# WOOLEN AND WORSTED LOOM FIXING

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## INTRODUCTION

**1. The Loom.**—Among the many machines in a textile mill that are subject to a large number of defects in their operation, imperfections in their product, or breakages of their parts, perhaps none is more often at fault than the **loom.** Imperfections in the work and diminished production in the majority of textile machines are often due to an inherent defect in the stock or some obvious wrong adjustment of the machine; but with a loom, the trouble in the majority of cases is with the machine itself, and in very few instances is the cause obvious. One reason for this is that most machines continue in operation even when producing defective work, thus permitting one to study their action and find out exactly what the difficulty is. With a loom, however, improper adjustments or other defects will, in a great many cases, cause the machine to instantly stop, leaving the fixer in doubt as to the cause of its action; if started again it is liable to continue in operation for an indefinite length of time and seem to be in perfect working order, but may go wrong again as soon as the fixer's attention is withdrawn. A very trivial defect in a loom will, in many instances, cause the machine to operate unsatisfactorily, to stop, or make some serious imperfection in the woven fabric. Often a change in the humidity of the atmosphere will cause trouble with looms that have been in practically perfect operation.

The reason for this sensitiveness of a loom lies, of course, in the great variety and complication of the movements necessary in weaving machinery. Many of these movements also are crude and hence particularly liable to give trouble, as, for instance, the picking motion, which perhaps requires more care than any other part of a loom. Although this motion has been greatly improved in the form and construction of its parts, it has undergone little change in principle since the introduction of the first power loom. It is a powerful and noisy mechanism driving a heavy shuttle with great force, and all for the purpose of laying across the loom a pick of filling weighing frequently less than a grain. The amount of energy expended is out of all proportion to the amount actually required; yet no improvement in the principle of picking seems possible without adding greatly to the complication of the mechanism and impairing its practical value.

Other parts of a loom also are prone to give trouble—some on account of their delicacy and sensitiveness, others because of wear and improper care and adjustment—while all require accurate setting and timing, a slightly wrong adjustment of one part sufficing in many instances to render valueless the accurate adjustment of other parts. It will be found also that in many cases a combination of several slight faults in adjustments, not one of which is important in itself, will interfere with the operation of the loom. Each and every part of a loom has its particular work to perform, and yet each part must at all times act in harmony with the other parts; consequently, to lay down hard and fast rules for overcoming any one of the many difficulties that are sure to confront a loom fixer is impossible. However, by considering those difficulties that are most frequently met, and by carefully studying the different circumstances that may cause them, some help may be given to the student.

**2. The Loom Fixer.**—Since looms are so peculiarly liable to get out of order, every mill maintains a body of men known as *loom fixers*, each of whom has charge of a number of looms, known as a *section*. The number of looms

in a section depends to a great extent on the kind of looms and the variety of cloth being woven. Generally, in a mill making fancy woolen or worsted goods one fixer has charge of from sixteen to twenty looms; this number may vary in different mills according to the class of fabric being woven. The duties of a loom fixer are, briefly, to keep the looms in his section running and producing cloth of good quality; he is expected to remedy all faults in the operation of the looms and to make all ordinary repairs, although his duties should be confined to fixing and he should not be required to repair looms that need the services of a skilled machinist; he is also required to set up and start new looms, and to put the warps into the looms and make them ready for the weaver.

A good loom fixer occupies a position of importance in a weave room; for on him, as much as on any one else, depends both the quantity and quality of the cloth produced. To be successful, he should be a fair mechanic and a good weaver. Not only must a loom fixer understand how the various parts of a loom should be adjusted in order to run to the best advantage, but he should also thoroughly understand the manner in which these parts are assembled, in order that he may remove and replace broken parts of a loom with as little loss of time as possible. It should be the object of every fixer to see that the looms in his section attain the highest possible percentage of production, and in order to accomplish this he should always be careful to have the loom stopped for repairs as little as possible. He should see that the weavers keep the looms well oiled, since if the parts that are constantly working against each other are allowed to become dry the wear on the loom and the amount of fixing necessary is greatly increased.

In those mills that are constantly changing from one class of goods to another, a fixer should study the different fabrics that are being woven and note just what conditions are necessary to weave each to the best advantage; cloths of different weights and woven with different yarns and weaves require in many cases different settings of the various parts of the looms. A good fixer will also carefully ascertain the

cause of any trouble with the operation of the loom before attempting to remedy it. He will never alter various parts nor change the adjustment or setting of the different motions with the expectation of remedying the difficulty by chance. When a loom has been running perfectly for some time and all at once commences to exhibit some fault, it is evident that some one thing, and that probably something of a trivial nature, is the trouble, and by carefully ascertaining what this is in the first place the fixer avoids changing parts of the loom that are perfectly adjusted and well adapted to the work in hand; when the cause of a defect is found it is generally but a moment's work to remedy it.

Whenever a new difficulty is encountered, the fixer should study the case carefully until he finds the exact cause. If new difficulties are not thoroughly mastered at the start, the fixer learns nothing, and when the same difficulty arises the second time there will be the same trouble in fixing the loom.

A good loom fixer will constantly be on the lookout for worn parts on the looms of his section, and be ready to replace these when necessary. By this means breakage of parts will be prevented, in many cases serious smashes avoided, and the fixer will not be so much sought after by the weaver. This will be found the cheaper method in the end, since while a certain small part may be replaced at slight expense, if it breaks while the loom is in operation other parts may be broken or injured.

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### ERECTING AND STARTING LOOMS

**3.** In starting new looms, it is first necessary to decide on their arrangement in the weave room. The usual custom is to have two rows of looms face a narrow alley, in which the weaver stands; a wider alley is left between the backs of two rows so as to allow the beams to be easily brought to the looms on a truck when it becomes necessary to replace an empty beam with a full one. If the looms are right- and left-handed they should be alternated in each row, so that the driving belts of two looms will come together.

After the general arrangement of the looms is decided, each loom must be lined with the driving shaft so that the belt will run true; this may be accomplished in the following manner: A plumb-line is dropped from two somewhat distant points on the driving shaft and from the points thus found on the floor a distance is measured equal to the distance that the looms are to be placed from the shaft. Between the two points thus obtained a mark may be made on the floor, with a chalk line, that will be exactly parallel with the driving shaft; if a permanent mark is desired, it may be scratched on the floor with a knife. The looms are now arranged with their feet just touching this line, in which position they will be perfectly square with the shaft. A spirit level should next be placed on the breast and back beams and on the loom sides and the loom carefully leveled, so that the crank-shaft and bottom shaft will not bind in their boxes. This may be accomplished by placing packing of the required thickness under the loom feet, after which the loom should be securely fastened to the floor with coach screws, or lagscrews.

The loom is now ready to be belted; to obtain the length of belt required any convenient method may be adopted, though it should be borne in mind that as new belts will stretch in the course of a few days, the belt should be cut 1 or 2 inches short, so as to be rather tight at first. The best way to fasten loom belts is by means of malleable-iron belt clasps, since when fastened in this manner they wear longer; and in addition, a belt with a belt clasp can be placed on the loom in a mere fraction of the time that is required to lace it. Care should be taken in putting on a belt clasp to prevent its being flattened; the belt should be hammered and not the clasp. It is a good plan to place a piece of leather or wood on the belt when fastening the clasp; this will prevent turning the points of the clasp, and also will prevent injury to the belt.

Belts should be run with the grain, or hair, side next to the pulleys. Loom belts should be neither too tight nor too loose, since in the former case the loom will run very rigidly, while if the belt is too loose it is liable to slip and cause a loss of power. When the loom runs rigidly, every slight variation of

speed is immediately felt by the loom, and it is also difficult to adjust the different mechanisms, especially the picking motion, so that they will run smoothly and easily. On the other hand, when the belt is loose, it will slip when the power is most needed, that is, when the loom is just starting to pick. If the belt slips at this point, the shuttle will receive a weak impulse, and, as explained later, serious difficulties arise from this cause. If the belt is very loose, the loom will run with a variable motion that is detrimental to good work.

Loom belts should be kept clean and pliable, and for this reason should be occasionally cleaned by lightly holding a piece of fine card clothing against them so as to remove the accumulation of dirt and gummy matter. For convenience in holding, the card clothing may be attached to a small piece of wood. Crossed belts do not require this treatment, as they are kept clean by the face of the belt being constantly rubbed where the belt crosses. To keep them pliable, belts should be frequently dressed with either liquid or bar belt dressing; castor oil is one of the best dressings for leather belts.

**4.** After the belt is on the loom, a reed should be placed in the lay, empty shuttles in the boxes, harnesses connected with the shedding mechanism, and box and harness chains put on; the loom should then be thoroughly oiled and allowed to run for half a day without a warp. This allows the machine to become thoroughly limbered up, and if it is carefully watched during this time many minor adjustments can be made and bolts tightened that would otherwise cause more or less trouble after the warp was in the loom and cloth was being woven. In running a loom in this manner, it will be necessary to fill the groove in the lay with waste, so that the filling fork cannot drop into it and stop the loom.

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### PUTTING IN WARPS

**5.** It is the fixer's duty to put warps in new looms and also to remove the harnesses and warp beam from old looms and put in new warps. In putting in a warp, after having removed the empty harnesses and beam, the full warp, with

the harnesses and reed attached, is brought to the loom on a truck especially designed for that purpose. One of the journals of the beam is run directly on to the bearing prepared for it at the back of the loom and the other is then lifted into its bearing. The harnesses and reed are lifted over the whip roll and supported by two strips of board so placed that they rest on the whip roll and reed cap. The harnesses are then hooked to the straps that connect them with the top of the harness jacks and these strips of board removed. One let-off friction band is placed around the beam head, so as to hold the warp beam steady, and bunches of warp yarn are then tied to the **apron;** this is a strip of strong cloth long enough to be passed around the take-up roll and over the breast beam; it is either made with holes in it or is torn in strips at the free end. On tying the bunches of yarn to the apron, care must be taken that all the ends are drawn forwards with equal tension before being tied. The beam is then loosened and turned forwards and the warp drawn forwards a short distance by turning the ratchet gear by hand. The reed is set into the groove in the lay and the reed cap set down on top of the reed and securely fastened, care being taken to place the reed in the proper position with relation to the warp.

The harnesses are carefully evened by hooking them in the correct holes in the straps that connect them with the harness jacks, and they are then connected, by means of straps underneath, with the other end of the jacks. After putting both friction bands on the beam, the warp may be placed in the temples and the loom turned over a few picks by hand, after which a shuttle with some coarse filling may be placed in the loom and a few inches of cloth woven; a bobbin containing white yarn should then be placed in the shuttle (if the warp is dark) and a heading of 3 or 4 inches woven; this will greatly assist in showing mistakes in the drawing in of the warp, if there are any. If the warp is white, a bobbin containing dark yarn should be placed in the shuttle. After this is done, all the harnesses should be dropped and the lay pushed as far back as it will go; each

harness should then be raised in turn, so as to afford an opportunity to inspect the yarn and to see if each thread is in its proper place. When this has been attended to properly, the right kind of filling can be put in the shuttles, the picks per inch regulated by means of the take-up motion, the tension of the let-off motion adjusted, and if the proper harness and box chains are on the loom it is ready for the weaver. The fixer should watch the loom for 5 or 10 minutes after it is taken by the weaver, and if everything is going all right it can then be left in the weaver's charge.

## LOOM MECHANISMS AND THEIR DEFECTS

### SHEDDING MECHANISM

#### HARNESS SKIPS

**6.** As a general rule, the **shedding mechanism** of fancy woolen and worsted looms when once set and adjusted properly gives but very little trouble, especially if the loom is not an old one and the various parts are but little worn. When, however, a loom has been in operation for a considerable length of time and the different parts have become worn and loose, there is often more or less difficulty in making it properly perform its work. This difficulty is usually shown by the loom making what are known as *harness skips*.

A **harness skip** is an imperfection in the cloth caused by a certain harness (or possibly there may be more than one harness that is giving trouble) failing to rise or fall as required by the pattern chain, thus allowing the warp yarn that is controlled by that harness to float over or under one or several picks that it should not.

On a Knowles loom, harness skips are sometimes due to the lock knife failing to hold the ends of the vibrator levers securely in position. This may be caused either by the

knife itself being very badly worn, in which case it should be replaced, or by the ends of the vibrator levers themselves becoming worn. When the work is heavy and the strain on the harnesses in being lifted is severe, the tension of the spring on the lock knife may be insufficient to hold it in position. It often happens also that the rod that supports the back ends of the vibrator levers is bent or loose so that the riser on the pattern chain fails to lift the vibrator gear into the top cylinder gear properly; or if the rod is bent backwards in the center, certain of the vibrator levers may slip off the lock knife. In the case of very old looms, the teeth on the vibrator gears or on the cylinder gears, especially the starting, or first, teeth, become worn so that the vibrator gear is not fully turned but slips off and rebounds when the harness is partly moved. Again, the vibrator levers themselves may become bent so as to bind against each other or in the comb, or guides, through which they pass. In this case the vibrator lever is slow in dropping when it is required to lower the harness, and sometimes fails to assume its lower position in time to allow the vibrator gear to properly engage the bottom cylinder gear. It frequently happens also that a spindle in the pattern chain becomes bent, which is a very common cause of harness skips, as well as being liable to make a serious smash in the head-motion.

Occasionally the springs on the followers that press down the vibrator levers will drop out, and harness skips will often occur from this cause. Other parts, such as rivets and nuts, will sometimes work out and become caught in the head-motion so as to make a harness skip. Usually when this is the case, only one harness skip is made, and then the loose part drops through to the floor and gives no further trouble, at least for some time, although some future difficulty may apprise the fixer that a particular rivet or nut is gone, and he will then understand what made the harness skip for which he could not find the cause. Sometimes a riser on the pattern chain may become broken or mutilated so that it fails to raise the vibrator lever sufficiently to allow the vibrator gear to properly engage the top cylinder gear.

**7.** Often harness skips are occasioned by a combination of circumstances, any one of which alone would not cause any great difficulty; for instance, when several gears are loose or when the gear-teeth are worn so that two worn parts come together; also if the adjustments of the various parts in the head-motion are not made so that the mechanism will run smoothly a great deal of vibration will be occasioned and the head-motion will run in a jerky manner, which will sometimes cause the vibrator gears to rebound and harness skips to result.

On a Crompton loom, harness skips are sometimes occasioned by the jack-hooks slipping off from either the lifter or depressor. This may be caused by the edge of the depressor becoming worn and rounded, or by the notch, or hook, in the jack-hook becoming worn; occasionally also the spring that forces down the jack-hook so that it will engage with the lifter becomes broken and drops out, in which case the hook often fails to engage with the lifter, and allows the harness to remain down when it should be raised. Sometimes the rivet of the jack-hook will become worn so that the jack-hook will have some play, which will cause it to slip off the lifter or depressor. Occasionally the jack-hook will become gummed up with dried oil and dirt so that it will not fall freely and engage the lifter. It sometimes happens also that stiff links in the pattern chain will cause the chain to ride the chain cylinder, which may result in a harness skip. Crooked bars in the pattern chain or broken risers will cause difficulty from harness skips, as will also various other minor causes, which are usually readily apparent.

When a harness skip occurs, the best way to find the cause of the difficulty is to observe which harness is failing to work properly, and then trace back its connection to the head-motion and see that all parts are properly adjusted and that they are not worn or bent or out of their proper positions. If the connections of the harness in the head-motion appear to be all right, the risers on the pattern chain that control that harness should be examined. If this

method is followed, the cause of the harness skip will be quickly observed in almost every case. The greatest difficulty with harness skips is usually found when the cloth that is being woven is very heavy, and the strain on the shedding motion in raising the harnesses very great. Harness skips are particularly liable to occur when the work is heavy and a large number of harnesses are required to be moved on every pick; the difficulty is increased also if the loom is old and worn. It is very infrequent that any difficulty is experienced with harness skips where light fabrics are being woven. Occasionally, when an old loom gives a great deal of trouble with harness skips, it is advisable to take it apart and replace all parts that are worn, tighten all loose parts, and generally overhaul it until it is as nearly in perfect condition as is possible under the circumstances. This will be found in the end to save considerable of the fixer's time, where a loom has been running so long that the shedding mechanism has become loose and shaky.

**8.** In strapping the harnesses to the jacks of the shedding motion it is advisable to strap them rather tight when the lift on the harness is severe, and somewhat looser when a light cloth is being woven. This is a point in which a considerable amount of judgment must be exercised, and the best results can only be obtained by practical experience. Care should be taken to put the same tension on the straps of each harness, so that all will rise and fall together, with no lost motion in the case of any harness.

It may sometimes be found that on heavy weaves, if the harnesses are not strapped tight, there will be considerable lost motion in the harness straps; when this is the case it will sometimes cause the stirrups to jump down a notch or two on the jacks, which of course will result in giving the harness a wrong position. In cases where heavy work is being constantly run it is advisable to use *locking stirrups;* these are so arranged that the stirrup is locked in its position and thus cannot move from one notch of the harness lever to another.

The harnesses usually are well oiled before being placed in the loom, so that as they rise and fall they will not be chafed by rubbing against each other; sometimes when harnesses are very dry, the frames are much worn from this cause.

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### WHIP ROLL

**9.** The relation of the height of the **whip roll** to that of the breast beam of the loom is of importance in governing the shedding of the loom and the appearance of the cloth. Generally speaking, the position of the whip roll should be such that a straight line drawn from it to the breast beam will pass through the center of the shed. In this case the line of the warp will be exactly level when the harnesses through which it is drawn are in a central position. In some cases, however, it is of advantage to alter the position of the whip roll so that the warp line will pass through either the upper or lower part of the shed. For example, suppose that a light fabric is being woven with a simple weave and that it is desired to have a well-covered surface on the face of the goods. In this case the whip roll can be raised slightly, which will result in the tension of the warp yarn in the upper shed being slacker than that in the lower shed, so that the warp yarn will spread and give a well-covered surface to the fabric; whereas, if the tension of the warp in the upper shed is the same or greater than that in the bottom shed, the cloth will have a tendency to appear bare and wiry. On other occasions it might be advisable to lower the whip roll; for instance, in some cases where a very fibrous warp is used and the bulk of the warp remains on the lower shed on almost every pick, it will be found that there is some difficulty in getting a clear shed. In order to remedy this the whip roll may be lowered slightly, which will result in the warp yarn in the upper shed being tighter than that in the lower shed so that it will rise well and form a clear shed.

### CHAIN STUFF

**10.** The **pattern-chain** and **box-chain stuff,** including the risers, washers, spindles, links, and cotters, should be kept in a place reserved for it, and care should be taken to see that it is not injured, especially that the spindles do not become bent. The pattern and box chains of a loom should be well oiled, since if not, there is danger of their bunching up on the chain cylinder under the vibrators and causing a serious smash in the head-motion. In order to prevent this, the gear on the chain-cylinder shaft is usually fastened with a soft setscrew, so that if the chain becomes jammed the setscrew will shear off and prevent more serious damage. A few of these setscrews should be kept on hand, so that if one is spoiled and is too short to use again, it may be replaced by a new one. Under no conditions should it be replaced by an ordinary setscrew, because if this is done and the chain becomes jammed again, it will usually result in all the teeth being stripped from the small pinion gear that drives the gear on the chain-cylinder shaft in addition to putting a strain on the loom that may result in other parts being broken or damaged.

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### BOX MOTION

**11.** The **box motions** of fancy woolen and worsted looms, like the shedding motions, seldom give very serious trouble when once properly set and adjusted, if their various parts are not worn or otherwise defective. They must be properly timed, so that the boxes will be completely moved before the loom starts to pick, and so that they will not start to move until the shuttle is well boxed. Each box, when it is called, should be brought in perfect line with the race plate, and in order to determine if the boxes are thus adjusted a straightedge should be placed on the race plate so as to extend into the box. By this means any difference in the height of the box and the race plate may readily be detected. The boxes themselves should usually be perfectly level,

although some fixers prefer to have the back end of the box a trifle, say $\frac{1}{8}$ inch, higher than the front. If they are not level, they may be made so by bending the lifting, or box, rod. When doing this, care should be taken to bend the rod as near the boxes as possible, and not at a lower point. A very slight bend will be found to be sufficient, and this method is preferable to that of adjusting the guides, since, if the adjustment of the guides is changed, the boxes are very liable to bind when dropping.

### BOX JUMPING

**12.** One difficulty that is sometimes met with in connection with the box motion is known as **box jumping,** though it does not occur very often on modern looms. By jumping it is meant that the boxes have an irregular movement and do not rise and fall smoothly. The box may start to move slowly and then finish its movement with a jump, or it may start with a jump but finish its movement so slowly as barely to come in line with the race plate in proper time. This defect is usually caused by some lost motion in the connection of the boxes with the box motion; it is sometimes caused by an improper adjustment of the box segment cylinders. Sometimes, also, a lay that is loose and shaky will cause the boxes to move with a jumping movement. It occasionally happens that when a large number of harnesses are run on heavy work, the head-motion will run with a jerky motion; this sometimes causes the boxes to move irregularly, especially in their downward movement.

### SHUTTLE SMASHES

**13.** Sometimes the shuttle will not be clear of the picker, or will project from the box enough to catch on the lay, when the boxes are dropping; this may cause the boxes to jump, but more frequently will cause a **shuttle smash.** When a shuttle prevents the boxes dropping, if the next shuttle is driven from the other side of the loom it will not find an empty box, but will be stopped by the shuttle that is caught,

with the result that when the lay beats up it will cause the shuttle to break out the warp. Other causes of shuttle smashes are mistakes in the box chain, broken risers in the box chain, shuttles placed in the wrong boxes by the weaver, and imperfect working of the box vibrators and cylinders.

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### PICKING MOTION

**14.** Probably no part of a power loom gives more difficulty than the **picking motion,** nor is any motion of the loom so hard to keep in good running order. It is impossible to get the best results if the pick is harsh and jerky, while on the other hand, a loom that picks easily will require far less fixing than one that does not. To procure a smooth, even pick necessitates delicate and accurate adjustment of the various parts of the picking motion, and so many different parts must be properly regulated that the fixer will often overlook the one vital point. A very great strain and also considerable wear is brought on the loom on account of the picking movement; the shuttles, picker sticks, straps, picking balls, shoes, and all other parts connected with this motion are either constantly wearing out or breaking, and if the best of care is not taken the cost of these supplies will soon become excessive. Much of this wear and strain is caused by the harshness of the pick, consequently the easier and smoother the picking motion can be made to run, the better it will be for the loom; but even when all that is possible has been done, there will still be considerable wear and tear that it is impossible to overcome, owing to the imperfection of the principle of picking.

The picker stick in delivering the shuttle, besides supplying force enough to send the shuttle across the loom, must also overcome the resistance of the binder pressing against the side of the shuttle. As soon as the shuttle leaves the box, however, this additional strain is removed, and consequently power that has been exerted in pushing the shuttle from the box will now be free to act on other parts of the loom, so that the speed of the loom will have a tendency to

suddenly increase, on the same principle that a body, having a force acting on it while restrained by friction, will move rapidly in the direction of the force applied if that friction is suddenly removed. This is sometimes known as the *reaction of a loom*, and it can be easily seen that the more of a drag there is to a pick, the greater will be this reaction, and consequently the greater will be the wear and tear not only on the parts of the loom in direct connection with the picking motion, but also on all parts of the loom. This reaction is, of course, more noticeable on light than on heavy looms, because a heavy loom tends, by its momentum, to run more uniformly.

**15.** The first requirement of the picking motion may be said to be the sending of the shuttle through the shed in a very short period of time; the second is to give the shuttle sufficient power to enter the box. Thus, regulating the power of the pick and the tension of the binders on the shuttle are important features in governing the running of the loom. The tighter the box, the stronger must be the pick; and the stronger the pick, the tighter must be the box. It will be seen, therefore, that these two settings react on each other, and in regulating the power of the pick it should be the aim of every fixer to give it just sufficient power to accomplish its work and no more; the tension of the box can then be regulated to correspond to the power of the pick.

In setting the picking motion so as to obtain a smooth and easy-running pick, particular attention should be paid to the adjustment of the picking shoes. These should be so set that their curve will conform with, or be tangent to, the circle described by the picking ball in revolving around the bottom shaft. If the blow of the picking ball is too sudden, and if when the ball first strikes the picking shoe it knocks the latter down too rapidly, the pick will be harsh and a smooth motion will be difficult to obtain. Almost every fixer has some special rule for setting the picking shoes, but generally a plumb-line is dropped over the bottom shaft and the picking shoe moved

up on the picking shaft until its point just touches this plumb-line. On equally geared looms, where a longer picking shoe is used, it is generally customary to allow the point of the picking shoe to project about 1 inch beyond this plumb-line. After fastening the shoes, the loom should be turned so that the crank-shaft is on its top center, and each pick ball should be adjusted so that it just starts to move the shoe and the picker stick. On equally geared looms both pick balls should be set so that they start to move the picker stick at exactly the same time. On unequally geared looms, where there are two pairs of pick balls to adjust, each pair must be made to pick together and at the proper time. Great care should be taken in setting these parts also to see that the picking, or shoe, shaft is not bent, since this will be apt to make a harsh pick. The shoe shaft should be set level, at least when starting to set the picking motion, although in some cases it may be desirable to raise or lower either end in order to slightly alter the strength of the pick.

In adjusting the picking motion, the most important point to bear in mind is to have as little power as is actually necessary to drive the shuttle across the loom; if this is done the binders will not be required to press so hard against the shuttle in order to hold it in the box and prevent rebounding. Raising the back end of the picking, or shoe, shaft tends to make the pick stronger during the latter part of the movement of the picker stick, while raising the front end of the picking shaft tends to make the pick stronger and quicker during the first part of the movement of the picker stick. Lowering the front end has about the same effect as raising the back end, and lowering the back end has a similar effect to raising the front end, although in both these cases the shoe is drawn away from the picker ball slightly and the power of the pick as a whole is decreased, whereas raising either end of the picking shaft tends to bring the shoe nearer the picking ball and consequently to generally increase the power of the pick. Sliding the picking shoe forwards increases the power of the pick, and moving it backwards softens the blow of the picker on the shuttle.

### ADJUSTING THE LUG STRAP

**16.** Around the **lug strap** that connects the sweep, or picking, arm with the picker stick is usually placed a small leather strap, which is fastened to the picker stick by means of a screw. This strap serves to hold the lug strap in position, and by adjusting its height on the picker stick more or less power is given to the pick, since if the lug strap is raised on the picker stick the power of the pick is decreased, and if it is lowered the shuttle will be driven with greater force across the loom. The normal position of the lug strap should be such that it is level, but of course in some instances it is desirable to raise it a little to decrease the pick or lower it a little to increase the pick. If possible, however, the lug strap should never be connected to the picker stick on a lower level than to the sweep stick, since when this is the case it has a tendency to slide up on the picker stick as the loom picks. This is due to the force coming from above the point where it is connected and is very liable to result in a weak pick, the shuttle not receiving sufficient power to reach the opposite box. In placing lug straps on a loom, care should be taken that they have a little play. Under no condition should they be tight when the picker stick is at rest at the outer end of the box.

When the picker stick is brought back to its extreme position against the back end of the box, it should rest against a roll of cloth placed in the back of its slide. At the other end of the box a strap is threaded on the picker spindle to serve as a bunter and prevent the damage to the picker and picker stick that would occur at this end of their movement, if the iron end of the box were not protected. The length of the movement of the picker stick, or its *sweep*, may be regulated by the picking arm on the picking shaft. The sweep should be so adjusted that the picker will be moved to a point about 2 inches from the bunter. If the sweep is too long, the picker stick will be broken when the loom picks.

### SETTING BINDERS

**17.** The shuttle is sent with such force from one side of the loom to the other that some arrangement must be provided by means of which it can be gradually checked instead of being brought to an abrupt stop, since if this is not done, not only will the picker and picker stick wear out much more quickly, but what is still more objectionable, the shuttle in striking the picker will rebound. If the shuttle rebounds, the picker, when brought forwards to drive it across the loom again, will have to move a considerable distance before coming in contact with the shuttle, and as a result the force of the blow will be greatly lessened and the shuttle will probably not reach the opposite box in time to prevent the shed closing on it. The **binder** is the movable side of the box that presses against the shuttle so as to produce this retardation.

Many methods of adjusting binders have been adopted, the one aim in all cases being to set the binder in such a manner that the shuttle on entering the box will receive a uniform and gradual check. In order to obtain this result the shuttle should commence to press against the binder only when its widest part comes in contact with that part of the binder that projects into the box. It should then steadily press out the binder until that part of the shuttle that first came in contact with the binder has reached the other end of the part of the binder that projects into the box. When set in this manner the binder will present its full face to the side of the shuttle when the shuttle is at rest in the box. If the binder is set too loose, the shuttle is liable to rebound; and if set too tight, additional power will be required of the picking motion to drive the shuttle into the box. The pressure of the binder on the shuttle must be regulated to correspond to the power of the pick, and if the power of the pick is properly regulated so that it is just sufficient to properly drive the shuttle across the loom, a very light tension on the binder will be sufficient to hold the shuttle in the box.

Sometimes when the shuttle rebounds, the tension of the binder may be increased by bending the binder spring, while at other times more spring on the protector motion will remedy the defect if it occurs in several boxes. The binder should be bent should it fail to hold the shuttle because the full face of the binder does not touch it. When doing this, the binder should be taken out and the parts that are worn bright located; then strike the binder with a hammer on the opposite side at a point midway between the bright spots, or in other words, at a point opposite to where the binder fails to touch the shuttle.

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### SHUTTLES

**18.** In picking out a set of **shuttles** for a loom, care should be taken to secure those that are the same size and weight; therefore, each shuttle should be tested by running a pair of calipers along its length; it should be also noted if both ends of the shuttle are of the same width. The shuttles should be weighed accurately, in order to ascertain that their weights are exactly alike.

After the shuttles have been run for some time they will become worn, and consequently their size and weight will not remain exactly the same; then it will often be found that certain shuttles will not be checked well, or perhaps this may occur only in certain boxes, while in other boxes they may be found to work correctly. To overcome this it is necessary to true the shuttles. To do this some fixers use a plane, but many rub the shuttles on a strip of coarse sandpaper, which may be tacked to the bench. Either method will answer the purpose, but care should be taken to keep all the shuttles the same size and weight. Considerable trouble results from the liability of the shuttles to accumulate dirt on the sides, which causes them to stick as they enter or leave the box; consequently, they should always be kept clean. Shuttles often become chafed owing to rough places at the mouth of the box, which is often aggravated by the shuttle being thrown slightly crooked; the cause of the chafing should be

removed and the shuttle smoothed with sandpaper. Frequently the points of a shuttle become broken, either through striking another shuttle or some other cause. In this case the point of the shuttle should be ground down. Shuttles should always be kept smooth and all bruised spots eliminated with sandpaper. The fixer should always see that the shuttle pin does not project from the shuttle and also that any screws used to hold the shuttle spring in position are securely tightened. A brush of yarn or a piece of flannel or felt should be inserted in the shuttles, so as to cause sufficient tension on the filling.

### FILLING STOP-MOTION

**19.** The **filling stop-motion,** while its parts are very sensitive and delicate, is not frequently the cause of any great amount of difficulty. Sometimes the fork is not raised high enough to clear the shuttle, so that when the shuttle is driven across the loom it will strike the prongs and bend them. Occasionally also the groove in the lay is not deep enough, or it may become filled with lint, dirt, and other accumulations, so that the fork will not drop freely into it, and consequently when the filling breaks the loom will not stop. The remedy for this is obvious.

The filling stop-motion should be kept well oiled, and care should be taken to see that its parts are properly adjusted and work freely and that none of them are loose. Sometimes the filling stop-motion will fail to stop the loom when the filling breaks, on account of the dagger rebounding and failing to engage the knock-off finger. The end of the dagger or the notch in the knock-off finger becomes worn sometimes so that the dagger will slip out of the notch even if it engages properly in the first instance. On the Crompton filling stop-motion the loom may fail to stop because the slide that lifts the fork is not properly set, the fork failing to fall quickly enough.

Sometimes difficulty is occasioned with the filling stop-motion marking the cloth; this is especially noticeable when the fabrics are of light weight or of a light color. When this is the case, the fork should be so set as not to interfere with

the cloth in any way, and it should be noticed if the prongs of the fork are perfectly straight. Sometimes with fine filling the weight of the fork will press the filling into the groove in the lay so far as to make a little slack, which will then kink the filling at that point.

### TAKE-UP MOTION

**20.** The **take-up motion** rarely gives any trouble, but sometimes it will be found that the throw of the take-up pawl is not properly adjusted, and the loom will therefore occasionally take up two teeth instead of one. When this is the case the pawl should be adjusted so that the ratchet gear will be moved only one tooth at each pick of the loom. Care should be taken also to have the tension of the cloth between the cloth roll and the take-up roll somewhat less than between the take-up roll and the breast beam, since although there is but little backlash in the gears, it is sometimes found on light fabrics that the backlash will be sufficient to cause the cloth to be slightly uneven. All the gears of the take-up motion should mesh perfectly with each other, neither too hard nor too light, in order to obtain even cloth. Care should be taken also that all gears are fastened securely when necessary. Take-up rolls that are covered with sandpaper sometimes become so smooth that they fail to grip the cloth securely, especially in the case of heavy fabrics woven with considerable tension. When in this condition they should be recovered; they can be made to run a little while longer, however, by changing them into a loom of the other hand so that their direction of rotation will be reversed.

### LET-OFF MOTION

**21.** In regulating the **let-off motion** care should be taken to have the warp tight enough so that there will not be any great amount of slack cloth on the breast beam when the lay beats up. When watching a loom run it will sometimes be noted that as the lay strikes the fell of the cloth it

causes considerable slack in the cloth when the reed comes in contact with it. To remedy this it is advisable in most cases to add some weight to the let-off motion.

Trouble with the let-off motion is usually confined to light-weight fabrics and is generally shown by uneven cloth, which is caused by the friction sticking fast and then letting off all at once. This trouble is greatly aggravated by damp weather or by a damp weave room. When the let-off motion will not work smoothly, the friction strap should be taken off and the leather with which it is faced thoroughly cleaned. A new strip of cloth should then be placed around the beam head and a little black lead rubbed upon it to prevent sticking.

## GENERAL LOOM FIXING

### BANGING OFF

**22.** One of the most frequent difficulties that a fixer has to contend with, and one that is probably due to as many different causes as any other, is known as **banging off,** or sometimes as **slamming.** A loom is said to bang off or slam when for any cause it is stopped by the dagger of the protector motion. This takes place every time the shuttle fails to reach the opposite box, either on account of its meeting with some obstruction or on account of its not receiving sufficient force from the picker stick. It will be seen that when this takes place a very great strain is brought on the various parts of the loom, since the momentum of the loom is checked so suddenly that the shock must necessarily be very severe. This being the case, various parts of the loom are liable to be broken if the loom bangs off frequently, and while in some cases these breaks may be readily fixed, as a general rule a break resulting from the shock of banging off will cause the loom to be stopped for considerable time for repairs. It sometimes happens that the shock is so great that the teeth of the gears on the crank-shaft

and bottom shaft will be broken, owing to the tendency of the gears to revolve after the loom is stopped. The liability of this happening may be greatly lessened by having the teeth on these gears sufficiently meshed into each other; because if the teeth merely touch each other at their points, the concussion due to the sudden stopping of the loom will be much more liable to cause breakage than if the teeth are properly geared. In other cases it sometimes happens that one or both of the lay swords will be broken, since the movement of the lay is instantly checked when the loom bangs off and its weight and momentum will be sufficient to break the swords. The crank-shaft is sometimes broken, as is also the side frame of the loom, the protector casting beneath the breast beam, and various other parts..

**23.** A great variety of causes tend to make a loom bang off, and when seeking to remedy this difficulty it is first desirable to see if the loom is picking properly. Turn the loom over and see if it picks on time. It may be found that the shoe on the picking shaft is loose or badly worn or that the picking ball is loose. Sometimes the stud that supports the picking ball or the hole in the picking ball will be badly worn; sometimes, also, the picking ball will be worn flat in places. Such things as these result in a weak pick, and the shuttle when it is driven across the loom fails to reach the opposite box in time to prevent the protector motion from operating. Sometimes banging off is caused by the shuttles being covered with a gummy grease, which prevents their entering the box freely. Sometimes also the binder will be too tight or too loose, which will cause the shuttle to rebound and then on the next pick a sufficient impulse will not be given to the shuttle to cause it to reach the opposite box. The picker stick may bind, which will also occasion a weak pick, or the picker spindle may be bent. The loom may be caused to bang off by any loose parts on the protector motion, as, for instance, sometimes the protector finger will become loose; also it will be frequently found that the hole in the binder will become enlarged, or the spindle that

supports the binder may become bent so that the binder will fail to impart a sufficient movement to the protector finger to cause the dagger to clear the casting beneath the lay.

Banging off is also sometimes occasioned by a loose belt, or by the friction slipping, or by the belt itself slipping. In these cases it will be found that the slip will occur just as the loom starts to pick, which will result in a weak impulse being imparted to the shuttle. The friction when slipping is often difficult to remedy, although in some cases it can be fixed by simply moving it up closer. Sometimes the trouble is due to the countershaft having too much play, in which case the wooden block that holds its end in position should be adjusted or a new block inserted. The cause of the friction slipping is generally due, however, to the leather with which it is faced becoming greasy; this can be remedied by rubbing it with slaked lime or whiting. Sandpapering the leather, as a rule, is of little value.

The bearings of the picking shaft may have become loose, which will also result in banging off. Sometimes the shuttle will be retarded by the shed not opening wide enough or early enough to give the shuttle a clear path across the loom, or it may close upon the shuttle so soon as to prevent its entering the box freely.

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### SHUTTLES GOING CROOKED AND FLYING OUT

**24.** If the speed at which the shuttle travels across the loom is kept in mind, it will not be difficult to understand that any obstruction to its flight, however slight, will serve to throw it out of its course and very probably out of the loom. When this happens, the loom will of course bang off, but the shuttle is also liable to break out the warp threads and injure the weaver, if it flies out of the loom. When looking for the cause of this defect, the shedding of the loom should be carefully considered. It is very important that the bottom shed should not be so high that it will give the point of the shuttle an upward tendency as it is delivered from the box. Also it is important to notice the timing of

the harnesses; they should change in time to offer a free shed to the shuttle as it starts on the passage across the loom. Very often a broken end of the warp will become entangled with other warp ends, preventing their opening the shed freely and thus causing an obstruction to the passage of the shuttle. When this is the case, it is easily noticed and quickly remedied. The position of the reed should also be carefully noted, and it should be seen that it is perfectly in line with the back of the boxes; for if it should be set a little forwards of this position, it is sure to give the shuttle an outward tendency, causing it to fly from the loom or at least to cross the loom with a crooked flight. One or more dents of the reed protruding into the course of the shuttle will have a similar effect.

The position of the boxes in regard to the race plate should be noted; each box should be brought exactly level with the race plate when the loom starts to pick. The point where the shuttle leaves the boxes should also be carefully noticed, as any obstruction here, however slight, is liable to result in the shuttle being deflected. Occasionally a screw in the race plate will become loose and the shuttle striking this is sure to be thrown out. Sometimes also the race plate will be raised a little in places, which will also result in the shuttle being deflected. The shuttles themselves are liable to become worn so that they do not rest flat but have a rocker-shaped bottom, in which case they are almost sure to give trouble, either from going crooked or flying out. A worn picker will also cause the shuttle to fly from the loom, and occasionally a broken picker stick or strap will have the same effect. It will sometimes be noticed that the shuttle in entering the box will stop with its outer end projecting a slight distance, in which case when the boxes are dropped it will rest on the race plate and, as the loom picks, will sometimes fly out, but usually in this case the shuttle will be held fast and the picker stick broken. Sometimes the picker spindle may be loose or bent, which will cause the shuttle to be deflected as it is thrown, or the picker spindle may not be fastened exactly parallel to the box. Occasionally

the lay will be out of true, or the pitman arms may be loosely connected or worn. This makes the lay shaky, which in combination with a harsh and jerky pick will often result in the shuttle being thrown from the loom.

### PICKER STICKS BREAKING

**25.** Owing to the nature of the work performed by a picker stick, broken ones are not of infrequent occurrence. Picker sticks should be made from straight-grained hardwood, the best ones being made of hickory, straight- and fine-grained. A coarse-grained stick, even if made of harder wood than a fine-grained one, will generally be found to be weaker. When the picker stick breaks, it will usually be found to be split through the hole at the heel. This is often caused by too long a sweep or by a shuttle becoming caught in the boxes. Sometimes also the picker will become caught in the boxes and when the loom starts to pick the picker stick will be broken. There are a great many other causes that tend to break the picker sticks, but the cause can usually be ascertained in any particular case. Occasionally the picking arm, which is connected by means of the lug strap with the picker stick, will be broken. This is usually due to similar causes to those that break picker sticks. It is also occasionally due to the loom running too rigidly.

### CUTTING FILLING

**26.** Sometimes a loom will develop an aggravated case of cutting filling, in which event it will constantly be stopped by the filling stop-motion, owing to the pick being cut or broken in some manner. In the great majority of cases the filling is cut when the shuttle is entering or leaving the box in which the end of the shuttle containing the eye is in contact with the picker. Sometimes when the shuttle is thrown from this box that part of the filling that extends from the eye of the shuttle to the selvage is doubled on itself; in this case if the filling is rubbed by the shuttle against the binder

or any projection or rough place, it is almost sure to be cut. When seeking to remedy a case of filling cutting, the broken pick should be extended until it is found just how far it reaches. Sometimes it will reach just to the mouth of the boxes, in which case that is the place to look for the cause of its cutting. Frequently it will reach to the temple, in which case it may have been cut by the temple striking the reed or rubbing on the race plate. The sides of the boxes and the binders should be carefully examined to see if there are any projections or rough places that will interfere with the filling. Sometimes when the loom is throwing a crooked shuttle, the shuttle will enter the box in such a manner as to pinch the filling between itself and the side of the box and cut it. Occasionally the pin that holds the spindle in the shuttle may become loose and project a short distance from the side of the shuttle, in which case the shuttle is almost sure to cut the filling. Occasionally splinters on the shuttle will catch the filling and break it, or the pot eye in the shuttle may be cracked so as to catch the filling and break it, especially in the case of fine filling.

Sometimes when the shuttle is checked in the box, the shuttle spindle will be thrown up sharply, which will result in the filling being snapped if it happens to be tender. If it is noticed that the filling is being cut in a certain box, it will generally be found that the cause is with that box and in many cases it will be the binder that is causing the difficulty. Occasionally considerable filing is needed on the mouths of the boxes to prevent the filling being cut, and at all times it is advisable to keep the shuttles perfectly smooth and have them thrown across the loom straight.

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### FILLING KINKING

**27. Kinks** in the filling are usually the result of too much twist in the yarn, or a yarn of a wiry nature. When such is the case the filling should be thoroughly dampened before weaving, either by being steamed or by having water sprinkled on it.

Another point to be noted is the friction that is placed on the filling in the shuttle. If the filling is allowed to run out of the shuttle too freely, more than the required length for 1 pick is very liable to be given off, and when beaten up by the reed it will be sure to form ridges. In order to prevent this, a small piece of flannel or a small brush should be placed in the nose of the shuttle in such a position that the filling running through the eye will come in contact with it, thus causing a drag on the filling yarn as it is leaving the shuttle. When fine yarns are being used, however, care should be taken not to produce so much friction that the filling will be frequently broken as the shuttle crosses the loom.

Another cause of kinky filling is the shuttle rebounding in the boxes sufficiently to cause slack filling, but not enough to result in the loom banging off. Occasionally filling kinking may be remedied by setting the shedding mechanism so that the shed will be closed early; in this way the shed will close on the pick of filling before it has time to kink in the cloth.

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### KNOCKING OFF FILLING

**28.** It frequently happens that when the shuttle is checked in the box the momentum will be sufficient to cause the yarn to slip off or, as it is sometimes spoken of, *knock off*, or *slub off*, the bobbin in lumps. This produces a great amount of waste besides causing the filling to break and the loom to stop and also, in some cases, double picks to be inserted in the cloth. The cause of filling knocking off is fully as often found in the spinning department as in the weaving. Very frequently the yarn will be wound on the bobbin in such a manner as to be so soft or have such a taper that it is almost impossible to throw the shuttle across the loom without the filling slubbing off when it is checked. In most cases when the filling is being knocked off, the principal point is to regulate the power of the pick, reducing it as much as possible. It is also necessary to see that the shuttle is as gradually and uniformly checked as possible. If the shuttle is being sent

across the loom at a high speed and is then suddenly stopped and the bobbins are in any way soft, the filling is almost sure to be knocked off; consequently, anything to lessen this blow will also lessen the liability of this defect.

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### BOBBIN SPLITTING

**29. Bobbin splitting** is a defect that is caused by the spindle in the shuttle rising so that as the shuttle enters the box it strikes the top of the box and as a result a piece of the bobbin is split off. This is sometimes caused by the shuttle going across the loom crooked, or sometimes because the bottom shed is too high; sometimes also the box may be too low, and thus the shuttle enters the box too high. Bobbin splitting is also caused by the spindle in the shuttle being loose, which causes it to rise as it is thrown across the loom.

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### THICK AND THIN PLACES

**30. Thick and thin places** in the cloth, or *uneven weaving*, may result from the weaver making an imperfect start after a pick-out has been made, or they may occur while the loom is running. In the first case, the difficulty is due to the cloth not being let back the correct distance, or the tension of the warp not being adjusted exactly the same after a pick-out has been made as previously, in which case either a thick or thin place is made when the loom is started. The thick or thin places that occur when the loom is running, however, are an entirely different matter and are not at all times easily overcome. Sometimes a loom will run for many hours, then make a thick or thin place, and then run for an hour or two longer before repeating this defect. Sometimes the friction let-off is the cause of this defect, it being frequently found that the friction will hold the warp tight for several picks and then all at once let off a considerable amount. In damp weather, the let-off motion will sometimes get in such a condition that it must be cleaned of all foreign substances and

rubbed with black lead. Occasionally it will be found that the beam is not true, or sometimes the casting that supports one of the journals of the beams may be loose. Sometimes thick and thin places are caused by the take-up motion. This defect is more noticeable when weaving light goods, in which case particular care should be taken with the let-off and take-up motions. Sometimes the weights on the levers governing the let-off motion may be striking on the floor, on the frame of the loom, or on one of the warp beams, in which case the warp is apt to let off unevenly. Sometimes the flange of the beam may rub on the floor or on some part of the loom and thus cause thick and thin places.

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### SHADED GOODS

**31.** The defect known as **shaded goods** is sometimes caused in piece-dyed goods by the heddles not being evenly divided by the hook supporting the heddle bar in the center of the harnesses; that is, the heddles will be crowded on one side of the loom. This often results in the goods having a darker shade on one side after being dyed. The remedy for this is of course obvious. Shaded piece-dyed goods are not always the fault of the loom or the fixer, since they are frequently caused in dressing the warp by unequal tension on certain sections and by other causes.

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### REED MARKS

**32.** **Reed marks** are stripes lengthwise of the cloth caused by some of the splits of the reed becoming bent, usually through carelessness in handling the reed. Reeds are easily bruised, and when a reed is thus damaged it is impossible to weave perfect cloth from it until the damaged splits are straightened. This may be easily accomplished by means of a pair of reed pliers or by drawing out the damaged splits and inserting new ones in their places.

### CHAFING AND BUTTONING BEHIND THE REED

**33.** It will be understood that the constant chafing of the yarn in passing through the heddles on the harnesses tends to wear and weaken the yarn and to break it, while the reed in working forwards and backwards in beating up the filling chafes the yarn even more than the harnesses. Very often on fibrous warps the reed will scrape the loose fibers from each thread and collect them in buttons just behind the reed and in front of the harnesses. When these buttons grow large, through the constant accumulation of loose fibers, and the warp is drawn forwards by the take-up motion, the yarn will not be able to pass through the reed and so will be broken out. This may be prevented by properly sizing the warp; but if a warp is already in the loom it can be helped by making a loose rope of waste yarn and attaching it to the lay just behind the reed so that it will rest lightly on the warp. Then as the lay moves forwards and backwards the projecting fibers on the yarn will be smoothed down and the yarn passed through the reed all right. In case the difficulty is very great, this rope of waste may be kept moistened, either with water or a thin size.

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### POOR SELVAGES

**34.** With some warps it is often found difficult to produce clean and even selvages, especially when single yarns are used for selvage ends. When ragged selvages are being made the defect is usually due to the selvage ends being broken out in weaving. This is often caused by the temples failing to hold the cloth out as wide as necessary, so that as the reed beats up the pick of filling, the selvage ends are broken out. When this occurs repeatedly, the weaver will fail to keep the selvage ends tied in, with the result that poor selvages are made. Occasionally when the shed is being opened a little late the shuttle will start to cross the loom before the shed is open sufficiently to prevent the selvage ends being broken by the shuttle. Late shedding

is especially liable to cause the selvage ends to be broken if the shuttle is a little rough.

When loose weaves, like baskets and sateens, are being woven, it is often impossible to produce a good selvage by drawing the selvage ends through the regular warp harnesses, because the latter do not rise and fall frequently enough to produce a firm edge on the cloth or to hold the picks of filling out well. When this is the case, a selvage motion should be used to operate the selvage ends; it will often be found impossible, however, to use a motion that changes the selvage on every pick and produces a plain selvage, because the selvage ends will in this case take up so much faster than the warp that they will become so tight as to break. In this case a selvage motion arranged to change the selvage ends first on one side of the loom and then on the other, so as to put 2 picks of filling in each selvage shed, may often be used to advantage, since in this case the take-up of the selvage ends in weaving is not so great.

Sometimes the selvage ends instead of being too tight will be slack, in which case if there is much tension on the filling the selvage ends will not hold out the cloth to the full width. Sometimes it is difficult to so set the temples as to hold out the cloth. In either of the above cases it is sometimes of advantage to wind a strip of coarse sandpaper about 4 inches wide around each edge of the take-up roll, so that its diameter will be slightly increased, which will result in the edges of the cloth being drawn down a little faster than the body of the cloth and the selvages thus kept tight. This method will sometimes be found to aid greatly in holding out the cloth to the full width when heavy fabrics with a hard weave are being woven.

Occasionally a temple will damage the selvage or the edge of the cloth. This is sometimes caused on delicate fabrics by the burr of the temple being damaged, and sometimes one or more of the rings of the burr will be bent so that they fail to turn. Sometimes the cap of the temple will rub the cloth so as to damage it, and at other times

the cloth may be too far into the temple. It is sometimes found that on light and delicate fabrics the end ring of the temple will mark the cloth, because the greatest strain in holding out the cloth to its full width is at this point. In such cases it is necessary to remove this ring from the temple, and in exceptional cases it may be necessary to take out two or more rings.

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### WEAK WARPS

**35.** Occasionally there is sent to the weave room a warp that is composed of such tender and twitty yarn or that is so slack-twisted that it is almost impossible to weave, on account of the warp breaking out so frequently. Warps of this character require a great deal of skill in handling, even if normal results only are expected. The worst feature of these warps is that very little can be done to positively remedy them, and about the best that the fixer can generally do is to adjust the loom so that it will run as smoothly and easily as possible. The tension of the warp in weaving should be made as slight as is consistent with forming a clear shed. The shed also should be made to open just enough to nicely clear the shuttle; if it opens too wide the warp is strained by the harnesses, while if it does not open wide enough it is chafed by the shuttle.

The shed should not be made to open too early, but should rather be set a little late. It is also of advantage sometimes to set the top cylinder gear a little ahead of the bottom cylinder gear, so that the harnesses that are rising will reach their destination just before the reed strikes the fell of the cloth, while those that are falling will come to rest just after beating up. By doing this the strain on the warp is lessened somewhat, because these three actions all produce a strain on the warp yarn, and if they do not all occur at one and the same time, this strain will not be so liable to cause breaks. When weak warps are to be woven, it is very important to have the whip roll in such a position that there will be an equal strain on both the top and bottom sheds.

## MINOR MATTERS OF IMPORTANCE

### OILING

**36.** Looms should be oiled twice a day; in most mills the **oiling** is performed every morning and noon. The weavers are supposed to keep their looms well oiled, but as a loom that is not properly oiled requires a great deal more fixing, and as the fixing falls on the loom fixer, it behooves him to see that the weavers are not negligent in this matter. The fixer should notice if the weaver is oiling the loom at all the places where oiling is necessary, and if not he should point out to the weaver the parts that require oiling. Whenever a warp is woven out and the beam and harnesses taken from the loom, the weaver should take the opportunity to oil those parts of the loom that are difficult of access. The fixer should occasionally grease the gearing of the loom, especially the heavy driving gears. An excellent grease for this purpose may be made by filling a suitable receptacle about half full of soft soap and stirring powdered black lead, or graphite, into it. Good heavy oil may be used instead of the soft soap, but the latter is cheaper and serves the purpose as well—which is merely to hold the black lead, or form a body for it.

### CLEANING

**37.** The weavers are also required to keep the looms clean, since if large amounts of dirt and flyings are allowed to accumulate, the warps and cloth are liable to be soiled and the danger of fire is also greatly increased. Looms should not be cleaned while in motion, though in some states where the law allows, this is done. To clean the looms a short-handled brush should be used; a bristle brush is the best, but a good brush, or swab, may be made by tying a bunch of waste yarn on the end of a short stick. The weavers should not be allowed to wipe or clean their looms with a rag or a bunch of cotton waste held in the hand while

the machine is running, as this is a very dangerous practice and is sure to result in an accident. The weavers should give the loom a thorough cleaning every time the warp is out of the loom, and if they are required to keep the floor clear of waste, the general appearance of the weave room will be greatly improved. A scrubber should be employed to scrub the floors and wash the windows. The latter especially should be kept clean and bright, as good light enables good cloth to be woven, because the weaver can then readily note any imperfections that are being made in the cloth.

### BLACK OIL

**38.** White and delicately colored fabrics are sometimes stained with black and dirty oil. Although this rarely happens, it may be prevented by proper care in wiping off surplus oil from the various parts of the loom where it is liable to come in contact with the warp, filling, or cloth, and by having the hangers of the driving shafts so located that they are not directly above the loom. Large stains may be removed with a solution of oxalic acid, afterwards thoroughly washing the place where the spot was.

### SUPPLIES

**39.** In order to do good work, a loom fixer requires **supplies** of the very best quality and of as extensive an assortment as may be necessary for the class of looms under his charge. He should, however, exercise the greatest care and economy in their use, as this is an item of considerable expense to the mill and a point that is generally carefully watched by the management. If a loom is breaking picker sticks frequently, the cause, which may be nothing more than too much sweep on the stick, should be ascertained and the difficulty remedied; the entire stock of spare sticks should never be used. A number of pickers may be strung on a wire and kept in the oil tank, so that when a new picker is required, one of these may be used; it will last much longer. Other supplies should also be made to last as long

as possible. The practice of doing without supplies by patching up a makeshift should not be tolerated, however, and when it is necessary to draw on the supplies, the quicker it is done the better it is for the loom and the fixer. A saving in supplies may be effected if the fixer is vigilant in observing and remedying little defects about the loom. For instance, he may notice that a box is a little too high or low and the shuttles are consequently becoming chafed; leveling up the boxes not only saves the shuttles, but very likely saves a case of shuttle flying.

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### WORKMANSHIP

**40.** The fixer should endeavor to do everything in a workmanlike manner, since by so doing he will show himself to be the master of his trade. Many things about a loom may be fixed in a makeshift way and the loom will run just as well, but in order to have an appearance of neatness, a loom should be fixed in the best and most substantial manner possible under the circumstances. For instance, if a harness strap is too long, the fixer should not tie a knot in it to save going to the bench for the belt punch, nor should he make a new hole in the strap with a knife, since in this case the strap will break sooner or later and perhaps cause serious damage. In order to do good work a fixer should have a good set of tools, each stamped with his name or initials. These should include one 14-inch monkeywrench, one 8-inch monkeywrench, a good assortment of flat **S**, or angle, wrenches, at least two good screwdrivers, an awl, a steel straightedge, a pair of strong pliers, a pair of reed pliers, a small spirit level, a machinist's hammer, a ball-peen hammer, a prick punch, a cold chisel, a few files, and a revolving belt punch. To these may be added various other tools that are convenient and useful, such as drills, bits and a bit stock, a chalk line, and a steel tape.