diagram as it is concealed by the box rod. It is by the stud on the outer end of the lever S, for the stud holds the connecting arm, the bottom of it being at U above the locknuts V.

A special difficulty arises after the loom has been running a few years. Most work for the boxes is confined to three boxes. When the fourth box is needed, it is found to lift too high. No amount of " halving the leverage " will make the box level, because the stud is least worn where the connecting lever rests when the fourth box is up. What can be done is to turn the stud half way round and reset all the boxes, if it has not been previously turned, or insert a new stud. In the older type of Dobcross box loom shown at Fig. 270, the box chains pass over several flanged pulleys like those at G. At A is the end of the chain which passes through the lever F and the higher it is set and the greater is the elevation given to the second box. At B is the slide, which, when tapped in gives greater leverage to the third box. The two acting at the same time control the fourth box. The stud for the third box is at D, but the stud for the second box is the pin that holds the flanged bowl at the bottom of the double lever C. In the Hodgson drop box loom, it is a gain to alter the long star wheel rods so the weight assists the alteration. The levelling for the first box is best and the easiest performed by the locknuts at the back end of the swing lever instead of by the locknuts at the base of the box rod.

Extra Roller Work.

One of the many ways of making woollen and worsted fabrics more attractive, is by introducing coloured twist threads. Cotton and worsted are often twisted together, the most prevalent colours of cotton being blue, yellow, red, or light brown. The choice of colour chiefly depends in what colour the fabric will be piece dyed.

The colour of a twist thread is halved by the twist, and reduced to a quarter by an even weave. As the shrinkage of woollen, worsted, cotton, silk and rayon are each different, it is prudent to have the twist threads wound on a separate roller to be let-off independently. If cotton or rayon be woven too tightly, they are liable to " crack " in finishing.

When threads are thicker or thinner than the ground threads, these too must be woven from a separate roller.

Rope Wrapping for Light Work.—This is outlined in Fig. 271. A is the upper cross rail of the loom, and B the holding hook for brake rope C. D is the weight that has to conform to the correct speed of roller. E is the roller and F the extra threads that pass under rod G on their way to the healds. H is the ordinary back rail, with I the ground warp.

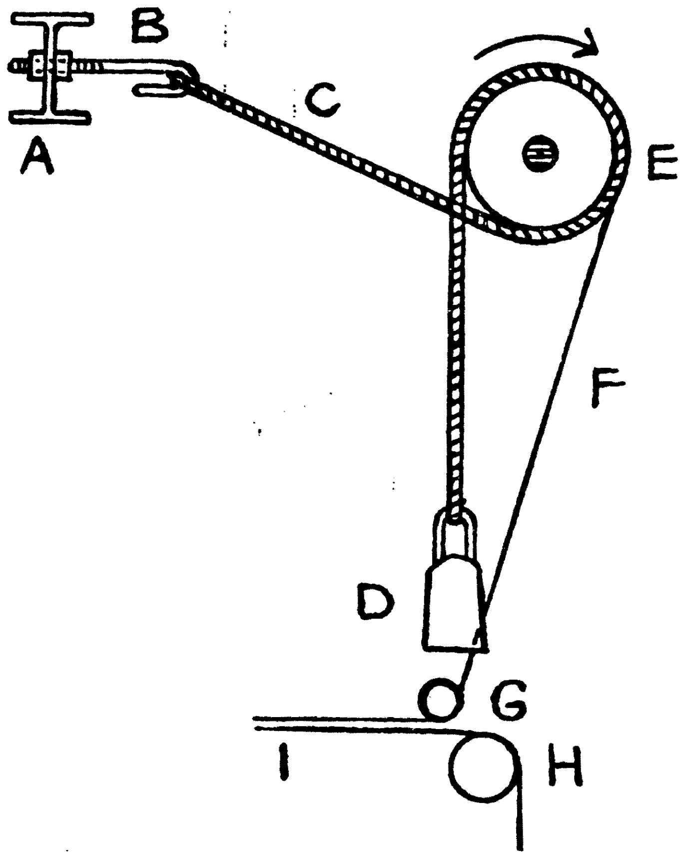


Fig. 271. Weighting Light Roller Work.

What is of importance is how the rope is wrapped, and which way the roller turns. Rope C does not make a complete turn on the collar of the roller, and gives a lighter and easier braking of the threads.

The weight end of the rope must always pass on the inner side of the wrapping, to prevent it working off, or being knocked off the collar.

The roller turns *away* from the weight. This imparts resiliency to the unwinding, for as the roller turns the weight is lifted a little, and then drops back. To obtain the best slippage, the frictional side of the rope is rubbed with block blacklead.

Rope Wrapping for Heavier Work.—In Fig. 272 the rope is wrapped 1½ times round the collar, and the arrow indicates roller movement. The way the roller has to rotate, has to be decided before looming takes place.

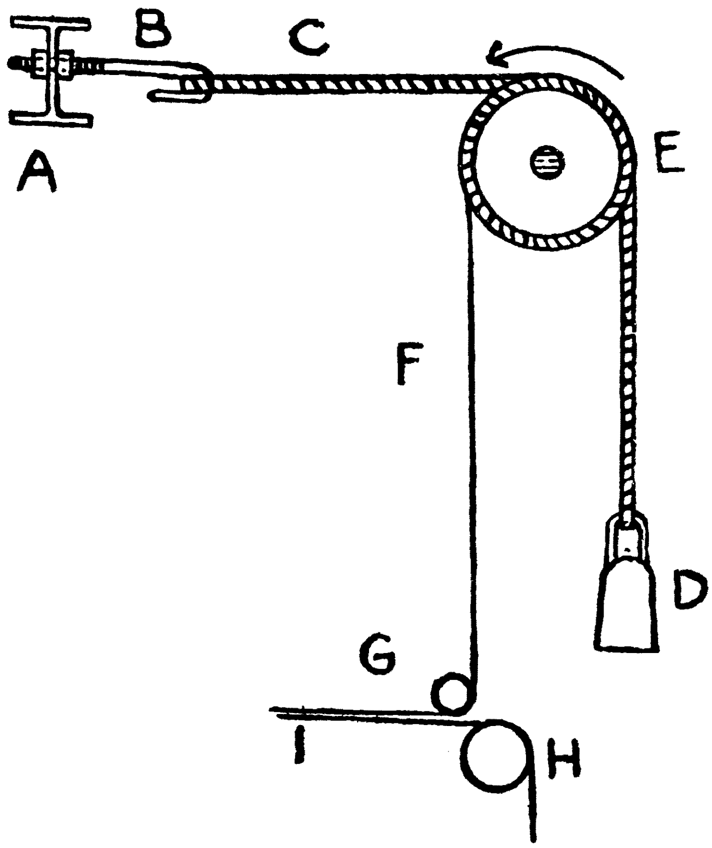


Fig. 272. Braking Heavy Roller Work.

One rope may suffice if the threads are not numerous, but if they are, then a rope is needed at both ends.

In any adjustment, the coils of the rope have to be kept straight, for if locked, the whole of the extra threads may be torn out. The turn of roller and the placing of weight are the opposite way to the previous example.

Front View of Roller.—In Fig. **273**, roller A is turned as arrow B, and C is the gudgeon in the holder bracket D. The metal roller collar E and the rope wrappings show the weight length on the inner side of F. At H is the packing to prevent the roller making lateral movement. The holding brackets are all the better for being wider than the beam, for at times, the winding does not conform to the ground threads. The extra space allows of the best spacing of the roller.

Measurement for Relative Speeds.—A correct amount of brake weight has to be obtained as soon as possible, and a system of checking arranged. A good method is outlined at Fig. **274**. A starting line is made at A, and a finishing line a yard below. A few spare threads from the ground warp at D are wound on bobbin E. As weaving proceeds, the threads at B are wound on spool C, and spare threads from the roller cloth are examined to see that no curls are made by slackness, and tightness is found by pressing the edge of the

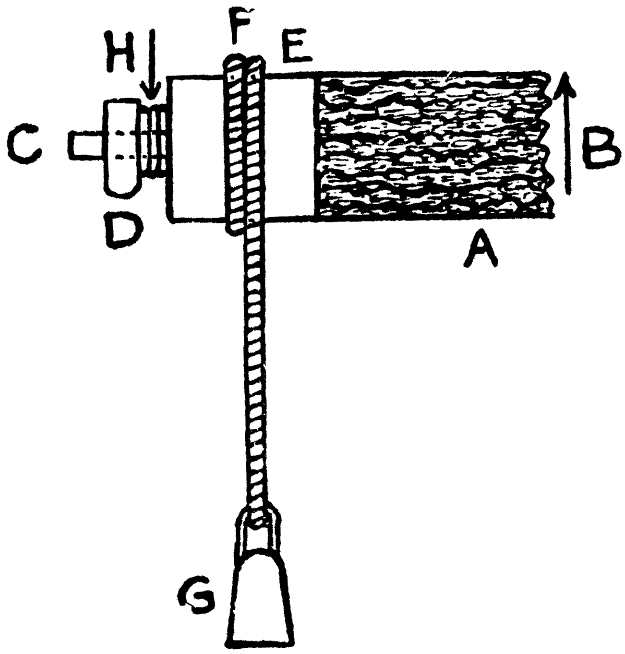


Fig. 273. Correct Rope Wrapping.

hand downward on the cloth, for then ridges are felt, and brake weight reduced. When the heads of the bobbins have reached the lower mark, the distance between them is measured, and any necessary adjustment is then made.

Other Yarns.—When silk is used on the roller in connection with woollen or worsted ground warp, the silk must have a thin false reed wire placed at either side of single threads, or a group so as to show them clearly in the cloth. The loose fibres on the ground warp drag at the silk, make it slack, and it appears and disappears in the fabric and spoils it. The false reed wires prevent this.

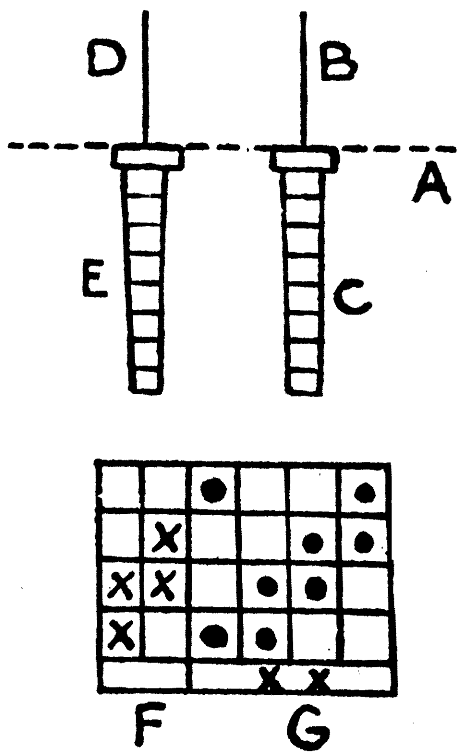


Fig. 274. Testing Take-up of Warp and Roller Threads.

Filament rayon has to be kept as free from friction as possible. If the threads are chafed, the broken filaments are pushed back by the reed and form " buttons." What has to be done is to pass a rod underneath all the rayon threads and draw them forward while the weaver turns the roller. The buttons have to be individually threaded through the reed. A few picks may be woven by means of the balance wheel to fasten them down, and the shafts bearing the rayon have to be elevated to make them clear the shuttle race. Suppose rayon is drawn on the first two shafts as suggested by crosses in Fig. 274, they will be on shafts G, and these must clear the running board at back centre.

Thread Interceptor.—This has proved to be a valuable aid on the Northrop loom in preventing unwanted strands of weft getting into the shed. It was invented at the firm of Messrs. Henry Lister & Sons Ltd., Troydale Mills, Pudsey, Leeds, Fig. 275. A is the lever on the change shaft which moves arrowward as B, when bobbins are changed in the

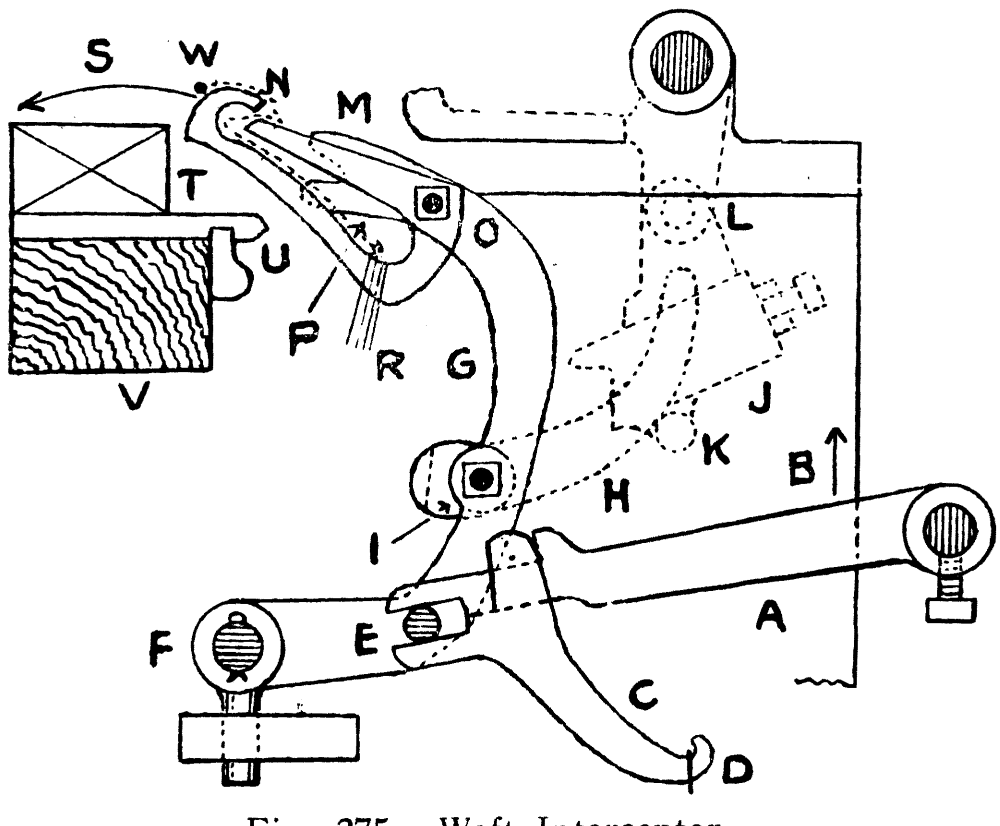


Fig. 275. Weft Interceptor.

shuttle. C is the spring lever, the spring being hooked at D. At F is the fulcrum of the protector G, and E its pin by which the protector is moved by lever A. At I is the fixing point for the latch depressor H that exerts pressure on pin K when the shuttle is not properly in the box at transfer.

The battery latch at J swings on its pivot at L, and M is the bifurcated end of the shuttle protector. N is the hooked end of the thread interceptor that is bolted at O to the shuttle protector.

The interceptor is pear-shaped and made of mild steel, its total length being four inches. It is made with a slot at P, that is $3\frac{1}{4}$ inches long. The hooked end N is $\frac{3}{4}$ inch in front of the protector, and when both are pushed forward, and the reed is at its front centre as at S, the front of the interceptor is only $\frac{3}{4}$ inch in front of the reed.

The interceptor cannot be set backward or forward, but can be moved up or down. It is set so that when the protector is at its full forward traverse, the strand of weft is not below the centre of the hooked end of the interceptor. When so arranged, the forward movement of the reed, conveys the weft over the hooked end, and deposits it on the sloping upper part.

As soon as the protector moves backward, the weft slides into the hooked end, and there it remains until the cutter in the temple head severs the weft.

As the interceptor is tilted upward as shown after being moved backward, the weft slides down the slot to the position at R, and is then quite out of the way of being dragged into the cloth.

The path of the weft traverse is indicated by the dotted line W.

T is the shuttle box, and U the bunter that meets the battery latch when the transfer of bobbins take place. V is the going part. There is no weft cutter at the mouth of the box, and the weft waste in the interceptor is removed by the weaver.

When inspected by the writer, it was doing excellent work in the weaving of army blankets.

WASTE REDUCTION IN WEAVING.

All weaving yarns go through an elaborate process between the raw and finished state, which increases the cost per lb. considerably. As a matter of business principle, all conscientious workers endeavour to convert the maximum amount of yarn into saleable cloth. The less waste is made, and the more is gained in output with the same expense of labour and machinery.

As waste is valued at about $\frac{2}{3}$ less than the cost of yarn, there is a drop of 66$\frac{2}{3}$ per cent. between the yarn on the bobbin and the waste in the basket. The question therefore arises as to ways and means of preventing excess waste.

Structure of Bobbin.—When a weft bobbin is properly grooved; it is a good foundation for the weft to rest upon.

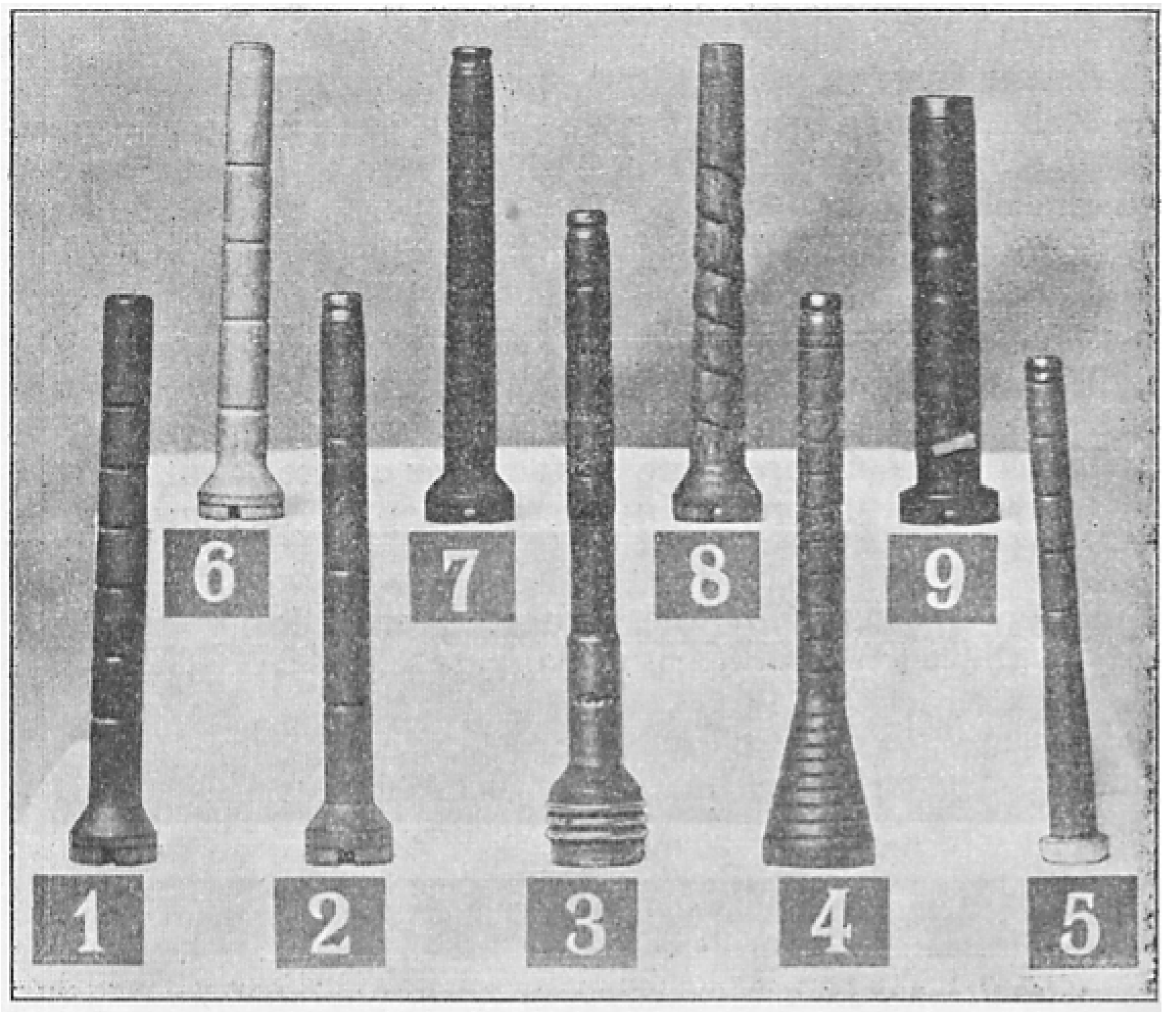


Fig. 276.
Styles of Weft Bobbins.

A 7 inch bobbin that has only three grooves is a prolific waste producer, and a profit destroyer. Such a bobbin is shown at No. 2, Fig. 276. A 6 inch bobbin for woollens should never have less than 5 grooves equally distributed on its shaft, and a good thickness for its shaft is $\frac{11}{16}$ inch from base to summit. This size gives ample wood for 6 grooves, which is an improvement on the five. This style of bobbin is presented at E, Fig. 277. A 7 inch bobbin of the thickness mentioned can have 8 grooves, and is an excellent bobbin.

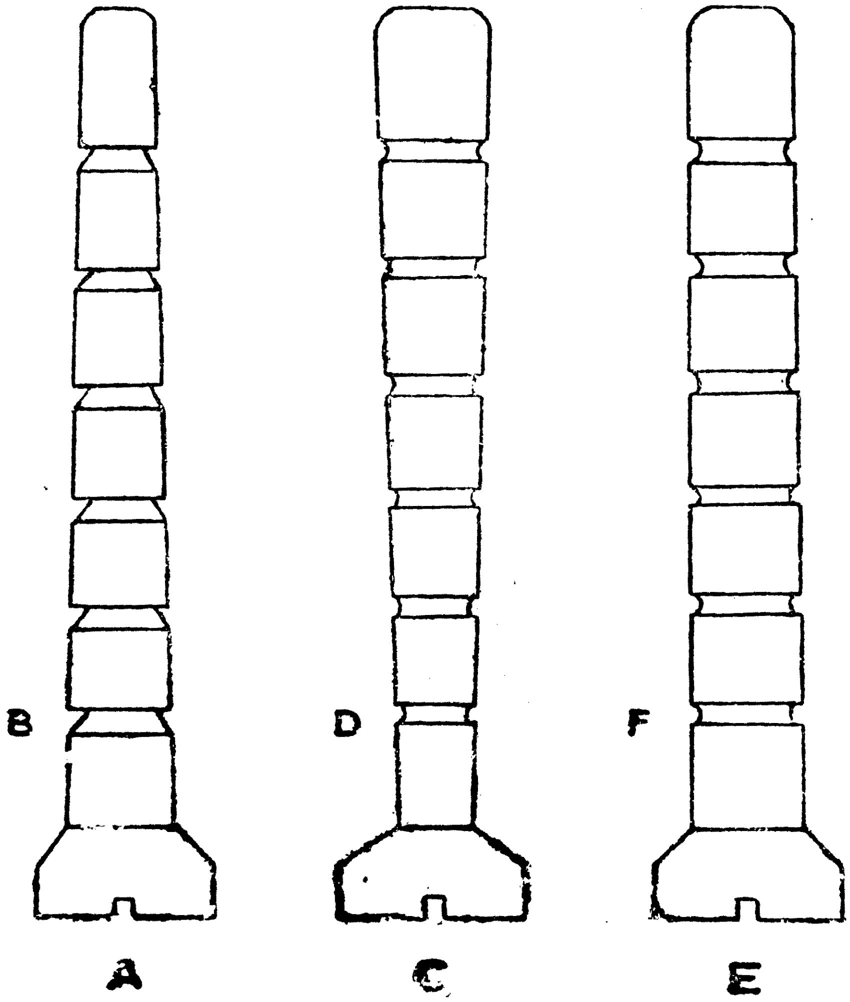


Fig. 277.
Structure of Weft Bobbins.

The best kind of groove is semicircular. The one formed like an inverted **L** at B, on the bobbin marked A, would appear in theory to be a very good groove to hold the weft, but it is not. If the coils move at all, they are wedged fast, and the weft is constantly breaking during weaving.

The bobbin C has a reverse taper on the shaft to the one at A, and is claimed to be a non-slough bobbin, but it has not been generally adopted.

Another style of groove is that with a spiral groove at No. 8, Fig. 276. This has 6 turns on 6 inches. It was found to be too chippy for fine work, but was good for the medium or low skein woollens. Metal tipped bobbins as at Nos. 2 and 7 are not a necessity, and fine grooves as at No. 7 are only useful for the finest weft. No. 3 is the well-known but costly Northrop bobbin, and No. 4 the Universal winder spool, and No. 5 one kind used for cotton. At No. 9 is the substantial worsted spool, tipped with metal.

Winding of Yarn.—However perfect the bobbin, its advantages are nullified for the time being if the weft is too slackly wound. Slack spindle bands also cause slack weft. The nose of the bobbin is an important factor in reducing waste, for long nosed winding gives better results than a short one. A short nosed bobbin D is 1½ inches, but a long one E is from 2 to 2¼ inches. The width at the base of the coils is the same in both, but the inclined angle is less severe in the long nose. When the weft is well wound, there is less waste made with a 7 inch bobbin than with a 6 inch. (Fig. 278).

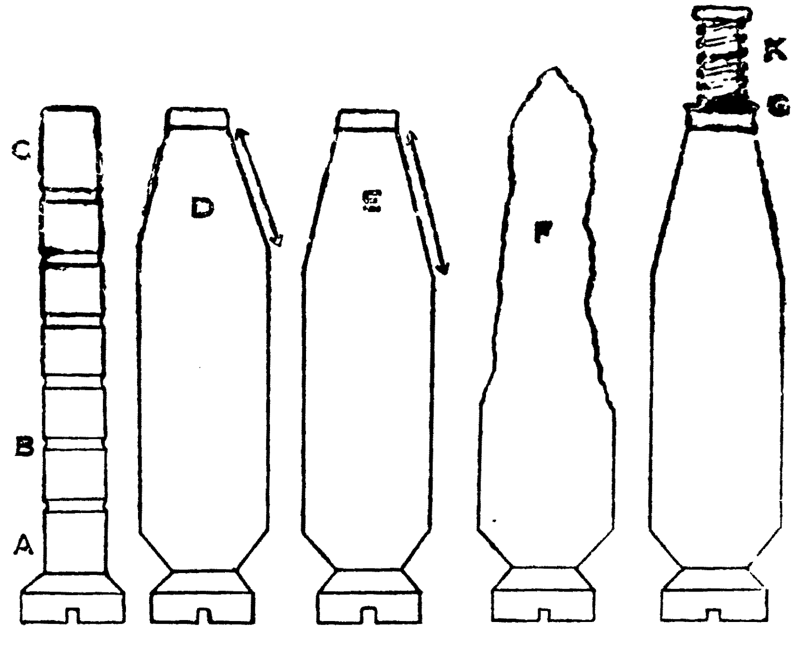


Fig. 278.
Prevention of Weft Sloughing.

Mule spinners are provided with a gauge fork, or a ring to test the diameter of the yarn on the bobbin. When too bulky, the weft binds against the inner sides of the shuttle. To make the weft weave, the inside of the shuttle has to be scraped, which weakens it.

Adjustment of Loom.—When well wound weft sloughs during weaving, it is chiefly due to hard picking from the right side of a left hand loom. When the coils collapse, as at F they do so owing to the bump of the shuttle against the picker in the left hand box. Coils collapse towards the nose of the bobbin, and, to a certain extent, are driven on towards the head when weaving.

In the overpick motion, harsh picking is mainly caused by the picking nose being too pronounced in its curve, and is modified by rounding the end off. Its power may be decreased by giving more length to the picking strap, or, when possible, by setting the stick a cog further back. In the under pick of the Dobcross type, the thick strap round the picking stick is elevated, or the picking shoe is set further back a quarter inch.

The checking of the shuttle is also partly responsible for the sloughing of the weft. The shuttle is travelling at a good rate of speed when it enters the box, but is slowed down by the friction of the box side, the box swell with its spring pressure, and by the picker and its check. When the blow against the picker is nearest the nose of the bobbin, the weft has a tendency to slide forward. The higher the speed of the shuttle when it enters the box, and the more severe is the blow of the shuttle on the picker, and the greater the possible disturbance of the weft. What has to be done is to either increase the amount of check, or decrease the picking power, or modify both. As force is the chief factor, it is usually reduced unless the checking is too slack. It is reduced consistent with preventing the loom banging off.

As showing the importance of keeping the coils of weft in their weavable position, a 7 inch bobbin carrying 34 skein yarn will weave 4 inches of cloth 72 inches wide with 40 picks per inch. This would give 320 yards of weft on a bobbin. In ordinary weaving, not more than 6 yards per bobbin need be turned to waste. If such a bobbin were to slough almost at the beginning of weaving, it would make as much waste as 50 good ones.

Fig. 278 shows a standard woollen bobbin, 6 inches long having 6 semi-circular grooves. The bobbin on the right is fitted with a loose spindle. On it is the washer G to prevent damage to bobbin nose, and above it at K is an open spiral spring which takes checking shock, and prevents the weft from sloughing.

Weft Fork Assistance.—Weft forks play their part in waste reduction. When in order, it should stop the loom within two picks of the weft breaking or running off. In most factories, an allowance is made for three picks to be missing out of a piece, but beyond that there is a possibility of a fine being imposed. Rather than be fined, the weft is pulled out. (*See* chapter on weft forks).

When weft runs off and the fork is out of order, the loom continues to run until stopped by the weaver, but if the weft breaks and catches on again as is often the case with poor or soft twisted weft, the picks have to be pulled out.

Cut weft is different, for poor weft leaves a trail of fibres at the end, but cut weft is shorn as with a pair of scissors. It is usually cut in the box by the weft dropping down between the shuttle and box side. It is prevented from doing that by making the inner box front of plain tappet and dobby looms slope at the same angle as the shuttle front. The feet of the box are packed with tapered cardboard. (Fig. 193, Page 255).

The good condition of the weft fork is all the more demanded when a weaver has to attend to several looms.

The tumbler weft fork cuts the weft when the prongs do not fit through the centre of the grate.

Missing Pegs.—Wooden pegs have the excellent advantage of wearing the under side of the feelers very little in years of service. They have the disadvantage, however, of drying in during hot weather, and then dropping out. Before any set is placed on the loom, every peg should be tested with the finger and thumb to see they are secure. Long lengths have to be prevented from swinging, and should have as few bends as can be arranged. The worst weaves for pegs missing are warp backed cloths and double cloths. If a peg be missing belonging to the back cloth, a couple of yards can easily be woven before a discovery is made, for in all looms, the cloth back cannot be seen until it reaches the cloth beam, unless the piece is slackened, and taken off the temple. Though in the back cloth, it may spoil the face cloth. No litter should be left on the floor underneath the lags, so that any dropped pegs may be better seen. Secure pegs saves much time, labour and waste.

Wrong Lifts.—A wrong lift is made when a shaft is up when it ought to be down, and down when it ought to be up. Worn bushes in the Dobcross loom may be packed with band to prevent two levers being actuated with one bowl. In looms using wooden cylinders, the ends become worn and give too much play to the lags. New ends are best, but as a temporary measure, the end pegs of groups, and both sides of single ones may be pared down to prevent them touching too many feelers. Short needles, short pegs, worn hooks on catches, and wrong timed cylinders are some of the causes of wrong lifting.

The more complicated the weave, and the darker the colour, and the less chance there is of making an early discovery if something is wrong. Such defects in cloth have to be made good by the weft being taken out, but if too much has been woven, it goes forward as a damaged cloth. If time will allow, a periodic overhauling of the dobbies is an all round gain.

Tearing at Temple.—Weak weft is usually responsible for the cloth being torn at the inner end of the temple, and it is mainly woollen weft. Most woollen and worsted cloths are woven with temples having 10 rings. Now pieces contract most at the selvedges. If a cloth tears with such a temple, the picks may be reduced to ease the tension, but the real remedy lies in having a temple that reaches further into the cloth. What cannot be done by a temple having 10 rings, is safely performed with one having 15 rings. (*See* chapter on " Temples.")

Bulb-nosed Weft.—In worsted weaving there is seldom any sloughed weft, owing to the high speed of winding the yarn. Such compactness greatly assists in overcoming the shocks of weaving. What weft does slough is single twist, and what bulk of waste is made is through the wearing of the heart-shaped lifter cam having become flat in one place, which keeps the lifter stationary. The winding then takes place at the same spot. Such winding cannot well be woven. When bobbins are wound too full, or wound too much on the head, more waste than by proper winding will be made.

Clean Yarn.—This is a great aid to a high per cent. of weft being woven. Burrs, slubs, pieces of waste, long ends on knots, single yarn instead of two-fold, crushed bobbins, and soiled weft for delicate colours, are all waste makers.

Cracked Bobbins.—Cracked bobbin ends may be held together with wraps of cotton, but if the weft can be woven off, the bobbin should be broken up after. In worsted shuttles, the welded tongue used to be a prolific source of bobbin breakage. The more flexible curved spring is a great improvement.

Ravages of Moths.—Stored yarn spoilt by moths, and not too badly damaged may be partly woven, but it saves much of the weaver's time if it is rewound. Wormwood is one preventative, flaked napthalene another, but eulan is about the best means of preserving the weft.

Warp Waste.

Whilst warp waste never approaches the dimension of weft waste, it is most made in the fancy woollen and worsted trade. One cut orders means considerable resetting in the warping creel, and extra waste is made by looming or twisting, as well as starting and felling the warp. Lengthy warps are better than short ones in this respect.

Warping and Beaming.—Accurate clock work in automatic warping machines curtails waste. Defective beam bands and too few bands may mean the loss of a yard or more of cloth. The reasonable position of lease bands and lease rods is of some consequence in yearly reckoning. The proper weighting of the warp beam before twisting, and the commencement of weaving as near the twistings as is safe to do, are each items for the prevention of warp waste.

Backed and Double Cloths.—The speeds of two beams contributing to the same cloth needs careful calculation, setting, and daily examination. Even if the warp be the same on the two beams, the one that does the binding has to be the longer. When there is the binding and also a drastic difference in the take up of the two cloths, careful management is imperative if the felling ends are to be together at the end of a 6 cut warp. The designer orders the different lengths of warp, and the overlooker makes the calculation, sets the weights, and measures the initial speed marks when weaving in. Waste reduction implies good workmanship both before and during weaving. (*See* Figs. 291-2-3-4, Page 385).

THE WEAVING OF TYPICAL DESIGNS.

Both warp, weft, and weave, have each to receive due consideration if any kind of cloth is to be woven with credit. Loom adjustments that are admirable for one kind of cloth are unsuitable for another. Experience decides. Weaves are here presented along with suggestions that might prove helpful. The simplest designs are omitted, but their treatment is included.

Floats for Worsted Weaving.—As an approximate guide for the making of designs in relation to the yarns to be used, the following particulars are given:—

Floats.		Minimum Counts.
4	......	2/36
5	......	2/48
6	......	2/60
7	......	2/66
8	......	2/72

Plain Weave.—This is the simplest of weaves, but not so easily managed. For most cloth produced with this weave, four things are required.

(1) *Timing of Shed.*—In an ordinary dobby loom, the shed has to be timed fairly late, for if soon, the bottom shed rises too quickly from the shuttle race, which is likely to cause stitches near the selvedges, broken threads, and tilts the shuttle before reaching the box. If the warp be tender, the shafts should not cross each other until the reed is almost in contact with the fell of the cloth. There is then much less drag on the warp.

Poplins are woven on four shafts in a tappet loom, and with two pairs of plain tappets. They are set in relation to the crank so the two back shafts are level when the crank is at its top centre: the two centre shafts level when the crank is midway between the top and front centre, and the two front shafts level when the reed is within an inch of the cloth. This relieves considerable friction on the warp.

(2) *False Reed.*—This has been fully explained elsewhere, and reference may be made to Fig. 302, Page 398.

(3) *Lease Rods.*—Front shafts make a less shed than the back ones, and to equalise the tension on the warp, lease rods are placed in the back shed as given at Fig. 303, Page 399.

(4) *Good Temples.*—Pieces contract most at the selvedges, and the more intersections there are in one repeat of the weave, and the greater is the shrinkage. The use of temples are fully explained in Chapter on temples.

Hopsacks.—When the warp is all one colour, it may be woven with an ordinary sley, but if there are colours in single threads, they have to be woven with a double sley when the back reeds are in the centre of the gap in the front one. (*See* Fig. 2).

Angles of Twills.—These are at Fig. **279.** There are nine, and each is given its degree. The **45°** is the most common, but all have their uses.

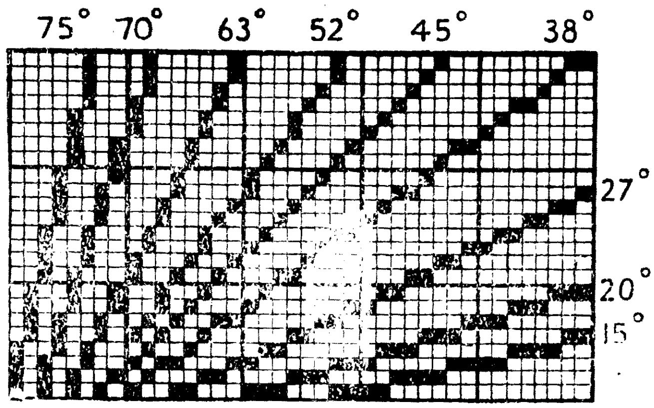


Fig. 279. Angles of Twills.

Ordinary Twills.—Twills like the 2 and 2 and the 3 and 3 are fairly easy to weave unless overcrowded with picks. The following points for their production are advanced.

(1) Except for fibrous warps, the timing of the shed is late to avoid stitching at the edges, and especially if the picking is weak at either or both ends.

(2) In pieces of light weight, and woven with a negative let-off, the weaver should observe the motion of the warp beam. Any holding and sudden jerks should be mentioned at once to the overlooker, for such an unsteady motion spoils the cloth.

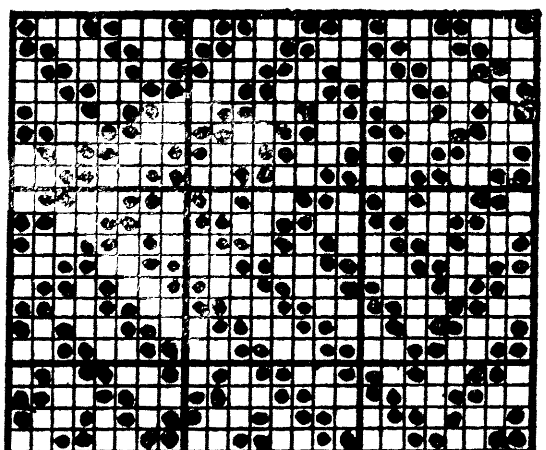


Fig. 280.
Diamond Twill.
(No Duplicate Picks).

(3) In heavy work, good temples must be used to keep the fell of the cloth at the same width as the warp in the sley.

Diamond Twills.—These are excellent variations of the 2 and 2 twill. Fig. 280 is on 24 threads and picks for one repeat, and, contrary to most, has no duplicate picks. There is therefore no excuse for making broken patterns after extracting picks.

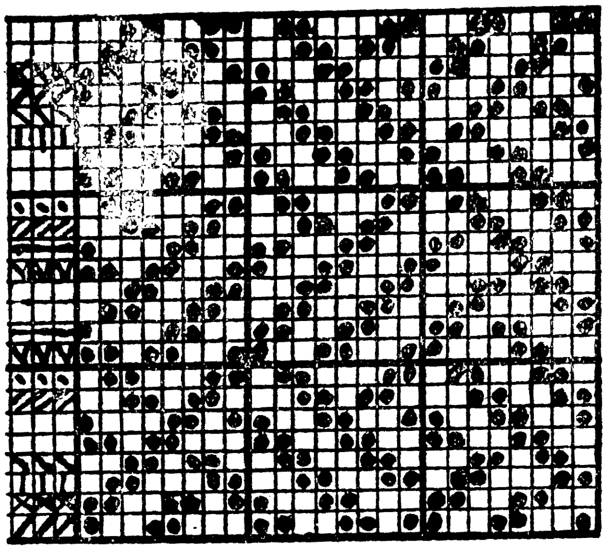


Fig. 281.
Diamond Twill.
(With Duplicate Picks).

Fig. 281 is built a little similar to the previous example, and is on the same number of threads and picks, but in it there are 12 duplicate picks. These are marked on the left of the design, each kind of mark having the same lift. Such weaves ought only to be woven by experienced and careful weavers. To avoid wrong patterns, the following plan is suggested. (1) The 5th lag of the series is marked, because this has no duplicate. (2) When this lag operates, the position of the shafts are marked on the loom front. (3) Before any combing out takes place, the marked lag is brought into play, and the shafts are checked by the numbers on the loom. (4) The combing out must pass beyond the defective place until the pick is open, and this pick is left in the cloth. (5) When the cloth and warp have been adjusted, the loom is ready for weaving.

In some diamond weaves every pick has duplicates, and such weaves demand the best weavers and the best condition of the weft fork.

Twills with Heavy and Light Lifts.—This kind of weave is demonstrated at Fig. 282, the pegging particulars being lift black. In picks one and two, 6 shafts are lifted out of 16, but on the third pick, 12 shafts are raised. The average lift for the three picks is 8 shafts, which gives equal quantities of warp and weft on the face. The shafts, however, have to be set different to a regular twill. The shafts are set for the bottom shed when the heavy lift takes place, for this pulls the bottom shed higher, and when set, should be a little above the shuttle race. If set lower, too much friction is placed on the threads by the shuttle race, and " buttons " are formed on the front shed. They may even form when the shafts are well set. On their first appearance, a " sweeper " is made of coarse listing. The

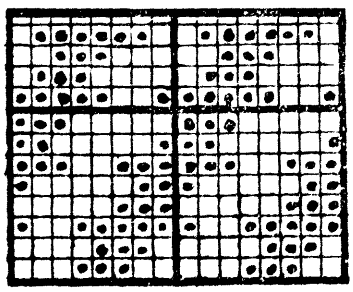


Fig. 282.

length of it has to be longer than between the swords. The "sweeper" is tied level to the swords, and when the crank is at its front centre, it should be slack enough to reach the first lot of healds. This method collects some of the loose fibres, and sweeps others to the floor.

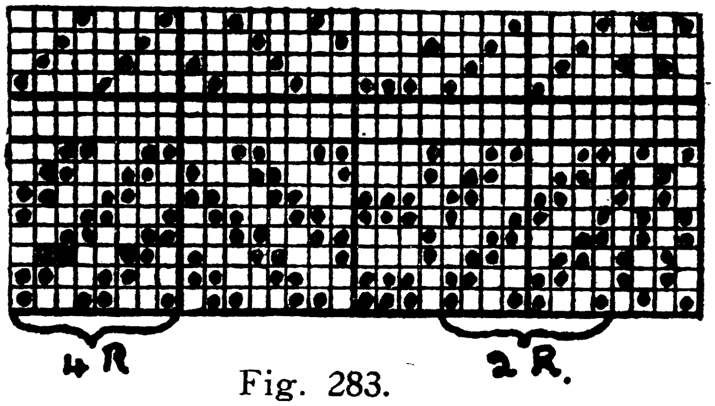


Fig. 283.
Fancy Design and Draft.

Fancy Drafts.—In the fancy woollen and worsted trade. elaborate patterns are woven on few shafts by drafting and pegging.

Fig. 283 is one of the simpler examples. Though on 4 shafts, it takes 64 threads to complete the pattern. The upper section is the draft, and the first four threads on the left of the design is the pegging plan. To keep such cloths free from mistakes there are 5 safeguards. (1) A draft with special threads marked is supplied the weaver. (2) A few inches of contrasting weft is woven at the beginning of the cloth, and a full pattern is sent to the designer to pass. (3) Before proceeding, every shaft is separately lifted and all the threads examined. (4) The lease rods are left in the back shed. (5) A full width strip of cloth from the starting of weaving is sent to the designer.

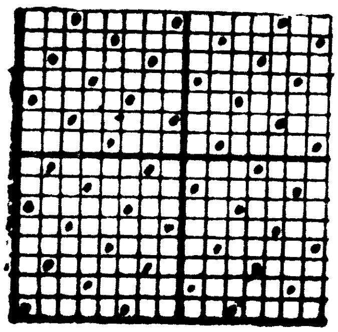


Fig. 284.

Sateens.—For woollens, the 5 and 8 shaft sateens are the most popular, but for worsteds and linings, a larger number of shafts are used. A 5 shaft is woven face up, but the 8 shaft and those above are produced back up as missing threads are quicker seen. Care has to be taken to see the lags are pegged right.

Fig. 284 is the 5 shaft sateen back up and twilled to right, the pegging particulars being lift black. There are two other matters. (1) There must be a fresh setting of the back rail. If only one shaft out of 5 is now lifted, the most tension would be on the raised threads. It is transferred to the bulk of the warp by elevating the back rail. (2) The selvedge threads must be woven different to the warp or the cloth would roll badly when liberated. The selvedges are woven on separate shafts weaving 3 up and 2 down on one shaft and 2 up and 3 down on the other, along with a catch thread. To make the selvedge rather slacker and for 10 lags, it would be pegged 3 and 3, and then 2 and 2.

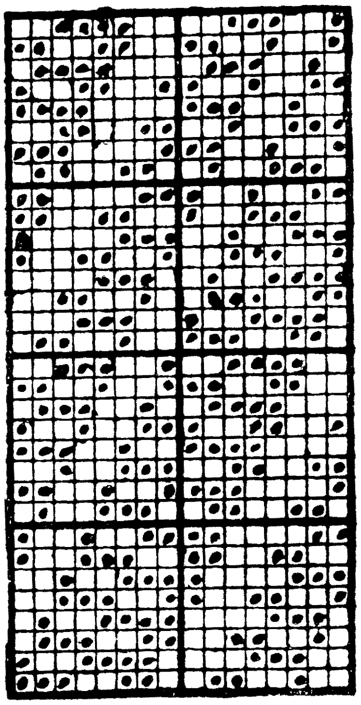


Fig. 285.
Whipcord Design.

Whipcords.—These are constructed from two ordinary twills on the same number of threads and picks. One design is placed on all the odd picks, and the other on all the even ones. The ordinary twills give an angle of 45 degrees, but the new design is at least 65 degrees, and entirely different in appearance. In Fig. 285, the strong twills are made with weft, and the low angled cross twills with warp. Such goods require good tension in weaving, and the cloth is given a clear cut finish to show the weave. The selvedges are woven on separate shafts. Design 286 is a contrast, the pegging particulars being lift black.

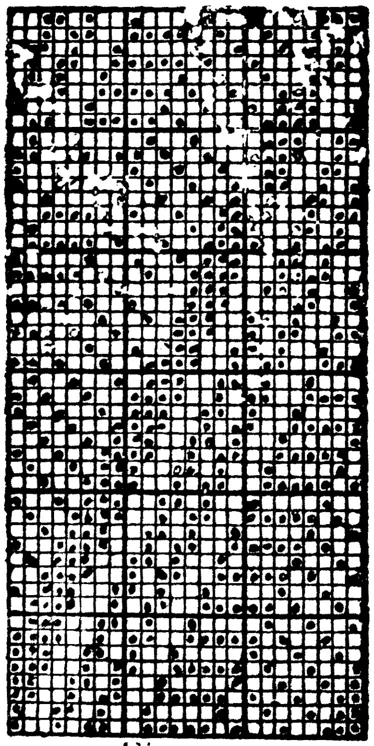


Fig. 286.
Whipcord Design.

Corkscrew.—These are difficult to weave owing to the amount of plain weave the weft way of the design. The 13 shaft corkscrew is at Fig. 287. The warp has to be well tensioned, good brushes in the shuttles, and the shed as early timed as possible. The tension required involves well gripping temples.

Cloths Backed with Weft.—This is the cheapest way of adding weight to the cloth. Fig. 288 is for one face and one backing pick, and requires two boxes at either end of the loom. The pegging particulars are lift white. The face cloth is 2 and 2 twill and the backing cloth 3 and 1 twill. In making the box lags, it is better for the weaver if the backing weft runs into the top box where she stands, and goes into the second box at the other end of the loom. As the backing weft runs off quicker, and may be black or brown, it is much better observed. Face lifts and face picks must go together on the cylinders.

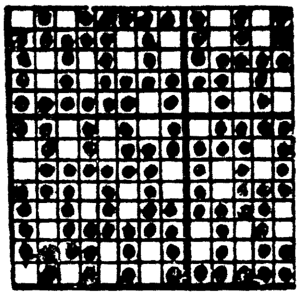


Fig. 287.
13 Shaft Corkscrew.

Cloths Backed with Warp.—These are of better quality than those backed with weft, and may be woven in a plain dobby loom, but it must be fitted to take two beams. Fig. 289 has a 13 shaft corkscrew face and a 13 shaft sateen back. In addition to the points about corkscrew weaving already given, there is the additional one about the respective speeds of the two beams. Having ascertained how much quicker the face takes up in comparison to the backing, a yard is measured from the fell of the cloth, and both warps are then marked at that spot. The difference between the two is then measured just before the marks are woven into the cloth, and the weights adjusted if not correct. This has to be carried out daily.

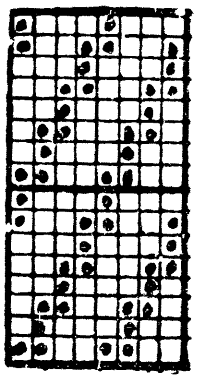


Fig. 288.

Double Cloths.—One of the simplest and lightest makes is given at Fig. 290. The face weave is 2 and 2 twill, and the backing weave plain, and stitched to the face in 8 end sateen order.

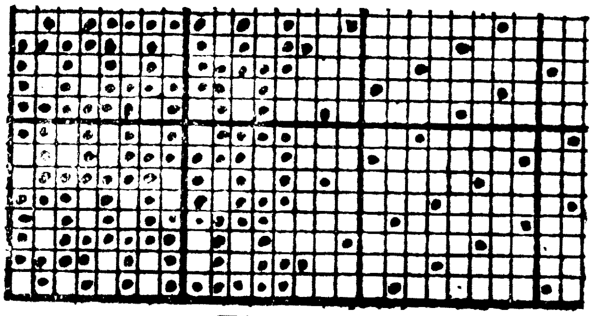


Fig. 289.
Cloth Backed with Warp.

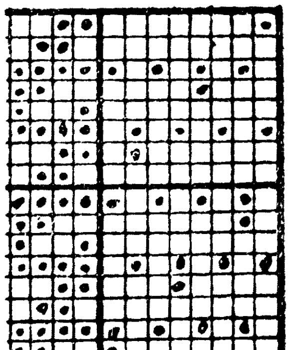


Fig. 290.
Peg Plan.

There are 2 threads face to 1 backing, and the same with the weft. Two beams are required though both have the same counts of warp. The weft is woollen and the pegging particulars are lift black. There are two settings of the shed, one being for the face weave and the other for the backing. The respective speeds of the beams have to receive attention. If woven in a negative dobby, the spring on the under motion may be weaker for the backing shafts. Fig. 291 is a proper double cloth, both cloths being 2 and 2 twill, the back one being stitched to the face in 8 end sateen order. The backing warp has to be longer than the face.

The face lift and the backing have to receive separate attention in adjusting the shafts.

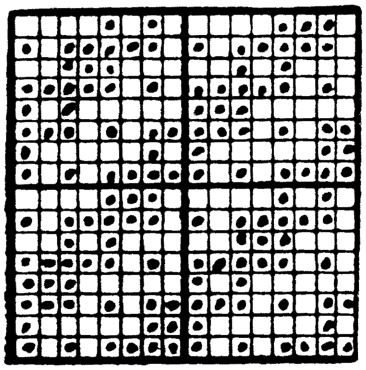
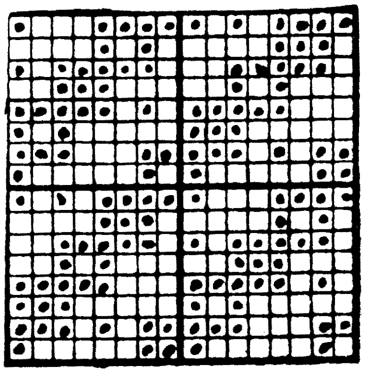



Fig. 291. Double Cloths. Fig. 292.

Fig. 292 is the same double cloth design as the previous one with the exception of stitching. In this, it is stitched backing to face, and face to backing in 8 end sateen order, and as the taking up is the same on each thread, only one warp beam need be used. Fig. 293 is a fancy twilled double cloth, for both face and backing weave are 3 up, 2 down,

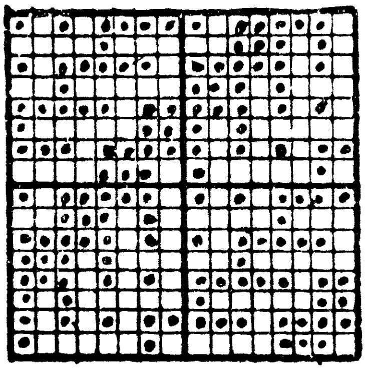
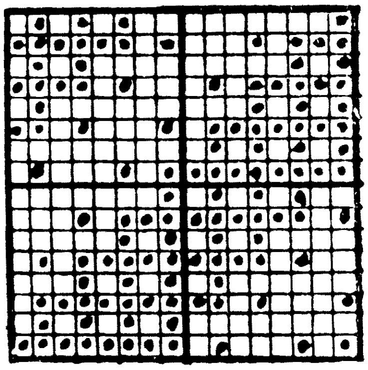



Fig. 293. Double Cloths. Fig. 294.

1 up, 2 down. The back is stitched to the face in twill order. If any fault is suspected in any backing cloth, the piece is slackened out, taken off the temple and examined.

Fig. 294 is the 4 and 4 twill weave for face and back, the face being stitched to the back in twill order, and is the longer warp.

FAULTS IN WOOLLEN AND WORSTED FABRICS.

The chief faults found in fabrics are herewith placed in alphabetical order.

Barry Places.

(1) *Cheese Bars.*—Made during warping by variation of tension in winding cheeses. Rectified during beaming by hand braking.

(2) *Letting-off Bars.*—Fig. 295 gives the negative chain

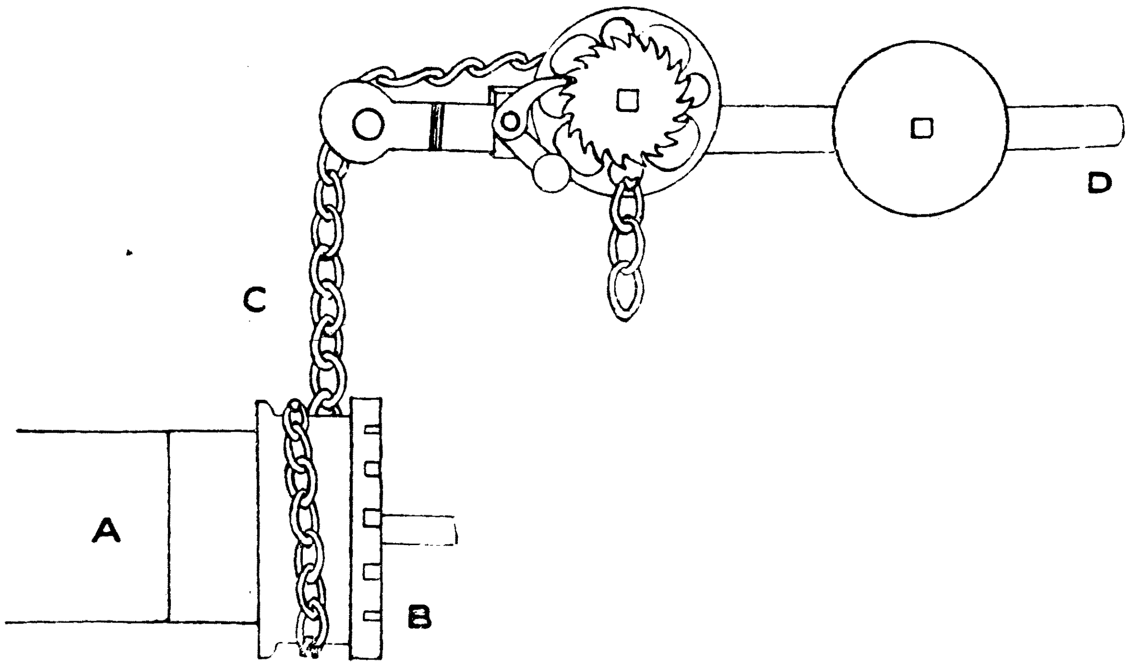


Fig. 295.
Negative Let-off Motion.

arrangement. Bars are made across the cloth by the erratic movement of pulley B. A good system is to clean chain C and pulley before beginning to weave last piece. It is then sprinkled with powdered graphite. Hattersley's positive motion is shown at Fig. 296. By wearing, catch C becomes shorter and blunter and misses cogs on wheel F. The catch is sharpened and the catch stud lowered a little. Back catch for reversing. At Fig. 297 the double catches used on the Dobcross loom are shown. To avoid barriness, one catch E must be half a cog ahead of the other on wheel F.

(3) *Mixed Weft Bars.*—Usually mixed by carelessness in spinning department. Should be discovered by different appearance in cloth, both colour, and angle of twill, and, when thicker counts, by the bumping of piece.

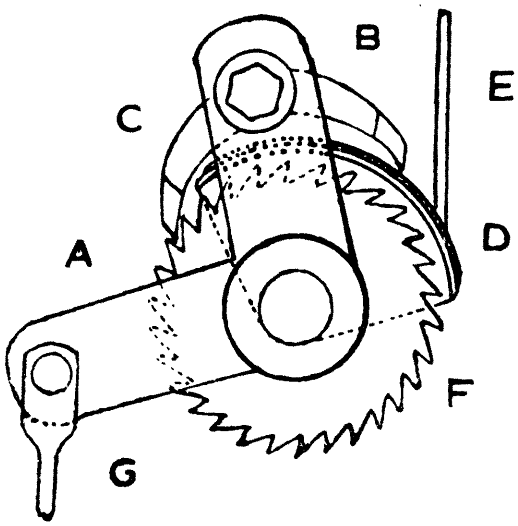


Fig. 296.
Hattersley's Let-off and Reversing Motion.

(4) *Taking-up Bars.*—In the negative motion (Fig. 110), by the slipping of pulling catch C, and also the holding catches not being half a cog distance between as at G and H.

In positive take-up (Fig. 268), when the leverage given to the pushing catch G is inadequate the chief offender is

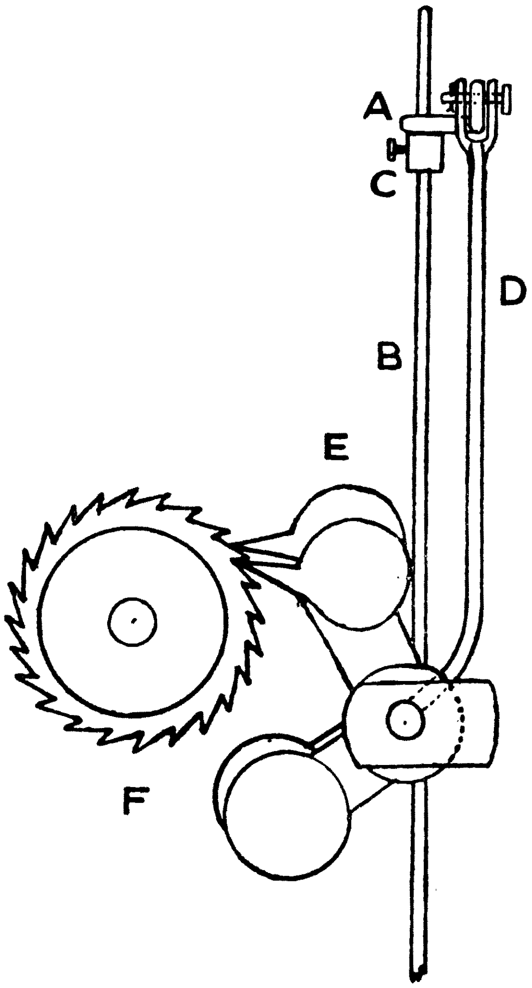


Fig. 297.
Dobcross Let-off Motion.

the holding catch L when it fails to hold the ratchet wheel F. This wheel is sometimes defective owing to snipped cogs. Occasionally the swan-neck casting drops, and has to be packed with metal.

(5) *Setting-up Bars.*—Due to inaccurate adjustment of cloth and warp after combing out by weaver. Light weight goods more subject than heavy cloth.

Bright Picks.—Confined to rayon. Made by stretching the yarn abnormally. A knot on the weft, a sunk shuttle spindle, or catching inside the shuttle, or a rough shuttle eye.

Broken Threads.

(1) *Healds.*—Defective eyes, or ravelled yarn on cotton and worsted healds. Broken mail eyes in wire healds.

(2) *Shed.*—When too large, too much tension placed on warp. When crank at back centre, shuttle top front to just clear top shed. In negative dobby loom, all bottom shafts to have double row of hooks for spring levers, for straight heald movement.

When on bottom shed, warp to barely touch shuttle race. Timing of shed to be in accord with warp and weave.

(3) *Shuttles.*—Rough shuttles to be rubbed with fine sand paper. Shuttle spindles to be held firmly, and loose tips fixed, or shuttle dispensed with. Cracked cross grained shuttles to be removed.

(4) *Sley.*—Rusty sleys treated with paraffin. Broken reeds removed and replaced with others obtained from end of same sley. Choked sley rubbed with paraffin and cleaned with carding. All sleys tested with straight edge for good running of shuttle.

(5) *Temple.*—Worn cap to be replaced as there is insufficient grip at selvedge. Must be set to miss shuttle race and reed.

(6) *Twist.*—Hard twisted yarns wear grooves on shuttle race if not well set by shafts. Such grooves snaps threads by their knots. Race filed when waiting for warp. Soft warps lack twist. Improved for weaving by damp cloth behind healds. Another improvement by mixing 1 lb. of white sugar with 1 gallon of clean water. It acts on warp like sizing, and no ill effects after. Hard twisted yarns working with others with less twist, best separated by broad heald shaft behind healds.

(7) *Warps.*—Over-dried warps sprayed with paraffin. Moderately fibrous warps treated with French chalk. Tender warps improved by Stephenson's wax rollers placed on warp beam. When finer threads in warp break, and are all on one or two shafts, those shafts decreased in lift, and the others increased. In looms having two beam racks, the beam to be placed in bottom rack to give longer length. Overdrafting responsible also for very weak warps.

Cracks.

These made by slack crank arms. On setting loom in motion, less momentum by going part. If cottering at limit, outer bushes can be packed with hard leather.

Curls.

Made by rebounding shuttle. By shed not being properly timed. Fig. 298 shows range of shed timing from

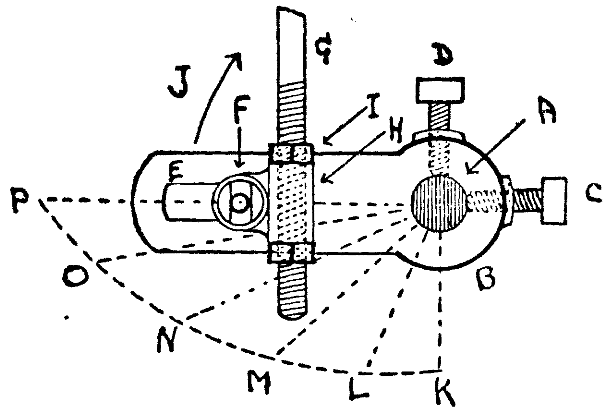


Fig. 298.
Timing Shed for Negative Dobby.

K to P, which is equal to quarter revolution of crank. It is altered by setscrews C and D on lever B fixed to shaft A. Weaves like corkscrews are timed early, and plain weaves timed late.

(1) *Shuttle.*—Smooth yarns like worsted and mohair, when the former is two-fold need a good Botany brush, but silk and rayon must have the shuttles fur lined. There should be the same drag on weft in both shuttles.

(2) *Warp.*—Worst kind for making curls is one close setted and somewhat fibrous. A double sley where back reed is opposite front gap is the most effective remedy. (*See* Fig. 2).

(3) *Weave.*—The one most subject to curls is the corkscrew owing to the amount of plain weave the weft way of the design. It must be timed early, be well tensioned, and shuttles have good brushes.

(4) *Weft Fork.*—Centre weft fork makes curls down cloth when cut on slide catches tippler. The prongs have to be bent down a little to hold prongs up longer.

Cockled Pieces.

Due to pressure between breast and cloth beams. A fruitful source is additional roller above taking-up roller. It accumulates waste, or strips of cloth or canvas, which exert pressure on passing cloth. The weft fork rod bracket is sometimes too low. Pieces are also cockled by unbalanced weaves. Another source is a marked variation in the amount of twist in the yarns.

Dirty Weft.

It may be soiled by long storage. Pieces destined for creams and delicate colours have to be kept exceptionally clean. Warp and cloth during weaving protected with brown paper. Picker spindles oiled with feather, and buffers made from dry leather. When weft soiled in box, usually the most effective cure is to make the inner box front slope at the same angle as the shuttle front. (*See* Fig. 193).

Double Picks.—Many due to carelessness of spinners. Others caused by too tender weft which breaks and catches on again. Some are left in the fabric by the weaver. Another source is the defects in the weft cutting mechanism on the Northrop loom. It has been greatly improved in this respect. (*See* Fig. 275, Page 370).

Fleaks.—Made by a number of threads being held together in front shed. They are easily formed in quick changing weaves such as plains and reps. Broken worsted and cotton healds are also responsible.

Heavy Pieces.—One cause is when yarns are spun to rather lower counts. The warp cannot well be altered, but picks can be reduced. Pieces woven beyond felling mark are checked by measurement.

Knotty Places.—A fresh setting in the warping creel may be spread out and cause little inconvenience. Heald traps cause many knots to be made, but a shuttle trap is about the worst. A weak shuttle spring, stop rod mounting frog, a bobbin left behind box swell and finger, a split shuttle, frogs not set further forward for tender warp, are causes for warp damage. Knotty places on worsted warps weave in much better with the aid of soap and water.

Light Weight Pieces.—By warp, weft, or both spun to higher counts. The use of wrong change wheel, or weight dropping off warp beam lever. Too short in length. Last piece of double cloths lack weight when speeds of warp beams not properly regulated, and length of warp left on one beam.

Loom Stains.—Droppings from top jacks. Surplus oil from shuttle springs. Excess oil from picker spindles. Marks from overlooker's hands in service under loom. Oil from shuttle guard and weft fork.

Misplaced Threads.—Every warp with fancy draft and a number of colours should have lease rods left in back shed. and weaver be supplied with heald plan. Threads on every shaft to be examined at commencement of weaving, and every dinner hour. A commencing strip of first piece to be supplied designer for examination. Reversed threads best discovered by weaving a strip of contrasting coloured weft.

Mixed Weft.—May be detected by vigilant weaver. If thicker, angle of twill higher, and piece will bump more. If smaller, the piece thinner, and angle of twill lower. If woven in grey, usually a difference of appearance in cloth. Mixed weft due to carelessness. All dropped bobbins best handed to weft man. Bobbins of old and new lot can be woven pick and pick if one set are marked.

Pegs Out.—All wooden pegs to be tested for firmness before being placed on loom, especially so in hot weather. Long length of lags, elaborate designs, and double and treble cloths need greatest care. No litter to be left underneath lags.

Picks Missing.

Three picks out of a piece is the usual allowance. Missing picks may be caused by:—

(1) *Weft.*—Soft spun to be woven with small brushes in shuttle, or none at all. Shuttle spindle level, and picking not too violent so weft coils not disturbed.

(2) *Shuttle.*—Cracked ones to be sandpapered or removed. Spindle block to be firmly held, and eye whole. Brush centrally grooved. Long worsted pirns checked by double length of loom cord. Cotton cops to be aided by side brushes, and rayon by fur. Shuttles held by turned up shelves to have frayed thrum pegged on shuttle front.

(3) *Box Side.*—Blow holes filed and polished. Plain box front to be made same angle as shuttle front. No nipping of shuttle in box.

(4) *Weft Fork.*—(*See* chapter on this subject).

Picking Over.—One cause erratic run of shuttle. Delivery wrong, or shuttle hump-backed, or reed not straight. Late picking by strap not right length, or picking nose too weak, or shell having slipped. In horizontal pickers, underside wears and delivery alters. (*See* Figs. 195-196).

Reed Marks.—Bent by careless shuttling, loose tips, and bumps by bobbins. Reed marks showing for lack of cover in fabrics like poplins. Cover obtained by increasing height of back rail, so loose fibres on weft thrown more on cloth face.

Selvedge Faults.

(1) *By Beam Flange.*—Beam flange insecure and slips. Fallen threads can be lifted out and held back by looped wire. If not, a flanged bobbin weighted containing number of ends required takes their place.

(2) *Temple.*—A worn cap to be replaced, and temple set far forward without touching sley. Selvedge hook and weight may assist.

(3) *Shuttle.*—Brushes to be equal in drag. (*See* Fig. 191). Spindles to be level. Edges of tips next to wood become prominent and have to be ground down. Loose tips difficult to fasten. Liquid glue and pieces of tapering cane give good results, the thickest part being at bottom.

(4) *Sley.*—A rusty end rubbed with paraffin. A rough one rubbed with pumice stone and smoothed off with fine emery cloth.

Setting Up Places.—Made by weaver after lagging back or combing out. On restarting, the fell of cloth too far off or too near sley. The greater care needed with light weight fabrics.

Stitching.

Stitching and picking over much the same, but the latter is larger.

(1) *Warp Stitch.*—When bottom band too slack or has broken, or bottom jack wire or rod worn through. Surplus healds of worsted or cotton at end of shafts are better bunched.

(2) *Weft Stitch.*—When shuttle passes over warp. One cause is wrong timing of shed. (*See* Fig. 298). In some looms, 2-and-2 twill has to be timed late, and same for 3-and-3 twill. Shedding rod G to be at or near its top or bottom centre when crank at back centre. If this be correct, then power of pick to be increased on opposite side of loom to where stitches made. Stitching caused by fibrous nature of warp which must be timed early and be false

reeded. The way the shed is being formed can be viewed from end of loom. Such warps aided by good tension. New worsted healds with soft warp are aided by French chalk on healds, or oil, but not both.

Temple Marks.—Made by the pins forcing threads a little further apart. In medium and heavy woollen and worsted cloths, such marks disappear during scouring. In light weight fabrics they are apt to show. All rings but two are taken off, wrapped in brown paper and carefully stored. Two rings sufficient to grip cloth. (*Refer* Figs. 213-4). Temple marks made by cutting is done by pins on rings, which, by blows or pressure, become hooked. Bent ends to be nipped off by sley pliers, or other rings fitted.

Torn Places.—Most responsible agent is perforated roller. Tacks holding tin should have round heads, and all torn tin removed. When cloth torn at beginning, caused by ends of knots being left too long, which are gripped by perforated roller, or by knots being too bulky to pass between roller and smoother.

When pieces pulled off cloth beam, any projections on shuttle guard should be covered. Pieces split at temple due to tender weft and cloth contraction. It is overcome by longer temples having more rings.

Traps.—Two kinds. Heald traps and shuttle traps. (*See* Knotty places). The end of the stop rod tongue as well as the cut on the frog may have become rounded off, these being at A and B respectively in Fig. 299. When so worn, the tongue will mount the frog when the shuttle is in the shed, and tear out top shed for length of shuttle. After filing, the loom is set on to observe effect, and further filing takes place if not efficient. Box swell finger at C which has to be kept in close contact with head of swell for maximum lift to stop rod tongue. Cross grained shuttles subject to sudden splitting, and ought to be set apart for plainest work.

A trap caused by peg dropping out of box lags, when shuttle tries to enter box already occupied.

Uneven Colours.

(1) *Hopsacks.*—When these woven in colours, and some of colours in single threads, the line of colour in cloth appears and disappears by threads rolling round each other. This is prevented by using double sley. (*See* Fig. 2). A different pegging will sometimes improve matters.

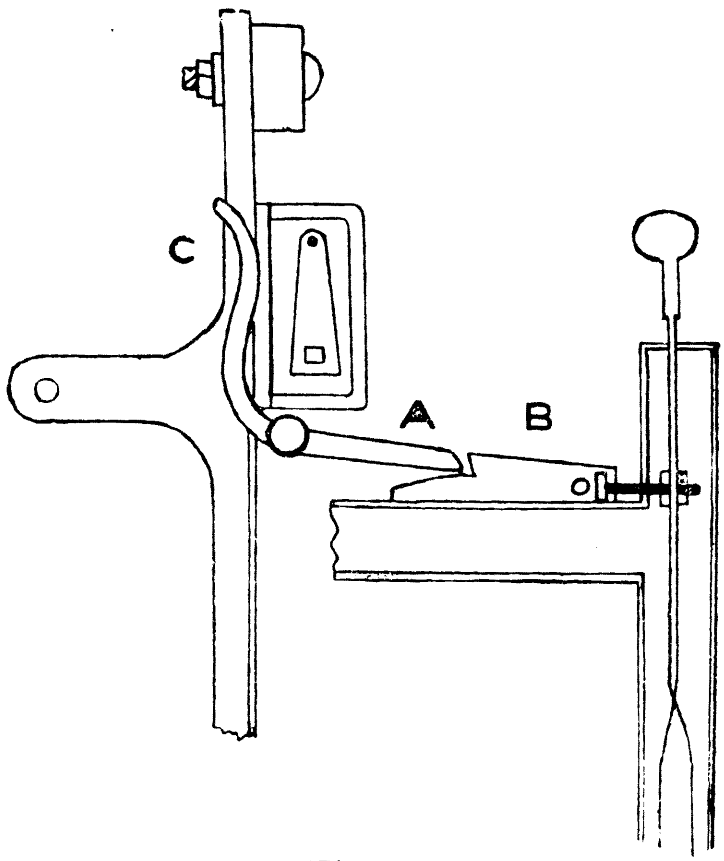


Fig. 299.
Stop Rod Tongue and Frog.

(2) *Silk Stripes.*—Both woollens and worsteds enriched by introduction of silk threads. These appear and disappear in cloth by clinging to adjacent threads. The defect rectified by use of fine false reed wires placed at either side of silk threads.

Variation in Twist.—Mixed lots of same counts and quality cause faulty fabrics by variation of twists per inch. Twist varies in all threads, but average difference of 6 to 8 per cent. in two-fold yarns will show in finished cloth. In single twist it will take a variation of 20 per cent. to make obvious difference in cloth.

Wrong Lifts.

Made when shaft remains up that ought to be down, and when shaft remains down that ought to be up. Usually at irregular intervals. Quickest way to find mischief is to lag back to faulty pick, or comb out to it. Wrong lift examined by overlooker who notes which shaft, and which draw bar forward. A short needle does not lift catch high enough to be held by holding bar. A too long needle prevents catch being properly seized by draw bar and may slip off. Worn cylinder ends gives too much freedom to lags, and one peg actuates two feelers. A wrong set, or wrong timed cylinder detrimental to cloth. Deduction from observed facts is invaluable for a quick and effective remedy.

Wrong Colours.—Misplaced colours as bad as misplaced threads. As correction, a comparison to be made by weaver between one where broken threads taken up, and one with none down, or with plan. Shafts should be lifted separately for checking and correction. Weavers defective in colour sense are better on plain work.

Wrong Patterns.

No wrong starting places should ever be made with 2 and 2 twill, but when checks made by cuts with same weave is another matter. Lags should be marked. Some diamond designs made from the same weave have duplicate picks in one repeat. If any pick is different, it becomes a guide for weaver. This lag is marked, and its lift chalked on loom. When combing out has to be done, the loom is turned over until marked lag is operating. The combing out goes beyond defective place until pick is open. In this way wrong patterns are eliminated. (*Refer* Fig. 280-81).

In 2 and 2 twill weave as example with checking and overchecking, the size of check made on back of weaver's card as guide. It is done the same way with plain weave. A few picks more, or less, is easily made. In all colour and weave effects the relation between shaft and box lags must be maintained all through. One lag difference spoils pattern and piece. The first shaft lag and first box lag are marked as guide if ever lags become undone.

P.S. Many of the foregoing points equally apply to cotton cloths, and to silk and rayon fabrics.

USEFUL MODIFICATIONS IN WEAVING.

No weaving overlooker can ever hope to make the most of the materials to be woven if he adopts stereotyped methods, for adaptability is the fine art of loom management. What is constantly needed is the application of new ideas to new conditions. This subject is presented in alphabetical order.

Bumping Pieces.

When a cloth begins to bump at the commencement of weaving, it suggests a lack of balance between the letting off and taking up motion. If the change wheel G (Fig. **300**) is the correct one, then more weight is added to the warp beam lever. At A is the taking up shaft, with B the smooth

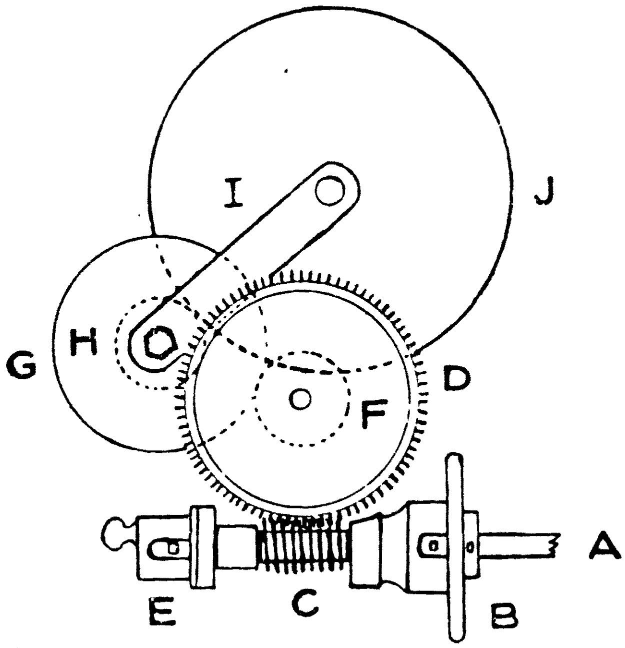


Fig. 300.
Hattersley Positive Worm Take-up Motion.

wheel used by the weaver. At C is the worm, and D the worm wheel, with F the standard worm wheel pinion. Into the latter meshes the change wheel G, the change wheel pinion being at H. The last two are at the end of the straight lever I, the fulcrum being the end of the take-up roller shaft which carries the wheel J, and is turned by wheel H. The change and pinion wheels are adjusted by a curved and slotted casting. A piece may begin to bump when weaving a new supply of weft. The weft may be wrong, or be spun a little thicker. If the latter, another wheel to take the cloth up a little quicker is put on the loom. Calculations have little to do with the qualities of warp and weft, but they sometimes need loom adjustments.

In looms served with a negative taking up motion like Fig. 109, the spring is tightened up when the cloth bumps, but pick counting should follow. If, however, any of the catches are not doing their work properly, they have to receive attention.

In the ratchet take up motion, Fig. 268, the fault chiefly lies with the holding catch.

For heavy cloth, and in plain tappet and dobby looms, the warp is passed over two back rails to relieve weight on the warp beam levers by increasing friction. Figs. 27-28.

Checking of Shuttles.

Shuttles cannot work in harmony with each other unless they be as near as possible, the same size, weight, and grain. This is fully explained in the chapter on "Shuttles."

In some wefting plans, the checking shuttle has to remain in the box for a considerable time. By the beating up of the weft, and the force of picking, the shuttle is apt to slide back from its picking position. On coming into play, the loom bangs off for the lack of the full force of the pick being applied to the shuttle. One way of assisting the shuttle to retain its proper position is outlined at Fig. 301.

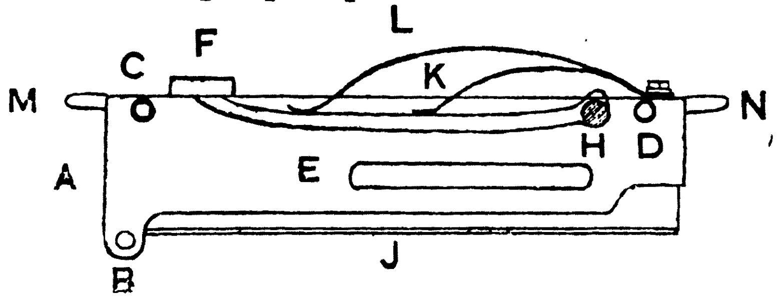


Fig. 301.
Preventing Shuttle Slipping Back.

At A is the entrance to the box, and B the front pin that braces up that end of the box. At C and D are the rods that pass through all the shelves and tighten them up. The front of the swell is at E, and F the head of it which is used by the box swell finger. The pin holding the swell is at H, and the shelf of the box at J. The ordinary spring that applies pressure to the swell is at K, and the ends of the box which fit into slides are at M and N. What is now done is to weaken the spring K, and add the longer spring L, the two applying about the same pressure to the swell as before. The pressure from the swell is now more towards the back end of the shuttle. Should this not prove as effective as desired, the box shelf is knocked in a little at its inner end, and a little out at the outer end to give more pressure at the back end of the shuttle.

False Reed.

Loose fibres on warp, hinder the making of a clear shed and cause stitching. Greater tension and earlier timing give improvements, but a false reed is the most effective remedy. This is given at Fig. 302. It is composed of small circular wires at F which are about 9 inches long with a loop at the top, and are threaded on wire. The false reed wires are each placed between every third group of threads except the selvedges, but between every two groups for very fibrous warps. The long wire is then fixed by wire staples to the back of the hand rail A, and the bottom of all the wires are held by the heald shaft J being placed in looped wires like H behind the going part. The sley is at B, the going part at C, the holding plate at D, and the stop rod at E.

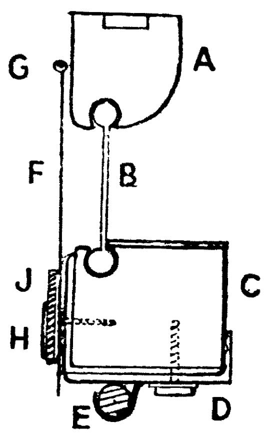


Fig. 302.
False Reed.

Lease Rods.

These considerably assist in the good weaving of some kinds of warp and weave. Fig. 303 shows two methods. In the top section, A is the warp beam and B the warp. At C is the back rail and D the back shed. The two heald shafts are at E, and the going part at F. The cloth is at G and the breast beam at H. The back shed extends from the back of the healds to the back rail. By curtailing it, more tension is placed on the threads, and is done in two ways.

(1) In the second section at I, the first thread is made to pass underneath the first rod nearest the healds, and over the second. The second thread is the opposite way. In ordinary one and one leasing for looming or twisting, the ordinary lease rods are used, and are an excellent guide to the weaver for fancy drafts and intricate warping plans. For poplins, there is another method. The front shafts make a less shed than the back ones, and to equalize the tension, a thick and thin lease rod are employed.

The thick rod is about three times thicker than the other, and is inserted when the second and fourth shafts are down. The thin rod is put through the warp in front of the other when the first and third shafts are down.

(2) The other arrangement is in the third section at J. One rod is placed at the top of the warp, and the other

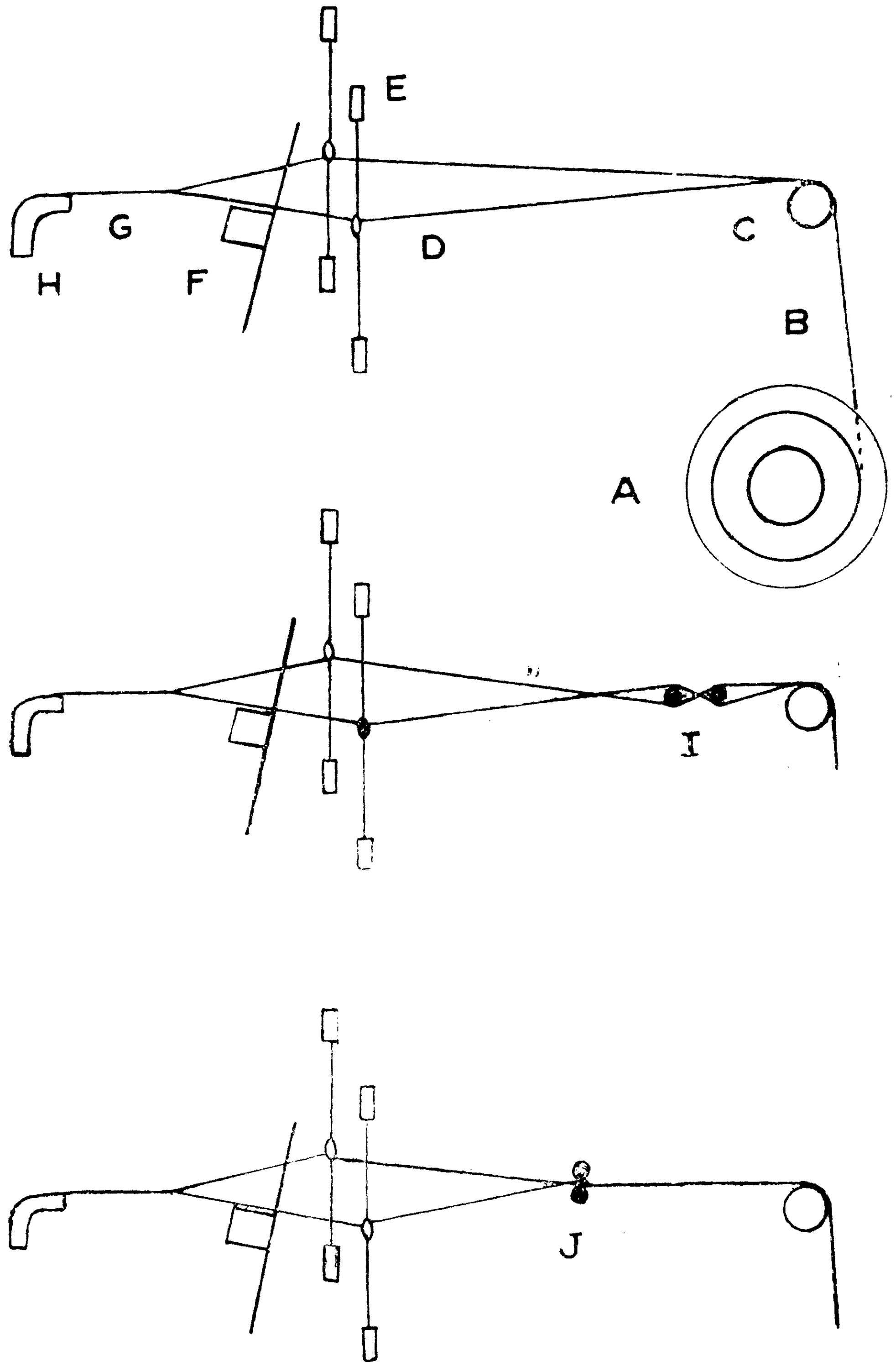


Fig. 303.
Arrangement of Lease Rods.

underneath, and the two are then lashed together. The nearer they are fixed to the back shaft, and the greater is the tension on the threads.

Picking.

The effective length of a picking stick for looms up to about 90 inch reed space may be obtained by dividing the reed space by 2.25. A 45 inch reed space would need $45 \div 2.25 = 20$ inches long picking stick. This rule does not apply for very wide looms. The usual standing place of a picking stick for the overpick is for the strap end to point over the outer box end. This is modified by the condition of the picking nose. If the nose is new and very strong, the stick is placed a cog further back, but when the cone is worn, it has to be set one or two cogs forward. When the velocity of the shuttle is so rapid that the bump of the shuttle against the picker disturbs the coils of weft, it may be modified by rounding off the nose, but this may be possibly avoided by using an old nose not too far worn. In the underpick of the Dobcross type, the picking shoe may be set a quarter inch back, but in the older type, the stirrup strap is elevated.

Barker's Patent Picking Mechanism.

A new style of picking stick and brackets has been invented by Messrs. David Barker of Crampton Street, Bradford, and are at Fig. 304. The side view is on the left. The picking shaft A and the toothed bracket B are of ordinary make. The upper bracket C is thicker at the front than back, and tilts the stick F upward, and prevents it injuring the tops of the healds and shafts. The upper surface

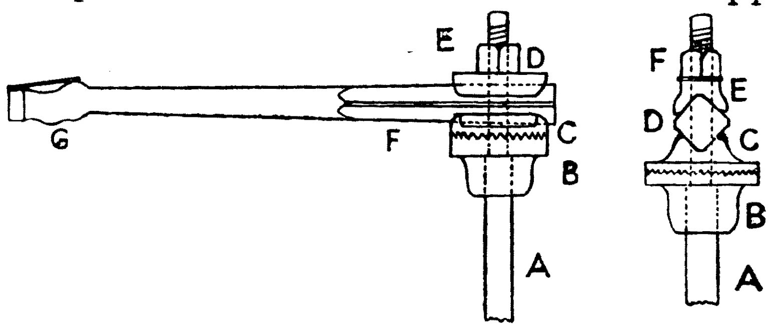


Fig. 304.
Barker's Patent Picking Mechanism.

of C is **V**-shaped, and so is the under side of the cap D, to fit with the new style picking stick G. The brackets and stick are held together by the strong nut E.

The shape of the stick and brackets are better seen by the diagram on the right. The bracket C and the cap E coincide with the shape of the stick D, which has the appearance of being tilted on one corner. The stick, however, is made $\frac{1}{8}$ larger in the diagonal than the brackets, and is held by its sides instead of top and bottom. If ever found necessary, a larger stick may be used with the same brackets. This method leaves more wood, and the stick is stronger. The cap E is malleable, and admits of a powerful grip. It is estimated that the cost of picking sticks is halved, and considerable time is saved as none come loose. The picking sticks are made in different lengths, and existing picking arrangements may be altered to this one at comparatively small cost.

The Hattersley Clutch Pick.—There are two kinds, one being outlined at Fig. 259. The latest type has only one leg, but the other has two, and it is the latter that is here mentioned. After being in use for some time, the bottom of the legs on their picking side become rounded off, and cause the clutch to be forced upward, and the loom misses picking. As a temporary measure, the grip of the legs may be increased by the application of some gritty substance. As soon as opportunity offers, the picking sides *only* of the bottom casting which receives the legs are chipped with a cross-cut chisel. This is best done when the loom is empty.

Dobcross Pick.—When more pick is needed in the older type, the thick strap on the picking stick is lowered, but if this be at its limit, then the picking shoe is brought forward a quarter inch. This shoe movement is the same for the whip pick when the picking strap is the right length, and there is a lack of power. The old style is at Fig. 260, and the new at Fig. 97.

Selvedges.

Warp and weft faced cloths have selvedges woven on separate shafts, and a different weave to the cloth. The 2 and 2 is selected for coarser work, and the 3 and 3 for the finer, and a catch thread is needed for both.

When hopsack weaves are woven in a tappet loom, the working of a catch thread is a little ingenious, and as it is only for one selvedge, it is fit up the farthest away from the tappets. A half moon lever is fixed in position on the 5th cross bar, and a long strap with a punched hole in to take the catch ends is held at the bottom by a closed spiral spring. Another half moon on the same bar is secured by a band to a spring lever on the under motion. This spring pulls down the half moon levers when the tappet allows. The wing screw on the rat tail is secured by band. An extra tappet is fixed to make the half moons move when the others are stationary.

Temples.

When experience decides that temple marks will show in the finished product, all the rings but two are taken off the barrel. On the other hand, when pieces with tender weft are split at the inner end of the temple, a longer temple with more rings is what is required. A piece contracts most at the selvedges, and least at the centre. (*Refer* Figs. 213-14).

Under Motion.

The spring power on the under motion has to be modified in two ways. (1) For selvedge shafts, and also for a light warp backing when being woven to a face cloth.

The springs may be changed for weaker ones, or the links may be placed on the inner hooks of the spring levers. (2) For heavier work, the spring power has to be increased, the most ready way being to attach two spring levers to one shaft. If the number of shafts will not admit it, then either stronger springs are used, or an additional spring is fixed to the inside links. (*See* Figs 210-211).

When a spring motion has been in service some time, the fulcrum pins become worn, and the levers lean towards the front of the loom. This is quite against good working. If the fulcrum pin has not been previously turned, it may be moved half way round by a pair of footprints.

Weft Fork.

When the weft is pulled off at an excessive speed, it becomes so slack, that the prongs of a centre weft fork are not held up long enough. The slide then holds the tippler, and the loom stops. This is known as "slipping off." For woollen weft, shuttle brushes are seldom used, but when slipping off recurs, small ones are inserted. If there is a good distance between the nose of the bobbin and the first brake pin, an extra pin nearer the nose is useful. (*See* chapter on weft forks).

When small cotton cops are substituted for worsted or woollen weft in the same shuttles, and the spindles are changed, small side brushes are inserted on that side of the shuttle to meet the weft as it comes from the bottom of the cop. They are better when tapered upward. Though prongs are highly tempered, they have sometimes to be bent downward a little to keep the prongs up longer.

Condition of Warp.

Warps are placed in the loom in all kinds of condition, and the overlooker has to find the appropriate method of dealing with them. Here are hints, the defects of warp being alphabetically arranged.

Brittle.—When over carbonised, or dried too long, or not had time to get its natural regain, it feels parched and rough, and when weaving, the threads snap and fly to the back rail. The warp may be sprayed with paraffin, and a chalk mark placed to the back limit of spraying. When the mark reaches the healds, the back shed is sprayed again.

Different Diameters.—Warp that is less or larger than the ground warp ought to be wound on a separate roller. When warped on the same beam, ways have to be found of making them weave. If the threads constantly breaking are smaller, and on particular shafts, those shafts may be reduced in size of shed, and the others increased to take the most tension. (*See* Figs. 271 to 274).

Fibrous.—French chalk placed in a dry cleaning cloth and shaken over the opened out heald shafts is an improvement. A handier and cleaner method is to use wax rollers. These are made by Messrs. Stephenson's, of Bradford. The firm have manufactured them for over 70 years, and can be highly recommended. These rollers are placed on top of the warp beam and against the unwinding warp. The friction leaves a double deposit of wax on the threads, for they are rubbed by the warp on the beam, and by the sheet of warp being pulled off. The latest development is abreast of the times. Instead of the ordinary wooden centre for the wax to adhere to, they are made with a hollow brass tube as the centre. This kind is specially made for the weaving of rayon. In ordering, the width of the warp is given, and the inner width of the loom. The rod is then placed in open brackets on the loom sides and above the warp, so the roller may rest upon it, and be turned by it. It is placed near the back rail where the warp is most solid, and is no hindrance to the weaver.

When fibres are longer, the warp is false reeded (Fig. **302**).

Overcrowded Warp.—All warps are not calculated on a scientific basis. Some are much too overcrowded, and if the yarn is somewhat on the fibrous side, innumerable curls appear on the fabric. Additional weight and early timing make little difference. The effective remedy is a double sley where the back reeds are directly opposite the gaps in the front ones. (*See* Fig. 2).

Overcrowded Picks.—The most obvious way is to reduce the picks per inch, but this would alter the weight of the cloth.

Woollen weft is often steamed, or wetted through with a pump, and the surplus water whizzed off. Early timing of the shed traps the weft, and gets the picks in easier.

Rolling Threads.—This takes place when one set of threads has more twist than others. These should be separated in the back shed by a broad heald shaft. If found that particular threads coil round each other, these may be separated if on different shafts, and a rod split in half, smoothed, and placed between the series. The edge of the rod acts as a blunt knife to sever the early making of buttons.

Sized.—Most woollen warps are sized, but some are over sized. They are difficult to open out and weave. A moderately damp cloth placed behind the healds is of assistance, but must be removed a little before ceasing work in the evening.

For ordinary woollen warps **36** lbs. of glue is boiled in **40** gallons of water.

When white sizing takes the place of glue, the quantity of size is 8 lbs. to 40 gallons of water.

For single twist worsteds, there is 56 lbs. of glue to 40 gallons of water.

Soft Spun.—When too little twist is inserted, many threads are drawn in two, and leave a trail of fibres at either end. A damp cloth placed on the warp behind the healds is helpful, and when 1 lb. of white sugar is mixed with a gallon of clean water and applied to the cloth, it acts in the same way as sizing.

Tender.—It may be owing to poor materials for woollen, or overdrafting for worsteds. Shed reduction and speed reduction assist the weaving, and so does a reduction in picks per inch. Wax rollers reduce friction. (*See* Fibrous Warp).

Unions.—In some worsted warps, union threads are introduced for striping effects. The union is one thread worsted and one thread cotton twisted together. These threads, though both white, have to be made distinguishable from the others, or results may be serious. The unions are treated with a fugitive tint which is easily removed when the cloth is scoured. Particular pains has to be taken at the commencement of weaving to see that all the threads are correct.

Uneven Lifts.—There is not much difficulty in weaving warps with uneven lifts in a positive dobby loom, but the light lift should be set when the shuttle is sent to the end of the loom where the weaver stands. The loom is much easier to stop.

In negative dobbies, the pull of the spring under motion has to be reckoned with.

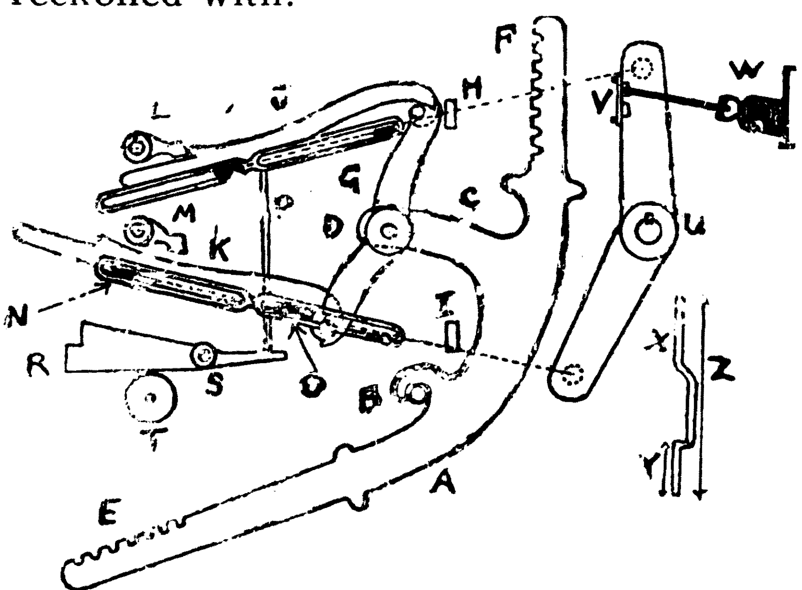


Fig. 305.
Hattersley's Positive " V " Dobby Used as a Negative.

In the diagram, A is the main lever and B its fulcrum. At C is the centre arm with its button for balk G. At H and I are the rests for the balk, and the pair of catches at J and K. Then L and M are the holding bars, and N the draw bar. At O is the pushing back bar, and P the needle. The feeler is at R and S, and T the cylinder.

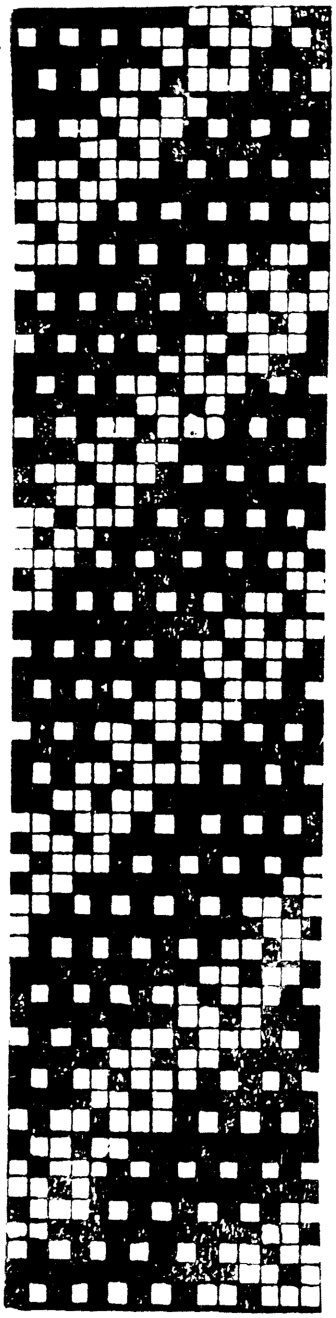


Fig. 306.
Design with
Uneven Lifts.

Uneven Lifts.

In a 15 shaft weave as a concrete case, the design is produced at Fig. 306. It is a fancy twill on 15 threads and 60 picks. It is a misleading design if not carefully followed. It is really a pick and pick effect, where the first pick moves one step forward on the 3rd pick, and takes two steps forward on the 5th pick. This move is maintained all through. The second pick has a heavy lift of 12 shafts; and on the 4th pick, takes two steps forward, and has 11 shafts to lift.

The first three threads are for the selvedge.

On the heavy lift the loom would hardly turn over, but on making the shed, the loom could not be stopped on that pick. What was needed was a balance of the weight. This is seen at Fig. 305. A strong spring W was attached to the upper arm of the main lever V, this part being forward when the light lift took place. The spring was 33 inches long to impart power and have good recovery. When the lever was full back it was given a stretch of one inch. When the heavy lift was about to take place, the spring was well stretched, and thus materially helped the heavy lift. The loom was then able to be stopped as exactly on one lift as the other.

Condition of Weft.

Bulky.—When weft is too bulky for the shuttles, the inside of the shuttles have to be scraped to make more room.

Curly.—When new spun, and a length is let slack, long curls are sometimes made 7 to 9 inches long. This may leave snarls in the cloth. The weft has not had time to condition. It is improved by being exposed to the atmosphere all night, and also by a wet cloth being placed over the bobbin board.

Dropping.—Weft that drops in the shuttle box is liable to be soiled or cut. For boxes in plain looms, the box feet can be packed with cardboard to make the box side slope like the front of the shuttle. (*See* Fig. 193).

Hard Twist.—This has to be well braked in the shuttle by good brushes. When the weft is made to pass through the bottom of the shuttle, and then out at the side, the ordinary brush may be made a double one by being left on the shuttle bottom, but trimmed. (*See* Figs 191-2).

Opposite Twist.—Some fabrics are woven 2 picks right twist and 2 picks left twist with the aid of a mixing box. These wefts have to be prevented from getting entangled with each other. Many of these fabrics are woven in a circular box loom, and in front of the box, a piece of swansdown is glued to the shuttle race to keep the two wefts separate. In a drop box loom there are several ways, one of the most effective being shown at Fig. 307.

Sloughed.—Soft wound weft sloughs off the bobbin by the force of the pick. For right hand shuttles, the power of the pick has to be reduced on the right side of the loom, and the checking to receive attention. Expanding spindles are very effective in prevention, but somewhat costly. A much less costly way is shown at Fig. 278 and shuttle one, in Fig. 191.

Smooth.—When weft is bulky and smooth like worsted weft wound on universal winder bobbins, it "flies" out of the shuttle. To stop it, two strands of loom cord are looped round the shuttle brake pin, and pegged down beyond the block of the shuttle. For drop boxes with open shelves, a frayed thrum is pegged on the shuttle front just below the groove.

Silk and rayon have fur lined shuttles, the fur being of a particular kind suitable for the yarn.

Slubby.—Such weft is made by faulty carding. If there are brushes in the shuttle, they have to be cut down, or the weft would be frequently broken.

Tender.—Single twist worsted only requires very small brushes to aid the weft fork, or none at all. Twitty woollen weft has very thin places, and all unnecessary pull on the weft has to be removed.

Uneven.—The most uneven weft is woollen, and to make the most level pieces, three shuttles are used, and a pick taken from each in rotation. The pegs in the box lags must all be firm, for the three shuttles only engage two boxes on either hand. Uneven weft of any kind may be woven the same way with beneficial results.

Weft Trails.—These are difficult to avoid with newly spun, or hard twisted, or opposite twisted weft. To prevent them, a weft divider may be made as represented at Fig. **307**, this being used on the Dobcross loom, the principle holding good for other looms. The wrought iron casting A is made with the long slot B and the shaft C. On the shaft are placed the spindle whorls D, E, F, and held on by locknuts H, and divided by washers G. This casting is for the front of the

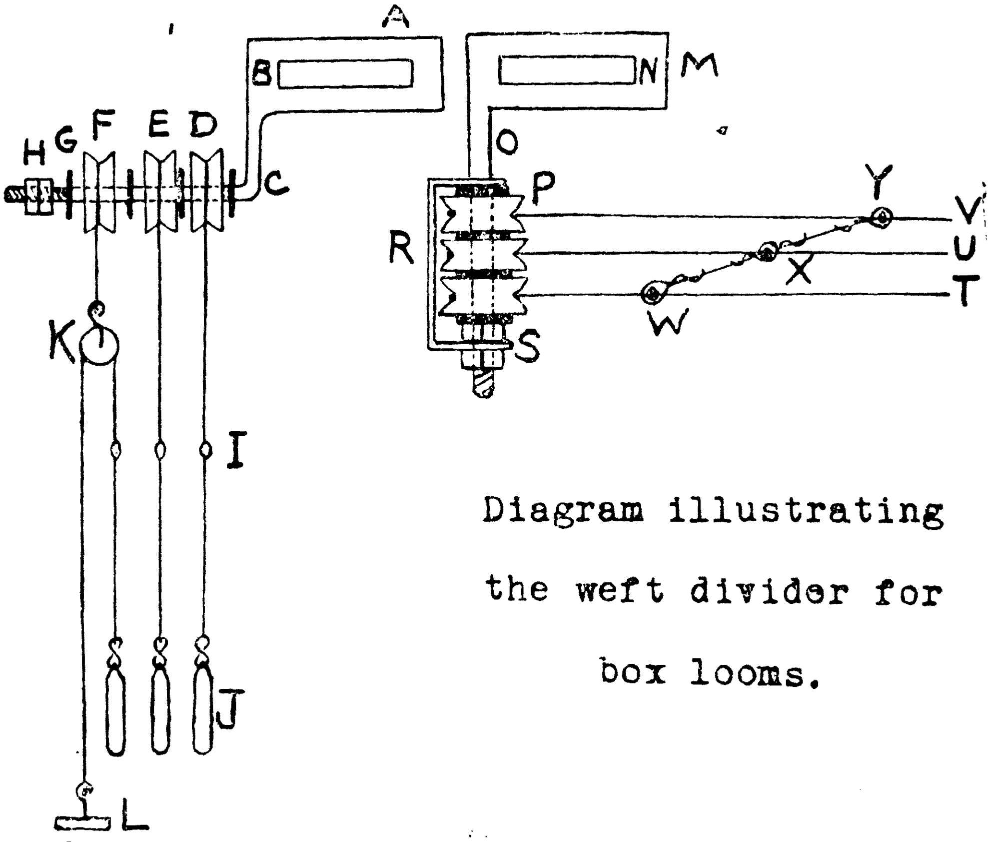


Fig. 307.
Weft Divider Motion. (To Prevent Weft Trails).

loom. The healds are at I and the weights at J. The casting M with its slot N is placed on the back top rail. It has the straight shaft O, which holds the three spindle whorls P, held on by locknuts S. At R is the cord guide which keeps the cords on their respective whorls when slack. These cords are at T, U, and V. The band T is connected to U by the looped band between the knots W and X, and the bands U and V are connected with a similar looped band holding the knots X and Y. These connections are essential, for when the 3rd box is lifted, the band T which is used for the second box must also be raised. When the 4th box is brought into service then the bands for the 2nd and 3rd boxes are retained for the top shed. Common blue cotton used for headings is employed for dividing threads. It is wound on to a flanged roving bobbin and weighted. There are 6 threads, two for each heald. After passing through the mail eyes and sley it is wound on to the perforated roller, or cloth beam. Special provision is made for the 4th box, for the lifting of it is by levers controlling the 2nd and 3rd boxes. When these levers have the same lifting band attached, there is then only half leverage. The full leverage is obtained by the lever band being attached to the whorl K, and the heald band being fastened to the floor. The dividing threads are placed midway between the selvedge and the entrance to the box.

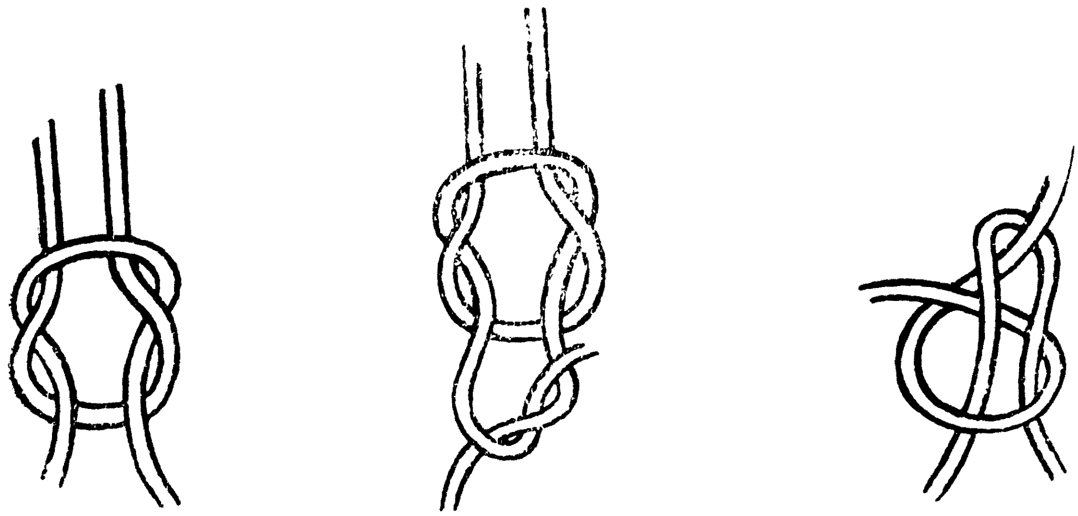


Fig. 307a.
Weavers' Knots.
Left, Woollen Knot; Centre, Worsted Knot; Right, Knot for Fine Worsted, Mercerised Cotton, Silk, Rayon and Nylon.

ADAPTABILITY OF DESIGNS.

In planning a design for cloth, there are essential considerations such as the yarns to be employed, the type, weight, weave, colour, cost, and finish, the claims of fashion, and the season. Except for novelties, there are fairly well defined limits in most classes of fabrics, beyond which lie the perils of poor construction.

The fancy flannel trade relies much more on colour than weave. For low woollens, it is seldom there are more floats than three. In high-class woollens, there are floats of 6 for buckskins, and 7 for sateens, and in rare cases 9 for fancy twills.

Yarns made from low crossbred wool follow much the same course as for low woollens, but Botany yarns which may run from 30's to 80's counts are elegible for the most elaborate designs. In cotton goods, the range of designs are much more limited than for the better class worsteds, but there are weaves like honeycombs, reversible effects in table cloths, embossed figures in quiltings, and others that are peculiar to the trade. Silk goods yield the largest variety of weaves in one fabric, and give the widest scope of any textile yarn for the ingenuity of the designer in colour and decorative art.

The strength and elasticity of the threads makes possible the use of plain weave, twills and sateens, and long floats in the same fabric, and without ill effects afterwards.

Mohair stripes and figures have also a class of their own in the dress goods trade, and though it is impossible to spin to such fine counts as either worsted or silk, the special lustre which the fibres possess is made the most use of in both ordinary weaves, ornamental fabrics, and gauze.

Hairline Stripes and Checks.—As mentioned, the simplest weaves are employed in the woollen trade on account of the fibrous nature of the yarns, the thickness of the threads, and the nap finish given to many of the cloths. The introduction of colour makes a wonderful difference. This is evident in the making of hairlines. A hairline running in the direction of the warp is made by the same colour of weft covering its own colour of warp. A hairline in the direction of the weft is formed by the same colour of warp covering its own colour of weft.

A change from one to the other may be made by altering the weave, or altering the footing of warp or weft.

Fig. 308 is plain weave, but when warped 1 black, 1 white, and wefted 1 white, 1 black, it produces the warp hairlines at Fig. 309. When the same warping and weaving plans are employed, but the wefting is 1 black, 1 white, it creates the weft hairline at Fig. 310. To give both effects as demonstrated at Fig. 311, plain weave is placed on design paper for

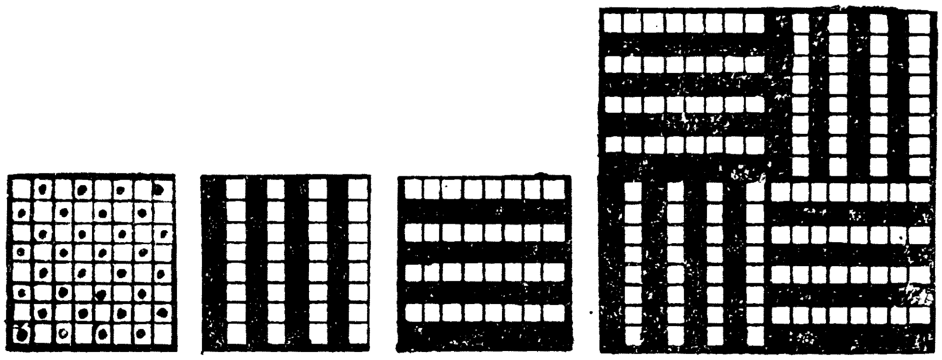


Fig. 308. Fig. 309. Fig. 310. Fig. 311.
Plain Weave Hairlines.

16 threads and picks. It is then warped 1 black, 1 white to 4 repeats, and 1 white, 1 black to 4 repeats. The wefting is 1 white, 1 black to 4 repeats, and 1 black, 1 white to 4 repeats. The pegging particulars are lift black.

For a three coloured hairline, a weave is essential that is complete on 3 threads and picks. This is the 2 and 1 twill as at Fig. 312 and the pegging particulars in this series is lift white. Fig. 312 is a warp twill and Fig. 314 a weft twill.

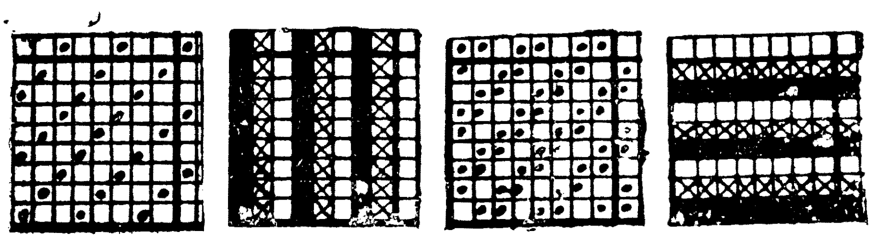
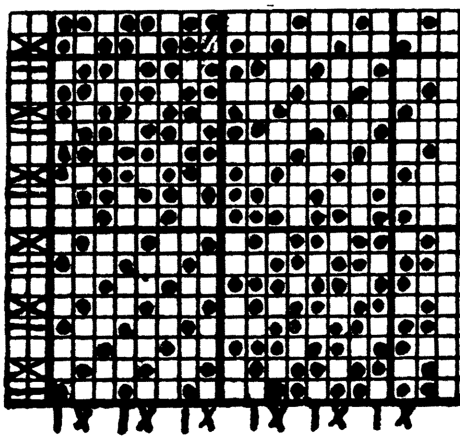


Fig. 312. Fig. 313. Fig. 314. Fig. 315.
2 and 1 Twill Hairlines.

When the first of these is warped, 1 black, 1 grey, 1 white, and wefted the same, it produces Fig. 313. With the same warping and wefting plans, but with the 2 and 1 twill at Fig. 314, the hairline then goes the weft way of the cloth as at Fig. 315. If a check with these two weaves is required, they are combined as at Fig. 316. From a weave point of view, there are objectionable floats of 3 in both warp and weft, but this is the only way a complete hairline on every thread and pick can be built.

If the warp twill be placed as given, and the weft twill reversed, then both sections of vertical hairlines are correct, but only the grey hairline is preserved weft way, the other two lines being mixtures. In the first, the correct weave is sacrificed for the sake of complete hairlines, but in the



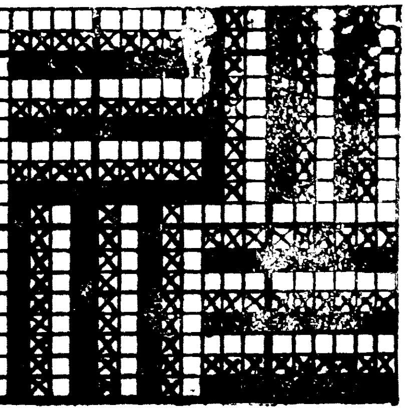


Fig. 316. Fig. 317.
Three Coloured Checked Hairline.

second, it is the hairlines that are broken for the sake of a correct weave. The full three lined check is given at Fig. 317. A four-lined check hairline is woven with the **3 and 1** and the **1** and **3** twill.

Elaborate Hairline.—This is presented at Fig. 318. The weave is plain weave throughout, but it is the warping and wefting plans that make the elaboration so effective. It is warped and wefted:—

White 1 1 — 1 — 1 — 1 — 2
Black 1 — 2 — 1 — 2 — 2 =40 threads.
5R 3R 5R 2R

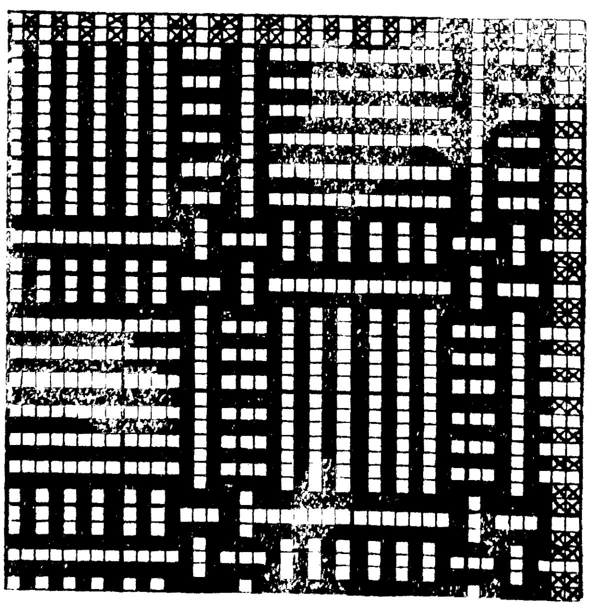


Fig. 318.
Fancy Checked Hairline with Plain Weave.

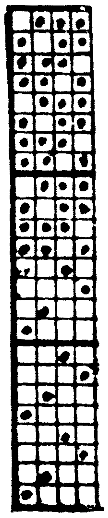


Fig. 319.

Four End Sateen Check.—A pretty effect for ladies' wear is made with design at Fig. **319.** This is the 4 end sateen in warp and weft with 12 picks of either. It may be constructed from 28 skein warp and weft and with 36 threads and picks per inch. It is warped 12 threads light brown, 12 threads white, and woven on 4 shafts with white weft.

Crèpe Weave in Check Order.—One of the neatest crêpe weaves is given at Fig. **320.** It is the 2 and 2 warp and weft ribs placed in check formation on 4 threads and 4 picks. It is an all-over effect, and when woven in the grey, can be dyed any fashionable colour.

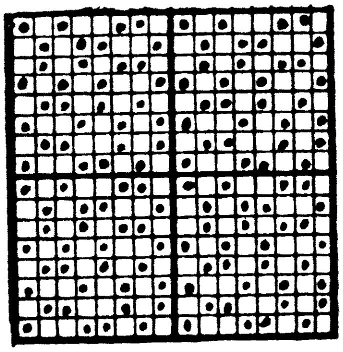


Fig. 320.

Crossed Diagonal.—The 2 and 2 twill is one of the most serviceable weaves, and a very pleasant diversion from an ordinary reversible effect is at Fig. 321. As it cannot be drafted, it is woven on 24 shafts. The floats of three are modified by weaving it with fine yarns.

Diamond Patterns.—Fig. **322** is another fruitful way in which the 2 and 2 twill is employed. Though on 24 threads and picks, it may be woven on 6 shafts. The weaver has

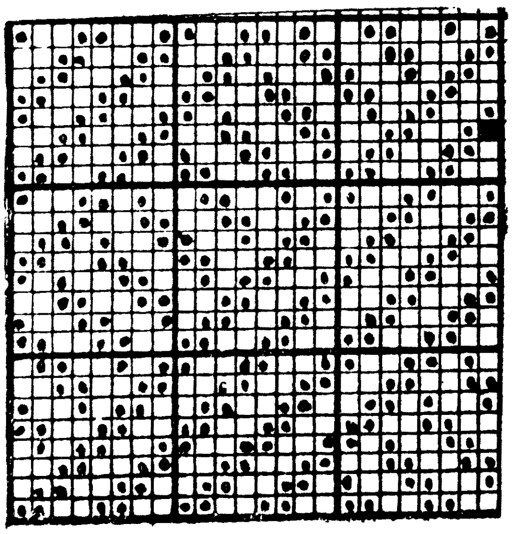


Fig. 321. Crossed Diagonal.

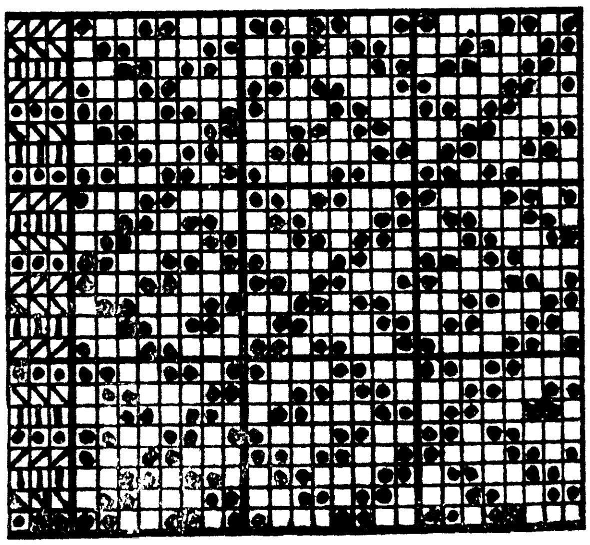


Fig. 322. Diamond Pattern with Duplicate Picks.

to be wary not to make broken patterns, for each pick is duplicated 6 times in one repeat. The marking of a lag in this case is of no use. The duplicated picks are marked the same way on the left of the design.

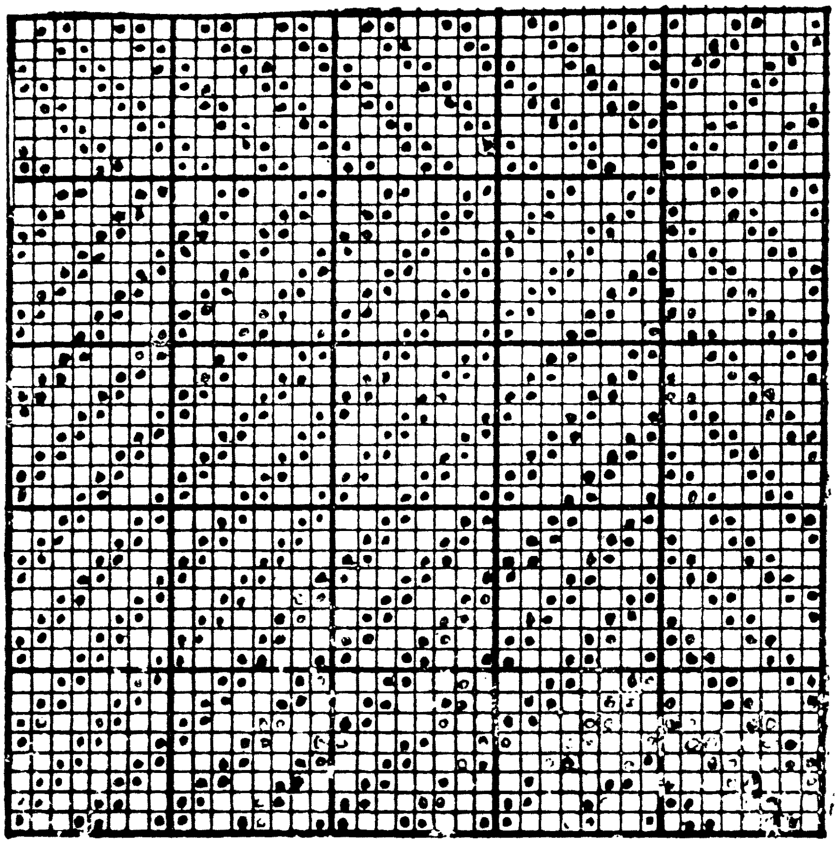
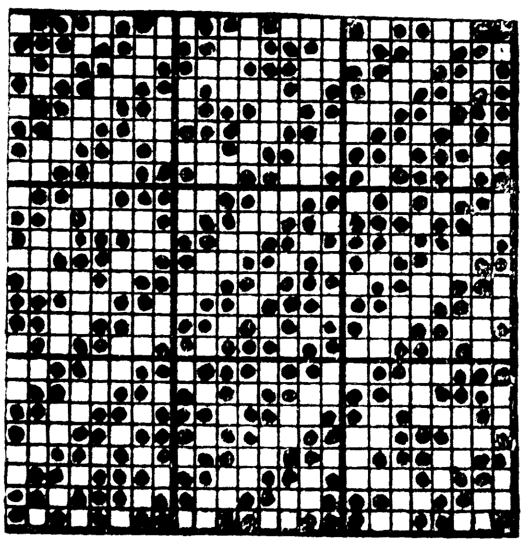


Fig. 323. 2 and 2 Twill Check.

Two and Two Twill Check.—Fig. 323 is the 2 and 2 twill placed in check formation. Though on 40 threads and picks, it can be drafted on 4 shafts, but 8 will weave better. The pegging plan is the first 4 threads and 40 picks. The weaver's special care is to have the large section correct, for it is an all too easy matter to have 4 picks too little or too many. The exact size is marked on the back of the weaver's card for comparison.

Figured Diagonals.—The design submitted at Fig. 324 has four twills, two of the spaces between being figured.



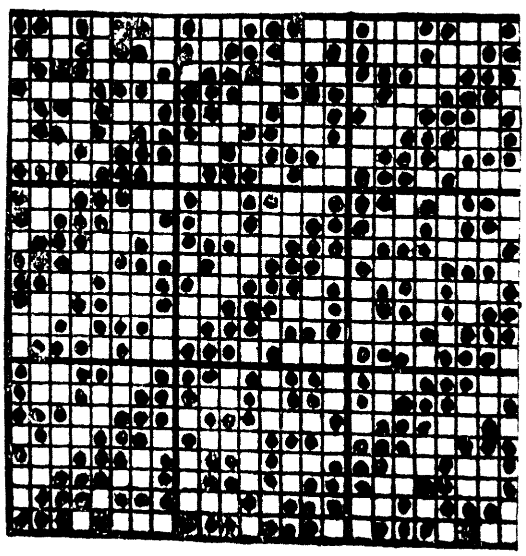


Fig. 324. Figured Twills. Fig. 325.

Both figures occupy the same number of small squares. The design is complete on 24 threads and picks.

Fig. 325 is a further example with bolder twills and different figures.

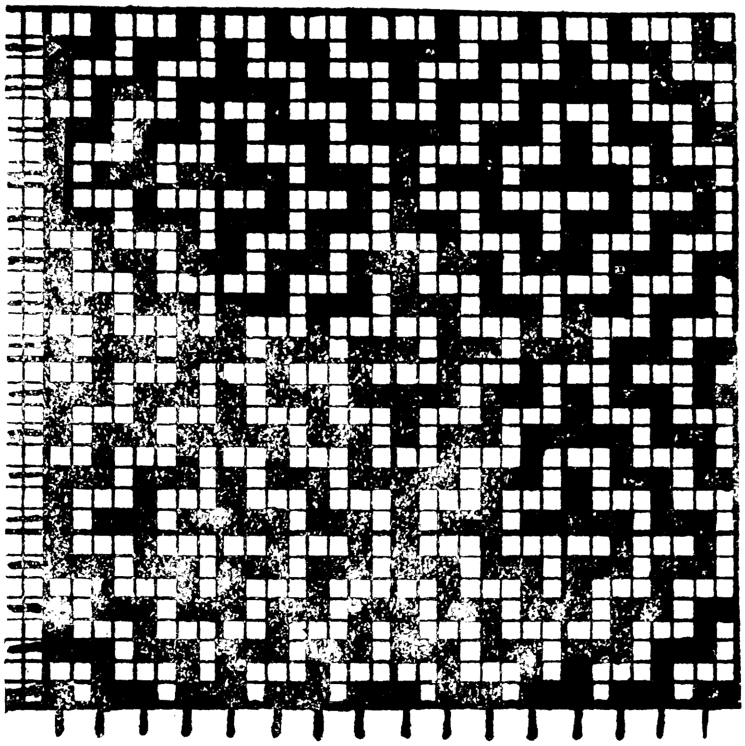


Fig. 326. The Maze Pattern.

Colour and Weave Effects.

Simple weaves are beautified by colours. The " Maze " pattern at Fig. 326 is a striking example. It is composed entirely of the 2 and 2 twill, 8 threads and picks twilling to right, and the same number twilling to left. It is warped and wefted 1 dark 1 light and complete on 16 threads and picks. It can only be made as demonstrated in this way. If dots mean warp, then the first two threads in the left hand corner are dotted, and all the rest can then follow on the lines mentioned. Misplaced threads have to be avoided, for the colour sequence may be right, but the draft may be wrong.

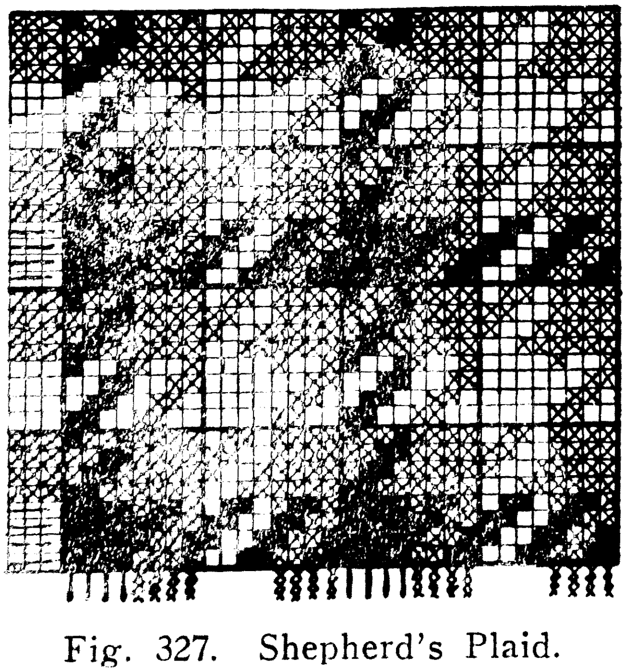


Fig. 327. Shepherd's Plaid.

Shepherd's Plaid.—This is an excellent contrast to the Maze pattern. It is given at Fig. 327, and is woven in black, grey, and white, the grey section forming the ground. All the figures are of equal shape, and the twills, are solid in all three colours. This simple weave is the basis of the fascinating Glenurquhart check and the Gun Club variety.

Eight Shaft Step Pattern.—The weave to give the effect at Fig. 328 is shown on the left of it. The pattern is

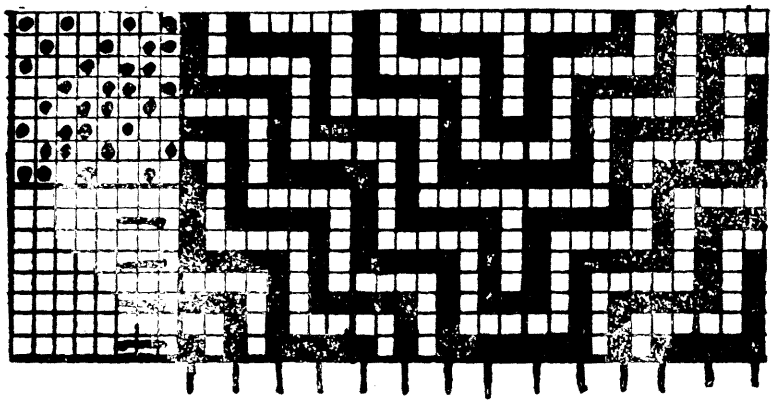
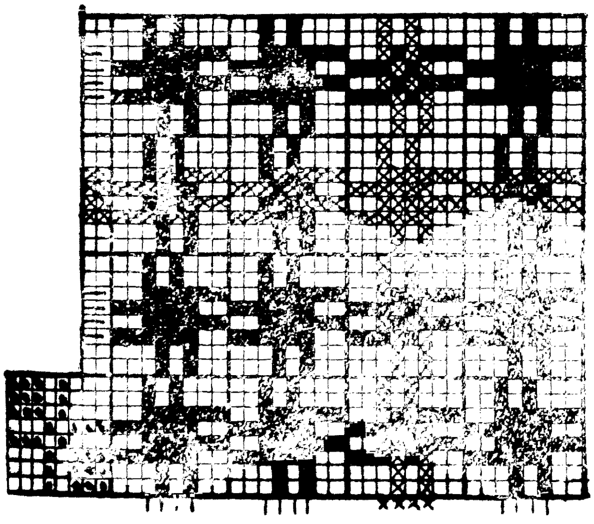


Fig. 328. Fancy Step Pattern.

worked out on 32 threads and 16 picks, but by drafting, 8 shafts will suffice.

All-over Figures.—The Design at Fig. 329 produces an all-over figure effect, and is worked out in three colours which produces five different effects. The design used is an adaptation of the 3 and 3 hopsack weave.



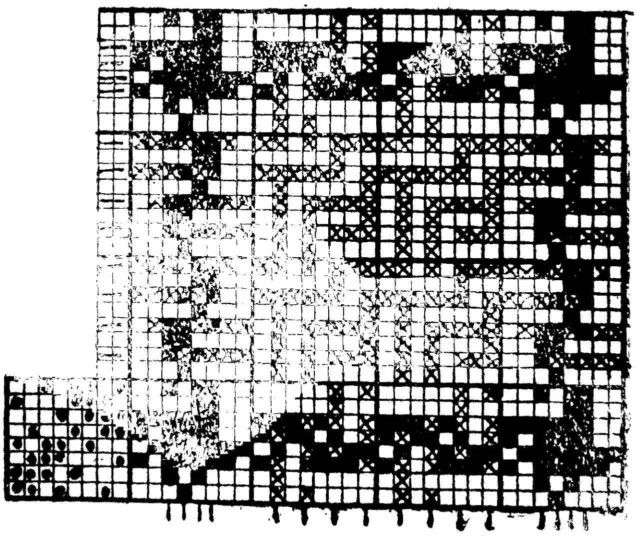
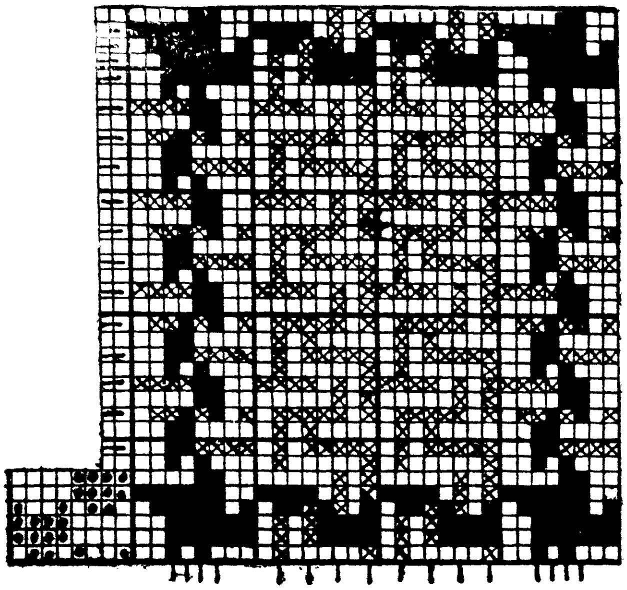


Fig. 329. Colour and Weave Effects. Fig. 330.

Novelty Colour and Weave Effects.

By using a weave of broken character, some remarkable effects in colour and weave are developed. Here are three. In Fig. 330, the interior is somewhat after the Grecian pattern, and when woven in low counts of worsted, develop very well. The design is a small spot figure which leans in alternate directions. Another example is at Fig. 331, and



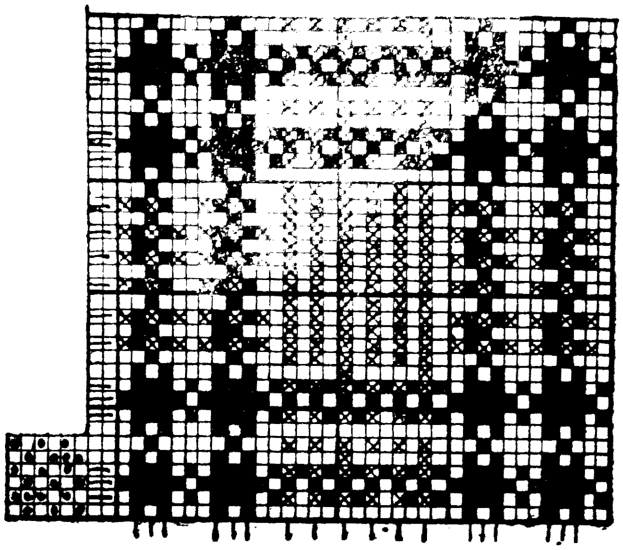


Fig. 331. Colour and Weave Effects. Fig. 332.

is more elaborate. It is formed by a weave which gives alternate warp and weft figures on 8 threads and 6 picks. Fig. 332 is another choice example. The centre develops a warp hairline effect. The weave is on 6 threads and picks. For each design, warping and wefting are indicated.

Warp Face Cloths.

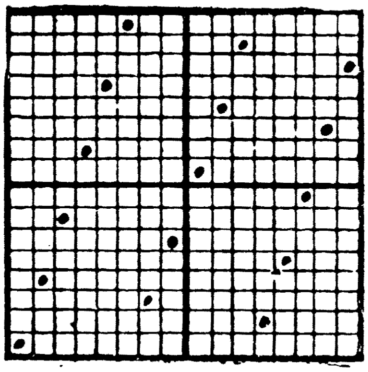


Fig. 333.

These kind of cloths have more warp than weft on the face. The 16 shaft sateen is given at Fig. **333**, the pegging particulars being lift white. Pieces of this kind have, as a rule, the same colour of weft as warp.

The rule for making sateens is, that the stepping of the dots must not be a measure of the number of threads in one repeat of the design. Patterns which are made beyond half the number of the threads employed are reverse twill to those already made.

The sateen base is an excellent means of developing other styles

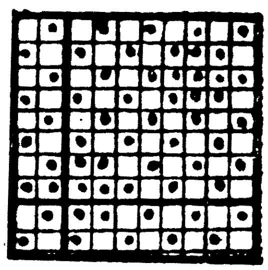


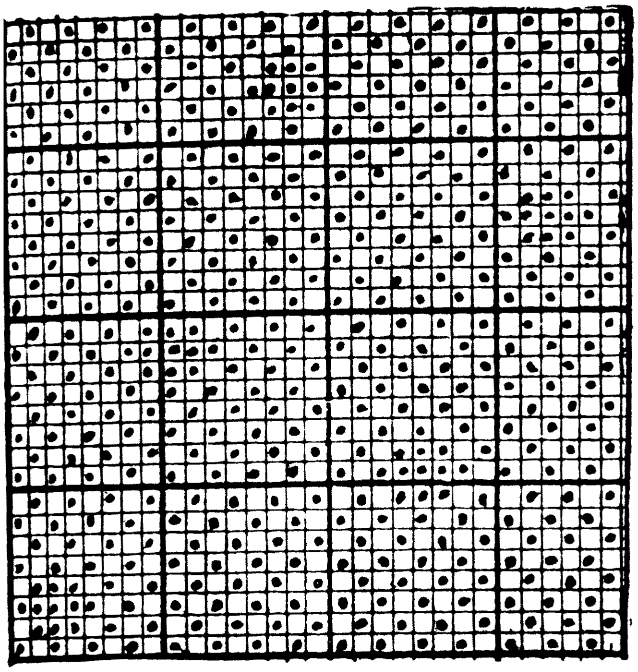
Fig. 334.

These are:—(1) The placing of spot figures; (2) Sateen derivatives; (3) Shaded effects. Examples of each follow.

(1) *Placing of Spot Figures.*—In dress goods, spot figures play a prominent part. At Fig. **334** there are two small figures on a plain ground, the whole being on 10 threads and picks.

This is placed in **5** end sateen order at Fig. **335**, only one spot in design **210** being used.

A further example is at Fig. 336 where the small spot



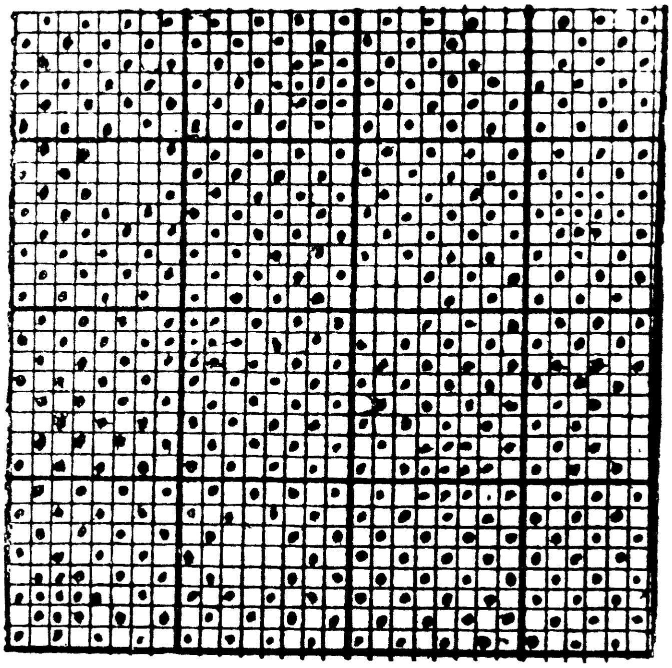


Fig. 335. Placing Spot Figures. Fig. 336.

is developed in both warp and weft. To make any kind of figure have a clear outline with plain weave, it should be on an odd number of threads and picks.

(2) *Sateen Derivatives.*—This is a very fertile way of making new designs. The sateen base is first placed on design paper, and a twill on the same number of threads and picks is then placed on the sateen base. As an example, the sateen base on 16 shafts with a 3 step advance is at Fig. 333. The twill used is at Fig. 337, and the sateen derivative is at Fig. 338.

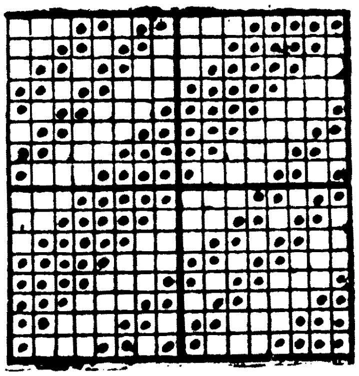


Fig. 337.
Ordinary Twill.

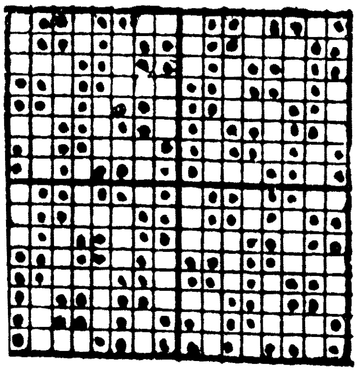


Fig. 338.
Sateen Derivative.

(3) *Shaded Effects.*—Such effects are used for ribbons, and all kinds of silk structures, and especially for floral designs.

A sample of a shaded stripe effect is at Fig. 339. It is developed on the 5 end sateen base, shading from warp to weft and back again. The full repeat occupies 32 threads and 5 picks.

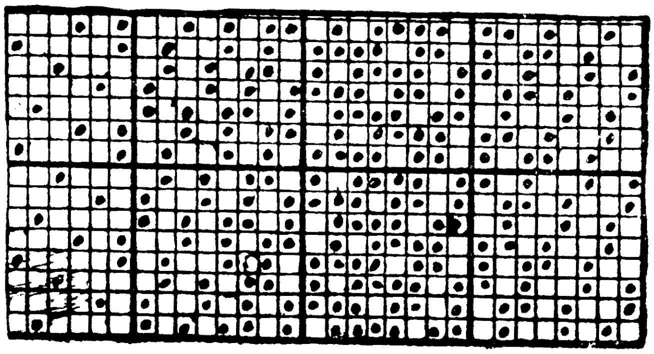


Fig. 339. Shaded Effect.

Pick and Pick Effects.

These designs are known as whipcords. They are derived from two common twills, each twill, as a rule, being on the same number of threads and picks. One twill is placed on all the odd picks of the new design, and the other on all the even ones. The result is quite as transforming as sateen derivatives. Figs. 340 and 341 are on 12 threads and 24 picks. The first two picks in each design are the twill bases.

Fig. 342 is on 14 threads and 28 picks. It develops two strong twills, and a 2 and 1 section twilling to the left.

These, and such designs, are particularly suitable for worsted coatings. Fig. 343 is on 16 threads and 32 picks.

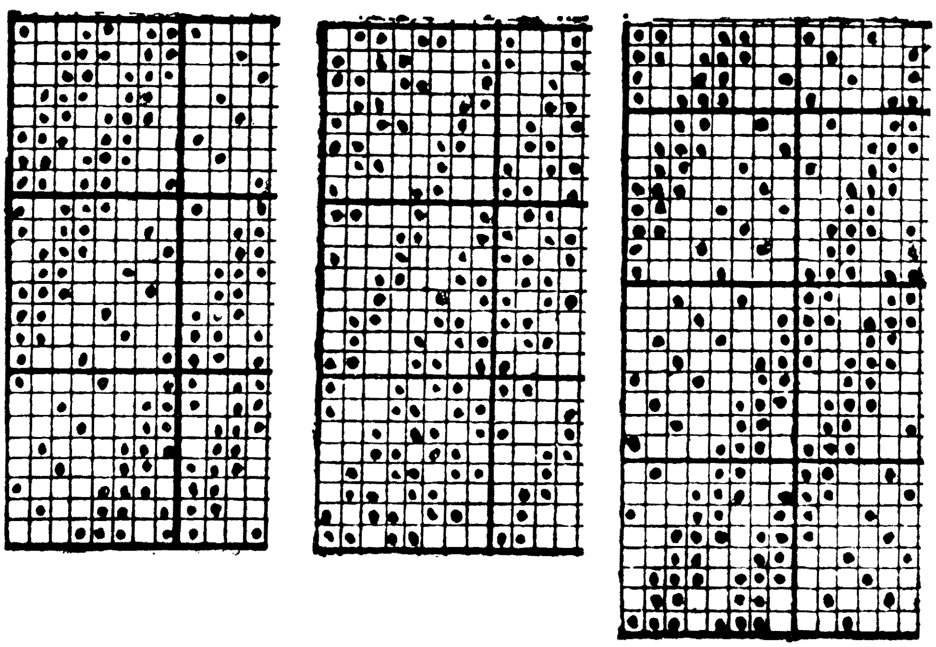
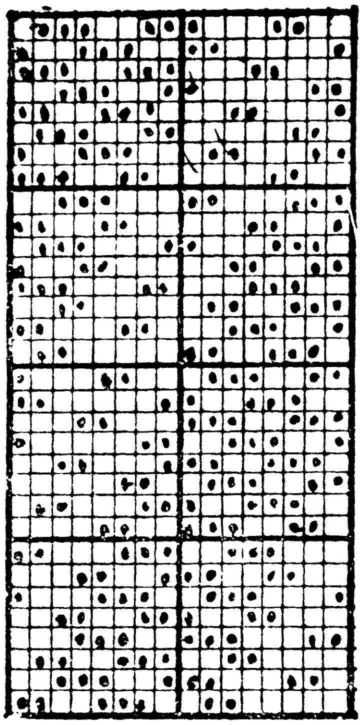


Fig. 340. Fig. 341. Fig. 342.
Whipcord Designs.



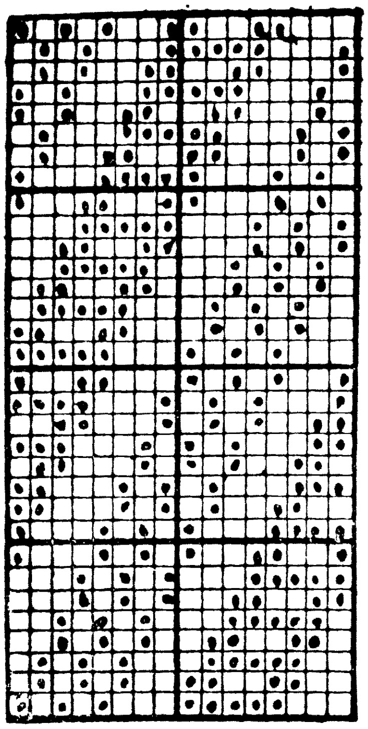


Fig. 343. Fig. 344.
Whipcords on 16 Shafts.

It produces a much flatter effect in the cloth than the previous example. Fig. 344 is in contrast to the two previous examples. There is a running warp and weft cord. If the twills developed are to be the chief feature of the cloth, then the pegging particulars would be lift white, but if the cords are catered for, it would be lift black.

Alternate Pick Design.—Instead of using a pick in turn from two twills, all the odd picks from one twill may be placed on all the odd picks in the making of another design. The odd picks in the other base twill are then placed on all the even picks on the design under construction. These develop peculiar constructions like the one shown at Fig. 345. It is a wavy effect which leans to the left, though it may be made to lean in the opposite direction.

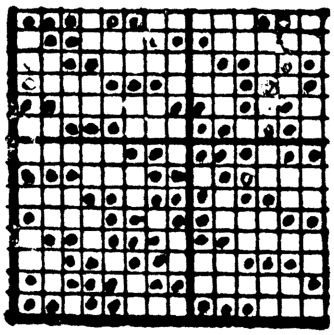


Fig. 345.
Alternate Pick Design.

Stripe Effect.—A wavy twill is introduced in stripe formation in Fig. 346. It occupies 16 threads, and is separated from the 2 and 2 left twill section by two stripes of warp cord. The design would require 20 shafts.

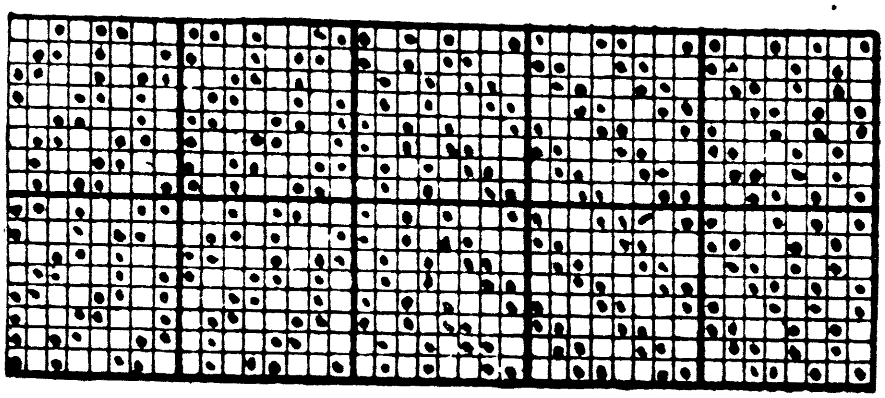


Fig. 346 Fancy Stripe Effect.

Bedford Cords.

These fabrics are made in four styles. (1) Vertical stripes; (2) Diagonals; (3) Squares; (4) Figured. In all four there is a basic similarity, for one pick will weave plain for a certain number of threads and then float. A subsequent pick will float where the other was plain weave, and weave plain where the other floated.

The weft is usually single twist and chiefly woollen owing to its better shrinking properties. On shrinking during scouring, it increases the roundness of the cord effect which is the special feature of this kind of cloth. The structure is not confined to the 1 and 1 build of cloth, but may be 2 and 1, or 2 and 2, or any other way desired.

Fig. 347 is one of the simplest kind. One repeat is on 16 threads and 4 picks. Drafted to a minimum, it could be woven on 6 shafts, though it would work better on eight.

Fig. 348 is a 2 and 2 arrangement, a complete pattern being on 20 threads and 6 picks. It is harder to weave than the previous example, for there are two plain picks together, and the shrinkage is greater.

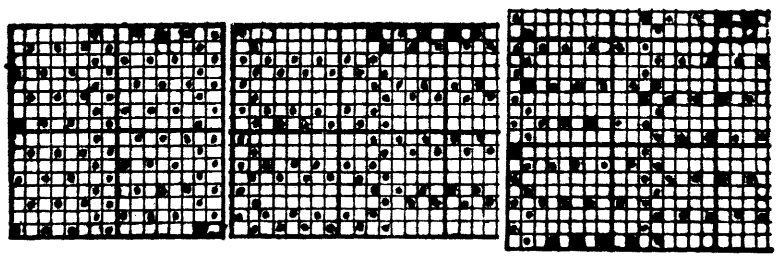


Fig. 347. Fig. 348. Fig. 349.
Bedford Cords.

Fig. 349 is a 2 and 1 style, and has a flatter effect than Fig. 348. It lends itself to a fine face effect.

Figured Mohair Design.—In these cloths, it is customary to give the lustrous mohair the fullest surface display. One

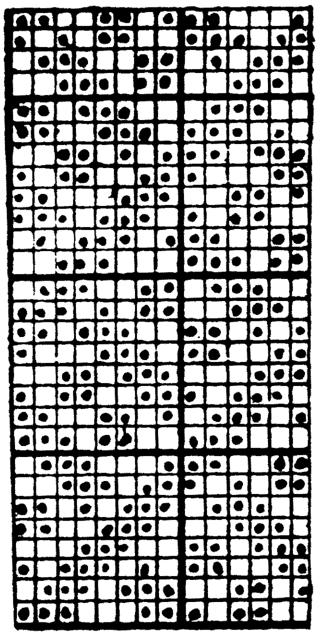


Fig. 350.

example is at Fig. 350, and is on 14 threads and 28 picks. It has heavy 3 float twills in both directions interspersed with hopsack. In cheaper fabrics, the ground is cotton, but in more expensive cloths it is worsted.

Figured Dobby Work.—A good example of this is shown in Fig. 351. This is for a neat and substantial coating cloth. The warp is 22 skein with 38 threads per inch, and the weft 18 skein with 31 picks per inch.

The figures are made with 2 and 1 warp twill, and the ground is 2 and 1 weft twill. Both figures and ground twill to right and left. One complete pattern is on 24 threads and 26 picks.

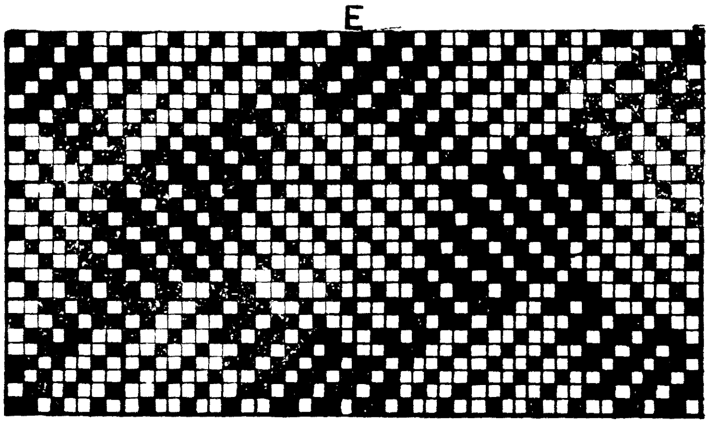


Fig. 351 Figured Dobby Work.

Double Plain Cloths.

These textures are very neat, and, by being double cloths, are much heavier than a single cloth made from the same counts of warp and weft. When they interchange frequently, no stitching of one cloth to the other is necessary, but otherwise, the 8 end sateen is a handy method. On the plan of interchange, reversible cloths, carriage rugs, and fancy effects are easy of production. By the adjustment of the weave, and the application of colours to warp and weft, seven distinct effects are produced. These are demonstrated. All the odd numbers are designs, and the even numbers are cloth. Fig. 352 has the first section warped and wefted 1 black, 1 white, the pegging particulars being lift black. This first thread and pick are for the face, and the second thread and pick for the backing. Fig. 353 is the result. The face cloth is solid black, and the backing cloth all white.

For Fig. 354, the warping and wefting are the same, but the weave is altered to make the first thread and pick for the backing cloth. At Fig. 355, the face cloth is now white,

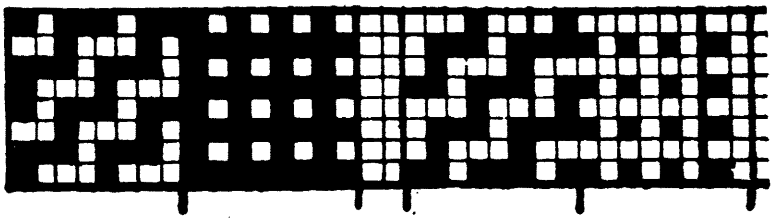


Fig. 352. Fig. 353. Fig. 354. Fig. 355.
Double Plain Designs.

and the back cloth black. Other styles of double plain cloth are given from Figs. 356 to 359. At Fig. 356, the design is arranged 2 threads backing and 2 threads face, and the same with the weft. By having it warped and wefted 1 black, 1 white, it develops a horizontal hairline on the back cloth, and a vertical hairline on the face as given at Fig. 357.

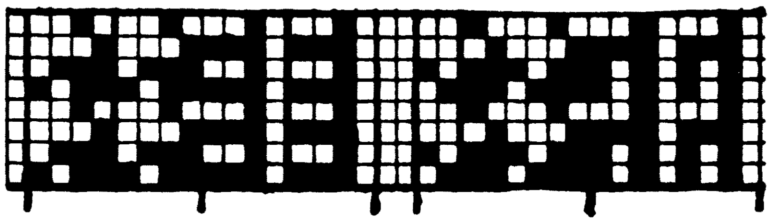


Fig. 356. Fig. 357. Fig. 358. Fig. 359.
Double Plain Designs.

At. Fig. 358 the footing of the weave is altered for the backing, but the face is the same. It now produces vertical hairlines on both cloths as at Fig. 359.

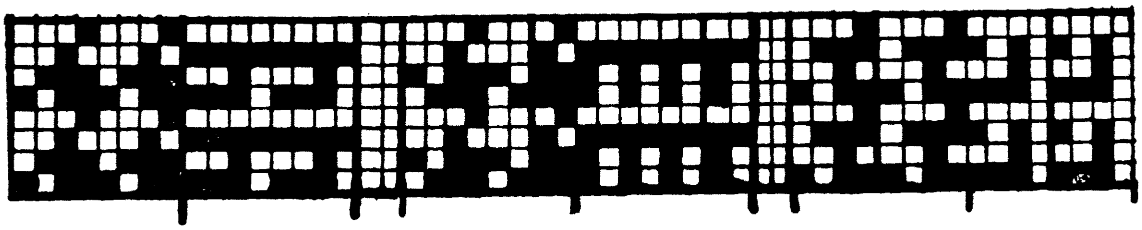


Fig. 360. Fig. 361. Fig. 362. Fig. 363 Fig. 364. Fig. 365.
Double Plain Designs.

In Fig. 360, both sections of the design are altered, and Fig. 361, horizontal hairlines are formed for both cloths.

At Fig. 362 there is the same face weave as at Fig. 360, but the backing weave is altered, and gives a horizontal hairline face, and a vertical hairline back as at Fig. 359.

As a final, Fig. 364 is on a different designing footing to any of the others. It is planned to have 2 backing threads and 2 face threads as before, but the wefting is now 1 back, 1 face. This gives a white bird's eye effect on the face—that is, a small white spot on a black ground, and on the backing cloth, it is a black bird's eye effect as given at Fig. 365.

Backed Cloths.

To add weight, a cloth may be backed with warp or weft. Fig 366 is for a cloth backed with weft, the first pick being face, and the next backing, the pegging being lift black. It is an 8 shaft weave on 16 picks.

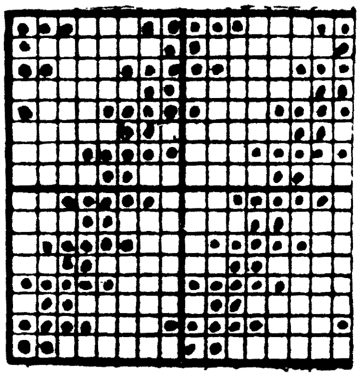


Fig. 366.
Twill Backed with Weft.

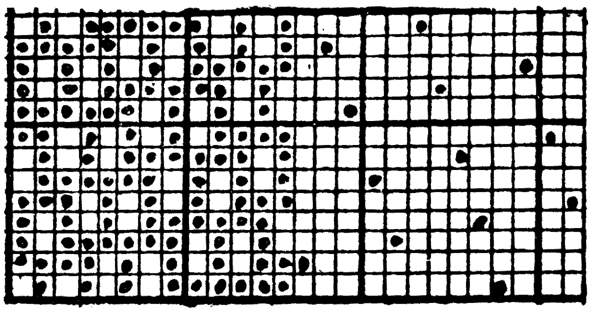


Fig. 367.
Corkscrew Backed with Warp.

As an example for a cloth backed with warp there is Fig. 367. It is a 13 shaft corkscrew face, and a 13 shaft sateen back. It is one of the most difficult cloths to weave.

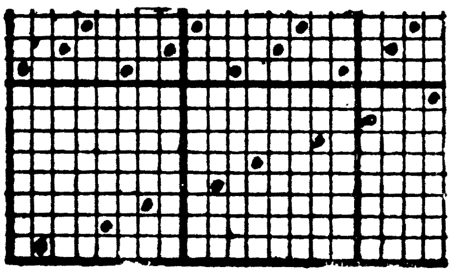


Fig. 368.
Draft for Cloth Back with Warp.

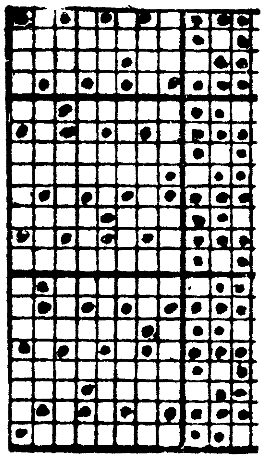


Fig. 369.
Full Design.

Double Cloths.

A proper double cloth is one where two cloths are woven at the same time, the two cloths being held together by stitching. The stitching may be backing to face, or face to backing, or both. One of the less costly kinds of double cloth has the draft at Fig. 368. The 3 face shafts are placed at the back, and the 8 backing shaft at the front. It is loomed 1 face, 1 back, 2 face, 1 back, and there are 20 threads in one repeat. There are 12 face threads and 8 backing threads.

The face shafts weave 2 and 1 warp twill, and the backing shafts weave plain, and are stitched to the face in

8 end sateen order. This can be traced at Fig. **369**. Both warps are single twist worsted, and are sized.

A more substantial double cloth is at Fig. **370**. The weave is the running hopsack for face and back, the healds

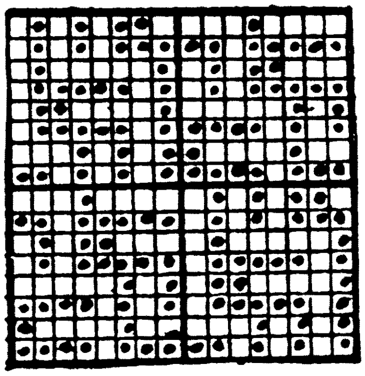


Fig. 370. Running Hopsack Double Cloth.

being drawn straight gait, 1 thread face 1 thread backing. The backing is stitched to the face in 8 end sateen order.

LANCASHIRE TAPPET LOOMS.

A good part of the foregoing chapters aptly apply to the Lancashire cotton industry, as well as the woollen and worsted trade. Such looms as the circular box, the jacquard, and the Northrop have much in common for the staple trades of Yorkshire and Lancashire. Then the negative let off, the overpick, the fast and loose reed, and the Kenyon under motion all work on the same principle. In the use of shuttles, belts, pickers, temples, and electric motors, the principles already propounded hold good, and therefore need not be repeated. Mention has also been made of rayon weaving.

There are differences, however, and these are set forth in the following pages.

The Lancashire Calico Loom.

The ordinary Lancashire inside tappet loom has a reed space of 45 inches, and a speed of 180 picks per minute. The heald shafts are assisted in making the shed by a horizontal shaft seen above the upper framework. On the shedding shaft are two pairs of rollers, the smaller pair being connected to the two front shafts, and the larger pair to the two back ones. The first two shafts rise and fall together, and so do the two back ones. The warp is gaited 1, 3, 2, 4, and weaves plain cloth.

When the heald shafts are level, the setscrews holding the rollers or shedding collars are just above the centre of the rollers. This gives liberty for the winding and unwinding of the straps without binding. The amount of collar turn depends on the leverage imparted by the tappet treadles. It is customary to have the size of the shed, so that when the crank is at its back centre, the top shed is just clear of the top shuttle front. The tappet for the two back shafts may be from $\frac{1}{8}$th to $\frac{1}{4}$ inch larger than the other so as to give a larger movement to the healds. The dwell made by the tappets may be from $\frac{1}{2}$ to $\frac{1}{3}$rd a revolution of the crank, and for light weight goods, it is usually the latter. The picking, as shown in the illustration is the overpick, and though acting in the same way as already expounded, the shaft is outside the loom frame, and is more readily unloosed. The back rail is set a little higher than the breast beam, so the warp is slacker on the top shed than the bottom one, and gives better " cover " to the cloth.

The letting off is the negative one of rope or chain and weight lever as already explained.

Fig. 371 gives Messrs. Robert Hall's high speed calico loom. This has a reed space of 36 inches, and a speed of

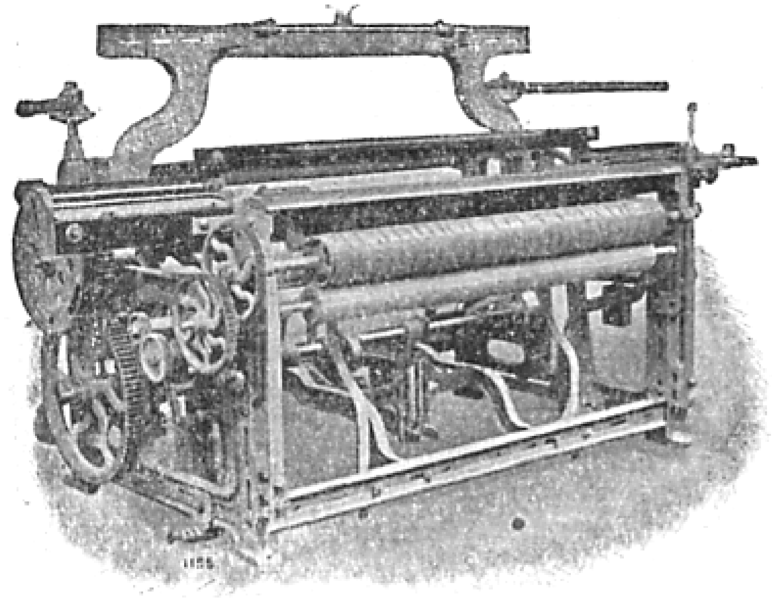


Fig. 371.
Robert Hall & Sons High Speed Calico Loom.

210 : 220 picks per minute. (*See* Chapter on "Tappet Looms.")

Bordered Cotton Blankets.—Many makes of Lancashire looms are of simple construction, but gadgets are added to weave certain types of fabrics. One of these is for the weaving of bordered cotton blankets and shawls for the South African and South American markets. There are also huckaback towels, scarves of the cheaper kind, and certain makes of tablecloths. These are woven by an arrangement that automatically stops the loom when the borders have to be woven.

Chain Motion.—In Fig. 372, A is the shaft of the take up roller, and to it is setscrewed the chain wheel B, having 32 teeth, the fixing screw being at C. Roller D has a circumference of 16 inches, so that one tooth on the chain wheel B will weave a half inch of cloth.

The link chain path is at E. After contacting with the teeth on the change wheel, it passes over the flanged guide bowl F, and in the loop at the bottom, is the hooked weight G that prevents the chain from sagging. At H is the stop bracket clamped on weft fork lever I, and is fixed by set screws. The weft fork lever is in front of set-on handle L, and moves on the surface of breast beam J. On the surface of stop bracket H, are three pegs set at equal distances. These form two grooves, the most convenient being used by the chain.

All parts controlling chain traverse have to be plumb straight to keep the chain in contact with the chain wheel.

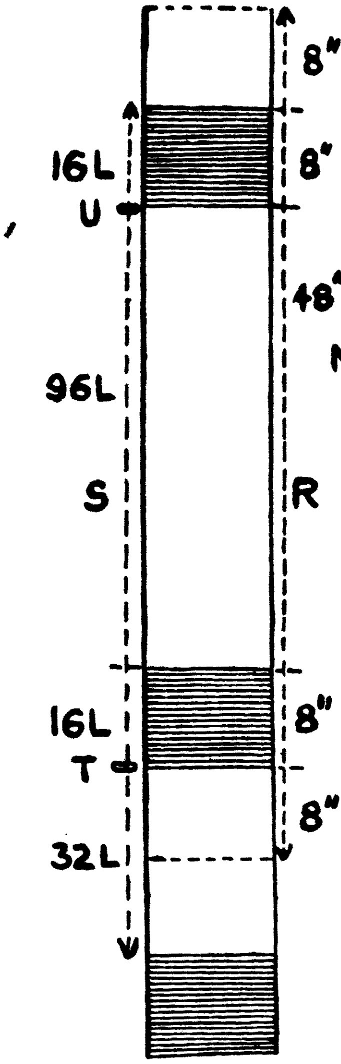


Fig. 373.
Bordered Cotton Blankets.

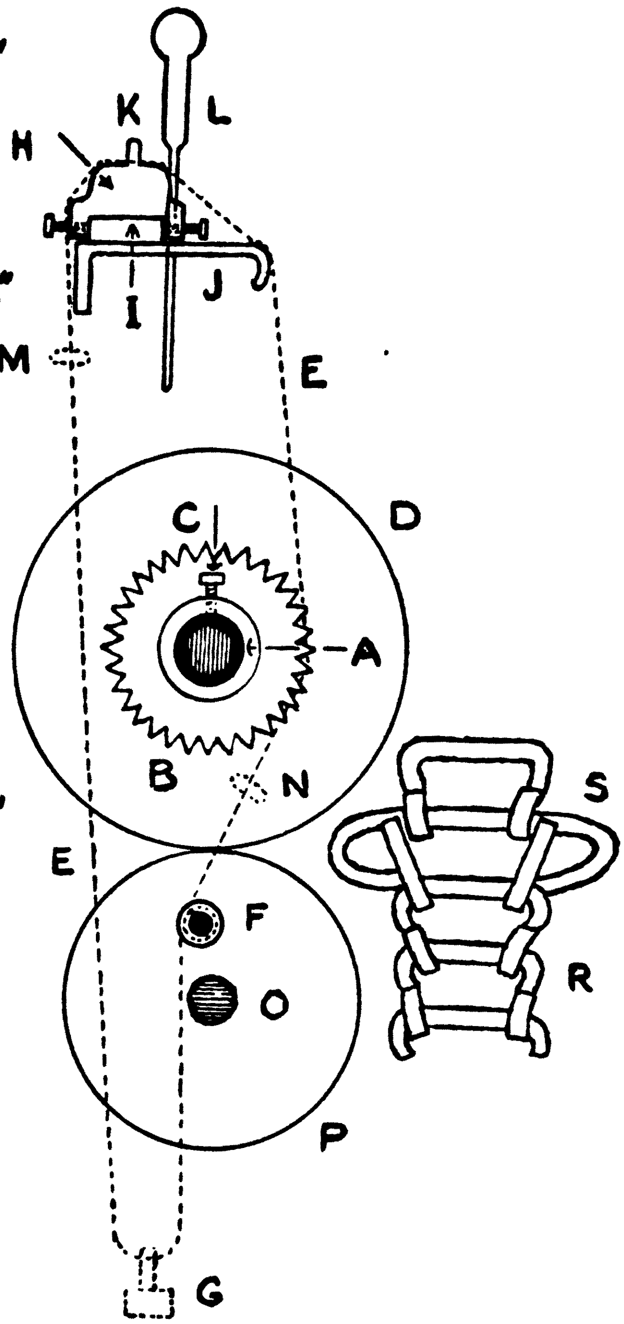


Fig. 372.
Chain Motion.

The chain has two stop links, one at M and the other at N. The actual size and structure of the chain is at R and S. Each link like R is equal to a half inch of cloth.

It is the wider link at S that is the means of stopping the loom, for it cannot pass the groove in the stop bracket H. As the chain is bound to revolve when the loom is running, this larger link forces the weft fork lever back and stops the loom. These links are arranged to stop the loom when the border has to be woven.

The motion is outlined in Fig. 373, and is one of the simplest plans for weaving these goods on a plain loom.

Blue or pink borders on a white ground are the usual colours, but others have a coloured ground with white borders.

The actual blanket, shawl, scarf or towel is indicated by dotted line R, and a knife cuts the cloth at the two dotted lines on arriving at the warehouse. There are various standard lengths and borders. The one given has an 8 inch ground, 8 inch border, 48 inch body, 8 inch border, 8 inch ground, and has a total length of 80 inches.

The chain is indicated on the left at S. Here, the first section has 32 links to weave 16 inches, and then comes the first stop at T for weaving the first border with 16 links to weave 8 inches. Then follows the body width 96 links for 48 inches, and a second stop at U. The final is 16 links to weave another 8 inch border. This makes a total of 160 links for 80 inches of cloth. More elaborate borders are woven in box looms. The chain motion is a decided gain over having to use a tape measure.

Pickles Motion.

This motion is the one generally adopted in the Lancashire cotton trade for the positive take up of the cloth. It is a seven wheel motion, and the pawl is a puller. In this arrangement, the change wheel is driven, so that if a larger wheel is used the speed of take up is reduced and the number of picks per inch are increased, Fig. 374. Referring

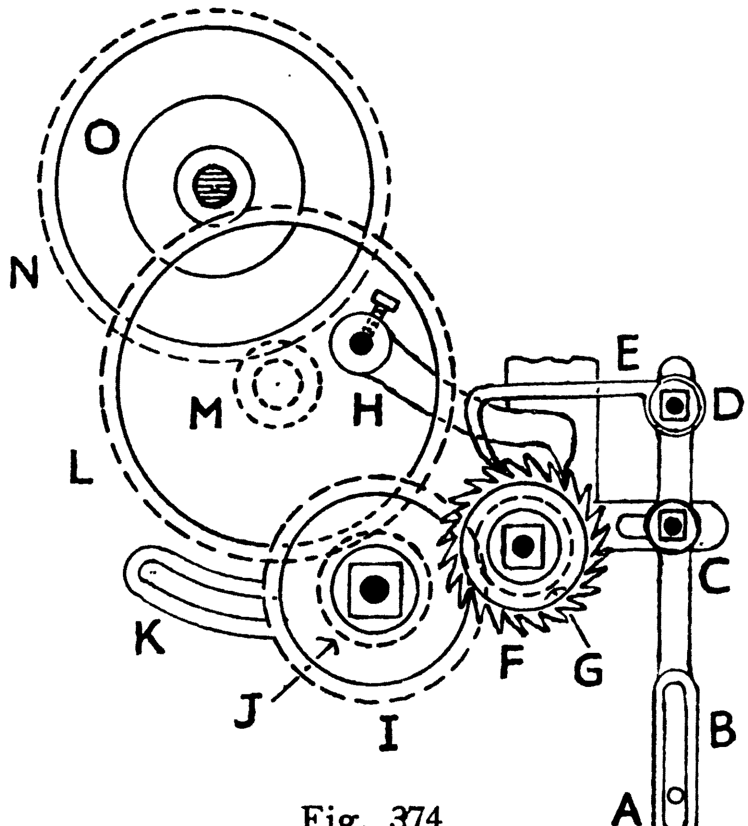


Fig. 374.
Pickles Take-up Motion.

to the sketch, A is the rod attached to the sword, and B the slotted part of the take up lever fulcrumed a C, and at D is the fulcrum for the pulling pawl E. At F is the rack wheel with 24 teeth, and G is the standard wheel with 36 cogs. This turns the change wheel I, and on the same stud is the swing pinion J with 24 cogs. The swing pinion meshes with the carrier wheel L with 89 teeth, and its carrier pinion wheel at M has 15 cogs. This pinion turns the take up roller wheel with 90 teeth, the diameter of the take up roller being 15.05 inches, or 60.2 in $\frac{1}{4}$ inches. The curved slot K accommodates the various diameters of the change wheel or a change in the standard wheel.

For calculation:—

$$\frac{\text{Drivers} \quad 36 \times 24 \times 15 \times 60.2}{\text{Driven} \quad 24 \times \text{C.W.} \times 89 \times 90} = 4.06.$$

To allow for contraction $1\frac{1}{2}$ per cent. is deducted which brings the gauge point to 4 one quarter inches which equals one inch in the cloth. The number of teeth in the change wheel is the number of picks per inch. When the standard wheel is changed to one less, it will give more picks per inch, if it is larger, the picks will be reduced. For example, if a 36 standard wheel gives 60 picks per inch with a 60's change wheel, what will a 30 standard wheel produce?

$$\frac{36 \times 60}{32} = 72.$$

If the standard wheel be changed to 45's cogs, what picks will it give?

$$\frac{36 \times 60}{45} = 48.$$

Medium Weight Duck Loom.—This loom at Fig. 375, and four other makes of duck looms are made by Messrs. Wilson and Longbottom of Barnsley. The one illustrated weaves from 20 to 24 oz. per square yard.

The loom frame is milled so the parts bolted to it have a solid fit. The going part is plated back and front to give a strong beat up to the weft. The shuttle race is made of durable wood. It is a fast reed motion, the frogs being held forward by double springs bolted near the base of the loom. The crank shaft is made of special quality steel with a diameter of two inches. Its supports are of gun metal.

As shown the picking is overpick inside the loom. For additional security, both boss and picking shell are toothed for firmer gripping, and the boss is also firmly secured by a key in a sunk keyway.

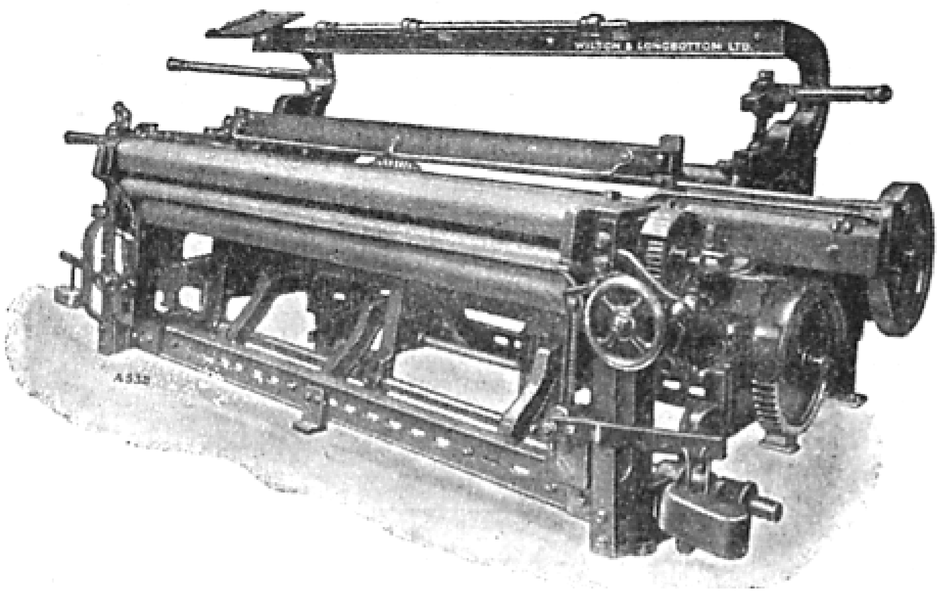


Fig. 375. Wilson & Longbottom's Duck Loom

The healds are controlled by two sets of plain tappets of robust construction. The warp beam is constructed of $4\frac{1}{4}$ inches steel tubing, with special flanges with a diameter of 24 inches. The beam pulleys have a diameter of 9 inches, and thick chains are used to brake it. The brake weight levers are long, and comparatively small weights are used. The take-up motion is a positive worm and wheel type that turns in an oil bath. The take-up roller has a 6 inch diameter of steel tubing covered with coarse perforated steel strip. The cloth roller is in contact with it.

Underneath Utility Tappets.

This motion is demonstrated at Fig. 376. It is shown as fixed to an old type Burnley loom, and reveals its adaptability to almost any kind of loom. There is more

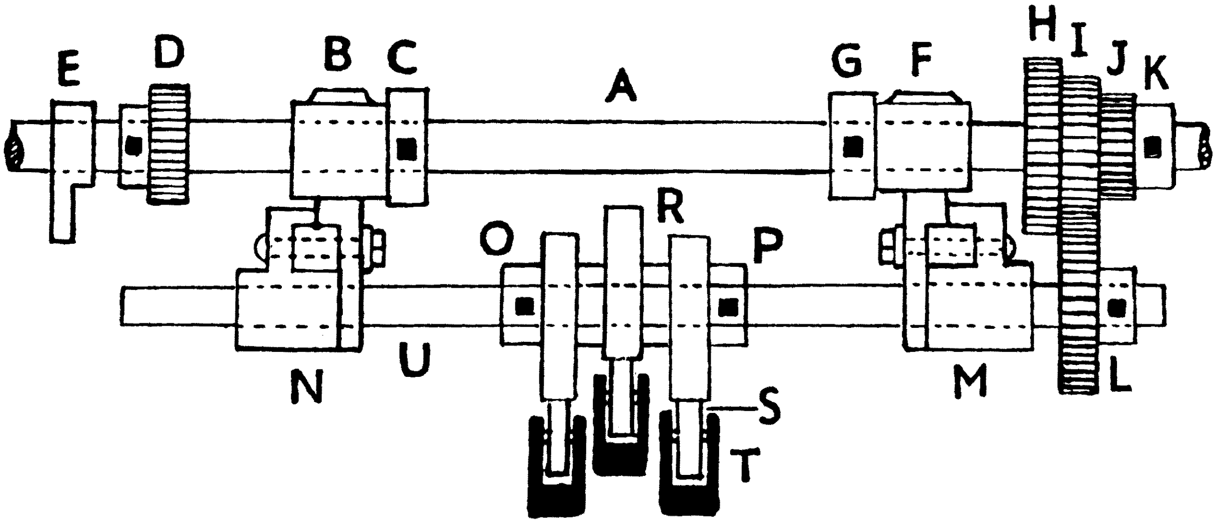


Fig. 376. Underneath Utility Tappets.

need for adaptable looms these days than ever before, owing to the more rapid changes of fashion, and the greater demand for novelties in the home and foreign markets.

The loom has a reed space of 32 inches, but is equally applicable for wider looms. For very wide looms, two motions are desirable, which are timed exactly alike, and equalize shed tension on the healds. The 5-shaft motion is for warp and weft twills, and warp and weft sateens. On the low or picking shaft of the loom on the right is the driving pinion wheel which has 16 teeth, and is the timing wheel for the tappets. It meshes with the wheel below which is on the same shaft as the tappets, and has 40 cogs. The driving wheel only turns 8 cogs for each revolution of the crank and thus completes 2½ revolutions to the tappet shaft once.

Treadle bowls and tappets are set in relation to each other to produce the best working conditions.

On the right, but on the picking shaft is a three decker wheel by which 2, 3, and 4 shafts are woven. The 30 and largest wheel is for 2 shafts; the 24 wheel for 3 shafts, and the 20 wheel for 4 shafts. These wheels mesh respectively with tappet wheels having 30, 36, and 40 cogs. It will be noted that the wheel with 40 cogs does for both a 4 and 5 shaft weave, but the upper or low shaft wheel has 20 cogs for the four shaft weave and 16 cogs for the 5 shaft. The crank shaft wheel has 48 teeth, and the low shaft wheel 96 teeth.

Here is a brief explanation of Fig. 376. A is the picking shaft, with B and F the bearer brackets for casting M and N on the countershaft below. The upper brackets are kept in position by collars C and G. At D is the wheel having 16 teeth for the weaving of five shafts, and E a pedestal bracket. The three decker wheels H, I and J have been explained. K and L are collars for their respective wheels. The tappets for three shafts are at O, P and R, the anti-friction bowls for the tappets being at S, and the upper part of the treadles being at T. U is the counter shaft.

Tappet Easing Motion.

For looms weaving medium plain cotton fabrics, there is usually a tappet on the crank shaft A. Some loom makers fix the tappet with a key, but it is better to have a couple of setscrews, for then, the timing can be altered to suit the warp, and the timing of the shed. Fig. 377.

A lever C rests on the top of the tappets B, which is secured to the bottom back rest of the loom D. On this rest is a setscrewed casting E at either end, each having an open slotted top. In these, the upper oscillating rail is placed at F.

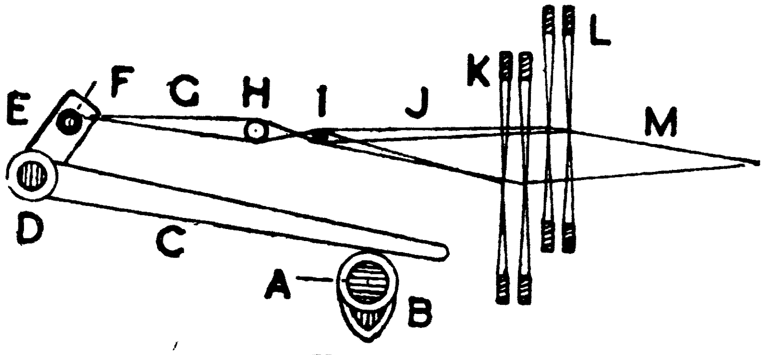


Fig. 377.
Tappet Easing Motion.

The warp is made to pass under the bottom rest and over the top one on its way to the healds.

The tappet is timed so as to lift the easing lever to its full height when the heald shafts are level. This tightens the tension on the warp when the eyes of the healds are passing each other, and slackens it as the healds divide the warp. This is realised in Fig. 378. G is back shed, H and I lease rods, J the open back shed, K the two back shafts on bottom shed, L the two front shafts on top shed and on the open front shed in Fig. 377.

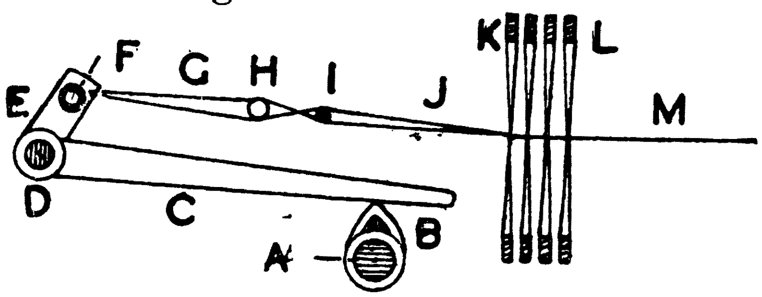


Fig. 378.
Tappet Tightening Warp.

When low quality goods are being woven, the easing motion has to be put out of action as it has a tendency to make uneven cloth.

For heavy goods, the tappet is placed out of service, and the lever left on. The warp is made to pass over the two rails as before, but both are held rigid, and in this way, friction on the warp is increased, and dead weight on the warp beam levers decreased. It produces better cloth, and less ends are broken.

Lease rods are placed in the back shed. The 1st and 3rd shafts have their threads passing over the thick back rod, and the 2nd and 4th shafts threads pass over the front thin rod to equalise the tension on the threads.

Spring Top Motion.

As the tappets here mentioned are negative in action, they work in conjunction with a spring top motion outlined in Fig. 379. The framework is at A, and B are the fulcrums of a pair of levers. At C are the metal fingers which act in unison, for if the lever G on the right is drawn up, its finger descends, and takes its companion with it, and so raises the arm D. The shaft levers are provided with two

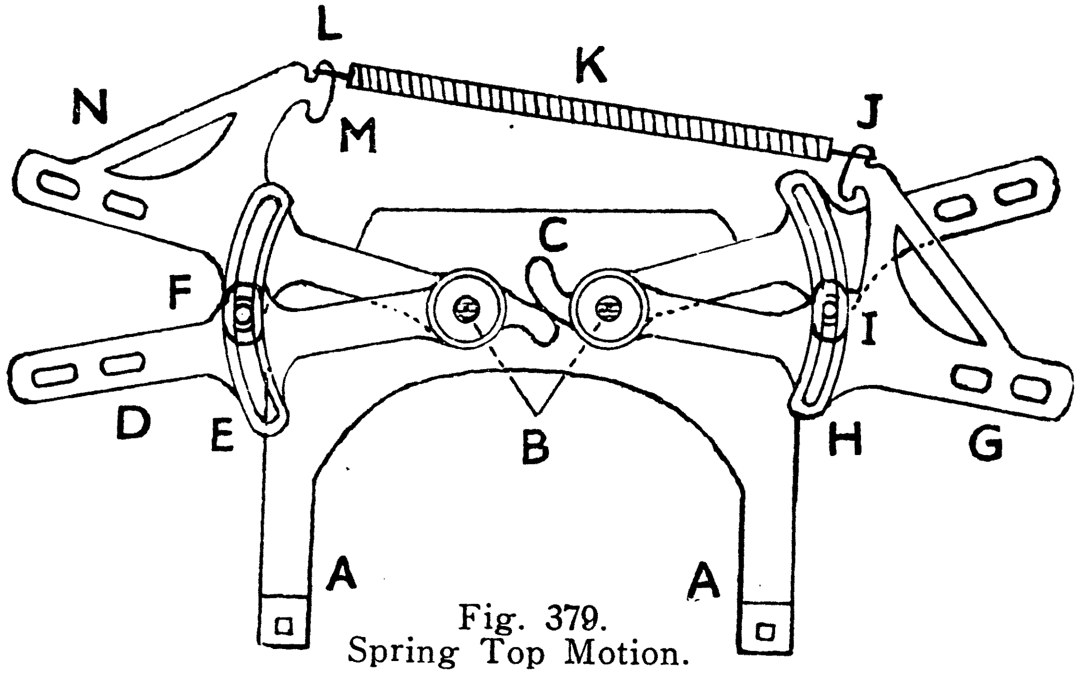


Fig. 379.
Spring Top Motion.

slots each at their outer ends, from which attachment is made to the heald shafts. They are also made with long curved slots at E and H, and are prevented from descending too low or getting out of position by the bars F and I that pass through them. At their upper ends, the larger levers G and N have two hooks, and to these at J and L the spring K is attached. The same spring acts for two pairs of levers. The spring can be attached to the lower hooks M for the weaving of the lighter goods, or as set forth for greater pressure, or two springs can be attached to the same levers for heavier work. The strength of the springs is another source of alteration. It is the small part of the tappet that raises a shaft and the larger part that depresses it. The spring top motion is provided with a hand lever (not shown) for levelling the shafts.

Lupton and Place's " Climax " Super Spring Top Motion.

A later and stronger mechanism is the " Climax Super Spring Top Motion " presented at Fig. 379A. There is only one set of levers to control the heald shafts, but there is a set of pulleys to assist. It is made for 8 shafts. The front top of the levers take charge of the leathers with their attendant bands for the top of the shafts at one end. Behind and near the top are the strong hooks on which the springs are placed to draw the shafts to the top shed. These springs at the opposite end are placed on hooks above the pulleys that guide the straps and bands to another set of hooks on the top heald shafts.

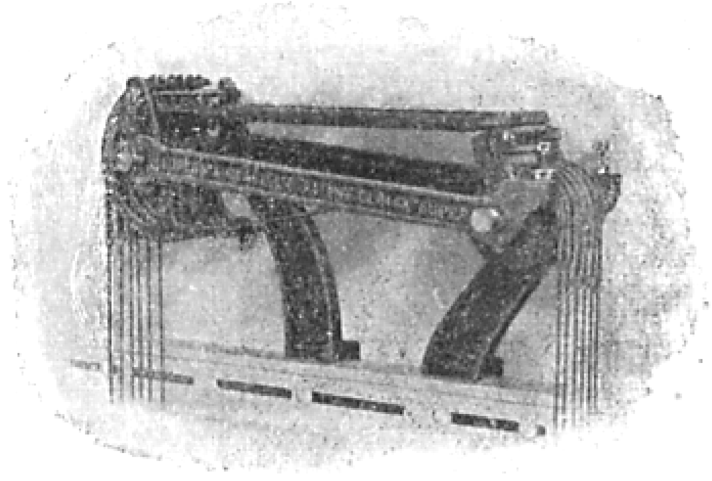


Fig. 379A
Lupton and Place's Spring Top Motion.

The framework bearing the springs can be regulated by locknutted setscrews to adjust the pull of the springs.

At the base of the levers, rods are hooked in that pass forward and upward to take the heald shaft straps for the other end of the shafts.

The heald shafts have to be adjusted in two ways.

1. To see that the threads on each shaft barely touch the shuttle race when on the bottom shed.

2. To make the levers be clear of the top stay bar when the shafts are on the top shed.

There are no menacing teeth; no knuckle joints; no links; no unequal lifts.

Pull of Springs:

8° springs, 48 lbs; 9° springs, 34 lbs.; 10° springs, 20½ lbs.

Butterworth and Dickinson's Tappet Loom with Circular Box.

This loom, Fig. 380, is very substantially made with outside treading motion, and cross rod shedding arrangement, the latter being fitted with cast iron bushes in all their bearings. The working of the tappet loom has been fully explained in Chapter 4. This loom combines the reliability of tappet motion with the advantages of a circular box for weft mixing, check patterns, and fancy coloured effects. The circular box is fully dealt with in Chapter 10. The picking is the cone overpick motion, and the letting-off is the rope friction and weight levers. The take-up is the Pickles motion, the gauge point of the change wheel being a tooth per pick.

It is made in various widths. On average goods with a 48 inches reed space, it is run at approximately 170 picks per minute. The framework is specially constructed that it may have a roller motion for 2 or 4 shafts with inside tappets, the 8-shaft cross rod arrangement as given, or be fitted with a dobby. If a dobby is fitted, it will take 16 shafts and in

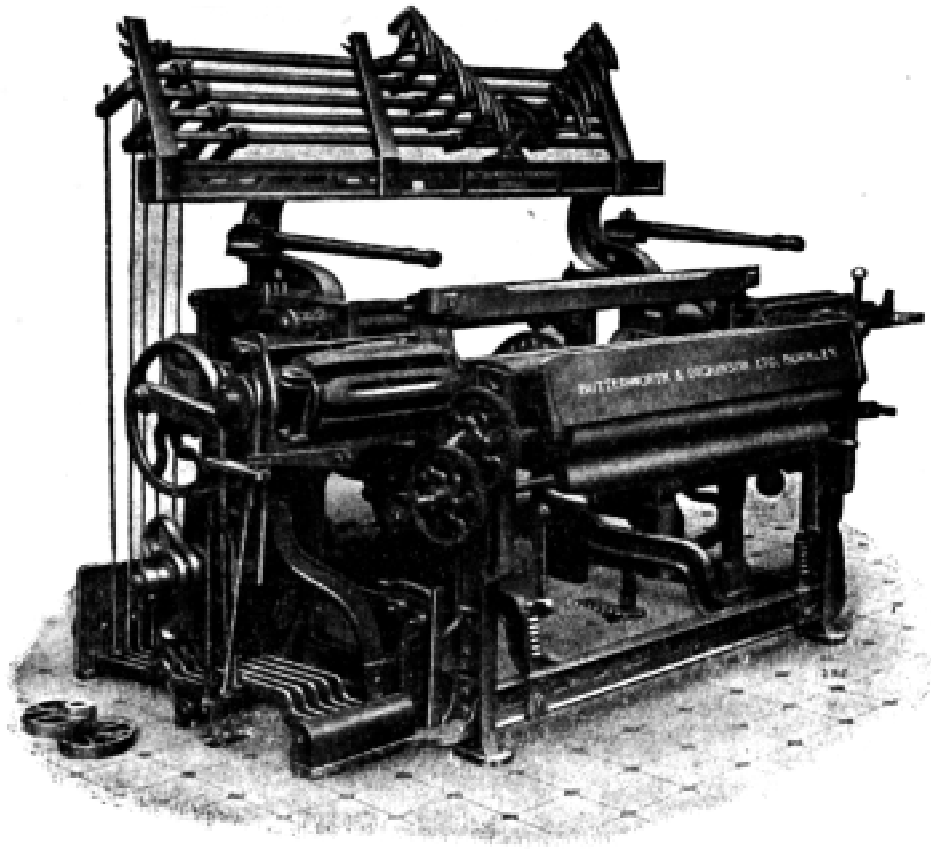


Fig. 380.
Butterworth & Dickinson's Tappet Loom with Circular Box.

addition to good scope for cotton fabrics, a large variety of rayon fabrics can be successfully woven. The dobby jacks, balks, and catches are made on the Lancashire ball and socket principle.

Hall's Woodcroft Tappet Loom.

The loom presented at Fig. 381 is fitted with a Woodcroft tappet motion, and is employed in the weaving of light and medium goods, and particularly such cloths as moleskins, beverteens, corduroys and velvets. The cloths mentioned are usually woven on 6-shafts, but the tappets are constructed to give up to 32 picks to the round.

The loom has a reed space of 46 inches, and a speed of 165 picks per minute. It is fitted with the overpick, the negative chain let-off, and Pickles take-up. What is of particular interest is the Woodcroft tappet motion. This is fitted up at one end and outside the framework, with treadles arching over the top, and fulcrumed at the back. At their centre they carry the bowl, and at the front top are notched to receive the connector casting that links the bottom levers and the bottom of the shafts, to the top levers and the top of the shafts.

The tappet is constructed for centre shed or open shed, and both are positive in action. They are built up by sec-

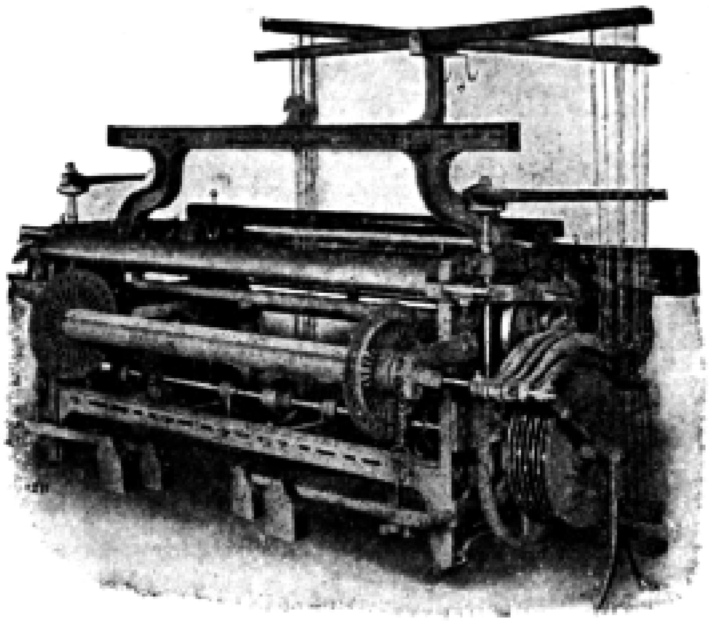


Fig. 381.
Hall's Woodcroft Tappet Loom.

tional risers and sinkers being bolted to a ring plate. There has to be as many active ring plates as there are number of shafts to be used, and there has to be as many sections on each ring plate as there are picks in one repeat, or duplicates of one repeat.

As an example, a 12-section ring plate will weave a 12-pick pattern, but also any design which will divide into 12, such as 2, 3, 4 and 6.

Fig. 382 shows the method of constructing a centre shed ring plate for 8 shafts. The pattern commencing at No. 1 is 3 down, 1 up, 2 down, 2 up. No. 5B is a sinker, because the bowl working outside the metal section pulls the bottom lever upward, and lets the top lever down which is directly fixed to the heald shaft. At A, No. 4 section is the riser, for it controls the bowl the opposite way to No. 1. The circles represented at C are for the fixing bolts which pass through all the plates, so that when bolted up, they are as one solid whole. The parts D and E are for locking with the outer flange. In building the sections, it has to be borne in mind which way it has to revolve—whether for a right or left hand loom.

Fig. 383 is an open shed ring plate, and for the same pattern as Fig. 382. It has the appearance of being more simple in construction, but is more complicated in the parts. There are 8 different plates, 6 of which are seen in the drawing, and are as follow: 1, right hand sinker; 2, sinker dwell; 3, left hand sinker; 4, riser; 5, right hand sinker; 6, left hand sinker; 7, right hand riser; 8, left

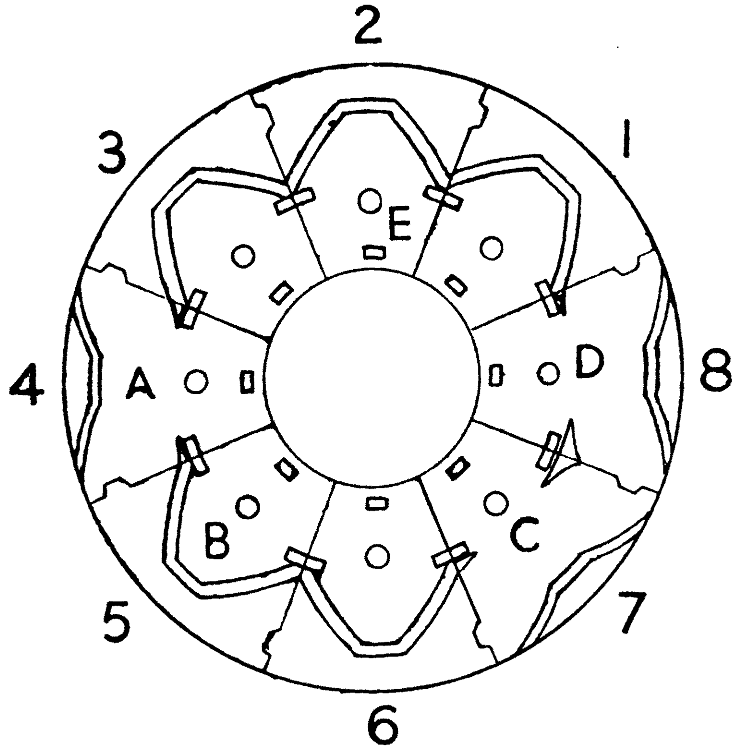


Fig. 382. Woodcroft Centre Shed Tappet.

hand riser. As each section plate is completed, it is best to oil it well, as thoroughness cannot well take place when

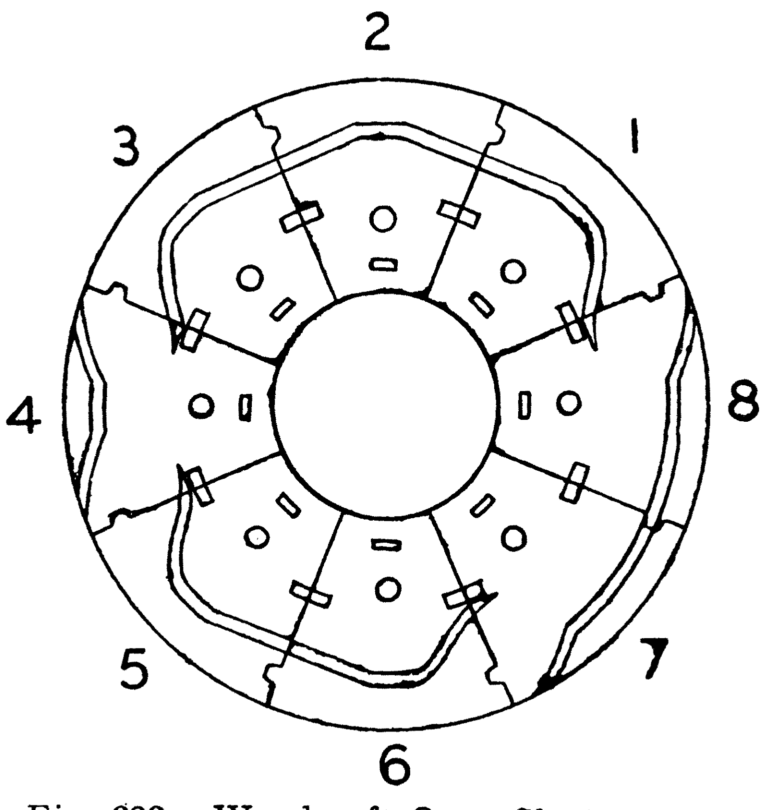


Fig. 383. Woodcroft Open Shed Tappet.

working. The speed of tappet revolution depends on the number of picks in one round, and is on a similar plan to the Yorkshire tappet loom explained. The firm also make whole plate tappets.

Ward Bros. (Blackburn) Dobby.

This set forth in Fig. 384. It is a double draw dobby built on the square. At A is the shedding rod and B the centre arm of the T lever. C is the fulcrum for both T lever and the front main dobby lever, which carries the connecting rods D and E that are coupled to the draw bars. At F is the top slot in which the draw bar moves, a similar one being below. G is the top catch which is fulcrumed at H on the balk M, the back rest for the top of the balk being at I, and the bottom rest at N. At J is the needle that influences the top catch. When a peg in the lags tilts a feeler, the needle descends, and the catch is lowered on the top draw bar, and the corresponding shaft is raised. K is the bottom catch and is moved by a fingered feeler. The

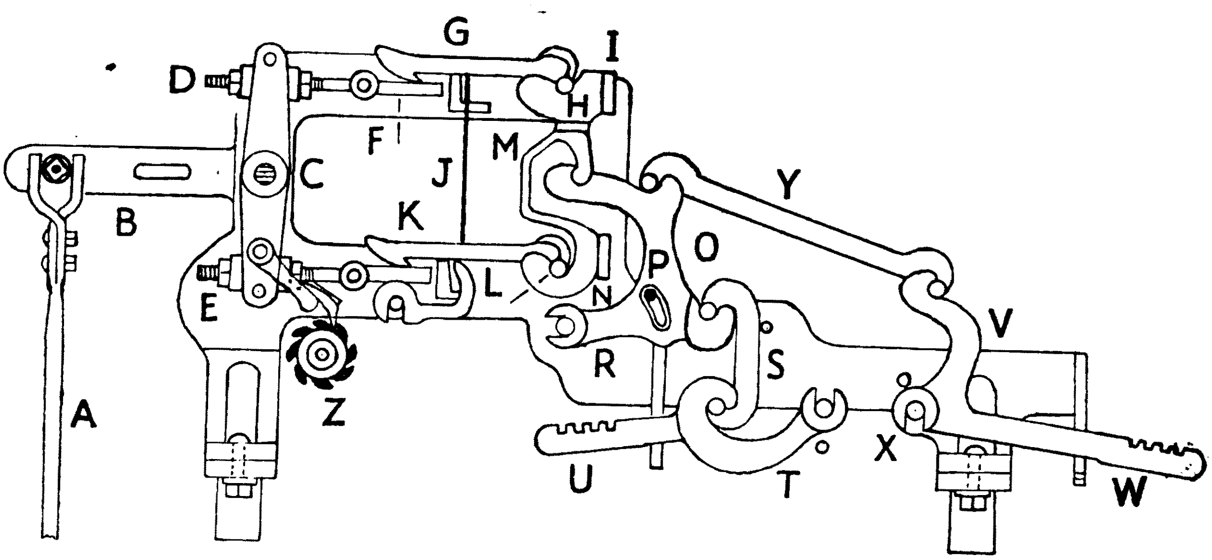


Fig. 384. Ward Bros. (Blackburn) Dobby.

catch is pivoted at L, both being connected to the balk on the ball and socket principle. At O is the peculiarly shaped dobby jack, that oscillates on the bar at R and is prevented from getting out of its working position by the pin P passing through the jack slot. S is the connector from dobby jack to shaft jack U by means of the curved section T. At V is the upper arm of the other shaft jack, the notched lower arm being at W, the jack being fulcrumed at X. Y is the connector from outer jack to balk. The 8 toothed cylinder wheel is at Z. The parts are easily liberated.

Lupton & Place's Four Cylinder Climax Dobby.

The "Climax" dobby made by Lupton & Place of Burnley, is very similar to the one at Fig. 384. The exception is that instead of the independent jack shaft lever on the right, an arched lever takes its place that is cast to the dobby lever.

This particuar kind of dobby is about the most precise used in the cotton industry. Though having four operating cylinders, and also a master cylinder that stops any one cylinder and brings another into play, the same dobby can be made for 1, 2, 3 or 4 cylinders, which are the most suitable for the manufacturer's trade. The one cylinder is limited to the plainer goods, but the four cylinder can give the most varied aspect to the woven structure. For such a dobby, accuracy of workmanship is vital for the establishment of confidence and good results. This confidence has been established, and is the pride of the firm.

The ground weave is taken by the outer cylinder, and the other three contribute their share to the texture as planned by the designer and pegged by the overlooker or lag pegger. Usually, the three inner cylinders only require a small number of lags.

The master cylinder operates four levers, to each of which is attached a rod that controls a cylinder pawl, raising the pawl to place it out of action, and dropping it for service.

The outer roller for the master cylinder is adjustable to the length of the lags. The jack levers for the shafts pass through grates to prevent jacks and shafts catching each other.

For this dobby, the firm claim six points.

1. Simplicity and minimum number of working parts.
2. Each pattern cylinder is worked independently.
3. There is only one ratchet wheel to each pattern cylinder.
4. Ratchet pawls work on the same centre as its own ratchet wheel, and this gives more positive controlled motion to the pattern cylinder.
5. The break-back mechanism of the feelers gives a fool-proof setting to the mechanism.
6. Accuracy and reliability of the registering mechanism.

The usual speed of the loom is 230 picks per minute.

For block of this dobby see advertisement, page 572.

THE WEAVING OF HOSEPIPING.

This class of fabric became of national importance during the World War.

Hosepiping requires a special loom to weave it, and the one presented is made by Messrs. Robert Hall & Sons, Bury, Lancashire.

Yarns Employed.—Cotton is not as suitable for this class of work as flax and hemp. When cotton is very closely woven, it becomes too hard after wetting and pressure, and is difficult to coil.

Flax and hemp swell after wetting, and when closely woven, become water tight. They can withstand pressure up to 500 lbs. per square inch, and after use, are readily coiled, and conveniently carried.

Hosepiping examined, had three strands in one thread of warp, and eighteen strands made one pick of weft. There were 30 threads and 9 picks per inch, and the weave was plain. The texture was 4 inches outside when flat, but had a diameter inside of 2½ inches. Both warp and weft were flax.

Shedding.—This was done by four positive tappets on the right in Fig. 386. Stout levers fitted with anti-friction bowls fit over the tops, and are fulcrumed at the back. The levers vary in length, the outside one being the longest. At the loose end, the levers have three bores each, and here is pinned the swivels to which the connecting rods are hooked. At top and bottom, the rods are hooked to swivels on the strong shedding levers. At their inner ends, there are V-shaped irons put through swivels that are hooked to the metal ends of the heald shafts. The shedding levers are 19 inches long, over and under the loom and 16 inches outside the loom frame

The tappets are turned by a small wheel on the crank shaft that meshes with the wheel below, the ratio being 1 to 4. The tappets are firmly held to the tappet wheel by four bolts.

Wefting.—It is done by a positive tappet seen in Fig. 386, in front of the shaft tappets. The tappet is keyed to the tappet shaft, and at its top front, is the operating lever and

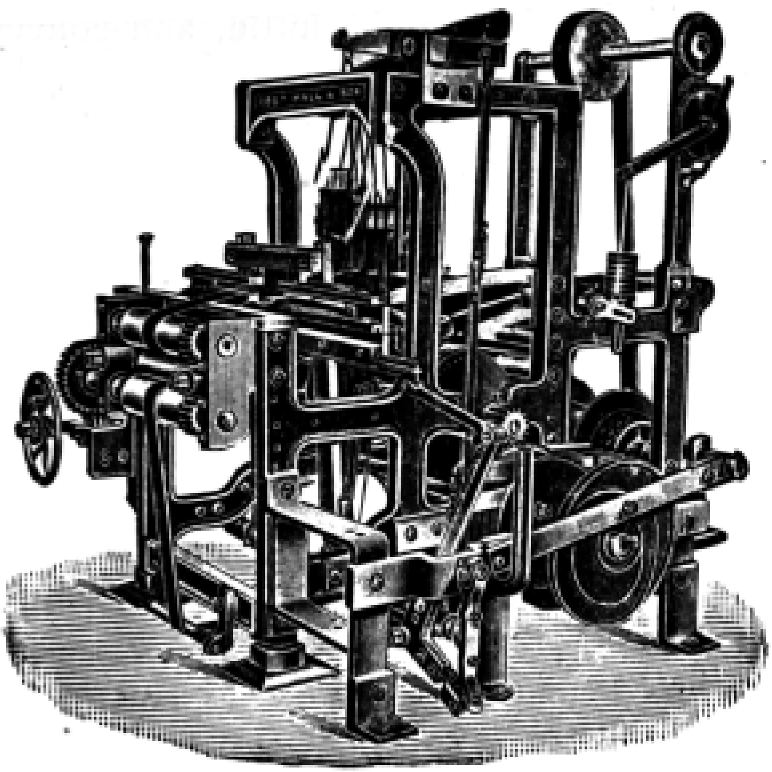


Fig. 386.
Hall's Hosepiping Loom.

bowl. There are a series of castings by which the bowl lever is connected to a lever that does duty as a picking stick. The upper part is seen in Fig. 386, and attached to it is a connecting arm pinned at A. The tappet causes the pick lever to move forward on one pick, and is drawn back the next.

A front view is at Fig. 387. A is the connecting place already mentioned. The rack with its upstanding teeth is at B, and C is the rib that keeps the rack steady and upright. The rack passes through the planed outer parts in the rack rests at D and E.

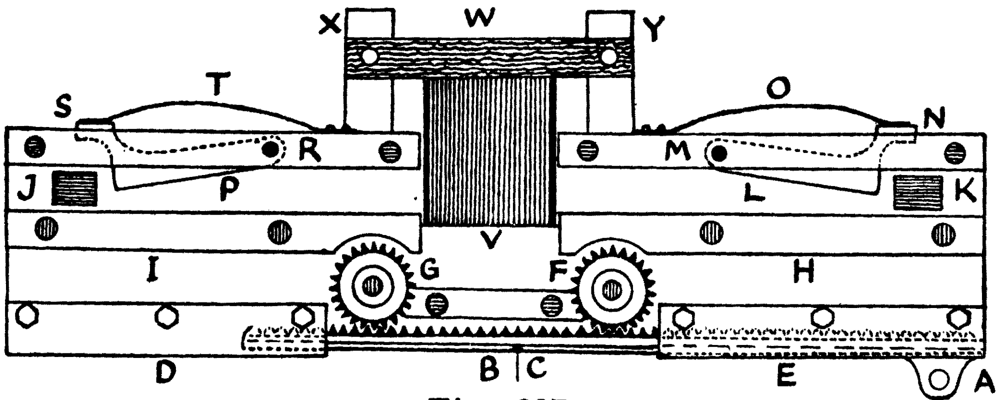


Fig. 387.
Front View of Reed and Shuttle Rack.

The movement turns the pinion wheels F and G, each having a diameter of 4 inches. These mesh with the cogs on the under side of the metal shuttle, and convey it from box to box.

At J and K are the stationary rubbers against which the blunt end of the shuttle contacts at the end of its run.

Box swell L hangs from the box top, and is pinned at M. At N is swell head, and O the curved spring that applies pressure to shuttle.

Though the actual measurements between the swords X and Y is 14 inches, the reed width is only 5 inches. The handrail at W is 20 inches.

Metal shuttle.—Fig. 388 gives a front view. A is the metal plate screwed to the cast part at B and C, and is 11½ inches long. D is a small riveted plate with a flanged roller at its centre, and an opening at either end for the weft to pass half round the roller. The three bores F, and another at G brake the weft, for it has to be held tight after the shuttle has reached its limit in the box. The length of the shuttle is 14 inches.

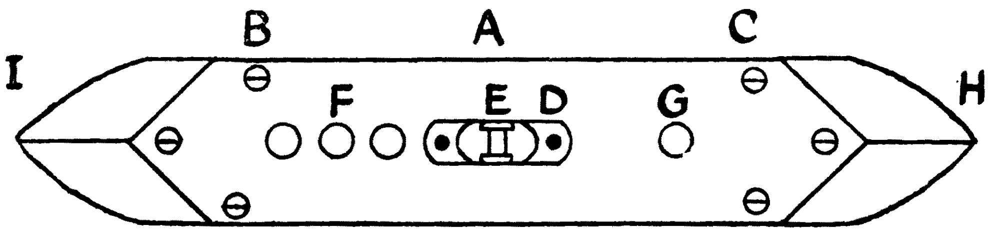


Fig. 388.
Front View of Metal Shuttle.

Fig. 389 is a top view. A is top of front plate, and B the spindle for weft bobbin. The cast part C is shaped to receive the brass casting D that has two bores to let the weft pass through. It is also fitted with two fluted rollers, one at E, and another to brake the weft. The casting D can oscillate a little, but is held by a flexible spring. The ribs F and G are the slides of the shuttle, and at the bottom are its cogs, the shuttle being positively controlled.

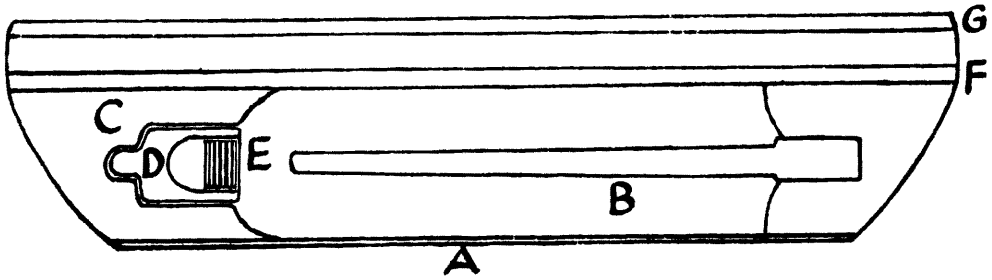


Fig. 389.
Top View of Metal Shuttle.

Beating up.—This is another special part of the loom that gives a double beat-up to the weft. The first beat-up is at Fig. 390. A is the protecting wheel on the outside of the crank, and is an aid to the momentum of the going part, and rotates as arrow R.

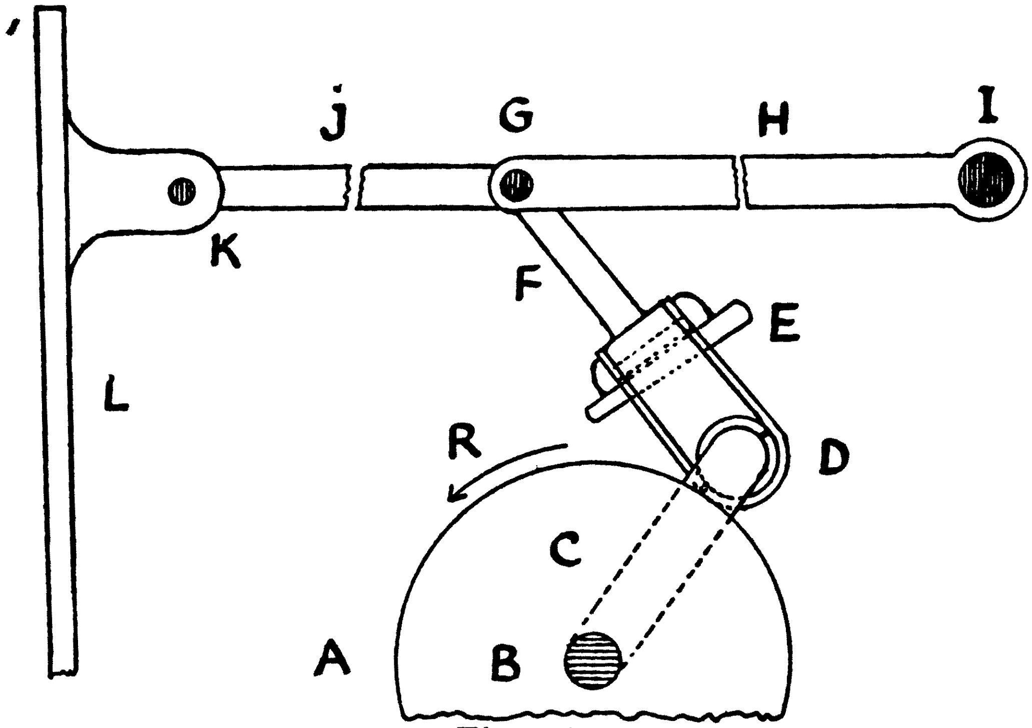


Fig. 390.
Double Beat-up (First Position).

Crank shaft B has a diameter of 2 inches, and crank C is 7½ inches from centre to centre. D are the brass bushes along with their metal band, and cottered at E. Crank arm F is pinned at G to the connecting arms H and J. Long arm H is fulcrumed to strong bar I, and short arm J is secured to the sword L at K. The horizontal arms H and J, along with the sword, are at their full forward movement, but crank C has not yet reached its top centre.

It has done so in Fig. 391, and has pushed up arms H and J above the beat up line N. By so doing, the sword has receded from the beat-up position at O for a distance of 2¼ inches (loom measurement). When the crank moves forward to line P in Fig. 391, the connecting arms H and J are then drawn down to the full beat-up line N, and the sword is pushed forward for the second time to O.

Take-up Motion.—This is outlined at Fig. 392, and is at the driving side of the loom. A powerful shaft slants downward from the loom front. The large handwheel is to draw the warp forward, or let off the cloth. Behind it is the worm that meshes with the take-up wheel, having 30 cogs, and turns the spike-covered take-up roller. This roller takes the place of the three cogged wheel rollers in Fig. 386.