaft, namely, one revolution of the auxiliary shaft to two revolutions of crank shaft.

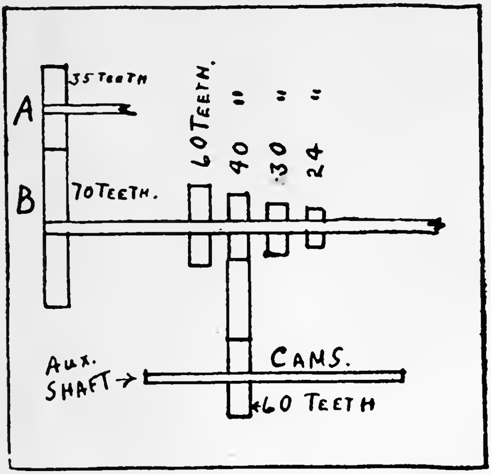


Figure 30

Example to Find Gear Required

A loom has to be changed over from plain cloth to four-harness twill. Gears on loom as follows: On end of crank shaft 35 teeth; on end of pick cam shaft 70 teeth; on auxiliary shaft 60 teeth. What size gear required to drive auxiliary shaft? Rule: Multiply driven gears together for a dividend. Multiply driver gear by twill required for a divisor. Divide one by the other and the answer will be gear required.

$$\frac{70\times60}{35\times4}=30 \text{ tooth gear required.}$$

By substituting in rule the gear on pick cam shaft that is meshed in gear on auxiliary shaft, the number of picks in one revolution of auxiliary shaft will be found.

Example: Gear on end of crank shaft 35 teeth; on end of pick cam shaft 70 teeth; on pick cam shaft driving auxiliary shaft 40 teeth; on auxiliary shaft 60 teeth. How many picks in one revolution of auxiliary shaft?

$$\frac{70\times60}{35\times40}=3 \text{ picks, or cams for three harness drill.}$$

Changes Required

When changing over from plain goods to twills or sateens several changes have to be made. These are as follows: New harness rolls; additional treadles; additional jack sticks and straps; gear to drive auxiliary shaft. If a vibrating whip roll had been used for plain goods, it would be advisable to reduce the vibration for the following reason: The vibrating whip roll is used to relieve the strain on the yarn when the harness are open, for at this point the greatest strain is on the yarn.

This vibrating whip roll is therefore more desirable for plain goods than for twills or sateens because one-half the yarn in plain cloth is raised and the other half lowered at the same time. In twills and sateens some harness are changing while others are stationary so that the vibrating whip roll is not of as great value as on plain cloth.

Timing of Twill or Sateen Cams

When two harness shafts are being changed, that is, one raised and one lowered, the crank shaft should be just past bottom center when they are level or just passing each other. The timing of this motion can often very easily be changed as an intermediate or carrier gear is used to transmit motion from the gear on pick cam shaft to gear on auxiliary shaft. By moving this carrier gear out of position, the cams can be set at any desired point in relation to crank shaft.

Roll and Spring Top

Twills and sateens are usually made on either roll or spring top. Fig. 31 illustrates roll top for three and four harness; also a spring top similar to that which is used on the Draper loom. The rolls shown in illustration are directly over the harness though on many looms these rolls are on one side of the loom arch. The principle of operation is the same whether the rolls are directly above or to one side of the loom. These rolls require careful adjustment or the straps will lap under and this causes the harness to jump.

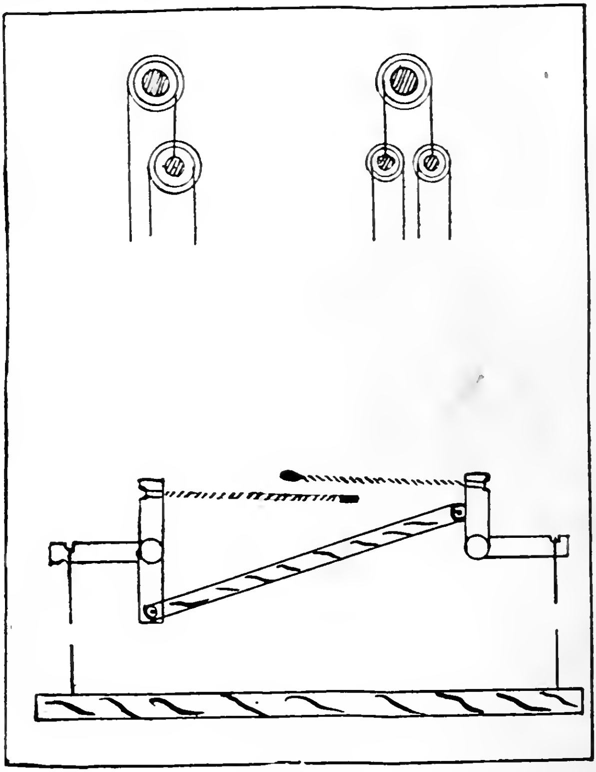


Figure 31

With the spring top this trouble is entirely avoided and it is an excellent motion. If the treadles are set correctly to the shedding cams and are in contact with the cams for the whole of the revolution, there is no difficulty whatever with this motion and good results are obtained. In all cases, whether rolls or spring tops, there must be correct setting of the harness and treadle balls otherwise the harness will not receive the easy movement that is necessary for good weaving.

CHAPTER XIV

LOOM FIXING POINTS

Under different heads the various causes of loom being out of order will be given, together with remedies for same. A loom fixer's duty is to keep the looms under his charge in good repair so as to produce the maximum production of first quality goods.

LOOM BANGING OR SLAMMING

This is what a loom fixer is called for in a large number of cases. There are quite a number of causes for this, which will be enumerated.

Late Pick

This is generally caused by lug straps slipping. The straps should be closed in so that the pick will start on time. The correct timing of picking motion is to have shuttle begin to move when crank is on top center. Late pick is sometimes caused by pick cam slipping. The cam will have to be reset on time.

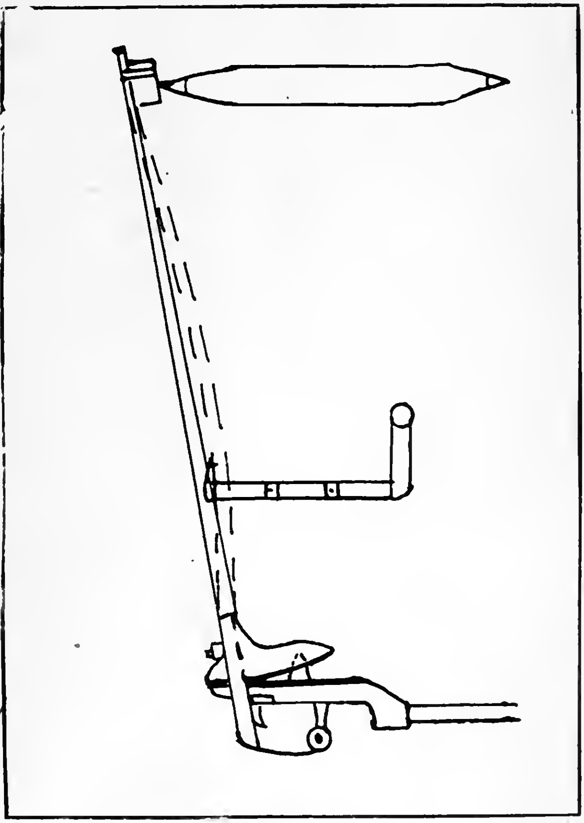


Figure 32

Weak Pick

When the picking motion is on time and the shuttle is not picked hard enough so as to get in shuttle box on opposite side in time, the pick has to be made stronger. This can be done in two ways. First, by lowering lug strap on picker stick. Second, by lowering driving arm, or dog on driving arm. Either of these methods can be used, but care should be taken so as not to have the lug straps at extremes. See Chapter Four.

Cracked or Part Broken Lug Strap

When the lug strap is cracked or part broken, much of the force of the blow is lost causing a weak pick. This should be replaced with a new strap.

Cracked Picker Stick

A weak pick is often made with a cracked picker stick. It is best to replace such a picker stick with a new one as soon as possible. One cause of picker stick cracking is by having the shuttle held too hard in the shuttle box, so that when beginning to pick, the picker stick is bent and when this occurs, neither the picker stick or shuttle lasts long. The shuttle should not be held too tight in the box, only sufficient to have the dagger clear the frog, and also to keep it from rebounding. Fig. 32 illustrates by dotted lines how a picker stick is bent when shuttle is held too tight in shuttle box.

Picker sticks are cracked and broken when the stick strikes too hard against the front end of the box. A buffer should always be used to protect both the picker and the picker stick. This buffer is sometimes made of leather; also of cloth wound tightly in a roll and put in the front end of race. The picker striking the buffer instead of the solid end of the race increases the life of the picker stick and also the picker, because the hard blow on picker and picker stick is reduced. Picker sticks should be made from hickory, cut straight with the grain. Poor quality picker sticks will more easily bend as shown in illustration.

Rebounding Shuttle

A rebounding shuttle is one that strikes hard against the picker and rebounds back in the box. Some looms, with the slightest rebound, will bang off, while others will continue to run. This depends on the pick from that side on which shuttle has rebounded. With a rebounding shuttle, a weak pick is made because of the loss of the initial movement in picking, that is, before the picker comes in contact with the shuttle, and the shuttle is not driven hard enough to get full into the opposite box and loom bangs.

There are four causes of rebounding shuttle: First, pick too strong. Second, insufficient check. Third, loose box. Fourth, protector finger slipped. First, if pick is too strong, shuttle will rebound and the pick must be reduced by raising lug strap on picker stick or by raising the driving arm. Second, when a shoulder swell is used and there is not sufficient check on the shuttle, it will almost invariably rebound unless the shuttle box is very tight and that should not be. If the picker stick is fixed so as to remain about two or three inches in the shuttle box and the pick is not too strong, the shuttle should not rebound. (See Chapter Five). With a gradual tapered shuttle and binder the check finger on protector rod should be set to hold the shuttle in position when it gets to the back end of the box. When the shuttle is almost full into the box the check finger should be in contact with the lay sole. (See Chapter Ten, Protector Motion). Third, if the box is loose the only remedy is to tighten up the box. Fourth, when protector finger slips there is lost motion between the finger and binder, and this allows the shuttle to shoot into the box and rebound. In resetting the finger in correct position, care will have to be taken that the dagger is full in the frog and frog in position it will be when loom is running, so that the dagger will clear the frog with shuttle in box and will strike full in frog when shuttle is not in box.

Loose Picker Stick

If the picker stick and parallel are not fastened securely together a weak pick is made owing to lost motion. The remedy is to tighten up the bolt that holds the two together.

Belt Slipping

A slipping belt often causes loom to bang. The belt should be thoroughly cleaned and a good belt dressing applied.

Lost Motion in Cone

This is caused by neglecting to oil the cone with the result that the cone wears and becomes loose on its stud and a weak pick results. The only remedy is to replace with a new cone.

Neglecting to oil will also cause a flat place to be made on the outside of cone because the pick point strikes the same place on each pick. This occasionally causes a weak pick and loom bangs off.

Change of Atmosphere

If there has been a sudden change from dry to damp weather the boxes will become sticky and damp. Shuttle will not fit correctly in the box and loom will bang off. To remedy, take a piece of waste and wipe shuttles and boxes thoroughly dry. If this does not immediately remedy, take a piece of fine sand-paper and rub the shuttle. It is advisable to rub both shuttles so as to keep them the same width. The very smallest drop of oil put on the binder with the finger after cleaning with waste will often remedy.

Lug Strap Too Far From Picker Stick

Sometimes the lug strap is too far from back of picker stick, allowing too much play. The pick may begin on time, but the cone will have traveled too far up the pick point and in this way a soft pick is made. The remedy is to tighten up the lug straps so as to reduce the space between picker stick and strap, then set picking cam back and in this way the full pick point will be used for the pick.

Shedding Cams Too Early

If shedding cams are set too early, the shed will be closing before the shuttle gets full across the lay with the result that the shed is often closed on the back end of shuttle and shuttle is tilted as it enters the box. The result is that the shuttle does not get full into the box and loom bangs off. This also causes the shuttle to be chipped, and the tip is also often blunted.

Shedding Cams Too Late

If shedding cams are set too late, the shuttle will enter the shed before it is full open and in this way will be retarded in its movement and loom will bang off occasionally.

Worn Pick Point

By continued use the pick point will wear off and the force of the blow reduced. Frequently when this occurs extra pick is added by lowering the lug strap, but when the pick point is badly worn it is advisable to replace with a new one. Neglecting to oil the pick cams and cone causes the pick point to wear off sooner.

LOOM STOPPING

The essential difference between loom banging and loom stopping is that in loom banging the loom stops with a jar while in loom stopping the shipper handle slips out of the shipper handle stand and loom stops easily. In the majority of cases when the loom stops, the trouble can generally be located with the filling fork and filling fork motion though there are other causes of loom stopping. Some of the causes of loom banging will also cause loom to stop.

In setting the filling fork have shuttle in shuttle box on filling fork side of loom. Push filling fork slide as far forward as it will go and have crank on front center. The prongs of filling fork should then be in the grate. Care must be taken that the prongs of the fork pass clear into the grate. If the prongs touch the grate the loom will, in some cases, stop with filling not broken, and in others will run when filling is broken. The bottom of the prongs of fork should not touch the lay sole when fork is raised, as this will cause loom to stop.

When the fork has been correctly set, and the crank on front center, the stop motion cam should be set so that the elbow lever will be just passing under the catch on fork. Sometimes a little later setting is preferable, that is, have crank just past front center with elbow lever just passing under catch on fork.

If loom stops and fork is set correctly then something else is the cause. Other causes of loom stopping are as follows:

Rebounding Shuttle

When a shuttle rebounds in the box the filling becomes loose. Instead of the fork being raised, the loose filling is forced through the grate and the catch on fork is caught by the elbow lever and loom is stopped.

Filling Catching on Fork

A rebounding shuttle will also cause filling to catch on fork because the filling is loose. If the prongs of the fork stand out too far or are too short the filling will catch on them. This holds down the catch on fork so that the elbow lever coming in contact with same stops the loom. If the filling catches on fork and does not stop the loom at once, the catch on fork will be raised up and if filling should run out or break, the loom will not stop until the filling that is caught on the fork breaks. The prongs of fork should be either straight or slightly concave, for with this shape, filling is not as liable to catch.

Fork Too Far Through Grate

This will cause the fork to be lifted too high and the result is that after dropping, the fork rebounds and the catch on fork is caught by the elbow lever and loom is stopped. This occasionally causes the filling to become slack and catch on the fork.

Not Sufficient Friction on Filling in Shuttle

If there is not sufficient friction on filling in shuttle, the filling will be slack and the fork will not be raised. A piece of flannel or felt inserted near the eyelet in shuttle will generally overcome this defect.

Filling Slipping Up or Down on Fork

As the fork is passing through the grate, the filling sometimes slips either up or down the fork. This depends on the shape of the fork. When possible a straight prong fork should be used and if filling should slip on same, two or three notches can be made in the prongs just about where the filling should be held. These notches must not be sharp or they will cut the filling.

Wrong Timing of Stop Motion Cam

If stop motion cam is set too early, the elbow lever comes in contact with the catch on fork and loom is stopped. If cam is set too late, the fork will have been raised and have dropped back again in time for elbow lever to come in contact with catch on fork and stop loom.

Crooked Running Shuttle

A crooked running shuttle will sometimes touch the fork in passing and this causes the fork to jump. The result is that the catch on fork drops in front of elbow lever and if lever is being moved outwards by the stop motion cam the loom is stopped. A late pick will sometimes have this effect, the back end of the shuttle touching the fork as shuttle passes into the box.

Stand for Shipper Handle Worn

If the shipper handle stand is worn, the shipper handle will slip out and loom will stop. This only occurs on old looms, but the stand will have to be fixed so that the shipper handle will fit securely in it.

Occasional Rubbing of Dagger Against Frog

When the lay comes forward to beat up the filling, the dagger should make a full clearance of the frog. Sometimes the dagger rubs against the frog, not enough to make the loom bang off, but enough to gradually push off the shipper handle. This can be seen by looking at the end of dagger, which will be worn and polished by coming in contact with the frog. To remedy this, the dagger and protector fingers will have to be reset. In resetting the dagger have frog in position it will be when loom is running. Bring lay forward and have dagger full in frog. The protector fingers should then be set full against the binders. When shuttle is in box, the end of binder should be clear from box about one-half to five-eighths of an inch. In setting the dagger and protector fingers, if frog is not in the position it will be when loom is running, but is back from that position, the dagger will strike too high and will often cause a smash.

CHAPTER XV

SHUTTLE FLYING OUT

Shuttle flying out of the loom is probably the most dangerous thing in weaving. However, shuttles do not fly out very often, considering the number of times the shuttle travels across the lay, and very little injury is caused by them. Practically all American looms are equipped with a shuttle guard. This is attached to the lay cap so that if shuttle should fly out of the shed in passing from one shuttle box to the other, the shuttle guard will keep the shuttle from leaving the loom. This reduces the danger of flying shuttles to a minimum.

The shuttle should travel straight across the lay. If there should be any obstruction in the path of the shuttle it causes shuttle to fly out. Sometimes when an end breaks it becomes entangled with the other ends behind the reed and if the shuttle should pass on top of the tangled ends it will have a tendency to fly out, especially if the cloth is being woven with a loose top shed. Sometimes the cause of a shuttle flying out is hard to locate; at other times the cause can readily be located. There are quite a number of causes of shuttle flying out, some of which will be enumerated.

Overfaced Reed

The reed should always be in line with the back of box. A straight-edge should always be used to line the back of box and reed. If the reed is in front of the back of box, or in other words is overfaced, the shuttle will almost certainly fly out. The tip of the shuttle is turned outwards on delivery and shuttle shoots out. Overfaced reed can sometimes be remedied by adjustment of the lay cap so as to have the reed in line with back of box.

Sometimes only the ends of reed are overfaced. This is due to the loom fixer using the hammer or wrench on the ends of reed to prevent overfaced reed, but when reed is turned around an overfaced reed is made and the ends of reed have again to be knocked back into line. The ends of a reed should never be knocked back, but should be lined up accurately with the straight-edge.

The reed should be perfectly straight and smooth from one end to the other, and should not be dinged at any point, as this will cause a crooked running shuttle. Neither should any reed wires protrude in front, as this will have a tendency to cause the shuttle to fly out.

Underfaced Reed

An underfaced reed is one in which the end of reed is behind the back of box. This causes the shuttle to run zigzag across the lay and also causes shuttle to fly out. As in overfaced reed, the reed should be lined accurately with back of box. This defect will also cause the shuttle to be chipped on the back as it is entering the box.

Yarn Too High Off Race Plate

If the yarn is too high off the race plate, the shuttle will be raised at delivery and will often fly out. Yarn can be too high off race plate by harness not being pulled down low enough or by temple being too high above race plate.

Picker Too Low

If picker is too low at the back end of box, or when shuttle is being delivered, the shuttle will almost certainly fly out. When picker is fastened to picker stick after having found the correct position of same, it is advisable to make a small hole in picker where shuttle strikes, and to have this hole a trifle higher than tip of shuttle when shuttle is in box. The shuttle will run with the tip in center of hole in picker and shuttle level on race iron, but better results are possibly obtained by having the hole raised about one-sixteenth of an inch higher. Under no circumstances must the hole in picker be too low.

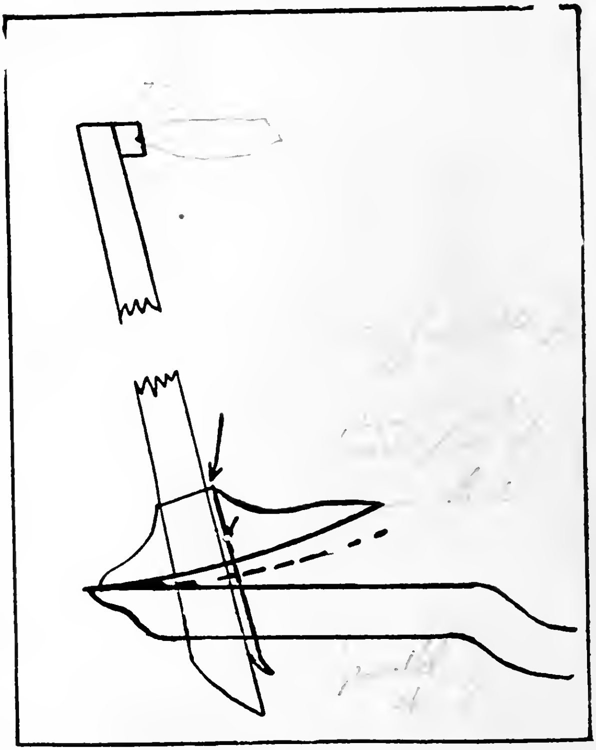


Figure 33

If the picker is too low when delivering the shuttle, the outer end of shuttle is tilted and shuttle will almost certainly fly out or hit the mouthpiece of the opposite box. To remedy this, put a piece of leather between picker stick and parallel tongue and this will elevate the picker at delivery. This is illustrated at Fig. 33. Arrow indicates where leather will be inserted. Parallel or shoe in solid lines shows position before leather is inserted. Dotted lines shows position of parallel after leather has been inserted. This lowering of the parallel alters the angle of picker stick at delivery and raises the picker. On some looms an adjusting set nut is used to make whatever adjustments are necessary and this does away with the necessity of using a leather wedge.

Loose Top Shed

If the top shed is too loose, the shuttle tip will pass on top of the loose ends and shuttle will fly out. Loose top shed can be caused by whip roll being too high; also harness shaft not raised high enough. Individual ends hanging loose in shed will sometimes cause shuttle to fly out.

Rebounding Shuttle

When a shuttle rebounds in the box, the picker in picking strikes the shuttle a sudden blow because of the distance between tip of shuttle and picker. The shuttle is driven crooked from the box and shuttle will fly out.

Race Plate Loose

A loose race plate is sometimes the cause of shuttle flying out, as this causes shuttle to travel crooked across the lay.

Pick Too Early

If the pick is too early the shuttle instead of going in the shed passes on the top and will fly out. Early picking also causes shuttle to travel crooked across the lay, and causes ridges to be made on back of shuttle. When a shuttle does not travel straight across the lay, it will sooner or later fly out.

Worn Picker

Pickers can sometimes be used until they are thoroughly worn out and are then replaced. At other times when the picker is worn and the hole made by the shuttle tip is too deep, there is a binding on the back of shuttle when shuttle is being delivered from box, and shuttle is thrown out. This binding can sometimes be remedied by elevating the picker at delivery as is done when picker is too low.

CUTTING FILLING

This is a source of trouble, as it is often difficult to locate. This will generally cause the loom to stop, though at times the filling will be cut and will show a broken pick in the middle of the cloth, the filling having been caught in the shed again on the same pick. This will spoil a pattern on some fancy fabrics. The following are some of the causes of filling being cut:

Groove in Shuttle Not Deep Enough

When the shuttle is in shuttle box, the filling lies in the groove of the shuttle. If the face of the shuttle has been worn by constant wear and the groove is not deep enough, the filling is likely to be cut. The groove on end of shuttle beyond the eyelet must not be allowed to wear off, as this is a source of cutting filling, especially on fine work. A shuttle, flat at the bottom, caused by the wear on shuttle in traveling across the lay will also cut the filling. The groove at the bottom of shuttle must be retained as well as the groove in front of shuttle.

Temple Too Low

If the trough of the tempie is too low, the filling which often gets under the temple will be cut by the race plate coming in contact with the temple.

Sharp Eyelet in Shuttle

This is caused by face of shuttle being worn and with shuttle striking mouthpiece of the box. The sharp edge will have to be taken off and the eyelet put a little deeper in the shuttle.

Shuttle Rising in Box

If the shuttle rises in box, the filling will get out of groove in shuttle and will be cut, especially if there is a groove in the binder, or the groove has a sharp edge. When an iron binder is used, the top can be bent over just a trifle and this prevents the shuttle from rising.

Sharp Filling Fork and Grate

Sometimes the grate becomes sharp on the edge and this cuts the filling. If the filling fork is sharp or passes too far through the grate, filling is sometimes cut. All sharp edges must be avoided.

Crooked Running Shuttle

A crooked running shuttle often strikes the mouthpiece of the box as shuttle is entering and filling is cut. Shuttle should go straight into the box.

Shuttle Spindle Sharp

When using cop filling it is sometimes necessary to open out the spindle to prevent the filling from breaking. In doing this, the end of spindle becomes sharp and when the cop is put on spindle the filling is cut inside the cop.

FILLING AND BOBBINS BREAKING

Pick Too Strong

If the pick is too strong, the shuttle will strike too hard in the box and filling will be broken. The base of the bobbin, namely, that part which is held so as to prevent bobbin from slipping, will be broken off. This causes much waste to be made and pick should be reduced as soon as possible.

Boxes Too Loose

In this case practically the same thing happens as in pick too strong. The shuttle is not checked and strikes hard against the picker and filling will be broken. The boxes should be tightened, but should not be too tight.

Soft Bobbin

If the spinning frame band is loose, a soft bobbin is made. It is almost impossible to weave a soft bobbin.

Shuttle Spindle Too Small For Cop

If the shuttle spindle is very much too small for cop it will have to be replaced with a new one. A spindle can often be made large enough to hold a cop by opening it, but care is required so that the spindle will not cut the filling.

UNEVEN CLOTH

Uneven cloth is a fabric in which the filling is not beaten into the cloth evenly, thereby causing the fabric to have a more or less cloudy appearance; also fabrics in which thick and thin places appear while loom is running. Very often uneven cloth is the result of imperfect working of the let-off motion though there are other causes for this defect as follows:

Rope on Friction Let Off Binding

The rope on friction let-off often binds in damp weather as it becomes sticky, owing to dampness and the yarn is not let off evenly. The rope should be taken off and thoroughly cleaned, then a little powdered black lead, French chalk or talc powder sprinkled on the rope and beam will work easy. Black lead is the best, also the most expensive, but only a little need be used at a time. Tallow is sometimes used, but this does not give good results, as the ropes soon become sticky again, owing to dust and flyings accumulating on them. Oil is sometimes dropped on the rope by the weaver, but this should not be allowed, as rope soon has to be cleaned owing to accumulations of dust and lint.

Take Up Motion Out of Order

If the gears on take up motion are meshed too deep in each other they will lock and uneven cloth result. If the take up pawl takes up more than one tooth of the ratchet gear at certain times the cloth will be more or less thin at that point. If the pawl slips over the teeth in ratchet gear occasionally, thick places will result. The pawl will slip over teeth because it is worn and sometimes because of the teeth not being clear or deep enough.

Loose Crank Arm

A loose crank arm will make uneven cloth on one side of the cloth.

Gudgeons or Beam Spikes Bent

Gudgeons are sometimes bent when the loom beam is banged on the floor. This causes the beam to bind in the loom and the yarn is let off uneven causing uneven cloth.

Worn Pawl and Gear in Gear Let Off

If the pawl in gear let off is worn it will pass over a few teeth in the ratchet gear when it ought not to, and yarn will not be let off evenly. Or, if the ratchet gear is worn the pawl will pass over a number of teeth and the yarn will not be let off evenly. In both cases uneven cloth will be made.

Weak Spring Behind Let Off Pawl

The pawl is kept in contact with the ratchet gear by a small spring pressing against the back end of pawl. If this spring becomes weak, the pawl will slip over some teeth occasionally causing yarn to be let off unevenly. It is advisable to look out for this, for if the spring should break, the yarn will not be let off at all and a smash will result.

Small Pinion Gear Too Deep in Beam Head

The small driving pinion should not mesh too deep into the teeth on beam head, as this will cause the beam to jump, especially if any small chips of iron have been left between the teeth on beam head. All new beam heads should be examined for this and all small chips taken out.

Worm and Worm Gear Binding

The whole gear let off motion should work free and easy. If there is any binding whatever, either in worm and worm gear, ratchet gear of any other part, uneven cloth will be made. Care should be taken with this let off motion to have all parts well oiled and carefully adjusted.

Uneven Filling

On fine goods uneven filling shows up very plainly in the goods and sometimes makes the cloth appear uneven.

Harness Straps Lapping Under

If the harness straps lap under each other, a jerky motion is given to the harness and this causes streaks in the cloth, especially on fine work.

CHAPTER XVI

Automatic or Labor Saving Looms

The automatic loom has been the means of saving much labor in the weave room. In general, there are two kinds of automatic looms in use. One is a bobbin changer, and the other a shuttle changer. The bobbin changing loom changes the bobbin while loom is in motion. The shuttle changing loom stops for a few picks while the shuttles are being changed. One shuttle is used continuously in the bobbin changing loom, but in the

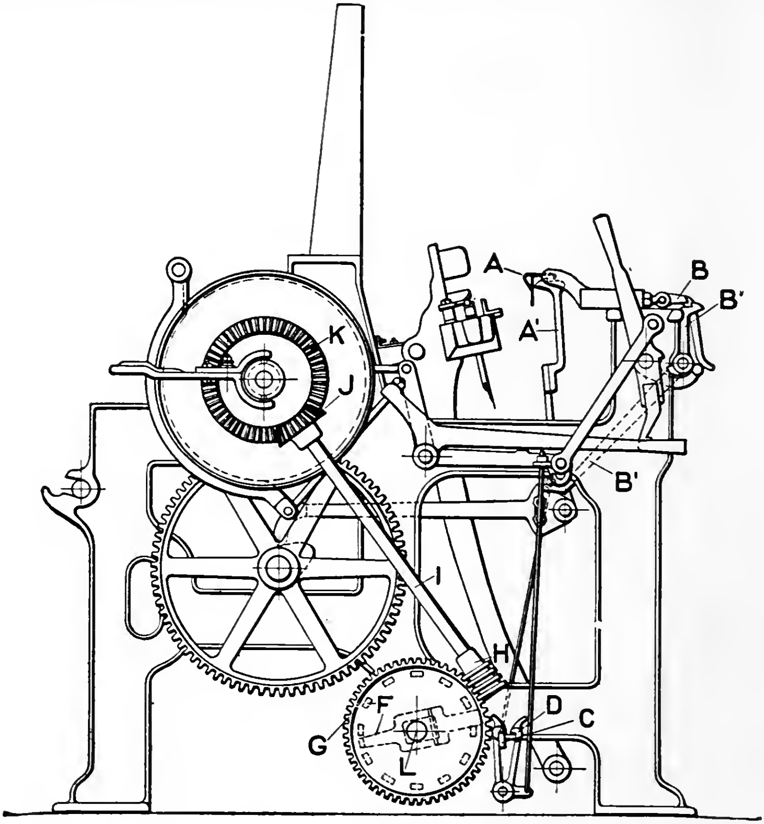


Figure 34

shuttle changing loom about nine shuttles can be used, eight being held in a magazine while the other shuttle is running in loom.

The automatic motion is an addition to a regular loom and the construction of loom and fixing points, as given previously, are as applicable to automatic looms as to ordinary looms. The only part of the looms that need consideration now is the automatic feature.

The Stafford Shuttle Changing Loom

Figs. 34 and 35 show the working parts of the Stafford loom. In Fig. 34 K is a bevel gear on friction pulley. This gear drives shaft I through bevel gear J, the shaft carrying on its opposite end a worm gear H. The worm gear meshes into worm wheel G, giving this wheel a continuous motion but at a slow speed. The worm wheel is loose on the shaft L and carries no load until brought into use by the filling fork and slide. A, represents filling fork; A′ filling stop motion lever; B and B′ connection between filling fork slide and changing motion. Another sketch of the changing motion is given at Fig. 36. When filling breaks, elbow lever pulls back the filling fork slide H. This performs two operations simultaneously. First, pushes off shipper handle; second, starts changing motion. When shipper handle is pushed off, cam A, through connecting rod B, is changed from one side to the other.

In making this change, the center or highest point of cam marked ×

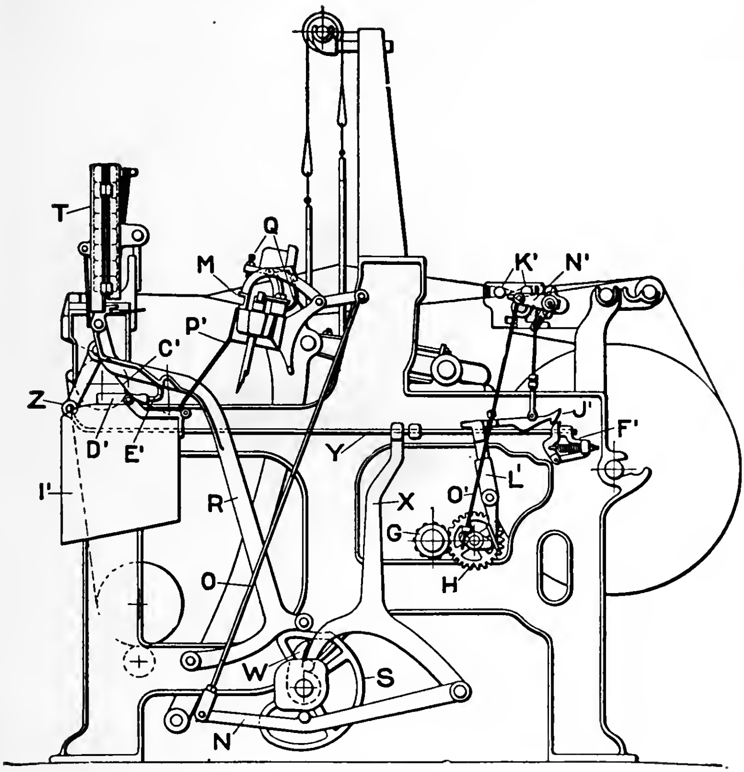


Figure 35

lifts the locking lever C. At this point the filling fork slide H is pulled back, and through connecting rod J lifts lever G, which pushes forward lever D. This relieves lever. E, which in turn causes point of clutch lever F Fig. 34, to engage with the disc, G Fig. 34, that is, to enter one of the recesses in the disc.

The clutch lever is mounted on a hub keyed to the cross shaft and the disc is cast integral with the worm wheel with the result that the cross shaft is set in motion.

Fig. 35 illustrates the changing cams and magazine end. There are three cams on end of cross shaft, two of them being cast together and the third locked to these two so that it is impossible for them to get out of connection with each other. S, is the conveyor lever cam; W, the starting lever cam which is cast with the front board cam.

The front board is the front part of shuttle box. The front board cam is shown in contact with the roll on lever N. As the cross shaft revolves, the cam S starts the conveyor lever R forward to receive a fresh shuttle from the magazine T. The cam W through the lever N and connecting rod O raises the front board M, to permit the spent shuttle to be ejected by ejector I and this throws out the shuttle, to be guided by the leather apron P′ into the receiving box I′. The conveyor lever R now starts back carrying a fresh shuttle. The front board is kept raised so that this shuttle can be placed in the box. When this is done, the front board is closed by means of a spring and the conveyor lever starts

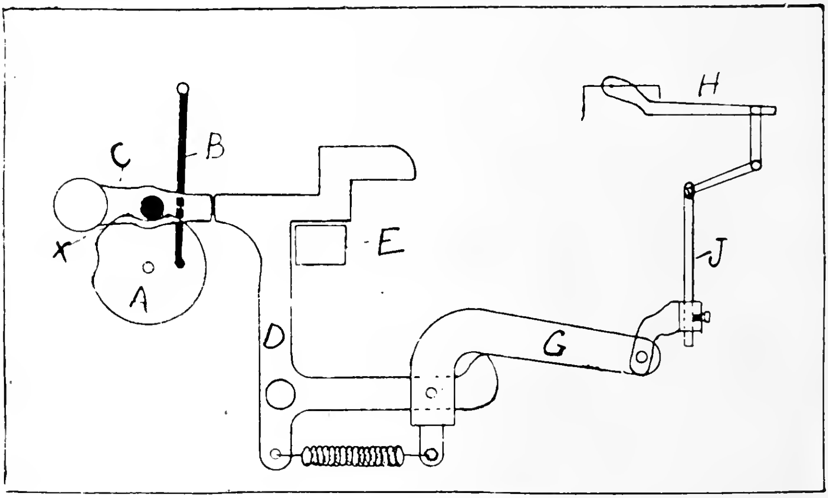


Figure 36

towards its normal position. The starting lever cam W now gives motion through lever X to the shipper rod Y and the give-away lever Z throws in the shipper handle and starts the loom. The conveyor lever by this time has returned to its normal position and the point of clutch lever F, Fig. 34 is thrown out of the disk. All parts are now stationery until it is necessary to replenish the filling again.

The spent shuttle as it is ejected, falls into the receiving box I′ where it is checked by the plate C′ so that it falls easily into the box. The plate C′ also acts in connection with the weighted lever D′ and the hook E′. As the conveyor lever goes forward to receive a new shuttle, the hook drops into a recess in the conveyor lever. When the spent shuttle falls on the plate C′ on its way to the receiver box, the hook is released and the lever can perform its regular functions. If the spent shuttle is not ejected, the hook remains in contact with the conveyor lever and a new shuttle is not put in the shuttle box, thus preventing a smash up.

A safety device prevents breakages also on the changing motion Fig. 36. Unless the highest point of cam marked X is just passing under pin on lever C when the filling fork is pulled out, the lever D cannot be moved and spring between connecting levers D and G merely expands and breakages are prevented.

Warp Stop Motion

This motion is illustrated in Fig. 35. Gear G is fixed on bottom shaft and is meshed into gear H, which drives the follower bar through connecting rod O′ and N′. The follower bar, as it travels backwards and forwards raises hook J′, which clears the give-away collar F′ on rod Y. When an end breaks, a drop wire K′ falls in the path of the follower bar and this causes the hook J′ to come in contact with the give-away collar F and loom is stopped.

The following points will assist in the operation of the loom:

The front board should be lifted just high enough to allow the

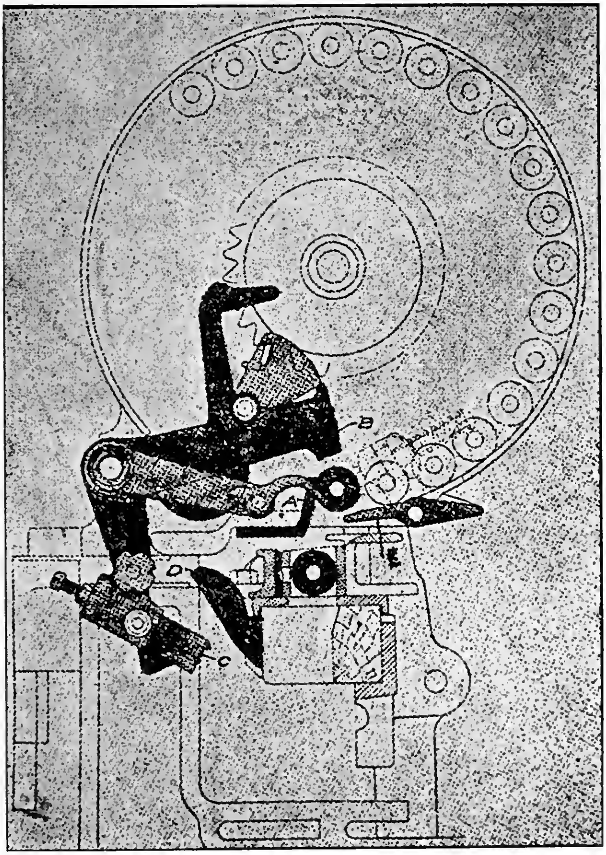


Figure 37

empty shuttle to be ejected freely. The ejector should be out of the way of the new shuttle that is being put in the box. The new shuttle should be delivered freely out of the magazine. The shuttle in magazine should not rest on shuttle that is being put in shuttle box. The conveyor top should be perfectly square with the lay and conveyor fingers should just clear the race plate.

CHAPTER XVII

NORTHROP LOOM

The Northrop loom is a bobbin changing loom, the bobbin being changed while the loom is in operation. The forcing of the empty bobbin out of the shuttle and the placing of a full bobbin in the shuttle while the loom is in operation requires every part to be set and adjusted correctly.

When filling feeler motion is not used, motion is imparted from fingers in contact with the filling fork slide to the working parts for

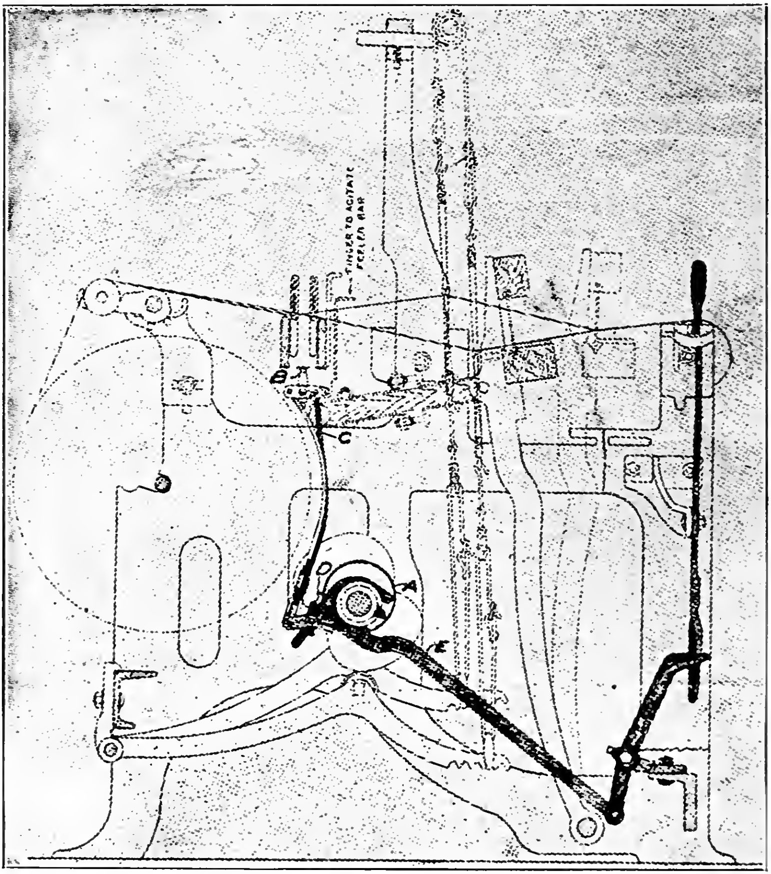


Figure 38

transferring the full bobbin to shuttle. Fig. 37 illustrates these parts. When filling breaks, the filling fork slide is pulled back and being in contact with the finger on starting rod, will turn the starting rod into operative position. The shuttle at this time is traveling to the hopper side of the loom to be in position to receive a fresh bobbin. The bobbins in hopper being in position, the bobbin to be transferred will be resting on the bobbin support E and against the bobbin rest A. When the starting rod has been turned, the latch C is raised and as the lay comes forward to the front center, the bunter D comes in contact with latch C, forcing down the transferer B on the full bobbin. The full bobbin forces the empty bobbin out of the shuttle and remains there.

The shuttle should be in correct position in the box with the shuttle spring in line, with the heads of bobbins in the hopper. With shuttle in correct position, the transferrer should not touch at any point. If the transferrer should touch the shuttle, the proper position can be secured by turning the eccentric pins in lay swords. The pins in both swords should be turned an equal amount so that both of the crank arms will remain equal.

In setting the transferrer to the bobbin the head of transferrer when at its lowest point should show a clearance of about one-sixteenth of an inch. The adjustment for this is made by means of set screw and adjusting nut on latch C.

With lay in its forward position and a bobbin being transferred, the shuttle feeler will extend across the mouth of the box with the end of feeler close to the back of box but not touching it. When shuttle does not go far enough in the box, the end of shuttle comes in contact with the shuttle feeler and the feeler is pushed back. This causes the latch C to be out of position, thus preventing the bunter D from engaging with the latch and a fresh bobbin is not inserted in the shuttle. The shuttle feeler should be kept in good working condition and properly adjusted.

With filling feeler in use, motion is imparted to the working parts for transferring bobbin, from the feeler through the slide and starting rod arm. When using filling feeler, the shuttle feeler is made in the form of a thread cutter and care must be taken so that it will cut the thread at the proper time and also prevent the transfer of bobbin when shuttle is not in position.

The shuttle should be in correct position in box. If the shuttle is too far in box, the spring cover at the end of shuttle will permit the bobbin be put in the shuttle because it is beveled. The loom, however, should not be run with shuttle too far in box but should be remedied as soon as possible. A worn picker will often cause this. The eye of shuttle should be kept clear of cotton or lint and the thread entrance to the eye should be kept open the correct distance and not be opened too wide.

For friction, a piece of flannel placed near the mouthpiece of shuttle is often sufficient, this flannel being changed from time to time. A good friction is made from bristles, the bristles being fastened to both front and back of shuttle.

If the shuttle is in correct position, the thread entrance in shuttle open the correct space, a light easy pick with not too much pressure on the binder, misthreading of the shuttle will be reduced to a minimum.

Warp Stop Motions

When steel heddles are used the heddles are used as detectors to stop the loom when an end breaks. When ordinary twine or cotton harness is used, drop wires are used between lease rods and harness or as in illustration Fig. 38, where there is one drop wire for each end and the drop wires are arranged in two banks. As the cam A revolves, the feeler bar B oscillates backwards and forwards. Movement is imparted to the feeler through C and the cam follower D. The knock off lever E should be set against its bearing on the cam hub so as not to have any back lash. The feeler bar should move an equal distance on each side of the shaft to ensure good working of the stop motion. The cam follower should be set to follow the cam properly and this can be obtained by adjusting the spring to its proper tension.

CHAPTER XVIII

GINGHAM LOOMS

When fabrics have to be produced in which there are various colored threads in the filling, drop-box looms have to be used. These looms are usually constructed with either two, four or six shuttle boxes at one end of the lay and one shuttle box at the other end. An even number of picks of any given color of filling must be inserted in the cloth, as the shuttle must return to the drop-box end before a change can be made from one color to another. There are a number of different motions in use to operate the drop boxes, one of the best of these being known as the Crompton Box Motion.

Box Motion

Fig. 39 illustrates two views of this box motion. First, at A, when looking at motion from end of loom. Second, at B, when looking at motion from back of loom. At C, the shape of the eccentric C and the crank E is illustrated. The parts are as follows: A is the driving pin in pin-wheel, said pin-wheel being set screwed on pick-cam shaft. B is the star gear. C, the single-box eccentric. D, the side lever. E, crank for two-box movement. F, small segment gear. G, the double-sliding finger. H, rod through which the top double-sliding finger is operated. J, rod through which the bottom sliding finger is operated.

Operation of Motion and Boxes. As the pin-wheel, which is set-screwed on pick-cam shaft, is carried around with the shaft, the driving pin A passes into one of the recesses in the star gear B and carries the gear forward. The periphery of this gear is divided into ten equal parts,

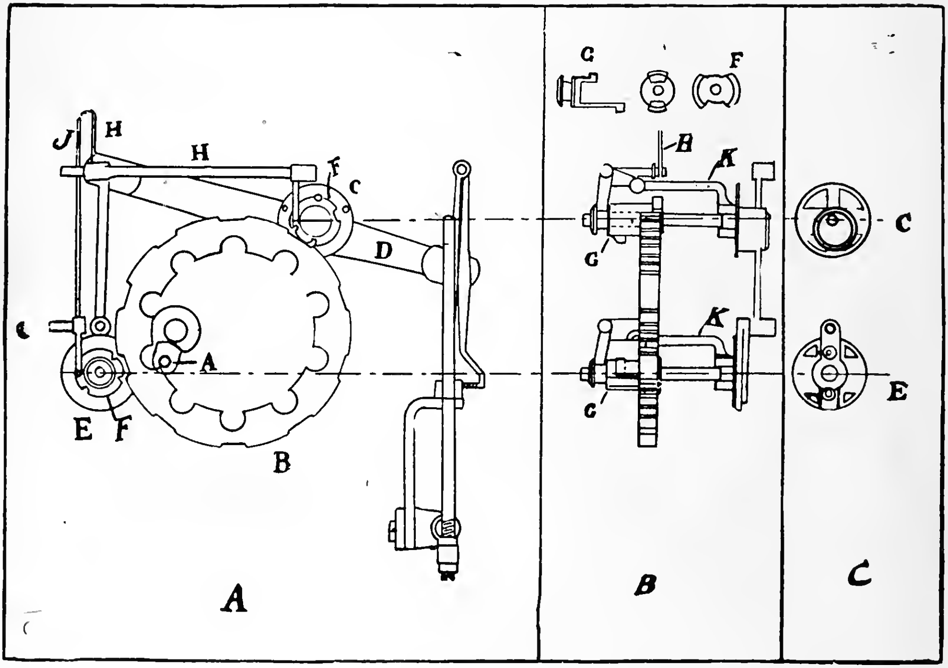


Figure 39

each part consisting of seven teeth and an empty space equal to three teeth. The small segment gears F have six teeth on each side and an empty space between teeth. An empty space on the star gear and small segment gears are always opposite to each other before and after a box has been raised or lowered. This is to allow the double sliding finger G to pass in and out when boxes have to be changed. The single box eccentric C is fastened on the shaft which carries on its opposite end the small segment gear F. The crank for two-box movement is fastened on the shaft which carries on its opposite end the small segment gear F.

The illustration given shows the box motion when the boxes are in their normal position, namely, with first or top opposite the race plate. When the single-box eccentric and the two-box crank are in this position, the projection on end of double sliding finger is on the outside so that when loom is running, the gear will revolve without coming in contact with the projection and boxes will not be changed.

Timing of Box Motion. The boxes are timed by the pin wheel on end of pick cam shaft. This can be set to turn the star gear at any point. A good setting and one which will generally give satisfaction, is to set the driving pin in pin wheel to turn the star gear so as to have the boxes about one-eighth of an inch above or below the race plate when the dagger is in contact with the frog. The frog must be in the position it will be when loom is running. By the term, above the race plate is meant, when boxes are being raised; below the race plate, when boxes are being lowered.

To Raise from First to Second Box. Insert a riser in the box chain under the lever which operates (through the rod H), the double-sliding finger on the single-box eccentric. This will force the short end of the double-sliding finger between the star gear and the small segment gear and the projection on the end of the finger will fill in the space between the two gears. When the driving pin in the pin-wheel turns the star gear, the first tooth in the gear will come in contact with the projection on sliding finger. This enables the teeth in both segment gears to be meshed into each other and the eccentric is turned half around. The deepest portion of the eccentric is turned from bottom to top, which raises the side lever D and consequently the boxes. This brings the second box opposite the race plate. The long end of the double-sliding finger is now between the segment gears with the projection on end of finger beyond the gears—this allows the star gear to revolve without coming in contact with the small segment gear. The finger will remain in this position until the boxes have to be changed.

To Return Box to Original Position. On the next bar in box chain leave off the riser. This will force outwards the double-sliding finger and the projection on the end of finger will fill the space between the two gears. When the driving pin in pin-wheel turns the star gear, the first tooth of the gear will come in contact with the projection, and the eccentric will be turned to its original position, which will bring the first box opposite the race plate.

To Raise From First to Third Box. Insert a riser under the lever which operates (through the rod J), the double-sliding finger on the crank which controls the two-box movement. This will bring the projection on the small end of double-sliding finger between the two segment gears, and the crank will be turned half around exactly as in the case of the eccentric above described.

To Bring Boxes Back to Original Position. On next bar of box chain, leave off the riser. This will bring the projection on finger between the two segment gears, and the crank will make half a revolution and to its original position with the first box opposite the race plate.

To Raise From First to Fourth Box. Insert a riser in box chain under both levers. This will bring the projection on the short end of both double-sliding fingers between the two segment gears. When the driving pin in pin-wheel turns the star gear both the eccentric and the crank are turned half around and the fourth box is brought opposite the race plate.

To Bring Boxes Back to Original Position. On next bar leave off both risers. This brings the projection on long end of both double-sliding fingers between the segment gears and both the single-box eccentric and the two-box crank will be turned half around, which will bring the boxes back to original position, the first or top box opposite the race plate.

When making a fabric, the boxes do not change in the order given, that is to say, they do not return to normal position each time before a change to another box is made. The order as given above shows the principle of raising and lowering the boxes separately. In actual practice the changes are made according to the colors in the shuttles and the colors required in the fabric.

The changes thus far indicated are as follows: First to second box, riser under single-box lever. Second box to first box, empty bar. First box to third box, riser under lever that operates the crank for the two-box movement. Third box to first box, empty bar. First box to fourth box, riser under both levers. Fourth box to first box, empty bar.

Any change between these can be made. If two risers will raise from first to fourth box, then to lower to third box, the riser on the single-box lever is left out. To lower from fourth to second box, the riser under lever that operates the crank for two-box movement is left out.

CHAPTER XIX

GINGHAM LOOM BOX CHAIN BUILDING

In building box chains there are several points that have to be taken into consideration in order to have the loom operating to the best advantage. There should not be a skip from first to fourth box, or from fourth to first box if it is possible to avoid same, as this subjects the motion to a great strain, for the boxes must be changed in the same time as when making a smaller lift of one or two boxes.

The shuttle carrying the color of filling that is used most is very often put in top box. At other times, when the number of picks are about equally distributed throughout the pattern, the dark color is put in top box.

White	1	2	3	=6 Picks
Black	2	1	1	=4 "
White	1	2	3	=6 "
Red	3	3	2	=4
White	1	2	3	=6 "
Green	4	4	4	=2 "

S	C
X	
X	
X	
X	
X	
X	
	X
	X
X	
X	
X	
X	X

Figure 40

Arranging the Colors in Boxes.—Example: A gingham fabric is required to be made from the following colors: 6 picks white, 4 picks black, 6 picks white, 4 picks red, 6 picks white, 2 picks green. One of the best methods for obtaining the arrangement of colors in boxes is as follows: Write under each other the different colors as they occur in the fabric, then opposite each color mark the number of box in which the color is to be tried in; the top box in loom being the first box. Using example given, Fig. 40 illustrates the colors as they occur in example, also beginning in first line with the first color in first box. This does not give a good arrangement, as there is a skip from first box white to fourth box with green, also from fourth box with green to first box with white. The number of picks of each color to be inserted in the fabric is indicated at the side. The second or third arrangement will be satisfactory, as there is only a skip of one box. The box chain for this example is also given at Fig. 40 using the second arrangement of colors. S indicates single lever to raise one box. C indicates crank to raise two boxes. X represents risers or balls. Empty squares represent sinkers or tubes. Each bar in box chain is equal to two picks.

MULTIPLIER MOTION

When check patterns have to be woven in which a large number of picks of the same color are inserted in the fabric before a change is made to another color, a multiplier motion is used. This motion is of much value, as considerable time is saved in building box chains, in space occupied, and in cost of chains. When a multiplier motion is used the box chain is considerably reduced, for example: If 24 picks of a color had to be inserted in the fabric, 12 bars would be required in box chain if a multiplier motion is not used, but with a 12 pick multiplier motion only two bars in the box chain would be necessary. With a 24 pick multiplier, only one bar in the box chain would be required.

There are two kinds of multiplier motions, namely, the chain motion and the disc motion. The chain motion can be made to multiply on any even number of picks but the disc motion is generally used to multiply on 12 or 24 picks.

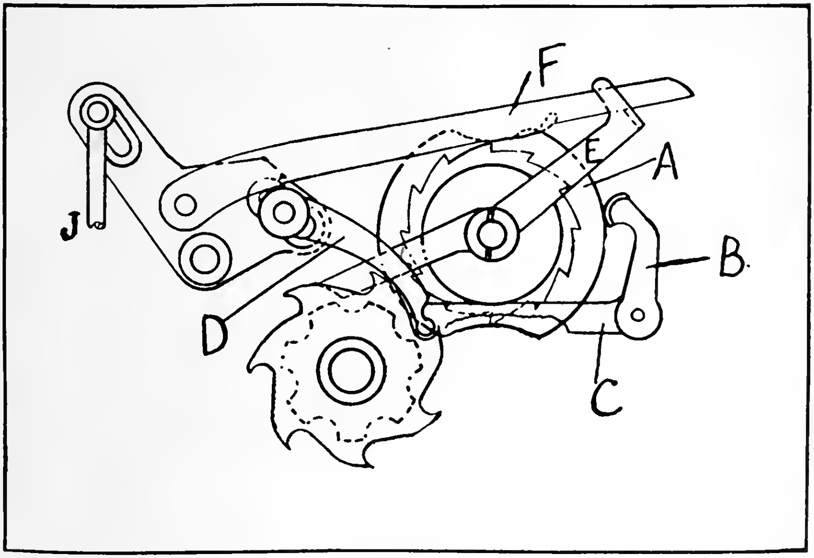


Figure 41

The Disc Multiplier motion is used on Crompton Box Looms and is illustrated at Fig. 41.

A disc A has on its periphery two depressions. A ratchet gear is fastened to the disc, said gear having twelve teeth, each tooth representing two picks. With two depressions in the disc this will represent a twelve-pick multiplier. A small finger B presses against the periphery of the disc, said finger being connected to a lever C, which is under a pin in the pawl D, that drives the box-chain barrel. When the finger is in one of the depressions in the disc, the multiplier is stopped and the chain barrel is working, namely, the chain-barrel pawl is turning over the chain barrel one bar every two picks. To start the multiplier, a riser is put in the box chain under the multiplier lever. This causes lever E to be lowered and the pawl F comes in contact with the ratchet gear on disc, and disc is turned. The finger is forced out of the depression on disc, as shown in illustration, which also raises the chain-barrel driving pawl out of connection and prevents further movement of the box-chain cylinder. The disc will continue to turn until finger drops into the next depression, and this will start up the box chain. From one depression on the disc to the other represents twelve picks of the same color that will be put in cloth before a change is made, so that if twenty-four picks of the same color are required in the cloth a multiplier riser will have to be put on two adjoining bars of the box chain.

To illustrate the principle of making a box chain when using multiplier motion the following pattern is given:

Example: A gingham fabric is required to be made with the following colors, using a 12-pick multiplier; 6 picks black, 12 picks green, 6 picks black, 24 picks red, 4 picks white, 24 picks red. Fig. 42 illustrates the different arrangement of colors in boxes. The second and third lines give the best arrangement, as there are no skips whatever in these. The box chain is also illustrated at Fig. 42 using the second time. X represents risers or balls, empty squares represent sinkers or tubes. S indicates single lever to raise one box. C indicates crank to raise two boxes. M indicates multiplier lever.

Fig. 43 shows the complete box chain as it would be made for the loom.

STILL BOX MOTION

This motion is also called the Head Release Motion and is indispensable to the box loom. Its purpose is to prevent broken patterns, that is, if the filling breaks, the chain barrel is not pushed forward and the loom can therefore be started up without making a mis-pattern. There

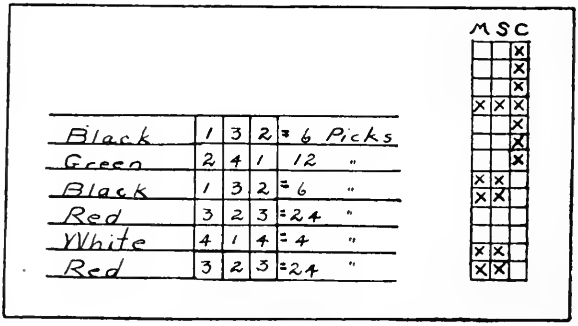


Figure 42

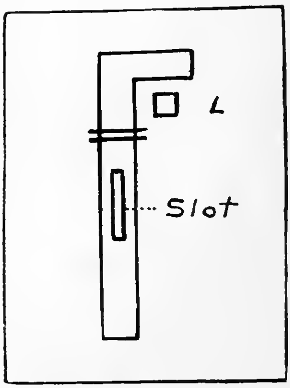


Figure 45

3rd Box Black—2 picks

3rd Box Black—2 picks

3rd Box Black—2 picks

4th Box Green—12 picks

3rd Box Black—2 picks

3rd Box Black—2 picks

3rd Box Black—2 picks

2nd Box Red—12 picks

2nd Box Red—12 picks

1st Box White—2 picks

1st Box White—2 picks

2nd Box Red—12 picks

2nd Box Red—12 picks

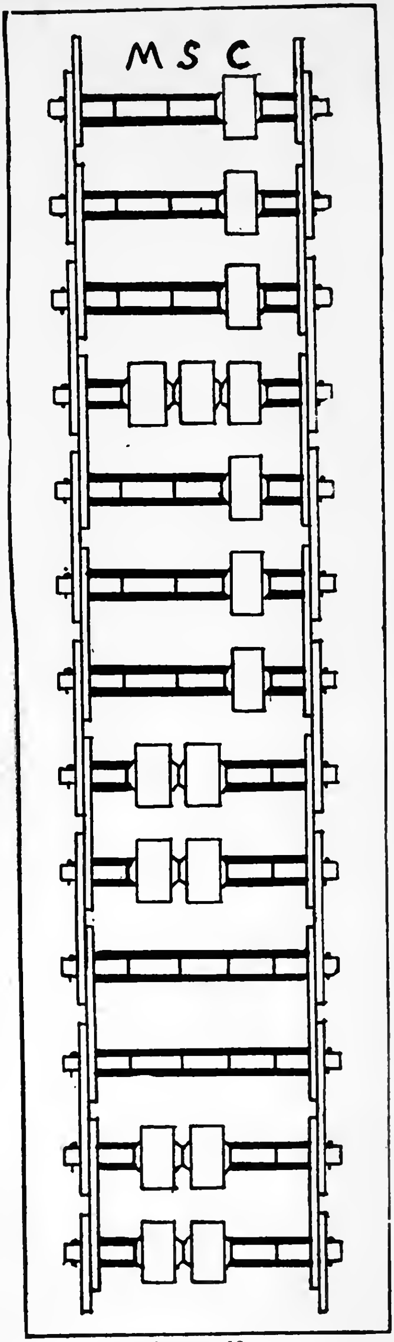


Figure 43

are several makes of this motion, one being illustrated at Fig. 44. A double cam A is fixed on the pick cam shaft. This cam revolves between the two levers B and C, which are pivoted at D. A locking lever E is mounted on a stud on the upper lever B at G, said lever E locking with arm E′, mounted on stud F in lower lever C. A catch slide H is attached to the top end of the locking lever E. The cylinder connecting rod J is attached to the lower end of the cylinder lever C. The catch slide works forward and backward through a slotted sliding bar K, which is supported by a bracket to the side of loom. The slotted bar is illustrated in Fig. 45.

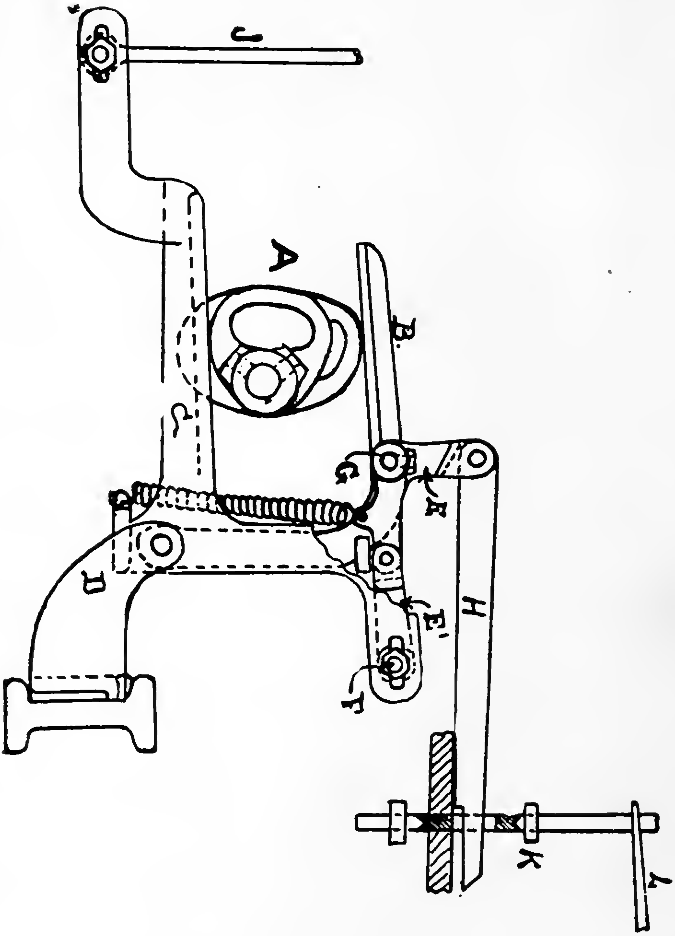


Figure 44

Operation of Motion.—A rod extends the full width of breast beam. On one end of the rod a finger is attached which is in contact with the filling fork slide, and on the other end of rod the finger L is attached. When loom is running, the cam A revolves with the shaft, the larger of the two surfaces operating under top lever B. The two levers, B and

C, are held together through the combined action of the spring and locking lever, so that when top lever is raised the bottom lever is also raised. The cylinder connecting rod J is therefore raised, which forces over the chain barrel through pawl D, Fig. 41, page 67—and at the same time gives a forward movement to the catch slide H, which passes through the slot in sliding bar. The small cam will draw back the levers. When filling breaks, the filling fork slide forces back the finger which is in contact with it, and this raises finger L, at the same time raising the slotted sliding bar K. As the catch slide H comes in contact with the bottom of slot the forward movement is stopped. This forces back locking lever E and causes the lever to turn on its pivotal support G, against the action of the spring, allowing the arm B to be raised by the movement of cam while the arm C remains stationary, and the action of connecting arm J on the chain barrel is immediately arrested.

Timing of Still Box Motion.—With lay on front center and shuttle in single box end, the cam should begin to move forward the catch slide H.

Breakage Preventors

The breakage preventer in the box motion consists of a spring bolt which holds the top of the sliding finger shaft box in position. This is a spring on an ordinary bolt and is of sufficient strength to keep the top of box in position when everything is in good working order. The empty spaces of the star gear and small segment gears should be directly opposite each other, so that the large gear can revolve without coming in contact with the small gear, but if from any cause the small gear should be turned over so that the large gear connects when it ought not to, the top of the sliding finger shaft box will be forced up, and this will prevent the breaking of teeth in gears and also the top of the sliding finger shaft box from being broken.

The small gear turning over farther than it ought to is often caused by a weak spring on the spring lever. On the back of each cam are four projecting pins and a spring lever is held on two of the pins, which, if of sufficient strength, will prevent the cam from moving out of position after being changed, but if the spring is weak the small gear will partly turn over and be caught by star gear. Spring lever is shown at K, Fig. 39, page 64.

Another breakage preventor is in the form of a spring clamp. The stud in end of lifting rod D, Fig. 39, by which the boxes are raised and lowered, is held by a spring clamp. Fig. 46 illustrates an end view of the boxes and spring clamp with the stud in clamp marked A. If the shuttle should be trapped between lay sole and boxes as boxes are being raised or lowered, the stud will be forced out of its position and no damage will be done to either shuttle or shuttle boxes. This figure also illustrates the shuttle trapped between shuttle box and lay sole as box is being lowered. It will readily be seen that unless the stud was forced out of position either the shuttle or shuttle box would be broken. If the picker or anything else should get stuck in boxes the same thing will occur.

Shuttle Check Cam

On some box looms a shuttle check cam is used. This is a small cam about three inches in length and extends about one-half inch beyond the surface of the pick cam on the drop box side of the loom. When crank is on back center the pick cone should be in center of cam and the lug straps set to hold the picker stick not more than one inch on the spindle.

CHAPTER XX

GINGHAM LOOM FIXING POINTS

Shuttles.—All shuttles must be as near the same size, shape and weight as it is possible to get them or good results cannot be obtained. The single box has to be fitted to all the shuttles, and if one shuttle is very much different from the others there will be trouble in running same. The shuttles should not be too large or they will chip through striking the mouthpiece of the box. Neither should they be too small or the picker race will cut the shuttle at the top.

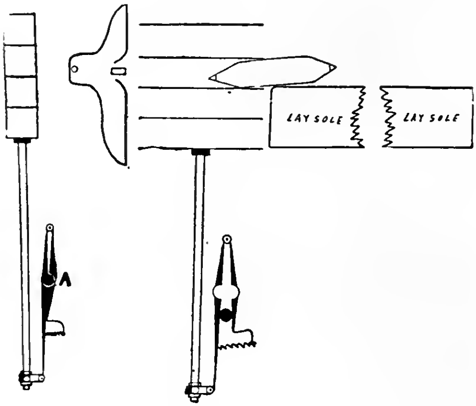


Figure 46

Binders.—The binders should be bent to grip the shuttle about half-way, also to give a gradual check to the shuttle as it enters the box. The flat end of binder should not be set full against the box, as there is always more or less loose filling when shuttle is leaving the box, and if the end is full against the box there is a tendency to cut the filling. It is only necessary to have the extreme end of binder against the box.

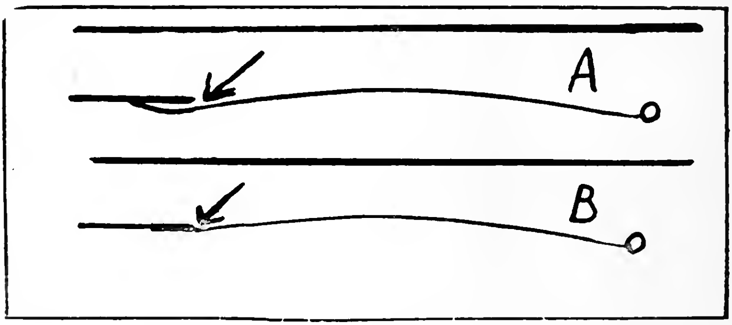


Figure 47

This is illustrated at Fig. 47. A shows how the end of binder is against the mouthpiece of box. B shows the end of binder flat against the mouthpiece of box. Arrow indicates where filling will get between binder and mouthpiece of box.

Sharp Edges in Boxes.—In starting up a new set of boxes it is advisable to take off all sharp edges with a very fine file. The groove in swell must be perfectly smooth, as any sharp edges will cut the filling. The sharp edges of picker race should be taken off or shuttle will be cut.

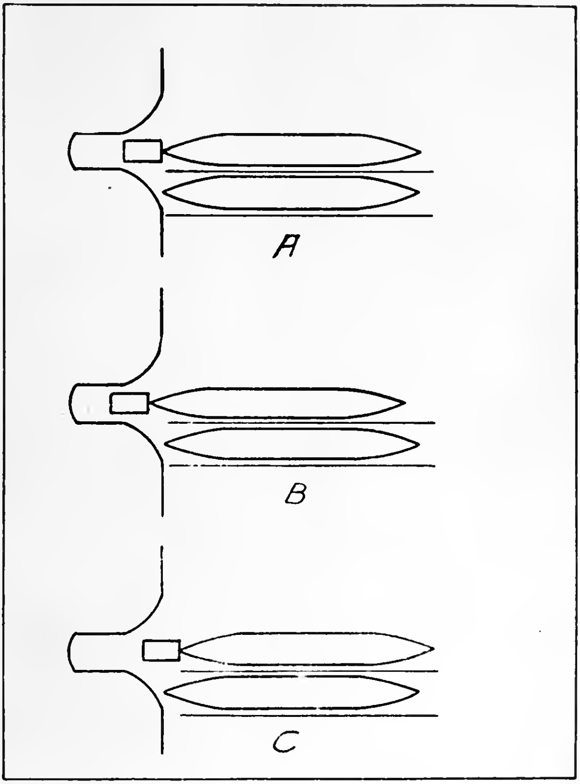


Figure 48

Shuttles Working Loose in Box.—When large patterns are made in which a shuttle is used only occasionally, there is a tendency for this shuttle to work forward in the box with the result that when shuttle is picked across the lay the loom will bang off. To overcome this the swell should grip the shuttle about half-way and shuttle should be held firmly in box, but not too tight. The boxes should work freely in the slides, but should not be loose or they will swing about and this has a tendency to cause the shuttle to gradually move to the front of box. The picking motion must also be set to give an easy pick.

Putting on New Picker.—When a new picker is put on it must be perfectly true. If warped in any way, good results cannot be obtained from it. The picker must work free on spindle and in the picker race. A small hole is often made in the picker where the shuttle strikes. A good bunter should always be kept on the spindle, as this saves the picker and stud from the jar that would otherwise be given when picker strikes the spindle stud. Bunters are made in different ways, but a serviceable one is made from a strip of leather with spindle holes cut in it about two and one-half or three inches apart. A leather washer can also be put on the spindle between the holes.

Guide Plate.—Fig. 48 illustrates the setting of picker to guide plate. When the picker is at the back end of box, the face of picker should be flush with the guide plate. This is shown at A and this setting allows the shuttle boxes to change without in any way affecting the shuttle.

If the face of picker is not flush with guide plate, but is too far back in box the shuttle will also be too far back and when boxes are changing, the tip of shuttle will strike the guide plate. This will cause the shuttle tip to become flat on the end. It will also cause the guide plate to be worn. The boxes are also apt to skip and sometimes cause a smash. This is illustrated at B.

When the face of picker is too far out in the box the back end of shuttle will be caught on the picker when boxes are being raised or lowered. This will also cause the boxes to skip and shuttle to fly out or cause a smash. This setting is illustrated at C.

A buffer is used on the back end of spindle and also in the back end of box, and by regulating this, the face of the picker can be made flush with the guide plate. These buffers also reduce the jar when the shuttle strikes the picker. The buffer in the back end of box can be made from cloth in the form of a roll, or can be made of leather.

Setting the Boxes.—The boxes must be set so that the bottom of each box will be level with race plate. If this is not done there will be considerable trouble with shuttles chipping and also flying out.

The first or top box is adjusted by set nuts at the bottom of lifting rod. The second box is adjusted by the stud in slot at front end of lifting lever. The third and fourth boxes are adjusted by the stud in slot at back end of lifting lever, also by crank E, Fig. 39, page 64.

No positive rule can be given to set the boxes. Each box has to be set separately, beginning with the top box. If, in changing from one box to another, the boxes do not come level with the race plate after setting first box, the leverage is not equally divided. By moving the studs in slot of lifting lever backward or forward according to whether the boxes are too high or too low, the right leverage will be obtained. Any change in either of the studs will correspondingly change the position of boxes.

To illustrate the difference in leverage when raising the boxes refer to Fig. 39. When a change is made from first to second box the single box cam C is turned. This brings the largest part of cam on top with the fulcrum of lifting lever at the back end of lever. To change from first to third box the crank E is turned. This brings the fulcrum of lifting lever on the single box cam with the cam in its normal position, that is the largest part of cam at bottom. To change from first to fourth box both cam and crank have to be turned. This will change the position of the fulcrum on lifting lever. From this it will be seen that as the position of the fulcrum changes there can be no hard and fast rules given to set the boxes, but judgment must be used in setting them. The boxes must either by perfectly level, or the back end elevated a trifle with the front end level with the race plate. Under no circumstances must the back end of the box be lower than the front end.

Boxes Skipping.—If the links on chain are not set right the chain will have a tendency to bind. The link should be put on the bars so as to have them alternate; that is, one outside and the next inside, on both sides of the chain to correspond. Fig. 43, page 69, illustrates this method of putting on the links. Short or bent links will cause the chain to ride on the barrel, instead of dropping in the notches. Double-sliding finger not working freely will cause the boxes to skip. It is necessary that this finger be kept well oiled, in fact, the whole motion must be kept well lubricated.

CHAPTER XXI

DOBBY LOOM

Fancy fabrics are made on the dobby loom. This loom is constructed on the same principle as the plain and gingham loom but two points must be given careful consideration if the best results are to be obtained.

First: It is necessary that there be sufficient space between the crank shaft and the lay when crank is on back center. If the space is not sufficient, the lay will strike the harness when the crank is at the back end of the stroke with the following results:

1. Harness will be moving back at the same time they are being raised or lowered causing chafing of the ends.
2. Harness shafts will strike each other, also catch on each other as they are being raised and lowered which often causes smashes.
3. If twine is used to connect harness shafts with the harness cords, the twine will jump out of connection with the harness hooks making miss-picks and smashes.

There are four causes for the loom not having sufficient space for the harness shafts:

1. Capacity of dobby too large for the loom, that is too many harness shafts.
2. Harness shafts too thick, thereby taking up too much space.
3. Crank arm too short, or space from crank shaft to back of lay insufficient.
4. Crank too thick or too heavy. This often prevents the use of the full width of harness to the capacity of the dobby.

Second: Many dobby looms have not sufficient depth of loom sides,

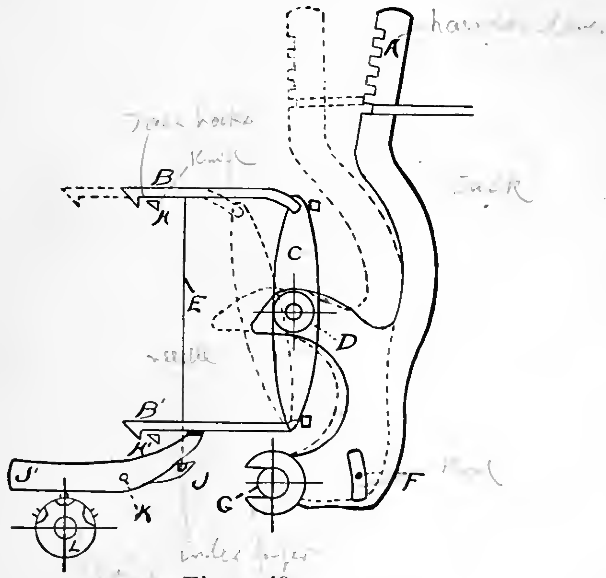


Figure 49

consequently only a short space is allowed between whip roll and harness shafts. A deep loom side gives a longer stretch to the threads, also a longer length of yarn is exposed, consequently the yarn receives the full benefit of the moist atmosphere derived from the use of humidifiers. In connection with the longer stretch of yarn, the best results are obtained when a large whip roll is used, about four inches in diameter. In fact, a large whip roll is preferable on all looms rather than a small one. The small whip roll causes too much strain on the yarn as it passes over the roll.

DOBBY HEAD MOTION

Two kinds of dobbies used in cotton mills are known as single action dobby and double action dobby. The single action has a closed shed, but the double action has an open shed. In a single action, the harness returns to the bottom of the shed every pick. These machines are not used very extensively, but where they are used, fancy lenos are generally made on them. This dobby has several disadvantages, the principal one is that the loom cannot run very fast because of the time required to change the harness from one pick to another. Another disadvantage is that the filling has to be beaten up into the cloth in a closed shed. The dobby that is most extensively used at the present time is the double action dobby. This dobby is often referred to as double index or single index dobby. The working parts of both are practically the same, the actual difference between them will be explained under separate headings.

DOUBLE INDEX DOBBY

A sketch of the working parts of a double index dobby is given at Fig. 49. The following are the names given to the different parts: A, harness lever, B, B1 are the jack hooks. C, jack. D, connection of jack with harness lever. E, needles. F, rod which passes through all the harness levers. G, rod on which the ends of all the harness levers work. H, H1, knives. J, J1, index fingers. K, rod which passes through all the index fingers. L, chain barrel. The harness lever A has a number of notches on the top. These notches are for the purpose of regulating the lift on the harness shafts. Each harness shaft is connected to a harness lever by a wire loop and harness strap. The loop is put in one of the notches. For front harness shafts the loops are put in notches near the bottom and are stepped higher in the notches for back harness. The reason for this being that the back harness shafts have to travel a greater distance than the front harness shafts in order to make the same size of shed. Rod F, which passes through all the harness levers, is fixed outside the frame of dobby. Its purpose is to keep the harness levers in contact with the rod G, and also to prevent the bottom of the levers from jumping when levers are being raised. The index finger J is in contact with the top jack B through the needle E, but the finger J1 is directly in contact with the bottom jack hook B1.

SINGLE INDEX DOBBY

A sketch of the working parts of a single index dobby is given at Fig. 50. In comparing this sketch with Fig. 49 it will be seen that the only difference between them is in the method of operating the jack hooks through the index fingers. In this dobby one index finger operates two jack hooks, the bottom jack hook by being directly in contact with the finger and the top jack hook in contact through the needle E. The top of the needle is directly under top jack hook and the bottom of the needle fits into a small groove at the end of the index finger, so that when the finger is raised both hooks are lowered at the same time, and one of them will be caught on the knife that is moving outward on that pick. Stated briefly, the distinctive difference between the two dobbies is as follows: In a single index dobby, one index finger operates both top and bottom jack hooks. The chain bar is turned over every pick, as each bar represent only one pick. In a double index dobby, one index finger is required for every jack hook. The chain bar is turned over once on every two picks as each bar represents two picks. There are twice as many index fingers in a double index dobby as there are in a single index dobby.

OPERATING DOUBLE INDEX DOBBY

In operating the dobby, the knives H, H1 are connected at each end by a knife hook to a rocking arm. The knife hooks are threaded on the end so that the knives can be set in different positions. Figure 51 shows the knives connected to the rocking arm by the knife hooks. The rocking arms are fulcrumed in the center, and as one knife is coming forward the other is returning. To raise the harness shaft a peg is put in a bar in the chain. The chain is put on the chain barrel L, and the peg comes in contact with an index finger. If a peg is put under the index finger J′ the opposite end of the finger is lowered, because the rod K acts as a fulcrum for the fingers. This lowers the jack hook so that when the knife comes forward, the catch on the hook is caught on the knife and the harness lever and harness shaft are raised. This is clearly seen in Fig. 49. A peg is placed in the chain bar under the index finger J′, which lowers the top jack hook over the knife H. As the knife comes forward, it catches the hook and pulls the jack and harness lever to position indicated by dotted lines. In many dobbies the rocking arms are of different sizes. The front rocking arm is smaller than the one at the back. This is to allow greater leverage on the back harness.

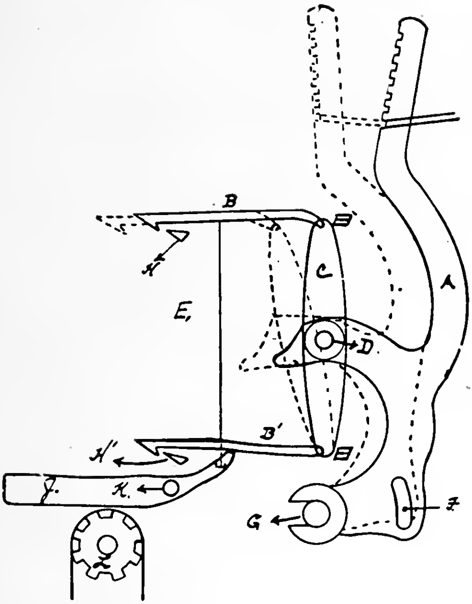


Figure 50

Driving Dobby.—The dobby can be driven either from the crank shaft or pick cam shaft. When driven from pick cam shaft a driving rod is connected from rocking arm in dobby to a crank setscrewed on end of bottom shaft. On this drive a pawl is always used to turn over the chain barrel. When the dobby is driven from crank shaft the rocking arm is connected by a driving rod to a gear, which receives motion from gear on crank shaft of half the number of teeth, so that two revolutions of gear on crank shaft are required to make the inward and outward movement of knives in dobby.

Driving Chain Barrel.—There are two distinct methods of driving chain barrel: First, by pawl fixed on front rocking arm. Second, by worm and worm gear. In the first method a ratchet gear is setscrewed on the front end of chain barrel shaft. This gear is pulled over by the pawl fixed to a stud in the lower portion of front rocking arm. The pawl pulls over the chain barrel when the lower portion of rocking arm is on its inward movement, so that when this driver is used each bar in chain represents two picks. The distance chain barrel is turned, can be regulated by raising or lowering pawl stud in slot of rocking arm. When stud is raised leverage is decreased, but when lowered, leverage is increased. When a change is made in either case a corresponding change has often to be made with the ratchet gear.

The second method of driving is used on both single and double index dobbies, generally on single index. In this method motion is imparted to the chain barrel from the crank shaft. One arrangement for single index is as follows: A gear of 30 teeth on crank shaft meshes in another gear of 60 teeth. This latter gear is setscrewed to an horizontal shaft that carries a small bevel gear on the opposite end, which meshes into another bevel gear fixed on a vertical shaft. At the top of the vertical shaft a worm is attached which drives the worm gear on chain barrel shaft. Other methods of driving are used, one of which is the use of a chain connecting crank shaft to another small shaft that carries the worm gear which drives the chain barrel. In all cases care is required in setting the motion so as to get the correct timing.

Setting Dobby on Loom.—To set a dobby on a loom there are a few points that will require to be taken notice of. Adjust the position of the cord rollers or sheaves so that the harness shafts will be suspended an equal distance from each side of the loom. Have the front cord roller adjusted so that the front harness will be from one-half to three-quarters of an inch behind lay cap when crank is on back center. Set the spring blocks on the floor in a line with the roller cords. This can be obtained by dropping a plumb from the rollers at the sides on which the cords work. The point thus found will be the center of spring block. Harness hooks can be put in harness shafts to correspond with plumb line.

Starting Up Dobbies.—When starting up a new dobby the harness levers will have to be adjusted so that they will work free and easy. The levers can be adjusted by set-nuts on each side of the frame. Dobby is generally run before connecting up the harness straps, and in running the levers should drop of their own weight. Every working part will require a good oiling. In a double index dobby with a worm gear drive for chain barrel, connection between driving of dobby and chain barrel will have to be specially noticed, so that both can be set together on the same pick. To illustrate: The dobby can be set so as to have either the top or bottom knife coming outward on the first pick. If the first row of pegs in the chain govern the top set of jack hooks, the driver will have to be set so that the top knife will come out on first pick. If driving is set so as to have bottom knife coming outward on first pick, a broken up pattern will result, because the second row of pegs, which is the second pick, governs the bottom jack hooks, and this will cause the harness that ought to be raised for second pick to be raised for first pick. The picks will be put in the pattern as follows: Second, first, fourth, third, sixth, fifth, and so on, which gives a ragged appearance to the pattern.

Obtaining the Size of Shed.—The size of shed required on a dobby is just sufficient to allow the shuttle to pass through without chafing the yarn. The shed can be regulated generally in three different places: First, driving crank. Second, rocking arm. Third, knife hooks. On some dobbies the size of shed can only be regulated at the driving crank and knife hook. In both cases the required adjustment can generally be made. First have the harness shafts strung up to harness straps, with the springs attached underneath. Keep the yarn tight when tied to the apron and have the yarn just resting on the race plate. The reason for having the yarn just resting on the race plate is that when filling is beaten into the cloth the bottom shed is raised up a trifle. Have the harness shafts level at both ends with the back harness shafts a little lower than the front. This is sometimes called an angular shed and is obtained by the harness levers coming in farther at the back, in other cases by increasing the length of the harness straps. Set the lower stud of driving arm about half way in the slot of the driving crank and the top stud of connecting arm also about half way in the slot. The rocking arm should be vertical when the driving crank is on front or back center and the loom crank shaft past bottom center. When the driving crank is on top center, set the top knife about one-fourth of an inch behind the catch on jack hooks. When the driving crank is on bottom center set the bottom knife the same distance behind the catch on jack hooks. This adjustment is made by set nuts on the knife hooks. If this setting does not give the correct size of shed the sweep will have to be adjusted at either the driving crank or rocking arm. The object of setting the stud about half way in the slot is because that position gives a medium sweep of knives. If the shed is found to be too small the connecting stud will be brought to the outer end of slot in driving crank. This will give a larger sweep, therefore a larger shed, but in consequence of this larger sweep, when the driving crank is on top and bottom centers the knives will be too far behind the catch on jack hooks. It is also possible that this change of sweep may pull the knives too far back, so that they will strike the back end of the knife slide. In either case the knives will have to be re-adjusted by the set nuts on knife hooks. If the shed is too large and a smaller shed is made it is possible that the knives may not get back of the catches on jack hooks, and will have to be re-adjusted in just the opposite way to the former.

Fig. 51 illustrates the three positions where adjustment in size of shed can be made, indicated by figures 1, 2, 3.

Pattern Chain Pegging.—In pegging chains, two items have to be taken into consideration: First, whether loom is right or left-hand. Second, the direction chain barrel revolves. It is necessary that these two items be known, especially the first, for the following reason: If loom is right-hand, the dobby will be on left-hand side; but if loom is left-hand, dobby will be on right-hand side. If chain has been pegged for dobby on right-hand loom it will not work on a dobby on left-hand loom unless turned round and last bar used for first. On some patterns this does not make much difference, but on others it does. It is advisable to have one system and adhere to it, namely, always begin with first harness on one side for all chain plans made. If this is done the chain can be made from chain plan with simple instructions.

To illustrate: Have first harness shaft on right-hand side; also have first pick in chain plan on top. On a right-hand loom, chain will be pegged from right to left, reading from first harness. On a left-hand loom, chain will be pegged from left to right, reading from first harness. If this system is used it is only necessary to state whether loom is right or left-hand. These instructions are for chain barrel revolving inward towards the loom. For an outward revolving chain barrel, it will be necessary to state this in giving instructions, as R. H. out, and chain will be pegged opposite to inward revolving chain barrel.

Requirements of a Good Dobby.—The dobby that is the simplest in its construction where the different parts can be taken out easily to be repaired will be the best to use, everything else being equal. All the different parts of the dobby should be made in their right proportion. The index finger, hooks, needles, should all work free with each other. Especial notice should be taken of the index fingers. See that these fingers are cast straight and smooth, otherwise they will rub against each other and miss-picks will result. This occurs occasionally in a double index dobby. When this is the case the fingers will have to be taken out and finished off on the emery wheel to take all the rough places off them. A dobby that will require all this work doing to it when

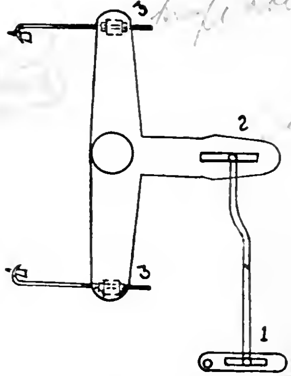


Figure 51

new is certainly not the dobby to select. Another requirement is that the dobby be of the right capacity with the loom, that is, if the loom is only adapted for a twelve harness dobby, it certainly is not wise to put on the loom a twenty or twenty-four harness dobby. If this is done, every time the lay goes back it will strike the harness shafts and cause them to vibrate. This will result in poor weaving, the harness shafts will be continually catching on each other and making miss-picks and smashes, also if the harness straps are not securely fastened to the hooks, the shafts will be continually dropping and making smashes. To use a dobby of a capacity of twenty to twenty-four harness shafts there should be at least ten inches between lay and crank shaft when lay is on back center. This is allowing the harness shafts to be about three-eights of an inch thick.

PREPARATION OF HARNESS SHAFTS

In preparing harness shafts there are several small details which if properly attended to will help very materially the production and quality of cloth. These details can be enumerated as follows:

Do not allow the heddles to get rusty. Rub heddle rods evenly with tallow or oil, or a mixture of tallow and oil. This allows the heddles to slide free on the rods. Put all heddles on shaft the same, that is do not put on some heddles with twisted ends on top and other heddles on same shaft with twisted ends at bottom. Have the twisted ends of the heddles on all shafts the same, that is, have all on top or all on bottom. Have only one counts of heddles on a shaft, do not mix fine and coarse heddles together. Heddles must work free on heddle rods. The hooks that support the heddle rod must not be too deep in the shaft or the rods will hold the heddles tight and they will not move freely. Have all hooks for heddle rods facing the front. Have heddle rods secured on both ends of the harness shaft. This must be especially noticed, as a smash often results through heddle rods slipping out. Have harness hooks on top of harness shafts set in line. Have harness hooks set so that there will be a straight and an even pull on the springs.

CHAPTER XXII

DRAWING IN THE WARP

Have the harness shafts suspended in front of drawing in frame with heaviest weaving harness in front. This is the general method of arranging the harness. For example, if a plain and fancy stripe is being made, the plain harness shafts will be on front. If single beam, have slasher comb or lease level with heddle eyes. If two or more beams, always put yarn from bottom beam over top of drawing in frame first, then yarn from the other beams to follow. Have a rod between the threads from each beam to keep them separated. There are two methods of arranging the combs. First. Have the combs on the top of each other. The comb for bottom beam will be on top with the other combs underneath. This brings the yarn from top beam in front of the yarn from bottom beam. This method does not take up much space. Second. Have all the combs level. The back comb will be from bottom beam with the other combs in front. Put up harness shafts in right order, then have warp drawn in. On many patterns the harness shafts can be divided into sections to have the warp drawn in. Take, for example, fancy stripe to be made on plain ground. Harness shafts for plain will be in front, harness shafts for fancy stripe will be at back. To divide in sections, leave off the plain harness shafts and draw in fancy stripe, keeping each stripe separate. Put up the harness shafts for plain and draw in the plain threads. When the required number of threads have been drawn in on plain harness shafts for one pattern, pull the threads for one fancy stripe through plain harness shafts. Repeat this until all the warp is drawn in. It must be understood that this cannot be done on all patterns, only on those patterns in which the threads from each beam forms a stripe with all threads together.

When warps are to be drawn in without a hander in, the drawing in hand begins on right-hand side; with a hander in, on left-hand side. When all threads are drawn through heddles, draw the warp in reed. If reed is too wide, divide the space equally on both ends.

STARTING UP THE WARP

Have the loops on harness levers in dobby stepped, that is, the front loops in lowest notches; raising the other loops in notches in the same proportion. Bring the beams from the drawing in frame on beam truck provided for that purpose. Support the harness shafts between crank shaft and lay on two rods, then put beams in loom. Hang the harness on harness straps. Attach the springs to bottom of harness shafts carefully. This is very important, especially when using fine yarns. It is also necessary to have the same strength of spring on each side of the shaft. One method of testing springs is as follows: Have a straight piece of wood about one yard in length with a screw in one end and at the other end lines ruled about half an inch apart with the lines numbered. Take each spring separately, put one end on screw and suspend a weight on opposite end. This will pull out the spring a certain distance, which will be indicated by the lines. Lay together all springs of the same strength, take springs to loom and connect the strongest springs to the heaviest harness shaft; that is, the harness shaft that has on it the most heddles and has the heaviest lift. Have whip roll level with harness eyes so that there will be an equal strain on the yarn when shed is open. Fix reed in lay sole and tighten up the lay cap. Put friction rope around beam heads to prevent from turning. Set the harness shafts so that the back shafts will be a little lower than the front. Both ends of the shafts should be level. Have the yarn just resting on the race plate. When weaving the yarn will be raised from off the race plate somewhat. Tie in the threads carefully to an apron. On fine yarns do not tie in too many ends at one time, as it is necessary to have every thread drawn tight before tieing to apron, otherwise threads will be broken out.

Divide the heddles equally in sections made by heddle rod hooks. If the heddles are not divided equally more will be left on one side than the other, and as a result the heddles are pulled out of their true position at the heddle rod hooks, which will cause the heddles to be crowded at this point so that when the harness shafts are being raised and lowered the threads are chafed. This is illustrated at Fig. 52. Put in the lease rods. For large rod, raise back harness shaft and every alternate harness

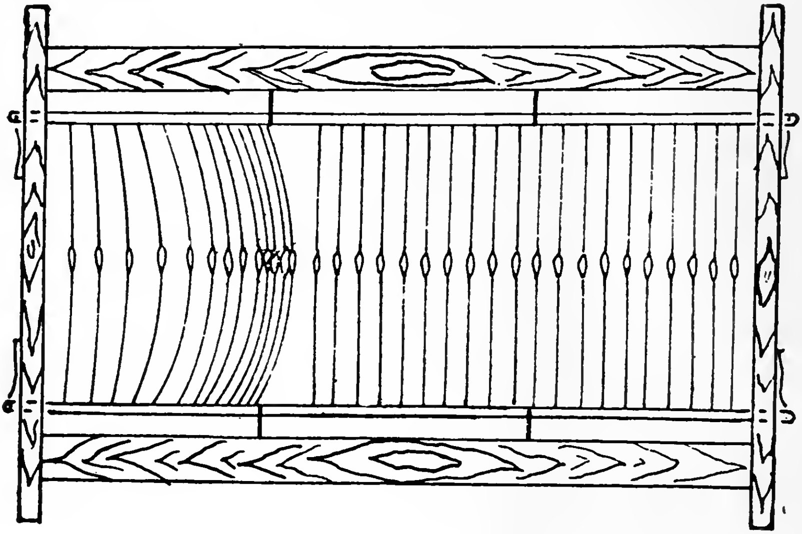


Figure 52

shaft. For small rod raise the opposite harness shafts. Set temples the required width. See that they do not come in contact with race plate or touch the reed. Put pattern chain in dobby and turn over lay. Open out the shed and throw shuttle through three or four times in same shed, then turn lay over and repeat this several times before starting up loom by power. Put on right pick gear. Occasionally a pattern chain is made to weave plain on all the harness shafts so as to get in the loose threads if there are any and to obtain a better starting up of the warp.

CHAPTER XXIII

DOBBY FIXING POINTS

The greatest fault that can be found with dobby cloths is miss-picks, and many pieces are rejected and put in seconds on account of them. This is especially true when old dobbies are used. There are various causes for miss-picks, which can by a little care be remedied before much damage is done. A number of these causes will be mentioned and a remedy for same, or a short explanation as to how the miss-pick is caused and the remedy can be applied.

Pegs in Chain Bar Not Set Straight.—The pegs should be put in the chain bar perfectly straight, if not, the pegs that are not straight will get in between the index fingers. The index finger that ought to be raised will not be and a miss-pick results. Under each index finger there is a small groove, and if the peg is straight in the bar it will work in the groove. The chain should be put on the barrel and every bar examined before the loom is started up. This is illustrated at Fig. 53, showing two pegs between index fingers.

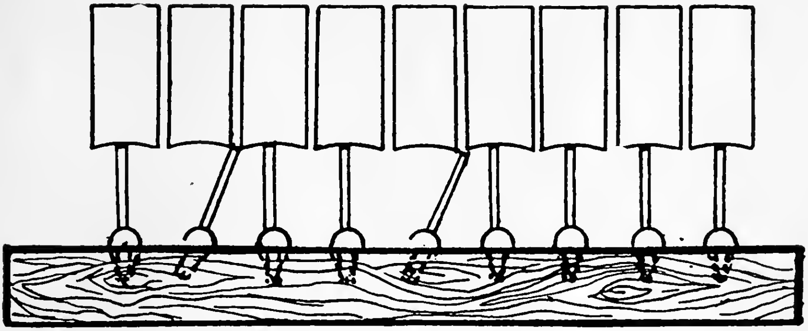


Figure 53

Wrong Setting of Chain Barrel.—The chain barrel should not be set too high nor too low. If set too high the index fingers will jump and this will have a tendency for them to catch on the knife when knife is coming out. If the chain barrel is set too low the hooks will not be lowered enough to get fully on the knife and as the knife moves out the hooks will often slip off. Especially will this be the case if the knife is worn. In some dobbies the knife can be turned when worn on one side. In other dobbies the knife will have to be ground down straight all the way across and then re-set to take up the amount ground off. When a harness shaft drops in this manner the threads on that shaft are often broken out. This also causes the shuttle to fly out occasionally.

Chain Barrel on Wrong Time.—The chain barrel must be set on correct time. A good general setting is to have the pegs in the chain bar directly under the index fingers with the knife about one-quarter of an inch from the catch on the jack hook with knife making its outward movement. If the chain barrel is being turned by a pawl from the rocking arm, see that the check on the shaft of the chain barrel holds the barrel steady after being turned, also, that the pegs are directly under the index fingers with fingers at the highest point. This means that if the fingers are at the highest point, the jack hooks will be at the lowest, or in other words, over the knife so that as the knife comes forward the hooks will be caught by it. The check on shaft is a star wheel setscrewed on the shaft. A small roll is held against the wheel by a spring, which holds the barrel securely after being turned. If this star wheel should slip, the chain barrel will be on wrong time and as a result the pegs do not fall under the index fingers and miss-picks result. The pawl may be set too low in slot of rocking arm and the chain barrel pulled over a little too far. In this case the check may possibly force the barrel to its correct position, but if it should fail to do this a miss-pick will result, because the barrel will not be in correct position. The remedy is to set the pawl higher in the slot and readjust the ratchet gear to the pawl.

Weak Spring on Chain Barrel Shaft.—The spring is held on shaft by a collar, which keeps the clutch in contact with the worm gear, this gear being loose on the shaft. If the spring should become weak, the clutch will be forced out of connection and chain barrel will not be turned. It occasionally happens when a large number of pegs are put in one chain bar that the check is forced out when the spring is weak. The remedy is to move in the collar which tightens up the spring.

Harness Levers Too Tight.—The harness levers should not be too tight or they will bind. They should be just tight enough to drop of their own weight before the harness shafts are attached to them. This is regulated by set screws on the front and back of the dobby frame. The ends of these set screws are in contact with the bottom portion of an harness lever, and by turning these set screws in or out the desired movement of the harness levers can be obtained. Also, neglect in oiling will cause them to bind.

Jack Hook Binding.—If a jack hook fits too tight on the jack where hook is connected, it will cause the hook to bind. This will keep the hook from dropping over the knife and harness shaft will not be raised. The end of the jack can be opened a little with a screw-driver, but care must be taken not to open too wide or it will catch on the end of the next jack when returning, and this keeps the threads from being lowered to their regular position and makes a miss-pick as well as causing them to be broken out. The jack with the opened end will be raised by the next jack when it ought not to be, and this often causes threads to be broken out. The best method to ascertain whether the miss-pick is caused by the jack hook binding is to raise up the hook and it should drop of its own weight. It will do this if working free. If a jack hook touches or comes in contact with the guide it is often prevented from dropping. In some cases the hook drops, but too late to be caught on the knife, and the harness shaft is left down when it ought to be raised.

Index Finger Binding.—An index finger occasionally touches or comes in contact with a pin in pin-board or the index finger guide. This prevents the finger from dropping and a harness shaft is raised when it ought not to be. This can be prevented by setting the index finger so that it will pass clear between the pins or guide. Another cause of finger binding is given in "Requirements of a good dobby."

Chain Bar Too Short.—Occasionally a chain bar is a little shorter than it ought to be. This allows the bar to slip about on the barrel and causes a peg to get in between the index fingers, especially if the peg should happen to be a little crooked in the bar.

Chain Bar Too Large.—Occasionally a chain bar is a trifle too large. The bar will fit tight in the chain barrel and instead of dropping from the chain barrel is taken around with it and the chain gets stuck.

Peg Too Short.—Occasionally a short peg is put in the chain. The index finger is not raised high enough, consequently the jack hook is not lowered sufficiently to be caught on the knife.

Bent Connecting Links.—Chain bars are connected to each other by small links. Often additional bars have to be added, and when connecting them together these small links are bent, and this in many cases brings the bars a trifle closer than they ought to be. The result is that the bars will occasionally bind on the chain barrel instead of dropping off, and this causes the chain to get stuck.

Chain Bars Too Far Apart.—If the connecting links are not pressed together as close as they should be, the bars will occasionally ride on the barrel, which causes a miss-pick. This often happens when chain bars are tied together with twine on account of the knots slipping.

Chain Barrel Not Turned Over Far Enough by Pawl.—If barrel is not turned over far enough by pawl, the pegs will not be in correct position. The check sometimes forces the barrel to correct position, but if it fails to do so a miss-pick results.

Worn Index Finger and Index Finger Rod.—If the rod which passes through all the index fingers is worn the fingers will not work steady, or if the index finger bearing is worn the result will be the same, there will be too much lost motion. The principal reason for the bearing or rod wearing out is neglecting to oil these parts. This fact cannot be emphasized too strongly. The only remedy is to insert new index finger and rod.

Other Causes.—Unequal springs on harness shafts will cause miss-picks. Poor filling will also cause miss-picks or perhaps a better term for this is broken picks. The filling will break and catch again on the same pick and this shows a broken pick in the middle of the cloth. This occurs mostly on fine work.

CHAPTER XXIV

WEAVE ROOM MANAGEMENT

Scientific principles are involved in all processes through which cotton is manufactured. In no part of the mill can the principles of scientific management be better applied than in the weave room, or in other words, efficiency is desired and striven for in the weave room. In a weave room there are so many small details to be attended to and so many different conditions in which labor is involved that there should be some form of efficient and practical management conducted in a scientific manner to produce the best results. It is impossible to name all the points that should be looked after in keeping a weave room up to the top notch in efficiency and production, but some of the principal points can be enumerated:

Starting Up On Time.—The overseer should be in his place to see that all looms are started on time. A loss of one minute on four hundred looms is a loss of 400 minutes work, and this is a big item. The influence of the "on time" overseer is a great help to the operatives.

Care of Looms.—Efficient weaving depends on the looms. Every part must be nicely adjusted and work in harmony with other parts. Looms should be thoroughly cleaned every time a warp is woven out. All oil holes should be cleaned out. All lost motion should be taken out, especially in crank arms. Loose nuts should be tightened. All parts of the loom should be thoroughly oiled with a good oil. An oil that drips and splatters should be avoided, as this causes too many "seconds," is wasteful and is not clean, as too much drops on the floor. A, 00000, Non-Fluid Oil gives satisfactory service, as it is adhesive and clings to the part being lubricated, therefore practically abolishing spattered warps. As looms are oiled when in motion, it is particularly desirable to have an oil that will not spatter when put on the cams, and K, 00 Special Non-Fluid Oil gives the desired results.

Belts.—The belts should be watched particularly. Belts too loose mean a loss in production; belts too tight also means a loss because of excessive wear on the various parts of loom. A medium tight belt should be used and a good belt dressing applied occasionally.

Good Warps.—Good warps are absolutely necessary to have good quality and good production. Good warps should be sized correctly, should not be either too soft or too hard sized. Ends should not come up broken, neither should they be rolled, that is crossed and twisted. All these defects cause bad work and loss in production. Many times warps have to be cut out of loom because of these defects. Soft warps can occasionally be remedied to a certain extent by having a wax rod on the yarn as the yarn is coming off the loom beam. This strengthens the yarn by coating it with wax, and in many cases is a big saving because soft warps can be woven out. Hard sized warps can sometimes be woven by having a damp cloth in the form of a roll resting on the yarn below the whip roll as the yarn is coming off the beam.

Even with good yarn it is almost impossible to weave cloth without having some ends break. Breakage will be more or less according to the strength of the yarn, the setting of the various parts of the loom, the regulation of weight on the beam, together with other details such as having shuttles in good condition; yarn bottoming too deep, etc. If there are excessive breakages and the loom is in good condition there is something wrong with the preliminary processes. The yarn may be good from the spinning room, but is being stretched and the elasticity taken out of it in the spooling and warping processes or the size is not penetrating into the yarn or the yarn may be scorched.

Waste.—All waste should be reduced to a minimum. Looms picking too hard is a waste of power and also causes a loss owing to excessive breakages. Time can be saved by arranging tie ends so they will pull out easily when a broken end has to be tied. On common looms, a full shuttle should always be ready for use when the filling is woven on the bobbin in the loom, or on automatic looms the magazine should not be allowed to get empty.

There is always a certain amount of waste in yarn and cloth at the starting up and finishing of a warp. The cut mark should be as near the end of the warp as possible and the end of warp should be tied to an apron or tied in some way to the loom beam so that the mark can be woven up to the lease rods. The first cut mark should not be too far from the end so as not to make too much waste at the beginning. It is better to tie new warps to aprons rather than to the cloth in the loom. If the cloth is torn in order to tie up the new warp, ten to twelve inches of cloth is wasted and this is quite an item on a large number of looms.

Bobbins on Floor.—Full bobbins on floor should be picked up at once, otherwise the yarn will get dirty and cannot be used. The bobbin is liable to be stepped on and get broken, so that through lack of care this is wasted. All filling waste should be kept clean.

System of Setting Shedding Cams.—Shedding cams should always be set on looms in a regular manner so that the loom fixer will know at once which is the large cam. This will save considerable time when starting up warp.

Setting of Whip Rolls.—On goods of the same construction, all whip rolls should be set in the same position. This will produce the same appearance on all the cloth. If the whip rolls are not set the same, some cloth will have "cover" on the face and other cloth of the same construction will be reedy.

Uneven Cloth.—A strict watch should be kept on uneven or streaky cloth. This is usually caused by either the let-off or the take-up motion being out of order. Sometimes streaks are made by the weaver turning the take-up gears but this should not be allowed.

Supplies.—The overseer should have all supplies locked up or in a stock room, a record should be kept of all supplies given out, the date, and to whom given. Shuttles are a great expense and it is a good plan to keep the date when shuttles are put in looms. This can be done by the loom fixer.

If the cost of each article given out is known, the cost for each loom fixer per month can readily be ascertained. The good loom fixer always strives to keep down cost of supplies.

Reports.—The various weave room reports should be made out each day, such as weavers out; looms stopped and cause for same; warps out; cuts woven, etc. An estimate should be made of the number of warps that will run out during the coming week, as this will enable the superintendent to plan his work, especially on fancy and colored goods.

Examination of Cloth.—The cloth as it is taken from the loom should be marked with the number of loom and carried to the place provided for it. Each day the cloth should be entered on the production sheet for the weaver and should be examined each day. By doing this the overseer can keep up with the amount of bad cloth made, the weavers who are making it and in many cases will be able to prevent the making of more bad cloth by looking into the various causes of same. The weaver is not always responsible for the bad cloth made and responsibility for same should be accurately and definitely placed.

Calculations

Cotton Yarn Table.—In order to obtain the counts of yarn from a bobbin or cop a reel is used. This reel is 1½ yards in circumference and is turned a certain number of revolutions to obtain a required length.

Two tables are used to obtain the counts of yarns, one for length and one for weight. The table for length is as follows:

1½	yards=1 Revolution.
120	yards=1 Lea.
840	yards=1 Hank.

The table for weight is as follows:

24	grains=1 dwt.
437½	grains=1 oz.
7000	grains=1 lb.

In making calculations for cotton yarns it is well to remember that the finer the yarn, the higher the counts.

For example:

1's counts contain	840	yards and weigh 1 lb. or 7,000 grains.
2's counts contain	1,680	yards and weigh 1 lb. or 7,000 grains.
3's counts contain	2,520	yards and weigh 1 lb. or 7,000 grains.
10's counts contain	8,400	yards and weigh 1 lb. or 7,000 grains.
100's counts contain	84,000	yards and weigh 1 lb. or 7,000 grains.

The higher the counts the finer will be the yarn, consequently more yards will be required to weigh one pound.

Cotton yarns are governed by hanks, and the number of hanks in one pound equals the counts of the yarn.

840 yards equal 1 hank. Therefore if 840 yards weigh 1 lb., the counts of the yarn will be 1's.

Reeling Yarn

The practical method of ascertaining the counts of yarn from either bobbin or cop is to wind a certain length on the reel.

If one hank or 840 yards is wound on the reel, then weighed and the weight divided into 7,000 grains, the result will be the counts of the yarn.

It is not customary to wind 840 yards from one bobbin, but to use four bobbins and wind 120 yards from each of these bobbins at the same time. This saves time and it is also possible to get a more correct average of the counts of the yarn being spun than can be done if only one bobbin is used.

Rule. To find the counts of yarn:

Weight of 840 yards divided into 7,000=counts of yarn.

Example. 840 yards of yarn weighs 140 grains; what are the counts?

7,000÷140=50's counts.

If 120 yards of yarn has been wound from each of four bobbins the counts of yarn can be found by

Rule.

Weight of 480 yards of yarn divided into 4,000=counts of yarn.

Example. 120 yards of yarn is wound from each of four bobbins and weighs 50 grains. What are the counts?

4,000÷50=80's counts.

Each skein of 120 yards can be weighed separately and the counts of each ascertained. This will show the variation in the counts of each yarn. The average counts will be found by taking the total weight and dividing into 4,000 as given.

If only 120 yards of yarn is wound on the reel the counts can be found by

Rule. Weight of 120 yards divided into 1,000=Counts of yarn.

Example. 120 yards of yarn is wound from bobbin and weighs 20 grains. What are the counts:

$1{,}000 \div 20 = 50$'s counts.

If only 30 yards of yarn is weighed the counts can be found by

Rule. Weight of 30 yards divided into 250=Counts of yarn.

Example. 30 yards of yarn weighs 10 grains. What are the counts?

$250 \div 10 = 25$'s counts.

The number to be used when finding counts of yarn from even lengths of yarn is obtained by taking an equal proportion of the yards in one hank and the grains in one pound. This can be illustrated as follows:

Weight of 840 yards divided into 7,000 grains=Counts.
Weight of 120 yards divided into 1,000 grains=Counts.
Weight of 60 yards divided into 500 grains=Counts.
Weight of 30 yards divided into 250 grains=Counts.
Weight of 12 yards divided into 100 grains=Counts.

In making cotton yarn calculations a constant is often used especially when the counts have to be obtained from irregular lengths of yarn. This constant is obtained by dividing the standard for weight, 7,000 grains, by the standard for length, 840 yards: $7{,}000 \div 840 = 8\ 1/3$ grains, which is the weight of 1 yard of 1's counts.

To find counts of yarn when using constant:

Rule. Multiply the number of yards weighed by 8 1/3 and divide by the weight in grains.

Example. 45 yards of yarn weighs 25 grains. What are the counts?

$8\ 1/3 \times 45 \div 25 = 15$ counts of yarns.

Very frequently the counts of warp and filling have to be ascertained from short lengths taken from a small sample of cloth. When this has to be done the following rule is used.

Rule. Number of inches weighed $\times$ 7,000$\div$weight in grains of inches weighed$\times$840$\times$36=Counts of warp or filling.

Example. 100 inches of warp or filling yarns weighs .7 grains. What will be the counts?

$100 \times 7{,}000 \div .7 \times 840 \times 36 = 33$ counts.

A constant can be used as a substitute for this rule, because three of the numbers used in rule are required for every calculation as follows: $7{,}000 \div 840 \times 36 = .23148$ constant.

This constant multiplied by inches weighed and divided by weight will give the counts. Take for illustration the preceding example:

$.23148 \times 100 \div .7 = 33$ counts.

Cloth Calculations

In making these calculations it is first necessary to ascertain the number of ends per inch in cloth and from this the total number of ends in cloth can be found when the width of cloth is known.

These calculations have special reference to weight of cloth so that in making the calculations, the length of yarn from slasher must be used on account of the contraction that takes places in weaving.

To find number of ends in warp.

Rule. Ends per inch $\times$ width of cloth + selvage ends.

Example. A cloth has to be made 30 inches wide with 60 ends per inch, 24 extra ends to be added for selvage. How many ends in warp.

$60 \times 30 = 1{,}800 + 24 = 1{,}824$ ends required.

To find weight of warp yarn in a piece of cloth.

Rule. Ends in warp × slasher length ÷ 840 × counts of warp. Add weight of size.

Example. What will be the weight of warp in a cloth 28½ inches wide, 64 ends per inch, 50 yards of cloth, 52½ yards slasher length of yarn, 40 warp. Add 32 extra ends for selvage, also 7% for size.

$64 \times 28\frac{1}{2} = 1{,}824 + 32 = 1{,}856$ ends in warp.
$1{,}856 \times 52\frac{1}{2} \div 840 \times 40 = 2.9$ lbs. warp.
$2.9 + 7\%$ size $= 3.103$ lbs.

To find weight of filling in a piece of cloth.

Rule. Width in reed × picks per inch × cloth length ÷ 840 × counts of filling.

Example. What will be the weight of filling in a cloth 28½ inches wide, woven 30 inches in the reed. Cloth to be 50 yards long, 64 picks per inch of 50 filling.

$30 \times 64 \times 50 \div 840 \times 50 = 2.285$ lbs. filling.

It will be noticed that the width in reed is multiplied by the picks per inch, which equals the number of inches of filling in one inch of cloth and is then directly multiplied by the cloth length in yards. This is done because the number of inches of filling in one inch of cloth also represents the yards of filling in one yard of cloth from the fact that if inches of filling in one inch of cloth is multiplied by 36 the result is inches of filling in one yard of cloth, consequently the number will have to be divided by 36 to bring it back to yards which is the same as at first.

To find weight per yard from small sample, also counts of warp and filling.

Take from sample a number of ends of warp and filling, then weigh each separately. From this data the counts and weight can be ascertained by the following

Rule.

(a) Number inches weighed × .23148 ÷ weight = counts.

(b) Total number of ends in cloth × 16 ÷ 840 × counts of warp = weight of warp. To this add contraction in warp.

(c) Width in reed × picks per inch ÷ 840 × counts of filling = weight of filling.

Example. A sample of cloth contains 64×64 ends and picks per inch. Cloth to be made 28½ inches wide and set 30 inches in reed. Warp contracts 6%. Add 16 extra ends for selvage. What will be the weight per yard?

100 inches of warp weighs .7 grains.
100 inches of filling weighs .7 grains.

$$\frac{100 \times .23148}{.7} = 33 \text{ warp and filling.}$$

$64 \times 28\frac{1}{2} = 1{,}824 + 16 = 1{,}840$ ends in warp.
$1{,}840 \times 16 \div 840 \times 33 = 1.062 + 6\% = 1.13$ oz.
$30 \times 64 \times 16 \div 840 \times 33 = 1.108$ oz.

2.238 oz. per yard.

To find yards per pound.

Rule. Ounces per lb. ÷ weight per yard.

Example. Weight of one yard = 2.238. What will be the weight per yard?

$16 \div 2.238 = 7.148$ yards per lb.

To find weight of one yard from small sample.

Rule. Number of square inches in one yard of required cloth × weight of sample ÷ square inch in sample × 437½.

Example. A piece of drill cloth 4x4 inches weighs 34.56 grains, cloth to be 30 inches wide. What will be the weight per yard?

$36 \times 30 = 1{,}080$ square inches in one yard.

$1{,}080 \times 34.56 \div 16 \times 437\frac{1}{2} = 5.33$ oz. per yard.

By previous Rule 11:

$16 \div 5.33 = 3$ yards per lb.

Another rule to find yards per lb. is as follows:

7,000 × number of square inches of sample weighed. Result divided by weight in grains × width of cloth × 36.

$7{,}000 \times 16 \div 34.56 \times 30 \times 36 = 3$ yards per lb.

From this rule a constant number can be obtained. 7,000 and 36 are always used, therefore $7{,}000 \div 36 = 194.44$ constant number.

194.44 ÷ width of cloth × weight of one square inch = yards per lb.

When more than one square inch is weighed, multiply 194.44 by number of inches weighed.

Use Example 12: $4 \times 4 = 16$ square inches.

$194.44 \times 16 = 3{,}111$.

$3{,}111 \div 30 \times 34.56 = 3$ yards per lb.

Another method of ascertaining the yards per lb. is as follows:

Rule.

Divide the ends per inch by counts of warp.

Divide the picks per inch by counts of filling.

Add the two results together and multiply by width of cloth. Divide 840 by resulting number.

Example. A cloth has to be made 30 inches wide.

Counts of warp 13.65; counts of filling 12.80.

Ends per inch 68. Picks per inch 44. How many yards per lb.?

$68 \div 13.65 = 4.981$

$44 \div 12.80 = 3.437$

$4.981 + 3.437 = 8.418$

$840 \div 8.418 \times 30 = 3.326$ yards per lb.

About 10 per cent would be allowed for contraction and size on yarns and this would bring the weight to about 3 yards per lb.

To find average counts when ends per inch, picks per inch and yards per pounds are known.

Rule. Add ends and picks per inch together and multiply the result by width of cloth and yards per pound. Divide by 840.

Example. What are the average counts in a cloth 62 ends per inch, 58 picks per inch, 38 inches wide and weighs 6 yards per lb.

$62 + 58 = 120$.

$120 \times 38 \times 6 \div 840 = 32.57$ average counts.

To find average counts in cloth when ends per inch, picks per inch, counts of warp and filling are known.

Rule.

Ends per inch ÷ counts of warp.

Picks per inch ÷ counts of filling.

Add the results and divide into sum of ends and picks.

Example. A cloth is made 80×100 ends and picks, 55 warp, 75 filling. What are the average counts.

$$\begin{array}{rl} 80 \div & 55 = 1.454 \\ 100 \div & 75 = 1.333 \\ \hline 180 & \ 2.787 \end{array}$$

$180 \div 2.787 = 64.58$ average counts.

CLOTH CALCULATIONS

To find average counts of warp when more than one counts of warp are used.

Rule. Divide the number of ends of each kind by its own count. Add the results and divide into the total number of ends.

Example. A cloth is made which contains the following yarns:

1860 ends of 60; 980 ends of 45; 540 ends of 2/20.

What are the average warp counts?

$$\begin{array}{rr} 1860 \div 60 = 31 & \\ 980 \div 45 = 21.77 & \\ 1080 \div 20 = 54 & \\ \hline 3920 \quad & 106.77 \end{array}$$

$3920 \div 106.77 = 36.71$ average warp counts.

(When ply yarns are used in calculations for average counts, the number of single yarns are usually considered.)

To find average counts in cloth when more than one counts of warp is used, also picks per inch and counts of filling.

Rule. Obtain average sley. Divide average sley by average warp counts. Divide number of picks per inch by counts of filling. Add the results together and divide into the sum of sley and picks.

Example. A cloth is made from the following yarns:

1860 ends of 60; 980 ends of 45; 540 ends of 2/20.
80 picks per inch of 75 filling.
Cloth width, 28 inches.

What are the average counts?

$1860+980+1080=3920$ ends.
$3920 \div 28=140$ average sley.

$$\begin{array}{rr} 1860 \div 60 = 31 & \\ 980 \div 45 = 21.77 & \\ 1080 \div 20 = 54 & \\ \hline 3920 \quad & 106.77 \end{array}$$

$3920 \div 106.77=36.71$ average warp conuts.

$$\begin{array}{rr} 140 \div 36.71 = 3.813 & \\ 80 \div 75 \quad = 1.066 & \\ \hline 220 \quad & 4.879 \end{array}$$

$220 \div 4.879 = 45.09$ average counts in cloth.

To find counts of filling required to produce a certain weight of goods.

Rule. Obtain average counts. Decide on warp counts to be used. From warp counts obtain weight of warp yarn. Then deduct weight of warp yarn from one pound. This result will be weight of filling required.

Yards of filling in one pound $\div$ 840 $\times$ weight of filling = counts of filling required.

Example. A fabric is required 62 × 58—6 yards—38 inches wide. Allow 10 per cent for contraction and size. Add 20 ends for selvage. What are the average counts and what are the actual counts to be used?

$62 \times 38 = 2356 + 20 = 2376$ yards $+ 10\% = 2640$ yards of warp in 1 yard of cloth.

$58 \times 38 = 2204$ yards $+ 10\% = 2448.8$ yards of filling in 1 yd. of cloth.
$2640 + 2448.8 = 5088.8$.
$5088.8 \times 6 \div 840 = 36.34$ average counts.

Assume the mill is making 30 warp counts.
$2640 \times 6 \div 840 \times 30 = .628$ lbs. of warp.

$1 - .628 = .372$ lb. filling required.
$2448.8 \times 6 \div 840 \times .372 = 47$ counts of filling required.

The average counts in this example could have been found by the short Rule 14, as follows:

$62 + 58 = 120.$ $120 \times 38 \times 6 \div 840 = 32.57$ average counts.

Allowing 10 per cent for contraction, the average counts would be just over 36.

To find average ends per dent in an unequally reeded fabric:

Rule. Add number of ends in one pattern. Add number of dents in one pattern. Divide ends by dents.

Example. A fabric is made in a 30 reed, and is reeded as follows:

20 ends in	10 dents.
40 ends in	10 dents.
60	20

$60 \div 20 = 3$ ends per dent average.

To find average number of ends per inch in an unequally reeded fabric:

Rule. Number of ends in one pattern $\times$ number of reed $\div$ number of dents in pattern.

Example. What will be the average number of ends per inch in a fabric made with 40 reed, 30 inches wide, and reeded as follows?

50 ends in	10 dents
20 ends in	10 dents
25 ends in	5 dents
10 ends in	5 dents
105	30

$105 \times 40 \div 30 = 140$ average ends per inch.

To find number of patterns in warp, the ends being equally reeded.

Rule. Divide number of ends inside selvage by number of ends in pattern.

Inside selvages are used so as to keep the same width of selvage on all goods or on the same line of goods. If the full number of ends are used to ascertain the number of patterns there is a tendency to have a variation in the width of selvages.

Example. How many patterns are there in a fabric 28 inches inside selvages, 60 ends per inch, warp dressed as follows?

20 ends white
8 ends blue
4 ends white
8 ends blue
—
40

$28 \times 60 = 1680$ ends inside selvages. $1680 \div 40 = 42$ patterns in warp.

Selvage ends would be added to white.

In laying out a pattern of this description the 20 ends of white that begin the pattern would be divided so that both sides of the fabric would be the same. The pattern, therefore, would be:

10 ends white
8 ends blue
4 ends white
8 ends blue
10 ends white
—
40

To find number of ends of each color in warp:

Rule. Obtain the number of patterns in warp inside selvages. Ends of each color × number of patterns.

Using previous example. There are 42 patterns in warp.

24 ends white
16 ends blue
42×24=1008 ends white
42×16= 672 ends blue

1680 ends

To find weight of each color of warp and filling in one yard of cloth:

Rule for Warp. Number of ends of each color × 16 ÷ 840 × counts of warp. Add contraction and size.

Rule for Filling. Total weight of filling × picks per pattern of each color ÷ total number of picks in pattern.

Example. What will be the weight of warp and filling in one yard of a gingham cloth, 28 inches inside selvages, 28½ inches outside selvages, 60 ends per inch, 60 picks per inch, 40 warp, 40 filling. Warp set 30 inches in reed. Add 10 per cent for contraction and size. Colors arranged as in previous example:

20 white
8 blue
4 white
8 blue

40

Weight of warp.
28 × 60 = 1680 ends inside selvage.
1680 ÷ 40 = 42 patterns in warp.
42 × 24 = 1008 + 60 selvage ends = 1068 ends white.
42 × 16 = 672 ends blue.
1068 × 16 ÷ 840 × 40 = .508 + 10% = .564 oz. white
672 × 16 ÷ 840 × 40 = .32 + 10% = .355 oz. blue

.919 = weight of warp.

Weight of filling:
30 × 60 × 16 ÷ 840 × 40 = .857 oz.
.857 × 24 ÷ 40 = .514 oz. white
.857 × 16 ÷ 40 = .343 oz. blue

.857 oz. total weight.
.919 × .857 = 1.776 oz. per yard.
16 ÷ 1.776 = 9 yards per lb.

To find number of dents in pattern, the ends being unequally reeded as in a satin and plain stripe.

Rule. Obtain the number of dents per inch in cloth. Measure with rule the full width of pattern. Number of dents per inch in cloth × width of pattern equals number of dents in pattern.

Example. A satin and plain stripe has been constructed 29¼ inches inside selvages, 29½ inches outside selvages, 32 dents per inch in cloth. Pattern measures 1⅝ inches.

The pattern arranged as follows:

1 inch plain
⅛ inch satin
⅛ inch plain
⅛ inch satin
⅛ inch plain
⅛ inch satin

32 × 1⅝ = 52 dents in pattern.

In order to check up the pattern and to divide the dents for the different stripes it is necessary to measure each stripe separately.

The width of stripes in previous example with the dents and ends in a pattern is as follows:

Plain stripe measures	1 inch	= 32 dents	= 64 ends.
Satin stripe measures	⅛ inch	= 4 dents	= 20 ends.
Plain stripe measures	⅛ inch	= 4 dents	= 8 ends.
Satin stripe measures	⅛ inch	= 4 dents	= 20 ends.
Plain stripe measures	⅛ inch	= 4 dents	= 8 ends.
Satin stripe measures	⅛ inch	= 4 dents	= 20 ends.
		52	

It will be noticed that this calculation has been made from dents per inch in cloth. This is found by counting the dents in cloth by the use of a pick glass. The reed used will have a less number of dents per inch, depending on the contraction between cloth width and reed width.

Another method of obtaining the number of dents in a pattern is to use a pair of dividers and measure each stripe separately, then compare with some part of the sample that is known to contain an equal number of ends per dent as in plain cloth. For example, a fabric is made with plain stripe, cord, and a satin stripe. The plain stripe will have two ends per dent, then by measuring the width of the satin stripe or cord with the dividers and placing the dividers on the plain cloth, the number of dents in each can readily be seen. In this way the dents in each stripe is easily ascertained.

To find patterns in warp the ends being unequally reeded as in previous example of plain and satin stripe.

$$32 \times 29\tfrac{1}{4} \div 52 = 18 \text{ patterns.}$$

To find ends in warp, the ends being unequally reeded as in previous example of plain and satin stripe:

Rule. Patterns in warp × ends of each stripe in pattern + selvage.

As this pattern consists of plain and satin two beams will be necessary. The plain warp will be put on the bottom beam and the satin warp on the top beam.

The pattern contains 40 dents plain = 80 ends.
12 dents satin = 60 ends.
18 × 80 = 1440 + 32 for selvages 1472 ends B. B.
18 × 60 = 1080 ends T. B.

PRODUCTION CALCULATIONS

The following examples will illustrate how loom production is obtained.

Example. How long will it take a loom to weave 100 yards of cloth with 80 picks per inch. Diameter of pulley on driving shaft 10 inches; diameter of loom pulley 12 inches; speed of driving shaft 216 R. P. M. Allow 10 per cent for stoppages.

216 × 10 ÷ 12 = 180 picks, speed of loom.
10 per cent of 180 = 18.
180 − 18 = 162, actual working time.
80 × 36 × 100 = 288,000 picks in cloth.
288.000 ÷ 162 = 1777.7 minutes.
1777.7 ÷ 60 = 29 hours and 38 minutes.

Example. How many yards of cloth will a loom produce at 150 picks per minute in a week of 60 hours weaving cloth with 80 picks per inch; also how many yards at 90 per cent production.

$150 \times 60 \times 60 = 540{,}000$ picks per week.
$80 \times 36 = 2880$ picks per yard.
$540{,}000 \div 2880 = 187.5$ yards at 100 per cent production.
10 per cent of $187.5 = 18.75$.
$187.5 - 18.75 = 168.75$ yards per week woven at 90 per cent.

There are certain numbers which must necessarily occur in these calculations. These are minutes per hour, hours per week, 36 inches in one yard. A constant number can be obtained from these three numbers, 60 minutes per hour, 60 hours per week, 36 inches in one yard, as follows:

$$60 \times 60 \div 36 = 100.$$

This constant number can be used as follows:

Rule. Loom speed $\times$ 100 $\div$ picks per inch = 100 per cent production per week of 60 hours.

Using previous example, $150 \times 100 \div 80 = 187.5$ yards. For a production less than 100 multiply by the per cent required.

A constant number can be worked out for any number of hours per week by substituting the number of hours worked for the 60 used for illustration. What constant will be used for 100 per cent in a week of 54 hours?

$$60 \times 54 \div 36 = 90.$$

Example. How many yards will a loom produce at 160 picks per minute in a week of 54 hours weaving cloth at 72 picks per inch, also how many yards at 90 per cent.

$160 \times 90 \div 72 = 200$ yards at 100 per cent.
$200 \times .90 = 180$ yards at 80 per cent.

Or by long method:

$160 \times 60 \times 54 \div 72 \times 36 = 200$ yards.
$200 - 10$ per cent $= 180$ yards.

CHAPTER XXV

CALCULATIONS FOR COTTON HARNESS

The counts of cotton harness are usually calculated in two different ways. First, by having a certain number of harness eyes on a specified width. Second, by having a certain number of "biers" on a specified width. A bier has always twenty harness eyes and is indicated by a piece of twine passing over this number of eyes, generally on top of harness.

Calculations for cotton harness are made for either two or four harness shafts, the finer grade of goods being made on four shafts. These calculations are always made to correspond with the reed, for example, if a number 30 reed has to be used then 30 eyes will be required per inch one each shaft, using two shafts.

Example 1.—A sheeting fabric has to be made with 48 ends per inch, 40 inches wide. Harness eyes will be spread about 43 inches on shapt. How many harness eyes on each shaft, using two harness shafts?

$48 \times 40 = 1920$ ends in warp, without selvage ends.
$1920 \div 2 = 960$ eyes on each shaft.
Selvage ends are added to outside ends in cloth and do not have to be used in calculation for harness eyes.

Example 2.—The harness for a plain warp has to be spread 40 inches, the warp having 3360 ends. Use two harness shafts.
How many eyes on each shaft? How many biers on each shaft?
$3360 \div 2 = 1680$ eyes on each shaft.
$1680 \div 20 = 84$ biers on each shaft.

Example 3.—A fine fabric has to be made with 120 ends per inch, 36 inches wide. Harness eyes to be spread 38 inches. Use four harness shafts.

How many eyes on each shaft? How many biers on each shaft?

120×36=4320 ends in warp, without selvage ends.

4320÷4=1080 eyes on each shaft.

1080÷20=54 biers on each shaft.

Frequently a fabric has to be made in which the number of ends in fabric are less than the number of eyes on harness shafts. When this occurs, the extra eyes have to be left on each side of the harness.

Example 4.—A set of two harness contains 96¼ biers on 40 inches on each shaft. The warp to be drawn through this harness has 3744 ends.

How many eyes will have to be left over and how left over?

96¼×20=1925 eyes on each shaft.

3744÷2=1872 ends to be drawn through each shaft.

1925−1872=53 eyes to be cast out or left over.

53÷2=26 eyes on one side, 27 eyes on the other to be left out.

When a mill is making only one or two grades of standard goods there is little difficulty in keeping a supply of harness shafts on hand. In mills that make a variety of styles it sometimes happens that when an order is received for a fabric of a certain construction, the correct counts of harness are not on hand and will have to be ordered. Often, to save time, an old set of harness can be used until the new harness shafts are ready. This can only be done when there is a smaller number of ends in the new cloth than there are harness eyes in the old harness. If there are more ends in the new cloth than in the old cloth, new harness shafts will have to be obtained.

When using an old set of harness shafts in which there are more eyes than there are ends in the new cloth, the extra eyes will have to be left over at different points across the harness. It is not advisable to leave too many empty eyes at one place.

Example 5.—A new cloth has to be made with 1792 ends, the harness eyes to be spread 30 inches. The old harness to be used has 1104 eyes on 30 inches, on each shaft. Two harness shafts used.

How many harness eyes will have to be left over? How will they be left over?

1792÷2=896 ends to be drawn through one shaft.

1104−896=208 extra eyes to be left over on each shaft.

208÷30=6.93 or 7 eyes left over per inch on each shaft.

Example 6.—A fabric has been made with 1542 ends. Harness eyes for same spread 30 inches. A new fabric is required with 1404 ends to be made on same harness. Two harness shafts.

How many eyes will be left over on each shaft? How left over?

1542−1404=138 eyes to be left over.

138÷2=69 eyes to be left over on each shaft.

69÷30=2.3 eyes to be left over per inch; or 7 every three inches; or 2-2-3 eyes per inch on each shaft.

Example 7.—A fabric has to be made with 2520 ends, harness for same to be spread 30 inches. The only available harness is a set of two shafts that has 96 biers on each shaft on 40 inches.

How many eyes will have to be left over on the width of harness used? How left over? How many biers to be left over at each end of harness shaft?

$$\frac{96\times30}{40}=72$$ biers on 30 inches on each shaft.

72×20=1440 eyes on 30 inches on each shaft.

2520÷2=1260 ends to be drawn through harness on 30 inches.

1440−1260=180 eyes to be left over on each shaft on 30 inches.

180÷30=6 eyes per inch to be left over on each shaft.

96−72=24 biers extra; 12 left over on each side of each shaft.

WIRE HEDDLES

On many kinds of plain fabrics, wire heddles are now being used. Some users of these heddles claim that they get as good results as with cotton harness with the additional advantage that they do not wear out as quickly as the cotton harness; also that they can be used on any number of ends in fabric by putting on each shaft the required number of heddles.

The calculations for wire heddles is about the same as for ordinary cotton harness, that is the number of ends in warp divided by the number harness shafts used will give the number of heddles required on each shaft.

CALCULATIONS FOR REEDS.

On all reeds there is a wide strip of steel at each end, on which the number of reed is indicated. In general there are two systems of indicating the number of reed. First, The number of dents per inch is stamped on the end of the reed. Second, the total number of dents in reed and the width of reed is stamped on the end of reed. A third method is also used, by indicating on end of reed the sley reed, that is the number of ends per inch in the reed. In ordinary work, two ends are supposed to be drawn through each dent. The selvage ends are extra on each side and are not used in calculations.

When the number of ends per inch is known and the number of ends in a dent equal, thenumber of reed can be ascertained.

Example 9.—A fabric has to be made with 1584 ends, spread 28 inches in reed. 16 extra ends added for selvage. What reed used?

1584—16=1568 ends without selvages.
1568÷28=56 ends per inch in reed.
56÷2=28 reed.

Example 9. A fabric has to be made 27 inches wide with 64 ends per inch. 30 inches in reed. Add 24 ends extra for selvage.

How many ends in warp?
What reed will be used?
64×27=1728 ends without selvages.
1728+24=1752 ends with selvages.
1728÷2=864 dents to be spread on 30 inches.
864—30=28.8 reed. Or, reed can be indicated as follows: 864—30 which means 864 dents on 30 inches.

In the production of stripe fabrics the ends are not drawn through the reed equally throughout. Some portion of the fabric may have two ends per dent, then another portion four or six ends per dent, according to the density of the stripe required or the thickness of the ends used. The following example will illustrate.

Example 10.—A warp is reeded as follows:

16 dents 2 ends in a dent equals	32 ends
4 dents 4 ends in a dent equals	16 ends
14 dents 2 ends in a dent equals	28 ends
6 dents 4 ends in a dent equals	24 ends
40 dents	100 ends

100÷40=2½ ends per inch.
Using a 20 reed, how many ends per inch 2½×20=50 ends per inch in reed.

There is always a contraction between cloth width and the width of yarn in reed. This contraction varies according to proportion of ends to pick; sizes of yarns used; weave used and other causes. For example, there is generally more contraction on plain weave than on a sateen weave because there are more intersections in plain weave than in sateen weave.

If the warp is hard twisted and the filling soft twisted the cloth will contract more in width than length.

If the filling is finer than the warp and soft, the cloth will contract more in width. Too much tension on the warp will make cloth longer and narrower in width. One method of obtaining the contraction between cloth and width in reed is to take a thread from a certain length of cloth and measure same. The difference between cloth length and length of thread represents the contraction.

Example 11.—A cloth 30 inches wide has 64 ends per inch. Width of estimated at 32 inches. What number of reed will be used?

$64 \times 30 = 1920$ ends.

$1920 \div 2 = 960$ dents.

$960 \div 32 = 30$ reed.

Still another method is to make a calculation from the sley of cloth required and use a rule that will give a sliding rate of contraction. This rule is as follows:

Rule: Deduct 1 from the sley, then from the answer subtract 5 per cent. The answer will be sley or ends per inch in reed.

Example 12.—A cloth 30 inches wide has 64 ends per inch. What number of reed will be used?

$64 - 1 = 63$.

$63 - 5\% = 59.85$ sley or ends per inch in reed.

$59.85 \div 2 = 29.92$ reed.

It will be noticed that the answers to examples 11 and 12 are practically the same. This is due to the fact that ends and picks would be about equal. This rule is not always practical, but is used frequently on average constructions because of the sliding rate which decreases as the sley increases.

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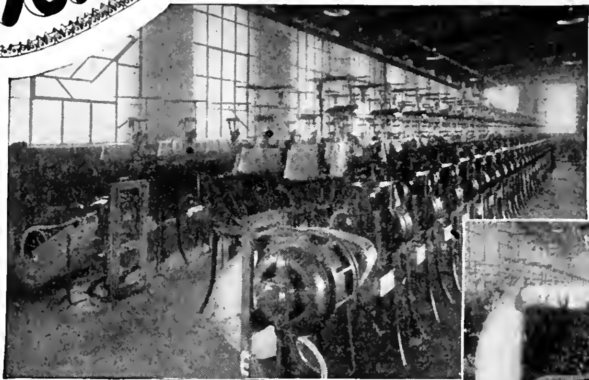
MORSE SILENT CHAIN DRIVES



Saving Valuable Space

The installation shown here admirably illustrates how a Morse Silent Chain Drive is saving space in this Southern Knitting Mill.

The motor, chain and casing are mounted on a stand and occupy a surprisingly small space on one side of the line shaft.

In addition, this method of installation has the following distinct advantages:

MAKES ROOM CLEANER
The elevated mounting precludes dust and lint adhering to base of motor.

GIVES BETTER ARC OF CONTACT
Because the small sprocket is higher than the large sprocket.

REDUCES FIRE HAZARD
By preventing oil soaked floors.

These advantages, coupled with the fact that Morse Chains transmit 98.6% of power developed, demonstrates its efficiency in providing smooth continual operation of the spindles at constant speed, with the minimum of upkeep.

Permit Morse Engineers to prepare a drive that will solve your transmission problems to your entire satisfaction.

MORSE CHAIN CO., ITHACA, N. Y.

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