FIXING LOOMS

Serial 492 Edition 1

DEFINITIONS

1. There are several terms applied to a loom and its parts which will be frequently used, and consequently should be defined so that the student may fully understand their application.

If, when facing the front of a loom, the shipper handle is at a person's right, it is said to be a **right-hand loom.** If the shipper handle is at the person's left, it is a **left-hand loom.**

To determine whether a shuttle is right- or left-hand, hold the shuttle with the top, which carries the larger opening, upwards and the heel pointing toward the person. If, when in this position, the eye of the shuttle is on the person's right, it is a **left-hand shuttle;** if on the person's left, it is a **right-hand shuttle.** Right-hand shuttles are run in right-hand looms, and left-hand shuttles in left-hand looms.

By the term **heel** of the shuttle is meant that end which does not contain the eye.

The different parts of a loom are all set with relation to the position of the crank-shaft, which is variously spoken of as being on its **top, bottom, front,** or **back center,** according to whether the crank on this shaft is at its highest, lowest, front, or back position, respectively.

The expression *turn the loom over*, or *pick the loom over*, a certain number of picks, is frequently met with in the mill and implies turning the crank-shaft one or more revolutions, as may be indicated.

ERECTING AND STARTING LOOMS

2. In setting up new looms, care should be taken to have them perfectly square with the line shaft. To accomplish this, drop a plumb-line from two points on the line shaft, and from the points where the plumb-bob touches the floor measure out the distance that the looms are to be placed. This gives two points equally distant from the line shaft. Between these two points stretch a chalked line; raise this line at the center, and then let it drop. This will produce a mark on the floor perfectly parallel with the line shaft. The looms are then set with their feet just touching this line. A spirit level should next be placed on the breast beam and loom sides, in order to ascertain if the looms are level. If they are not, they should be made so by placing packing under the loom feet. After this has been accomplished, the looms should be firmly fastened to the floor.

The loom is now ready for the belt. In order to obtain the length of belt required, pass a line around the pulley on the line shaft, and also around the pulley on the loom. Cut the line to the exact length; then lay it on the floor and cut the belt to correspond with the line. It should be remembered that belts will stretch after being run a short time; consequently, they should be cut from 1 to 2 inches short, according to their length.

3. The best way to fasten loom belts is by means of belt clasps, since when fastened in this manner they wear longer and give better satisfaction. Care should be taken in putting on a clasp to prevent its being flattened. The belt should be hammered and not the clasp. It is also a good plan to place a piece of leather or wood on the belt when fastening the clasp. This will prevent any turning of the points.

4. The loom should be run for some time without the warp, but with all the parts set and with the reed and shuttle in position; during this limbering up the loom should be thoroughly oiled, much more frequently than during the ordinary running of a loom.

TYING IN WARPS

5. When the warp is brought to the loom, the beam is placed in the supports at the back and the friction bands or ropes applied to the beam heads. The warp yarn, together with the harnesses and the reed, is then passed over the whip roll to the center of the loom, and the harnesses connected at the top to the straps attached to the top rolls, and at the bottom to the jack-straps that connect them with the treadles, although the latter may be done after the warp has been tied in. The reed is then fixed in the lay, where a groove has been cut to receive it, and the lay cap, which also contains a groove and fits upon the top of the reed, is then fixed in position and friction applied to the loom beam.

A piece of cloth known as the **apron,** and which should be the same width as the cloth to be woven, is passed around the sand roll and carried over the breast beam. Bunches of the warp yarn are then taken and tied to the apron, which should be torn in strips at this end. Care must be taken that all the ends of the warp are drawn at an equal tension before being tied to the apron. The warp is then loosened and *turned down* by turning either the sand roll or the ratchet gear by hand. A few picks of filling are then placed in the warp in order to tie the ends.

It is necessary to perform the operation of tying in a warp as just described each time that an old warp is replaced by a new one, but on a new loom a number of additional operations are necessary, known as settings.

SETTINGS

REGULATING THE SIZE OF SHED

6. The **size of shed** is, of course, largely dependent on the throw of the harness cams, and this point is dependent on the class of goods that it is intended to run, and is generally decided on before the looms are ordered. However, the size of the shed may also be regulated, to a certain extent, by means of changing the point at which the jack-strap is connected to the treadle, since the farther this point is from the fulcrum on which the treadle rests, the greater is the distance through which it will be moved, and as a result the size of the shed will be increased.

A good rule to follow when regulating the size of the shed, is to have the shed large enough to clear the shuttle, by, say, about $\frac{1}{8}$ inch. In some cases, however, when the work is light and there are no loose fibers in the yarn, it will be found to be an advantage to reduce the size of the shed, the chafing due to the shuttle rubbing against the yarn being more than compensated for by the fact that less strain will be placed on the yarn, due to the harnesses not lifting so high.

SETTING HARNESS CAMS

7. When **setting the harness cams** for ordinary work, in order to have them move the harnesses in the correct manner, turn the crank-shaft until it is on its bottom center; then turn the harness cams on the cam-shaft until the treadles are exactly level. Fasten the setscrew in the cams when the loom is in this position. This will bring the harnesses level when the reed is about $2\frac{1}{2}$ inches from the fell of the cloth. It should be noticed that this is for ordinary setting of the harness cams.

If the harness cams are set so that the harnesses will be level before the reed reaches this point, that is, before the crank-shaft reaches its bottom center, the harnesses are said to be **set early**; on the other hand, if the harnesses do not

become level until the crank-shaft has passed its bottom center, the harnesses are said to be **set late.**

The crank-shaft should next be turned until it is on its back center; the lay will then be in its backward position and the harnesses should be open to their fullest extent. When in this position the yarn that forms the bottom shed should just clear the race plate of the lay. If the yarn presses on the race plate it will be chafed, and breakage of the ends will result. On the other hand, if the yarn is too high, it is liable to give the shuttle an upward tendency as it enters the shed, which often results in the shuttle either being thrown from the loom or not passing straight from one box to the other; in fact, it will result in a number of faults, which will make both bad cloth and low production. The position of the yarn when the harnesses are open can be regulated by raising or lowering the harnesses by means of the strap connections.

The crank-shaft should next be turned over one pick. This will bring the yarn, which formerly formed the top shed, at the bottom. This bottom shed should be regulated in the same manner as the previous one.

8. Different Settings of Harness Cams.—It has been stated that, for ordinary setting of the harness cams, the crank-shaft should be on the bottom center when the harnesses are level. It has also been stated that this would bring the harnesses level when the reed is about $2\frac{1}{2}$ inches from the fell of the cloth; that is, the top and bottom sheds would close over the picks of filling when they were required to be pushed $2\frac{1}{2}$ inches in order to form part of the cloth. This means that if the cloth was being woven with 64 picks to the inch and the loom set in this manner, each warp end in moving the $2\frac{1}{2}$ inches would be chafed by the pushing up of $64 \times 2\frac{1}{2}$ (or 160) picks of filling after the sheds have crossed over them. This chafing of the warp ends would raise the fibers of the cotton and give to the cloth a well-covered appearance, which would be lacking if the cams were set late.

It can readily be seen that if the cams were set earlier and the harnesses were made to change when the reed was about 3 inches from the fell of the cloth, a greater chafing of the warp would result; consequently, more of the fibers would be raised and more covering produced. On the other hand, if the harness cams were set later, the opposite effect would be produced and the cloth would have a bare appearance.

Some warps are so tender that, in order to weave them at all, they must be favored to every possible extent. When this is the case, the harness cams should be set so that the warp ends will be chafed as little as possible.

LEASE RODS

9. The object of the **lease rods** is to retain the lease of the warp ends. This is necessary in order to keep the ends from becoming tangled, and also to enable the weaver to readily piece up any broken ends. To lease a plain warp, turn the crank-shaft until the back harness is up; then place the larger of the two lease rods in the shed that is formed back of the harnesses. Next turn the crank-shaft over until the front harness is raised, and place the other rod in this shed.

Although the lease rods may appear to be insignificant, they play an important part in the running of a loom. With very little thought it will be seen that when the front harness is up and the back harness down, the warp ends will open up from a point between the two lease rods; but when the position of the harnesses is reversed, the warp ends will open up from a point in front of the front lease rod. Thus it will be noticed that it would be impossible to produce as large a shed when the yarn is opening from a point in front of the lease rods without producing more strain on the yarn. To overcome this difficulty, the dimensions of the front lease rod should be as small as possible; then, by regulating the leverage of the treadles, the difference in the size of the sheds may be made almost imperceptible.

EFFECT OF POSITION OF WARP LINE

10. The **warp line** may be defined as an imaginary line drawn from the top of the whip roll to the top of the breast beam and passing through the shed when open. This will be seen by reference to Fig. 1, where *a* represents the whip roll; *b*, the breast beam; *f c e*, the line of the top shed; *f d e*, the line of the bottom shed; and *a b*, the warp line.

The position that the warp line *a b* assumes forms an important point in the production of cloth on which there is to be more or less cover. In Fig. 1, the warp line *a b* forms the line *a e f b* of the warp yarn; in other words, when the harnesses are open, the warp line passes through the center

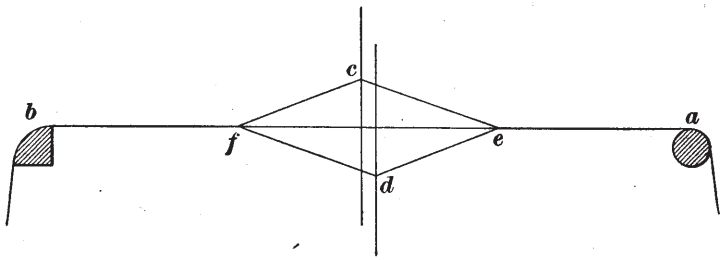

FIG. 1

of the shed; consequently, when the shed is open, as shown in this figure, there will be an equal strain on both sets of warp threads, since both harnesses move an equal distance from the point at which they become level.

When the warp line occupies this position, it generally results in the cloth having a hard, *reedy* appearance; that is, the warp ends have the appearance of being laid in the cloth in pairs, since two ends will be close together and a space between these and the next two. This appearance of the cloth is sometimes desired, though, as a rule, it is generally considered a defect.

Fig. 2 is an illustration of the warp line when in a different position. In this instance, the whip roll and the breast beam have been raised, and it will be seen that the warp line *a b* passes through the upper half of the shed. This will result

in the yarn in the top shed being more slack than the yarn in the bottom shed. Then, as the pick of filling is beaten up by the reed, it will spread the yarn that forms the top shed between the ends that form the bottom shed. This will tend to give the cloth an even appearance, and will remedy the faults that have been spoken of in connection with the warp line running through the center of the shed.

It should be noted in this connection that as the whip roll and breast beam are raised, the strain on the yarn of the bottom shed will be correspondingly increased; consequently, in setting a loom to obtain a cloth that will have a full appearance, it is necessary to consider the

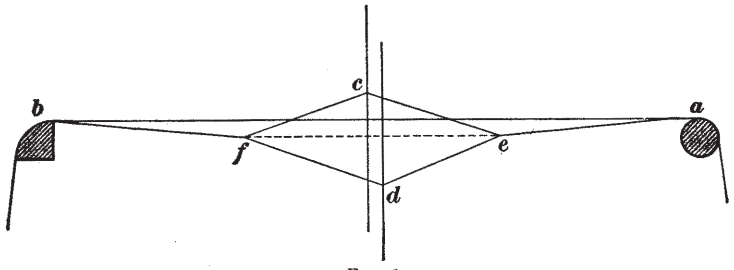

FIG. 2

strength of the warp yarn. If the warp is tender, it is best to set the whip roll and breast beam in such a manner that the warp line will pass through the center of the shed. This will cause the top and bottom lines of the shed to be raised and lowered equally, and will produce the least strain possible.

It may be stated that any setting of the loom to produce cover or a full appearance in the cloth, puts a greater strain on the warp ends, and in setting a loom to give either of these results, care should be taken not to go to such an extreme that the advantages gained in one direction will be lost in another.

SETTING PICKING CAMS

11. Picking cams are now generally made in two parts—the **picking cam** proper and the **picking-cam point,** which is fastened to the picking cam by means of bolts. The picking-cam point is the part that comes in contact with the pick cone, and is made separate, since it is more convenient to replace only this part as it wears out than it would be to replace the whole picking cam. This method of construction also saves considerable expense.

In placing the picking cam on the cam-shaft, it should be in such a position that it will come in contact with a point about midway of the length of the pick cone; then, if any further adjustment is necessary, it may be moved either way.

12. To **set a picking cam,** turn the crank-shaft until it is on its top center; then set the picking cam so that it will just start to move the picker stick. Turn the crank-shaft until it is on its top center again, when the pick cam on the other side of the loom should be set in the same manner.

If the student remembers that the crank-shaft revolves twice while the cam-shaft is revolving once, it will readily be understood that one pick cam will operate on one pick, and the other on the next, as the cam-shaft revolves only once every two picks.

13. Some fixers think that the harness cam that is pressing down the harness should be the one nearest the picking cam operating that pick; that is, if the right-hand cam is pressing down the harness, the picking cams should be set so that the loom will pick from the right-hand side. This is merely a notion, as it is immaterial from which side the loom is picking.

If the picking cams are set so that the point of the cam starts to raise the pick cone before the crank-shaft reaches its top center, the loom is said to be **picking early.** On the other hand, if the picking cam does not start the pick cone until the crank-shaft has passed its top center, the loom is said to be **picking late.**

SETTING THE LUG STRAP

14. On the lug strap that is around the picker stick, there is usually placed a small strip of leather, which is fastened to the picker stick by means of a screw. This serves to hold the lug strap in position. By lowering or raising this lug strap, more or less power is given to the pick; that is, if the lug strap is raised on the picker stick there will be less power, and if it is lowered the opposite effect will be the result.

Power is a term that in this instance refers to the force that the picking cam imparts to the shuttle. It is the object of every good fixer to run his looms with as little power as possible.

A good setting for the lug strap is to have it in such a position that the lug strap which is connected to the picker stick will be on a level with the lug strap connected to the picking-shaft arm. If possible, the lug strap connected with the picker stick should never be on a lower level than the rest of the connections, since when in this position it has a tendency to slide up on the picker stick, due to the force coming from above the point where it is connected. This is very liable to result in a weak pick and 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 strike against a strip of leather placed in the slot. This prevents the stick being damaged, which would be the case if the iron end of the box were not protected. The distance that the picker stick travels in moving from the back to the front of the box, or the **sweep** of the picker stick, can be regulated by taking up or letting out the lug straps.

STARTING PICKERS

15. When placing **pickers** on the picker stick, the part that rests on the bottom of the box is generally cut in such a manner that, if the picker is held perpendicular, this part will slant upwards toward that side of the picker which comes in contact with the picker stick. It will be seen that by doing this the under side of the picker will be parallel with the bottom of the box when the picker stick is starting to deliver the shuttle.

To place a picker on the picker stick, have the picker stick at its backward throw, and place the picker so that its under side will just clear the bottom of the box. Bring the shuttle up hard against the picker so as to mark it. Where this mark comes on the picker, cut a small circular hole for the reception of the shuttle point. Next fasten the picker by means of the loop, or collar, that passes around the picker and that is fastened to the picker stick by either tacks or screws. Bring the picker stick forwards to the limit of its throw, and notice where the hole in the picker comes in relation to the point of the shuttle. Under no conditions should it be lower, since this would have a tendency to raise that point of the shuttle which first enters the shed, thereby resulting in the shuttle being thrown out, or at least in its going crooked.

16. It is generally the practice to have the hole in the picker, when the picker stick is at the limit of its forward throw, a little higher (say about $\frac{1}{16}$ inch) than that point of the shuttle with which the picker is in contact. This will slightly depress the forward end of the shuttle, or the end first entering the shed, and consequently render the shuttle less liable to fly out.

If, when trying the picker, it is found to be too low, it may be regulated by placing a very thin strip of leather between the front side of the picker stick and the top part of the clasp through which the bolt that fastens the picker stick to the parallel motion passes. Some looms are provided with a

setscrew that contains a check-nut, this setscrew being fastened to the rocker of the parallel motion. By means of this, the picker may be adjusted to its proper height with respect to the point of the shuttle.

Considerable care should be exercised in the setting of pickers, particularly after they have been worn a great deal by the point of the shuttle striking them; if they are not set right, they will throw the shuttle crooked. If the shuttle for any cause is being thrown in this manner, it will generally be noticed by means of a clicking sound, which is due to the shuttle striking the side of the opposite box as it enters it.

It will be remembered that a slot is cut in the bottom of the shuttle box, in which the picker stick moves while delivering the shuttle. At the forward end of this slot, or the end nearer the loom, thick strips of leather are placed. These form what are known as bunters, and serve as cushions for the picker stick as it is brought forwards.

STARTING PICKER STICKS

17. In setting the **picker stick** with regard to the length of the sweep, turn the crank-shaft until the picker stick is brought to the forward end of its stroke; when in this position, it should be from 1 to 2 inches from the bunter. It should never have so much sweep that it will be brought in contact with the bunter while the picking cam is in contact with the pick cone, since under such conditions the picker stick is very apt to be split.

SETTING BINDERS AND BINDER STRAPS

18. The shuttle being sent with such force from one side of the loom to the other, some arrangement must be provided by means of which it can be checked gradually 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 to be still more avoided, the shuttle in striking the picker will rebound, thus leaving some

space between the picker and shuttle. Then as the picker stick is brought forwards to again drive the shuttle across the loom, it will have to move some distance before bringing the picker in contact with the shuttle. 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 warp yarn closing on it. The **binder** and other appliances attached to the boxes of the loom serve to hold the tip of the shuttle in actual contact with the picker while the shuttle is in the box.

19. It is the object of all good loom fixers to have their looms set in such a manner that the least possible wear will be brought upon the different parts. To accomplish this, the least power that will send the shuttle across the loom and into the opposite box should always be sought. It can readily be understood that the tighter the shuttle boxes are made, the more force will be required to drive the shuttles into them; consequently, all boxes should be set so that they will no more than *check* the shuttle and at the same time retain it in its position after it has fully entered the box.

Many different methods of setting the binder are advocated, the one aim being to set it in such a manner that the shuttle on entering the box will receive a uniform and gradual check. In order to procure this, 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 which first came in contact with the binder has reached the other end of the projection on the binder. When set in this manner the binder will present the full face of its curvature to the side of the shuttle when the shuttle is at rest in the box.

20. It will be noticed that the shuttle may, in some cases, strike the binder with sufficient force to throw the finger out with such suddenness that it will not act as a check after the shuttle has once come in contact with the binder. To

prevent this, a strip of leather known as the **binder strap** is placed around the finger.

To attach the binder strap to the loom, have the shuttle in the box so that the binder will be at its outward limit; then stretch the binder strap of leather over the finger, drawing it tight and fastening it with screws. In case the binder is placed at the front of the box, a casting is placed on the protector rod to serve the purpose of the binder strap.

STARTING SHUTTLES

21. The regulating of the **shuttles** forms an important part of the fixer's duties. In all cases, a weaver should have at least two shuttles for each loom, so that when the filling in one shuttle runs out, a full one will be ready with which to replace the empty one. It is necessary, therefore, to have the shuttles that are to run in the same loom exactly alike, both in regard to their size and weight. If this is not attended to, the power suitable to carry one will not be right for the other.

22. In starting a new pair of shuttles a pair of calipers should be run the length of each shuttle to make sure that they are of an exact size. They should also be weighed in order to ascertain that their weights are alike. After shuttles have been running for some time they will become worn, and consequently their size and weight will not remain the same; then when the shuttle box has been set for one shuttle it will not be found to work correctly with the other. To overcome this it is necessary to frequently true the shuttles. In truing shuttles some fixers use a plane; others rub the shuttles on a strip of coarse sandpaper, which may be tacked to the bench. Either method will answer the purpose.

23. A cause of considerable trouble is the liability of the shuttles to accumulate dirt on their sides, thus causing them to stick as they enter or leave the boxes; consequently, they should always be carefully looked after in order to do away with this evil. This more properly comes under the

weaver's than the fixer's duties, although such things are often left for the latter to attend to.

24. Generally a small piece of flannel, known as **friction flannel,** is tacked to the shuttle at that part of the eye where the filling first enters it. This serves to keep the filling at a certain tension while running out of the shuttles.

25. Care should be taken that the reed is exactly in line with the back of the shuttle boxes. If it projects beyond this part, the shuttle in striking it will be turned from its true course.

The race plate should also be on an exact level with the bottom of the shuttle boxes, any other position being detrimental to a satisfactory running of the shuttle in its flight from one box to the other. In order to ascertain whether the race plate is set in this manner, place a straightedge in either box, having it rest on the bottom. When in this position, see that its whole edge is in contact with the race plate and the bottom of the box.

SETTING THE PROTECTOR MOTION

26. To set the **protector motion,** have the shuttle out of the box; then adjust the fingers at the back of the boxes in such a manner that they will press against the binders; bring the lay forwards and see that the dagger engages with the bunter on the frog. Next insert the shuttle in the box and see that the dagger clears the bunter, by about $\frac{1}{4}$ inch, when the lay is brought forwards. If there is not the proper space between the dagger and the bunter when the shuttle is in the box, the sides of the boxes will have to be adjusted in order that the shuttle when in the box will press the binder out sufficiently far to cause the finger to give the dagger the correct elevation.

The protector should be well oiled and work quite freely, since if there is any inclination on its part to stick, it is liable at any time to fail to knock off the loom when the shuttle is trapped in the shed.

FILLING STOP-MOTION

27. To set the **filling stop-motion,** have the shuttle on the filling-fork side of the loom; this is, in almost all cases on modern looms, the side on which is placed the shipper handle; then bring the lay up to the full throw of the crank, so that it is on its front center. When the loom is in this position, turn the filling-fork cam on the cam-shaft until its point is just commencing to raise the lever on which it acts. Notice the position of the finger of this lever in relation to the back end of the filling fork. There should be a space of about $\frac{1}{4}$ inch between them.

The filling fork is, at times, the cause of considerable trouble. It should be carefully balanced on the pin that supports it, the back end being just a trifle heavier than the forward end. The prongs should be bent in such a manner that they will just project through the grid when the lay is at the farthest throw forwards. Care should also be taken that the prongs of the fork come in contact with no part of the lay or grid during its operation.

TEMPLES

28. There is not much that would be considered difficult in setting the **temples** of a loom, the principal points being to note that they hold the cloth out to a sufficient width to prevent the breaking of the selvage ends. It is well understood that the yarn is somewhat wider when in the reed than it is after it has become cloth; consequently, as the lay is brought forwards in beating up the filling, considerable strain is brought upon the selvage ends. The temples should be set as near the fell of the cloth as possible without interfering with the yarn, so that they will relieve the selvage ends as much as possible.

Care should be taken that the bar of the temple does not come in contact with the race plate of the loom, although on plain work the bar is generally set as near as possible to the race plate.

The temple should also be prevented from coming in contact with the reed. To prevent this, the temple is provided with a **heel,** which the lay of the loom strikes when coming forwards, and pushes back. It is not considered necessary that the temple in being thus pushed back should move through more than $\frac{1}{4}$ inch.

Temples should always be kept well oiled so that the rollers will work freely.

LET-OFF AND TAKE-UP MOTIONS

29. In regulating the **let-off** and **take-up motions,** care should always be taken to have the warp tight enough to prevent any slack cloth on the breast beam. When watching a loom running, it will sometimes be noticed that the lay, in beating up the filling, will cause considerable slack in the cloth when the reed comes in contact with the fell. When this is the case, weight should be added to the **let-off motion.**

30. In setting the **take-up motion,** be sure that the take-up pawl acts on only one tooth of the ratchet wheel at a time. If the pawl takes up one tooth of the ratchet wheel for a number of picks and then acts on two teeth, bad cloth is sure to result. A good rule to follow in setting the pawls is to turn the loom until the take-up pawl is at its full forward throw; then set the stop-pawl so that it will rest in a tooth at a point that is about half the depth of that tooth. If, after having done this, the pawls do not work properly, the gears will have to be adjusted.

KEEPING THE LOOM IN GOOD RUNNING CONDITION

31. The settings of the loom that have just been described have been given in relation to the starting of a new loom and are more or less permanent; consequently, they do not have to be attended to again until parts of the loom have become misplaced or worn, unless widely different styles of goods are to be woven that require the parts to be set differently.

However, after a loom has been running some time, many things combine to throw it out of order, and the fixer very soon has new problems to contend with. It would be well to consider what action of the loom has the most to do with this, and point out what method is best to adopt to reduce the liability of breakages to a minimum.

32. Probably no part of a power loom is so hard to understand, and consequently so hard to keep in good running order, as the pick. To procure a good, smooth-running pick necessitates so many different parts of the loom being regulated that the fixer will very often overlook the one vital point.

A very great strain, together with considerable wear, is brought on the loom on account of the picking movement. Shuttles, pickers, straps, and all other parts connected with it are constantly wearing out or breaking; and if the best of care is not taken, the cost for these supplies will soon surpass the allotted amount. Much of this is caused by the harshness of the pick, and consequently the easier this can be accomplished, the better it will be for the fixer, as well as the manufacturer. But even when all that is possible has been done, there will be considerable wear and tear that it will be impossible to overcome.

33. The picker stick in delivering the shuttle, in addition to supplying force enough to send the shuttle across the loom, is also obliged to overcome the resistance of the binder pressing against the side of the shuttle. As soon as the shuttle leaves the box, this additional strain is removed, and, consequently, the power that has been exerted in pushing the shuttle from the box will now be applied to some other part of the loom. As a result, the other moving parts of the loom will have a tendency to jump forwards, on the same principle that a body having a force acting on it, but restrained by friction, will move rapidly in the direction of the force applied if that friction is suddenly removed. This is known as the **reaction** of the loom, and it can easily be seen that the more of a drag there is to the 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 in fact on all the parts of the loom.

It can readily be understood that the less pressure that is brought to bear on the shuttle while in the box, the better it will be for the loom; but, at the same time another point should be considered, namely, that there always must be sufficient pressure to prevent the shuttle rebounding when it strikes the picker in entering the box. This leads to the consideration of another point, namely, the *power of the pick*.

34. 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. Next, it must give to the shuttle sufficient power to enable it to enter the box. Thus it will be seen that these two features of fixing—setting the boxes and regulating the pick—may be said to act one upon the other; for the tighter the box, the stronger must be the pick; and the stronger the pick, the tighter must be the box. In regulating the pick, it should be the aim of every fixer to give it just sufficient power to do its work and no more; then the tension of the box should be regulated to correspond with the power of the pick.

35. In every case when the shuttle fails to reach the opposite box. whether on account of its meeting with some obstruction or on account of its not receiving sufficient force from the picker stick, the dagger on the protector rod engages with the frog and the loom is stopped. This is known as **banging off,** and it can be seen that the suddenness with which the loom is checked will necessarily bring considerable strain on the different parts. In some cases, the momentum of the loom is so great and the shock so severe that the teeth in the gear on the end of the shafts will be broken, owing to the tendency of the gear to revolve after the loom is stopped; or, in other cases, the lay swords may be broken.

The liability of such things happening may, however, be greatly lessened by carefully setting the different parts. The teeth in the gears on the crank- and cam-shafts should be sufficiently geared into each other, since 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 would be the case if the teeth were properly geared.

36. When the loom is stopped by the dagger, the shipper is pushed from its retaining notch, throwing the belt from the tight to the loose pulley and applying the brake. It is always well to keep this part of the loom set exact; for the sooner the belt is removed from the fast to the loose pulley and the brake brought to bear on the brake wheel, the more quickly is the loom relieved of its momentum, and, consequently, the less violent will be the concussion of the parts. In fact, if these parts are properly adjusted, when a loom is running at a fair speed, the belt is actually on the loose pulley and the brake practically in full operation, by the time any concussion takes place in the various parts, so that it is robbed as much as possible of its violence.

37. Thus it will be seen that the loom may be fairly set in motion and left in charge of the weaver—whose duty it is to merely change the shuttles and repair broken yarn—and

yet, owing to its reactionary nature, it frequently gets out of order and breaks some of its parts. The fixing of looms is a duty that is peculiar to itself. Each part of a loom has its particular work to do, and yet that part must act in harmony with the loom as a whole. Consequently, to set down any hard and fast rules for the fixing of any one of the difficulties that are sure to confront the fixer, would be absurd. However, by considering those difficulties that are the most frequently met with, and by carefully studying the different circumstances that may cause them, some help may be given to the student.

BANGING OFF

38. About the most frequent difficulty with which a person fixing looms must contend, and one that is probably due to as many different causes as any other, is the shuttle not entering the box in time to prevent the dagger of the protector motion engaging with the frog, and thus causing the loom to **bang off.**

When seeking to remedy this difficulty, turn the crank-shaft and see if the loom is picking properly; that is, if the picker stick starts to move when the crank-shaft is on the top center, the cam may have slipped on the shaft and thus made the loom pick late. Another thing that should be noticed in connection with the pick cam is that, after running some time, its point is very apt to get worn. When it has been so far worn that it will not serve its purpose, it must be taken off and replaced by a new one. The shed should be noted to see if there is sufficient room for the shuttle, since a shed that does not open wide enough will retard the progress of the shuttle.

Next notice the action of the boxes; ascertain, by pushing the shuttle in or out, whether they are too tight. A person easily becomes accustomed to the necessary force required to push the shuttles into the box, so it can readily be told whether this needs changing or not. The shuttles themselves are frequently the cause of this trouble. They should be carefully examined, and, as there are two shuttles to each

loom, they should be compared and made exactly alike. Sometimes one shuttle will run without any trouble at all, but when the shuttles are changed there is frequent banging off. The cause then is almost sure to be with the shuttle, although there may be other defects that are so slight that the loom would run were it not for the fact that the defect in the shuttle is acting together with them.

Very frequently some foreign substance will adhere to the sides of the shuttles, causing them to stick as they leave and enter the boxes; this should be noted. Observe the position of the dagger, and see if there is plenty of clearance between it and the frog when the shuttle is in the box. The finger may have slipped on the protector rod, or the binder may not be shaped exactly right to give the required lift to the dagger.

Notice the pickers; sometimes these are either worn or in such a position that they will throw the shuttle crooked, so that it will strike on the sides or top of the opposite box in entering and thus retard its progress. This defect can generally be noticed by a clicking sound, caused by the shuttle as it hits the sides or top of the box.

The driving belt may be too slack, and, consequently, slipping; if this occurs just as the loom starts to pick, it is very apt to bang off. This defect will show itself by a tendency of the loom to slow down at times. This may not be easily noticed by watching the loom run, but by placing the hand on the lay when the loom is in motion, it may be felt whenever it occurs.

The rocker should work freely on the shoe, and care should be taken to prevent its binding in any part of its action. Nothing has been said of bolts breaking and such things as would be so apparent that a novice would notice them.

39. If after all these different parts have been examined and set right the loom still bangs off, more power must be applied; but it must be understood that this is the last

resort. Enough has already been said regarding the evils of too much power.

Power may be added to the picking motion in several places; the cam on the cam-shaft may be altered. By sliding this cam toward the framework of the loom, more power is given to the pick; by bringing the cam nearer the center of the loom, less power is given to the pick. Another part of the loom where the power of the pick may be regulated, is the picker stick at the point where the lug strap is connected. By lowering this connection more power is given the pick, and by raising it the opposite effect is obtained. In this connection, however, what has already been said as regards the point of fastening the lug strap to the picker stick, should be carefully observed.

Too much power will result in the loom banging off just as readily as will too little power, since in this case the shuttle, as it strikes the picker, will rebound and thus, as it is being returned by the picker, lose a certain amount of the force that should be given to it, and, consequently, will not reach the opposite box in time to prevent the loom from banging off. Very little practice will enable one to discover this fault by simply watching the shuttle when the loom is running, and noticing whether it comes to rest when it is well in the box and with its tip bearing against the picker. It will be seen that a loose box will also cause the shuttle to rebound.

Thus there are numerous points, any one of which may cause the loom to bang off. Sometimes it is a combination of two or three of these, and then it is that the fixer is obliged to use his best judgment.

SHUTTLES GOING CROOKED AND FLYING OUT

40. If the speed at which the shuttle travels in passing across the lay of the loom is kept in mind, it will not be difficult to understand that any obstruction, however slight, will serve to throw it out of its course, and very probably 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 by the picker; also, notice the timing of the harnesses. They should change in time to offer a free shed to the shuttle.

Very often a broken end will become entangled with the other warp ends and cause an obstruction to the passage of the shuttle. When this is the case, it is easily noticed and quickly remedied.

Bring the picker stick forwards and carefully notice the position of the picker in relation to the point of the shuttle As explained previously, the hole in the picker should be slightly above the point of the shuttle when the picker is delivering.

The position of the reed should be carefully noted. As already stated, it should be perfectly in line with the back of the boxes; for if it should be set a little forwards of this position, it would be sure to give the shuttle an outward tendency. One or more dents protruding into the course of the shuttle will have the same effect.

The position of the race plate in relation to the bottom of the shuttle box should be noted. These should be on exactly the same level. The race plate or lay will sometimes get out of true and must then be leveled. Notice carefully the boxes at the point where the shuttle leaves. Any obstruction here, however slight, is liable to result in the shuttle being deflected.

The different parts of the loom are sure to wear out in time; and when they are so far worn that they can no longer be used without poor results, they should be replaced by new ones. It is a mistake to try to run anything that is worn out on a loom simply for the sake of saving supplies.

THIN PLACES IN THE CLOTH

41. Thin places may result when the loom is started after replacing the filling, or they may occur while the loom is running. Those resulting in the first case are so easily remedied that no further mention is necessary here. Reference has already been made to the arrangement on the take-up motion that aids in preventing this. The thin places occurring 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 thin place in the cloth, and then run for an hour or two longer before repeating the defect. This is what may well be called an aggravating case.

When a friction let-off is being used, the cause for this defect is frequently found in the rope that is wound around the beam head. This, at times, will get into such a condition that it will hold the beam tight while a certain amount of cloth is being woven, and will then slip, letting off the warp all at once. In such a case the rope should be thoroughly cleaned of all foreign substances and rubbed with blacklead. If an automatic let-off is being used, the gears should be carefully examined and all the setscrews tightened. The gears of the take-up motion should also be examined. These are very apt to become clogged, and should be thoroughly cleaned. If these different parts are carefully examined, the cause of this defect can generally be removed.

KNOCKING OFF FILLING

42. Knocking off filling is a defect, the cause of which is quite as often found in the spinning as in the weaving. Very frequently the yarn will be spun in such a manner that the cops or bobbins will be so soft or have such a taper that it seems impossible to throw them across the loom without the filling coming off in lumps.

In many cases when the filling is being knocked off, the principal point of the loom to regulate is the pick.

Considerable has already been said in regard to the regulation of the pick, and this should be carefully considered in this connection. If the shuttle is being sent across the loom at a high speed and is then suddenly stopped, the filling that it carries on the spindle will have a tendency to leave the spindle; consequently, anything to lessen this blow will also lessen the liability of the filling coming off. As light a pick as will do the required work should be given to the shuttle, and when the shuttle is entering the box it should be checked in as gradual a manner as possible. So much has already been said on this subject that no further remarks are needed here. Frequently, when cop filling is being used, it will be knocked off on account of the spindle of the shuttle not being large enough to firmly retain the cop. When this is the case, a small piece of leather may be placed near the point and between the sides of the spindle, thus enlarging the spindle sufficiently to hold the cop.

KINKS IN THE FILLING

43. Kinks in the filling is usually the result of too much twist. When such is the case, the filling should be thoroughly dampened, either by being steamed or having water sprinkled on it.

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

Another cause of kinky filling is the shuttle rebounding in the box sufficiently to cause slack filling, but not enough to result in the loom banging off.

CUTTING THE FILLING

44. In the great majority of cases, filling is cut when the shuttle is leaving the box in which the end of the shuttle containing the eye is in contact with the picker. When the shuttle is thrown from this box, that part of the filling that extends from the eye to the selvage is doubled on its own track. If, when in this condition, the filling is rubbed by the shuttle against any projection or rough place on the side of the box, it is almost sure to be cut. The box sides that come in contact with the filling should be carefully examined, to ascertain if there are any projections or rough places that will interfere with the filling.

The filling fork should also be carefully examined to learn if it is passing through the grid freely. If it does not, but comes in contact, it is apt to cut the filling. The pin that holds the spindle in the shuttle may become loose and project a short distance from the side of the shuttle. This is quite liable to result in the filling being cut.

See that the shuttle spindle is not thrown up when the shuttle is checked in the box. If it is, the spring in the heel of the shuttle, known as the **spindle spring,** should be tightened.

Sometimes the heel of the temple may be set in such a manner that the temple will come in contact with the reed. When this happens, the filling is very liable to be caught between the temple and the reed, which will surely result in its being cut.

MISPICKS

45. A defect frequently met with in the woven cloth, and one that is due entirely to the carelessness of the weaver, is what is known as **mispicks.** As previously explained, when the loom is stopped by the filling breaking or running out it will run for a pick or two before being

entirely stopped. Then when it is started again with fresh filling, if the weaver is not particularly careful, the chances are about even that the first pick of filling placed in the cloth will lie in the same shed as the last pick, thus giving two consecutive picks in the same shed. This defect is more serious in fine than in coarse goods, yet it should be guarded against at all times, and especially so in fancy or colored goods.

DEFECTS CAUSED OUTSIDE OF WEAVE ROOM

46. Foreign Matter in the Cloth.—Imperfect cloth is very frequently caused in the weave room through defects that are entirely outside the province of any of the help in this room, yet as these are defects that will interest the loom fixer as much as any other one person, it will not be out of place to make brief mention of them here.

In examining a piece of cloth, especially if it is held to the light, there will often be found foreign substances, such as leaves, seeds, neps, etc., intermingled with the warp and filling. This, of course, is no fault of the weaver, yet it is something that must be avoided as much as possible, since such cloth appears dirty and does not have that clear, bright appearance that must be sought. These leaves, seeds, and other foreign substances found in cloth are due to the imperfect carding of the cotton; and, consequently, the fault lies with the overseer of the card room, who should always be capable of delivering the cotton to the spinning room in a fairly clean condition, unless the stock being run is of an exceptionally low grade, or the machinery with which he is supplied is inadequate for the results desired.

47. Uneven Yarn.—In many cases when examining a piece of cloth, it will be noticed that the warp or the filling, and sometimes both, are made up of thick and thin places, which give to the cloth a lumpy appearance. Yarn of this character is imperfect and is due to poor spinning. The

overseer of the weave room when given such yarn as this with which to produce perfect cloth, should always bring it to the attention of those in authority.

48. Poorly Sized Yarn.—Mention has been made of the manner in which the warp yarn is chafed by the action of the reed, thus causing the fibers of the yarn to be raised. It frequently happens that when the yarn has been imperfectly sized, this chafing will cause bunches, known as **buttons**, to form on the warp back of the reed. When these have grown to a considerable size and become firmly fastened to the yarn, one of two things is sure to result: either the yarn will be broken by the reed pressing against the buttons during the backward swing of the lay, or the buttons passing between the dents and forming in front of the reed will be pushed up to the fell of the cloth, where they will form in bunches and deflect the filling from a straight line when it is being beaten up by the reed, thus causing holes to appear in the cloth. As already stated, defects of this character are due to the imperfect sizing of the warp yarn; yet, when such a warp is received in the weave room, there is much that can be done to lessen the difficulty. The harness cams should be set late so that the filling, in being pushed up to the cloth, will chafe the yarn as little as possible; the warp line should be in such a position that it will pass through the center of the shed when the shed is open, in order that an equal strain may be brought on the yarn both in the top and bottom sheds; the let-off motion should be regulated in such a manner that the least possible strain will be brought on the yarn when unwinding from the beam. Then, again, the weaver should be required to watch such a warp, and when bunches form in this manner they should be clipped off. This, of course, means more time and patience on the part of the weaver, but it pays to see that it is attended to.

49. Large Knots in the Warp Yarn.—Another evil that will cause holes in the woven cloth is **large knots in the warp yarn.** When the yarn is being spooled in the

spooler room it frequently breaks or runs out, and the spooler tender, in order to turn off as large a production as possible, or through carelessness, will tie the ends in such a manner that a large knot is formed. When this yarn reaches the process of weaving and the knot comes in contact with the reed, it will act in exactly the same manner as the bunches previously described. This defect is largely obviated by the spooler tenders using a mechanical knot tier.

THE LOOM FIXER

50. A good **loom fixer** is one of the most important hands in the weave room; for on him, more than on any one else, depends both the quantity and quality of the production. It is necessary for a fixer, in order to make a success, to be both a fair mechanic and a good weaver; for not only must he understand how the different parts of a loom should be set in order to run to the best advantage, but he should also thoroughly understand the manner in which these different parts are assembled.

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 it is, of course, necessary to have the looms stopped for repairs as little as possible. The looms should always be kept well oiled, since if the parts that are constantly working against each other are allowed to become dry, difficulties are sure to arise. This is the duty of the weaver, excepting in those mills where a loom oiler is employed, but it should also be the duty of the fixer to see that it is attended to. In a mill that is constantly changing from one class of goods to another, the fixer should study the different cloths and learn just what conditions are necessary for the best running of each. Different-weight goods require different settings of the parts of the loom, the heavier weaves requiring in most cases more power on the picking arrangement; this, in turn, necessitates the binders on the shuttle boxes being adjusted to meet the new conditions. The harness straps may need

readjustment, and the let-off motion should be looked over to see that it is working properly.

Whenever a new difficulty is met with, the fixer, instead of altering different parts with the expectation of fixing the loom by chance, should study out the causes that would result in this particular defect, and then carefully study the different parts of the loom which would cause these conditions. If new difficulties are not thoroughly mastered at the time they are met with, the fixer learns nothing, and when the same difficulty comes up a second time there will be the same trouble in fixing the loom.

A good loom fixer will constantly be on the lookout for worn-out parts on the looms of his section, and be ready to replace these when necessary. By this means broken parts will be done away with and the fixer will not be so much sought after by the weaver. This will be found to be the cheaper method in the end, since a new picker stick or a new lug strap is not very expensive, but broken shuttles, smashes, and lessened production are important causes of lessening profits.