LOOM-FIXERS' MANUAL

TEXTILE DESIGNER,
AND PUBLISHER OF TEXTILE WORKS.

THE

LOOM-FIXERS' MANUAL.

CONTAINING

RULES AND INSTRUCTIONS

FOR SETTING UP AND OPERATING

THE CROMPTON, AND THE KNOWLES LOOMS;

THE PRODUCTION OF CLOTH ON CAM LOOMS; SPREADING THE WARP THREADS IN THE PROCESS OF WEAVING;

AND OTHER VALUABLE INFORMATION TO

LOOM-FIXERS, WEAVERS, AND ALL

OTHERS INTERESTED IN

WEAVING.

COMPILED AND REVISED, BY A. A. BALDWIN.

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ERRATA.

Page 10, 3d line from bottom, for "persistant" read persistent.

" 15, 10th line from top, for "an wide" read an inch wide.

" 19, for "91" read 19.

" 21, 11th line from bottom, for "threfore" read therefore.

" 23, 11th line from bottom, for "raises" read raise.

" 24, 12th line from bottom, for "hight" read height. Same page, last line, for "raise" read raised; for "tuched" read touched.

" 56, 4th line from bottom, for "aud" read and.

" 61, 12th line from top, for "ink" read ing.

" 71, 1st line, for "part" read parts.

PREFACE.

The publisher of this work, having had numerous inquiries for back numbers of the DESIGNER & WEAVER, published in 1881—2 while under his management, and not being able to supply that demand, he has, after many requests, decided to compile and revise into book form most of the articles written under the *nom de plume* of "X.," and "WEAVER," which appeared in the paper during that time. Being desirous of issuing such a work in a more complete manner than these articles alone would make, he has added such other reprints and original matter as he deemed would be of special interest to the craft.

In justice to all, the publisher would say that "X." is the *nom de plume* of Mr. A. N. Whipple, of Greenville, R. I., and that "WEAVER" is the *nom de plume* of Mr. E. M. Sinclair, of East Rochester, N. H.

The chapters on Loom Fixing, in reference to the Crompton Loom, by Mr. Whipple, have been somewhat changed in their compiling and revising, by taking from and adding to, so that they may not be recognized in some instances, yet their general meaning remains the same. These changes the publisher has deemed advisable in order to make them more comprehensible.

The introductory chapter and those on the Knowles Loom, also the last one in the book, are by Mr. Sinclair, and, in stating that it is to the above gentlemen the pub-

lisher owes his gratitude for the principal subject-matter of this work, and also that it needs no further recommendation as to its practicability, he feels as though it is but doing justice to those who merit it.

To further add to the value of the work, he has reprinted from the *Industrial Record* of 1874, the "Rules for the Production of Cloth on Cam Looms," by "E. P." Also from the *Textile Manufacturer* of 1876, the "Spreading the Warp Threads in the Process of Weaving," by "A Practical Man." These articles have also been somewhat revised, but their general substance remains the same.

In placing this little work before the manufacturing public, the publisher believes he is supplying a long felt want, and as to how far he has succeeded in this undertaking, he leaves it for the craft to decide.

A. A. B.

March 10th, 1883.

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PART I.

CHAPTER I.

LOOM FIXING.

INTRODUCTORY.

Loom fixing, like all other branches of work about a mill, requires good intelligent men. The requisites extend farther than this, even.

It requires men of steady nerves, keen perception, perseverance, and above all, men of more patience than ordinary beings possess.

Looms are constructed on about the same principle as all other machines; having its driving and driven pulleys, its gears, shafts, belts, etc., and yet, unlike all other machines in the employ of manufacturing cloth, they have an independent part. The movement of the shuttle is conditional.

Upon the exactness and nicety of arrangement of nearly all the other parts depends this movement, hence the fixing.

No inventive genius has yet been able to bring forth a positive movement for the shuttle, which has proved a

success. It remains yet to be accomplished, and will be. But so long as shuttles are thrown back and forth with picker sticks and pickers, so long will the services of skilled men be required to keep them in motion.

The first and great study which every loom-fixer ought to devote himself to, is that of "cause and effect." Loom fixing does not consist of continually changing and re-arranging the parts of a loom. The best loom-fixers in the country to-day are those who do the least work. If a loom has been running for some length of time all right and then begins going badly, the most sensible conclusion to arrive at is that some *one* thing is wrong, and not that the whole loom is out of order.

There is always a *cause* for every wrong about a loom, and to put that right is never much of a task, but to get some other part out of place in trying to do so only makes matters worse.

There are several degrees in loom fixing. The man who has plodded along for years on flannel work, where but one shuttle and four harnesses are required, knows nothing of the intricacies of fixing on fancy work. The difference is as wide as that which exists between the simple sums in a child's arithmetic and the brain-racking problems of Euclid.

The knowledge and practical ability which every first-class fancy loom-fixer possesses, has been acquired only by careful study and persistant labor. That experience which is not supplimented with brain force will profit but little.

Many of our young men who are running looms, or filling some subordinate position, and cherishing the hope that sometime they may occupy the position of "loom-fixer," must remember that there are many hard lessons to learn. A thorough and practical knowledge of looms is not to be acquired in a month or year; but many years of patient toil and persistent effort will be required to attain to that place where one can presume to be master. As it is often said, there is no code of rules which can be laid down for fixers whereby in every case they can go to a loom and immediately discover the cause of trouble, and apply the remedy, and then go back to the bench.

There can, however, be many suggestions by those who have had years of experience which will wonderfully aid and assist the young men just starting.

The Crompton, and Knowles looms for fancy weaving which are herein spoken of, contain nearly all the modern improvements, and as the principles of fixing are the same, on whatever looms it may be, or whatever improvements they may have, the suggestions herein given will, no doubt, be appreciated by fixers on all kinds of looms.

CHAPTER II.

THE CROMPTON LOOM—

ITS SETTING—BELT, AND PICKING MOTION.

Our first instructions will be upon the proper attention that a loom should have when setting it.

It is evident that when setting, and starting, a new loom it should have a good foundation, and that when placed in its proper position should be level.

In levelling, some fixers place the spirit-level upon the top of the frame, while others place it on the main shaft, —the picking shaft we have reference too—which is the proper place for levelling a loom. If the loom is very much out of level, be careful about raising one side too high or giving it sudden jerks, as it will spring other parts out of place. After you have it leveled up in good shape, put the screws into the foot of the frame and make firm to the floor. Now set and level the lathe, as follows: Draw the lathe up and place the spirit-level upon it, then loosen the bolts at the bottom of the lathe swords; raise or lower each end of the lathe as needed.

Another way—and the most proper—is to place a piece of board on the breast beam; measure from that down to the top of the lathe, or shuttle race, which should be ¼ of an inch. Be particular about getting it level, then tighten up the bolts and the lathe is ready for use.

Next, try the small shaft at the belt end—called the driving shaft—and see if it binds; it may not be level, if not, make it so. Now try the working parts to see if they work, as they should, with freedom and ease, if so, the next in order is the

BELT.

Loom-fixers, as a general thing, do not give proper care to their belts; the way to put them on, and the running of them afterwords. First, examine the laps to see which way they lay on the inside of the belt—that is, the smooth side—and be sure to put it on so that when running they will run from, and not against, the pulley. If against it, it would cause them to start up and would soon need mending. Remember to put the belt on with the smooth side in, as the closer it hugs the pulley the more friction there will be.

The question of oiling belts, is one greatly neglected in our mills at the present day; they should be oiled at least once a month, and done while running, as the oil will penetrate much better and the result will prove more satisfactory.

After putting on the belt, disconnect the head motion and start up the loom; let it run a while to limber up; watch the boxes to see that they do not heat; if so, raise

the caps and put thin pieces of pasteboard under them.

After the loom gets well limbered up, sufficient not to bind and become heavy in running, your attention is then called to the

PICKING MOTION.

It is essential that this motion should have considerable attention given it. First, set the standard that holds the front end of the shoe shaft so that it has $\frac{1}{8}$ of an inch play, and the top of the standard is even with the loom frame. To set the shoes and picking rollers, take a piece of wood, if setting a narrow loom, 7 inches long by $\frac{3}{4}$ of an inch square; if a broad loom, $7\frac{1}{2}$ inches long. Into one side of this put through a screw $4\frac{1}{2}$ inches from one end, letting it stick through $\frac{3}{8}$ of an inch; this file to a point. This point, place in the centre of the picking roller stud, and set it $4\frac{1}{2}$ inches from the shaft, and do so with all the rest. Then take your 7 or $7\frac{1}{2}$ inch stick and place it against the socket in which the back end of the shoe shaft plays, and laying it on the shaft, move the shoe up to it and fasten it there. The picking rollers and shoes are now as true as measurement will make them.—In starting a new broad loom it will work better to have the shoes set $7\frac{3}{4}$ inches instead of $7\frac{1}{2}$.

There is an upright shaft on the shoe shaft which is the picking arm. On the broad loom this is solid, but on the narrow loom it has an extension and can be made longer or shorter. As a general rule, run them down short and set far enough back so that there will be no danger of the lathe swords breaking them. Now put on the picker

stick and connect it to the picking arm by means of the connector,—sometimes called the sweep stick,—which should be 17 inches from centre to centre of holes, and ¾ of an inch thick at the end through which the picking arm stud passes, and tapering to ½ of an inch at the other end. A piece of strong leather 2 inches wide and 8 inches long or over, passes around the picker stick and is bolted to this end of the connecting stick, which is called the tug strap, and to hold this strap in its place make a loop strap ½ of an wide by 6 inches long to pass around the tug strap; through the ends of this loop punch holes and fasten to the back of the picker stick by means of a small screw. To start with, place the tug strap up about 9 inches from the stud on which the picker stick works. Below this stud there is another strap that connects the picker stick to a coil spring under the loom, which pulls the stick back after making a pick. Be careful about having this strap too tight, as it will cause the loom to pick heavy; have it just tight enough to pull the stick back on time, that is, before the shuttle enters the box.

To prevent the picker stick from splitting, take a 2 inch or a 2¼ inch bolt, ¼ of an inch in diameter; bore a hole through the stick 1 inch above the hole for the stud, and drive the bolt in snug; screw the nut up tight so that it will sink into the wood, using no washer.

After the picking rollers, shoes, and shoe shafts, picking arms, connectors, picker sticks, and tug straps, have all been properly adjusted, partly spring the loom, stop-

ping with the lathe arms standing up perpendicular; this is the starting point for these motions to commence their work. Be particular to have both picker sticks move at the same time, if not, fix them so they will by varying the rollers as judgment admits; but see if you use all the shoe, which you should to get an easy motion, and not have the loom pound or jump. The cams which hold the picking rollers may not be right. The proper way is to use but one-half of the roller when the loom commences to pick, and as the roller passes over, and the shoe goes down, then all of the roller is brought into service at the point of the shoe where the force lays. In giving these few points close attention, many obstacles will be overcome.

After you have all the above fixings in their proper places, spring on the sticks, by holding them back at the top end, and watch the sticks the distance they travel; they should come within 1 inch of the bunters; if not, extend the picking rollers more from the main shaft, this gives a larger travel;—sometimes shorten the connecting stick—but judgment must be used in all cases even when the theory is understood.

It is necessary now that you should have a picker to do its part of the labor, and this should be examined to see if it is straight, and not all warped out of shape. It should work free upon the spindle to avoid catching and causing trouble.

For packing, place a roll of cloth in back of the picker just far enough to make the ball of the picker even with

the box guide as you look down into the box. Now put on the picker strap, which should be soft and pliable, and run the loom a while to watch its operation, and by so doing if you have any mechanical ingenuity, you will see improvements to make if any is needed.

CHAPTER III.

THE BOX MOTION AND SHUTTLE SWELLS.

As we now have the main running part of the loom all ready for operation, your attention is called to the

BOX MOTION.

Here it is essential that everything should be done well and not slighted, but great pains taken, and the result will prove much more satisfactory; and when once properly placed in a right position, and well tightened up, it will cause but little trouble for sometime.

In setting the box motion, we will use a three-box tappet section to start with; this you will notice has upon one side, a place cut in to just fit the tappet wheel. In putting the tappet on, have it fit in good shape, if not, as the tappet moves around it will be thrown out of a true circle, which would vary the box either too high or too low: but this will be more plainly seen further on.

Now place the roller which rests under the tappet about

the middle of the slot in the side lever; we have now gone as far as we can with this, as it is necessary that we should have something to operate the motion. Well, you will find a cam plate attached to the main shaft, and upon this plate is fastened cam blocks which are subject to changes; and to set these, bring up the lathe to the centre. —What we mean by this, is when the arms are in an upright position, and the loom starts to pick.

The picking of the loom, and the work of the cam plate, are motions which are very sensitive to each other; one does its work after the other has prepared its portion. When the loom starts to pick, the cam has, of course, pushed the tappet in its proper place. But suppose it has not? Then examine what has been done, and you find the cam has been moved to its proper place, and yet the tappet is not pushed far enough. Well, what now? You will notice there are four ratchet wheels subject to be moved at will, and as the cam has pushed the forks out as far as it could, loosen up the bolts that hold these wheels together, and set the two with points running the same way up to the forks. Should you wish to reverse the motion, raise the forks under the ratchets and set the ones up that point in the opposite direction.

We will here quote a few remarks on the reverse motion, by "Weaver."

"Doubtless the greatest difficulty met with by new beginners, is in starting boxes on reverse motion. Many experienced loom-fixers, also, meet with trouble here which are not easily overcome. The most essential thing

about this is to have the box chain move at *just the right time*. Some might differ with me on this, and bring strong arguments to show there were other things of more importance. But if the chain moves at the time when it should, not much difficulty will be experienced in starting boxes on reverse motion. The boxes should work very easily, and should commence to change just as the protector strikes. The forks should be adjusted both the same, and care taken not to have them too high. There should be no more friction on the tappet shaft, than enough to steady the boxes. If the boxes are working independent of each other, the friction on each should be the same. Wires should be used to connect the forks with the levers above the chain, and after the forks have been properly adjusted, the little nuts above and beneath the levers should be securely fastened. Check-nuts are found to be of great advantages. As to having the boxes all come to a level with the race as they rise and fall, no specific directions can be given. Some old fixer has said this is a "hair-splitting job," and we agree with him.

"After adjusting the tappet, the boxes can be brought to a level with the race by raising or lowering the lever which connects the boxes with the tappet, by means of the stud on which the lever moves. But this, of course, is a matter of experiment as to how far the stud should be moved."

Turning to our previous remarks: Tighten up the bolts and examine what has been done, then push the lathe over and see if the tappet moves the same each time

just far enough for the rollers to stop in the places made for them in the tappet. After having completed this, notice if the boxes are even with the race; if not, loosen the set screw at the bottom of the lifter rod; raise or lower it as the boxes require. But we find that the bottom box does not come up high enough, after having set all right for the middle one, so what must be done? You will notice that the side lever works upon a stud below the cam plate, which can be raised or lowered as required. But we find that the box does not come up high enough yet, and the top one does not go down low enough! Then move the stud down a little; this drops the top box. Now set for the middle one, being careful not to move the stud but a trifle at a time until you get it right, after which you will need the

SHUTTLE SWELLS;

but will have no occasion to do anything with them only to bend suitable for the shuttles. Before taking out the swells, weigh up a set of shuttles—we would not recommend as to weight, any heavier than 14 ozs.—and be very particular about weighing them and also as to their width. Place one of the shuttles into the box and see if it fits the swell, if not, take out the swell, get a square piece of lead $5 \times 1\frac{1}{2}$ inches to bend it upon for fitting to the shuttle, being careful not to have it bind too much at the back, as it will cause the loom to pick too hard. Also be careful about bending the front end too blunt. A sloping bend when the shuttle strikes it, will have a tendency to go into the box straighter, and often prevent the cut-

ting of the filling. The portion of the swell which strikes the protector finger, should not be more than one inch from the box when the shuttle is in.

CHAPTER IV.

(SWELLS CONTINUED.)

THE FILLING CHAIN AND HARNESS MOTIONS.

That it requires patience and good judgment in bending the swells—as they are so apt to break—will be admitted, and if once bent too much, in trying to bend them back again you will be apt to make a break, thus rendering them useless, except as scrap iron; threfore, a few more suggestions will not be out of place.

In noticing a Crompton swell, you will plainly see what part of it is required to hold the shuttle; this we will divide into three equal parts, and each part should just touch the shuttle, but do not have quite so much friction on the end towards the box guide; if so, it will cause a hard pick, as the friction from the swell and also from the wire that holds the same in the box, calls for considerable attention in this respect.

The bending of the swell where the shuttle first strikes

it, in entering the box, should be sloping, but not too blunt, if so, it will have a tendency to decrease the speed and also the power of the shuttle and many times causes the cutting of the filling, which will be explained further on.

After you have adjusted the swells and are satisfied all has been done that is required, and that the shuttles fit just right, see if you can put one into each box without taking hold of the swell, if not, loosen the spring a little, and try again until you can: and when so, you have the swells in a good condition, and will not require so much power to drive the shuttle across or at least to hold it when once gone into the box.

As to shuttles, we will not speak of any particular make, being prejudiced against none, but would suggest that they be about 17 inches in length by 1¾ in width.

A long shuttle is preferable to a short one, as it can be held in the box better and with less friction and wearing.

Some shuttles are bulging at the ends, although the points are set in the centre, but would suggest those with only a little of this so called improvement, as it is found they are not so apt to go straight, especially if the picker is worn, or the reed does not come up perfectly straight with the box. Then again, shuttles should be weighted alike at both ends: some are the heaviest at the spindle end, but see no just reason why they are made so.

We will now call your attention, for a while, to the

FILLING CHAIN MOTION,

which gives us the ways that the filling is woven in.

First, build a chain all straight work, that is, with no rollers upon it, and be particular to have the links which connects the chain, to run from the chain cylinder, then they will not ride it. Now spring up the lathe and when the loom commences to pick, the cam block has, of course, pushed out the forks, and the tappet has moved one box. You will observe that the filling chain and forks are very sensitive to each other, and also that the moving of one will interfere with the other. When the forks are out as far as required, and ready to go back, that is the starting point for the filling chain to commence to draw another bar, and as soon as the forks get back, the filling chain shou'd have just got through its work, which shows that they should work on time with each other, if not, the pattern will be apt to change.

There are small straps, or wires, that connect the forks with the little levers above the filling chain cylinder, and in setting these levers on the chain, spring over the lathe a few times, after which, notice if the levers just raises the forks enough to clear the ratchets. Now put on a warp chain roller, this will raise the fork sufficient to reverse the ratchet. With these rules and suggestions, we see no reason why the reader cannot set this motion so far as directions can be given.

We will now call your attention to the setting of the

HARNESS MOTION.

The rules for this motion will be somewhat varied according to the goods being made; but a starting point, of course, will be necessary, and good judgment required

afterwards. First, bring the lathe up to the breast beam, place a rule up to the reed, have the distance from the reed to the breast beam 5¼ inches; at this point the jacks should be closed up, and ready for another opening. Now see if the eveners on the face and back of the jacks just come together, but not so close as to bind, if so, move them back, or at least ease up on the arm that connects the head motion with the cam on the small shaft below, then bring the jacks together and tighten up the stud.—We wish to state here that, we have reference to the upright lever finger-jack loom.

We should not—if a small number of harnesses are to be used,—extend out the whole of the motion upon the plate that works the head motion, as the more harnesses used the larger the shed will need to be: this you will easily see into. Now notice each finger of the jacks, and see if they are all right so as not to catch each other, and all just of a hight; if not, they will bind against the eveners.

Each finger has attached to it a small casting that rests upon the chain, which is movable from one side to the other, and by building the warp chain with all rollers you will find which fingers bind and which do not: in this you can display a little of mechanical ingenuity and patience in adjusting them, either by bending a little higher or lower as required. You will probably have to file some of them a little. The cylinder can be moved, but not usually done, only when the head motion has become badly worn is it raise,—if ever touched,—when it

may be done to raise the fingers. Under the fingers is a rest, which is for stopping them from bounding as they drop, and it is a good thing, especially in fast speed.

In building the warp chain, follow the same directions as given for the filling chain, so as to have it run with and not ride the cylinder. In setting the motion that moves the chain and cylinder, have the jacks just close when the warp chain has been pulled to another bar, but do not have it too quick, as it might better be a little slow, which will often times stop the jumping of the fingers on the back side of the jacks.

Now put on the jack wires, and in doing so you will notice the small notches in each jack at the top, and also at the bottom of them. Commence at the front jack and place the first four wires about level with the rollers that the harness straps work upon. The next four wires elevate a notch, and so on with the rest of them. By placing the wires in this manner, when the shed is open, the back harnesses will be about even with the front ones. This gives a clear and open shed.

When putting the wires on, be careful and have them all straight, and bend the hooks so as to not catch each other. The bottom wires run down on the jacks, instead of up: commencing at the front jack and working to the back ones.—Some fixers may think this a small thing to write about, but let them break a few jacks, harnesses and straps by the wires catching, then they will think different of it.—Care and attention is very essential in

the small things about a loom, as well as the larger ones.

After getting the wires all on in good shape, put on the straps that connect them with the harnesses, and have them as even as possible. When you have a few straps on, set in a harness and make the heddle-eyes even with the back roll and breast beam; even up both ends of the harness the same, then put on the remaining straps, even with the first ones. The bottom straps can be better regulated after the warp is put in.

You will notice that the back roll bearings have notches in them for setting the roll in different places, and in using a small number of harnesses, say from six to twelve, put the roll in the first notches the *nearest* to the harnesses; and for a larger number, move the roll farther back, this gives the back harnesses a better chance to shed and leave the strain on the roll.

CHAPTER V.

PUTTING IN THE WARP.—THE SPEED.

Having the loom in proper shape, we will proceed by

PUTTING IN THE WARP.

For this purpose, we will choose one with twenty-four harnesses. First, tie around the warp beam heads a narrow strip of woolen cloth, then set the warp into the loom, and hang the harnesses as level as possible; after which hook them at the bottom, but not so tight as to break the straps, but just tight enough to keep them from coming off the rollers.

Before commencing to tie in the warp, put on the friction bands and weights; then tie in the warp by means of an iron rod or apron fastened to the cloth roller, and pull the warp through far enough to start it up.

Now put the reed in the lathe, and have the centre of it even with the centre of the harnesses, so that the yarn will draw through from the warp straight; then put on the reed binder and fasten it.

The loom is now ready to start up, so weave in a heading, for which use a bobbin of white yarn, as it will show wrong threads to a better advantage. Now put in

the filling and spring the lathe over a few times to see if the harnesses are all right, and if anything catches. If all is right, start up the loom and weave from 4 to 6 inches for a heading, then push the lathe back and drop the harnesses: now raise one at a time to see if any wrong draws are in the warp, if so, fix them in each harness before raising another.—Don't fail to do this with every warp you put in.—After you have the wrong draws fixed, weave in a few more picks to see if you have them right, then spring the lathe over and leave it back; take notice at the same time and see if the yarn is raised from the race plate, if so, the shedding of the loom is too quick, which would have a tendency to raise or throw out the shuttle. Also notice whether the shed is large enough, if not, make it so, but use good judgment and run it as small as you can, so as to not strain the yarn.

The draft for the weave and filling chain, the boss weaver will give you, so that you can build and attach them to the loom; but, before commencing to weave this twenty-four harness warp, there is one essential thing for us to consider, and that is the

SPEED.

It is a well known fact, that good steady speed, and at a certain rate, is one great point in loom fixing: therefore, we will dwell for a few moments upon the required speed of the loom to which our attention is called.

It is evident that the smaller a machine is, the greater the speed may be, but a large machine like a loom with twenty-four harnesses, stopping and starting at short in-

tervals requires slow speed, and, now the question is: at what speed? We would not recommend over 80 picks per minute.—Some, run them as low as 75 picks; although with a small number of harnesses, the loom may be run at 85 picks to a good advantage, but in no case would we recommend any higher speed, for a broad loom.—It is the good steady speed of the loom that gives us the most cloth, besides it will be much more even.

Having decided upon the speed; the warp and filling chains on; the filling in the right boxes, and every thing in readiness; weave in a few picks to see if the pattern is running right, if so, then call the boss weaver's attention to the loom for his examination, and to regulate the picks. The loom now running, keep watch for a while and see that the pattern does not change; the warp beam gives off regularly; the take-up motion is working even; the protector does not knock off; the picker don't catch, and, that there is power enough to drive the shuttle across on time. Watch all these things close, as no one else will for you. A little attention at this time, may save you many hours of hard labor, and perhaps many broken castings.

We will now leave the loom and warp that we have said so much about, and devote our further remarks to some of the many difficulties which are connected with loom fixing.

CHAPTER VI.

SHUTTLES FLYING OUT—FILLING CUTTING—MISS-PICKS—SHUTTLES CATCHING—SHUTTLE SMASHES.

It is quite evident that the small things about a loom often prove the most perplexing, and at times tend to disarrange many others; for, in trying to remedy one thing beginners are apt to move parts of the loom that, in reality, have nothing to do with the object sought after; and perhaps lose hours of hard labor, besides keeping the loom stopped. All will agree with us when we say, that for a person to become efficient, and master, over any trade or profession, he must first learn to control his temper, and by so doing, the way is made much clearer for him.

Turning our attention again to the loom which we recently left, it would be impossible for anyone to say what would be the first trouble to contend with; however, we will suppose that it is the

SHUTTLES FLYING OUT.

First, examine the condition of the boxes and see if they are level with the race plate; the first box appearing all right, spring the lathe over and notice the next box in turn, and continue in this manner for one revolution

of the tappet section. If one box comes right and the next one wrong, the tappet is not properly adjusted to the tappet wheel; therefore, move the tappet until the boxes come even. Now notice whether one end of the boxes are higher than the other, and if so, which end: it certainly should not be the front end, as that would tend to raise the shuttle from its proper course, thereby causing it to fly out.

But, supposing that the boxes are all right, and yet the shuttle flies out? Well, there is another cause for this, which may be the picking of the loom. By springing up the lathe we notice that the loom picks too quick, and before the shed opens sufficient to receive the shuttle: therefore, set the lathe back one tooth of the cog wheel at the gear end, then start up the loom and out goes the shuttle again—but keep your temper. Now look at the picker, it may be warped or worn out of shape so that the ball does not strike the tip of the shuttle, as it should, in the centre. Also notice if the picker stick is splintered or badly worn where it strikes the picker, if so, it may catch on to the picker when it starts to move; this would also cause the shuttle to fly out. Then again, the loom making miss-picks by the harnesses rising out of place; —often caused by the guides at each side of the harness jacks not being set up close enough, and in consequence, the levers or fingers of the jacks do not travel squarely over the chain rollers;—the shed too quick; back harnesses not coming up level with the front ones; threads breaking and tangling with others; bad dents in the reed

or the speed too quick; all, these difficulties are among the many troubles which a loom-fixer has to contend with before he is sure that the flying out of the shuttle is stopped.

We will now suppose that we are being troubled with the

FILLING CUTTING.

All loom-fixers are aware that this is rather a troublesome thing at times. First, examine the shuttle swells, they may be rough or bent too much in front; the picker rivet loose; the side of the boxes rough; the groove in the shuttle too small; the shuttle going from one box to the other in a zig-zag manner, or the boxes too high or too low; all these difficulties will cause the cutting of the filling. But with everything smooth, and the shuttle running straight, very little difficulty will be met with in this line.

MISS-PICKS,

are also, at times, rather a hard thing to stop. But supposing that we were having trouble with such: First, draw up the lathe and close the jacks together, then examine the fingers of the jacks and see if the rivets are worn so as to give any play, if so, put new ones in their place; also, see that the fingers do not slip off the evener; then watch the moving of the chain, and the closing of the jacks—which should be together. Also, notice how the rollers on the chain strike the jacks, and also if the speed is too quick, which would cause the fingers to jump when falling. Again, notice each finger

and see if it comes up high enough against the evener, if not, bend it so that it will; also see if the chain rides the cylinder and that the links are all right; if not, make them so. Watch all of the above difficulties spoken of, and before changing any part of the loom, pause and think what the result will be, and by giving the second thought to every thing that you do, you may rest assured that you will soon become master over the loom.

Again, we will suppose that the loom has become troublesome by the

SHUTTLES CATCHING.

This trouble we must look after, and find the cause of it.

After giving the loom a few picks, we notice that the power is weak, and, an examination of the picking motion is necessary before we are satisfied that no blame can rest here. The shoe is all right and its shaft is not bent; the sweep is sufficient and thus far, apparently, all seems right. Well, let us look farther: the picker strap may be too long, which would give the picker a chance to catch as the boxes rise or fall, but this we find satisfactory. The picker packing may be too small so that the shuttle will catch in under the back guide, or the picker may be bent; the boxes may rise or fall too quick or too late; the boxes may not be level with the race plate, and the harnesses may be too high or too low. From these illustrations you will see that all the above difficulties may be classed among the causes of shuttles catching, and if proper attention be given these points not much trouble will be met with, here.

The next difficulty to which we call your attention, is

SHUTTLE SMASHES.

There is no doubt but what many a loom-fixer has been severely censured for this particular thing.

The first move to make in this case is to examine the boxes, and if they are found to be working all right, the picker, picker stick or strap becomes broken, the protector should stop the loom before the shuttle makes a smash or "breakout" in the warp. Why should it? Is the query, and the answer is as follows: When the lathe is brought up and the shuttle is out of the box, and the protector point up against the bunter, you will notice that the protector *finger* point is in about the middle of the swell which holds the shuttle, and if the boxes move too quick—especially their changing before the shuttle arrives across on time—it will throw the finger out, and the result is a smash. Also, examine the finger point and see if it is worn off flat; it should be provided so as to drop between the shuttle swells, in case the shuttle does not arrive in the box on time; also have spring enough on the protector to make it work quick.

Too quick speed will, at times, bring the shuttles together and make a smash when no cause can be seen, but smashes are more apt to occur when the yarn lacks proper elasticity. The protector point should be kept sufficiently pointed, so as not to slip off when it strikes the bunter; all these difficulties will cause shuttle smashes, but if properly looked after, little trouble need be met with in this direction.

CHAPTER VII.

WEIGHTS USED FOR TEMPLES—UNEVEN CLOTH AND ITS CAUSE.

It is not an uncommon thing—and we doubt if it ever will be—to have

WEIGHTS USED FOR TEMPLES.

We have seen weights of 20 pounds hung upon each side of the cloth, to hold the selvage out to its place, and at the same time, the weaver was continually mending up threads, when a weight of one-third the amount would have answered the purpose as well, for all that is required is to keep the cloth out even with the yarn in the reed; therefore, you should give this matter proper attention and see that no more weight is used than is necessary.

UNEVEN CLOTH AND ITS CAUSE.

It is evident that the yarn must come in good shape from one room to another in order to give good results, and, as a general thing, if the stock is handled with care in the card room and spinning room, and properly after leaving these places, the weave room will be obliged to give good even cloth, or the trouble would soon be found out and the *room* that caused it.

But, suppose that it was caused in the weave room? Then, to guard against such in the future, give close attention to the dressing of the warp, and observe if each section is run on the warp-reel with equal tension, and also beamed off hard and even; as slack beaming will cause considerable annoyance.

In getting a beam for beaming off the warp, examine the heads and see if they are good and tight, if not, make them so, then put around them a clean piece of cloth, and when you put in the warp see that the friction bands do not bind; and also, when starting up the warp, see that the take-up motion does its work just as fast as the lathe beats the filling into the cloth.

When looms run too fast, uneven cloth will be more apt to make its appearance.

Look out about having too much weight upon the take-up motion, especially if making goods with few picks.

Always bear in mind that these small things are often the most bothersome, and as loom-fixers are so apt to get slack and negligent about their work, is the reason why we speak of so much care and attention being given such.

It is almost impossible to make good perfect cloth without good filling and warp, and the more the warp breaks, the more picking out there will be, and the cloth *will* be uneven from such work; but, more especially in light weight goods.

CHAPTER VIII.

CONCLUSION.

In closing these remarks on the Crompton upright lever loom, we wish to state that we would have been pleased to give a more detailed account concerning, the setting and operating, the different harness motions in use on Crompton fancy looms. But, as there are so many different kinds of them, and so many of the old styles being set aside, we decided to speak of only the above style, and that which, in our estimation, is the best and most in use at the present day.

Setting aside the harness motion, the remaining running parts on all of Crompton's fancy cassimere looms, are on or about the same principle. Hence, a Crompton fixer, cannot help finding some assistance in the preceding chapters; either on one or more of the motions about the loom.

All will agree, that it is essential for anyone attempting to learn loom fixing, to have *some* starting point; either through practical showing, or theoretical instructions. It was with this point in view, that the preceding chapters were written; believing, at the same time, that the beginner after giving their contents a careful study,

would be as far advanced in the general principles of loom fixing, as would otherwise require him months of hard labor and perplexities.

The most successful men in any department of life, are those who give their attention to details: and if there are any class of young men on whom this should make a deep and lasting impression, it is those who have chosen loom fixing as their trade.

In conclusion we would say, that if we have overlooked any point or points about the loom, and the many difficulties of which a loom-fixer has to contend with, that it is an oversight on our part, and not done intentionally: and, we trust that the reader will excuse such, if any.

It has been our aim to give the preceding details in as exemplifiable manner as possible, and as to how far we have succeeded in this undertaking we leave it for the reader to say.

As we now close these remarks, we trust that the reader may receive some benefit from them, and that in years to come he can look back to this little work with feelings of gratitude for the benefit derived from it in years gone by.

PART II.

THE KNOWLES LOOM.

CHAPTER I.

ITS ADVENT INTO THE MANUFACTURING WORLD—ITS ADVANTAGES OVER OTHER LOOMS—ITS MECHANISM —SUGGESTIONS TO CHAIN BUILDERS.

To one who has become familiar with the workings of a Crompton loom—previous to the "1880" style—the harness and box motion of this loom may seem complicated.

It is too often the case, and we may venture to say a rule with most young fixers, when looking at a loom with which they are not familiar, to try to take in at a glance and apprehend the whole combination, and the relation which each separate part sustains to the other. This cannot be done unless he possess a brain of wonderful power, and to that class this feeble attempt to instruct will be wholly out of place. To be sure, the general principles of weaving are the same on all looms, but each and every improvement made on weaving machinery demands study of the fixer, however well informed he may be in other matters pertaining to weaving and fixing; and fifteen minutes of careful study, occasionally, on any loom is never wasted time.

The advent of the Knowles loom into the manufacturing world, brought with it many advantages over the looms then in use. The harness and box motion was constructed upon new principles, the latter being so arranged that any box can be brought to a level with the race regardless of the box which preceded it.

This, especially by designers, was considered a great improvement as it would facilitate in making patterns.

If it was an advantage to that class, it was doubly so to fixers as it did away with all the vexatious troubles caused by "reverse" and "double reverse" on other looms.

As the working of the boxes is so intimately connected with the harness motion, many suggestions which might be made for running one would also be applicable to the other; it will, therefore, be necessary to follow the movements of both in their workings, and in so doing we shall try to present our ideas in as clear a manner as possible, so that fixers who have spent their days on the old style of looms, and find that they have drifted on the great tide of progress into a position where the Knowles loom is in use, they may be able to take hold of it with little or no trouble.

We do not expect that the ideas herein contained will meet with the general approval of all fixers on the Knowles loom. There may be some thoughts suggested which they cannot agree with; but let it be understood that experience under different circumstances generate different ideas, and however good an experience one may

have had, or however good ideas one may possess, another may rank as high in both and yet differ in many points.

It may be well enough to state at the commencement that the loom we have before us is the "Knowles' Patent Open Shed Fancy Loom."

The Head which operates the harnesses and boxes is driven by an upright shaft running from an intermediate gear close behind the crank shaft, and connecting at the top with two long driving gears or cylinders which lie one above the other in a horizontal position running in opposite directions.

The top gear is for raising both harnesses and boxes, the bottom gear for falling the same.

These gears or cylinders, the fixer will of course understand, run at the same speed as the crank shaft.

That part of the cylinder which operates the harnesses is adjustable and can be set so that the harnesses will change in advance of the boxes according as the work may be.

For common work four teeth in advance is about right.

In making a change at any time, the fixer should be very careful and have the top and bottom cylinders the same number of teeth in advance, in order that the harnesses may commence to rise and fall at the same time.

It will be observed that the cylinder has nineteen teeth, thus using half its circumference, and that the vibrator gear has seventeen teeth on either side and between two spaces; one space of four teeth, the other of only one.

The space of four teeth is for the cylinder to pass without working the harness or box, while the space of one tooth is the starting point either up or down.

Now in order that the vibrator gears be placed in the right position at the right time for either cylinder to catch them, the chain must pass under the vibrator lever at just the exact time; and herein lies the whole secret of managing the Head of a Knowles loom.

We will remark right here, however, that if the directions and suggestions herein contained are carefully observed the fixer will have but little trouble as far as the working of the harnesses and boxes are concerned.

In the first place, then, the chain shaft, being run by a gear, is a constant and not an intermittent movement; and having six places for chain bars would, consequently, run one-sixth times as fast as the cylinders, thereby bringing a bar of the chain directly under the vibrator lever at a point where it would either raise or lower the vibrator gear at every revolution of the cylinder.

We will suppose that one of these looms has been put into a mill where the fixer has been used to other kinds of looms, and it becomes his duty to put in the warp and begin the weaving.

The building of the chains will be the first thing to attend to, and unless the fixer gives heed to what is said on this point, he may have occasion to regret it in a short time after starting the loom, for *very* much depends on the way in which the chain is built.

The harness chain is constructed the same as for other

looms; a "riser" brings the harness up, a "sinker" or tube carries it down. And now for the most important lesson to be learned in chain-building, *be careful how the links are put on.*

In constructing a chain for any loom, fixers and boys are taught to place the links with both ends in on one, and both ends out on the other. This is right and if carried into effect there will be no trouble.

The following suggestions may be of profit to the chain builder: Use the rack furnished by Knowles Brothers. if there was none sent with the looms apply for one at once which will be forwarded free of cost. This should be placed on a nicely constructed bench made on purpose for chain-building. A common work-bench is no place for chains.

There should be a place beneath where the bars can be kept, also a place for the links where no heavy weight can fall and bend them. On the top and either side of the chain rack should be separate places for "risers," "sinkers," links and pins. Knowles Brothers make no double "risers" nor "sinkers," they are all single. Right here a word of warning may be given in regard to mixing other chain stuff with this. It will not work.

Now with the rack in its proper place proceed to fill each space with bars, then beginning on the left hand side place a link on the first two bars, then another on the third and fourth, and so on, until an even number of bars are filled, then beginning again, place a link on the second and third, on the fourth and fifth and so on to the last

bar when it will be found that the last link will connect the last and first bars together, or any even number of bars, without having any link wrong. Then the pins should be put in and spread a very little, at the point just enough to keep them from falling out. In making pins, eare should be taken not to have them too long. They should not reaeh past the link.

One sinker should now be put on to each bar, and if there are only eight, ten, or twelve harnesses in use, the spaee may be filled a part of the way with "risers," but in doing so, it is a good plan to take a certain spaee, and fill it evenly the whole length of the ehain. For instance, on a twenty harness loom, where but eight are required to weave the pattern there will be a spaee of twelve harnesses, and a space of eight may be filled with "risers" without detriment to the unused jaeks. The harness chain should not be less than twelve bars in length, and sixteen are better.

CHAPTER II.

CHAIN BUILDING—METHODS FOR OPERATING BOXES—CHAIN DRAFTS—HANGING HARNESSES.

Before proceeding with an explanation of chain-building for the boxes, and the working of the same, it will be necessary to say that all looms built since 1880 have a little different mechanism for working the boxes than those built prior to that time.

The difference consists in the construction of the Compound levers, the latter is considered quite an improvement over the old.

Now in order that the fixer may easily comprehend the ideas intended to be conveyed, we will illustrate with a box chain for both the new and the old make of levers. We will suppose there are four kinds of filling to be used, thus: 2 picks of black, 1 pick of red and black twist, 2 picks of gray, 1 pick of orange and black twist. This pattern is selected, not for its practical use, but for two reasons; first, as four boxes are required, to show how the chain should be construced, and second, as one would naturally begin with top box and work to bottom to show that in a pattern of this kind the boxes at both ends of the loom ought not to work from top to bottom together,

and then drop to top again, but when one is up, the other should be down. and this rule should be invariably followed when the pattern will allow whether there be four, three, or two boxes at both ends in use.

The reason will be obvious when the fixer understands the amount of labor which the cylinder and compound levers have to perform in working the boxes.

In adopting this method it will not only be much easier for the loom, but lighter work for the weaver in turning the crank hunting for a lost pick, or picking out. Before giving the draft for building a chain for weaving the above pattern, the careful attention of the fixer is called to the principle on which the boxes are worked.

The vibrator gears and levers are made the same as those which work the harnesses

From the vibrator gears long connectors reach to the Compound Levers. From these levers a chain runs over little pulleys and is attached to the rod which supports the Box Rest. Now it will be observed that there are four vibrators which work the boxes, two for each end of the loom. The two next the back of the loom works the box on the belt end, the two next the front works the box on the end nearest the head motion

Always bear in mind that the vibrators which control the boxes at one end of the lay work independent of the other. Therefore, in building a box chain it would be well to draw a line with pencil through the centre of chain draft and thus keep the fact in mind that the two spaces on one side of the line are for the boxes at one end

of the lay, and the two on the other side are for the boxes at the other end, as in the draft below, which is for looms made prior to 1880.

TOP.

2 Black	. .	× ×
	. .	× ×
1 Red & Black	× .	. ×
2 Gray	. ×	× .
	. ×	× .
1 Orange & Black	× ×	. .

We think the idea is made plain in this draft. Beginning at the top it will be seen that for the first two bars the two spaces on the left of the line have "sinkers," while the two spaces at the right of the line have "risers;" therefore, the box at one end is clear down, while at the other it is clear up, and will put in two picks of black. Now comes a change. It will be observed there is a "riser" at the extreme left, also one at the extreme right.

The box which has been clear up will fall one, and the other will rise one, and put in one pick of red and black twist.

The next change will bring the boxes both at the second where two picks of gray will go in.

At the next change it will be seen that the boxes stand opposite to what they did at starting, the one having gone up one box at a time, while the other is going down.

One very important feature in this connection, is the simple manner in which a thread of filling can be put into any desired shed. For instance, if the single pick of

orange and black twist is desired to go into a particular shed, all the fixer has to do in putting on the chains is to have the bar on the box chain exactly off against the bar in the harness chain which contains the shed in which it is intended to go, or in other words, have the end of one come to the end of the other on the chain shaft.

Fixers who have worked on Crompton's "1880" style of loom, where boxes are worked on about the same principle, knows that the box chain has to be placed one bar in advance of the harness chain, and unless a fixer be skilled in putting on chains, several trials have to be made before the pattern comes right.

Previous to giving a draft for building a box chain to weave the above pattern with the improved Compound Levers, we will quote from a manuscript kindly loaned us by the builders which gives very clear directions for adjusting these levers to work the boxes properly. "The boxes are adjusted by sliding the movable bolt at centre of long lever, or the movable slide at end of short lever. Raising the movable bolt gives more motion to the box with single lift as from first to second, and pushing in the movable slide gives more motion to the box with double lift as from first to third, etc. And the two short or inside levers with pulley are the double lift and call the boxes from first to third, second to fourth, etc."

Now for building a chain adapted to this mechanism, proceed the same as with the old by drawing a pencil mark through the centre, and it will be found that on the right of the mark the chain will be the

same as in the old, while on the left it will be exactly opposite. Thus:—

	TOP.	
2 Black	. .	× ×
	. .	× ×
1 Red & Black	. ×	. ×
2 Gray	× .	× .
	× .	× .
1 Orange & Black	× ×	. .

The following is to the point, and if observed will aid the fixer in building the chain.

A roll with a tube at the right brings the second box on the Head end of the loom, and a roll with a tube at the left brings the second box at the pulley end of the loom. A roll with a tube at the left brings the third box on the Head end of the loom and a roll with a tube at the right brings the third box on the pulley end of the loom.

When the chains are constructed of all new material they should be dipped in oil, and many fixers have adopted a plan, which is a good one, of fastening the chain together over a line of shafting and let it run for several days when it becomes limber and pliable.

When the chains are ready for the loom they can be put on very easily.

In the first place unlock the clutch on the upright shaft before mentioned. This is done by pulling on the little shipper lever inside of the arch stand. Then with one hand turn the cylinder crank slowly until the lock-knife is back, then with the other hand pull the Evener Slide out; then turn the crank over once and it will be found

that the harness jacks are all even, and that the cylinders do not catch the vibrator gear. The Evener Slide holds the gears from meshing into the bottom cylinder, and it will be seen that the space where four teeth are gone in the gears are all *up*, thereby not letting the top cylinder catch the gears. Now with the head motion in this position the chains can be put on also the warp put in.

In hooking the harnesses on at the top it will be seen that they are all up, and their tops should be about 9½ inches from the under side of the loom arches, under which they hang.

The harness jacks have notches for both top and bottom wires, and a very good rule to observe in placing the wires is to put the first three in the third notch from the bottom, the next three in the fourth, and so on; be sure and have the wires at the other end of the jacks correspond with these already put on, beginning at third notch from the jack comb.

Mr Knowles says "the harnesses *should be hung very loosely, as* nothing is gained by tight strapping, and it tends to hinder the free working of the harness head." In order to have an even tension on the harness straps, when hooked underneath, after tying the warp in, begin at the front harness, and by raising the connectors one at a time, it will be found that the harnesses will drop clear down. Then with the cylinder crank bring them just half way up, that is, bring them just high enough so that a warp thread will be on a line with the breast beam and whip roll, or thread bar. With the harnesses in this posi-

tion hook them underneath, then they will have the same tension whether up or down.

Everything being now in readiness, push the Evener Slide in, and then turn the cylinder crank over quite a number of times to make sure that nothing in the harnesses or chains can catch.

Now before starting the warp it will be well for the fixer to examine very closely, and understand if possible, the workings of the three pinions and the relation which they sustain to the Chain Shaft Gear.

We will say, however, that the builders have recently made a change in these pinions, and also done away with what was called the "Snap Handle." But as there are so many of the old kind in use we will deal first with them, after which will try to explain what the improvements are.

CHAPTER III.

WORKING OF THE PINIONS—REVERSING THE CHAINS FOR PICKING OUT—SETTING THE CHAIN SHAFT GEAR —PRACTICAL HINTS AND GENERAL RULES.

On the end of the bottom cylinder shaft towards the front of the loom are two pinions; the one on the outside, or end of the shaft, is the larger of the two and is called the Single Reverse Pinion, the smaller, the Chain Shaft Pinion.

These work on a movable spline, or key, on the end of which is a knob and is called the Reverse Knob. This spline is only long enough to reach through one pinion, and in this simple arrangement is the whole plan for reversing the pattern chains for picking out; which is done by placing one hand on the cylinder crank and slowly moving it back and forward while its position is nearly horizontal, and with the other hand pull the Reverse Knob, which will slide out very easily when the spline beds in both pinions are in a line with each other. The outside, or large pinion will then be the one which works the pattern chains, and it will be found by turning the crank forward that both chains are running backwards; hence the

simple manner in which a lost pick may be found or filling threads removed from the shed.

When the right pick is found there is no going around the end of the loom with a pry to set the boxes, for while reversing the chains the boxes also reverse and keep pace with each filling thread removed so that when the right one is found the boxes are in the right position. Work the cylinder crank in the same manner when pushing the spline in, and when this has been done, turn the crank over once before locking the clutch on the upright shaft.

The weaver should be instructed to use great care in working the Reverse Knob, and see that it is never left a part way out, for the fixer can see at a glance that if this should be done and the loom started one of the pinions would be snapped at the first movement. This is only applicable to the old style of pinions. Above these is a double pinion which acts as an intermediate, and is called the Double Reverse Pinion. By watching its movements the fixer can easily understand its relation to each other.

It will be seen that the chain shaft gear is not fastened to the chain shaft itself, but that the casting which holds the Snap handle is fastened thereto by a soft set screw, and then fastening itself to the gear by the snap pin; and, says Mr. Knowles, "as this is the only medium by which power is communicated to the chain shaft, it is very essential that this be kept in proper position."

This brings us to our starting point in which we said "herein lies the whole secret of handling the Head mo-

tion of a Knowles Loom." Mr. Knowles goes on to say that "Any change, however slight, at its (that is the casting of the Snap Handle) connection with the chain shaft, is increased many fold through the long arm of the snap handle in its connection with the chain shaft gear, and if set so as to move the chain shaft sooner, will allow the vibrator gears to drop out of the cylinder gears before they have done their work, and if later, will not bring them into position at the time when they should commence working."

Now before starting the loom, if there is not already a mark, it would be well for the fixer to take a sharp cold-chisel and with a hammer make a fine mark on the end of the chain shaft extending it on to the casting so that if the shaft gets out of place it can be easily replaced, having the mark for a guide.

Right here we will say that before the looms leave the shops where they are manufactured, they are all timed and pinned; and for the information of any, (although we doubt if there are such) who are as ignorant of such things as one fixer we have in our mind, we will say that these pins which are inserted between the teeth of the bevel gears on the upright shaft, also on the chain shaft gear and reverse pinions, *are put there for a purpose*. The fixer above referred to having occasion to put on a new gear and not giving heed to placing it so that the pins would insert themselves into counterbore in opposite gear, thought they were in the way and took a chisel and cut them off.

It must be apparent to any fixer that as these gears are all pinned it will be impossible for any part of the Head motion to go wrong so long as these do not get misplaced.

And now in regard to the improvements above mentioned, the first under our notice is in the two pinions on the bottom cylinder shaft. On all looms of recent date these pinions have a chamber in which the spline may work independent of either pinion. These pinions are three-quarters of an inch in width, and one-quarter of an inch in each is used for the chamber, which leaves a half-inch of spline bed on the outside of each pinion. Therefore, it will make no difference in what position the cylinder crank is, the spline can be pulled into the chamber, then by working the crank slowly, it can be drawn into the Reverse pinion.

Another improvement, which has already been mentioned, is, the snap handle has been done away with, and the gear is now fastened to the chain shaft with a soft set screw.

The leading cause for disarrangement, as has already been intimated, is in the having one of the chains kink and run up under the vibrator levers. Occasionally, however, a rivet may wear off, or slip out and let the vibrator gear fall into the lower cylinder, but in this case almost invariably results in unhooking the connector from the harness jack without further damage.

The first cause always results more disastrously, and we will call the fixer's careful attention to the point as he

will doubtless be called to adjust these parts which have become disarranged from this cause.

We will suppose that in building the chains proper care was not taken in placing the links according to instructions, and in consequence the chain kinks and runs up double.

It will be seen at once that when the chain has gone as far as possible that the chain shaft must stop.

Something *must* give way.

As has been stated the casting which holds the Snap handle on the old loom, and the chain shaft gear on the new, are fastened to the chain shaft with a soft set screw, which inserts itself into a hole drilled into the shaft. A very important lesson is to be learned right here.

This set screw is made soft so that in case the chain should catch, or any thing get misplaced to hold the shaft from turning, this screw will shear off and no further damage be done.

In the example which we have before us, the chain runs double as far as possible and the strain all comes on the screw which shears off and lets the shaft revolve.

A case came under the writer's observation at one time where this happened several times in succession, and the fixer who entertained no very intelligent ideas on cause and effect, procured a *steel* set screw, thinking to obviate the trouble by fastening it in that way. Fixers *must* learn that cause will have its effect, and if difficulties are overcome the cause must be removed. To strike a blow at the effect will not remove the cause.

As in the above instance, if the chain had been properly constructed, due care having been taken to see that every part was perfectly pliable and in working order, there would have been no trouble; but as it proved to be, in one place links were found lapping by each other which caused the chain to bind and to run up under the levers double.

The steel set screw having been put in did not prevent the chain from catching as the fixer learned in due time. The loom was started, however, and very soon he was called again. This time he did not find the set screw sheared off, but he found every tooth in the chain shaft pinion gone. But we have drifted away from the point we were intending to touch.

How is the chain shaft gear to be set after having been misplaced? On the loom where the snap handle is used it is done in this way: remove the set screw, and then with a cold-chisel placed between the casting and chain shaft gear, serving as a wedge, strike several blows with a light hammer, and it will be found to start quite easily.

Procure another set screw very soft, unless the same one is long enough to use again. Replace the Snap handle, being guided by the mark above mentioned, which had previously been made with cold-chisel, on end of shaft and casting.

The same rule is good where no snap handle is used.

In case the hole in the chain shaft becomes worn so that the set screw does not hold the gear in just the place it ought, it will be remembered that there are five other

places where a hole may be made for the screw. After having replaced the gear and set screw, run the cylinder crank over several times, pulling out the reverse Knob to make sure that it works both ways.

Now the reverse Knob may be pushed in, the clutch locked, and the loom is ready to start.

In closing these chapters on the Knowles loom, a few practical hints and general rules might be given which may be found of great advantage to the inexperienced fixer. In the first place, then, it will be seen that the boxes set on a Rest so arranged that they can be lifted out and replaced without any trouble whatever.

No packing should be put under or around them in any way. To time the boxes, we again quote from manuscript previously referred to. "Bring the lay forward to protection, loosen the two set screws that fasten the small spur gear to the crank shaft, and with the clutch at bottom of upright shaft, *locked*, turn the cylinder gear crank forward until the box rises ¼ of an inch, then fasten the set screw. This times both the box and harness motion."

In working the old style of compound levers, if at any time one of the boxes should be too low and another too high, they can be regulated by the little slide at the top of the levers, on about the same principle as one part of the new style of levers which has been spoken of.

The vibrator gears should be kept as closely in the top cylinder as possible and work easily: this can be done with the set screws under the boxes at each end of the chain shaft.

In referring again to the cylinder, Mr. Knowles says as follows: "For very light work the teeth on both harness and box sections should be in line with each other; for medium work the harness section should be about 4 teeth ahead of the box section; and for very heavy work 7 teeth ahead, which is the limit of adjustment."

The object of the lock-knife is to hold the vibrators into bottom cylinder, the arrangement is very simple, and the parts easily adjusted.

If at any time the knife appears to be late in moving back or locking in, the fixer must not be hasty in thinkink the trouble is with the Knife, for the cam which operates this is Keyed to the bottom cylinder shaft, but look first and see if the chain shaft is moving on time.

Whenever the weaver has a break-out in the warp, the harnesses may all be brought to a level in the manner above described by pulling out the Evener slide and turning the crank once over.

The relative position of the two chains can never be changed after being adjusted without unfastening and removing them from the shaft.

PART III.

CAM LOOM WEAVING & MISCELLANEOUS ITEMS.

CHAPTER I.

RULES FOR THE PRODUCTION OF CLOTH ON CAM LOOMS.

To acquire a competent knowledge of any art, it must be learned either by reading, verbal teaching, observation and reflection, or by actual practice; and it is of the utmost importance to the apprentice in any branch of business to be told the theory of it, and shown how to use the tools connected with that particular branch, and it must be of use to the apprentice or a young beginner in the weaving trade. Believing this, I have written this chapter in hopes to aid those, who are running cam looms, in producing different patterns. I think I have given full explanations and such instructions, that any one, with ordinary capacity and perseverance, may learn the theory of the art. The writer, when a beginner in the trade, often felt the want of such information, and considering that others might be similarly situated, was induced to write these pages.

DRAFTING CLOTH FROM SAMPLE.

Take the piece of cloth you intend to get the pattern

from, hold the face towards you, and pick out to the depth of half an inch: then hold the piece to be drafted between your thumb and forefinger, cutting off all the threads of filling except those you intend to get the pattern from—say from eight to eighty threads or as many as the pattern may require:—then raise the threads of warp, one at a time, so as to look under and see how the threads of filling run: then begin on the side towards your right hand, and set them down on the designing paper reading up like a column of units in arithmetic: every thread of filling that runs *over* the warp mark as one *down*, and every thread of filling that runs *under* the warp mark as one *up*. Now raise another thread and look under and see how it runs; then begin to set it down at the left of the first line as you would a column of tens in arithmetic. Always begin with the same thread of filling to work from; pick out until your pattern repeats: then you know that you have got the pattern required, that is, that the cloth is nothing more than a repeating or combining of many patterns. If your sample was plain cloth you will find that, on looking at the following pickout:

the third line is just the duplicate of the first. and the fourth is a duplicate of the second, and so on it would be through the whole of the cloth.

As the horizontal of the designing paper represents the number of harnesses it takes to make the pattern, up and down on the designing paper represents the number of picks it takes to weave the pattern. Now if your pattern begins to repeat so that your first horizontal row is

like the third, and the second is like the fourth, you know it takes two harnesses and two picks to make the pattern. If the pattern requires three, four, five, or up to one hundred before it repeats, that shows that the pattern is thus large. All patterns are not square; and there may be more harnesses than picks, and *vice versa*, or they may be square. After you practice a while you will see the resemblance of your sample on the paper.

Having got your pattern as it is woven; now examine the twist in both the filling and warp, and have your yarn twisted like the sample, or you can never produce the same pattern. To find the number of ends in the warp count the number of threads in one inch and multiply that by the number of inches the cloth is wide. If it is single width, then it is 27 inches wide; this gives you the number of threads in the warp. Now calculate your reed from those threads obtained in your calculation.

In calculating reeds, divide the number of threads in the warp by the number of inches you wish to lay goods in the reed, that gives you the number of threads to one inch, and this divided by the number of threads wanted in a dent will give you the required reed.

If you have a plain doeskin pattern of 1760 threads in the warp, and you wish to lay it 36 inches wide in the loom, a reed of 10 dents to the inch and 5 threads in a dent, will make 35 inches and two dents over, then put in the selvage, which reeds an inch on a side, and you have all told, little over 37 inches reeded yarn; but it will make just about 36 inches of cloth when off the loom.

Doeskins twist towards you in warp: in filling from you. Twills, wind on the right of the bobbin, when they are produced by the loom and filling.

SPOOLING AND DRESSING PLAIN DOESKIN WARPS.

The spooler drum is one yard round; dresser reel is three and a half yards round; 4 run yarn, 1760 ends in warp; 40 ends on a spool; three warps 112 teeth on the spooler clock; 72 teeth on the dresser clock; 4 sections, and 11 spools to a section.

CALCULATING RUNS OF WOOLEN YARN.

All honest reels are just two yards round: 40 threads round the reel make a knot, or 80 yards; 10 knots make a skein, or 800 yards; 2 skeins make a run, or 1600 yards.

CALCULATING STRIPED WARPS.

Count the different colors and see where they repeat and see how many patterns there are in a section: then start with one-half of a pattern, and end with one-half a pattern, so they will come together right when you change sections.

COMBINING PATTERNS IN THE CAMS.

These patterns are the two smallest that can be woven with two harnesses, and two picks long, and three harnesses and three picks long: as two will not go in three without a remainder, so we have to repeat the patterns until they will come together. In these two patterns we have to make the plain cloth pattern three times over, and the three pick pattern twice over, so three in six twice, two in six three times. Now every dot represents a harness

up, and where there is no dot, represents a harness down.

CALCULATING CAMS TO WEAVE THE PATTERNS THAT CAN BE MADE ON THE STAFFORD LOOM.

I have learned by observation and experience, that there are no other proportions that will work the patterns smoothly and perfectly, except these I lay down in this rule. If there is any change necessary it is in the shoe, and not in the proportion of the cam.

I lay out my circle equally into 10, 12, 14, 16, 18 and 20 parts on those dials. All the different cams can be produced that can be worked on cam looms.

DRAFTING UPRIGHT CAMS FOR DOESKINS.

Take a pair of dividers and cut a circle ten inches across on a good smooth board; divide it into ten equal parts, lining it straight from the centre to circumference of circle; then cut out ten leaves 8½ inches in diameter on press paper, cut them out perfectly round; then take a sweep made so it will have a straight edge on one side from the centre to circumference; put on one leaf, and put a screw through your sweep so as to be able to turn it; now take seven-tenths of the circle and cut out three-tenths; now the other four leaves in the same proportions. This is the top cam. The bottom is made by the same tools. Put on your circle another leaf of press paper, put your sweep on as before, cut out nine-tenths, leaving one-tenth in this. After you have drawn your lines, take the dividers and space next to hub ¼ of an inch on a side. Take a straight piece of tin and mark

from those points each side direct to the outside point of the one-tenth of circle, so as to strengthen the castings, for if left too weak next to the hub it is liable to break at that point. Now the top cam would be very heavy: so we take a straight piece of tin; after you have marked round ½ inch from the outside with a pair of dividers, take the tin straight-edge, mark down to the hub ½ inch from the outside, leave two spokes ½ an inch wide, which will leave it strong enough for all practical purposes.

These leaves are to be ¾ of an inch thick when sent to the pattern-makers. Now observe that proportions and locations are taken from the pattern as it is taken from the cloth, as you will see illustrated in the rule for drafting.

Now we will locate these cams so that they will produce the pattern laid out. As your circle is divided into ten parts, we will number them for convenience; we will lay one leaf on the circle—let it be put on with centres—perhaps it would be better to put a wire into the centre so as to keep them perfect at that point. Now the pattern, as it comes from the cloth, is put on a piece of designing paper, making 25 points, five each way. Now as each leaf represents an up and down line on the design paper, each dot or mark represents one harness up. In this line there are two up, one down, two up, each one represents two on the dial or circle. Always beginning with your largest number on the dial, we will begin at ten; on this we take two; that brings us up to four on the circle; turn your leaf to the figure four, and fasten it by tacking it to the board. You will see by examining

that as you set it up to the four, then miss one, take two counts from the four to six, then take two, then count from six to ten, cutting one-tenth off for a change of harness, carries you up to ten, and back to seven; from seven to six is what is cut off for a change; thus you see the proportion and location.

Now we will take the second leaf; put on another leaf. The next is take four, miss one, two times 4 is 8, turn your leaf up to eight and fasten it there; now we will take the third leaf, that is, take one, turn up to two, and fasten it there, miss one take three; put another leaf on the fourth one, take three and miss one, take one; so you count up to six, put your leaf on there and fasten; the fifth and last one of the top is miss one, take four, count two, miss three, count eight, that brings you up to ten; put your leaf there and fasten; now put an awl through one side of the hub, and you can take them off the circle, numbering 5, 4, 3, 2, 1; now put them on a small screw, put No. 1 first, put a screw through the hole on the side of hub and centre; now put on No. 2, putting them on those screws; now No. 3, 4, and 5, and that part is ready for the pattern-makers.

Now we will lay out the bottom and locate them. We miss two, take one, which would bring us up to six, cut off one-tenth, then we come between five and six; now put on a leaf, turn up to six and fasten there; now take the second leaf, that is miss four, take one, which would bring you up to ten, fasten there; put the third leaf on, miss one, take one, that brings us up to four, fasten there;

put on a leaf, the fourth one, that is miss three, take one, that brings us to eight, fasten there: put on a leaf, the fifth one, that is take one, miss four, that brings us up to two, fasten there; put an awl through one side of the hub, take them off, numbering 5, 4, 3, 2, 1: then put on small screws; you can put a leather nut on the screws; now the pattern is ready to send to the pattern-makers: when fitted up, put them on the shaft so the bottom will stand in the middle space in the top. Some like it better to set them vice versa, and finish the back or warp side.

DRAFTING ON THE SEVERAL CIRCLES.

Mentioned on the twelve, those we cut one-twelfth for a change of harness: when we put a four-pick pattern into that, we divide it into four parts; in short, we always divide the circle by the number of picks in the pattern. We sometimes, in combining and doubling up patterns, have to divide by the number of picks we proposed, and calculate our gears from the length of patterns. The gears for cams, two picks, we double up so as to make it 4 or 6 picks; four picks is a sixteen on pinion shaft, thirty-two on cam shaft; or the pinion gear is one-half as large as the cam gear. Six picks is sixteen on pinion shaft, forty-eight on cam shaft; five picks, sixteen on pinion shaft, forty on cam shaft; seven picks, sixteen on pinion shaft, fifty-six on cam shaft; eight picks, sixteen on pinion shaft, sixty-four on cam shaft; nine picks, sixteen on pinion shaft, seventy-two on cam shaft; ten picks, sixteen on pinion shaft, eighty on cam shaft. On the circle of fourteen parts we cut off one-fourteenth for a

change; on the one with sixteen part we cut off one-sixteenth part for a change; on the eighteenth we cut off one-eighteenth for a change; on the twentieth we cut off one-twentieth for a change. Now for any pattern that can be put into a cam as you get it from the cloth, or from any other source, you can make, and calculate your cams to weave the patterns you desire to produce. All patterns have been invented, they never *grew*, but were *made* by some one.

The example in the rule for combining is plain cloth and three-harness twill; the first two lines are the plain cloth, and the other three are the twill. Now we will draft a cam to weave them. As they are combined, the patterns count six picks, so we take two-twelfths for a pick; the first one is miss one, take one, miss one, take one, miss one, take one, our first one counts up to four, and we set the cam between three and four. The next is set between seven and eight, and the third is set between eleven and twelve. These are the three positions of the cams; it has three raisers in a revolution on the plain cloth cam; the first is located between one and two, the second is between five and six, the third between nine and ten; you will see by referring to your dial how they stand.

The three-harness pattern is located, the first between five and six, the second is located between eleven and twelve; the pattern reads, miss two, take one, miss two, take one; the next leaf is located between three and four, next between nine and ten; the next leaf is located between one and two, the next between seven and eight.

Now cut ten circles 8½ inches in diameter perfectly round, put the leaf on to your board with twelve divisions, count up and cut them as they come on the circle; one-twelfth is the proportion for the top part of this cam; then locate as indicated above. The bottom cam is the same proportion in the plain cloth; they are set so as to have the top come just in the middle of the open space on the bottom.

The bottom cams of the three-harness twill is of this proportion: it holds down two picks, is three-twelfths of the circle; take two, miss one, take two, miss one. We cover from one to four, and then from seven to ten; this is the proportion and location. Now the second leaf of twill is, take one, miss one, take two, miss one, take one; we cover from eleven to two, and from five to eight. The third leaf on twill is miss one, take two, miss one, take two; we cover from three to six, and from nine to twelve.

The conical shoe that works with this cam is drafted thus: two and three-eights inches to point of cone, with a half inch face, three and three-quarter inches base, with a centre mark one and a half inches from the back end, leaving two and a quarter inches; now from these ends draw a line and you have the right proportion of shoe for eight picks, and all under that number: you can make the base to suit yourself.

The shoe for eight, nine, or ten picks, is drafted this way: it is conical in shape, two and three-quarter inches from base to point of cone; make a half inch face on the points, and then draw a base line two and three-quarter

inches, and line from the ends of line on face and base lines; you can make the base to suit yourself.

SATINET CAM.

This pattern is put in the cam twice over, and makes an eight-pick pattern of it. Now to draft a cam for it, we miss three, take one, miss three, take one; we cover between seven and eight, and fifteen and sixteen, leaving one-sixteenth on the back end of our counting, always covering up to the counting; the second leaf is miss one, take one, miss three, take one; we cover between three and four; the next is between eleven and twelve; and third leaf is, miss two, take one, miss three, take one; we cover between five and six; the next is between thirteen and fourteen; the fourth leaf is, take one, miss three, take one; we cover between one and two; next nine and ten; this is the top cam.

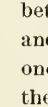
The bottom cam for a four-harness satinet, reads:—take three, miss one, take three, cut off a sixteenth for a change of harness; we cover between one and six; and next between nine and fourteen; the second leaf is, take one, miss one, take three, miss one, take two. It is evident that the extremes come together; so we cover between fifteen and four, and next between seven and twelve: the third is, take two, miss one, take three, miss one, take one, covers between fifteen and four; the next is between seven and twelve; the fourth leaf is, miss one, take three, miss one, take three; we cover between

three and eight; next is between eleven and sixteen.

DIAMOND CAM ON THREE HARNESSES.

Miss two, take one, miss two, take one; No. 1 leaf the first cam, between five and six, the next is between eleven and twelve; No. 2 leaf is miss one, take one, miss one, take one; the first is covered between three and four, the next is covered between seven and eight; No. 3 leaf is take one, miss three, take one; the first is covered between one and two, the next is between nine and ten. On the bottom part of the three-harness diamond cam, the No. 1 leaf is take two, miss one, take two; the first is covered between one and four, the next is covered between seven and ten; No. 2 leaf is, take one, miss one, take one, miss one, take two; the first is covered between nine and two, the next is covered between five and six; No. 3 leaf is, miss one, take three, miss one, take one; the first is covered between three and eight, the next is covered between eleven and twelve.

DRAFTING THE OLD FASHION FOUR-PICK AND FOUR-HARNESS CAM.



No. 1 leaf is, miss three, take one, as it takes three-twelfths for one pick, so we cut off one-twelfth for a change; this covers between four and six; No. 3 leaf is, miss two and take one: we cover between seven and nine: No. 4 leaf 4 3 2 1 is, take one, miss three; we cover between one and three. Bottom cam of the old-fashion four-pick and four-harness cam—No. 1 leaf is, take three: we cover between one and nine:

No. 2 leaf is, take one, miss one, take two; we cover from seven to three; eight-twelfths are covered; No. 3 leaf is, take two, miss one, take two; we cover between ten and six; No. 4 leaf is, miss one, take three; we cover between four and twelve.

PLAIN CLOTH CAMS, WOVEN ON FOUR HARNESSES AND FOUR PICKS.


1 2 3 4

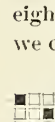
No. 1 leaf is, miss one, take one, miss one, take one; the first is covered between one and three; the second is between seven and nine; No. 2 leaf is, take one, miss one, take one; the first is covered between one and three; the second between seven and nine; No. 3 leaf is, miss one, take one, miss one, take one; we cover between four and six; No. 4 leaf is, take one, miss one, take one; we cover between one and three; the second is between seven and nine.

LASQUINETT PATTERN.

This pattern is well adapted for woolen cloth; warp 3 run yarn, filling 4 run, 1440 threads: left twist in the warp, filling right twist. The top cam—No. 1 leaf is, miss one, take one, miss two, take two; we cover between three and four, the second we cover between nine and twelve: No. 2 leaf is, take four; we cover from one to eight; No. 3 leaf is, take three, miss two, take two; we cover from eleven round to six; five picks up; No. 4 leaf is, take one, miss three, take three; we cover from nine round to two; No. 5 leaf is miss two, take two, miss two, take two; we cover from five to eight, the second

from thirteen to fourteen. No. 1 of bottom leaf is, take one, miss one, take two, miss two, take one; we cover from thirteen round to two, from five to eight: No. 2 bottom leaf, miss four, take three; we cover from nine to fourteen; No. 3 bottom leaf, miss three, take two, miss two; we cover from seven to ten: No. 4 bottom leaf miss one, take three, miss three; we cover from three to eight; No. 5 bottom leaf, take two, miss two, take two: we cover from one to four, second from nine to twelve.

MAKING AND SETTING UP THE SHELL CAM.



This is done by plates and blocks, the plates are cast thin, nine inches in diameter, slotted and put on a spline, drilled by an index into 20, 24 and 32 holes, put on to shaft so situated that all the holes will correspond with each other, and so that the 20 top and bottom holes will be in a direct line, and on with the 24 and 32 holes. There are blocks to cover these holes as the patterns require. The range is from two picks up to eight, and from two harnesses up to eight. They are set up by dividing the number of holes by the patterns to be set up, and calculating your blocks by the patterns. For this pattern you take the 32 holes, 8 in 32 four times; four holes make one pick in this pattern, so we count sixteen holes and leave two holes for a change, covering two holes, setting up to our counting as the other. Up to your starting point you set a block up; to that point we say miss three, take one, miss three, take one, so we count twelve, miss them, take four, leaving two holes for a change; then we put on another plate, etc., with the other

leaves. The bottom is put up in this way: Take a straight-edge and fill up the cam within two holes of the blocks on top on each side, so that the top will stand in the middle of the open space in the bottom, and so on through the whole pattern.

BEAVER CLOTH ON FOUR HARNESSES.

Eight picks long—leaf No. 1 we say: take three, miss three, take one; we cover from one to six, from thirteen to fourteen; No. 2 leaf is, miss two, take one, miss one, take three; we cover from five to six, from nine to fourteen; No. 3 leaf, take one, miss one, take three; we cover from one to two, and from five to ten; No. 4 leaf, take one, miss three, take one, miss one, take two; we cover from thirteen round to two, and from nine to ten. The bottom is like the top. All patterns that can be put into the upright cams can be put into the side treadle looms. The same proportion is right for all cam looms. In locating the patterns for the side treadle looms with two shoes on one treadle, it is necessary to locate your pattern producer on a board, with its treadle, so as to locate your follower right, put them together where they will turn smooth, and move the treadle out and in.

SLOTTING CAMS.

When you wish to locate them to produce the patterns required, lay out the circle that the pattern requires, count up and make the place for the slot, making a mark on the bearing you revolve the plate on to represent the spline on the shaft; then count up the next leaf, making the

place for the slot with the last, and so on through the pattern.

SETTING UP NEW LOOMS AND TIMING THEM.

Set them straight with the main line of shafting, level them, strap up, and time them by bringing the shuttle motion so that the shuttle will start sufficiently slow as not to press off the selvage threads; set the crank perpendicular when your shuttle starts; now bring the cam or whatever raises the harnesses,—for you know that a selvage, whether crank, eccentric, or heart motion, is nothing more than a plain cloth weave—so time your harnesses on a rising shed, turn up until it is just wide open for the shuttle; your lay will be from two to three inches from the cloth.

After you begin to weave, spring your loom, hold the shuttle back in the box, and turn over slowly so as to see whether the shuttle presses on the selvage: it ought to clear it so that no friction will come upon them. In starting new looms, you want to run the shafts a while and put in a reed, and set your protection finger and put your shuttle in to see how it will work. When you are satisfied that all is right, put your warp in. hang it so that it will not touch either the race plate or reed rail. In working, straps all new will stretch; so you will have to draw them up until they are in their proper places.

* * * I will withhold any further remarks, as I have been plain enough for any man who will study the rules laid down, so that he can take his patterns from cloth and produce them again in the loom.

CHAPTER II.

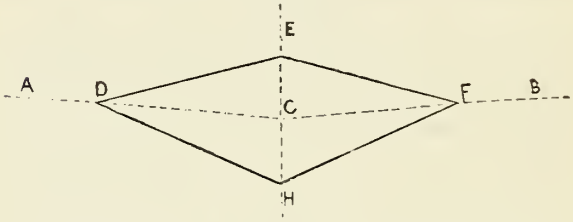
SPREADING THE WARP THREADS IN THE PROCESS OF WEAVING.

The reader may be disposed to ask, and it may be as well to explain at the outset, what is meant by "spreading the warp threads in the process of weaving." It is a method by which the warp, instead of being run together in splitfuls, each thread is made to stand out equally distant from each other in the cloth. In some fabrics, this gives a much better an more filled-up-like appearance than it otherwise would have, even when less warp yarn is employed. Indeed, this method of weaving converts what in some cases would be but a mere rag, into excellent cloth.

We are aware that this sort of weaving in some parts of the country is almost unknown. There are also those who object to it on the ground that it throws too much strain on the yarn, but we will endeavour to show that for the most part this extra strain is caused by imperfect methods being employed. There are others who would gladly take advantage of it if they knew how it was done and how to cope with the difficulties that crop up when they try it, while there are large numbers who practice it with the best results.

The spreading of the warp threads in the cloth, then, is produced simply by weaving with the two halves of the shed, held at an unequal tension. It is most convenient that the lower half be tight and the upper half a little loose. This is accomplished by lowering the warp lines a little at the heddles. Let us suppose Fig. 1 to represent the shed, and we will see at once what takes place.

FIG. 1.

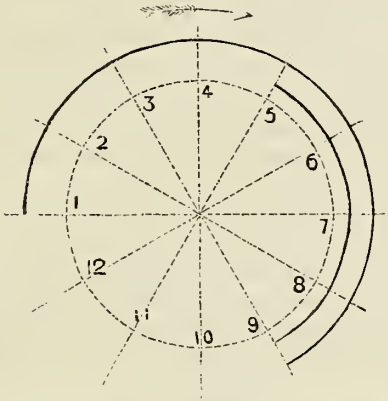


The dotted line A B is the warp line, and it will be seen that the upper part of the shed has risen as far from the centre C as the other part has sunk: but if we measure the distance D E F, and the distance D H F, we will find that the latter is considerably longer than the former, and, consequently, that part D H F will be held tight while D E F will remain loose. This is what must take place before the warp threads are spread, and a beautiful texture produced; but there are other things that may occur to mar the whole effect of this, which we will require to notice.

The method of shedding in this sort of weaving differs so much from that of any other that we deemed it neces-

sary to introduce Fig. 2 to bring out the whole system as clear as possible. Then suppose the dotted circle to represent the circle of the crank, and point 1 to be its position when the reed is at the fell of the cloth.

FIG. 2.

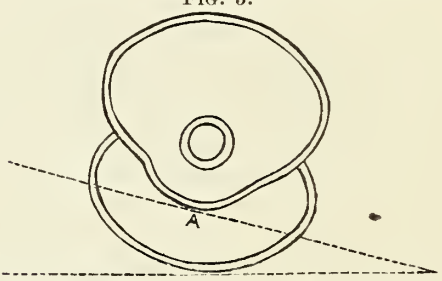


If we divide the circle into twelve equal parts, and it is revolving in the direction of the arrow, the shuttle will begin to move at point 4, and enter the shed at point 5, and leave it again at point 9. Now where the warp does not require to be spread, the shed only requires to be open from point 5 to 9, or $\frac{1}{3}$ of the crank's revolution. But when spreading the warp, the shed has to be full open at point 1, and of course remain open till it reaches point 9. The reason of this will be quite obvious if we consider that the cloth is formed when the shot is beaten up, and

the threads must be held in the position we have already described in order that they may take their proper place at that time; in fact, the opening of the shed requires to be adjusted with mathematical precision to the beating of the shot. Too late, and it is seen in the cloth—too soon, and it has a detrimental effect on the yarn.

We have seen this description of cloth frequently spoiled by an imperfect construction of the shedding wiper or tappet. Those who are acquainted with the subject will be aware that the ordinary rule for the construction of cams, etc., is not altogether suitable for shedding wipers. This is owing to the treadles moving in a circle instead of a straight line at their point of contact with the wipers. They are frequently made, however, to that rule, and the consequence is that when the sheds are opening and closing, the leaves of the cam are quite tight: but when the shed is full open the treadle does not come quite up to the wiper, as indicated at point A, Fig. 3. This want

FIG. 3.



requires to be made up on the wiper. When this is not done

the treadle springs up, and the leaf of the cam goes up with it and draws the upper part of the shed tight, which requires to be held a little loose, and, as a matter of course, makes "reed marked cloth."

There is another thing that affects the spreading of the warp in a very marked degree, but from its very simplicity is frequently overlooked. That is the position of the lease rods in the yarn—their distance back from the cam. A little observation will explain this more clearly than any language we could employ. Change their position nearer and further back from the cam, and mark the effect on the cloth. It will soon make itself visible, and by this means their proper position can easily be ascertained.

We are now in a position to consider how all this affects the strain on the yarn. First of all there is the sinking of the warp line, which adds to the strain in so far as it increases the angle of the shed; but if everything else is right it requires to be sunk so little that it cannot make any appreciable difference. There is a very bad practice however prevails in some places of raising the back beam alone to produce this result. This throws all the strain on that part of the thread between the cam and the lease rods. It will be quite obvious that this is detrimental to the yarn, and ought to be avoided.

Then there is the great length of pause necessary in this sort of shedding which causes the change to take place more suddenly. But the bad effect of this can be entirely obviated by giving to the heddle leaves an eccentric movement, fastest in the centre of the stroke, and get-

ting gradually slower until it merges into the full pause.

The only difficulty there is to contend with in regard to this is the full weight of the thread being on the yarn during the time the shot is being beaten up. But a little experience will teach the operator how to adjust the opening of the shed to the beating up of the shot, so that they both may occur almost simultaneously, the shed just the least shade behind. When this is accomplished there will only be a few threads at the selvage subject to any extra strain. This is caused by the shrinkage which takes place in the cloth, during the process of weaving. The cloth is always a little narrower than it is in the reed: consequently when the reed comes forward to beat up the shot with the full weight of the tread on the yarn, those threads near the selvage will be strained in proportion as the cloth has shrunk. The only remedy is to make the selvage threads strong enough or elastic enough to sustain it.

Many fabrics, both of cotton, woolen, linen, and jute are made in the manner described; and, moreover, there are many other fabrics that would be greatly improved if the same process were adopted with them.

For all practical purposes at present, we may divide all descriptions of weaving into three classes. There is what is commonly called open cloth, that is, where the threads are run together in splitfuls, and a vacancy left between them. This is done to show the colors of the weft. The writer once saw a fine example of this class of weaving in a large diamond pattern. The warp was wholly composed of a bright scarlet, and the weft of a dark brown

color. It formed diamonds within diamonds, the one scarlet, and the other brown, until they reached a point in the centre. Of course, all that is required with this, so far as our present purpose is concerned, is to see that both parts of the shed are held at an equal tension, and the reed will do the rest. Then there is that class we have just been considering, where it is not necessary to show the weft, but that the cloth must have as thick and "filled up-like," appearance as possible. Now, if we take an ordinary plain web, for example (of any fibre), with two threads in the split, if the warp threads are well spread the cloth will present exactly the same appearance as if it had been wrought in a reed of twice the count, with one thread in the split. It will now be easily enough understood, I think, what descriptions of cloth are best suited to this. Then there is the third class, to which I referred; it is a matter of indifference whether it is wrought the one way or the other. This is generally the heaviest fabric, where the threads both of the warp and weft are packed so closely together that neither process will tell on it.

We now come to a point of more importance to weavers in general—treading the shot. The reader may not be fully aware of what "treading the shot" means, I will explain it with reference to Fig. 2. Instead of having the shed full open at point 1, as here indicated, it is open a considerable time before the crank reaches that point; consequently the full weight of the tread is on the shot, while the reed is perhaps two or three inches from the

fell of the cloth; and the weft thread is dragged through the warp to its place in the web. The consequences of this to the yarn are so apparent that it will be understood by a mere tyro in weaving. But had there been any compensating advantages in an improved fabric of cloth, the mischief thus done the yarn might have been over-balanced; but there is absolutely none. As has already been pointed out, that to spread the warp threads each alternate one should be a little loose; now all that is required in the shedding is to hold them in that position just at the instant the shot is being beat up. This can be accomplished with the shedding and felling occuring simultaneously. It may be observed by any who may care to examine it, that when the crank is forward with the lay, it moves round a little, and consequently takes the wiper-shaft with it, during which it may fairly be said that the reed stands still. Some take the advantage of this to save the yarn as much as possible, by keeping the shed a little behind; but as this is but a small matter it need not be insisted on.

We have frequently come in contact with those who insist that the style of shedding we have just described is what is commonly termed "treading the shot," and condemn it accordingly. But it will be found that none of the evils attendant on the latter, accompanies it. And perhaps this opportunity that has been afforded of showing the difference, may lead some to adopt it with profit who have hitherto rejected it.

CHAPTER III.

PRACTICAL HINTS ON WEAVING—THE MANAGEMENT OF A WEAVING ROOM—SOME OF THE ELEMENTS OF SUCCESS IN WEAVING—NEW NOTIONS AND OLD LOOMS—WHAT CONSTITUTES A "GOOD FIXER."

A loom should be kept well oiled.

Heddles should be kept straight.

Loom belts should not be kept too tight.

Shuttles should be kept very smooth.

Hard twisted filling should be steamed.

Every weaver should understand drawing in.

Harnesses should be hooked with uniform tension.

Cloth and warp beams should be perfectly straight.

Weavers should be made to share the responsibility of the work.

Side weights are better than temples for most kinds of work.

The more a loom is kept running the more even the cloth will weave.

Hoop iron faced with leather makes the best friction for heavy work.

Harnesses should be kept well cleaned and oiled, and not allowed to chafe.

Spoolers should not be allowed to learn to tie any other than a square knot.

A warp will weave with much less strain in an open shed, than in a close shed loom.

No heavier weight than is actually necessary should be used on a conditional "take-up."

Cotton rope for friction, with very little weight on the "take-up," will make even cloth on light weight goods.

Nothing is gained, but great losses is generally the result of speeding looms higher than they should run.

A little brush made of waste, tacked on the lay near the shuttle box, is better to prevent filling drawing in on the side of the cloth, than friction on the filling.

The shed should only be just deep enough to admit the shuttle in its passage without chafing the warp.

Reeds should be well cleaned before warps are drawn through them.

A good selvage not only improves the general appearance of a piece of cloth, but is of great advantage in the weaving.

Fining weavers for bad work is not the best method to adopt. Cloth *can* be made perfect, and weavers receive the full pay for weaving. Persons of vicious, slovenly, and immoral habits have been the cause of such rules being made; while good weavers, by accident, have suffered by it. Hence, the penalty of fines should not be applied indiscriminately.

THE MANAGEMENT OF A WEAVING ROOM.

That the success of a mill depends upon competent

overseers, no one has ever denied. It would be useless for a designer to toil early and late unless men of ability stood ready to carry his designs into execution. The position of overseer, however, in any department of a mill is not an enviable one by any means. To those who do not understand the cares and responsibilities, the perplexities and annoyances to which an overseer is subject, the position may seem a very desirable one; and many young men look forward with high hopes to the time when they can take charge of the department in which they are employed.

This is commendable, and we would not discourage any who are striving by merit to gain position; for merit deserves its reward; but how few there are who have any conception of the great weight of responsibility that must rest upon them after they have stepped into the position of overseer.

They may think they understand the work very well; they may flatter themselves that no obstacle can come in their way which they cannot easily surmount; but years of experience will teach them that overseers are doomed to meet obstacles and difficulties all the way long.

An overseer of a weaving room is doubtless subject to his share of troubles, and finds himself as often in places where brains must be brought into requisition as any one about the mill. There are so many wrongs to be righted, and so many avenues of escape for those who have committed the wrongs, that he finds himself continually in

search of causes, but finally has to shoulder the responsibility, and face the result.

He learns that a weaving room will not manage itself, but that he must constantly be on the alert. The old saying, that "an ounce of preventative is worth a pound of cure," is of great import to the weaver. The power of applying attention, steady and undissipated, is something which will greatly aid a man in his work. Nothing should escape his notice.

It is not only necessary to understand weaving, and to have good ideas of dynamical forces, but a knowledge of human nature is equally essential.

Humanity differs so widely in its traits of character that it is very important for one who is to take charge of a lot of help to understand something of human nature. An overseer who is ignorant in this respect may make a great many mistakes which will cause him much trouble and anxiety. He may speak in sharp tones of reproof to a weaver who has committed some wrong, either carelessly or ignorantly, and a spirit of retaliation will take possession of her and manifest itself on every convenient occasion, proving a source of continual annoyance. Whereas, if spoken to kindly, she would have seen her wrong, and ever after avoided any thing of the kind.

On the other hand, there are some weavers so constituted that kind words are of no avail, and more stringent measures have to be adopted.

A supercilious overseer can so disgust his weavers that they will avail themselves of every opportunity to make

his administration a failure; and every effort on his part to ascertain the cause of bad work will be thwarted by their adroitness, aided, of course, by sympathetic loom-fixers. It is useless for one to think of success with a class of help who care nothing for his interest, or the interest of the concern. The sooner such help are disposed of the better it will be for overseers and owners.

It is a lamentable fact that there are a great many young men who are so unsettled in their purpose as to go from place to place importuning overseers to give them work at weaving, and after having secured work, remaining only long enough to earn a few dollars and then away to some other place. Overseers, however, are learning that this class of help are not profitable; and managers of mills are learning that it is for their interest to pay sufficient wages to keep the best of help; so that in the future, that large class who depend upon factories for a living, will learn the all important lesson that it is the meritorious who are employed.

As competition in the markets have driven manufacturers to that place where nothing short of the best work will answer the demands, it has necessitated greater care and vigilence on the part of overseers; and, in fact, the continual changes going on brings more labor, and a demand for greater skill. Hence we see that nothing short of practical talent, backed by a powerful executive ability, will answer as characteristics in the man who is to successfully manage a weaving room in a mill which is supplying the wants of a fastidious people.

SOME OF THE ELEMENTS OF SUCCESS IN WEAVING.

In writing on this important subject, I am impressed with the thought that one page of practical reading is worth more than volumes of theoretical teachings to one who is desirous of fitting himself for a lucrative position in manufacturing.

Recognizing this fact, I shall endeavor to be practical; yet, as I search among the cobwebs and dust of past experience, for something which may serve as a stepping stone for others to higher attainments, I am forcibly reminded of wrongs and inconsistencies which I have witnessed emanating from administrative powers, and in view of these facts, I shall underlie the whole with philanthropic principles.

The man who enters a mill and accepts the position of weaver, must assume the responsibilities connected therewith, and his success only depends upon his abilities to perform the duties of his office. The several elements of which this ability consists has afforded thought for serious consideration among weavers of experience. It is too often the case that serious thoughts can only be aroused by serious failures; but if the thoughts could be awakened at the beginning, the failures might be unknown. If, by the few ideas presented in this chapter, a train of thought may be awakened in the mind of some one just entering upon an experience through which the writer has passed, I shall have accomplished my purpose, trusting the result may be beneficial. A thorough knowledge of the mechanism of looms is not all that is requir-

ed of a weaver. To understand the effect of colors, the different weaves and combinations, and the relative strength and size of yarns, are some of the qualifications, but certainly not all.

* * * The results always looked for from the weaving room, is perfect cloth, and as much of it, of course, as facilities allow. To managers and others, who occasionally pass in and out, and always hear the click-clack of looms, this may seem an easy matter to accomplish; but to the weaver who takes pride in his work, and is anxious for the best results, there is something formidable in the array of work before him. His first thoughts are of his help. If they are intelligent, and in some degree conscientious, he knows there will be but little trouble, comparatively, in turning off good work.

Overseers in all departments know that trouble among help, or caused by help, almost invariably originate among that class who are so ignorant as to entertain no higher ideas of manufacturing, than was expressed by one during a strike some years ago: "that capitalists build mills to crowd down the poor!" A weaver stands between his help and the owners. On the one hand if he is detected in sympathy with any movement to reduce wages, or enforce too stringent laws, he must expect curses, and worse than that; manifestations of vindictive spirits which may work injury, not only to himself, but to the owners. On the other hand, if he is known to be in league with rebellious or "striking" help he might as well make up his mind to vacate his position at once.

Therefore, in all matters of these kinds, there seems to be but one way, which is to be governed by a high sense of duty to both and justice to all.

There has always existed in the minds of nearly all classes of help mistaken ideas regarding the rules and regulations which are laid down for mill government. Because certain requirements are made in one direction, and certain restrictions laid down in another, it is no reason why help should think an injustice had been done them. Let them take more sensible views of the matter. What would States, committees, societies, or families be without their laws, rules and regulations?

In the first place, it is left optional with people whether they accept work in a mill or not: but if necessity compels them to work, let them accept the conditions upon which work is given, with the assurance that *rules are only made for the unruly.*

But allowing a weaver to be fortunate in having an intelligent class of help, there still remains a watchfulness and care to be exercised on his part, aside from his own personal experience and knowledge of weaving which must continually be brought into requisition. One old manufacturer who has had a practical experience in all departments of a woolen mill, says that "it requires three score and ten years for the most intelligent man to become thoroughly practical in any one department. Whether this be true or not regarding other rooms, I should coincide with him so far as the weaving department is concerned.

After a man has spent one score of years in a weaving room, and thinks he has been dilligent in acquiring a knowledge of its workings, he still finds his mind exercised in solving a multiplicity of new problems. Practical experience, then, is not to be regarded only as an essential, but an indispensible element in the way of success. A persistency in righting wrongs, and overcoming difficulties is to be commended; but the ability to *foresee*, and to *prevent* is more preferable. When once the services of an incompetent fixer has been secured, it is better to dispense with him as soon as the fact is learned than to wait until bad cloth is made as the result of bad fixing.

It is surprising to know the power for good or bad affect a weaver may exercise simply by the habit which he has cultivated. If he is slothful or negligent about his room, his help are not slow to note this element in his character and to be governed by the same principles about their work. If he manifests a carefulness and concern about the work, he may almost rest assured that his help will follow his example. He may also rest assured that gruffness, peevishness, oaths or inconsistances on his part will not be conducive to his own interest. Rebelliousness is a part and parcel of every one's nature, and to rebel at ill treatment is quite natural as he himself can testify when in times past his superiors have attempted to enforce obedience or offered rebukes in a gruff manner or accompanied by oaths; and a man of good sense cannot expect his help to bear more than he can bear himself. Kindness is more effective than harsh treatment, and

while it may be necessary to employ the latter under certain circumstances, the former should be the rule and guide of a weavers' conduct towards his help.

NEW NOTIONS AND OLD LOOMS.

* * * It is to be hoped that inventive genius supplemented with ambition will not over-reach itself among loom-builders of the present day, as it seems likely to do and fill the mad houses with poor unfortunates who have started out with bright hopes on a loom-fixer's career.

Inventive genius has indeed made many grand achievements and placed before an admiring world the beauty of her labors; but there are very many inventions of a few years ago that practical men are unwilling to lay aside for some of the "new fangled notions," which seems to have sprang into existance more from pecuniary motives on the part of inventors than from any practical use they might ever be to manufacturers—were it possible to select the very best—the parts which have been often tried and never denied, from among the many inventions and from these to compile a loom, it would seem that perfection might be attained. The simplest is always the best. Every addition made to a loom only adds perplexity and labor, until fixers have become acquainted with it and usage has discovered its weak points; and these must be pointed out to builders with suggested improvements; and while the buyers of the next make will receive the benefits, the former must go on crippled.

It is a hard matter to draw comparisons between the different make of looms and point out the decided advan-

tages one has over the other, for there is no make but has some good qualities, and there is certainly none but has many deficiencies. However good the late improvements on the Knowles and Crompton looms may be pronounced, every loom-fixer, who has had experience on them, knows perfection has not been reached and old fixers can see where many parts are not quite as good as some parts in the old patterns. Most any fixer of experience will agree with the statement that no harness motion has ever yet been invented, for simplicity and easy management, that can surpass the *shear motion* patented by Gilbert in 1868.

When old fixers look back over a space of twenty years and see the long line of different looms with which they have struggled, often times in doubt as to which would come off conquerer, loom or fixer, they do not fail to recognize among that formidable array the loom which was the most easily managed; and it is quite natural for one to speak of that loom as the *best*. Among such reminiscences a fixer's brow will darken as he thinks of the harness chain on the old Greenhalge loom with its wooden pegs; and the sheet iron shuttle binders with the protecting rod fingers at the outer end of the box; and when he thinks of hours spent in driving pegs and "tinkering" on binders, it seems like wasted time, to say nothing of the long string of oaths that have gone clattering away with the wooden pegs.

Fixers also remember a certain pattern of cam loom sent out by Davis & Furber, about sixteen years ago with the dagger on the protecting rod in the centre of the

lay, which acted as sort of a pivot on which the lay could swing, and twist itself all out of shape whenever the shuttle failed to reach the box at such times as the "knock off" did not work. This was considered by many fixers as the greatest nuisance extant and heartily corroborated by all others. But the many improvements afterwards added have placed them among the best cam looms in the country.

One very bad feature of the late patterns of the Crompton harness motion, is in having the chain run backward, or at least what would seem backward to one who has been used to fixing on other looms. And being underneath the fingers as it is, one person finds it quite a difficult task to put a long chain on, being obliged to hold its entire weight in one hand while the other has to be used in working the cylinder. On the old "pump motion" this trouble is obviated by hanging one end of the chain on the cylinder with both hands, after which it can be easily worked. Another advantage the old "pump motion" has, as has also the Gilbert "shear motion," over the newer styles, the cause of harness miss-picks can be more readily detected; for the simple reason that the jacks stand out where their workings with the chain can be easily seen.

There has doubtless been more brain-racking, neck-twisting work, in trying to study out and peep into the cause of harness miss-picks than in any other one trouble about a loom. There have been many "new notions" regarding frictions and "let offs" for woolen weaving,

but for all kinds of work nothing as yet seems to take the place of the weight and lever friction, (unless it be the very latest improvement on the Crompton loom which remains to be decided). Unevenness in weaving seems to have been one of the motives which prompted men to devise something new; and a friction with connected levers and pad which rested on the warp was the result of much study. This was claimed to be a friction, which if adjusted to the right number of picks at the commencement of a warp, would keep the uniform number throughout, without changing, until the warp beam became bare. It was also claimed that a weaver could not change the friction in order to put in a less number of picks, but it failed in both cases to perform what was claimed for it. It would not keep in a uniform number of picks throughout an entire warp, but invariably has to be changed. It is also quite as easily changed by a weaver, who feels disposed to weave light cloth, as is the old weight and lever. It cannot be expected, however, that the many so called improvements on looms will meet with decided favor by old fixers, but as the weight of years compels them to lay aside the monkey-wrench and screw-driver, and give place to the younger ones who can more readily adapt themselves to the "new fangled notions," inventors will not find it so difficult to please.

WHAT CONSTITUTES A "GOOD FIXER?"

It is not in the fact that a man has seen, and handled, and perhaps had a little experience in fixing nearly all kinds of looms.

I have seen a man who could talk very well concerning the different make of looms, and as he expatiated on the good qualities of this, and condemned that, and related marvelous things about the workings of another, I regarded him as a wonderfully learned man among the craft. But I saw that man placed in a position where practical knowledge only, could avail, and lo, he was a begger.

Now a good loom-fixer will be a pretty good man in other ways; for the two essential elements, good judgment, and good sense, which he must possess, will accomplish more for him than to make him a good fixer, and without these he never will be much of anything.

If one were to listen to the different opinions expressed by weavers, regarding a fixer, it would be a hard matter to form an estimate of his abilities. It is not the man who can curse and swear the loudest at his weavers, nor the one who can joke and tell stories the longest, that is the best fixer; although a good fixer may possess the qualifications for doing either to a *very limited* extent. If a loom has been running nicely for several days, or several weeks, and all at once begins throwing the shuttle out, or stopping, or going wrong in any way, it is but a reasonable conclusion to arrive at, that something is wrong about the loom, and the man who can go and readily right that wrong, without making the loom go a great deal worse before making it go better, is a man of good judgment, and doubtless a good fixer. Some men go to work on a loom as though it was all wrong from the picking dog to the head motion; just because it has stop-

ped several times. Now when a loom begins to stop, it is useless to take the harness chain off to see if any of the bars are crooked. The man of good judgment will not move a bolt, or screw until he has satisfied himself where the trouble is, and then he quitely removes the cause of the trouble, and the loom runs along as though nothing had occurred; while the impetuous man who would begin at once moving the picking shoe forward, letting the tug-strap down, and taking an inch or two out of the belt, when he discovered the real cause of the trouble must go and undo all that he has done, and by the time he is through he finds the loom does'nt run as well as it did before; and no wonder.

I have known men who were good fixers in all respects save one. Their looms were in good condition and running well. They knew *when* a loom ought to be fixed and *how*. They were pleasant with the help. But a lack of *something*, which can come under no other head than neatness, was plainly visible. This may not be considered as essential in the qualifications for a fixer; but it covers a large ground. It means more than *cleanliness*. For instance, in passing along a section of looms which is being run by such men, I have noticed that the harnesses were not hung exactly even, and that where the middle hooks were, more warp would be on one side than the other; and a picker stick would be several inches too long, running up past the shuttle box like a flag staff, straps would be left with flapping ends, and many other little things, which do not hinder the loom from running

well, nor the cloth from being perfect, but have a bad look, and shows that a little place somewhere in a fixer's character has been left uncultivated.

In short, a loom-fixer should possess a symmetrical character, and his qualifications should not fall short of fitting him for the trying position he is to occupy; for of all the positions which have fallen to the lot of man, since man has fallen, this is the one which try men's souls.

* * * * * * *

A fixer should own a kit of tools, and keep them in a good condition. Says one man on this subject:—"Let me see a fixer using a monkey-wrench with the handle gone, and a screw-driver with one corner of the point gone, and a split handle, and the rest of his tools to correspond, and I know about what condition his looms are in." A fixer should have three sizes of flat wrenches, two sizes of monkey-wrenches, two screw-drivers, two sizes of belt punches, and a good awl: a steel straight-edge, and small spirit-level, a good pair of plyers, a large and small hammer, including a nicely tempered key-set. He may, of course add such other things as may come in handy, but these tools should be of the best quality, stamped with the owner's name, and then used properly, and well taken care of. If a "carpenter is known by his chips," a fixer is certainly known by his tools.

THE END.

ADVERTISEMENTS.

ADVICE!

There are few loom-fixers without the aspiration to be Boss Weavers at least. Few who would hesitate long enough if offered a shop, to make sure they possessed the natural qualification, without which even the best mechanic must fail if he aspires too high.

It is more honorable, easier and in the end more profitable, to be a first-class loom-fixer than an indifferent Overseer, Designer or Manager. But if you are qualified to go higher, fit yourself thoroughly and go; for the want of really well qualified men is greater and greater the higher you aim.

How should a loom-fixer fit himself for higher positions? First, aim only to be second-hand, do not try to prepare yourself for a Super's place until you are a Super's assistant, and then as before go slow and sure. These smart people who go up so fast are seldom held in their places by their own thoroughness. To be up with the times, you must be a most persevering reader, without a wide knowledge of what other men have done and can do, you meet competition as a warrior meets an enemy whose power he does not know.

Make sure that the implements you employ are not surpassed in efficiency and durability, if you would stand at the head of any class of workmen. It is almost impossible to avoid a favorable impression of a man who has the very best implements available for his work, and knows how to take care of them.

KNOWLES' OPEN SHED BROAD FANCY LOOM

THOUSANDS OF THEM IN OPERATION IN THE BEST MILLS IN THE COUNTRY.

WITH POSITIVE CRANK DROP-BOX MOTION, BACK and FORWARD PICK-OUT, GRADUATED LET-OFF MECHANISM. TWENTY-FIVE HARNESSES and FOUR BOXES EACH END. Perfectly Positive in all its Operations, and can never be made to put the wrong Filling in any Shed.

WE CLAIM FOR OUR LOOM:

1. Making Superior Goods by reason of its open shed peculiarity.
2. Freedom from Mispicks by reason of its positive motion, both on the harnesses and boxes.
3. The facility with which the pick is found, when lost by reason of the breaking of filling.
4. The box chain controls the boxes positively, and will call any one designated by the chain without any setting of cams or lifters. The boxes at each end are operated independently of each other, so as to use conveniently seven shuttles.
5. Great speed, on account of the peculiar harness and box motion which enables the loom to produce a large per cent. more goods than any other fancy loom.
6. Saving in power, on account of only moving such harnesses as are required in the pattern at each pick.

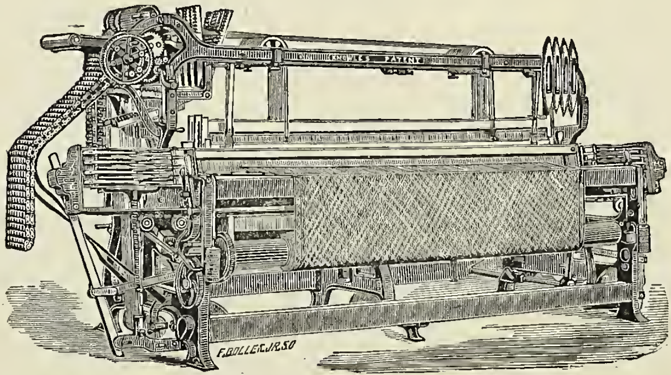
We call attention to our 16-HARNESS, 4x1 BOX, FANCY LOOM, designed especially for the more extensive patterns in fancy cottons, worsted dress goods, etc. Also to our Knowles Two or Four Shed 4x1 Box, "Pick and Pick" Gingham Loom, with positive box motion, so arranged that either one of the series of four boxes can be called at will, with Knowles' Patent Stop Motion, combined with Clutch Pulley and Brake.

The Looms are of first-class workmanship an are very durable. All the working parts of the harness and box motion are either of wrought or malleable iron, and are case-hardened. We have now several thousands of them in successful operation, and are more fully prepared than ever to meet the rapidly increasing demand for them.

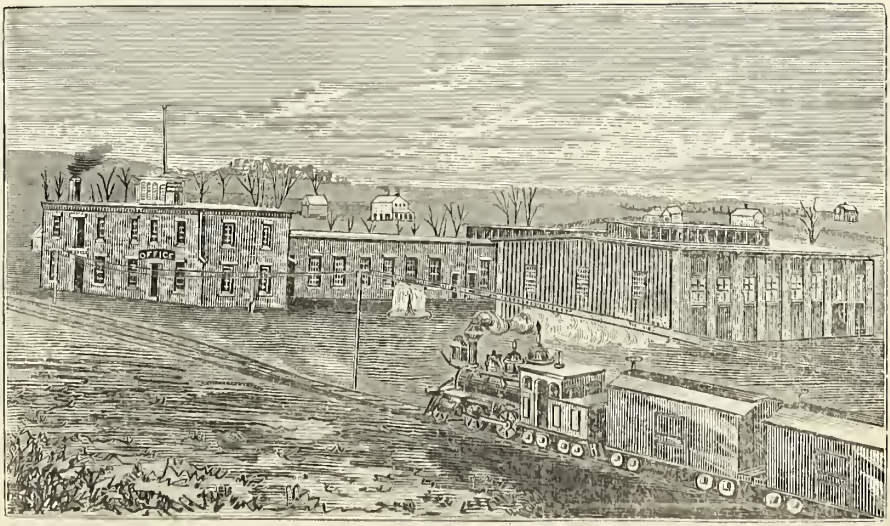
L. J. KNOWLES. }
F. B. KNOWLES. }

L. J. KNOWLES & BROTHER,
57 Jackson Street, WORCESTER, MASS.

SEND FOR CIRCULAR.



Knowles Open Shed Fancy Loom.



Works of J. McLaughlin's Sons, Teasel Growers,

Skaneateles, N. Y. Post Office address Skaneateles Falls, Telegraph address Skaneateles Junction.