COTTON LOOM FIXING

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Contents

Shedding

There are three primary motions in weaving: shedding, picking and beating-up. All other motions are auxiliary and include the let-off, let-back, take-up, filling and drop-box motions, handkerchief, multiplier, double-cylinder and jacquard motions.

The simplest form of shedding is accomplished by cams and top rolls. This arrangement is termed a positive motion; that is, the motion imparted by the cams to raise one harness operates also to depress the other harness.

A conditional motion is one in which springs are used, either to raise or lower the harness, and works in conjunction with a cam taking the place of a top roll. There is nothing very positive about a spring top. Even when the motion is provided with slides for adjusting the tension, it does not work satisfactorily and is used very little nowadays.

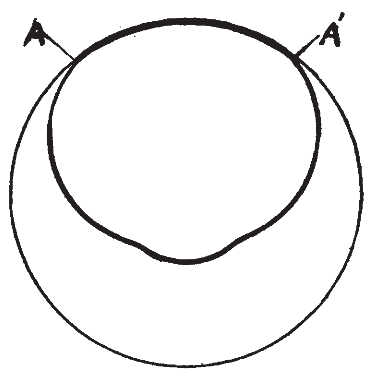


Fig. 1. Rolling Cam.

The cams ordinarily used include three types: rolling cam, Fig. 1; medium quick shed cam, Fig. 2; and a quick shed cam, Fig. 3.

In each of these illustrations the letters A A indicate the start and finish of the dwell. Fig. 4 shows the three types of cams placed on the same center for comparison.

Rolling Cam.

The first or rolling cam, shown at Fig. 1, is used for making organdies, light lawns and voiles or any other very light goods. The motion imparted to the harness by this cam results in a gradual and easy opening of the shed and is very easy on the yarn. The dwell on this cam is very short, but is long enough for making the cloths named above. The yarns used in the making of organdies, usually 100s, or light lawns, from 60s to 80s, will not stand the shock of a quick opening. While the yarn in voiles is comparatively strong this fabric is a very open texture, and to make even cloth the harness must be opened gradually.

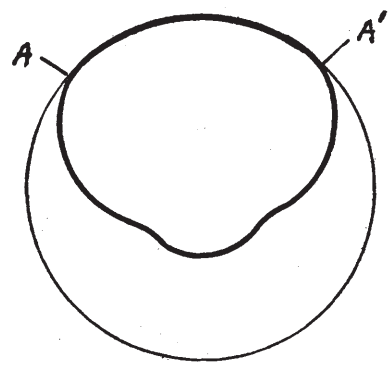


Fig. 2. Medium-Quick Cam.

Medium Shed Cam.

Fig. 2 shows a medium-quick shed cam, used for weaving medium sley cloths made of yarns from 50s down. This cam permits the harness to open more quickly, because the rise from the lowest to the highest point is more abrupt and the dwell is a little longer. This is the cam generally used for weaving a variety of plain cloths, in which the yarns are not finer than 50s or 60s.

Quick-Shed Cam.

Fig. 3 shows the quick-shed cam used for heavy corset cloths, shoe linings and heavy sheetings. The sley on these cloths is usually very heavy and a quick opening of the shed is necessary. No matter how well the yarn is sized, it is, because of unavoidable friction, in a more or less fuzzy state after leaving the drop wires and harness and before reaching the reed. At least one-half of the size is shaken off at this point.

As the pick is usually heavy on these cloths the yarn is subjected to high tension and friction for a considerable time before it reaches the fell of the cloth. This explains why the shed should be opened as quickly as possible in order to get the yarn apart before the shuttle begins its passage across the loom. The quick opening of the shed imparts a shock to the yarn, which loosens the fibers. The yarn must be strong enough to stand the shock and should not be finer than 30s.

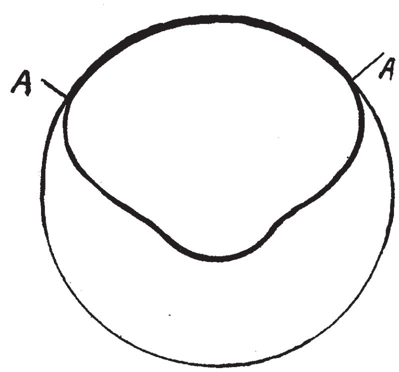


Fig. 3. Quick Cam.

The term "pause" or "dwell," as used by some writers, is misleading. Cams should not be classed by the pause or dwell. They should be classed by the speed of opening as "slow," "medium" and "quick" shed-cams. This is the practice in many New England mills.

Figs. 2 and 3 show that the dwell of the medium and quick cams is practically the same, but the peculiar shape of the quick cam, Fig. 3, from the base to the dwell, is what makes the shed open quickly. When the treadle bowl is resting on the dwell there is no movement of the harness, consequently the dwell serves merely to keep the shed open for a certain period. It is the abrupt or gradual movement of the treadle bowl, from the base of the cam to the dwell that determines the suitability of a cam for the weaving of different grades of cloth.

Nearly all mills use the first two types, slow and medium. They are usually made in split form so they can be clamped

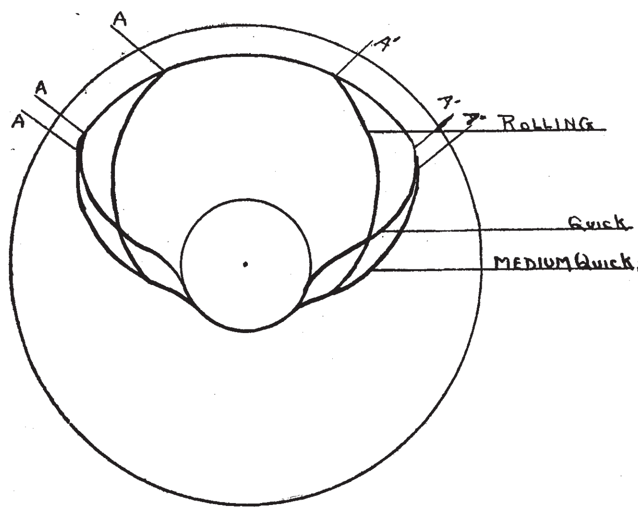


Fig. 4. Rolling, Medium and Quick Cams.

on the bottom shaft without disturbing the loom. When a great variety of plain cloths are woven, two sets of cams are usually clamped on the bottom shaft. This makes it very easy to change from one kind to another, as the fixer knows where they are when he wants to use either kind.

Picking Motion

Picking is the term applied to the motion by which the shuttle is thrown back and forth through the shed. There are so many types of picking motions a detailed description of all of them would fill a fair-sized volume. We will deal here with the two principal types in use, which are the cone or Mason pick and the batwing pick.

The Cone or Mason Pick.

This picking motion, Figs. 5, 6 and 7, is used on the majority of American looms made within the last twenty years and now being made, and has become a standard. It comprises a pick-cam A, pick-point B, cone C, pick-lever D,

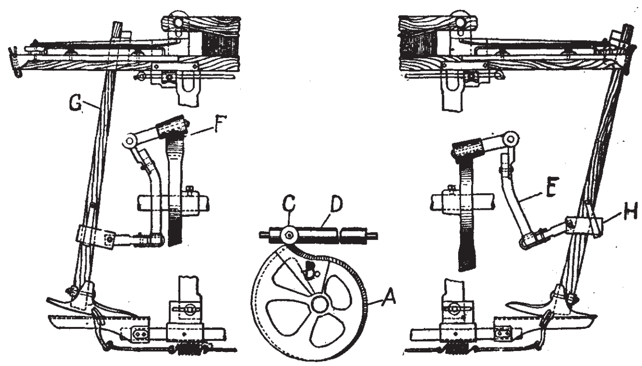


Fig. 5 **Fig. 6.** **Fig. 7**

and pick-lever arm E. Mention will also be made of lug-straps, picker sticks, rocker and rocker-foot, parallels and pickers, which are auxiliaries, but essential parts of this important motion.

The pick-point B varies very little in shape, but on some looms is bolted in a groove on the cam. On other looms it is made so that it can be moved without disturbing the cam.

When changing the time of the pick with the first construction, the set screws which fasten the cam to the shaft must be loosened and very often the thread on the screws or on the cam are stripped in the operation, which means a big job for the fixer. Sometimes the fixer will pull up a little too hard on the set screw and rip off the head of the screw. This means that the entire bottom shaft must be taken from the loom in order to drill out the broken screw.

The second construction consists in keying the cam proper on the bottom shaft and fastening the key with a big set screw, the picking-point being fastened to the cam with two bolts. The point can then be moved backward or forward without disturbing the cam. This type of cam with adjustable point is used on nearly all box looms where a lot of extra machinery is used at the end of the loom, making it rather difficult to take out a bottom shaft. It is an ideal type of a pick-cam and gives little trouble to a fixer.

The cone C on the pick-lever varies very little on different looms, but when fitted to the lever must work freely so that it will revolve freely. If the cone should bind on the shaft the pick-point will strike in one place all the time and very soon wear a hole in the cone and also in the point. The arm of the pick-lever D varies but little. It is sometimes made in two parts, that is, the lever arm E is made separate from the lever in order to admit of adjustment. If it is made of one piece, the adjustment of the lug-strap is effected by a slide, which moves up or down on the lever arm.

To Set the Pick.

There are two adjustments for the pick. The first is made to determine the throw of the picker-stick. The second is made in order to start the throw at the right time. The first will be termed "setting the lug straps" to determine the distance the stick must travel.

Setting the Lug Straps.

Turn the loom so that the picking point will be in the position shown at F, Fig. 5. The picker-stick should then be in the position shown at G, Fig. 5. If it is too far forward, let out the lug strap. If not far enough forward, take up the lug strap.

In no case must the lug strap that encircles the stick be any lower than the lug strap encircling the picking lever arm. The pull of the stick must be forward, not upward. It is good practice to have the lug-strap at least one inch higher on the stick than on the lever arm when the stick is at rest, as shown at H, Fig. 7. The pick is now set for the length of throw.

Setting the Pick for Time.

Bring the crank to full top center. Move the cam or cam-point so that the picker-stick will be just beginning to move when the crank is in this position. Then tighten up the cam or cam-point good and tight, because these parts have a heavy and violent duty to perform and need to be very solid. See that the cam is fast on the bottom shaft with the face of the cam running in the center of the cone. Start up the loom.

Now comes the period when good judgment on the part of the loom fixer is most important. There are so many factors

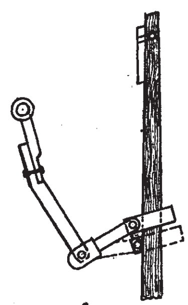


Fig. 8. Set Wrong.

that operate to retard the progress of the shuttle across the loom that the best of fixers will be deceived as to what is making the loom bang off.

If the pick has been set for position and time as explained above and the loom should bang off, more power should be applied. This is done by lowering the lug-strap on the picker stick. The fixer must not forget to lower the lug strap on the lever arm E an equal distance, because the same relative positions must be maintained. If the fixer should lower the lug strap on the picker stick and fail to lower the strap the same distance on the lever arm, a condition will obtain as shown by the dotted lines at Fig. 8. This would change the throw of the stick. If, however, the lug strap is lowered on the lever arm also, the stick will be drawn in farther and make up for the distance lost by lowering the strap on the picker stick alone.

If the loom still continues to bang off, it is well for the fixer to look the loom over very carefully. When the shuttle leaves the picker it is traveling at its greatest speed and the slightest deviation from a straight course across the loom will result in retarding the progress of the shuttle, causing the loom to bang off. A weak picker stick, although it may appear to be sound, will hold the shuttle back. A reed out of line with the back of the shuttle box, the shed being too high above the race board, the race plate in the box not being in line with the race plate on the lay, any of these faults may cause a loom to bang off.

Testing Picker Sticks.

The only way to determine whether a picker stick is weak is to bring the loom to full stop center, get a firm grip on the top of the stick just above the picker and then push back hard on the lay. In this position the lug strap will pull hard on the picker stick, and if the stick should bend too much, the wood is either green or weak, which are common faults in picker-sticks. The remedy is a new stick, but the fixer must not forget to break the weak stick. If kept around the bench it is liable to be used again.

Controlling the Shuttle.

When entering the shed a shuttle is traveling at its greatest speed. If the shed is too high above the race-board, the shuttle will be deflected upwards, and if the shed is very light the shuttle will fly out. Under these conditions it is clear that it is not a lack of power which makes the shuttle fly out and the loom bang off. If the shed is heavy the shuttle will be deflected, but the weight of the shed will keep it down.

The contact with the yarn will retard the progress of the shuttle and very often it will ride over a few threads of the top shed when it is deflected upwards. If the loom continues to run under these conditions the cloth will be full of small filling skips not very noticeable in heavy grey goods, but very distinct in the finished cloth, particularly if the cloth is mercerized in the piece.

Frequently the number plate on the end of the reed gets bent and presents an obstruction just as the shuttle is entering the shed. This tends to throw the shuttle out towards the weaver, a very dangerous condition, which has caused serious injury to weavers. Shuttle guards are of little use under these conditions. If the shuttle should continue to run with a bent plate on the reed, the tendency is for it to strike the selvage. As this part of the warp is already under the greatest strain the yarn will become frayed and broken before it is woven into the cloth.

Sometimes the race-plate in the shuttle-box will not be in line with the race plate on the loom. Do not use a short straight-edge to line up the two plates. The straight-edge should be long enough to reach from one end of the lay to the other. When using a short straight-edge the fixer is liable

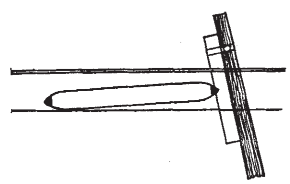


Fig. 9. Wrong Position.

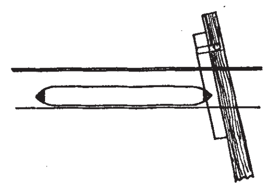


Fig. 10. Right Position.

to get the part of the box plate which is next to the plate on the lay exactly in line, while the part of the box plate at the end of the lay is higher or lower. If the straight-edge is not long enough the fixer is liable to be deceived. The only remedy for a faulty race plate is to take the lay to the carpenter shop where a good job of repairing can be done.

Another and very frequent cause of banging-off is the shuttle rising too high in the box before being delivered. Fig. 9 shows the wrong position of the shuttle. Fig. 10 shows the right position. If a shuttle is constantly flying out the fixer will be prompted to put more "rise" on the picker, which in most cases makes a bad matter worse. A shuttle should finish as it started, perfectly level, and should remain level during the progress of the throw. This condition can be maintained on a drop-box loom or on an English plain loom, where the shuttle runs on a spindle, because the course of the picker is controlled by the spindle on which it runs and not by the picker stick.

In the case we are considering, however, the picker stick acts only as a driver on the single-box or plain loom. The picker is fastened to and is controlled entirely by the picker stick, so that any rise of the stick means a rise of the picker. As the shuttle is in contact with the picker until the pick is finished, it will rise in the box. As the shuttle rises it is pressed against the top of the back side of the box, where there is a projection or lip. This pressure acts as a brake and not only retards the shuttle, but causes undue wear on the top, back side of the shuttle. It also has a tendency to cause the shuttle to rock and fly out, because the end of the shuttle which is raised from the race board by the action

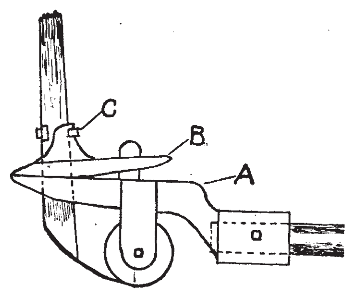


Fig. 11. Rocker-Foot and Rocker.

of the picker will fall suddenly after leaving the picker, causing a rocking motion until steadied by the shed.

Rocker-Foot and Rocker.

In order to prevent an excessive rise of the picker, the rocker which holds the stick was first made with a curved surface so that the stick would not rise as it was brought forward. On account of the wear and tear of the rocker-foot or rocker-support, no matter how accurate the rocker was made, it was only a matter of time before the rocker-foot wore out, permitting the stick to stand at a greater angle. When it was drawn forward by the lug strap under these conditions, the rise was excessive. This made it necessary to use an adjusting device called the "parallel," which is a piece of iron that lies between the stick and the rocker. By adjusting this parallel the angle of the stick can be changed, thus changing its rise or fall.

Fig. 11 will throw some light on the operation of this important auxiliary of the picking motion, the rocker-foot and rocker. The rocker-foot A is level. The rocker B is curved. Note the adjusting screw C. By means of this screw the parallel that lies between the stick and rocker can be adjusted to any reasonable angle, thereby controlling the rise and fall of the picker.

The wooden plug formed in the base of the rocker-foot is used to avoid making a new rocker-foot when it becomes worn by a little motion of the parallel. These plugs, made of hard wood well soaked in oil, are cheap and easy to replace. Iron plugs have been tried, but, because of the tendency to work loose, have not proved very satisfactory. To get good results everything connected with the rocker must be firm and tight.

Care of Friction Pulleys.

Friction pulleys are used on some looms. If these get oily, they will slip, causing the loom to bang off. The picking motion is often blamed for what is caused by oily or improperly set friction pulleys. The only remedy for a slipping friction is to clean the leather facing, which must be kept dry all the time.

Protector Fingers.

The improper setting of the protector fingers causes the loom to bang off, but not in such a violent manner as is the case when the shuttle fails to reach the other box. Very often a weaver will notify the fixer that the loom is stopping, when as a matter of fact the loom is really banging off, but in a gradual manner. The dagger on the protector-rod will be tipping the knock-off lever and every one of these tips will move the knock-off lever slightly, which in turn moves the starting handle from its slot. After a while the handle will slip off and lead the weaver to believe, and rightly, that the loom has been stopped by some other means than the picking-motion.

Frequently when the fixer comes to the loom he will lay the blame for stopping on the picking-motion. By placing the finger on the end of the knock-off lever, the fixer can determine if the dagger is touching the bunter as the lay comes forward. He may attribute this constant tipping to a weak pick when as a matter of fact in nearly all cases the cause is the imperfect opening or setting of the protector-rod fingers, which are operated by the action of the binder when opening.

The Protector Rod.

While the protector rod and its parts have no direct bearing on the picking motion, they are so closely related to that important motion that they may well be considered at this point. Nearly all fixers know what the purpose of the protector rod is, but many fixers do not know how to set it properly. If the protector rod could be eliminated, loom fixing would be one long, pleasant dream.

But the protector rod is there to protect and the dagger must be long enough so that there will be no warp breaks when a loom stops suddenly with the shuttle in the shed.

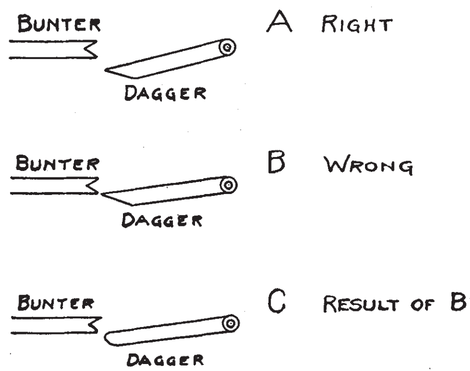


Fig. 12. Right and Wrong Positions of Dagger.

When the shuttle reaches the extreme end of the shuttle-box the dagger must clear the bunter with a good margin.

Many fixers make the mistake of not giving the binder enough opening. Under no circumstances must the binder be open for less than ¾ inch when the point of the dagger is passing the bunter. By allowing this distance or more the fixer provides for a slipping belt, which under certain atmospheric conditions is found in every weave room and has a tendency to make the shuttle a little late in its passage across the loom.

If the dagger is allowed to keep on touching the end of the bunter, it will round off the end of the dagger and sometimes the end of the bunter also, causing the condition shown at C, Fig. 12. If a lug-strap should break or the shuttle remain in the shed when the lay is approaching the front center, the rounded end of the dagger will slip over the worn lip of the bunter and a bad warp smash for the entire length of the shuttle is the result.

The dagger should pass the bunter in the position shown at

A, Fig. 12. B, Fig. 12, shows the wrong position. C, Fig. 12, shows the condition of the dagger and the under lip of the bunter after running under the conditions shown at B.

Another fault, which tends to make the binder open slowly and which in return will retard the speed of the dagger in tipping out of the way of the bunter, is the pressure exerted by the spring on the protector rod. The purpose of this spring is to bring the protector fingers back into place after the shuttle has left the box. Many fixers have the mistaken idea that this spring should be used for a shuttle check. This is not so. Any pressure exerted at the extreme front end of the binder is equal to ten times the pressure exerted in the middle of the binder. The binder spring is enough for a check. A tight spring on the protector rod often results in worn dagger ends and bunter lips, causing the loom to bang off by exerting undue pressure in the wrong place.

The Batwing Pick-Motion.

This type of pick-motion gives a snappier and more powerful pick than that given by the Mason or cone pick. When the shuttle travels a long distance, as on wide sheeting looms, a snappy, strong pick is necessary in order to get the shuttle across the loom in time. The reason why this type of pick is used on pick and pick looms is that the two sticks come forward at the same time and after the pick is delivered the picking-ball immediately leaves the picking shoe, permitting the sticks to fall back to the end of the shuttle box. Figs. 13, 14, 15, 16 and 17 give a good idea of the construction and operation of the batwing motion.

The timing of the batwing pick does not differ from that of the Mason pick. The picking-ball E, Fig. 15, takes the place of the picking-point on the Mason pick-cam. The shoe or batwing B takes the place of the cone on the Mason pick. The roller E must be set by the slot so that it will not strike the shoe or batwing below the center. The shoe must be set slightly back of the center of the bottom shaft, that is, the point on the shoe must be used as a guide, working from the back girt of the loom and moving towards the bottom shaft. The point of the shoe must not pass the center of the bottom shaft. The nearer the point comes to the center of the shaft, the harsher is the pick.

The best results are obtained by setting the shoe so that the ball will rest on the extreme point when the casting that carries the ball is a little past the perpendicular line. The farther the shoe is moved towards the rear the weaker is the pick, for the reason that when the picking-ball has passed the perpendicular line, the movement is then upwards and not directly forward. The moment the picking-ball

Fig. 14.

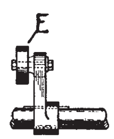


Fig. 15.

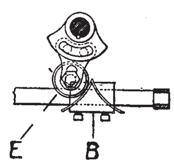
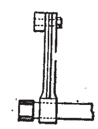
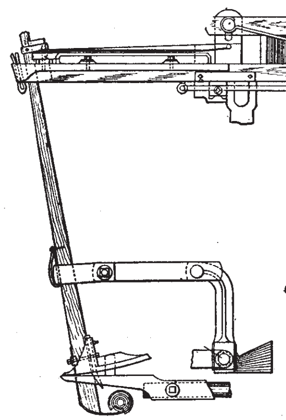


Fig. 16.





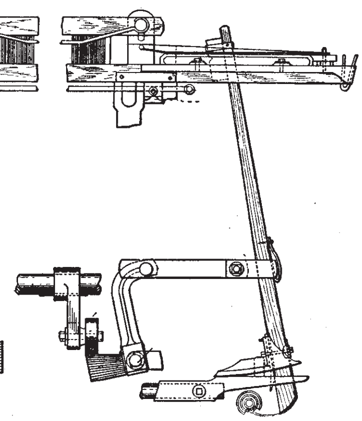


Fig. 13. Bat-Wing Pick-Motion. Fig. 17.

passes the perpendicular the power of the pick is gone. This picking-motion is easily adjusted, but is too powerful for narrow looms.

Beating Up.

This is the operation by which the filling, after being inserted by the shuttle, is beaten into the cloth. This beating-up motion is very important in making even cloth. The different types of cams to use for different kinds of cloth have already been considered. We must now deal with the setting of the cams to get the best results in beating-up the filling after the cams have formed the shed and the picking motion has inserted the pick.

On voiles, organdies or light muslins the shed should be closed on the pick when the latter is not more than ½ inch from the cloth; that is, the harness should be level and ready to make a new shed at this point. With this setting the pick is inserted easily. When the harness come together and the warp yarn closes on the pick, they immediately begin to make another shed. As the harness separate for the new shed the warp yarn, already crossed over the pick to be beaten up, gets still tighter. If the filling is very fine and the pick light, it is then a hard matter to beat up the filling to its proper place. This explains why the reed should be as close as possible to the fell of the cloth when the yarn closes on a pick of filling. The pick is then beaten in very easily and, what is more important, is properly placed so the face of the cloth is even. If the distance between the reed and fell of the cloth when the harness close could be kept at ½ inch or less for heavy cloths, it would save both the yarn and the loom. A loom runs better and with less friction on the yarn with this setting. There are, however, several reasons why this setting cannot be used on heavy cloths.

There is little difficulty in separating the yarn to make a new shed on organdies or voiles. The sley on organdies runs from 72 to 80 with 80s to 100s warp. On voiles the sley is about 60 with 56 picks. A distance of ½ inch from front center to top center is not very great, but is enough to permit the shed to open for the filling pick. As the shed has just begun to open when the reed strikes the fell of the cloth, this condition helps to place the pick in a proper position, because, when the harness are opening, the tendency is to draw the cloth towards the reed.

On heavy sley cloths it is more difficult to get the yarn apart when making a new shed. It is best, therefore, to have the harness close on the pick when the crank is on full bottom center. As the lay leaves the bottom center the harness immediately begin to open for a new shed. This is termed early closing and opening of shed and a greater distance has to be traversed before the pick is delivered. The time consumed in traveling the greater distance gives the warp yarn time to separate, so that when the reed reaches the cloth the new shed is open and the shock of the reed striking the fell of the cloth helps to shake apart any threads which might be sticking together.

Under these conditions the pick is inserted more easily, but the warp and filling are subjected to more friction because the average distance the filling has to be pushed is about 2½ inches. The greatest distance is always on the side where the strain on the yarn is greatest. As a result the filling is frequently weakened to such a degree that after it is inserted in the cloth it will crack or break about 2 inches from the selvage. This is caused by the cloth bending or contracting as it is drawn down to the cloth-roll.

When weaving heavy sley and pick cloths, the yarn must be held very tight. When the shed is opening the fell of the cloth is drawn towards the reed. If the cams are timed so that the shed is about half open as the reed strikes the cloth, the cloth will be beaten back, with the result that it will belly out under the impact of the reed. After the reed has passed, the cloth appears to be running slack, when as a matter of fact, it is being driven off the sand roll. It is slipping instead of being taken up. When this condition exists on a loom weaving heavy cloths, it will be found that the cams are set too late and that the filling is being beaten up in a moving shed.

"Twoy" Cloth.

While on the subject of beating-up and timing sheds, it is well to call attention to a very aggravating difficulty that often arises when weaving voiles, scrims, hospital bandages or any other light fabric, causing what is termed "twoy" cloth. Voiles and scrims are reeded 1 end in a dent. The filling threads must be inserted as evenly as the warp, but frequently the picks bunch together in pairs. Two picks will lie close to each other in the cloth and there will be a noticeable gap between the next two picks.

To overcome this fault some mills have recourse to a take-up motion which takes up every pick. While this helps a little it does not remedy the fault entirely. It is not a matter of take-up or let-off. The fault comes from uneven shedding, one harness rising higher than the other as the harness open. The tendency then is to draw the cloth towards the reed. The wider open the harness the more pronounced is this tendency. The wider the shed, the farther the pick will be driven in.

If one shed is a little higher than the other, the pick is driven well into the cloth, but on the next pick when the shed is lower, the pick will not be carried so far. As a result there will be quite a distance between the two picks. The lower shed does not draw the cloth as near the reed as the first or higher shed. We have now inserted two picks, the first with a high shed, and the second with a low shed. The third pick will be inserted with the high shed open. This pick will be driven well into the cloth and come almost in contact with the second pick that was not so well placed. As a result the second and third picks will lie close together, while the next or fourth pick inserted in the low shed will lie well away from the second and third picks.

It is very easy to fix a loom that is making "twoy" cloth. Either raise one harness or lower the other. Even cloth on voiles or scrims can then be made regardless of whether the take-up is working every two picks or not. Sometimes the "twoy" appearance will be on only one side of the piece. This means that one harness is lower than the other on that side.

The Warp Line.

This line depends on the relative positions of the whip roll or back rest W and the breast beam B, Figs. 18, 19 and 20. While it has no direct bearing on the beating-up of the pick, its influence is felt in the easing-up of the shuttle in its passage across the loom, also in the improved appearance of the face of the cloth.

Warp line for Heavy Sley and Pick. The warp of heavy sley cloths must be held very tight. This has a tendency to pinch the shuttle, because the shed is triangular and the body of the shuttle is square. Fig. 18 shows how the shut-

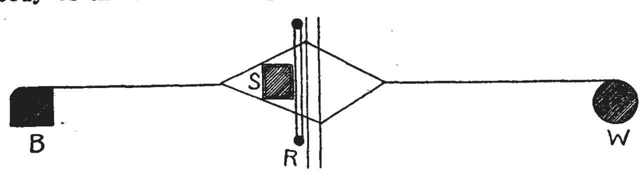


Fig. 18. Shuttle Pinched by the Warp.

tle is pinched when the warp line is straight and both sheds are under the same strain.

To overcome this pinching effect it is good practice to raise the whip roll so as to bring the warp in the position shown by the dotted line in Fig. 19. When the whip roll is raised the shed in going down must travel a greater distance

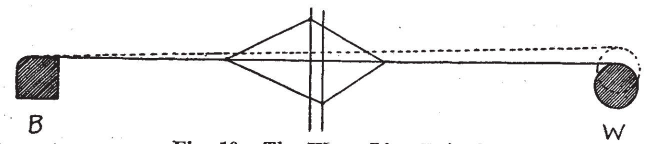


Fig. 19. The Warp Line Raised.

below the dotted line, which is the new warp line made by raising the whip roll. As this shed rises the yarn at the top

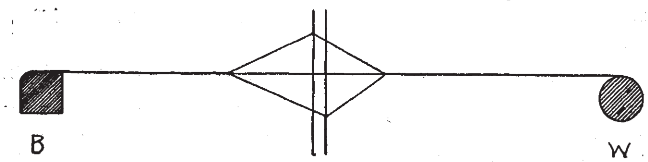


Fig. 20. Warp Line for Fine Yarn.

is slacker than that at the bottom, which makes the passage of the shuttle easier. Heavy sley cloths furnish their own cover. The object in raising the whip roll from a straight line is to ease up on the shuttle.

Warp line for Low Sley and Pick. To get cover on low sley and pick cloths the whip roll must be raised as shown by the dotted line at Fig. 19. This makes the yarn at the bottom slack when it reaches the center to interlace the pick. As a result the warp threads are woven into the cloth in more or less irregular fashion, preventing the reedy appearance that is always noticeable when the warp line is perfectly straight. The whip roll must not be raised when weaving yarns finer than 40s, because that causes too much strain on the yarn at the bottom.

When weaving low grade cloths, such as flannelettes, with 30s or 40s warp and 10s to 20s soft twist filling, about 48x48, it is good practice to raise the whip roll out of a straight line. Flannelettes or any kind of cheap outing flannel are napped and the better cover obtained during the weaving process contributes to a better finish.

Warp Line for Fine Yarn. Fig. 20 shows the right warp line for 50s warp and finer. The strain at both top and bottom of the shed is the same, and the ends on both sheds are held straight and firm in the reed when the pick is being beaten up.

Let-Off Motions

There has been a great variety of let-off motions in use since the power-loom was invented, but up to the present time they have narrowed down to the friction and Bartlett motions, the latter being a semi-mechanical motion which is dependent on springs to operate the mechanical parts.

When using the friction let-off it is possible to pull forward the warp without moving the harness, because the warp is held by the chain that it wrapped once of twice, according to the tension required, around the beam head. On the semi-

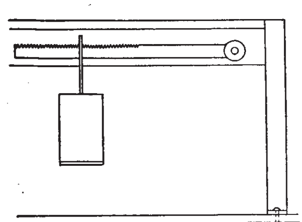


Fig. 21.

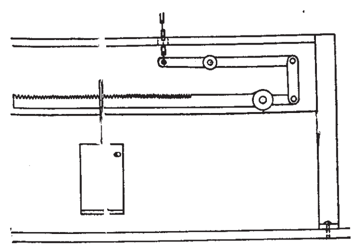


Fig. 22.

mechanical type the initial motion is imparted to the springs, then to the mechanical parts, by the motion of the harness.

Direct Friction Let Off.

Fig. 21 shows the simplest type of a direct friction let-off in use. The only adjustment required is the moving of the weight on the lever. For medium weight cloths the chain is wrapped around the beam-head twice; for light weight cloths, once.

Compound Friction Let-Off.

This type is used for the weaving of heavy cloths when a semi-mechanical let-off is not available. Fig. 22 shows how the extra leverage is obtained. This let-off is built on the principle of the block and tackle, the pull being indirect.

The Semi-Mechanical Let-Off.

This let-off, known as the Bartlett, is shown at Fig. 23. Nearly all modern looms are equipped with this let-off. It is an excellent motion for medium and heavy cloths, but is not suitable for cloths in which there are not more than 40 picks per inch. When the yarn on the beam gets low the motion is unable to let off fast enough for low pick cloths. The gear which meshes with the gear on the beam-head must then be

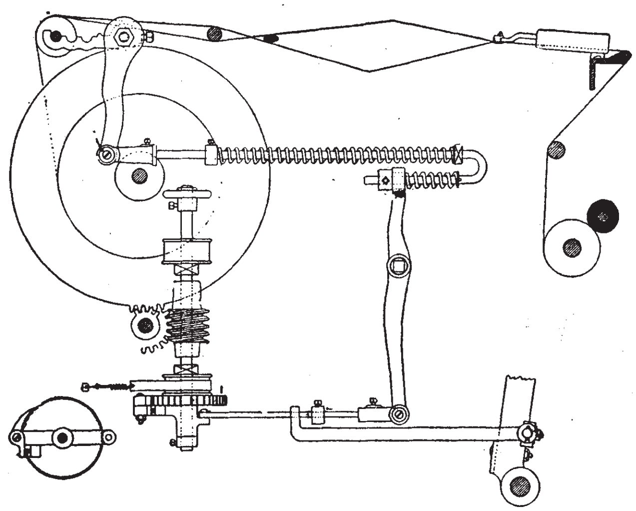


Fig. 23. The Bartlett Let-Off.

disconnected and a friction lever let-off will have to be used for the remainder of the warp.

The Bartlett let-off is easily adjusted and not liable to get out of order. Nearly all cotton weaving mills have a friction let-off attached to looms equipped with the Bartlett motion so that little time is lost if the loom should be changed from heavy to light goods. When running very heavy cloths it is good practice to use the friction let-off with the Bartlett motion to equalize the strain and prevent breakage of parts. The two motions work well together.

The Roper Let-Off.

This is the most up-to-date let-off motion in use to-day. It serves the double purpose of releasing the warp and regulating the tension from the full warp to the last wrap of yarn on the beam. These results are accomplished automatically. Every fixer knows that as the diameter of the yarn on a loom beam decreases, less friction on the beam is required to produce the same tension on the warp yarn. This regulation of the friction must be made either by the weaver or the fixer during the weaving of the warp.

Some weavers will run their warps tight, while others keep them slack. The tighter a warp is run, the more the cloth will contract in width. The slacker a warp is run, the

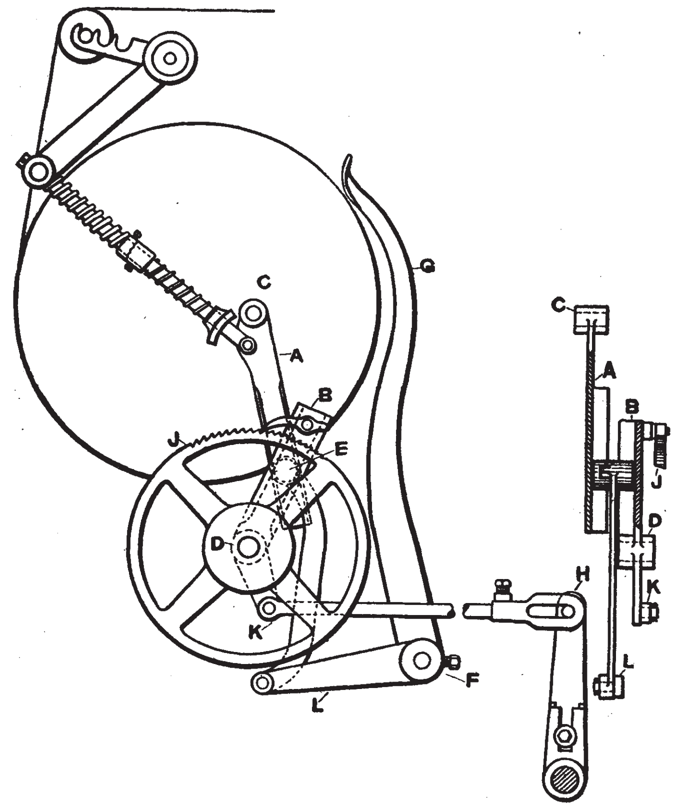


Fig. 24. The Roper Let-Off.

less the shrinkage in width. When woven slack some cloths have a cockled appearance, which buyers do not want. The Roper let-off is designed to overcome the irregularities in width and reduce the cockled appearance of the cloth. When the fixer puts a warp into the loom he regulates the tension.

It is not necessary to adjust the motion for tension after the first setting. The parts of this motion which makes it automatic are the levers A and B, which are centered at C and D. Both of these levers are connected by another lever E which is adjustable at F, Fig. 24.

The lever B carries a pawl at the top and is connected at the bottom with a rod E, the other end of which has a slot that fits over a stud H on the end of an upright bracket fast to the rocker shaft. Another lever G fastened on shaft F bears against the yarn on the loom beam.

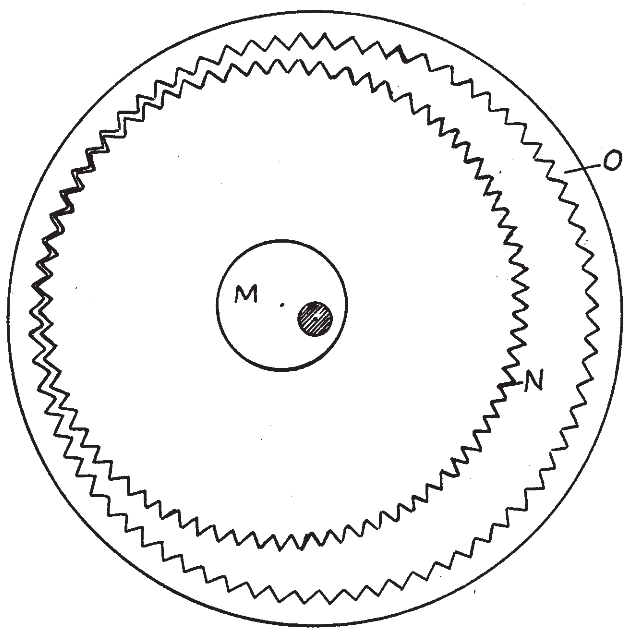


Fig. 24A. The Differential on Roper Let-Off.

When the loom is running and the take-up motion winds the cloth on the roll the tension of the yarn is increased. This forces the whip roll and the rod with the springs in a downward direction. As the spring carrying the rod connects with A, and as A connects with B, the pawl carried with B is forced back on the teeth of the ratchet gear.

The lever B being centered at D, its lower part moves in the opposite direction to that of the pawl. The lower end of the lever B, being fastened to the rod K is oscillated by the moving stud H. This moves the pawl located on the upper part of the lever, which in turn moves the large racnet gear J. As the shaft on which the large sprocket is fastened carries gears that connect with the beam head, the beam is turned and the tension on the yarn is reduced. As the diameter of the warp on the beam is reduced, the long lever G follows the yarn downward and by the connections at F and E, the leverage is changed by the lowering of E. The motion at H does not change, consequently the lowering of E gives B a greater sweep and moves the ratchet a greater distance. This in turn moves the loom beam more rapidly.

When a new warp is placed in the loom the tension is adjusted by loosening the set screw at F and raising the lever L, which in turn raises the lever E. This adjustment increases the tension as required for a full warp. If a partly filled beam is placed in the loom the tension is decreased by lowering the lever L. After it is once set the Roper let-off requires no further attention unless the loom is changed to heavier or lighter goods. Then it is necessary to tighten or loosen the controlling spring to suit the class of work.

The Roper let-off has passed the experimental stage and is working successfully on all grades of cloth. It is easily adjusted and gives the fixer very little trouble. The ratchet gear J is not fastened to the shaft which carries the gear that turns the loom beam. It runs loose on this shaft, but carries an eccentric, Fig. 24A, on the surface of which is a 40-tooth gear N. This gear does not revolve independently, but is part of the eccentric. It is always in mesh with the 46-tooth gear. It makes 7 2/3 revolutions to one revolution of the 46-tooth gear. These gears are connected and driven as described for the purpose of making the let-off more uniform. This is accomplished by reducing the amount of warp that would be delivered by one tooth of the ratchet if it were connected directly to the gear which turns the loom beam.

The Brunelle Let-Off.

The Brunelle friction let-off is giving general satisfaction. The writer has had considerable experience with this let-off and has found it suited to all grades of cloth. It is very compact, easy to adjust and convenient for the weaver. There are no unsightly weights for the weaver to stumble over. Two different springs make the Brunelle let-off suitable for all fabrics.

One feature of this let-off which should appeal to overseers and loom fixers is the locking device, by which the weaver is prevented from changing the tension on the cloth and causing irregular widths and injury to the fabric. The tension can be changed only by the use of a spanner wrench of special design, which is given to the loom fixer. Weavers in-

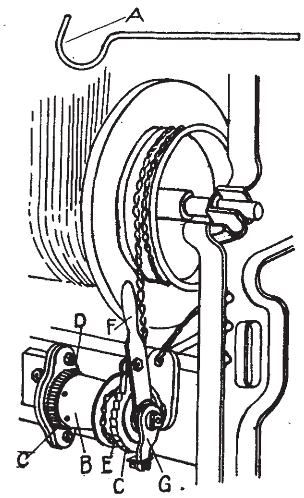


Fig. 25. The Brunelle Let-Off.

variably want to weave the cloth as slack as possible in order to let off the warp faster.

Fig. 25 shows a Brunelle let-off attached to a loom. A is the spanner wrench for changing the tension of the yarn. This wrench encircles the barrel B which is a part of the sprocket C. An upward pull on the wrench releases the pawl D. Pulling up tightens the spring and letting out loosens it. The teeth in the sprocket are quite close to each other so that the tension on the spring inside the barrel B can be adjusted very closely. One end of the spring is fastened to the inside of the sprocket C, and the other end is fastened to the flange E, which is not part of the barrel D. The friction chain is fastened to this flange.

When the weaver wants to pull back the warp after picking out, all that is required is to pull down on the handle F, the pawl on this handle pushing down flange E by means of the sprocket which is part of the flange. This releases the friction chain and permits the weaver to push the warp beam forward or back. After the yarn is under tension again the handle F can be pushed back out of the way. This handle F is loose on the shaft. At its base can be seen another pawl, which is apparently attached to the handle. This pawl is in fact attached to the arm G, which is fastened firmly to the shaft that supports the barrel. This is a very good feature, as it permits the warp beam to remain loose when desired.

If the fixer desires to pull the yarn through the harness and reed while he is in front of the loom, all that is necessary is to push down on the handle F and engage the pawl located on the arm G. There is no violent motion while the beam is being held by this let-off, hence the lessened liability for breakage.

Take-Up Motions

As soon as the shed opens the warp comes forward. The increased tension placed on the yarn by the opening of the shed causes the warp beam to turn and let off the warp. As the lay comes toward the front center the amount of warp let-off is taken up by the take-up motion.

The four principal types of take-up motions are:

(1) Positive motion, driven by bevel gears on bottom shaft of the loom.

(2) Eccentric and pawl take-up, driven by an eccentric on the end of either the bottom shaft or top shaft of the loom.

(3) Lay driven take-up, attached to the lay sword.

(4) The rocker-shaft driven take-up.

The Positive Take-Up.

Fig. 26 shows the end and front of the positive take-up. A is a bevel gear located on the end of the bottom shaft of the

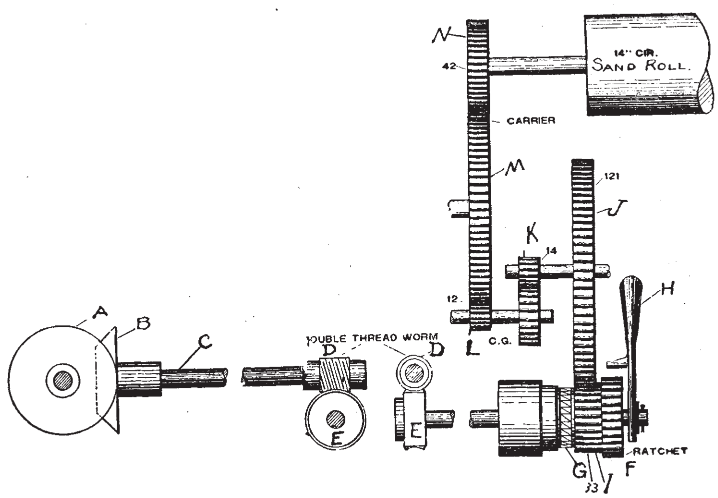


Fig. 26. Positive Take-Up.

loom. B is a bevel gear on the shaft C. D is the worm which drives the gear E. This gear is also shown in the front and is connected with the ratchet which is in turn connected with a gear by which motion is communicated to a train of gears. The figures at the side of each gear indicate the number of teeth.

G is a clutch which allows the ratchet to be disconnected from the shaft. This clutch serves two purposes:

(1) If the weaver should want to turn back the cloth for any distance this clutch can be thrown out of by placing the foot on a casting, which is not shown in the sketch. This leaves the ratchet loose on the shaft and by operating the handle H the cloth can be turned back for any distance.

(2) When the filling is exhausted a lever operated by the filling motion slide, but not shown in sketch, forces the clutch at G apart and permits the train of gears to fall back one, two or three teeth in order to prevent a thin place when starting up the loom after the new filling has been placed in the shuttle.

This type of take-up is suitable for all grades of cloth from the very lowest to the highest pick. The only part which is liable to give trouble is the worm gear D. When this worm is worn out it is well to obtain the new worm from a loom builder, as a worm-gear of this kind must be absolutely exact. If it is not exact the speed of the drive is affected and the picks per inch will vary. If the angle of the tooth of the worm-gear should be altered, which often occurs if the worm is cast, the speed of the train of gears will fluctuate, and with it the picks per inch. All worm-gears should be cut from solid stock and not cast.

The only adjustment required on a positive take-up is in the train of gears leading from the ratchet F to the sand roll. When these gears are in mesh they should turn under the slightest pressure when the clutch is disconnected at G.

Eccentric and Pawl Take-Up.

Fig. 27 shows the working parts of this type of take-up which is the one in common use on American looms. It is a very simple arrangement, has few parts and can be located on top or bottom shaft with very little change in adjustment. The illustration shows the eccentric on the bottom shaft. A is the end of the shaft on which is fastened the eccentric B. One end of the take-up pawl C is clamped to the eccentric. The other end of the take-up pawl is shaped like a ratchet-tooth reversed and lies on the ratchet D. The check pawl E swings on an adjustable stud above the ratchet. The let-back pawl F is also adjustable.

Setting Eccentric and Pawl.

It has been found by experience that the best time to take up the cloth is when the harness are coming together to change for another shed. At this time practically all the strain is removed from the warp and cloth and consequently the take-up will work easily. Move the loom until the take-

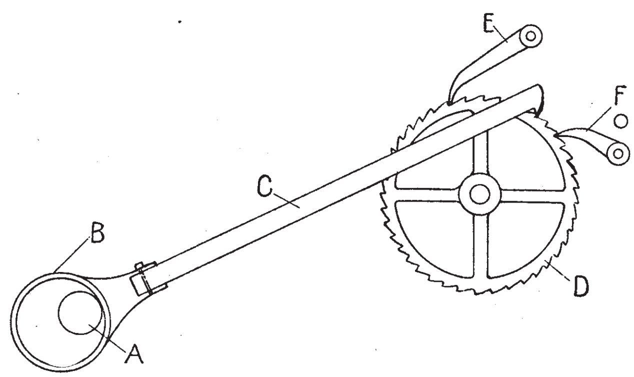


Fig. 27. Eccentric and Pawl Take-Up.

up C has reached the limit of the pull. Then set the check pawl E so that the end will lie exactly between the two teeth of the ratchet D. All the adjustments are made from a movable stud which holds the check pawl E.

The Let-Back Pawl.

No matter how good the brake on a loom is there are times when the cloth would be short 2¼ picks or even 2¾ picks. If the filling becomes exhausted just after the shuttle leaves the filling motion side, the loom will continue to run until the shuttle returns to that side, thus losing 1¼ to 1¾ picks. The lay will then have to come forward one more pick to make the filling stop motion operate. If the brake is in good condition the shuttle will come to a stop on the side opposite to the filling stop-motion. This leaves the cloth 1 to 2¾ picks short, depending on when the filling became exhausted. The let-back pawl F automatically lets back from 1 to 3 picks, according to the adjustments made by the fixer.

When the filling is exhausted there is an arrangement, not shown in the sketch, which lifts up both the pawls C and E. This is operated by the filling stop-motion slide. Because of the warp tension the ratchet D falls back, but is arrested in its backward movement by the let-back pawl F. This backward movement permits the fell of the cloth to come 1, 2 or 3 picks nearer the reed, so as to place the picks in the right place.

When the loom is started it is easy to see if the take-up is working right, for the pawl C will take up the required tooth

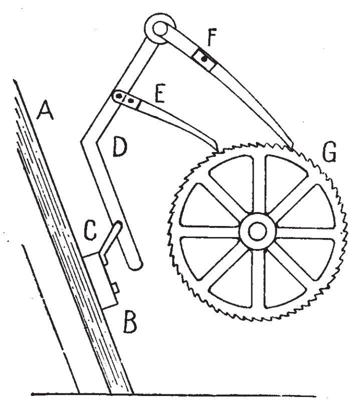


Fig. 28. Lay-Sword Take-Up.

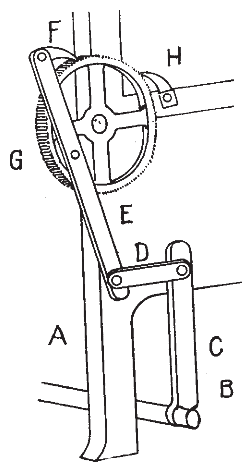


Fig. 29. Rocker-Shaft Take-Up.

of the ratchet and also ¼ tooth extra. The ratchet gear will then fall back the extra ¼ tooth and be stopped by the check pawl. On light cloths the train of gears leading to the sand roll must not be too deep in mesh or the ratchet will fail to fall back and thin places will result.

Lay-Sword Take-Up.

Fig. 28 shows the working parts of the lay-sword take-up. A is the lay-sword; B, an adjustable casting with an up and down movement. The face of the lay sword C is an extension of B and runs in the slot in D. The take-up pawl E is fastened to D. F is the check pawl. The ratchet is fastened on the shaft carrying a train of gears, not shown in the sketch. Adjustment for length of stroke is made by moving the casting B up to secure more throw, and down if less throw is required. The check pawl F is in two pieces and can be adjusted to control the ratchet when E is moving backwards. This take-up runs on the same time as the lay of the loom and cannot be adjusted for any other time.

Rocker-Shaft Take-Up.

Fig. 29 gives an idea of how the rocker-shaft take-up is operated. A is part of the loom side. B is the end of the rocker shaft on which is fastened the part C, to which is fastened D, which connects with the oscillating lever E. On the upper end of E is located the take-up pawl F, which drives the sprocket G. The check pawl H is seen resting on the right hand, upper part of the sprocket. Adjustment is made at the connecting rod D and check pawl H. Motion is imparted to the take-up pawl F through the oscillating lever E, which runs loose on the bearing as seen in the left hand side of sprocket and is fastened to a bracket on the side of the loom. Fig. 29 shows one of the large number of take-up motions operated by the rocker-shaft.

Filling Stop-Motion

The object of the filling stop-motion is to stop the loom when the filling breaks or is exhausted. The two types in use are the side and the center stop-motions. The center motion is used on looms fitted with drop-boxes on each side and will be described in connected with box looms. The stop-motion on all single-box looms and on looms with drop boxes on one side only is located on the handle side of the loom.

Fig. 30. Fig. 31.

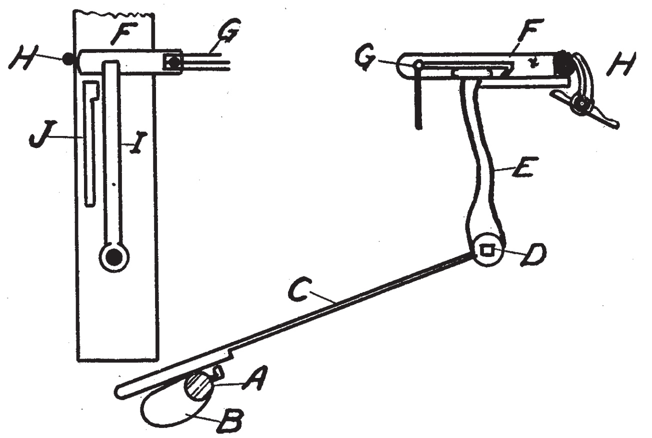


Fig. 31. Filling Stop-Motion.

The parts which make up the complete filling stop-motion are shown at Fig. 31. A is the bottom shaft of the loom. The cam B operates the lever C, which rests upon the stud D. This stud also supports lever E. F is the filling-motion slide; G, the filling-fork, which rests on a pin running across the slide. H is the lever which operates the handle knock-off. The latter is not shown in the sketch, but can be seen at the extreme left of Fig. 30. The lever I is the knock-off; J is the loom-handle slot.

Next to the picking-motion the filling stop-motion is the most difficult mechanism to adjust and time. A loom that has been running on 10s or 20s filling may be changed to 150s or single Canton 22/26 denier silk, the latter equal to 220s cotton and very wild in action. The coarse filling is heavy enough to tip the fork without using a piece of flannel for a friction, but the fine filling is not strong enough to stand the strain. The adjustment of the motion depends on setting the fork G in one position for all grades of filling and then timing the cam B for the changes made in the filling.

The best filling-fork is the one used on the Draper loom, because the striking point is in line with the fulcrum or pin on which the fork balances, Fig. 32 B. The striking-point of the other types is a considerable distance in front of the fulcrum, Fig. 32A. The Draper fork, being better balanced,

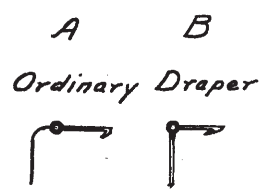


Fig. 32. Filling Fork.

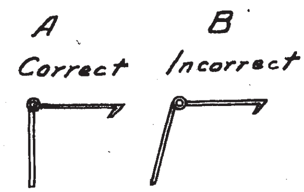


Fig. 33. Filling Fork

responds more quickly and easily under the impact of the filling and is more easily adjusted to different kinds of filling.

The other types of forks are unsatisfactory because of the lateness in rising when weaving fine filling. This explains why the average fixer forms the bad habit of pushing the fork slide forward, causing the tines of the fork to pass farther through the grate when the lay is at full front center. This setting will often fix a loom that keeps stopping on account of a tardy rise of the work, but is very hard on fine or soft filling, causing frequent breaking of the filling and thus making a bad matter worse.

Setting the Filling-Motion Fork.

A filling-fork should be set by the following method: Set the fork so that when the lay is at full front center the tines will project not more than ⅛ inch beyond the fork grate. Make sure that the tines are perpendicular. If they slant outward, the filling will slip up, reducing the force of the blow and making the fork rise slowly. If under these condition the fork should rise on time, the pressure of the filling will be exerted too near the fulcrum, and very often the filling will break under the extra pressure. When the tines are perpendicular the blow is given straight and the fork immediately begins to rise. As the tines are forced inward the pressure on the filling is reduced, because in this position the work of the fork is completed. Fig. 33 shows the right and the wrong way to bend a fork.

Timing the Stop Motion.

With the lay still at front center and the fork set for position, as described, loosen the cam B, Fig. 31, and move it forward until the top part of the lever E is fully engaged with the forward hook of the fork G. In this position the lever E is ready to pull back the slide F through the medium of the fork. Tighten the set-screw and start the loom.

If the loom should stop after the stop motion is set, do not touch the fork, which has been set for all kinds of filling, but work on the cam B, timing it for the grade of filling that is being used. If the filling is very fine or soft, the cam must be timed late, because the fork will be late in rising. If the filling is heavy or twisted hard, the cam must be timed early, because this kind of filling brings the fork up with a snap. The rising end of the fork will strike the guard, which limits the rise of the fork, and immediately snap back on the upper end of the lever E. If the cam is timed too late, the lever E will engage the fork and stop the loom.

There is no fixed rule governing the timing of the cam, but there is a very fixed rule governing the setting of the fork tines in relation to the grate which they pass through. The tines of the fork must not touch the side of the grate, especially when using silk filling, which will stand as much pulling as cotton, but is easily broken by rubbing against metal.

The tines of the fork must not touch the bottom of the slot in the lay when rising by the pressure of the filling. Many fixers are deceived by this condition. When setting a fork the loom is moved by hand and everything appears to be right, but if the rocker shaft bearing is worn the lay will be lifted by the thrust of the crank arm. With the loom running at full speed, as the filling strikes the fork and the latter begins to tip, if the bottom of the tines touch the lay, the tipping of the fork will be arrested while the pressure of the filling is being exerted, and in most cases the filling will break.

The aggravating feature of this kind of a filling break is that very often the loom will continue to run. When the filling breaks in this way the fork has been tipped sufficiently to clear the knock-off lever, and the ends of the filling will drag. If the sheds are closing early this dragging end of filling yarn after missing one pick will catch in the opposite selvage and when the shuttle passes to the stop-motion side of loom again, the filling will be fast in the shed, with a broken pick in the cloth. A weaver running six or eight looms will not see this defect at once and frequently it will pass over the breast beam out of sight. The only way to make sure that the tines are not touching the bottom of the slot is to bring the lay to a full front center, lift up the lay with one hand and tip the fork with the other hand. If the tines are touching, this is easily detected.

Center Filling Stop-Motion.

This type of filling stop motion is used on pick and pick, drop-box looms and is fitted to the center of the lay. Unlike the side motion, where the fork is tipped by the impact of the filling as the lay comes forward, the center filling-fork is controlled by a light spring and a rod. The spring controls the movement of the fork and dagger. The rod, which works on a stationary stud fastened to the lower brace of the loom, gives the necessary tipping motion to the fork. The center of the lay is recessed for a depth of about ½ inch to permit the fork tines to pass down for the full distance when the filling becomes exhausted.

This center motion is very compact and simple, but is only suitable for woolen, worsted or heavy cotton filling. If the yarn is not strong enough to resist the impact of the fork tines, it will either break or be forced through the warp yarn at the back of the cloth, causing in the latter case a pronounced filling kink.

There are not many parts to the center motion, but a high degree of skill is required to make the fine adjustments, for weaving medium sley and pick cloths. When the filling becomes exhausted, even if only ½ inch from the selvage, the loom must be made to stop on that pick. Owing to the difficulty in fixing the center stop-motion, many mills use two side motions, one on each side of the loom. This method is not very satisfactory. If the filling should become exhausted when halfway across the shed, the lay would have to move forward before the motion would function, and the loom would stop on the pick following. This would mean a broken pick if the loom was then started up. To make perfect cloth it would be necessary to turn back the pattern chain in order to come back to the place where the filling ran out. Much valuable time is wasted by this method. Timing and adjusting the boxes on this type of loom is exactly the same as on the 2 and 1, 4 and 1 or 6 and 1 box loom.

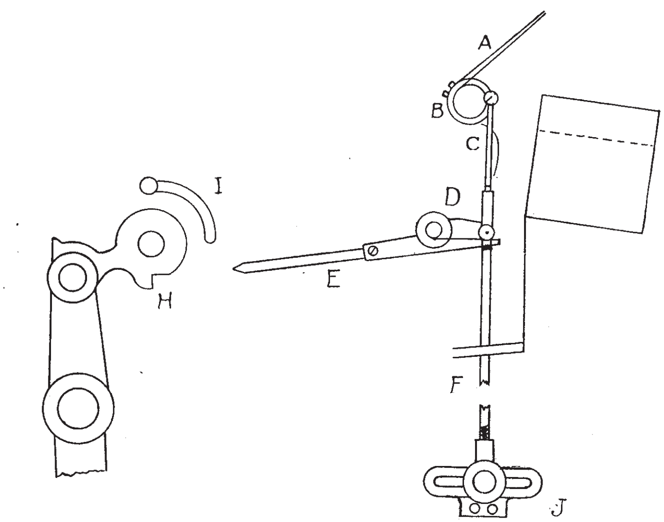


Fig. 110. Center Stop-Motion.

Fig. 110 shows a popular type of center stop motion. If properly fixed this motion will stop the loom on the pick on which the filling becomes exhausted even though the broken end of the filling extends one or two inches beyond the selvage. A indicates the fork tines; B, hub; C, tipping rod; D, control spring; E, dagger; F, control rod, which moves on stud fastened to the stationary bracket J on the lower brace of the loom; H, knock-off bunter, which is fastened to a rod connecting with shipper handle; I, shield which covers the knock-off bunter only when the shipper handle is back and the loom is stopped. This shield enables the weaver to draw the lay forward to the fell of the cloth, when the tines of fork are at the bottom of slot in the lay. The tipping rod C and the control rod F are adjustable.

Adjusting the Motion.

Move the lay so that the dagger will be in a position to strike the lip of the knock-off H. See that the fork tines are resting on the bottom of the slot in the lay. Adjust the rod F so that the end which rests under the dagger will be just clear. Move the lay to full back center. This will force the rod F upwards and the fork tines are moved to their most upward position by the tipping rod. When in this position there must be enough clearance for the shuttle. The action of the fork is timed by moving the stud in the slot in J. The fork tines must be clear for the shuttle to pass through the shed when the loom crank is between top and back center. This setting will answer for nearly all heavy fillings, but a very fine adjustment is required when using filling lighter than 10s cotton on light sley cloths.

The great difficulty in fixing the center stop motion results from the irregularity of the pick, caused by uneven speed and slipping frictions. To get the best results it is necessary that the shuttle should be traveling when the fork tines strike the filling. Unless the filling is very heavy there will be a kink on the back of the cloth. If the tines strike the filling when the shuttle is at rest and the filling is slack, or if the sley is very light, the filling will have a tendency to kink, owing to the lower resistance to the filling and fork. The only way to prevent kinks is to set the pick as late as possible.

When the pick is set late the shuttle will be moving towards the end of the box about the time the fork strikes the filling. Setting the sheds so as to close early will help to pinch the filling and hold it firmly.

The tines of the fork are made of flat steel wire much like the wire used in reeds. A round wire would help to eliminate kinks, but round wire tines can be used only on very light sley cloths. Owing to their thickness they will not pass freely through a heavy sley. Fixers on this type of loom should pay strict attention to the timing of the pick. The wrong timing of the pick is the cause of most troubles with the center filling stop motion.

Loom Temples

The temple holds the sides of the cloth in a straight line so that when the reed is beating up the filling, the wire of the reed will pass straight between the threads, and when the reed strikes the fell of the cloth there will be no undue strain or friction on the warp because of the reed striking the yarn at an angle. As the cloth is woven pick by pick, the tendency is for it to contract as it is drawn toward the cloth roll. This contraction takes place immediately after the cloth leaves the temple. The pull toward the center is from both sides and on heavy sley and pick cloths it is very pronounced.

If some means were not employed to hold the warp in a straight line at right angles to the reed, it would be impossible to weave some of the medium and heavy weight cloths. There is a tendency for the side pull to wear out the shank of the temple, as shown at Fig. 34. A temple running under such conditions holds the yarn at an angle. To do good work temples must face the reed in the position shown in Fig. 35.

Some of the finest organdies are woven without temples, but there is a small number of picks per inch and the strain on the warp is very light, just enough to keep the yarn tight. As a result there is very little side pull on the cloth. It would be better to use temples on organdies, but the texture is so fine that the cloth would be injured by the needle points of the roller.

Rubber and cork rollers have been tried in place of temples. While they do not tear the cloth, there is a tendency for the threads of warp and filling to be forced out of place as the cloth leaves the temple. The best substitute for a toothed roll is obtained by grinding off the needle points on an old roll and then covering it with very fine sand paper glued to the roll. This temple affords the only means by which tussah silk filling can be woven when the sley is very light and the weave is loose, for example a sateen or basket weave.

When weaving light pick cloths, it is not necessary to have the temple pushed toward the reed, so that it will strike the lay. The wise loom fixer will see to this, because the tendency is for the shank to wear on the sides and cause the condition shown at Fig. 34.

On the other hand, when medium or heavy weight cloths are woven the temple must be pushed well toward the reed so that the bumper will strike the lay and push back the

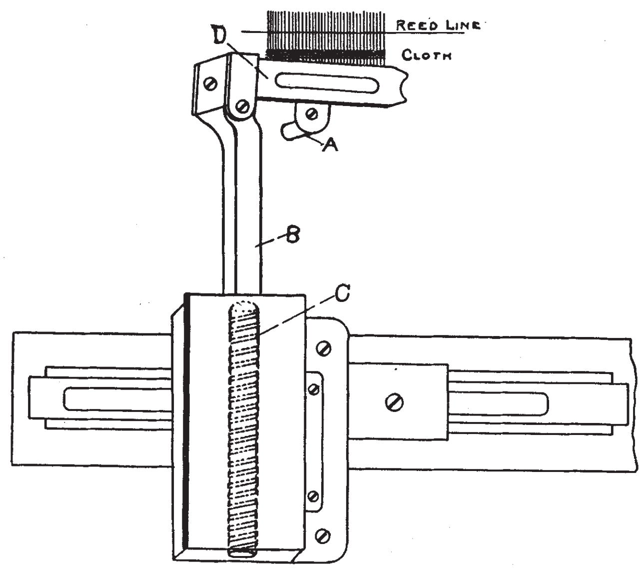


Fig. 34. Wrong Position of the Temple.

shank B. The spring C brings the shank back into place when the lay leaves the bunter. It is a good plan to tack a piece of leather on the lay, as leather has much more yielding surface than wood for the bunter to strike. The fixer should not, however, make the common mistake of putting too much leather on the lay. If the lay should strike the bunter too early the temple will be pushed away from the fell of the cloth, allowing the cloth to draw in and the warp to lie at an angle before the reed reaches the cloth. This condition of the warp and reed is shown at Fig. 36, which is a view of the temple, cloth, shed and reed. The decided slant of the yarn is seen as the reed approaches the fell of the cloth.

After the yarn has been bent by the whip-roll, chafed by the drop wires, and rubbed by the harness and reed, no matter how good the stock or sizing used, the yarn is none too strong when it approaches the cloth. If the reed is then allowed to strike the yarn at an angle, the best yarn is liable to break under the strain. Many a good warp has been re-

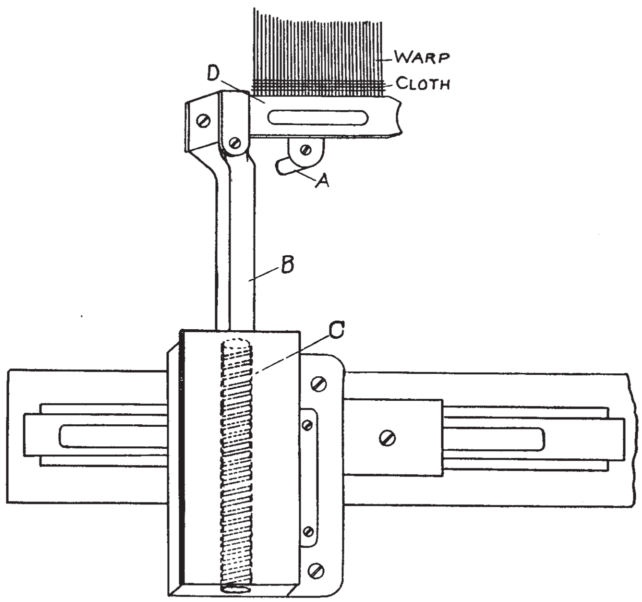


Fig. 35. Right Position of the Temple.

jected and thousands of yards of cloth spoiled because of the wrong setting of the temple.

The Dutcher temples are generally used in cotton weaving. Some have a single roller, others a double roller, but no matter how many rollers there are or how big the temple is, the main thing is to keep the warp in a straight line with the swing of the reed. That is what a temple is used for, and a single roller temple set right will do the work better than an expensive double roller set wrong,

If a temple is allowed to strike the reed it is a question of only a few minutes before the reed is ruined. The wire used in reeds is soft and will be flattened under the impact of the temple. The only remedy for a condition of this kind is a new reed, because the reed connot be fixed in the loom. If a temple should begin to strike the reed when the warp is nearly woven out, the reed on the new warp is liable to be damaged in the same way unless the fixer adjusts it properly.

A good way to avoid this trouble is to require the fixer to put a tag on the reed taken from the loom, marking on it the number of the loom from which the reed was taken. All the reeds that are taken out by the fixers should be kept in

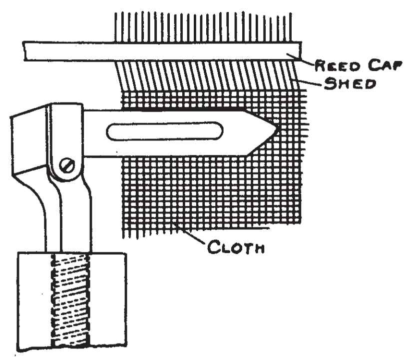


Fig. 36. When the Lay Strikes Too Early.

a certain place until inspected and either passed or thrown out. If a reed should show that it has been battered by the temple, the fixer is immediately notified and the offending temple is adjusted so as to save the new reed from being reduced to the condition of the old one. In this way serious losses caused by damaged cloth and reeds may be prevented.

There are few things more provoking to a weaver than to have the selvage breaking. A bad selvage on one loom will often hold up the production of the entire set of looms. The weaver becomes discontented and the cloth is damaged. As the remedy is easily applied, there is no reason why such a condition should obtain at any mill. Very often a reed struck by the temple will continue to run on a medium grade of cloth. After the warp is run out the battered reed may be used for a heavy grade of cloth. When drawing the warp in the reed the damaged side is brought opposite to the fell of the cloth.

If a selvage begins to chafe and break an inexperienced loom-fixer is often at a loss to know the cause of the trouble. Many old fixers have been fooled in the same way. This is another reason why the reeds should be inspected carefully as they are brought from the weave room. An inspection will not help much, however, if the inspector does not know what loom the reed came from.

Setting the Temple for Heavy Cloth.

First draw the lay to full front center and push the temple toward the reed until the bunter A, Fig. 35, touches the leather which is tacked on the lay. The cover D which lays over the rollers should be ⅛ inch from the reed. This prevents the temple from striking the reed. If light goods are to be woven it is well to draw the temple ¼ inch from the reeds with the lay at front center, but if heavy pick goods are to be woven, it is good practice to push the temple forward until the shank projects from the end of the temple from ¼ to ½ inch. In this position the temple will cover and hold the cloth until the lay comes forward and pushes it away. As the lay goes back the shank is immediately returned to position by the spring C. The right position of the temple is shown at Fig. 35.

Auxiliary Motions

A plain weave covers two picks, which makes it possible to place the cams on the bottom shaft of the loom. When weaving 3-, 4- or 5-harness cloths the speed of the cams must be changed. This is done by the use of an auxiliary shaft located back of and below the bottom shaft. The auxiliary gears and cams are set in a cradle with a bearing on each side. The entire set of cams can be put together in the order in which they are to run before being placed in the loom. It is better, however, to place everything on the shaft and set the shaft in the bearings. It is then easy to fasten

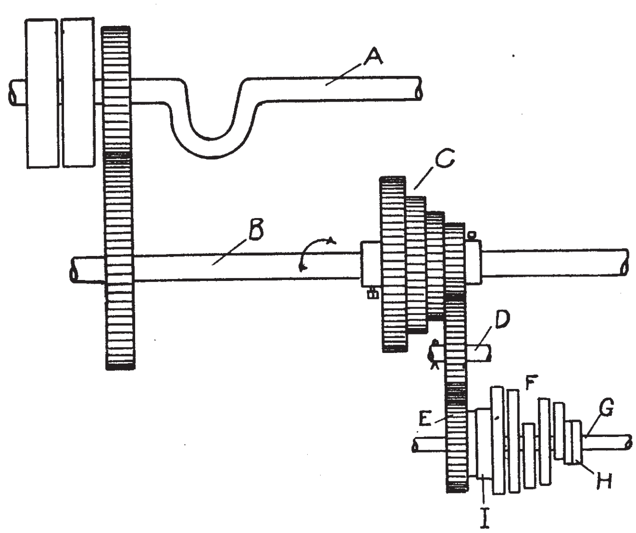


Fig. 37. Auxiliary Motion.

the cams in the required order for weaving, the only adjustment required being the timing of the cams.

Some of the earlier motions were not very satisfactory because it was necessary to move the entire shaft with the gear and cams when changing the weave. The treadle-bracket also had to be moved because placing the cams in a new position would change the leverage.

The latest auxiliary motion, Fig. 37, eliminates all these changes when changing a loom from one weave to another. A is the top or crank shaft; B, the bottom shaft; C, the change speed gears; D, the carrier gear which can be moved in a curved slot, not shown in sketch. This slot is so shaped that the carrier gear can be brought into full mesh with any speed gear. The gear on the auxiliary shaft E is the standard gear on the cam shaft. F is the set of 5-harness cams. The shaft G extends beyond the gear and cams. All that is necessary in order to change the cams is to loosen up the collar H. The cams can then be removed from the shaft and another set put in place.

Each cam is provided with five square projections on one side and recesses on the other side. The projection is just large enough to fit in the recess of the next cam. Each projection and recess corresponds to one pick. When the recessed side of one cam is engaged with the projecting side of the other cam, the two cams are locked. The disk I is provided with 5 projections. This arrangement makes it very easy to set the cams.

Setting the Cams.

For a 5-harness filling weave the cams are set as follows: Disengage the carrier D, leaving the auxiliary shaft free to turn by hand. Use the depression in No. 5 cam as a starting point. Engage this cam with the disk I in any position. Count two notches from 5 and engage No. 4 cam. Move No. 3 cam two notches from the depression of No. 4 cam and engage with No. 4. Move No. 2 cam two notches from the depression in No. 3 cam and engage with No. 3. Move No. 1 cam two notches from the depression in No. 2 cam and engage with No. 2. Move up and fasten the lock with H, locking all the cams together.

During these operations the shaft must be turned towards the operator from the top. This setting moves the harness in 1-3-5-2-4 order. To reverse this order of weaving move the cams three notches instead of two. This means starting with the cams having all the depressions up. Using No. 5 as a starting point, move three notches, and the order of weaving will be 1-4-2-5-3.

Fig. 38 is a side view of a set of cams for a 3-harness warp weave; Fig. 39, a set of cams for a 4-harness warp weave; Fig. 40, one of a set of four cams for a 4-harness cassimere twill; Fig. 41, a set of 5 cams to weave a 5-harness warp twill or sateen; Fig. 42, one of a set of five cams for a 5-harness filling sateen. The cam shown in Fig. 39

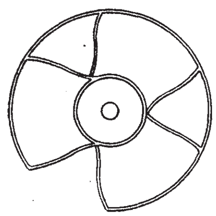


Fig. 38.

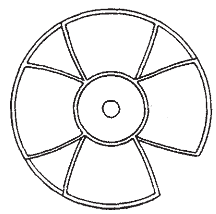


Fig. 39.

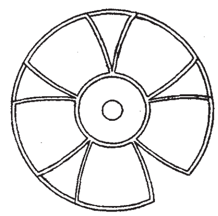


Fig. 41

can be used to weave a broken weave in the order of 1-2-3-4. The cams in Fig. 41 can be set to weave either twill or sateen.

Top Rolls.

These rolls are used with the auxiliary motion for the production of 3-4- and 5-harness cloths. The setting of top roll straps is the most difficult operation in fixing looms

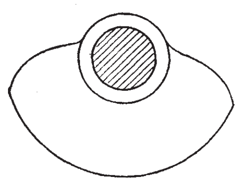


Fig. 40.

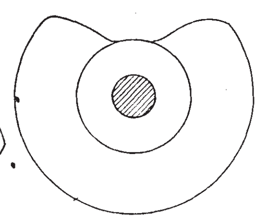


Fig. 42.

equipped with the auxiliary motion. A study of Figs. 43, 44 and 45 will help the fixer to rig up top rolls for the different weaves. If the top rolls are rigged up right at the start they will need little adjustment afterwards.

A good plan is to rig up the top rolls as shown, then get one loom started and adjusted correctly. After everything is running right the length of the straps that are running on the loom is taken as a standard. Using an empty loom or a wooden model as a guide, all the top rolls that are to be used are rigged up before being placed on the looms to be changed or started up. This method is used in a large New England mill and saves much time and money. If this plan is not adopted and the inexperienced fixer attempts to rig up the top roll haphazard while the warp is hung up in the loom, he will waste time and get into trouble.

In some mills spring-heads are used, but they are not popular as the springs do not operate correctly for the different kinds of work. The only good feature of a spring-head is the ease with which the loom can be rigged up, but there is a big difference between the weight or power required to lift up a harness when changing from 68-sley to 180-sley on the same number of harness. The former usu-

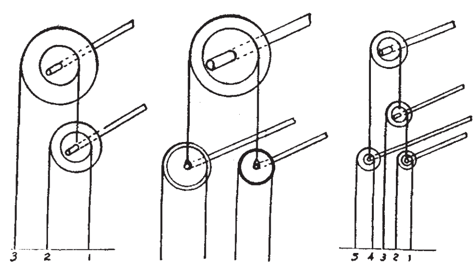


Fig. 43. Fig. 44. Fig. 45.

ally runs filling flush, and if the weave is a 5-harness sateen, will be 1 up and 4 down. The 180-sley is a warp flush and is usually run 4 up and 1 down, the harness carrying almost three times as much yarn on the 180-sley as on the 68-sley cloth. As a result the warp of the fine fabric must be held very tight, making it difficult to get the shed down to the race plate of the loom.

Side-Roller Motion

This motion is located on the side of the loom and operates on the same principle as the top roller motion, but has the advantage of being adjustable for 2-, 3-, 4- and 5-harness work without disturbing the rigging to any great extent. This is done by inserting a steel pin in certain parts of the motion making the parts that are pinned inactive.

Fig. 46 shows the side roller motion ready to operate on 2-, 3-, 4- and 5-harness. A is the loom arch; B, harness sheaves; C, arm which supports the motion; D, oil tray; E, harness wires; F, G, H, rollers; I, oscillating arm; J, bracket which fastens the sheaves to the loom arch; K, stud on which the oscillating arm moves and of which only half is shown, the other half being covered by the roller H.

When running a plain weave on 4-harness the roller F is used. The steel pin is pushed through the arm C, the oscillating arm I and the roller H, these becoming stationary, the

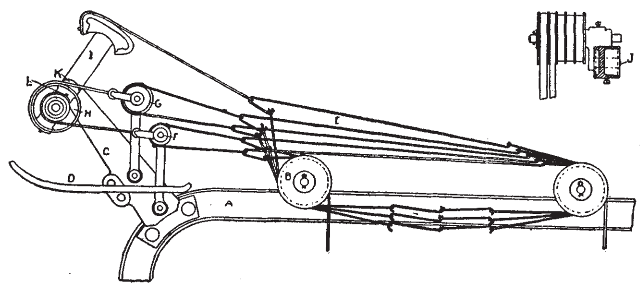


Fig. 46. Side-Roller Motion.

roller F being the only part in motion.

When operating 3-harness, either 2 up and 1 down or 1 up and 2 down, the rollers F and H are used, the pin holding the oscillating arm only, the arm-holding roller G being allowed to move back and forth with the roller G fastened.

For 4-harness work the arm I and roller H are fastened by the pin and the harness are operated on rollers F and G.

For 5-harness work the pin is removed entirely, all the rollers and the oscillating arm I working freely.

The side roller motion is well adapted for all cam work up to 5-harness. When once the proper adjustments of straps is made, the looms can be changed for any kind of work up to 5-harness.

Side Cams.

This type of cam is used for weaving heavy cloths, such as warp sateens, drills, pillow tubing and corduroys. The motion is positive, the cams raising and lowering the harness. They are made for work up to 8-harness, are very easy to operate, and change from one weave to another. They are set for the different weaves in the same manner as the bottom cams.

Fig. 47 is a front view, showing the side cams used for a 5-harness sateen or twill. Fig. 48 is an end view of the cam and lever arrangement. The cams are driven from the top shaft.

Fig. 49 shows a later arrangement by which the cams are driven from the bottom shaft of the loom. This gives a better leverage because of the lower position of the cams, which can be set farther into the loom with a firmer foundation for the cams by the use of braces bolted to the loom and floor.

While it is possible to weave with side cams any cloths from 2- to 8-harness, their use is confined to cloths of extra heavy sley or pick, such as heavy warp sateens and pillow

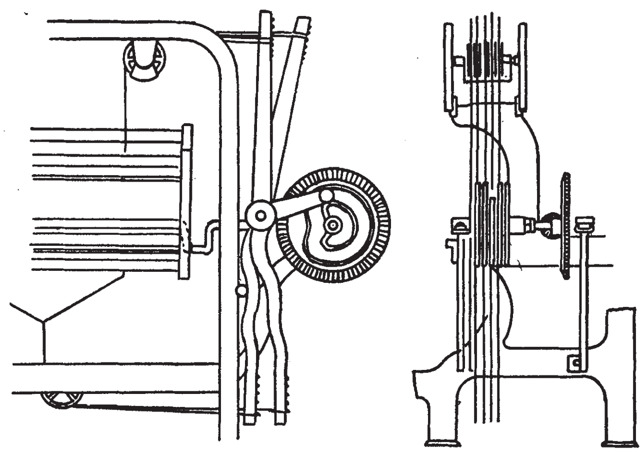


Fig. 47. Side Cams. Fig. 48.

tubing, which is really double cloth. Very little skill is required to set the harness for position, because the roller motion, both on top and bottom, has a straight run from the levers and is the same as that used on a dobby loom, which is the simplest adjustment known.

Cams are timed for 3- to 8-harness work as follows:

Bring the loom crank to bottom center. Loosen up the gear which drives the cams. Move the cams so that any 2 harness which make the change are about to pass each other. Tighten up the driving gear. This method applies to all bottom and side cam motions.

Weaving Warp Sateens.

The question is often asked, why are not all warp sateens woven face down? This method would be easier on the loom and also for the weaver. There are two reasons why sateens and warp flush twills are woven face up:

1. Because of the heavy sley there is a tendency for the warp and filling to kink. As the face of the cloth is down the weaver cannot see the imperfections.

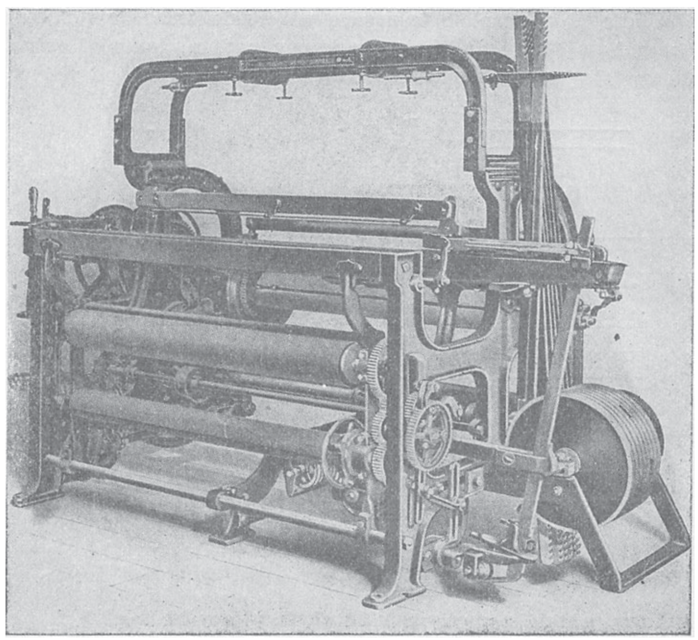


Fig. 49. Cams Driven from Bottom Shaft.

2. When the face of the cloth is not visible to the weaver, misspicks or broken picks cannot be seen and these are the worst imperfections on the face of a warp sateen or twill. Kinks can be and are very often singed off by the use of a hot plate or gas flame, but a misspick cannot be mended.

Warp Stop Motion

Warp stop motions by which the loom is stopped automatically when a warp thread breaks are in general use in cotton mills. The original purpose of this motion was to produce a better grade of cloth by eliminating thread runs, but it serves a double purpose. In addition to the elimination of thread runs, it enables the weaver to run more looms. It takes the place of the old English system of tending looms, under which boys and girls served their apprenticeship as weavers by looking out for broken ends and stopping the loom before the break made an imperfection in the cloth.

There are two types of warp stop motions in use. Very little skill is required to fix them, but for a long time the correct wiring of the threads was a difficult problem. Many fixers and boss slashers still find great difficulty in wiring the warps. The sizing of warps and the fixing of looms are often condemned when the fault is in the manner in which the threads are wired on the stop motion.

Warp stop motions are indispensable in the weave room, because the weavers have been educated to their use. They work equally well on all kinds of fancy goods, including lenos and jacquards. Many of the early types were double-thread motions, two threads being drawn in one wire, the wire having a long slot instead of a round eye. All the recent types are single thread motions, one thread to a wire.

The wires are set in banks and four banks are about the limit for cotton looms. The heavier the sley the more banks are required. A sley heavier than 92 threads per inch should be put on three or four banks of wires. It is obvious that if the wires are crowded they will be late in dropping. This is a serious objection on such cloths as corduroys and bedford cords, in which in a broken binding-thread causes a bad imperfection.

The weight of the drop wires should be regulated by the size of the yarn. A drop wire suitable for 20s or 30s warp will not work well on 80s or 100s warp. The wires of different weights can easily be kept separate.

In some mills the threads are first drawn in the wires, then through the heddles and reed. One type of drawing-in machine draws the thread through the drop wire, heddle and reed with one movement of the drawing hook, but this machine does not draw fancy warps. In other mills the wires are set on the threads after the warp has been placed in the loom and all broken ends drawn in. Boys do this work at a remarkable speed. A boy will insert 2,400 wires in 40 minutes. Some do even better than this.

The writer has found the last-named method the best, particularly on fancy work, for it is rather difficult to handle a 3- or 4-beam warp when the drop wires are attached to the threads. On jacquards the wires can be inserted only at the loom, because warps for jacquards must be drawn in at the loom.

The mechanism for operating the stop motion is very simple and is very easily understood, but, owing to the practice of weavers running their looms when the motion is out of order and the regular fixer is very busy, most mills have found it to their advantage to train a man to keep the stop motions in order. This plan gives good results, particularly on electric stop motions. Unless a fixer understands electricity when tinkering with an electric stop motion he is liable to set the loom on fire.

There is a right and a wrong way to wire a warp and while the methods given here might appear out of the ordinary, they are sound in practice and are used in many mills. The tendency of a drop wire, particularly on heavy pick cloths, is to chafe the yarn and throw off lint, which lodges in the yarn back of the wires. This is caused by the wires bobbing up and down as the reed strikes the fell of the cloth. The lint will become fastened to the two threads running on the same harness or in the same bank and the thread that runs between them will break. When drawing in the broken end the weaver fails to see the cause of the break because the bank of wires hides the lint and it is then but a short time before the same thread breaks again. There are two good methods of preventing this trouble.

First Method. The way to wire a 4-shaft warp for a plain weave is to use the only correct, plain-cloth lease, the 2 and 2 or split lease, Fig. 50, and apply it to a double bank of drop wires. A thread from No. 4 harness and another from No. 2 are wired on the rear bank. Then a thread from No. 3 and another from No. 1 are wired on the front bank. By this

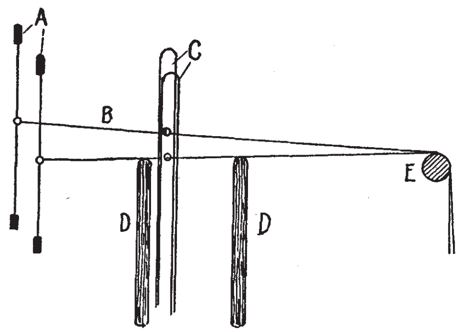


Fig. 50. First Method of Wiring Warps.

method the threads are kept separate and even though the lint falls from the yarn, the threads are not in contact long enough to knit together.

Second Method. This method, Figs. 51 and 52, is employed where two harness are used in connection with a lease rod

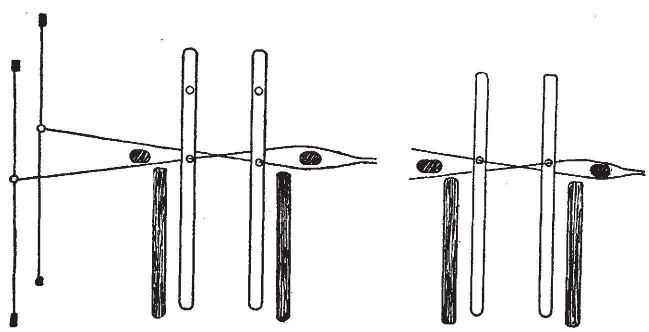


Fig. 51. Second Method of Wiring Warps. Fig. 52.

on each side of the bank of wires. If the threads are leased as shown in Fig. 51, the lint shaken loose by the wire falls to the floor, because the threads are leased so that each eye of the wire lies under the other thread. If the threads are leased as shown in Fig. 52, the lint falls on the thread underneath and causes the threads to knit together. Many warps

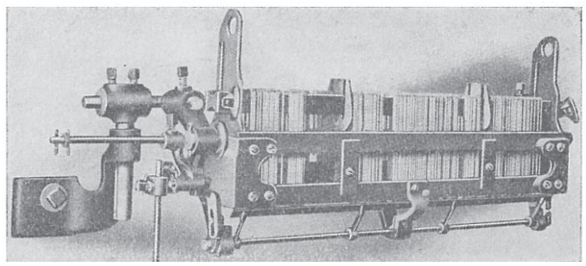


Fig. 53. Mechanical Warp-Stop Motion.

have been condemned and fixers and boss slashers put to no end of trouble by the wrong wiring of warps. Fig. 53 is

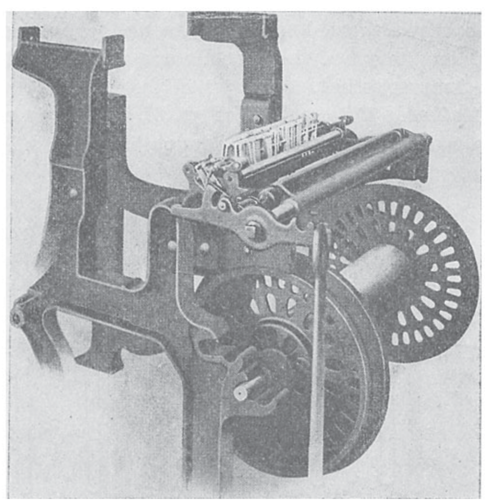


Fig. 54. Electric Warp-Stop Motion.

a view of a mechanical warp stop motion. Fig. 54 shows an electric warp stop motion.

Dobby Weaving

The dobbies in use today are based on the same principles as the first one invented in England about fifty years ago. The early types were set above the loom. The latest dobbies are located on the side of the loom, where they are easily accessible for fixing and changing. The single-index type is rarely used now, except when running as a double cylinder or on other special work. The single-index dobby requires a very long pattern chain, one bar for every pick. The double-index dobby requires but one bar for every two picks, making a large saving in labor and space.

The single-index dobby is very easily converted into a double-index by introducing new upright hooks and grates. A single-index dobby thus changed is just as good as a new dobby. Motion is imparted to a dobby from either the top or bottom shaft of the loom. When driven from the top shaft a reduction gear is used. When driven from the bottom shaft, an offset casting called a dobby-crank is used, on which a driving rod is fastened, which, in turn, is connected with the dobby rocker-arm.

The pattern cylinders are sometimes driven by a pawl and ratchet arrangement, but usually by a worm. The pawl and ratchet are used on the double-index dobby. The single-index dobby is always driven by a worm, either directly or indirectly.

All modern dobbies are open shed. The closed shed type is obsolete. The range of patterns that can be woven on a dobby is limited, but a dobby can produce a much wider range of patterns in high sley fabrics than can be made with the jacquard.

The dobby also lends itself to all manners of attachments for weaving novelties, such as bordered marquisettes, lenos of every description, sateen and plain and leno bordered handkerchiefs.

An almost endless variety of effects can be produced by the use of simple attachments.

Single-Index Dobby.

The outward construction of a single-index dobby differs but little from the double-index, except in the shape and number of the index fingers and indicating needles. It is a

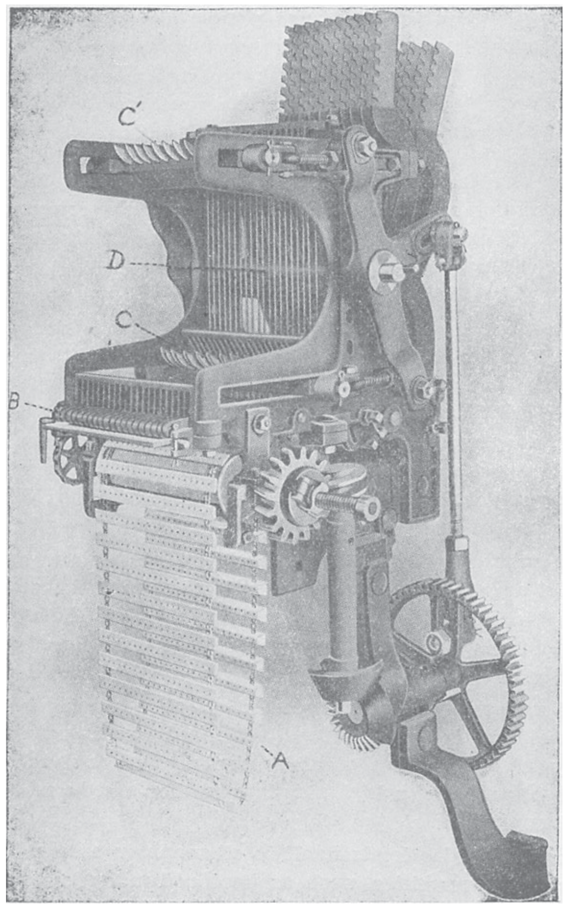


Fig. 55. Single-Index Dobby.

common practice to change the old style single-index into a double-index by changing the index fingers, needles and grates, the other parts of the dobby remaining the same.

Fig. 55 shows a single-index dobby. This type is always driven from the top shaft of the loom. Note the single row

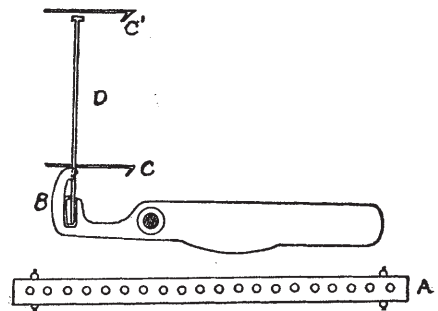


Fig. 56. Index-Finger, Needle and Chain-Bar.

of holes in the pattern chain bar. Each bar represents one pick. There are 20 index fingers B, each one controlling two

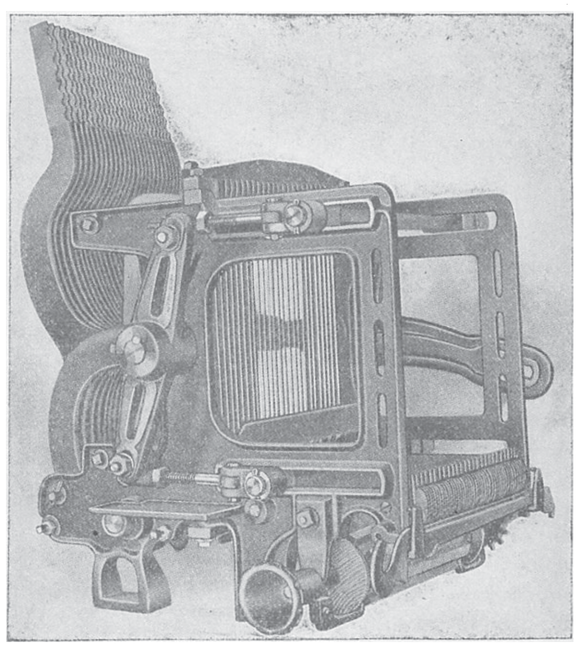


Fig. 57. Double-Index Dobby.

hooks, C, one bottom and one top. Fig. 56 shows the index finger B, also the needle D, and the bar A of the chain.

Double-Index Dobby.

Fig. 57 shows a 25-harness, double-index dobby. There are 50 index fingers in this dobby, working in pairs. One finger of each pair controls the lower hooks; the other, the upper hooks.

Fig. 58 shows a bar of a pattern chain, A, and a pair of index fingers, B and B^1, which index for one harness lever. While B controls the lower hook C, B^1 controls the upper

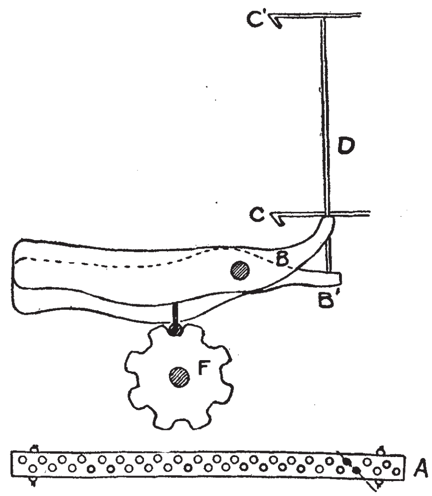


Fig. 58. Index-Finger Needle and Chain-Bar.

hook C^1 by means of the needle D. This type of dobby is almost a standard in mills weaving fancy cloths, and is familiar to nearly all fixers of fancy looms.

Fig. 59 shows the back side of a double-index dobby, with connection for driving with a reduction gear from the top shaft of the loom. A is the rocker; B, rocker arm; C, driving rod; D, lower connection and adjusting nut; E, reduction gear; F, driving gear on top shaft of loom.

Fig. 60 shows the reduction and driving gear, also the driving-rod with lower connections as seen from front of dobby. The sheds made by a dobby must open and close on either pick with the lay in the same position, that is, the same distance from the fell of the cloth. In order to bring this about, the division of the shed must be accurate. The lower connection on the driving rod is used for dividing the shed.

Dividing the Shed.

First turn the loom-crank until the lay is in the desired position in relation to the fell of the cloth. Then bring the arm, B, to the position shown in Fig. 59. Disconnect the rod C from its upper connection and loosen the large nut at D. Loosen the gear F and move the reduction gear E until the

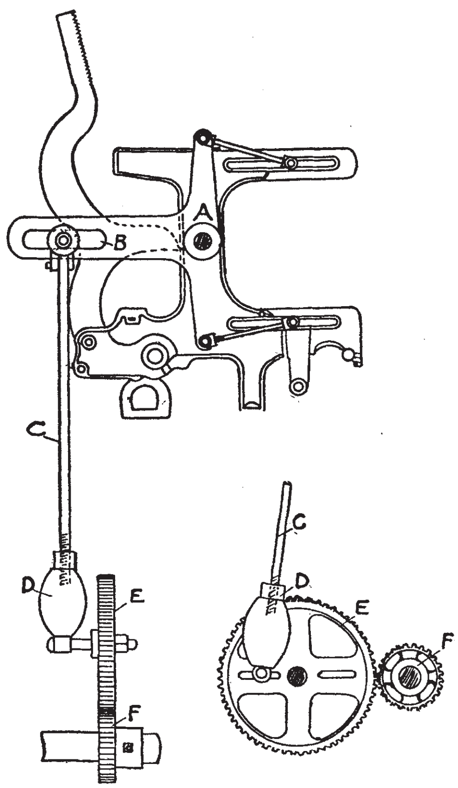


Fig. 59. Double-Index Dobby. Fig. 60.

slots are in the position shown in Fig. 60. Then connect the rod C to the arm B. If the rod is too short or too long, bring it to the required length by screwing into or out of the lower connection, but under no circumstances move either the loom crank or the arm B. All the adjusting must be done by rod C. Tighten the gear F and the nut at D. The throw of the rocker A is equally divided.

Setting the Knives.

Turn the loom crank until the lower or upper arm of the rocker A is in its innermost position.

Set the knife ¼ inch inside the catch on the hook. Follow the same process with both knives. It is bad practice to set the knife more than ¼ inch behind the catch, as it imparts a jerky motion to the harness. If the adjustments are correctly made the knives should be in the position shown in Fig. 59, directly opposite each other when the dobby is brought to that position.

Timing a Dobby.

Loosen up the gear F. Draw the lay to the desired position and tighten up the gear again. This does not affect the adjustments made for dividing the shed.

Changing the Size of Shed.

The shed is made larger or smaller by moving the stud in the slot of the reduction gear E towards the center for a smaller shed, and towards the outer edge for a larger shed. This does not affect the adjustment made for dividing the shed.

When making adjustments for a larger shed, the loom must not be started until the knives are reset. This adjustment gives a greater sweep to the rocker, A, which, in turn, carries the knives farther in and out. If the knives are not reset, they will be driven to the end of the slot in which they work, and strike the side of the dobby, breaking the dobby side, the knife-hook or the arm of the rocker.

After making adjustments for a larger shed there is no danger of breakage when adjusting for a smaller shed, but there is danger of making bad cloth, because the knives will not reach back far enough to receive the hooks, the result being skips and breaks in the weave.

Adjusting the Dobby.

Figs. 61 and 62 give two views of a dobby-crank, one from the end and the other from the side of the loom. This crank drives the dobby from the bottom shaft and runs at the same speed as the reduction gear on a top shaft drive. The dobby knives are adjusted for position and time in the same manner as with the top shaft drive.

If the dobby cylinder is driven by a worm, the power is always transmitted from the top shaft and if the time of the knives is changed, the time on the cylinder must be changed

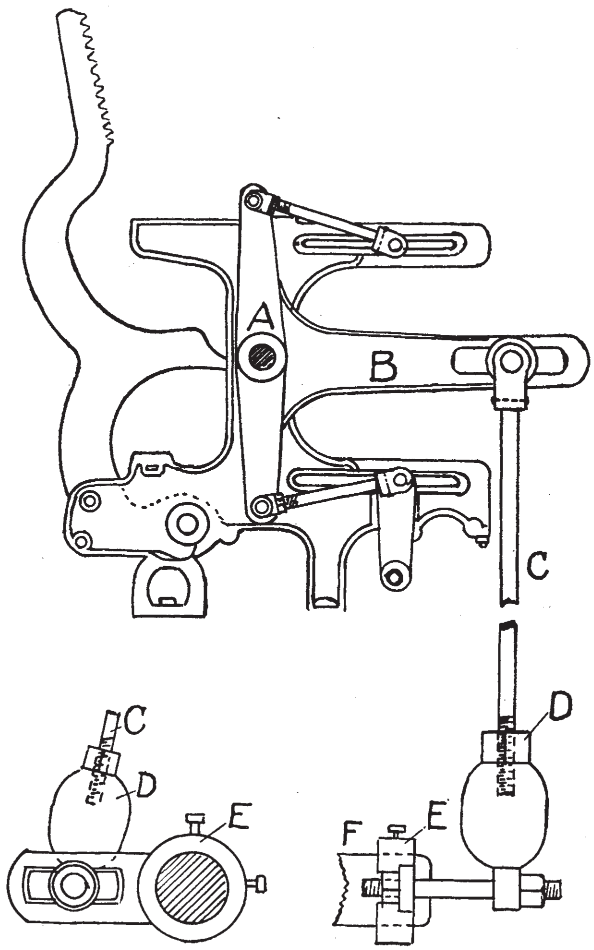


Fig. 62. Dobby Crank. Fig. 61.

also. The reason for this is that when changing the time on a bottom shaft drive, the fixer loosens the set screw which holds the dobby crank E and moves the loom crank, which in turn moves the lay to the desired position. As the sprocket which drives the cylinder worm is on the crank shaft, the worm moves also. This throws the dobby knives out of time with the cylinder because the knives do not move until the set screws are again tightened on the dobby crank.

Changing the time of a dobby on a bottom shaft drive has caused endless trouble for those who forget or do not know. The best method is to loosen the set screws on the dobby crank and also on the sprocket which drives the cylinder. When the lay is moved forward or back, neither the knives nor the worm will move. Get the habit of doing this, otherwise there will be trouble.

This condition does not obtain on the top shaft drive because the worm sprocket is usually carried on the shaft of the reduction gear, so that when the driving gear F, Fig. 59, is loosened, the reduction gear is stopped when the loom crank is moved.

Fixing Dobbies for Misspicks.

Misspicks are a torment to most loom fixers, because of the many things that contribute to their cause. Wrong time or position of the pattern cylinder is the most prolific cause of misspicks on both types of dobbies. Other causes are crooked pegs, ill-fitting pattern chain bars, binding lever-hooks and knives set too far back or too near the point of contact with the lever hooks.

There is a problem in fixing when a lever hook keeps either missing or staying on the knife when it is indexed to be on or off. Many things will cause a hook to miss, such as a crooked peg, a binding hook or a binding needle. A binding hook usually rubs against the side of the grate. The only way to fix this is to bend the hook slightly at the junction with the upright and not at any other place. A crooked peg is sometimes hard to find, but, like a binding needle, is easily fixed when found.

The best way to find the cause of a misspick is to bring a knife to its most inward position and turn the pattern chain bar for bar. Test the hooks, needles and index fingers, as each bar comes under the index-fingers. While this takes a little time, it is the only sure way.

Many fixers adopt the method of watching one knife at a time. This is the wrong way, because, while the fixers are guessing, the loom is humming and making misspicks. This hit or miss method is costly in the long run. Lots of second quality cloth is made in this way and quite often the weaver is blamed for it.

The index fingers on the double-index dobby are very light, and if oil or dirt is allowed to accumulate between the wire guides, they will stick and fail to come down when the peg passes by. The remedy for this condition is a little kerosene and a skein of yarn. The kerosene will loosen the dirt and the yarn passed between the wire guides will remove the oil and dirt.

It is bad practice to take out all the index fingers and clean them when only one or two are sticking, because fingers that have been in one position for a long time will not adjust themselves to a new position very readily. In most cases removing all the fingers and mixing them up only makes a bad matter worse. If one or two hooks are missing, find out the cause. Do not disrupt the whole machine to adjust one or two hooks, needles or index fingers. While the fixer is doing the big and unnecessary job, production is stopped on that loom and possibly on other looms which may be waiting for the fixer.

Some fixers have a bad habit of wanting new knives, knife-hooks and other parts when only one hook is missing. These parts cost money. The fitting of the parts in the machine shop also costs money. The time required to replace the parts, the time the loom is stopped and the other weavers are waiting are all costing money, which could in most cases be saved if a fixer would confine himself to the one or two hooks that were either missing or staying on. Dobbies are not hard to fix, but the successful fixer must use patience, judgment and system.

A very aggravating misspick, particularly on a double-index dobby, and always on the bottom knife, occurs when the hook at the beginning of the lift sets squarely on the knife, but for no apparent reason pulls off and allows the harness to drop when the knife gets about half way out. Very often the hook will pull almost off the knife and remain barely on until the knife is at the end of stroke. When in this position the pick is delivered and the vibration from the shock of the pick shakes the hook from the knife, causing the harness to fall as the shuttle is passing through the shed. This causes many warp breaks which are often attributed to bad yarn. The cause is that the button which holds the hook to the upright has worn flat in places and

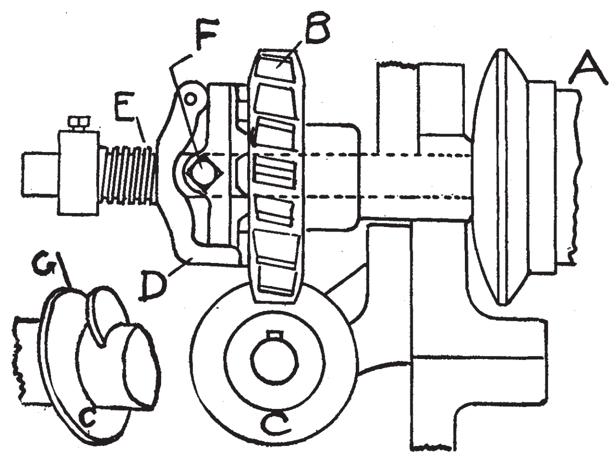


Fig. 64. Worm Drive for Dobby. Fig. 63.

cannot adjust itself when assuming a new position. This often occurs when adjustments have been made for a larger shed. The only remedy, in a case like this, is to put in a new hook.

Dobby Cylinder Drives.

As already stated, the pattern cylinders are driven in two ways, either by a pawl and ratchet, or by a worm. The worm drive is preferred on account of the easy manner in which the chain-bars are drawn under the index fingers. This type of cylinder drive is fast becoming a standard for double-index dobbies. A cut away sketch of a worm drive is shown at Fig. 63. A is the cylinder; B, the worm gear; C, the worm; D, the clutch; E, a spring which holds the clutch in engagement. These parts are more or less familiar to the fixer. All that is required is to give correct setting and timing in order to get the best results.

Setting a Worm-Driven Cylinder.

It is good practice first to loosen the nut or set-screw F, Fig. 63, and the spring E. See that the cylinder works freely in its bearings. Put a bar of chain on the cylinder and adjust the pegs to the index fingers so they will strike squarely. Tighten the connections which hold the cylinder in position horizontally. Next tighten the spring E with the clutch engaged. Turn the cylinder until the indicator pegs on the bar of the chain are in the highest position and tighten the set screw F. All these settings must be made with the straight part of the worm under the worm gear. The cylinder is now adjusted for position.

Setting the Cylinder for Time.

There are two ways to set the cylinder for time. Both give the same result.

1. Turn the loom crank until the bottom knife is farthest inward, then turn the worm until the straight part is just entering the tooth of the worm gear, Fig. 64. C is the straight part of the worm; G, the part which gives motion to the cylinder. The cylinder should remain stationary during the progress of the bottom knife outwards. When the bottom knife has moved ⅛ inch inward again, the cylinder should commence to move and finish its movement before the bottom knife is farthest inward. By this setting the first row of pegs on the pattern bar will index for the bottom knife hooks and the second row for the top knife hooks.

2. Turn the loom crank until the bottom knife is farthest outward and continue until the knife has covered about ⅛ inch on the return to the inward position. Move the worm until the crooked part strikes the worm gear and tighten up sprocket on worm shaft.

When setting the cylinder by either method, the cylinder must be placed so that the pegs on the pattern bars are in their highest position directly under the index fingers. The cylinder must never move when the top knife is moving inwards. If this adjustment is not obtained wrong patterns will be the result.

Pawl and Ratchet Drive.

Fig. 65 shows the pawl and ratchet drive. A is the dobby rocker; B, pawl; C, safety spring; D, stop-wheel check; E, stop-wheel; F, ratchet. The setting of the cylinder for position is the same as for the worm drive, but special attention must be paid to the free movement of the cylinder in the bearings. The slightest binding on the bearings will cause the cylinder to remain on the half throw, if the weaver

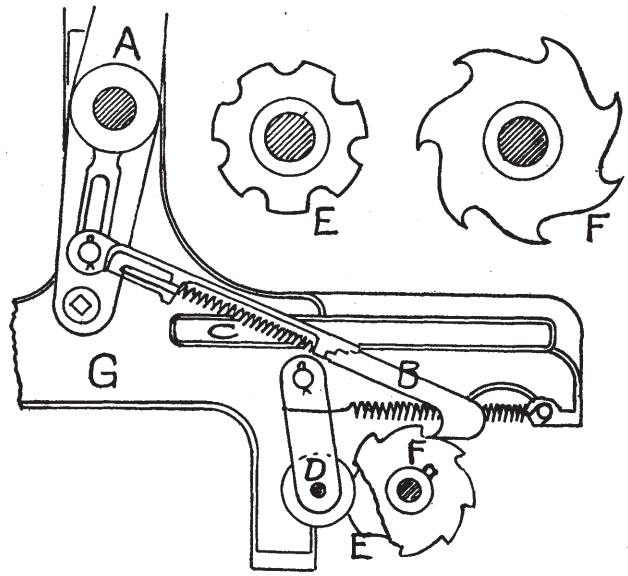


Fig. 65. Pawl and Ratchet Drive.

moves the loom while the pawl is pulling the cylinder over. This is a bad feature of this type of cylinder drive and explains why the worm driven cylinder is preferred.

Timing the Pawl and Ratchet.

First see that the stop-wheel E is fully engaged with the stop-wheel check D, and the pegs in the pattern chain are full up under the fingers. Move the loom crank so that the bottom knife is farthest inward. Loosen the set-screw holding the ratchet F and turn the ratchet to the right until a tooth is fully engaged with the pawl B. Tighten the ratchet. When the pawl is moved farthest outward, it should project at least ¼ inch beyond a tooth of the ratchet F. This is important, because the cylinder should not move until the top knife has fully engaged the lever hooks. As the top knife receives the hooks indexed by the second row of pegs on the pattern chain, a new bar is not needed until the bottom knife goes in again.

The throw of the pawl is regulated by moving either up or down in the slot of the rocker arm. If at any time the fixer should make a larger or smaller shed it will change the throw of the rocker arm and also the throw of the pawl B. This makes necessary the readjusting of the pawl by the slot in the rocker arm. Fig. 65 also shows enlarged sketches of the ratchet F and stop wheel E. They are usually separate on the cylinder shaft and can be set separately.

The pattern chain will frequently double up and get fast between the cylinder and index-fingers. Bad breaks of both chain bars and connections would then occur if some means

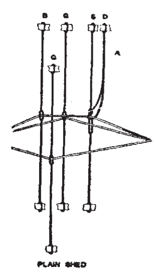


Fig. 66.

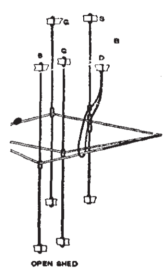


Fig. 67.

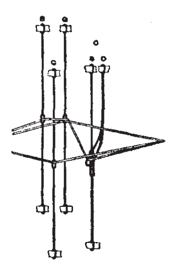


Fig. 68.

were not adopted to prevent this. The safety spring C, located on the pawl B, allows the pawl to be extended at least the length of one tooth of the ratchet. This prevents the breaking of any parts when the chain gets fast.

Lenos and Leno Motions.

There are three types of lenos: (1) half gauze, commonly termed a top doup; (2) full gauze, called the bottom doup; (3) full turn leno.

The top doup is used when elaborate face effects are desired, for which very heavy yarns are used.

The bottom doup is used for weaving marquisettes, real gauze, cloths to imitate lace, and also for binding the sides of open work stripes and checks and leno handkerchiefs.

The full turn leno is used for the center of wide open work effects on bordered marquisette curtains, also for scrim curtains with bordered effect. Lenos are always in demand, particularly marquisettes, which are used for a large variety of purposes.

A good leno fixer must understand the different orders of shedding, which are very easy to memorize. The fixer should know the order in which the open, plain and cross sheds run, otherwise he will be forever guessing.

Figs. 66, 67 and 68 show the plain, open and closed sheds of the top doup leno. B is the back heddle; G, ground heddle; S, standard heddle; D, doup heddle.

These lenos are usually woven with two ground harness in order to make a firm backing for the leno figure and

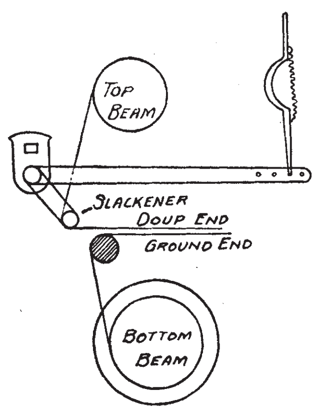


Fig. 69.

Slackener-Bar.

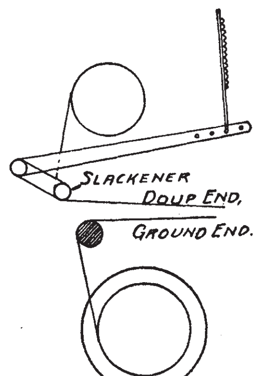


Fig. 70.

throw it up in bold relief. The order of shedding is as follows: 1, doup, standard and back harness up, ground plain; 2, standard up only, ground plain; 3, back only up and slackener drawn in, ground plain.

On this type of leno a change from open to cross or from cross to open shed cannot be made on the following pick. The weave must continue for at least 3 picks. After making a cross shed the next pick must be on a plain shed before passing to an open shed, or when passing from an open to a cross shed.

A thorough knowledge of shedding is of great value to the fixer, particularly if the chain is built wrong or a peg falls from the chain bar. Many hours of labor and worry can be avoided by obtaining a clear understanding of the shedding, as explained above.

Setting the Slackener Bar.

The slackener bar is an important auxiliary to leno weaving, but is sadly neglected by the average fixer. Its purpose is to provide for the extra take-up of the top beam or doup yarn when making a cross shed, Fig. 68. Note how the doup end makes an abrupt curve over the ground ends, one of which is up, and then goes to the bottom shed with the doup and standard. If some provisions were not made for this extra take-up there would be a severe strain on the worsted doup, hence the use of a slackener, Figs. 69 and 70.

The slackener must be set so that the bar will almost leave the yarn when lifted. Fig. 69 shows the bar at rest; Fig. 70, the bar lifted. The slackener bar should not move until the sheds are passing each other. It is a good plan to turn the loom crank until the doup is passing from plain to cross shed. The doup and standard should be well on the other side of the ground end and moving down before the slackener bar moves. When the doup and standard have reached the position as shown at Fig. 68, the fixer can easily tell whether there is slack enough by placing his fingers on the doup end.

The adjustments can be readily made by raising or lowering the lever which operates the slackener bar. The doup must not be allowed to pinch the end in the heddle eye. If this occurs the doup will be cut as with a knife. There is a slack strap connected with the slackener lever, so that the slackener will not move until all the slack has been taken up. This strap allows the slackener to remain at rest until the doups have passed to the cross shed side and are going down.

Setting for Top Doups.

The doup and standard should be set at least ½ inch higher than the back. This enables the doup end to carry the doup down without allowing it to curl up and break the ground ends.

A good plan is to use the plain or selvage harness as a guide, setting the doup and standard ¼ inch higher than the plain harness, and setting the back harness which carries the doup end ¼ inch lower than the plain harness.

Bottom Doup Lenos.

As already stated, this leno can be woven on a close shed dobby without the use of a leno or jumper motion, but this type of dobby is practically out of date now. To weave a full marquisette weave on an open shed dobby requires the use of a jumper motion, shown at Fig. 71. A, is the rocker; B, bracket for holding the driving rod of the jumper; C, driving rod; D, adjusting nut; E, toggle joint; F, segment; G, harness lever; H, long saddle; I, spring.

The object of this motion is to permit the doup to cross from an open shed to a cross shed, or from a cross shed to

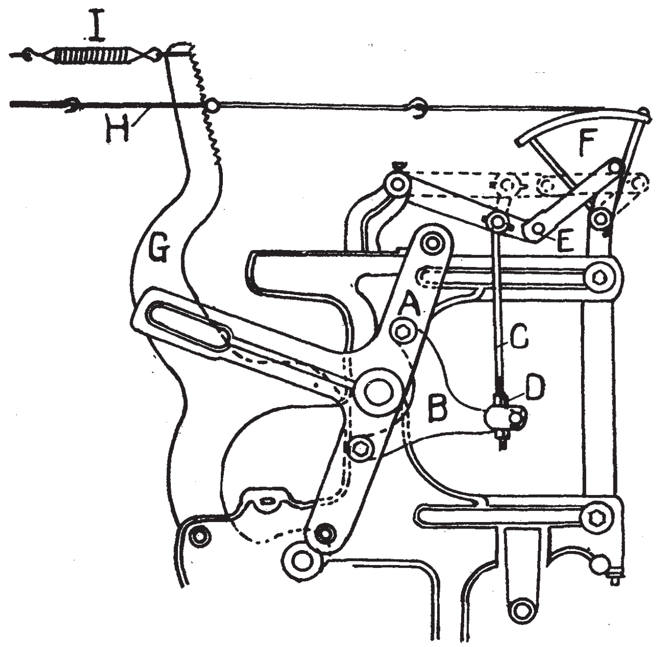


Fig. 71. Bottom Doup Leno-Motion.

an open shed on the following pick, so that the weave will repeat on two picks, as on a marquisette.

It is obvious that this could not be done if some special means were not employed to get the doup and ground harness to the desired position, which requires a half and return movement on the same pick. The shaft carrying the doup must move down to the center and the shaft carrying the ground end must come up to the center, so that the ends can cross over each other. One-half of a pick is consumed in the movement to the center; the other half, in returning to the original position.

A yoke, Fig. 72, is used to permit the doup harness to come to the center and return on the same pick. This en-

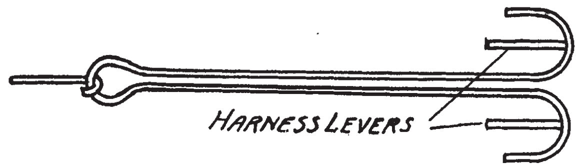


Fig. 72. Yoke for Bottom Doup Leno.

circles the first two harness levers, and is fastened only to the doup shaft. The long saddle H, Fig. 71, is fastened to the ground shaft only. Take for illustration one open and one cross shed in a repeat of a marquisette weave. The

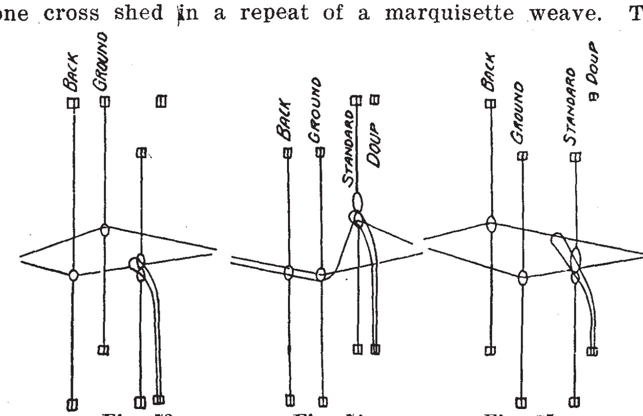


Fig. 73. Fig. 74. Fig. 75.

cross shed, Fig. 74, requires the doup and standard to be up on one pick, but the pattern chain is pegged only for the standard lever to be up, because the yoke which encircles the standard lever will bring the doup up when the standard harness rises. This leaves the first lever down. On the next pick in the open shed, Fig. 75, the standard lever will begin to go down and the first lever will begin to rise. The back and ground harness will also rise through the medium of the jumper, see dotted lines on toggle joint, Fig. 71.

When the doup standard, ground and back harness reach the center, the first lever will take the yoke away from the second standard lever, which brings the doup over the other side of the ground end. Just as this is taking place, the work of the jumper comes in, because the ground end must be out of the way when the doup end is changing. Immediately after the change is made the ground end goes to the bottom again, and the doup rises to the top. The standard is down and an open shed is formed, Fig. 75. The doup end is always on the top; the ground end is always on the bottom.

The shuttle does not ride over the doup or under the ground except when making a plain shed, Fig. 73. In this case the doup and standard go down and the ground end rises. The slot in the long saddle H permits the ground harness lever to rise without disturbing the rest of the motion. A plain shed is seldom found on the bottom doup and never when weaving a marquisette.

Setting Bottom Doup Lenos.

Set the doup and standard a little lower than the ground shed if the cloth is an all-over marquisette. Then assume the plain selvage to be the ground. See that the doups are not pinched in the heddle eye. This will happen if the doup harness is set too low, with the heddles supporting the doup harness instead of the doup harness being supported by the straps. This defect is a prolific cause of broken doups. Have the back harness a little higher than the doup and see that the ground end is not bearing on the doup end. Move the loom one pick and set the jumper motion, Fig. 71.

Setting the Jumper Motion.

Bring the rocker A, Fig. 71, to a vertical position and see that the toggle joint is exactly horizontal, as shown by the dotted line. This adjustment can be made by the nut on the rod C. With the rocker and toggle joint in this position, see that the ground ends are ⅛ inch above the doup. When in this position the doup and doup end should be making the change from one side to the other of the ground end, which should be out of the way to permit an easy crossing.

Timing the Slackener.

The position of the slackener bar when the ground and doup ends come from the bottom beam is an important factor in doup weaving. Figs. 76 and 77 show how the slackener bar should be set to get the best results. Fig. 76 shows the bar at rest. Fig. 77 shows it drawn in on the cross shed.

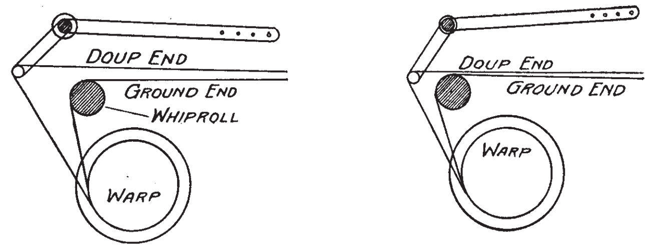


Fig. 76. **Slackener-Bar.** **Fig. 77.**

As the lever is lifted, the bar is drawn in and down. This gives a maximum of slack with a minimum of lift, and is the correct method of adjusting a slackener for a marquisette or for any leno when the doup and ground ends come from the same beam.

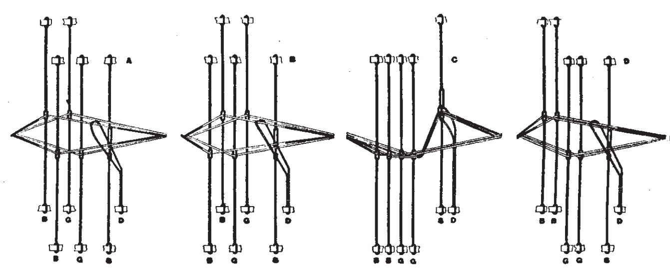


Fig. 78. **Fig. 79.** **Fig. 80.** **Fig. 81.**

Leno Handkerchiefs.

On this type of leno two single ends are used for the back and two for the ground. Figs. 78, 79, 80 and 81 show how this leno is woven. A jumper motion similar to the one described at Fig. 71 is used. The two ground harness are attached to segment F and hold to the harness levers by a long saddle H, one for each harness. When weaving plain for the body of the handkerchief the jumper motion has no influence on the weave, because the two ground harness are rising and falling alternately as in a plain weave.

When a cross shed, Fig. 80, is to be formed, the jumper motion operates as in a 1 cross 1 leno, and the open shed, Fig. 81, does the same when weaving plain. The yoke, Fig. 72, allows the doup to come to the center. The two back harness change at the same time and all doup and back ends meet at the center. The end that is rising and is inside the

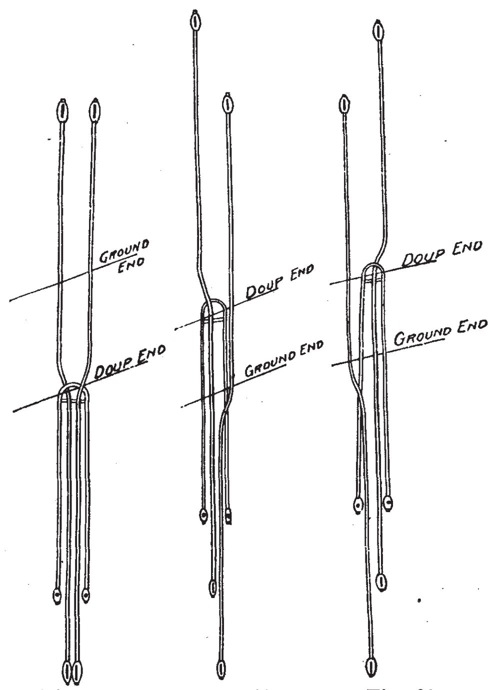


Fig. 82. Fig. 83. Fig. 84.

doup will take the doup away from the end that is falling which is also inside the doup. When making a cross border the sheds occupy the positions shown at Figs. 80 and 81. The setting of the jumper motion harness and slackener are the same as for a 1 cross 1 leno.

Wire Doups.

So far only the worsted doup has been described, but the flat steel doup heddle is fast taking the place of the worsted doup for the weaving of marquisettes and lace cloths. When weaving these lenos, a worsted doup is short-lived. While the fine worsted is a little easier on yarn, the flat steel doup heddle is better in the long run. Steel heddles are used successfully on single 50s hard twist yarn for the production of lace cloths. In some mills steel heddles are the regular equipment for bottom doup lenos, but are not suitable for the production of handkerchief lenos or any of the 2 cross 2 leno type, because the 2 doup ends cannot weave plain inside a flat steel doup heddle on account of the closed eye.

Considering the number of parts in the wire heddle it is remarkable how easily they perform the operation of leno weaving. A 50s yarn is rather fine for any kind of leno, but is run successfully and with little trouble with the flat steel heddle. The operation differs slightly from that used on worsted doups. No yoke is needed, but a jumper motion, Fig. 71, is required. Instead of the first lever being classed as the doup lever, it is called the standard. The second lever is the doup lever. The back and ground threads are drawn as on worsted doups. The pegging of the pattern chain is the same, but when making a chain draft for wire doups the order of douping for doup and standard is the reverse of that on worsted doups.

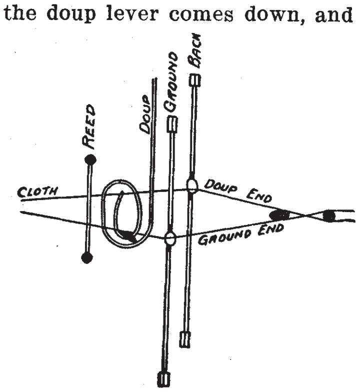
Fig. 82 shows a flat steel doup-heddle in position when weaving plain. The doup and standard levers are down, the ground end up. Fig. 83 shows an open shed, with doup up at left of ground thread. Fig. 84 is a cross shed, with doup up at right of ground thread.

Full Turn Lenos.

Rarely, if ever, is this type of leno used for any other than open-work warp effects on marquisettes or scrim curtain borders. One or two doups on each side of the cloth are all that is required. Fish line or strong twine is used in place of a worsted doup and is usually supplemented by a glass or porcelain eye, because the character of the yarns used is such that a worsted doup would not last very long. The tension on the yarn is also greater than with other types of lenos.

No leno or jumper motion is used other than one doup harness and a slackener. The harness lever which operates the doup should have an extension riveted on the top to give a greater pull to the doup, which completely encircles the ground end.

Figs. 85 and 86 show how to rig up the doup for a full turn leno. Fig. 85 is the open shed. Note how the doup encircles the ground thread, which is a 3/10s under great tension. When changing to a cross shed the doup is pulled completely around the ground end, the back harness falling in order to assist in the turning movement. Fig. 86 shows the end in the full turn position in front of the reed. To provide for the greater contraction of the doup end when making the turning movement the slackener bar must move almost twice as far as with an ordinary leno. When changing back to an open shed the back harness rises, the slackener falls back, the doup lever comes down, and the tension on the doup end



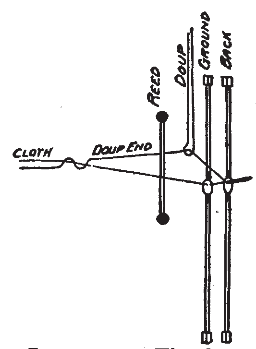


Fig. 85. Doup for Full-Turn Leno. Fig. 86.

forces it to unwind from the ground end and assure the position of the open shed, Fig. 85. These sheds are usually made for 4 or 6 open picks then 4 or 6 cross picks.

Dobby Chain Building.

Dobby chain building or pegging, as it is more generally called, is an important part of the weaving process. Considerable skill is required, not so much for the pegging as for the reading of the harness draft. Any boy of ordinary intelligence can be easily taught to drive in a peg, whether of iron or wood. Very few mills use wooden pegs now. Formerly the index fingers of the dobby were made of cast iron, not hardened. Now the iron pegs are all hardened, so that the friction has little effect on them.

The Tools and Their Use.

Speed and accuracy are essential in chain building and these can be acquired only by a clear understanding of how to read a chain draft. The tools required are few and inexpensive. They include two pairs of pliers, one with a flat nose and the other round, one peg puller and a hammer. The round-nose pliers are used only for forcing apart the links which connect one bar with the other. The jaws of the round nose pliers are pushed between the links and when pressure is applied the link is forced apart, but not damaged, and can be used again.

Many peggers and fixers who use a brad awl or the pointed end of a file for separating the links will carry scars all their lives because of the file or brad awl slipping and making a jagged hole in the palm of the hand.

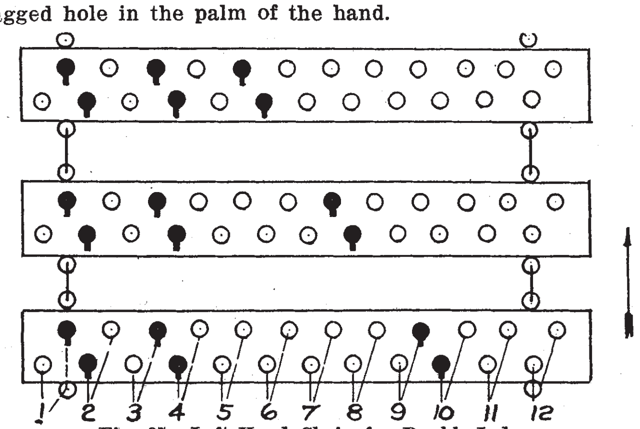


Fig. 87. Left-Hand Chain for Double-Index.

The first thing for a chain builder to understand is the harness draft. The pegger should follow what is termed a draft reading system, shown at Figs. 87 and 88, which show a left hand and right hand chain for a 6-end filling-flush twill on a double index dobby. Many peggers and some fixers read the first pick of Fig. 87 as follows: "Peg one, miss one, peg one, miss one, peg one, etc." Referring to Fig. 89, which shows two picks of a twill weave, the right way to read this chain draft is as follows:

First pick: "1-skip 2-3-1-2."

In this way it is very easy to memorize one complete pick. There is little danger of starting wrong, because most all weaves have either a plain selvage or a plain weave on the first 4 or 6 harness.

Designers start their drafts in the first upper left hand square so that the first hole in the upper row of the chain-bar will have to be pegged and the first hole in the second row is left vacant. The pegger understands that "alternate" means to alternate with only one space between pegs. If there are more than one he will say "skip" or "miss" 2, 3 or other number, and will know what that means. If two or more crosses come together on the draft he will say just "2, 3 or 4," as the case may be. Take the second pick of Fig. 89 for example. This would be read as follows: "1-skip 2-3-1-2." This is easy to memorize at first glance. The remainder of the operation consists in reaching the left hand to the tray containing the pegs, inserting the peg and driving it home.

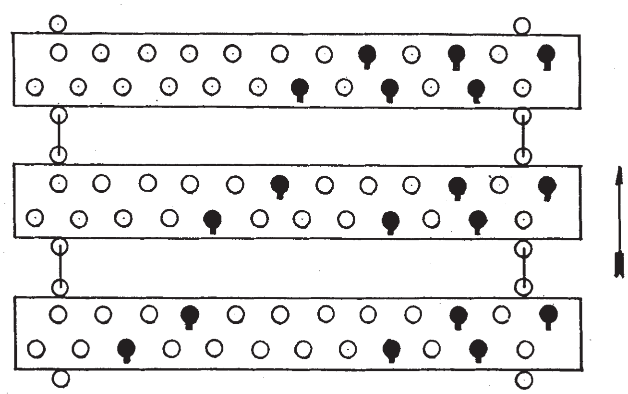


Fig. 88. Right-Hand Chain for Double-Index.

The writer has taught many men and boys this method. It is easily understood and gives good results when speed and accuracy are required. Bright boys become so clever they can memorize a full pick on a 25-harness pattern at a glance.

When building chains for handkerchiefs and big checks, requiring 300 and sometimes 500 bars, speed is very essential. The chain draft should always be read as one would read a book, starting in the upper left hand corner and reading to the right and down. If the draft calls for a right hand chain, a start is made from the right hand side of the bar; if for a left hand chain, the start is from the left side. Always build from the top down.

Contrary to accepted ideas, there is no need for a right hand and left hand chain on a double index dobby, unless the weave is a twill or sateen. Chains built for a left hand loom will make the same pattern if placed on a right hand loom, providing the warps are drawn in the same way. When a box motion is operated by a dobby, it will be necessary to move the box pegs 2 picks forward. The remainder of the chain requires no change whatever.

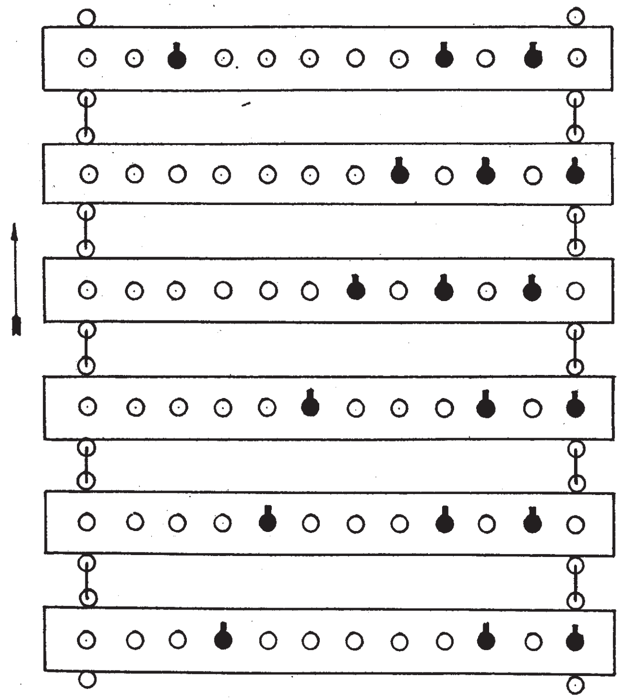


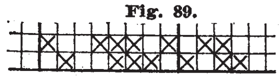
Fig. 91. Chain for a Double Index Dobby.

The reason why only one hand of chain is advocated is that warps are frequently changed from one loom to another. If they are different hand looms, a new chain would have to be built. Much labor can be saved by using the same chain. Another reason is that nearly every dobby pattern has either a plain selvage or a 4 to 6 harness weave running plain. When the order runs out the chains are put aside until wanted again, or required to be remade for other patterns. If a chain built for a left hand loom has to be rebuilt for a right hand loom, many pegs will have to be changed, but if the chains are all one hand much labor is saved.

All chains, except for twills and sateens should be built left hand, as the draft reads from left to right and down. Most people are right handed. The pegs can be fed from the left hand and the hammer being in the right hand there is very little lost motion.

When making drafts for a double index dobby, if a right hand twill is desired, the design will have to be inserted on the draft as a left hand twill and pegged in this matter. This is puzzling to most fixers and peggers. The reason for this

Fig. 89.



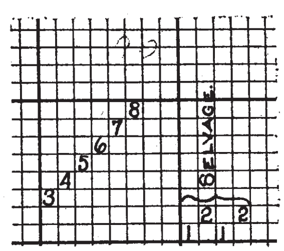


Fig. 90.

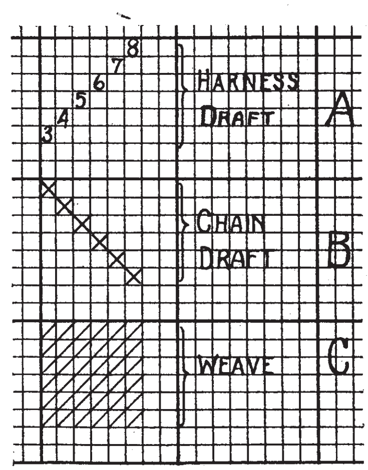


Fig. 92.

is that when drawing a warp straight the drawer-in starts to draw from the last harness. Drawing from right to left the draft for a 6-harness twill with 2 harness for selvage would read from 3 to 8, Fig. 90. The cylinder on a double index dobby runs inward, that is, towards the loom. The first pick of the pattern will raise the first or No. 3 harness; the next pick, No. 4 harness; continuing to a repeat of the weave. The cloth is woven just as the warp is drawn from 3 to 8 harness in a right hand diagonal direction.

If the same warp is placed in a loom equipped with a single-index dobby the chain must be pegged in the opposite direction, Fig. 91. The same chain draft is used, because the cylinder on a single index dobby runs out or away from the dobby. The first pick of the pattern raises the 8th harness and so on down to the 3d harness and repeat. To understand thoroughly the reading of a double index chain it is necessary first to understand what each hole in a chain bar represents. The bars are punched with two holes for each harness and these holes run in a diagonal direction always from left to right.

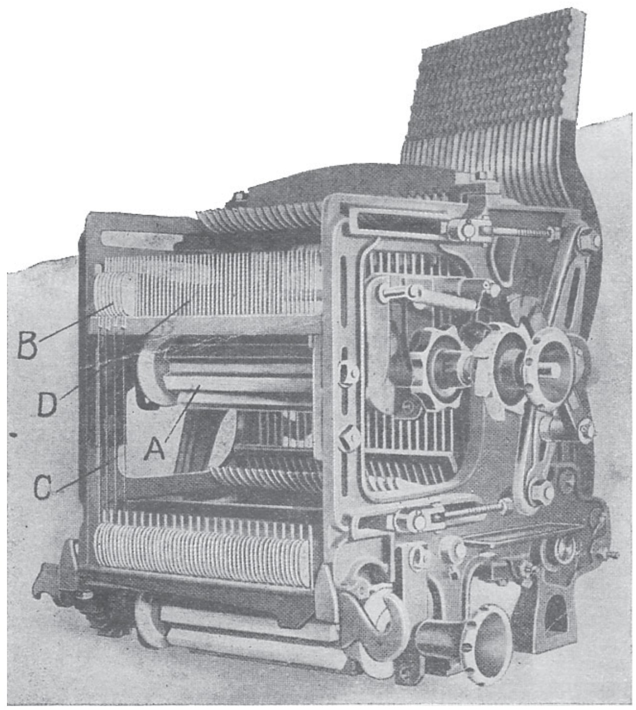


Fig. 93. Double-Index Dobby.

The first or top row of holes when pegged control the bottom row of hooks on the dobby. The second or bottom row of holes control the upper row of hooks. The first hook on a right-hand dobby is a lower hook; on a left hand dobby it is an upper hook. Fig. 92 A. B and C show how a twill is woven. It is the best method by which to make the average learner understand the working of a dobby chain in relation to the drawing-in draft. Fig. 92 A represents the harness as they lie in the loom, the selvage harness being omitted. B is the chain draft built to weave a right hand twill. C shows the line of twill running from left to right.

Double Cylinders.

Fig. 93 shows a 25-harness double index dobby equipped with an auxiliary cylinder. A is the cylinder; B, the extra index fingers; C, wire connections with regular index fingers; D, wire guides. This double cylinder can be used only when the weave of the side border is continuous through the handkerchief, napkin or towel and the body of the cloth is a plain weave. The regular cylinder is hung up to weave the body and cross or filling border only. The auxiliary cylinder is used to weave the side border and also measure the handkerchief, napkin or towel.

Suitable connections are made so that at every round of the chain carried by the auxiliary cylinder, the regular cylinder will turn over one bar while the body of the cloth is be-

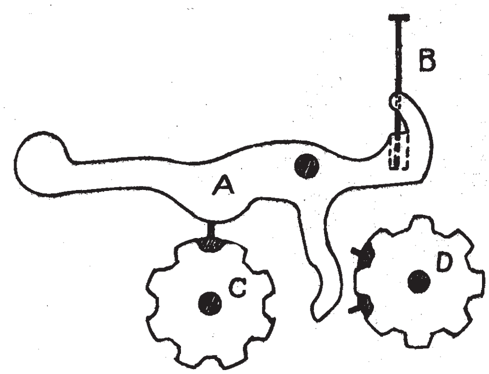


Fig. 94. Index Finger.

ing woven. This adjustment is governed by the length of the auxiliary cylinder chain. If there are say 20 bars in the chain, one bar of the regular chain will equal 40 picks of the body cloth, a saving of 19 bars in every 40 picks of body cloth.

After continuing in this way for the entire length of the body, the border is reached. As the border is included in the regular pattern chain, the latter will run continuously until the border is finished and then start to multiply again for the distance between borders. It will then run the second border without stop. When this is finished the handkerchief, napkin or towel is completed and the auxiliary chain begins to multiply again for another handkerchief dobby. It is a very simple arrangement. No more fixing is required than on a regular dobby. Its use is limited to weaves with a plain body, and with all kinds of sateen, basket or leno borders, but not satin or leno bodies.

Double-Cylinder, Single-Index Dobby.

This is a device by which any kind of fancy body or cross border can be woven, each of the 2 cylinders working independently on the same index fingers. The weave made by one pattern chain can be introduced into the body. Then by a very ingenious and simple arrangement the chain weaving the body comes into operation, and the other chain can be made to introduce an entirely different weave, both in body or side

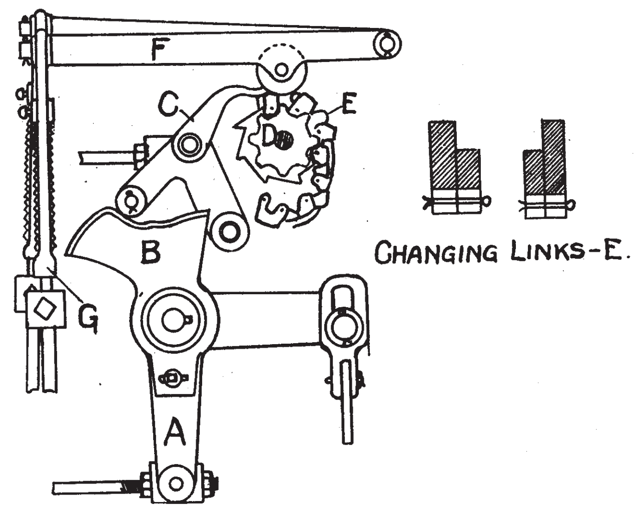


Fig. 95. Harness Changing Mechanism.

border, by operating the same harness that were operated by the other cylinder.

This is a regular, single-index dobby. The only change is in the shape of the index fingers, as shown at Fig. 94. A is the index finger; B, needle which indexes the top hook; C, outside cylinder; D, inside cylinder. Fig. 95 shows the changing mechanism. A is the dobby rocker; B, segment cam moving the pawl C, which imparts motion to the sprocket D carrying the chain links E. The levers F raise and lower the rods G which start and stop the cylinder.

Fig. 96 is a plan of the mechanism. AA are the cylinders; B, cylinder shafts; C, worm gear; D, worm; G is the cut away lifting rod as shown at G, Fig. 97; H, levers operated by rods G. The tilting of the levers H drives in the collar I, which engages the clutch J; when this clutch is engaged, the cylinder begins to operate. Fig. 97 is a side view of one cylinder and the changing mechanism.

Fig. 96 shows one clutch engaged and the other disengaged. This position must always obtain on this dobby. As one cylinder stops the other must start. There must be no time lost. The cylinder that stops holds the chain bar in the position shown at D, Fig. 94, which is the inside cylinder.

A, Fig. 94, shows a chain bar on the outside cylinder with peg inserted directly under the index finger. When this

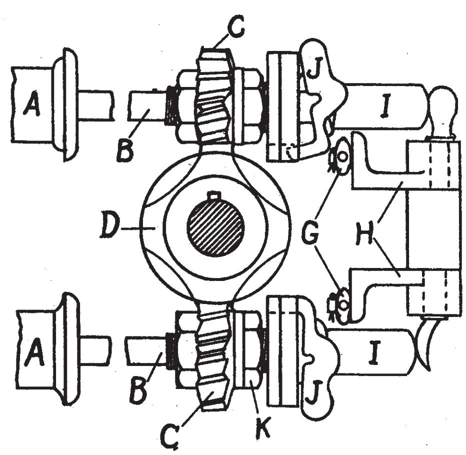


Fig. 96. Harness Changing Mechanism.

bar advances and the index finger falls, that part of the finger which operates on the inside cylinder will rest between the two pegs. When the outside cylinder is disengaged it stops in the same position, allowing the pattern chain of the other or inside cylinder to operate the same index fingers and make a different weave.

At the right of Fig. 95 there is a section of the chain links which make the change and also act as a measuring device. One side is about ¼ inch lower than the other. As the link comes under the rollers on the under side of the lever F, one lever is raised and the other is lowered. When a change is required the link on the chain is reversed and as the chain is pushed under the rollers on the levers F, the one that is up will come down, letting out the clutch J, Fig. 96. The lever that is down will rise, pushing in the clutch J on the other cylinder.

Timing the Cylinders.

First move the loom crank until the bottom knife is farthest inward. Loosen the worm and turn until the outside cylinder, which should be engaged, has moved the pattern chain bar directly under the index fingers. Tighten up the worm, then move the other cylinder by loosening up the large nut K, Fig. 96, until the pegs on the pattern chain are in the position, shown at D, Fig. 94. Set the knives as near to

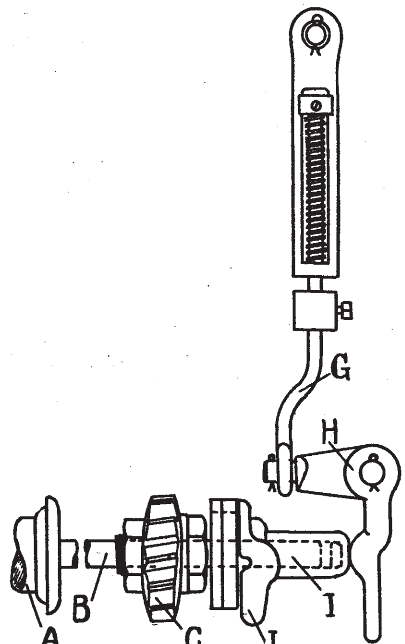


Fig. 97. Harness Changing Mechanism.

the hooks as is possible with safety. The bearing surface on the index fingers is very short, the peg either engaging or leaving the finger with very little time to spare. The chain E is timed by the motion of the rocker. This chain moves only on every repeat of the inside cylinder chain and is really a measuring device. Each link is equivalent to the number of picks in the round of the inside cylinder chain.

Box Looms

This type of loom permits the use of 2, 4 or 6 different kinds of filling in the same piece of cloth. The box loom of today is almost fool proof. The parts have been strengthened and simplified, and there is no guesswork about the fixing of the motions. The loom fixer can handle any number of boxes easily by strict attention to the instructions given for the 2-and-1 box motion. Fixing the 4-and-6-box and pick and pick looms is but a repetition of methods used in fixing the 2-1 motion.

Fig. 98 shows a 2-and-1-box motion of conventional type, very easy to understand, and with very few parts. AA are the boxes; B, box-rod; C, adjusting nuts on end box-rod; D, release motion; E, release-motion spring; F, release motion stud; G, box lever; H, box-lever stud; I, upper stud of box crank; J, box crank-shaft; K, box-crank, lower stud; L, box crank; M, lifting rod; N, sliding lever; O, sliding tooth; P, box-crank segment gear; Q, bottom shaft segment gear.

The lower sketch is a side view of the parts, I, J, K and L. An even number of picks of one kind of filling must be inserted at a time. The boxes must work freely in the guides attached to the lay end. These guides are for the boxes to slide in, and are adjustable only at the extreme end of the lay. The boxes must not bind in the guides, but should slide up and down without interference. The box lever G, Fig. 98, is intended to raise and lower the boxes, not to push them up.

Fig. 99 A shows the back side of the framework attached to the end of the lay and through which the boxes slide up and down. This is supposed to be a permanent fixture, adjustable at the extreme end only. The adjustment is for the purpose of sliding the boxes evenly up and down. B shows the back of the rawhide picker attached to and bored to slide on the spindle C. D is the slot in which the picker runs. This slot is an important factor in leveling the boxes and must run straight and parallel with a similar slot in the back of the boxes.

Fig. 100 is a sketch of the back of a pair of boxes for a 2-and-1-box loom. A is the lip or back bottom side of No. 1

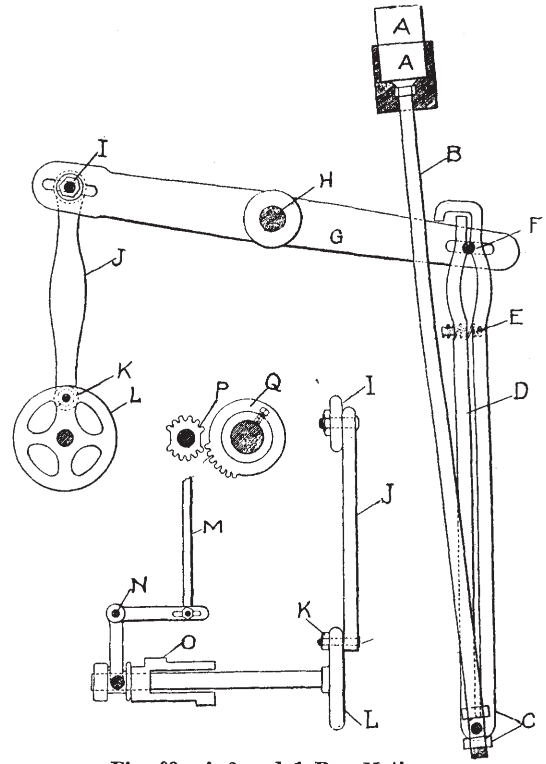


Fig. 98. A 2 and 1 Box Motion.

box; B, picker slot; C, back bottom side of No. 2 box; D, picker slot; E E, shuttles; F, box-rod.

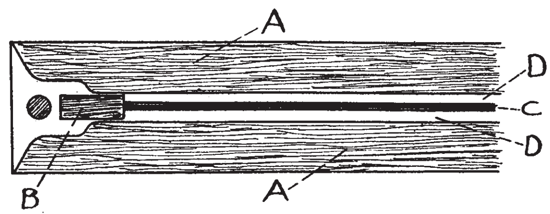
Leveling the Boxes.

Leveling and lining the boxes are separate operations and must be performed in the order named above. First see that the boxes work without binding in the box guides. This must be determined before attaching the box-rod to the bottom of the release motion. Attach the box-rod to the release motion by the adjusting nuts C. Then adjust the box by the adjusting nuts C, Fig. 98, until the lip or back bottom side, Fig. 100 A, is on a line with the lower lip of the slot D, Fig. 99. When this is accomplished, the boxes are level.

Lining Up 2 and 1 Boxes.

Lining up consists in placing both boxes on a line with the race plate of the loom. Start from the first or top box. Get this box on a line with the race plate by turning the

Fig. 99.



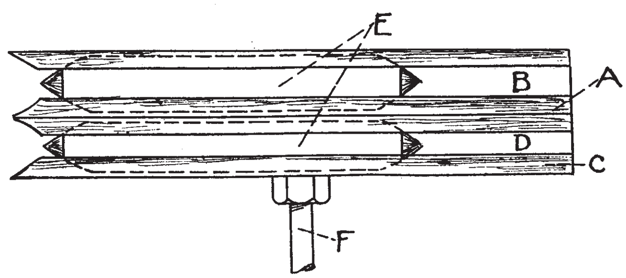


Fig. 100. Shuttle Boxes.

adjusting nuts C, Fig. 98. A steel straight edge will be found useful for this work. When the first box has been lined up, push in the sliding tooth O, Fig. 98, and turn the loom over so that the second box will rise. Now test the second box to see if it lines up with the race plate of the loom. If this box should be, say ¼ inch too high, the stud K, Fig. 98, is too far out from the center of the box-crank L.

To remedy this fault loosen the stud K and move it towards the center of the crank L, but be sure to move it so that the boxes will move only one-eighth or one-half of the distance in excess of that required. Then bring the first box in position again and line this box with the race plate. Regardless of the distance that the box moves, whether too much or too little, take only half of this distance by the stud K on the box crank L. Be sure to come back again to the first box and get the other half from the adjustments on the bottom of the box-rod.

If it is found, when coming from a level first box to the second, that the second box is about ⅛ inch too high or too low, get the adjustments from the stud F on the forward end of the box lever. Moving this stud out will give more throw to the boxes; moving it in will give less. This slot is used to get a rise or fall of only 1/16 to 1/8 inch. Under no circumstances should the stud I be moved after it has once been centered with the box crank. It is bad practice to get this stud off the center.

Timing the Boxes.

The boxes must not begin to move until the loom crank has passed the bottom center. The movement must be completed before the crank reaches the top center. They must be level and at rest when the pick is delivered.

One method of timing the boxes is as follows: With the loom crank on the bottom center, push in the sliding tooth O and move the segment gear Q until the first tooth is fully engaged with the projection or knuckle of the sliding tooth. Tighten up the segment gear, otherwise the weight of the boxes will cause it to slip. The only objection to this method of timing is that no two fixers will set the loom crank in the same position for the bottom center, and the distance of one tooth is the difference between right and wrong timing.

A method practiced by experienced loom fixers is to take the shuttle out of the box and draw the lay of the loom forward until the dagger strikes the bunter. With the loom crank in this position the boxes should be raised or lowered a full ⅛ inch. This is easily determined by watching the back lip of the box where it runs parallel with the lower edge of the picker slot. This is almost a standard setting with box-loom builders. Many of the later types of box looms are built with the segment gear Q keyed on the bottom shaft with the timing as described here.

Adjusting the Release Motion.

A release motion is intended to guard against breakage. If the shuttle is half in and half out of the box when the boxes are changing, it is obvious that something would break if some means were not employed to prevent it, hence the use of a release motion, which works well if adjusted correctly. The spring E must be strong enough to keep the two parts of the motion together when working under normal conditions, but must open up when the shuttle gets fast. Sometimes the shuttle will be so tightly bound in the box and in contact with the picker that when the boxes are changing the pressure will be too great, and the release motion will be forced open.

Some fixers remedy this condition by putting two springs on the release motion. This will effect a cure in one way, but on account of the additional pressure the teeth and the knuckle of the sliding tooth O will wear out very quickly. By the exercise of care this can be avoided. Place the shuttle half in and half out of the box. Have the sliding tooth fully engaged. Move the loom by hand and it is then easy to determine the amount of pressure required to open the release motion. Too much pressure is liable to break the teeth on the segments or break the end of the box lever G. Too little pressure leaves the boxes with a weak foundation. There is no hard and fast rule governing the strength of the spring. This is a matter of judgment.

Pickers play an important part in the running of a box loom. Pickers should never be bought from stock or without regard to the looms on which they are to be used. The manufacturer of pickers usually measures the loom parts in order to get the proper fit. A new picker should need no trimming. A rawhide picker should make its own hole. Pickers not in use should not be allowed to dry out. They should be kept in a bath of linseed oil. The wooden plug should not be taken out except when the picker is about to be used. After running a few weeks the picker will gather dirt and lint which clogs up the passage. Do not use a file to take out the dirt. A half-inch twist drill will clean out the picker, leaving a smooth passage. Pickers should be oiled by the weaver at least twice a day.

When a new bracket is put on the loom it often fits so as to bring too near to the boxes the end of the spindle at the end of the lay. This is a dangerous condition, because it causes a tendency to throw the shuttle out towards the weaver. If there is any variation the spindle should be a little farther from the boxes at the beginning of the pick than at the finish. This will cause a tendency to push the shuttle towards the reed.

All adjustments must be made when the shuttle is on the 4-box or dobby side of loom. This should not be forgotten. Otherwise many bad warp breaks will be made.

4 and 1 Box Motion.

The fixer who has paid strict attention to the explanation of the 2 and 1 motions will have little difficulty in handling the 4 and 1 box motion. The same methods are employed in leveling the boxes, adjusting the picker and picker spin-

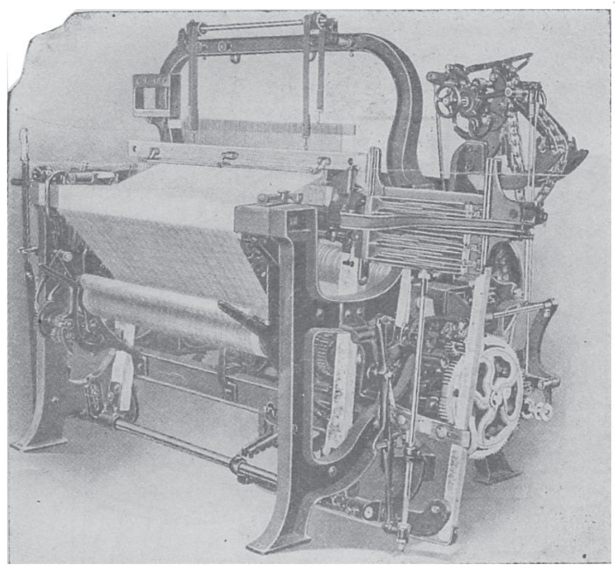


Fig. 101. A 4 and 1 Box Gingham Loom.

dle, timing the boxes and fixing the release motion. The only difference is in the timing of the boxes and operating the boxes for the different patterns. What is termed "boxing" the colors requires some judgment. The main point is to avoid skip boxes; that is, jumping from box 1 to box 4 or from box 4 to box 1, or even from box 1 to box 3 and the reverse. While the box motion is built to skip boxes, it is good practice to avoid them because the easier and shorter the lifts or drops, the longer the motion will run without fixing. There are times when skip boxes cannot be avoided. If the boxes are set to skip unnecessarily, the fixer, weaver and manufacturer suffer from the consequences.

Fig. 101 shows a 4 and 1 gingham loom of the ordinary type. This 4 and 1 box loom is frequently equipped with a

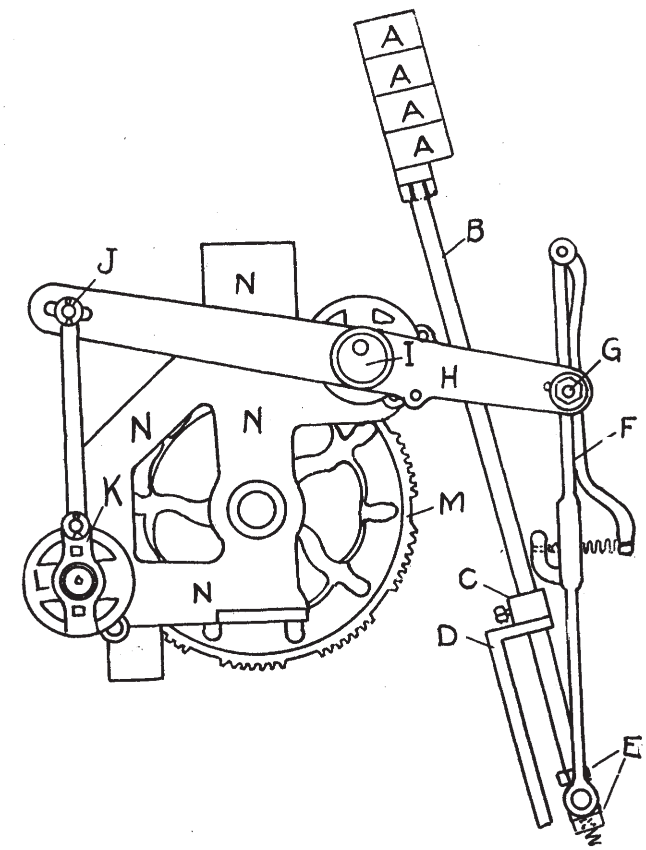


Fig. 102. Box Lifting Mechanism.

head motion, as shown in the upper right-hand corner of Fig. 101. This loom is of very solid construction and gives little trouble to the fixer.

Fig. 102 shows the box lifting mechanism and illustrates the directions for lining up the boxes, which is really the only difficult operation in fixing this loom. AA are the boxes; B, box rod; C, check collar; D, rod guide bolted to the rocker shaft; E, adjusting nuts; F, release motion; G, adjusting slot in box lever; H, box lever; I, eccentric; J, rear slot in box lever; K, box crank adjuster; L, box crank; M, star wheel; N, frame holding the entire motion.

Particular attention must be given the eccentric I, the box crank adjuster K and box crank L.

Lining Up the 4 and 1 Motion.

Half of a revolution of the eccentric I corresponds to the distance of one box either up or down. Half of a revolution of the box crank corresponds to the distance of two boxes. The eccentric I is not adjustable. It is built to move the distance of one box, but after running for some time it wears a very little. The distance lost through wear is made up by moving the stud in the slot G nearer to the end of the box lever, giving a slightly greater movement of the boxes up and down. Under no circumstances move the stud in the slot J on the opposite end of box lever away from a center with the box crank adjuster K.

After leveling the boxes as explained for the 2 and 1 box motion, turn the eccentric crank I half way around, bringing up box 2. If this box is too high or too low, make adjustments in slot G. Then come back to box 1, with this box exactly level. Turn the box crank half way around. This will give box 3. If box 3 is too high, make all the adjustments by the box crank adjuster K, as explained for the 2 and 1 box. The movement from box 3 to box 4 is made by the eccentric I, which has already been adjusted for a movement of one box. The motion moves the boxes as follows:

From 1 to 2, one-half turn of eccentric I.

From 2 to 3, one-half turn of box crank L, which raises 2 boxes; and one-half turn of eccentric I which lowers 1 box at the same time.

The eccentric I is again in neutral position.

From 3 to 4 turn the eccentric one-half turn again, starting from the first or top box. The box crank attached to the eccentric I can be turned by hand. Turn this half way around and make the adjustments as described above. This completes all the adjustments for the movement from 1 to 2 and 3 to 4.

The movements from 1 to 3 or from 3 to 1 are made by the box crank L and all adjustments must be made by the adjuster K.

Keep the shuttle on the 4-box or dobby side of the loom when making these adjustments or when fixing any part of the motion.

Fig. 103 shows the circular plates or studded disks which are called the box-cranks. A is a side view; B, an end view. The two fingers which can be seen lying on the studs at B are kept in position by the spring shown at A. One-half turn of the crank sets the fingers on the two lower studs. The spring at A must be strong enough to allow the fingers to assume the different positions without rebounding.

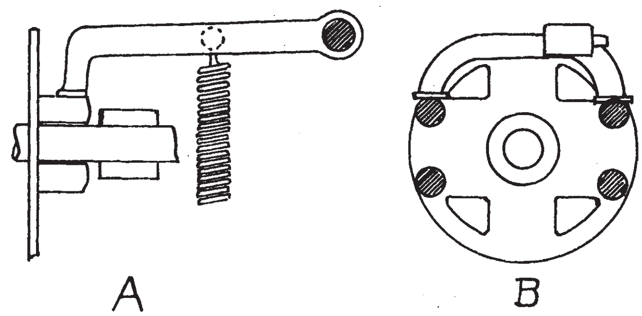


Fig. 103. Box Crank, Side and End.

The springs are adjustable for tension. The box cranks, segment gears and eccentrics are fastened to the respective shafts by pins driven through the gears and shaft. These pins often work loose, causing the cranks to be late in turning. This causes the picker or boxes to appear out of line. The shuttles frequently become chipped and fly out. The only way to locate the cause of the difficulty is to take the spring and fingers, Fig. 103, away from the box cranks. Everything now being free, it is easy to determine whether the box crank, segment or eccentric is loose on the shaft.

If either is found loose, the machinist should put in a new pin. Most all these parts are made from malleable iron which often wear inside, necessitating a new hole, as well as a new pin. The life of a new pin is not very long if the hole in the gears or eccentric is worn.

The initial move is given to the boxes by the first tooth of the star wheel striking the sliding tooth. The other teeth have comparatively little work to do, merely assisting in the further movement of the boxes. The first tooth becomes worn, causing a tendency for it to slip over the sliding tooth. New teeth made from steel wire can be put in but they do not last very long. The wise fixer will change the star wheels from a right to a left-hand loom, or from left to right, bringing the good tooth of the star wheel facing the sliding tooth. Time and money are saved by this method. A new star wheel is expensive and needs a lot of fitting to the older and worn parts of a motion. One of the most difficult parts to replace is a box-lever, as the slightest bind on the eccentric causes trouble. There must be no lost motion between the eccentric and the box-lever. If the casting has been made by some indifferent moulder and finished by an equally indifferent machinist, there will be trouble for the fixer. These parts should be bought from the loom builders, who have special machinery for making the castings. The extra cost is more than offset by the saving of the fixer's time and by increased production.

Boxing the Colors.

The method used in most gingham mills is to give the fixer a blank form showing the filling pattern, the boxing of the colors being left to the fixer. There is much difference of opinion as to whether it is advisable to lift the boxes or lower them when weaving a skip-box pattern. Suppose, for example, that the pattern is laid out so that a movement from box 1 to box 4 or from box 4 to box 1 cannot be avoided. Some fixers claim it is better to lower the boxes because gravity helps the motion, others claim it is better to raise the boxes because in this way they become settled quicker. There is force in both claims and that is the reason why looms will be found with boxes changing in different ways, but making the same pattern.

A form for the filling pattern and chain draft, which is used in many gingham mills, is arranged as follows with a space left for a sample of the cloth to be duplicated:

Picks	Color		Wrong	Wrong	Right
48	White		1	2	2
24	Blue	2	2	3	1
48	White		1	2	2
10	Red	6	3	1	3
10	Yellow	4	4	4	4
10	Red	6	3	1	3
10	White		1	2	2
10	Blue	2	2	3	1
6	White		1	2	2
6	Blue	2	2	3	1
6	White		1	2	2
6	Blue	2	2	3	1
6	White		1	2	2
10	Blue	2	2	3	1
10	White		1	2	2
10	Red	6	3	1	3
10	Yellow	4	4	4	4
10	Red	6	3	1	3
250					

A space is left in the form for the fixer to insert the order for boxing the colors. A good method is to start with box 1 and work up. If this does not avoid skips, then start with box 2 and work up. If skip boxes still occur then start with box 2 and work down. The form given above shows how this method works out. The third order of boxing colors is right.

The order of boxing colors for a 3-box pattern is shown in the following table:

Picks	Color		Wrong	Right
60	White		1	2
6	Pink	5	2	1
60	White		1	2
6	Tan	8	3	3
132				

Allowing two picks for each bar of the pattern chain, the first method would call for 125 bars of chain; and the second, 66 bars.

Box-Loom Multiplier Motion.

As the fixer in a gingham mill has to build his own box-chains, the chain building formerly took up much of his time which could have been better employed.

The multiplier motion eliminated the building of long chains, resulting in the saving of labor and cost of a large amount of chain stock.

The multiplier motion as used on gingham looms is one of the most efficient devices ever placed on a loom. By the use of different cams, which are easily changed, one bar of the chain can be made to serve for 8, 12 or 24 picks. One revolution of an 8-multiplier cam with three depressions will give 24 picks with 3 bars of chain. A cam with two depressions will give 24 picks with 2 bars. A cam with one depression will give 24 picks with one bar.

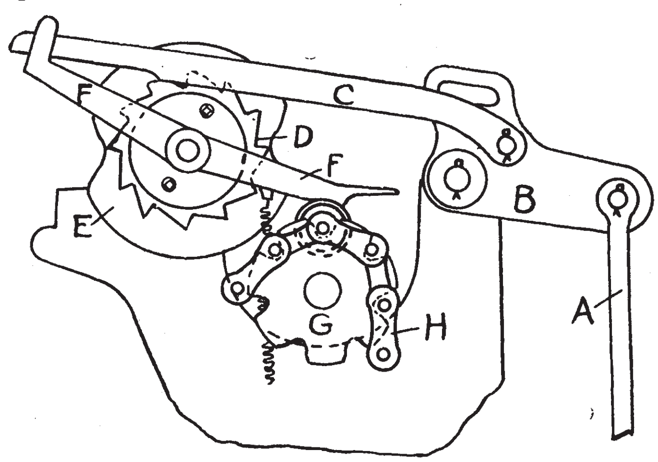


Fig. 104. Multiplier Motion.

Fig. 104 shows a multiplier motion equipped with a 2-depression cam equal to 24 picks for 2 bars of the chain at one revolution. A is the rod driven by a double cam on the bottom shaft; B, oscillating casting to which is attached the pattern cylinder pawl also the multiplier pawl; C, driving pawl for multiplier; D, cam sprocket; E, the cam; F, tipping lever; G, pattern chain cylinder; H, pattern chain.

Fig. 105 is a view of the opposite side of a multiplier motion, showing the pattern-cylinder pawl, stop pin K, pattern cylinder sprocket L and pawl lifter M.

Fig. 106 shows 5 bars of the pattern chain. The first bar is built with one extension ball which operates the multiplier for the shuttle in the first or top box. This kind of a ball can be used in the same position on any bar, no matter how many box operating balls there are on the same bar. The second bar is built to operate the first box also. The

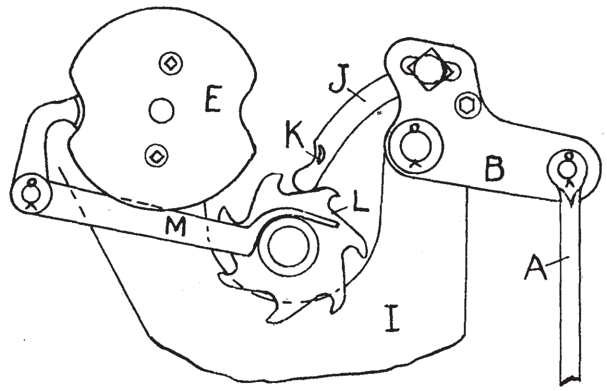


Fig. 105. Multiplier Motion.

third bar has one ball which engages the sliding tooth that turns the eccentric one-half revolution, which gives the second box. The fourth bar has a ball which engages the sliding tooth operating the box crank in the rear of the motion. This crank turns one-half revolution and raises a distance

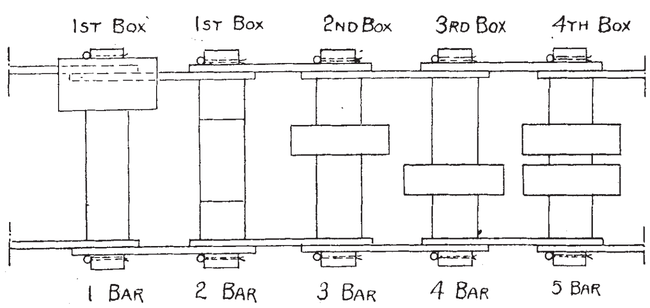


Fig. 106. Pattern Chain.

of two boxes. On the same pick the eccentric is again engaged and, turning back one-half revolution, lowers the box which is raised on the third bar. While the box crank is raising two the eccentric takes away one which brings the third box in line. The fifth bar has two balls, one of which keeps the third box in position. The other one again engages the eccentric which gives one box and brings the fourth box in line.

The boxes can be raised or lowered in any desired order. Fig. 106 merely shows the manner of building a bar of the chain to operate either the multiplier or any of the boxes. If a dobby is used instead of a box-head, two harness levers is all that will be required to operate the box motion for the four boxes.

Take, for example, 60 picks of white using a 2-depression or 12-multiplier cam as shown at Fig. 104. One complete revolution of this cam corresponds to two bars of the pattern chain or 24 picks, each depression being equivalent to 12 picks. Five bars (60 ÷ 12) of the pattern chain would be required to give 60 picks, whereas 30 bars would be required if no multiplier were used.

Fig. 104 shows a multiplier ball lifting the tipping lever F. This permits the pawl C to engage the sprocket D and turn the cam one pick. As the depression on cam E is turned out of position, the pawl lifter M, Fig. 105, rises and covers the outer surface of the pattern cylinder sprocket, stopping the pawl J from engaging with the sprocket. This continues until another depression appears on cam E, which permits the lifter to fall and lowers the cylinder pawl, which turns the pattern chain one bar. If the next bar contains an extension or multiplier ball, the operation of the multiplier cam is continued.

The sprocket D is bolted to the cam E. If the fixer wishes to change to a more convenient multiple, he can do so in a very few minutes. The resetting of the cam and sprocket is an easy matter.

Setting the Pattern Cylinder.

The multiplier and pattern cylinder pawls are located on the oscillating casting B, which is operated by rod A through the medium of a double-faced cam on the bottom shaft. With the shuttle on the handle side of the loom, move the lay of the loom forward until the oscillating casting B has been given its full movement upwards. Set the pawl J in full engagement with the sprocket L. Now turn the loom until the casting B is in its lowest position and set cam E so that the offset on the lifter M is completely in a depression and the pawl C, Fig. 104, is fully engaged with sprocket D. This is the correct setting for position. The timing will be given under the next heading.

The Still Box-Motion.

This device is for the purpose of preventing the boxes from changing when the filling is exhausted or broken, or when the filling fork is not working right. If the brake on a loom is in working order there is little need of a still box-motion because the brake should stop a loom with the shuttle on the box side and the lay of the loom no farther forward than at the bottom center.

No matter what position the shuttle is in when the filling breaks or becomes exhausted, the shuttle must come to the handle side of the loom and the lay must come forward to full front center before the filling stop motion becomes operative and the handle of loom is disengaged. When the lay has passed the front center and is moving towards the back center, the loom should come to a full stop with the lay no farther than bottom center.

If the loom should swing over for another pick and the boxes be changing on this pick, the weaver will find the loom stopped, but a shuttle containing another color with filling unbroken will be in the box. This often puzzles the inexperienced weaver. It is very easy to discover the cause and apply the remedy. Start up the loom and place the finger on the filling fork so that the handle will knock off. If the loom does not stop on the pick with the shuttle at the box or dobby side and the loom no farther forward than at the bottom center, it is evident the brake is not working right. If the still box motion is working properly the boxes will not change, no matter how many times the loom swings over after the handle has been knocked off. Fig. 107 shows the still box motion as used on a 2 and 1, 4 and 1, and 6 and 1 gingham loom. The lifting finger A is attached to a rod which extends to the handle side of the loom and is operated by pressure from the filling motion slide. B is the stop plate; C, push arm connected to lever D with a stud. The lever D works freely on the stud E. The lever F also works freely on the stud E. The release yoke G is attached to the lever F and works freely on a stud. The two parts of the yoke extend from this stud and clamp together on a stud located on the lever D, being held together by the spring H. The spring I holds the levers D and F clamped to the double cam J, which imparts motion to the entire mechanism and also to the rod A, Figs. 104 and 105.

Fig. 108 is a front view of the stop plate B showing the slot in which the push arm C slides. When the filling is not broken or exhausted the push arm C is free to pass through the slot in the stop plate B. When the filling is broken or exhausted the filling motion slide is pushed back and acts on the rod, which actuates the lifting finger A, raises the stop plate, and a blank instead of a slot is presented to the point on C. This arm is prevented from moving any farther, and by the continued rise of the lever F pressure is exerted against the stud which holds the yoke G together. The yoke is forced to open up, throwing F out of engagement with the cam J. The jaws open and the cam J revolves between the open jaws without imparting any movement to the rod A, Figs. 104 and 105.

The pattern chain cylinder does not move and the boxes cannot change. This condition continues as long as an empty shuttle or a shuttle with broken filling is running in the loom. When the filling is replenished the stop plate B is allowed to fall and the jaws D and F automatically close again.

Timing the Still Box-Motion.

When describing the multiplier motions the timing of the pattern-chain cylinder was omitted because this cylinder and the multiplier is operated by the cam J which also operates the still box motion. The movement of this cam must be timed to work in conjunction with the cam which operates the filling motion.

With double cam J, Fig. 107, in neutral position, set the stop plate so that the bottom edge of the slot will be level with the surface on which the push arm C slides. Have the cut out edge of this arm ¼ in. from the edge of the slot, with the shuttle on the hand side of the loom. Remove the filling from the filling-fork and move the lay forward until the filling-fork slide is being pushed outwards. With the lay in this position set the cam J so that it is just beginning to move the lever F upwards. This lever operates the push arm C. By the time the cut out part of the arm reaches the stop plate B, the slot in this plate will be raised and will present a blank surface with which the cut out on arm C will engage. Continue the movement of the lay and note the opening of the levers D and F. This is the right method of

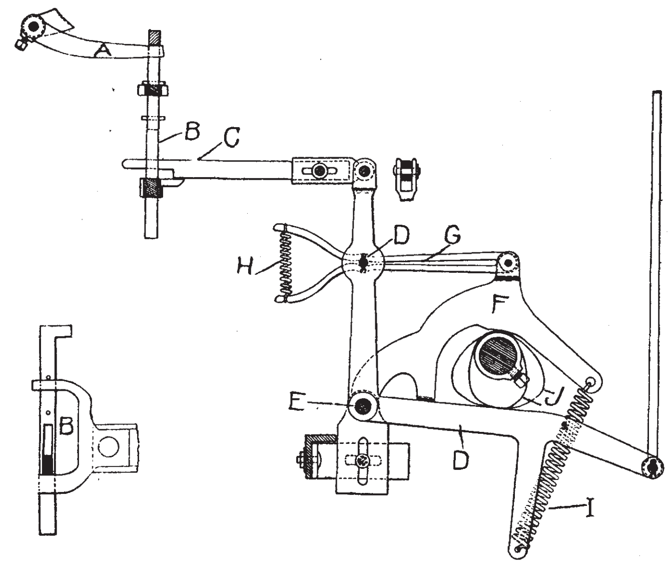


Fig. 108. Still-Box Motion. Fig. 107.

timing the pattern chain cylinder, still box motion and filling stop motion so they will all work together.

The cam J, Fig. 107, is a double cam. The cam with the larger surface acts as a driver, and the smaller surface cam acts as a disconnector. With a single surface cam it is obvious that every time the filling motion slide falls back after stopping the loom, the jaws of the levers D and F will come together, thus imparting motion to the driving rod. The double cam prevents this. As the bottom shaft continues to revolve the depressed part of the large surface cam is brought under lever F. This permits the lever to come down, but the larger part of the smaller cam is pressing down on lever D at the same time, keeping this lever from operating the driving rod. As the shuttle is again propelled to the other side of the loom the filling motion slide is pushed out again.

The 6 and 1 Box-Motion.

An explanation of this motion calls for little in addition to what has already been said regarding the 4 and 1 box motion. The same method is used to level the boxes as with the 2 and 1 and 4 and 1 box motions. The timing and adjusting are the same. The only difference is in the make-up of the box lever and the leveling of the boxes with the race plate of the loom. It will be noted that the release motion is located on the rear end of the box lever and that two box cranks are fitted to connect with the lever. Each crank is fitted with a large stud, which fits loosely into sliding blocks. These are fitted into a recess on each side of the lever stand.

Fig. 109 shows the 6 and 1 box motion. A A are the boxes; B, box rod; C, lifting rod; D, box lever; E, release motion; F, lower rear box crank; G, upper rear box crank; H, front upper box crank; I, balance weights; J, box lever stand; K, front sliding block; L, rear sliding block. These blocks operate the boxes. They permit the operation of the studs without allowing the box lever to swing back and forth. The only movement of the lever is up and down. The box lever on the 4 and 1 box motion has a slight movement horizontally. It is obvious that this movement is not permissible on the 6 and 1 motion because there are two box cranks to one lever. At times one box crank would be required to turn in a direction opposite to the other, hence the need of sliding blocks.

Operation of the 6 and 1 Box-Motion.

A half revolution of either one of the upper box cranks raises or lowers the boxes for a distance of one box. The cranks give the distance from 1 to 2 or 3 and from 4 to 5 or 6. A half revolution of the lower box crank gives a movement of 3 boxes. In order to raise the boxes consecutively the operation is as follows:

Starting from the first or top box, engage either the front or rear upper box-crank, as half of a revolution gives the second box. Engaging the other upper box crank gives the third box. These two cranks are now up, that is, out of neutral position.

Engage the lower box crank and disengage the two upper cranks. The lower crank will move the boxes for a distance

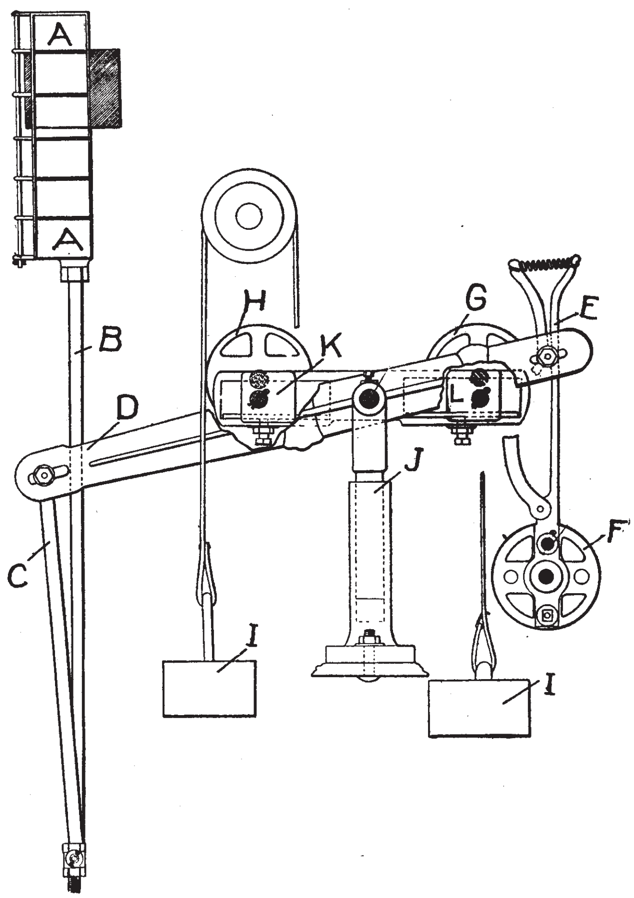


Fig. 109. 6 and 1 Box Motion.

of three boxes, but the two upper cranks coming back to neutral position will reverse for two boxes, leaving the fourth box in position. The two upper cranks are now ready to be engaged again for one box each, from 4 to 5 and 5 to 6. The boxes can be lowered in the same order or in any order desired.

Lining Up the 6 and 1 Box-Motion.

Starting with the first or top box, turn the front box crank one-half revolution. This brings up the second box. Note very carefully the position of this box in relation to the race plate of the loom. Turn the rear upper box crank one-half revolution. This brings up the third box. Note carefully the position of this box in relation to the race plate of the loom. Whatever difference there is between the position of the second and third box must be divided by moving the box lever stand J either forward or back, because the stud on the upper part of this stand is the center from which the two sliding blocks operate. If one block is farther away from this center than the other there will be a difference in the lift of the boxes.

After the lift of the two boxes has been equalized, come back to the first box, then to the second, and note if the lever is lifting both boxes the right distance. If any adjustments are necessary they must be made by moving the stud on the forward end of the box lever. Boxes 1, 2, 3, 5 and 6 are now lined up. Starting again from box 1, turn the lower crank F one-half revolution. This will bring the fourth box into position. If this box is too low or too high, make adjustments by moving the adjustable plate on the box crank F.

The Northrop Loom

This loom is an automatic filling-replenishing loom. The filling changing mechanism on the Northrop is made up of few parts, is easily understood and as easily fixed. The shedding, picking and beating-up on this type of loom is the same as on the ordinary loom. All the auxiliary motions are much the same, so that what has been said regarding the fixing of ordinary looms can be applied to the fixing of the Northrop loom, aside from the filling-changing mechanism and the feeler motion.

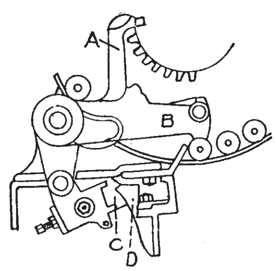
The filling-changing and filling-feeler device is not restricted to the plain loom, but is running successfully on fancy marquisettes, corduroys, jacquards and fabrics made with cotton, woolen or worsted filling. The filling-changing device works equally well on fine and coarse filling.

Some looms are run without the filling feeler motion, but nearly all mills are now using this device. Without the feeler the filling becomes exhausted entirely before a new bobbin or cop is inserted in the shuttle, the result being a broken pick on plain cloths, or a broken pattern on jacquards or fancies. By the use of the filling-feeler the filling is changed before it becomes entirely exhausted. If the filling should break the loom will stop and is then started by a weaver. Perfect cloth is obtained by using the feeler. The gain from the low percentage of second quality cloth far offsets the waste left on the bobbins or cops by the feeler motion.

The principal parts of the filling changing mechanism are a magazine or hopper for holding extra bobbins or cops, and a transferring arm for inserting a full cop or bobbin into the shuttle. This arm also acts as an ejector which throws out the exhausted bobbin or cop. There is also a shuttle-positioning device termed a shuttle feeler, which prevents the transferring of a bobbin or cop unless the shuttle is in the correct position.

Fig. 111 is an end view of hopper and transferring device.

The front end of the hopper which contains the retaining springs is cut away to give a better view of the transferring device. The circles at the lower part of hopper represent the heads of the bobbin or cop skewers. A is the pawl which turns the hopper into position after a full bobbin or cop has been inserted; B is the hammer or transferrer which drives a full bobbin or cop into the shuttle. The exhausted bobbin or cop is driven out by the impact. A fork extending across the top of the bobbin is fastened to the head of the hammer. This fork, not shown in sketch, steadies the end of the bobbin and prevents it from rising when the head is struck by the hammer B.



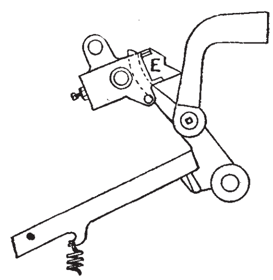


Fig. 111. **Northrop Loom.** **Fig. 112.**

C is the latch which operates the transferrer when brought in contact with the bunter D. The bunter D is fixed on the lay of the loom. The latch C is fastened to the starting rod which extends to the shipper side of the loom and is operated by the filling motion slide when the loom is not equipped with a filling-feeler motion. When a filling-feeler motion is used the latch C is raised by the starting rod independently of the filling motion slide.

When the loom is equipped with the feeler, the filling fork slide operates only when the filling breaks, and without changing the bobbin or cop it stops the loom. When not equipped with the feeler the loom does not stop when the filling breaks, but changes the cop or bobbin. If the hopper is kept supplied with full bobbins or cops the loom will run almost indefinitely, but a broken pick or pattern will show in the cloth when a change of bobbin occurs.

Fixing the Transferring Device.

The setting and timing of the filling fork is the same as on an ordinary loom. The only difference is in the shape of the cam which gives motion to the lever that operates the starting-rod and filling-fork slide. When the filling becomes exhausted or breaks, the knock-off lever engages the fork when the shuttle is on the shipper-handle side of the loom. The shuttle must then be propelled to the hopper side of loom and the lay brought to almost front center before a full bobbin or cop can be inserted into the shuttle.

During this period of engagement with the starting-rod and filling-fork and until a transfer is made the filling-fork or starting-rod must remain fully engaged. Immediately after the transfer the knock-off lever falls back on the flat part of the filling motion cam. When the knock-off lever engages the filling-fork the slide is pushed back. This turns the starting rod which extends to the hopper side. On this rod is fastened the latch C, which is brought in contact with the bunter D. The hammer B is forced down, making the transfer. When not operating the hammer B should rest about ½ inch above the head of the bobbin or cop skewer.

Setting the Latch.

First draw the filling away from the filling-fork. Move the lay forward so that the knock-off lever will engage the filling-fork. Keep moving the lay until the shuttle is on the hopper side of the loom and the latch C is fully engaged with the bunter D. Then move the lay forward until a transfer is made. If the transfer is not complete make the necessary adjustments by the set and check nuts at the back end of the latch C.

Do not in any case let the hammer B come any nearer than ½ inch from the head of the bobbin when not being operated because a sharp blow, not a pushing movement, is necessary to eject the exhausted bobbin.

Adjusting the Shuttle Feeler.

Fig. 112 shows the shuttle feeler attached to the transfer device. It is operated by an eccentric. As the latch C is lifted up the feeler is thrown forward across the race board of the loom. If the shuttle is not in the right position for a transfer the end of the shuttle coming in contact with the feeler forces the feeler and latch C back, preventing a transfer. The feeler must be set so that when the lay is on the front center the end of feeler will be level with the back of the shuttle-box. The back of the lay is recessed at this point so that the feeler will not strike.

Eccentric Crank-Arm Pins.

It is very important that the bobbin should strike exactly in the center of the shuttle when a transfer is being made. Wear and tear of the crank arms and pins will put the lay out of line so that the hammer B will strike the side of the bobbin. By the use of an eccentric crank-arm pin the lay can be adjusted so that a movement forward or backward can be given while the crank arm is stationary. This device enables the fixer to adjust the lay with very little trouble, so that there will be little danger of breaking bobbins or shuttles when a transfer is being made. When adjusting the lay by the crank pins the distance must be the same on both sides.

Filling Feeler-Motion.

The purpose of this device is to replenish the filling before it becomes entirely exhausted, thus preventing broken picks on plain cloth, or broken patterns on fancies, jacquards or marquisettes. The Stimpson sliding feeler is the latest and best device of this kind. The amount of waste made by the Stimpson sliding feeler is negligible. The weaver on ordinary looms who catches the filling before it becomes exhausted will make 25 per cent. more waste than is made by the Stimpson feeler. The tip is made of fiber or steel, and is corrugated on the end. As long as there are a few firm strands of filling on the bobbin the tip will not slide. When the filling on bobbin has run down to a few loose strands this tip will slide and then through the medium of a sliding block and wire connection the starting rod is made to operate and the bobbin is changed.

Fig. 113 is a sketch of the feeler with the cover in place. Fig. 114 is the feeler with the cover removed to show the construction. A, Fig. 114 is the feeler tip; B, feeler rod; C, sliding block; D, recess in sliding block; E, end of recess in sliding block; F, connecting wire; G, feeler-rod stop; H, feeler rod spring.

When a full bobbin or cop is in the shuttle the tip A does not slide and the rod B remains at the left of the recess in the block C. When the filling has run down to a few loose strands the tip A slides to the right of the recess and, pressing against the end of the recess D at E, forces the sliding block C to the right. The connecting wire F makes a contact with the knock-off lever. This operates the starting

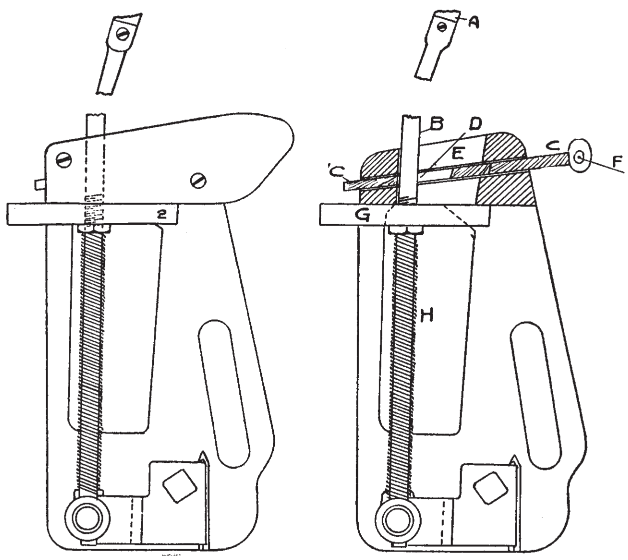


Fig. 113. Northrop Loom. Fig. 114.

rod and a transfer is made. Adjustment of the feeler is made by taking off the cover, removing the end of the connecting wire and making a few right or left-hand turns. The opposite end of this wire is threaded and fits into a square block. If the amount of waste is excessive a few turns of the wire to make it longer will reduce the waste. It is a simple arrangement and very little skill is required to fix it.

The Stafford Loom

The shedding, picking and beating-up motions, as well as the take-up and other auxiliary motions on this type of loom, are the same as on the ordinary plain loom. The filling replenishing mechanism changes the shuttle when the filling becomes exhausted, or nearly exhausted in case a feeler motion is used.

The loom is automatically stopped for approximately four seconds when the filling becomes exhausted. Then by the action of a series of cams the shuttle containing the exhausted bobbin or cop is ejected and a shuttle with a full bobbin or cop is carried into shuttle box, which is immediately closed and the loom started automatically.

The shuttle-changing mechanism is of solid construction and when set right there is little danger of slipping or breakage, as the loom is stopped when the shuttles are changed.

When the loom is started the changing mechanism is at rest with the exception of the worm, worm wheel and clutch shell, which are loose on the cross shaft. There is no strain on the mechanism until the filling again becomes exhausted.

This loom is adapted for jacquards, fancies, marquisettes and all kinds of heavy sheetings and tire duck and any kind of cotton goods that can be made on a single box loom. It is also operated successfully on linen, silk, worsted and jute fabrics.

Fig. 115 is a view of the shipper-handle side of the loom, with all of the shuttle-changing motion exposed except the starting-clutch lever, which is hown at Fig. 116. A is the filling motion slide; B. shipper knock-off; C, starting lever; D, starting-lever rod; E, clutch; F, worm wheel; G, cross shaft; H, worm; I, worm rod; J, bevel gear on upper end of worm shaft; K, bevel gear on friction-drive pulley.

The bevel gear J receives its motion from the bevel-gear on the driving pulley. The worm, worm wheel and clutch are loose on the cross shaft G when the loom is not running.

Fig. 116 shows the reverse side of the clutch E, with the clutch lever. The small squares at the edge of the outer circle represent recesses in the clutch disc. The disc is loose on the cross shaft G when the loom is running. When the filling-fork slide is pushed back because of lack of filling, the clutch lever engages the disc and sets the cross shaft G in motion.

Fig. 117 shows the magazine side of the loom; L is the front board and ejector cam; M, front board lifter and ejector lever; N, leather apron for guiding the exhausted shuttle

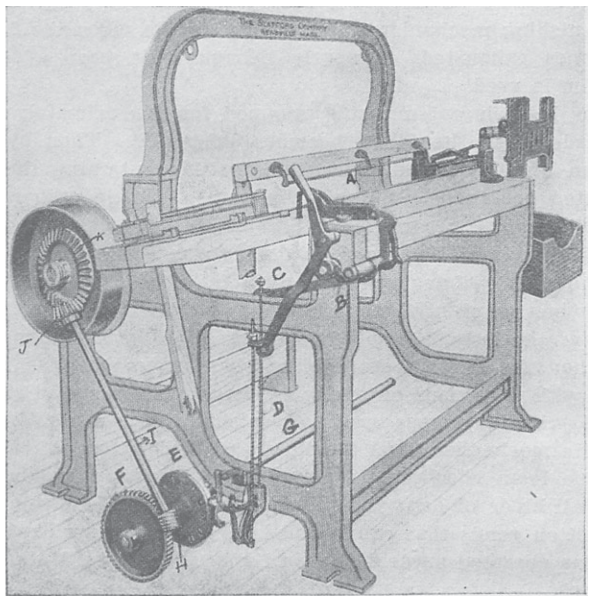


Fig. 115. Shuttle-Changing Motion-Driving End.

to the metal plate tumbler O on which is fastened the safety catch P; Q, conveyor cam; R, conveyor lever; S, starting-

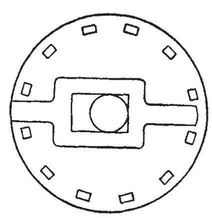


Fig. 116. Reverse Side of Clutch.

up cam, which starts the loom after a new shuttle is in place.

The starting lever cam and front board and ejector cam are cast together. The starting-up cam is separate. The three cams are securely locked together and fastened to the end of the cross shaft.

When the shuttle is to be changed the filling fork slide or auxiliary slide is forced back. This knocks off the handle and stops the lay slightly forward of the back center. The backward movement of the filling slide raises the starting lever C. This throws the clutch lever, Fig. 116, into engage-

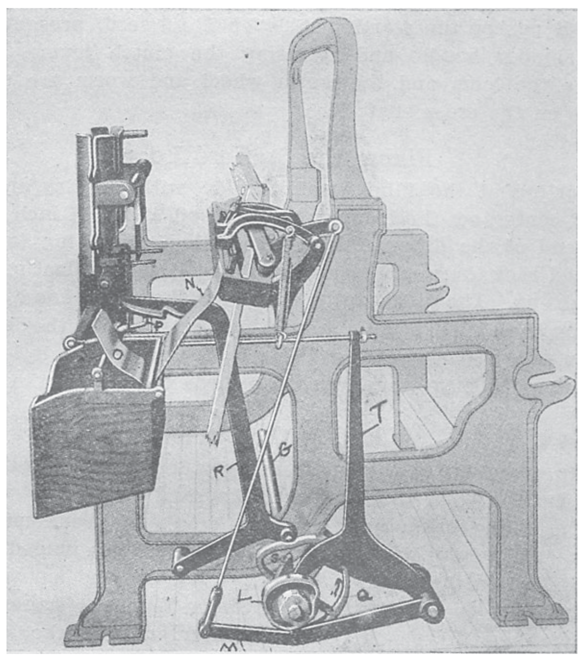


Fig. 117. Shuttle-Changing Motion-Magazine End.

ment with the clutch disc E, which is in continuous movement. The cross shaft is now started, turning the three cams on the magazine end of loom. One revolution of the cams completes the change of the shuttle and the re-starting of the loom.

As the cam L, Fig. 117, revolves it presses the lever M, which raises the front board of the shuttle box and forces the ejector in the shuttle box to throw the shuttle out. At the same time the conveyor cam Q forces the conveyor lever backwards, releasing a new shuttle and placing it on the conveyor fingers. As the exhausted shuttle falls it tips the metal tumbler O, which releases the safety catch D. This allows the conveyor to come forward towards the shuttle box, placing the new shuttle in position. The front board immediately begins to return impelled by a spring. When the front board reached the correct position the starting-up cam S pushes the starting-up lever T forward, pressing on the shipper handle and releasing the clutch lever. This starts the loom and the worm wheel and worm are again loose on the cross shaft G.

Fixing the Stafford Loom.

Starting at the filling motion slide with the lay in full front center, set the hammer or knock-off about ⅛ inch from the end of the filling fork, so that when the filling fork is pushed back there will be no more than ⅛ inch of lost motion to take up. The distance the slide is pushed back has a bearing on the action of all the starting parts. With the knock-off in this position set the filling fork cam so that it is just beginning to move the hammer towards the end of the fork.

Setting the Brake.

The operation of the brake is very important in running this loom. When the shipper is knocked off by the action of the filling-fork slide the loom crank is about midway between the front and top center. The brake is immediately applied when the handle is knocked off, but the momentum of the loom carries the lay a variable distance farther, but it should not reach the bottom center. The brake should stop the lay a little forward of the back center. The brake should be clear of the brake wheel when the loom is running. The brake is very powerful and if kept clean, free from oil and correctly adjusted will give very little trouble. It is easily taken apart for renewal of the friction surface.

Setting Shipper Handle.

Set the shipper handle so that it will move ¾ inch before taking the brake from loom. This prevents the strain of moving a heavy weight from a stationary position. The lever works more easily when it is set in motion before the pressure is applied.

Setting the Conveyor.

When laying a full shuttle in position the conveyor should be exactly square with the lay of loom, with the conveyor fingers just clear of the race plate. With the lay at the front center the conveyor fingers should clear the lay a full ⅜ inch when not in operation. The front board should rise only high enough to allow the exhausted shuttle to be ejected, and should be adjusted so that it will be out of the way of the incoming shuttle.

The Jacquard Machine

The jacquard machine was invented about fifty years before the dobby. Jacquard's original idea of shedding has remained unchanged to the present time, the improvements consisting in the strengthening of the parts and in new designs for the working parts, which enable the machine to be run at a higher speed.

The single-lift jacquard machine is rapidly becoming obsolete, because it cannot be run at a high speed and is very hard on the yarn. The type of machine now built in large numbers is the double-lift, single-cylinder jacquard now generally used; as it can be run at a high speed, brings less strain on the yarn and is easier for the weaver to operate. In the greater number of mills where these machines are installed women are employed as weavers.

At first glance a jacquard machine appears to be a very complicated machanism, but in reality it is as simple as a dobby. The comber board is the index to the machine and is not very hard to master. When the fixer has a thorough knowledge of the comber board, it is easy to locate any hook, needle or part of a pattern card that is causing miss-picks, broken patterns or other defects. If he is wise he will teach the weavers how to read the board. In this way he will save many fixing jobs and keep a loom running that would otherwise be stopped.

Needles will stick, hooks will get bent, cards will come unlaced in places and neck cords will break. Any weaver can fix them easily and quickly, if she knows what the trouble is.

Fig. 119 shows a double-lift, single-cylinder jacquard machine mounted on supporting timbers. A is the adjusting slide; B, leveling screw; C, check nut; D, upper griffe lever; E, lower griffe lever; F, cylinder lever; G, cylinder driving rod; H, cylinder; I, cylinder pawl; J, protector pawl.

A, Fig. 121, is the upper lever driving rod; B, lower lever driving rod; C, cylinder driving rod; D, double crank; E, hand wheel used for driving the cylinder.

Leveling the Jacquard Machine.

A machine will frequently sag on one side on account of some part of the support getting loose. This condition is indicated by the sheds presenting a wavy instead of a straight line. Until the cause of the sagging is discovered no attempt should be made to level the machine. Sometimes the braces which extend from the roof to the supporting timbers will work loose and cause two or three machines to get out of line at the same time. The sagging may be gradual, continuing over two or three days before the fixer discovers the cause of the trouble.

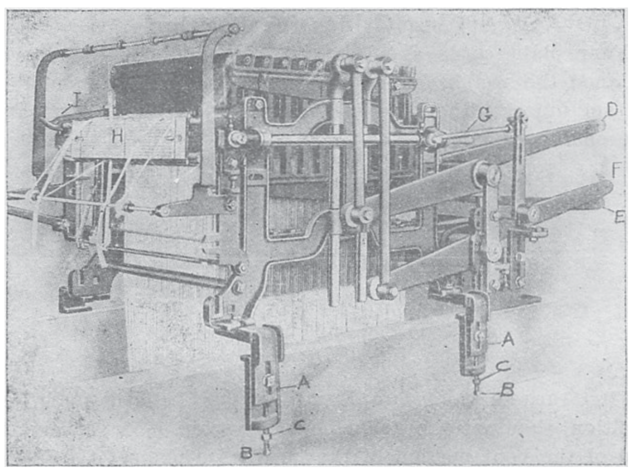


Fig. 119. Jacquard Machine.

If the fixer keeps leveling the machines without knowing what is causing the trouble he will have a big job on hand after a short time, as the work will have to be done all over again when the supporting rods are tightened up. If the rods break or suddenly get loose it is an easy matter to discover the trouble.

A long spirit level should be used when leveling a machine. The level should be used on the griffe blades, not on the frame. The leveling is done by turning the screws, Fig. 119, on all four corners if necessary. By means of these screws any corner of the machine can be raised or lowered as required. When the machine is level the nut and check nuts must be turned up very tight. Heavy bolts should be used to fasten the machine to the supporting timbers and also to fasten the comber board to the supporting brackets. Frequently the comber board will become loose and move up, down or sideways. When this happens the shed will have a very wavy appearance. The comber board must be moved gradually to the correct position, which is reached when the shed presents a straight line. There is considerable strain on the comber board, and unless securely fastened it will continue to work loose, causing much annoyance and bad work.

Setting Griffes for Position.

Four plain cards should be tied around the cylinder to balance the weight on each griffe. The griffes should not be set unless either the pattern cards or four plain cards are on the cylinder.

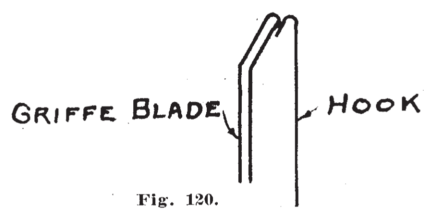


Fig. 120.

First turn the loom crank until one griffe is in its lowest position, then set the griffe blades a scant ¼ in. below the end of the bent portion of the hook. Do not set the blades any lower, otherwise the hooks will have a tendency to jump off the blade because of the shock when the blade and hook come in contact. Next turn the loom crank so that the blade that has been set will be brought to its highest position. Placing a ruler on top of the needles, measure the distance from needles to top of blade.

Next set the other griffe in the same manner, measuring the height of the blade as was done with the first griffe. If the sheds are not equal, make the necessary adjustments by moving the stud on the double crank, confining the operations to the plate which moves the driving rod of the griffe.

If a larger or smaller shed is wanted, the adjustments are first made on the stud attached to the short inner plate of the double crank. In whatever direction this stud is moved the stud on the long outer plate of the double crank must be moved twice the distance in the opposite direction. A study of the double crank will show the reason for this.

Assuming the griffes are equal as to height of lift, but that the entire shed is too small, the first operation will be to move the stud on the short inner plate which is fastened to the bottom shaft of the loom. This plate carries the long outer plate and is practically the only support of the long plate. When the stud on the short plate is moved out to make a larger shed, it carries the long plate with it. This brings the stud carrying the driving-rod in towards the bottom shaft, reducing the throw of the plate. The reduction is equal to twice the movement of the stud on the short plate. This is often forgotten and the result is uneven shedding.

After making adjustments for a larger or smaller shed, the griffes must be reset. This is done by lengthening or shortening the griffe driving rods, which are threaded where they connect with the double crank. After these adjustments are made the fixer must not forget to tighten up the check nuts on the rod, otherwise the threads will soon be stripped. Failure to make proper adjustments after changing the size of the shed will result in driving the griffe bracket down to the frame. Many frames have been broken in this way, causing great loss of time.

Because of the length of drive from the machine to the bottom shaft the strain is very great and double crank plates break very easily if they get loose. All nuts and screws must, therefore, be kept tight. Setting the griffes differs very little from setting the dobby knives. A good dobby fixer should readily master a jacquard machine.

Timing the Griffes.

First bring both griffes to a level just as both harness are leveled on a plain loom. Loosen up the four set screws which fasten the double crank to the bottom shaft, and move the lay of the loom so that the reed will be not less than 1½ in. from the cloth when the shed is closed and the warp level. If the sheds should be timed too early, the cloth will bump back, causing the lines and lingos to shake excessively and the lingos to tangle so that the lines will not be drawn down. These remarks relate to fabrics of medium density in which the pick and sley vary from 84 to 96 square.

On very light fabrics such as voiles, the reed can be brought to a point about ½ in. from the cloth when the harness are level, but it is never good practice to bring it any nearer.

When changing the time on the griffes the time of the cylinder must also be changed, because the cylinder has an independent motion; that is, the mechanism that controls the movements of the cylinder is driven from the top or crank shaft of the loom, while the griffes are driven from the bottom shaft of the loom. When the set screws are loosened in order to time the griffes the operating mechanism is stopped entirely. When the crank shaft is moved to bring the reed the required distance from the cloth the cylinder moves also. This changes the time of the cylinder, which must then be retimed. This is done by loosening the hand wheel. A good plan is to measure the distance between the cylinder and the needle board before changing the time of the griffes.

Setting the Cylinder.

This is the most important operation in jacquard fixing. The cylinder works at every pick, there being no pause or dwell. There must be no lost motion. The cylinder must be true on its bearings. The needles must strike the center of the hole in the card. All these conditions can easily be maintained if the fixer uses good judgment.

When a cylinder fails to work correctly the first thing to do is to take off the pattern cards and put on a blank set of four cards. This keeps all the hooks from the griffe blades and allows the cylinder to turn easily. Find out if any part of the cylinder is loose. Then test the bearings by turning the cylinder by hand. All parts must work freely. The cylinder must turn freely. Take off the blank cards and put on a set of four cards punched for a plain weave. Move the loom so that the cylinder will be at the farthest point from the needle board.

Cover the points of the needles with black oil. Detach the cylinder rods, so that they can be moved by hand. This is readily done and the rods can be replaced in two or three minutes. After blackening the needles, move the cylinder into and then out of the needle-board. The black oil from

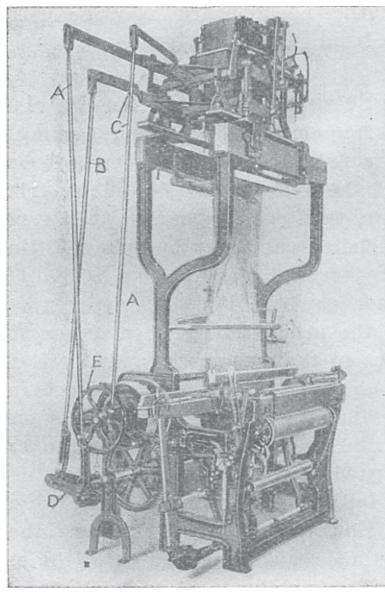


Fig. 121. Jacquard Machine.

the needles will mark the card between the holes already punched. It is then easy to see whether the cylinder is set in the right position. The adjusting screws on each side of the cylinder bearings are arranged so that a close adjustment can be made either vertically or horizontally.

A cylinder will frequently be out of time with the griffe. Many young fixers make the mistake of using a gauge for resetting. This method answers well when setting up new machines, but on old machines it is very bad practice. A cylinder should be set to conform to the wear and tear of the parts.

Timing the Cylinder.

Having loosened the hand wheel, turn the loom crank until one griffe is rising. Set the cylinder so that the hooks which do not engage will fall back to the rising griffe blade in the position shown at Fig. 120. This method is practiced by experienced fixers and works well. If a gauge were made to give this setting it might work all right on some looms and not on others. The only gauge required is a ruler when timing the griffes so that the distance between the cylinder and the needle-board may be measured before loosening the hand wheel.

Setting the Protector Pawl.

A cylinder frequently sticks when turning, and, instead of presenting a flat surface to the needle board, one corner sticks out. If the cylinder is allowed to strike the needle-board when in this position many needle points may be bent or the needle board may be split. Fitting a new needle board to a jacquard machine is a very difficult job.

The protector pawl J, Fig. 119, prevents the cylinder from striking the needle board when driven in on the half turn. It is set so that when the cylinder is flush with the needle board the end of the pawl projects about ½ inch beyond the cylinder and just rests on its end. The pawl works on a stud and is movable. As the cylinder moves outward the pawl is raised by the turning of the cylinder. If the turn is full the pawl will not touch the cylinder on its return journey, but if it is only a half turn, the rounded portion of the cylinder will be presented to the end of the protector pawl, allowing the pawl to push the cylinder back into position before it reaches the needle board. There is little danger from a split needle board if the pawl is set correctly.

Conclusion.

This concludes our study of cotton loom fixing. It is the sincere wish of the author that this work will aid all loom fixers, both young and old. We are all learning to be better workmen. None of us knows it all. Only by constant endeavor to improve the opportunities that present themselves to us can we hope to realize the most that is in us. As the poet wrote of opportunity:

They do me wrong who say I call no more
  Where once I knocked and failed to find you in;
But every day I stand beside your door
  And bid you wake and rise and fight to win.

TRADE MARK

LOOM HARNESSES

AND

LOOM PICKERS

GARLAND MFG. CO.
SACO, MAINE