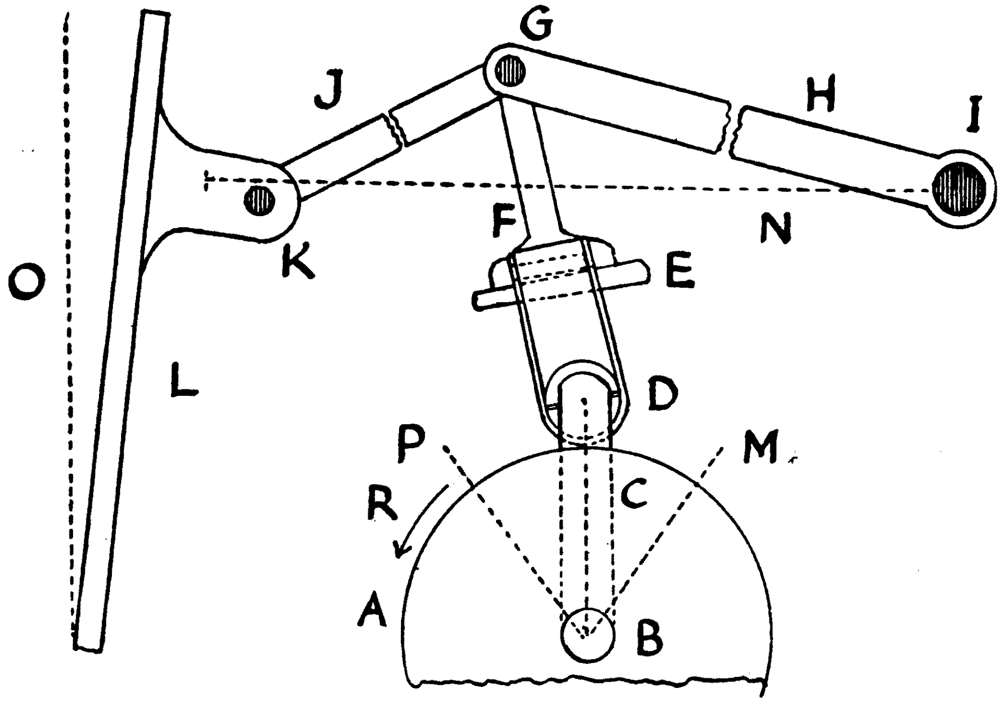



Fig. 391.
Double Beat-up (Second Position).

At the base of the take-up shaft, is the change wheel that is turned by a worm keyed to the crank shaft. The brackets holding the take-up shaft are adjustable to the change wheels. The gauge figures are 943. Suppose 15 picks per inch is required, then 15,000 ÷ 943 = 16.

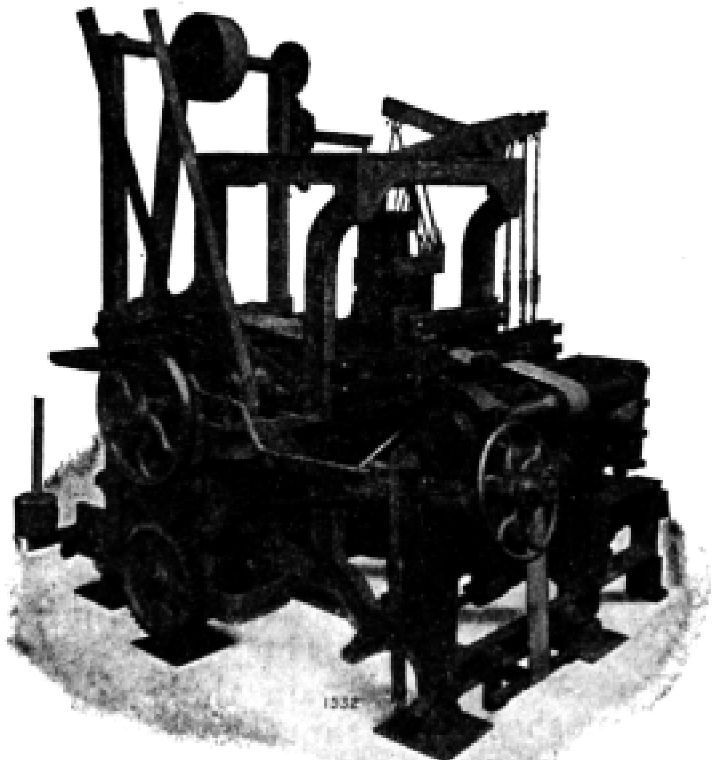


Fig. 392.
Hall's Hosepiping Loom (End View).

*Let-off and Take-up.*—Hosepiping may be woven from one beam, but is better woven from two, for then braking friction and weights are halved.

The beams are braked by a negative chain motion. fixed to a cross bar in slots in the loom frame. At each end of the bar is an upright rod, and on these are placed the flat and circular brake weights. When the woven piping leaves the spiked roller, it may pass over several smooth bars, but comes to the front again as in Fig. 392. It passes under bars at the front and back of the loom, and is automatically wound on a revolving bar at the top back of the loom as in Fig. 392.

The winding mechanism is better seen in Fig. 386. A cross shaft oscillates, and on it is setscrewed a lever that lifts a weighted rod. The rod drops of its own weight. The top of the rod is fixed to a lever that carries a pushing paul, and a stationary catch prevents a back run of the take-up wheel. The ratchet wheel has a small pinion wheel cast to it, and turns the intermediate wheel that winds the piping on to the roller.

# HATTERSLEY'S AUTOMATIC FOR CANVAS AND DUCK CLOTHS.

This is a shuttle changing loom recently made by Messrs. Hattersley's of Keighley, and is built for the weaving of canvas and duck cloths. The one shown in Fig. 393 weaves 20 oz. fabrics, but other looms are constructed to weave them up to 30 oz. per square yard.

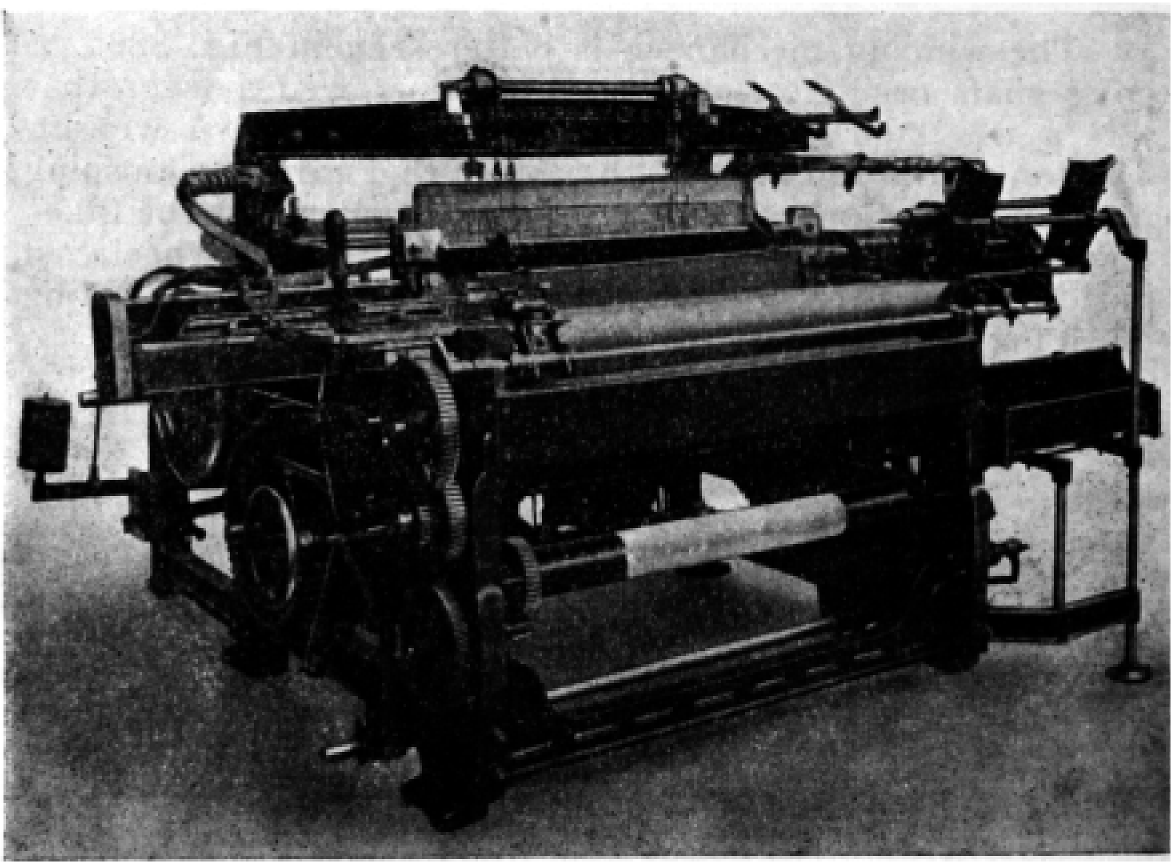


Fig. 393.
Hattersley's Automatic Duck Loom.

*Warp Beam.*—It is made of steel tubing that slides on to a square part of the supporting shaft. The flanged pulleys also fit on to the square section, and have a diameter of 9½ inches. There are three stationary rollers inside the loom over which the warp is made to pass before mounting the back rest. The rollers decrease brake weight, and increase friction.

*Novel Back Rest.*—At its centre, the stationary back rest is 6 inches broad, and then gradually tapers off towards either end. This shape prevents sagging at the centre during weaving.

The height at the top is 4½ inches above the breast beam, and this increases the tension on the bottom shed, and decreases it on the top one.

*Shedding.*—Two pairs of tappets inside the loom control the heald shafts. As a deep shed has to be made for the large shuttles, a special bar is fitted in front of the droppers so the droppers are not interfered with.

The picture shows the ordinary roller motion for top gearing, and the timing of the shafts is to have them level when the reed is a ¼ inch from the cloth fell.

Instead of leather connections to the shafts, there are link chains. The final row of links are threefold, and has a threaded rod. On it a casting is screwed and locknutted. The wing screw attached carries two hooks, and so distributes the weight on the shafts.

*Picking.*—The picking shafts are fixed outside the loom frame. The picking nose is hooked, and strongly made. Buffalo pickers are made to be used for either hand, or reversed at the same end. Shuttle checking is by buckle and checkstrap, the strap passing *behind* the handrail.

*Take-up Motion.*—All wheels on the loom have their teeth cut out of solid metal, and give maximum strength and wear. The take-up wheels and circumference of take-up roller are

$$\frac{72 \times 54 \times 51}{\text{C.W.} \times 14 \times 17.09} = \frac{198228}{239} = 830 \text{ gauge figures.}$$

The ratchet wheel inside the loom is turned by a pawl driven by the sword, and takes up one cog per pick. On the same stud as ratchet wheel, is the change wheel that meshes with the intermediate, and the pinion cast to the latter, contacts with the take-up roller wheel. The take-up roller is spiked to prevent cloth slipping. The hand wheel for weaver is on ratchet shaft.

*Cloth Beam.*—It is not turned by friction, but by preserving the balance between let-off and take-up. Its ratchet wheel is the bottom one outside loom frame, and its pawl is on a lever moved by a casting on the rocking shaft that holds the sword foot. The take-up lever has a closed spiral spring attached, the spring strength regulating the take-up. On the shaft of the take-up ratchet wheel, and seen inside the loom, is a small wheel having 12 teeth, and this turns the wheel on the cloth beam that has 41 cogs. The cloth beam can be removed with piece, and another substituted.

*Shuttles.*—These have solid bottoms, and shuttles are 18 inches long, 2 inch broad, 1⅞ inches deep at front and back, and have removable spindles that are held in the weaving position by spring clips at either side. The weft passes through an eye at an obtuse angle, and the weft emerges near the bottom front.

A thick wire shuttle guard is fixed to the metal hand-rail, and can be pushed inward. The first bump of the reed against the cloth, and the guard drops to its weaving position.

*Feeler Motion.*—It is seen on the left, and "feels" the weft every other pick. To do this, there is a slot in the shuttle front 1½ inches long, and a slot in the front head of the bobbin. When the feeler penetrates the bobbin slot, a finger is dropped behind the hammer head on the tumbler weft fork, and on being pushed back, brings the mechanism into play that stops the loom, changes the shuttles, and restarts weaving.

*Shuttle Changing Mechanism.*—The magazine on the right holds six shuttles. To change the shuttles, there are four tappets and a clutch motion driven by a link chain on two sprocket wheels, the upper wheel being on the crank shaft.

Commencing from the loom frame, the first tappet stops the changing mechanism if anything goes wrong.

The second tappet restarts the loom after the shuttles have been changed, and the carrier has retreated to its stationary position.

The third tappet controls the carrier to and from the box.

Then comes the friction clutch that turns the tappet shaft for shuttle changing. The fourth tappet operates a double mechanism, for it elevates the box front for the ejection of the spent shuttle, and by the same movement forces the spent shuttle out of the box into the hopper. The ejection is done by a curved and broad pusher that passes over the top of the box swell at the back of the box.

When the shuttles have been changed, the box front is lowered in position, and the shuttle changing mechanism is brought to a standstill.

Automatically, the loom restarts weaving in six seconds.

All the tappets are accurately made to perform their several functions precisely, and may be said to be "fool-proof." The loom is run by an individual electric motor and V ropes. The speed of the loom is 120 picks per minute, and the reed space is 42 inches.

# MULTIPLE FABRIC LOOMS.

The loom here presented is made by Messrs. Wilson and Longbottom of Barnsley, Fig. 394. The dobby is the Northrop Leeming dobby. For details of this dobby, reference should be made to the chapter on The Leeming Dobby, Fig. 35.

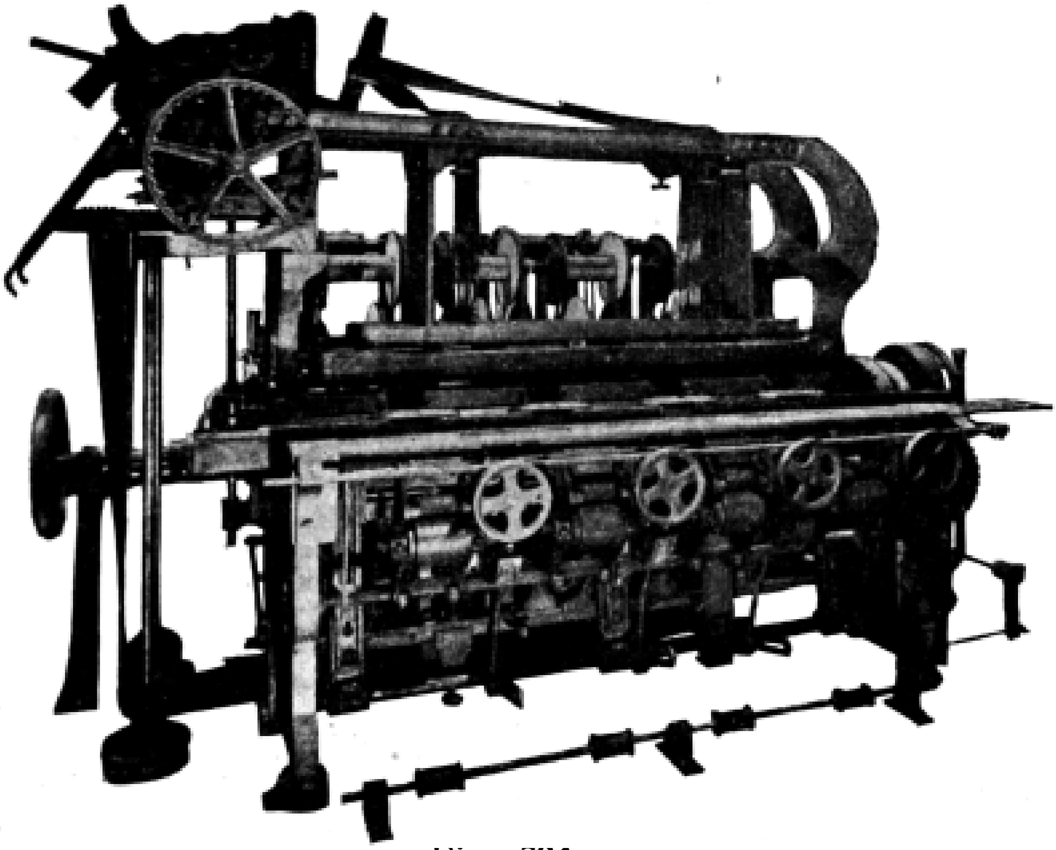


Fig. 394.
Wilson and Longbottom's Multiple Fabric Loom. (Front View).

*Design for Pouched Webbing.*—Fig. 395 gives the peg plan. It is on 16 shafts and 40 picks. The first 24 picks are to make the pockets on the face of the fabric, and the following 16 picks weave the ground. In the woven structure, the pockets resemble small glove fingers pointing to the centre from either side.

In weaving the pocket sections, four picks are woven with the take-up motion in action, and it is then stopped for two picks so the reed can give a harder beat up to the weft. The stoppage occurs four times in one repeat of the pattern, and is indicated by crosses on the right of the design. The stoppage is made by the lags operating a spare shaft jack which is connected to the pawl that turns the ratchet wheel.

*Warp Beams and Drafting.*—Behind the loom there are 16 small beams or cheeses. These are used in groups of four each to make one woven webbing. The back bottom cheese is for weaving the pockets; the inner bottom one is

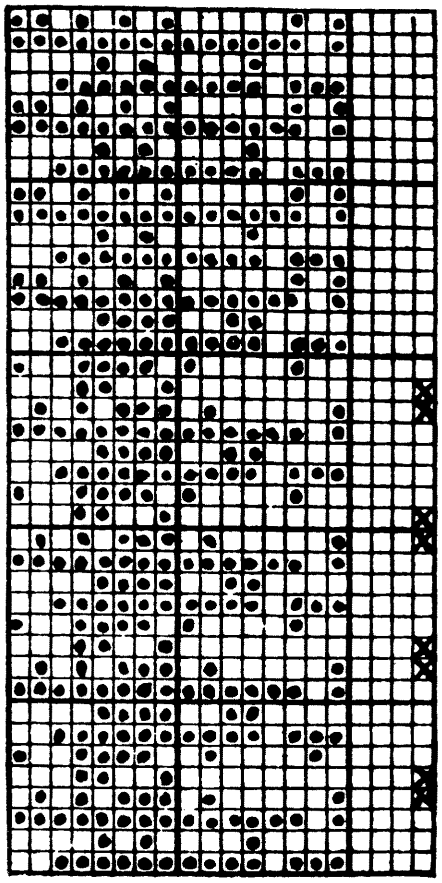


Fig. 395.
Design for Military Webbing.

for the ground; the centre one holds the binding threads; the upper one is for filling. At either side each cheese is braked with chains and weights.

The drafting is very complicated, but the first two shafts are used for binder threads; the next is a filler with double drawn threads; the following five shafts are also double drawn except the starting and finishing threads, and these are for pocket making; the next three are for ground; the last five are drawn double and are for ground = 16 shafts.

The threads are allotted as follows: Binders 21; Fillers 32; Pockets 76; Ground singles 26; Ground double 131; Ground single 2 = total 288 in each of the four fabrics woven at the same time on the same shafts. Each fabric is 2¼ inches wide. The warp has 128 threads per inch, and the weft 25 picks per inch.

*Shuttle Construction.*—The shuttles are made of aluminium, and without bobbin weigh 30 oz. The total length is 11¼ inches; depth at back 1⅛ inches and tapers downward at the front; width at widest 2⅝ inches.

The top view is at Fig. 396. A is shuttle front that bows well back at either end to the blunt points B and C. Weft bobbin D is on a spindle two inches long, and is divided to act as a spring to hold the bobbin. The spindle block, and the tempered covering spring F is fulcrumed at E. The spring is shown in its weaving position and its loose end is

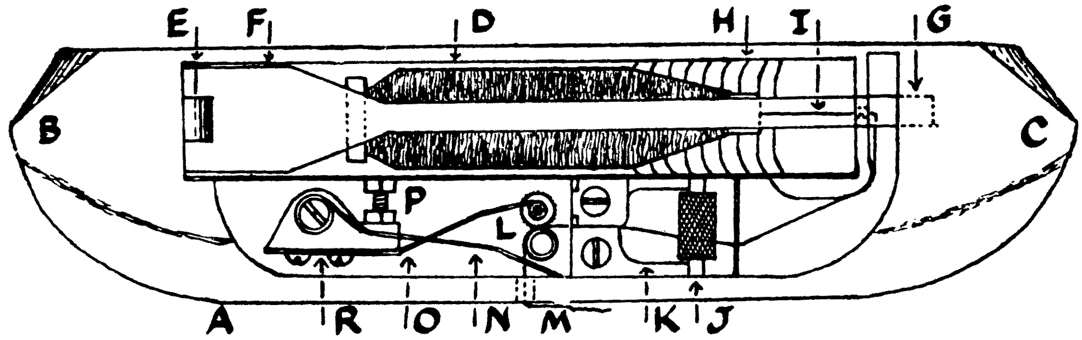



Fig. 396.
Top View of Metal Shuttle.

tucked inside the opening at G. The bottom of the bobbin section in the shuttle is grooved at H, and is handy for weaving cops. The weft is at I. At J is the fluted metal roller under which the weft passes to brake it, and there are stay plates at K.

In the next compartment is another fluted roller fitted vertically at L. Its pressure is against a companion roller regulated by the locknutted screw at P, the spring O being fixed to the brass casting R. Attached to the holding screw on the brass casting, is the guide wire N, that keeps the weft to the brake rollers L. The weft emerges at M, is five-fold cotton, and has to be held tight during weaving.

The shuttles are fixtures on the loom, and the weft bobbins are changed with the shuttle on the shuttle race.

The under side of the shuttle is at Fig. 397. Here again, the back of the shuttle is at A, and the braking plates at K, with L the guide wire. R is the brass casting and

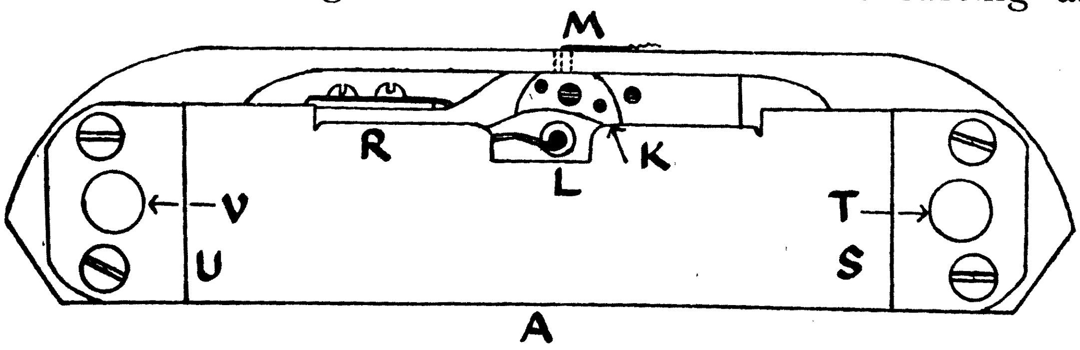



Fig. 397.
Bottom View of Metal Shuttle.

brake spring for vertical roller. The parts S and U are plates screwed and level with shuttle bottom. Through these plates, and into the bottom of the shuttle are the bores T and V that penetrate $\frac{3}{4}$ inch. Into these holes enter the pegs that propel the shuttle in both directions.

Each shuttle makes a forward, and also a backward run of $17\frac{1}{2}$ inches.

There is neither ordinary picking nor shuttle box front. To guide the shuttle, a strip of wood is doubly bolted to the box back, and a similar strip on the front of the shuttle race. The first prevents the shuttle from rising, and the second retains it on the shuttle race.

*Rail and Shuttle Movements.*—The system is depicted in Fig. 398. The long line A indicates the top of the shuttle race. The race is divided at its centre to allow pegs B and C to pass through, and makes contacts with shuttle bottom The pegs and attendant castings, are mounted on long slide D that moves on the projecting flanges M and N, the rail being below the shuttle race. E is the brass casting set-screwed top and bottom to rail F and G, and in its cavity at J is the pin B, with stud H, on which revolves bowl I.

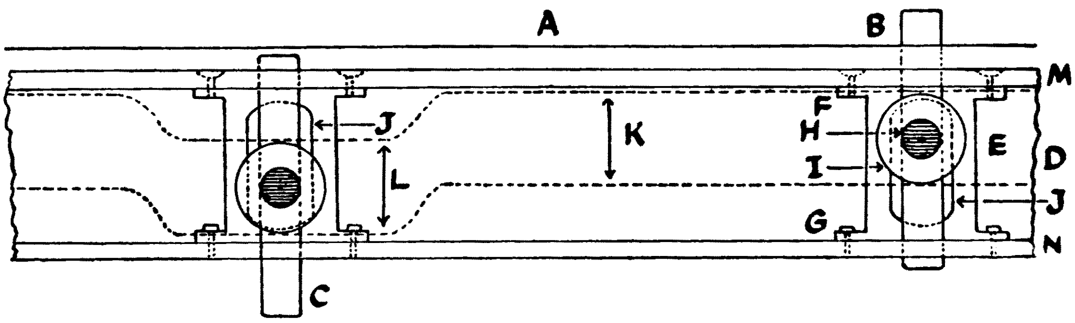



Fig. 398.
Rail and Pins for Shuttle.

Rail D is pushed forward and pulled backward by lengths of link chains, coupled to powerful treadles operated by a pair of half dwell tappets at driving end of loom. The chains pass over pulleys that move with going part. In the front inner part of the going part, is the long groove K for bowl I to run. The groove descends at L, and bowl and pin are lowered so the pin top is below shuttle race. It is above these sunken grooves where the fabrics are woven.

Peg C is shown in the centre of the depressed groove, and out of touch with shuttle, but the shuttle is still held by the uplifted pin B. As rail moves forward, pin C rises, and enters the front bottom hole in shuttle, and pin B is lowered in turn by the sunken part of the groove, and then rises again in the same manner as pin C. When the rail is drawn back, the sinkings and risings of the pegs take place but in reverse order. In this way, the positive control of all four shuttles is maintained. Both pins, bowls, and studs are case hardened. When the top part of a pin is worn, it may be placed at the bottom, for they are standardised.

The total depth of rail is $2\frac{3}{4}$ inches. The outer treadle moves the shuttle to the left, and the inner one to the right.

*Take-up Motion.*—The front view is outlined at Fig. 399 It is better than the older make, for being elevated, the overlooker can attend to inner repairs with more freedom. Each fabric has its own take-up motion like Fig. 399. A

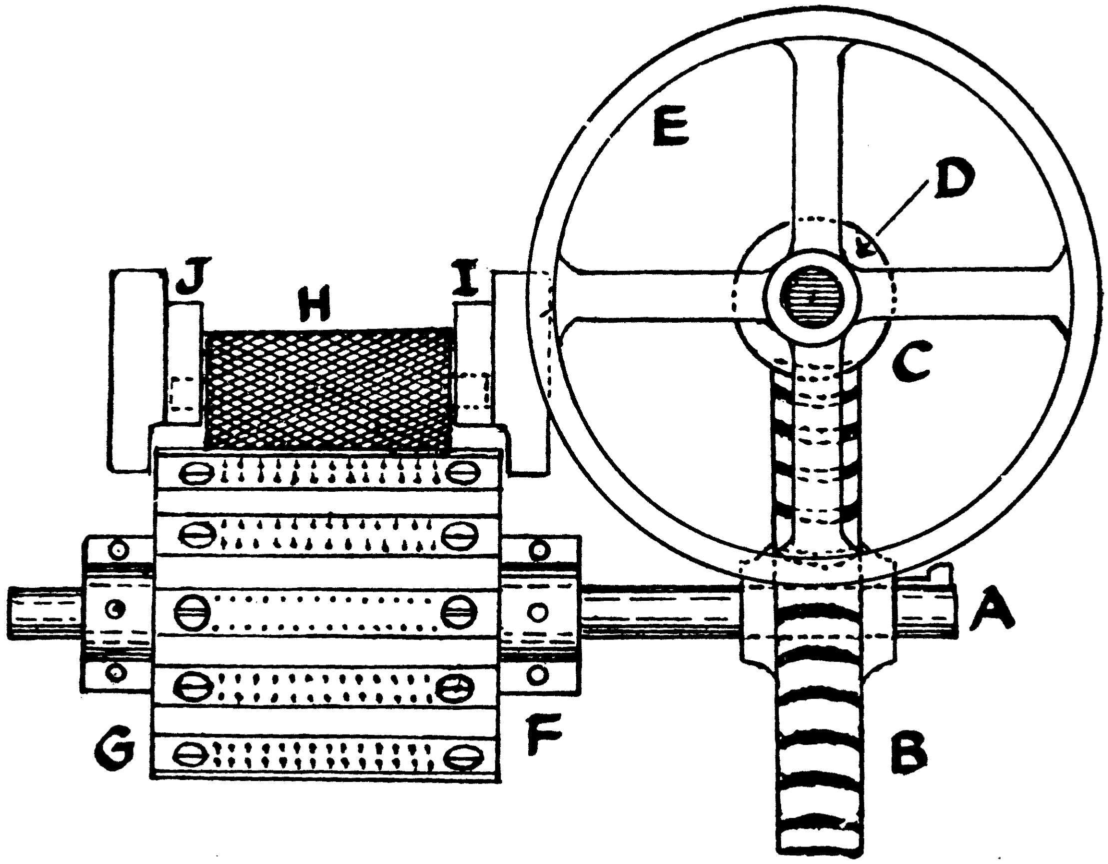



Fig. 399.
Take-up Motion. (Front View).

is the take-up shaft to which wheel B is keyed. At C is the end of the worm, and D the worm shaft. E is the hand-wheel for minor adjustments. The take-up roller is at F, and clamped at either side to the take-up shaft, and readily altered in position, or taken off. It has a width and diameter of five inches, is made of metal and furnished with broad grooves. Into each groove a plate having two rows of spikes is fixed by screws as at G.

Above the spiked roller F, is the iron fluted pressure roller H, the shaft being held by brackets I and J. It has a diameter of $1\frac{3}{4}$ inches, and a width of $4\frac{1}{4}$ inches. The open slots in the holding parts are the sides of one casting, the back part of which is heavy, so as to press the woven structure on the spikes. If it be that the pressure roller requires to be removed, the back end of the bracket is raised, and the roller can be taken out. A side view is outlined in Fig. 400.

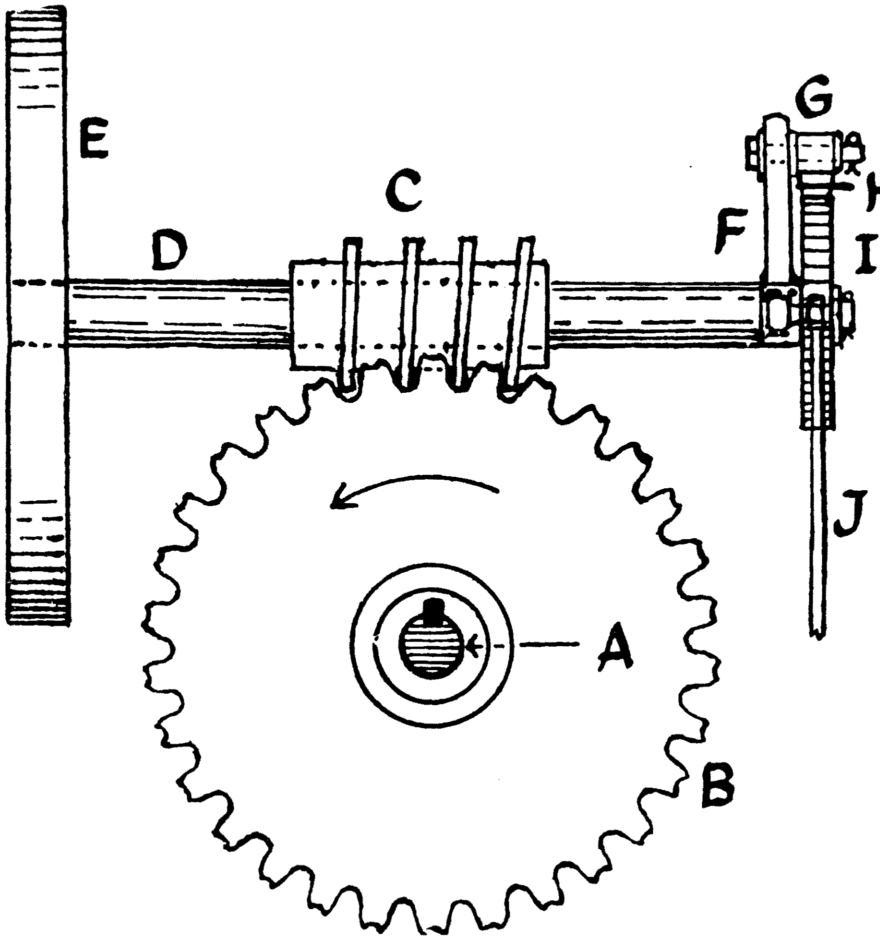



Fig. 400.
Take-up Motion. (Side View).

A is the take-up shaft, with B the worm take-up wheel with 30 cogs, and at C, the worm in contact with the teeth. The worm shaft is at D, with E the smooth wheel affixed. F is the right angled lever, and to its upper arm the ratchet pawl G is attached. On pawl G is finger H that raises the pawl when the take up has to remain stationary for two picks. This too is an improvement, for the ratchet wheel remains stationary, whereas in the former make, the ratchet moved to no purpose.

At I is the ratchet change wheel fixed to the inner end of the worm shaft, and has 40 teeth. The gauge point is a tooth per pick. On the bearer bracket is a pin carrying the holding catch for the ratchet wheel, the catch keeping contact by its own weight. The horizontal arm of lever F has rod J attached. At the bottom, the rod is fixed to a lever on the rocker rail, and by this means, the ratchet wheel and worm shaft are turned.

*Path of Webbing.*—The woven structure descends from breast beam to the spiked take-up roller, and on passing well at the back, goes over the top of the fluted roller. From here, it descends to the loom bottom, passes underneath, and ascends to the cloth roller at the back top of the loom.

The winding takes place by sword movement actuating a pawl driving a ratchet wheel. By link chains and sprocket wheels, the series of cloth rollers wind up the cloths. Each roller is fitted with friction drive, and by a thumb screw, the webbing can be wound tighter or slacker.

*Loom Driving.*—The loom is driven by an electric motor of 2.5 h.p., and four V ropes. The loom may be started and stopped at any part of crank movement, for there is no knocking off arrangement, and shuttle movement is positive. The crank arms are of ordinary make but doubly cottered. There are three swords to support the going part. There is also a fourth, but its primary purpose is to hold the revolving inner wheel around which the chains pass that moves the rail that carries the shuttles.

One weaver is in charge of from two to four looms. Fig. 401.

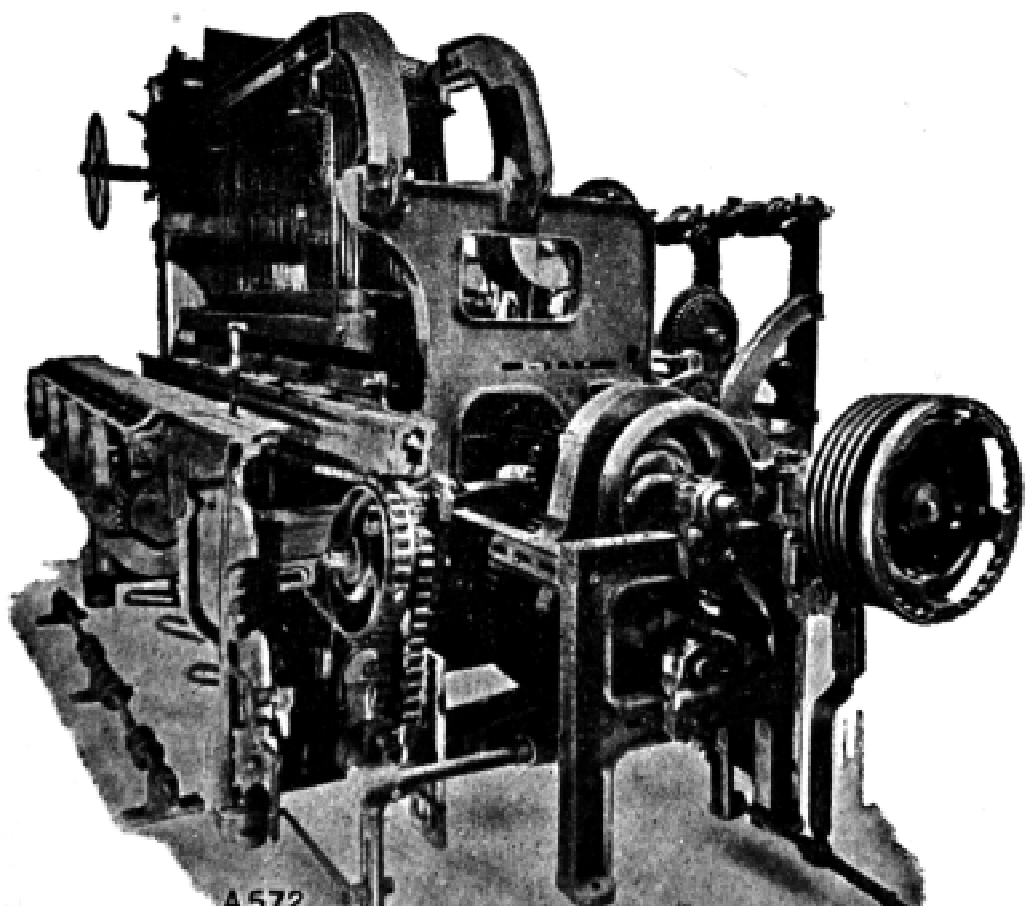



Fig. 401.
Driving End of Messrs. Wilson and Longbottom's Multiple Fabric Loom.

# PLATT BROS., NARROW FABRIC LOOMS

These are of different construction to Messrs. Wilson and Longbottom's.

The first is of the heavier type, and the other for lighter fabrics and ribbons. Both are of the Haywood construction. Fig. 402 is a tappet loom that takes 8 shafts.

*Warp and Binder Cheeses.*—The loom weaves four webbings at the same time. The cheeses are placed in stands at the back of the loom. Their inner width is seven inches and a depth of flange of 16 inches. There are four stands below and underneath the back rests; four more on a frame outside the loom; an additional four above the back rests, and seen on the crossrail in Fig. 402.

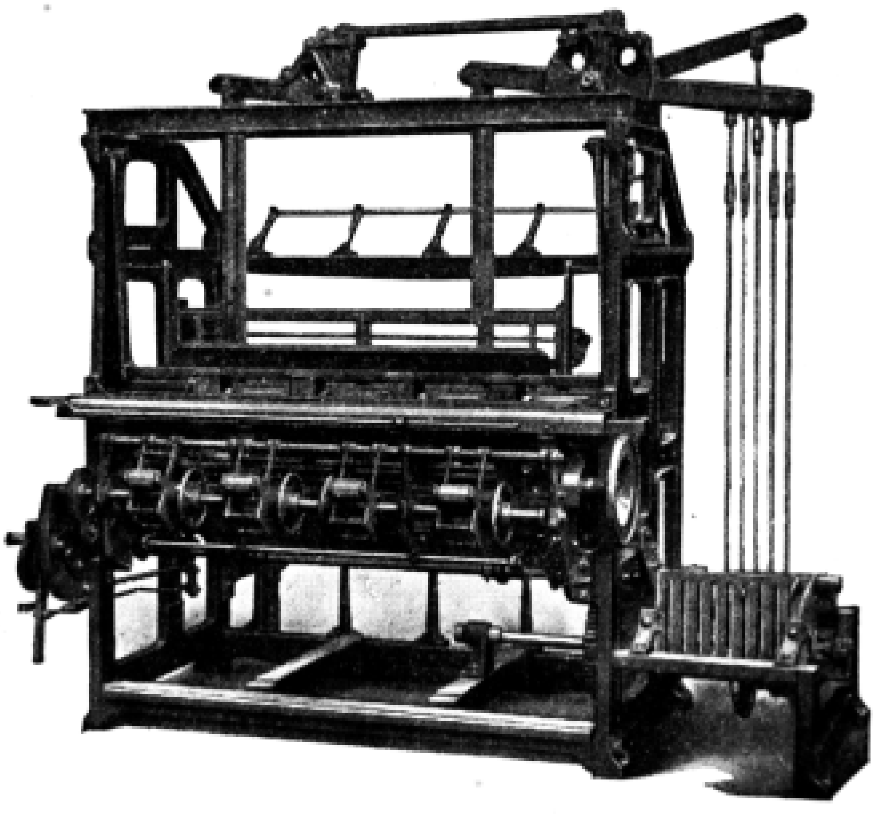


Fig. 402.
Platt Bros. Narrow Fabric Tappet Loom.

The binder cheeses are less in size as they carry less threads. Both sets of cheeses have a circular groove on one side for a brake chain, one end being held by a tension lever. The weights are respectively 18½; 12; and 6½ lbs. For the binder cheese, the weights are 7¼ lbs., and 1 lb. 10 oz.

If both sets of cheeses are near the same length, all the weights can be changed at the same time. In addition there are several back rests over which the warps may have to pass, to reduce dead weight.

*Shafts and Healds.*—The heald frames are steel, and occupy the ordinary weaving position. A shaft carries four sections of healds, and the ends of the shafts move in metal grooves. The healds are flat steel, the eyes being punched out and turned a little. They are 13½ inches long, and their flat sides are parallel with the warp. The heald shafts have no under motion, but drop of their own weight. The parts are riveted together, and are connected to the top jacks by flat bars. The shafts can be adjusted at one place in Fig. 403. A is the inner shaft adjuster and B the setscrew. C is the outer adjuster with setscrew D, both adjusters being cogged. In setting the shafts, the threads on the bottom shed have to be below the shuttle, but there is no ordinary shuttle race.

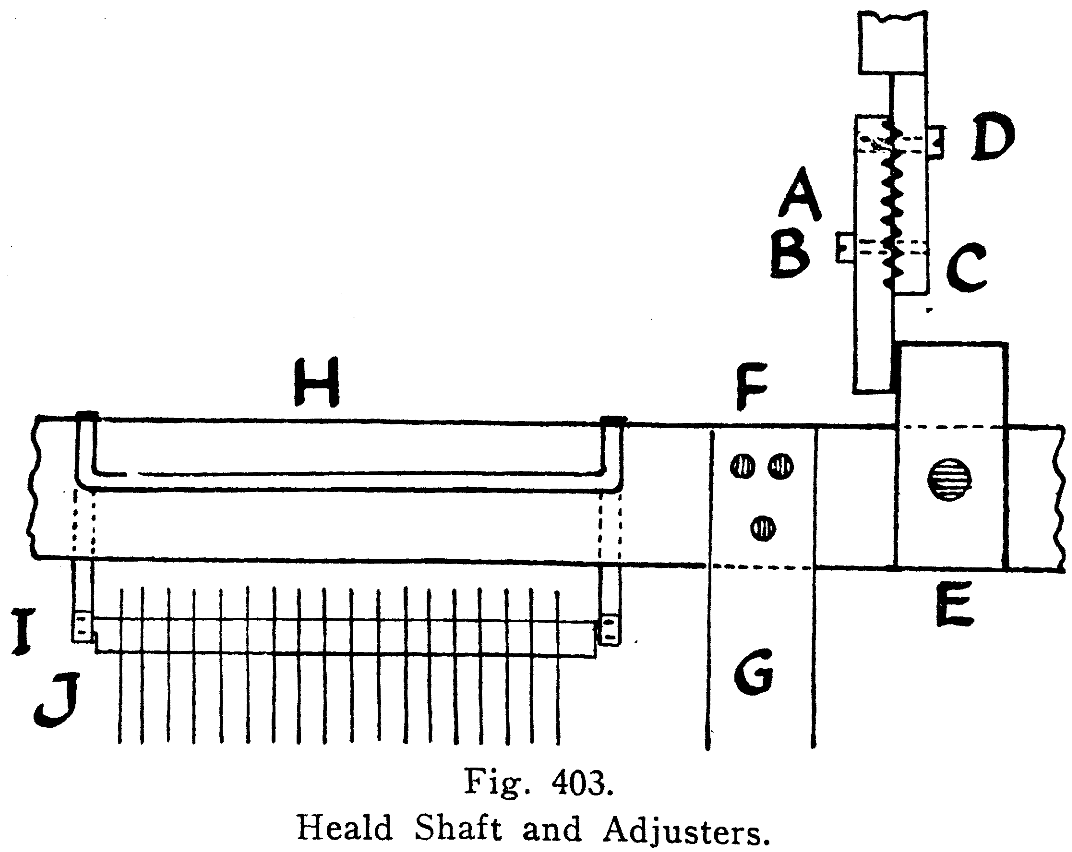



Fig. 403.
Heald Shaft and Adjusters.

At E the inner adjuster A is riveted to the top heald shaft F, and the two vertical bars G are also riveted to the cross bar. H is the hanger over the horizontal bar, and has charge of the small cross bar I, from which is suspended the flat healds J. This is duplicated on the bottom shaft, but in the opposite direction. The toothed part C is part of the vertical bar riveted to one of the three holes in the top jack.

*Positive Tappets.*—They are constructed to the weave required and are on the right in Fig. 402. They are run from a countershaft. The front of the treadles pass through a grate, and just inside are a series of screw holes for the fixing of connecting rods to the top jacks. The top of the rods are riveted to their respective jacks, but just below, both lengths of rods are held by a turnbuckle.

The loom has three shafts, and the centre one carries the grooved wheel connected to the electric motor by four V ropes. The motor is 1.5 h.p., and has 750 revolutions per minute. On the crank shaft is the tappet that oscillates the take-up motion. Almost at the other end is the sprocket wheel connected by link chain to the upper third shaft. On this are two wheels, the smaller being setscrewed to the boss of the other. The small wheel meshes with the large wheel behind it.

On the inner side of the large wheel is a tappet that moves a shuttle bowl lever below it. At the front end of the shuttling lever is a rod and link chain that turns the wheels that manage shuttle traverse. A similar arrangement is at the opposite end of the loom.

The larger outer wheel gears into a wheel on the same shaft as the handwheel in Fig. 402.

*Structure of Shuttles.*—An outline is at Fig. 404. With full cop, it weighs 20 oz. Its total length is $8\frac{3}{4}$ inches; width $3\frac{3}{16}$ inches; depth at back 1 1/5 inchs; front, $\frac{7}{16}$ inch.

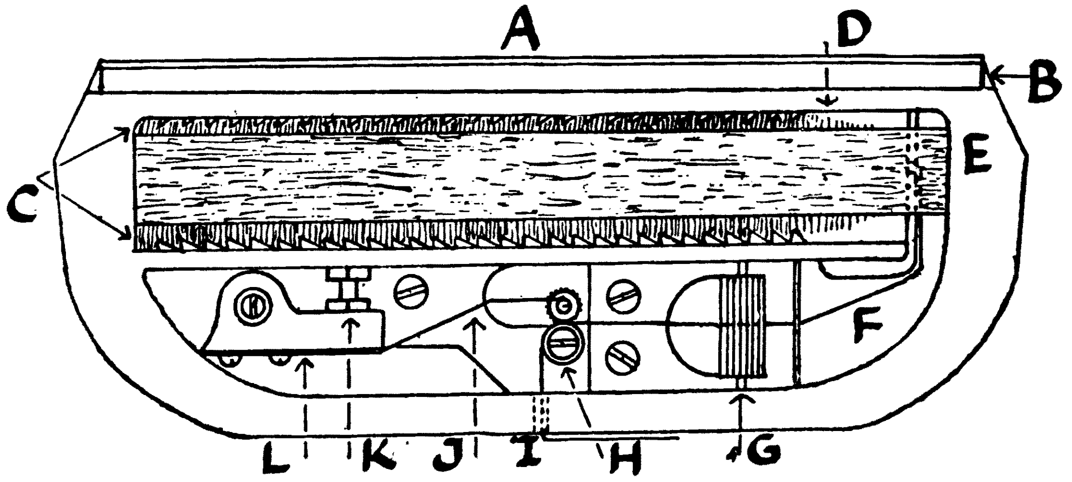



Fig. 404.
Metal Shuttle (Top View).

Fig. 404 is a top view. A is the back plate that is a buttress to the fibre cogs parallel with the shuttle bottom. B is the top groove into which the bottom of a flat bar fits, and keeps it in position. The two lines C are the tops of semicircular grooves that hold the cop D in its weaving position. E is the flat spring that holds the cop down. F is the weft braked by fluted roller G, the pressure opening out snarls. It passes between two small rollers at H, the inner being fluted, and held to the smooth roller by spring pressure J, fixed to casting L, and set by locknut K. The weft emerges through the porcelain eye at I.

Fig. 405 is the shuttle bottom, the special part being 23 fibre cogs at B, supported by the outer plate A. C is the bottom guide groove. The area D is the only flat part on the shuttle bottom, for areas E, F, and G, all slope downward. H is the brake spring and I the porcelain eye for the weft. At J is the long slot through the shuttle bottom.

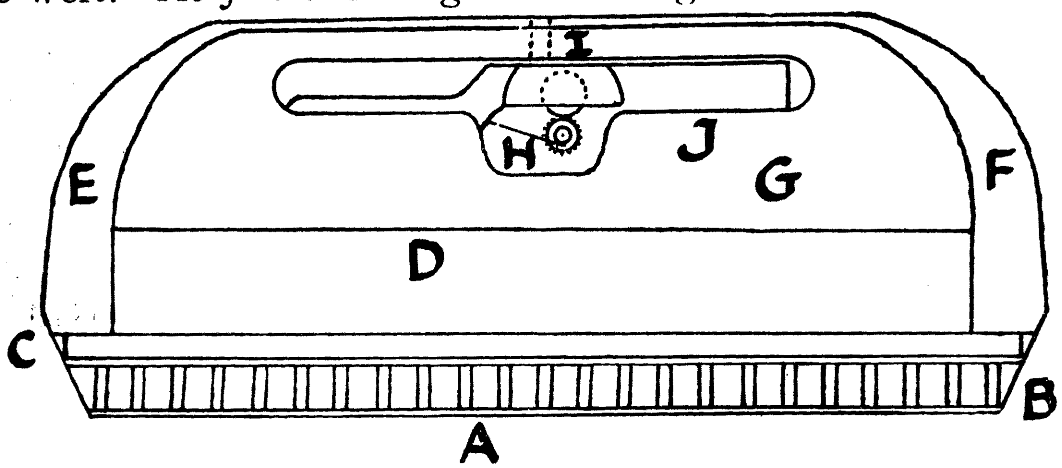



Fig. 405.
Platt Bros. Metal Shuttle (Bottom).

*Shuttle and Reed Movements.*—The cogs on the shuttle bottom engage with three cogged wheels in each section, and are passed forward to the next series on one pick, and taken back the next. All four shuttles begin to move forward before the beat-up arms reach their back traverse, and have moved forward an inch when the arms have reached their back limit, this being 5¾ inches from the front of the breast beam. The beat-up arms then remain at dwell until the shuttle has got within 1¾ inches of its full traverse, which is 12 inches. The shuttles are returned in a similar manner. The motion of the beat-up arms are actuated by a pin bolted to an ordinary cogged wheel. The pin passes through a die that fits into a half moon slot at the base of each beat-up arm. The effect is a long dwell during the time the shuttles make their run, and is followed by an accelerated movement to the front to make a firm beat-up of the weft, with a slight dwell at the front centre. The reed moves to within ⅛ inch of the breast beam. Contrary to ordinary weaving, the beat-up with handrail and sectional reeds move forward, and leaves the shuttles behind.

*Take-up Motion.*—The prime mover is a tappet on the crank shaft. The bowl lever contacts with the tappet by spring pull. At the lever bottom, a connecting rod joins it to the lever holding the ratchet catch. The long slot in the pawl lever is used to turn the ratchet wheel from one to four cogs every pick, but when altered, the first cog is chalked, the loom turned over by hand, and repeated until the correct leverage is obtained.

For the majority of heavy fabrics, the setting for four cogs per pick is common.

The standard ratchet wheel has 80 teeth. There is a train of seven wheels, and the last is on the shaft of the spiked take-up roller. The ratchet wheel is served by a weighted holding catch to prevent a run back.

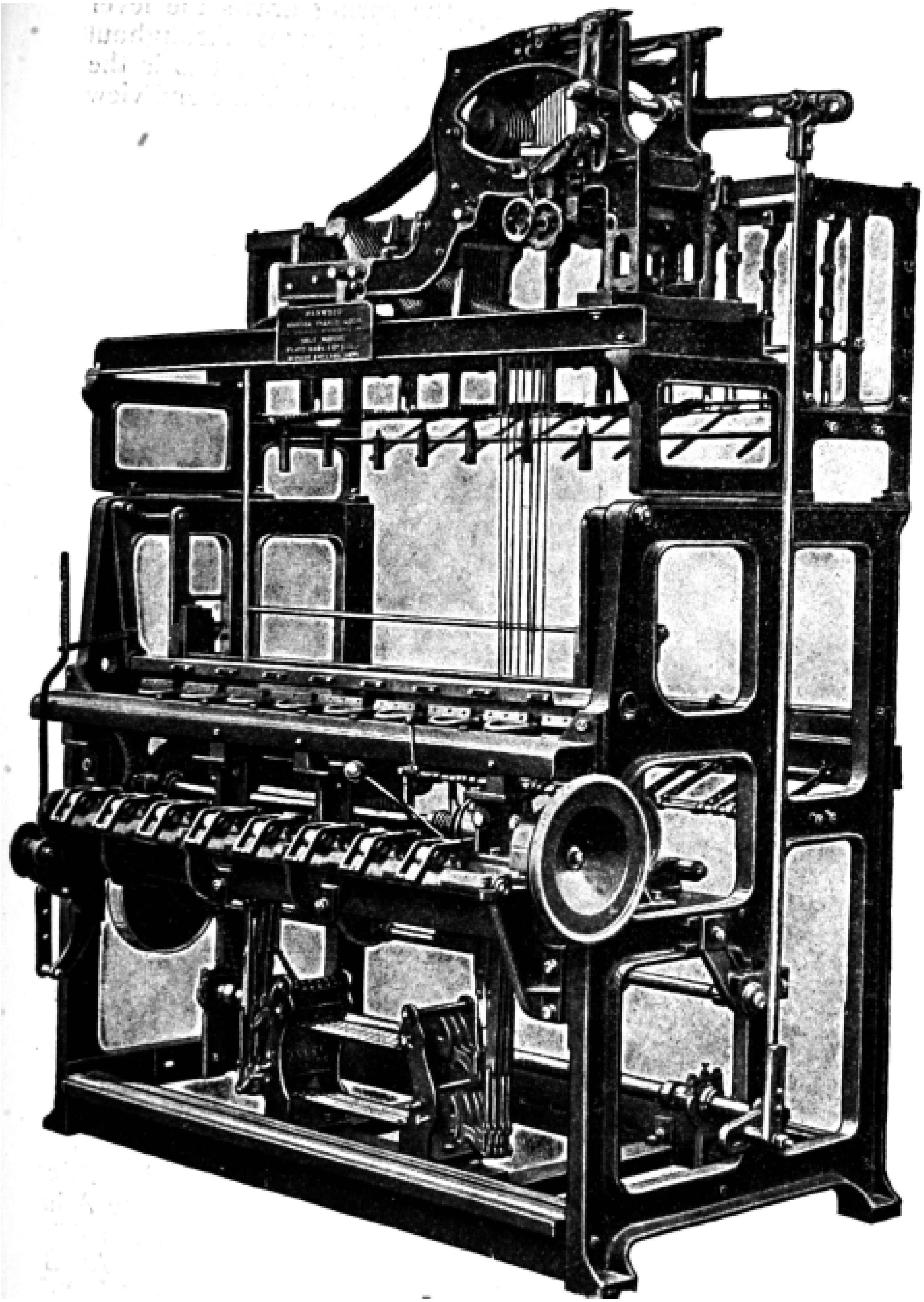
*Passage of Webbing.*—The woven structure passes underneath a raised bar on the top of the breast beam in Fig. 402. It descends to the spiked roller, and on passing underneath, goes over and under two fluted rollers. The shaft ends of the outer roller is pressed upon by encased springs. The webbing then descends to the receiving box. The handwheel at the side of each spiked roller is to regulate tension on the cloth.

## Loom for Light Fabrics or Ribbons.

In this make of loom there are 8 shuttles and in contrast to the 20 oz. for the previous loom, there is one made of boxwood weighing 4 oz. with full bobbin.

*Negative Dobby.*—In Fig. 406. it is made to take 16 shafts. The shaft lags have two rows of holes for pegs, and two feelers control each shaft. The shaft levers pass through grates, and, being a negative dobby, there is a spring under motion. The lag cylinder has 8 grooves and is turned one lag every other pick by a pawl in front of the dobby. The T lever at the back, is connected to the timing lever on the low shaft by a shedding rod. In Fig. 406. both are level, and this is how equal sheds are formed. The timing of the shed is set by the shedding lever. If the size of the shed is altered at either end of the shedding rod, the connecting rods to the draw bars must be immediately altered. The healds are fitted in the same way as on the previous loom.

*Arrangement of Cheeses.*—These are placed at the back of the loom. The frame has two rows of 10 each and each set has three places for them. The cheeses have a width of 3½ inches between the flanges, and a depth for yarn of 2½ inches. The flanges have a total depth of 8 inches and are grooved for brake bands. The method of control is outlined in Fig. 407. A is the warp, and B the knurl that holds one end of the brake band. The other is fixed to the brake weight lever D, with weight at E. F is the unwinding rayon



Platt Bros. Loom for Ribbons.

warp that passes under roller G on lever H, fulcrumed at I. Lever H is a compensator arm, for when the tension is greater than the pull of spring J, arm H is drawn to the left.

When the tension is decreased, the spring draws the lever back, and this " give and take " continues throughout weaving, with little alteration to the weights. At L is the back shed, and N the front one. The part O is the end view of the breast beam.

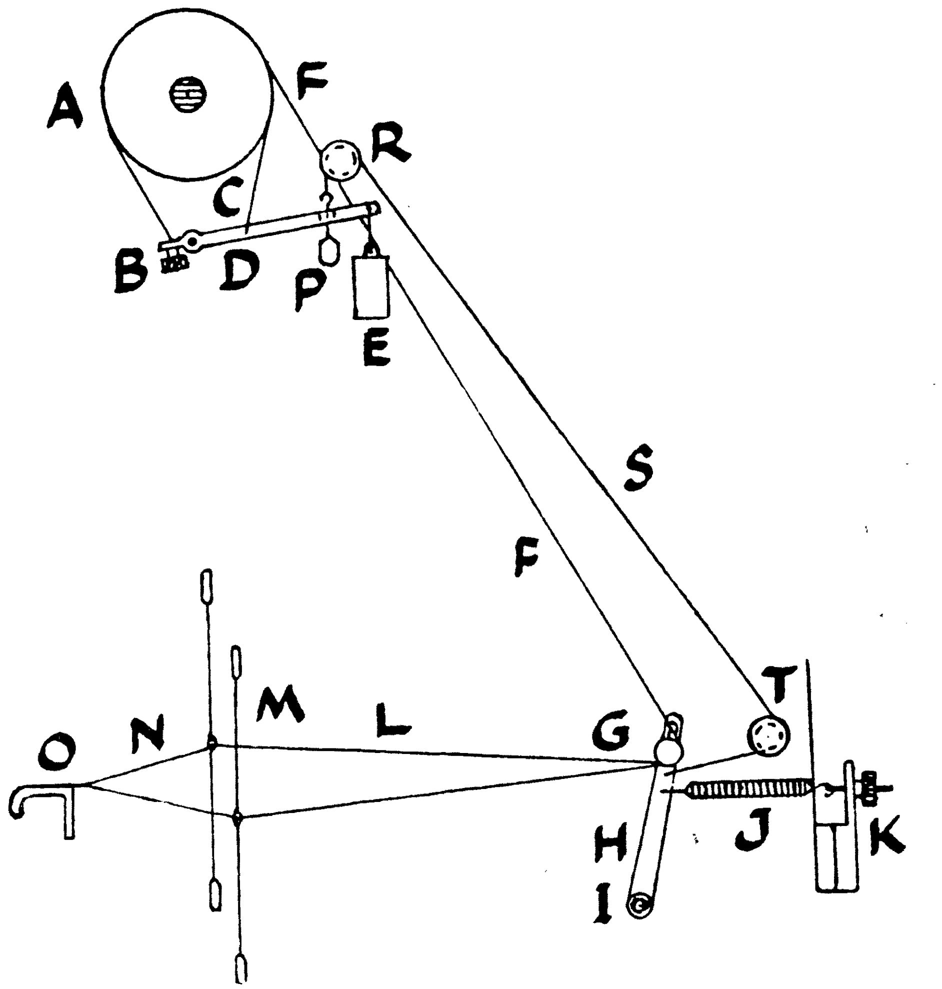



Fig. 407. Method of Un'erwinding Warp.

There are two bands, the one explained, and the other at S. The weight lever D has a slot, and through it passes a hook with weight P attached. The hook holds band S. which then passes over pulley R, and a lower one at T, and secured to lever H. When H is pulled to the left, band S is also drawn, and lifts weight P and lever D, and relieves pressure on the warp. Spring pressure on H is regulated by knurl K. Collar G can be moved to give the best effect to warp and cloth.

*Shuttle Structure and Movement.*—The boxwood shuttle is at Figs. 408 and 409. In the first, the back metal plate A is secured by screws. Back depth $\frac{7}{8}$ inch; widest width $4\frac{9}{16}$ inches; across centre from back to front $2\frac{7}{8}$ inches. At B is the broad top groove that assists in keeping the shuttle in position when weaving, for a flat bar is screwed to the box back, and fits into the groove. At C is the coiled spring made of wire, the hooked end going around wire E, and presses the oval porcelain brake D against the weft. Bobbin F has a wire pin passing through it, the pin lodging at either side of the stirrup shaped opening.

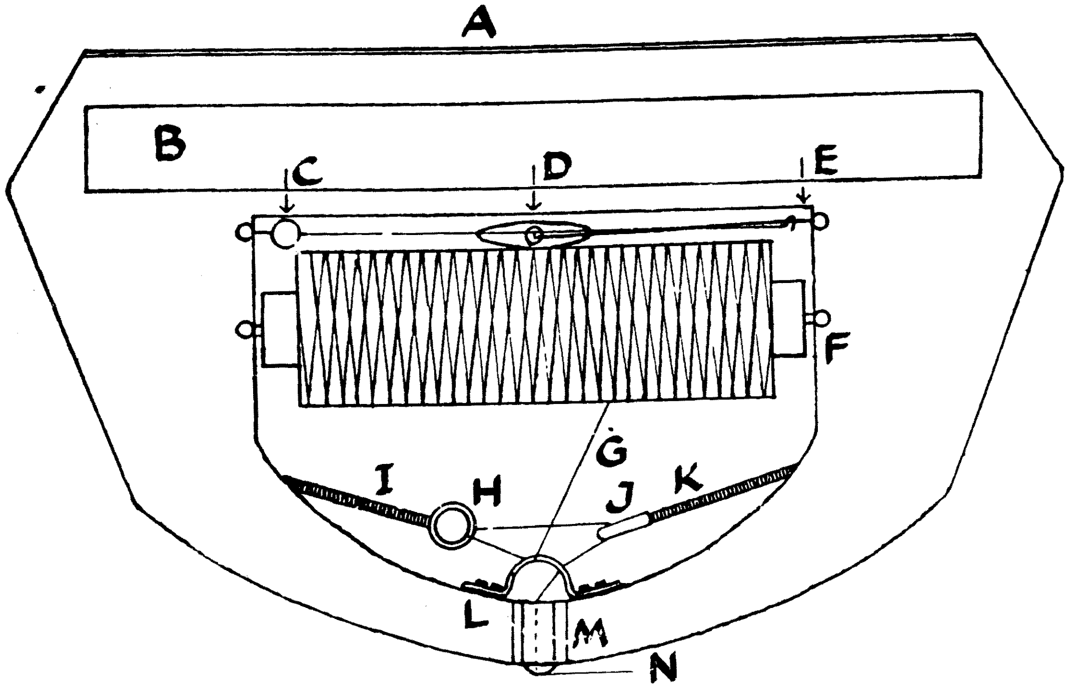



Fig. 408.
Top View of Boxwood Shuttle.

Weft G passes over the metal weft guide L, over glass ring H held by spring I, and across to glass ring J held by spring K, and after passing under guide L, goes through porcelain eye M, emerging from the shuttle at N. The flexible springs that only have a diameter of $\frac{1}{12}$ inch, recede into their cavities when the weft is slack or breaks, but comes near, or touches the metal guide L during the traverse of the shuttle.

Fig. 409 is the under side of the shuttle. A is the metal plate that is thicker at the bottom than at the top. B are fibre cogs that are used by a pair of cogged wheels in one section and by another pair in the next section. There are 17 cogs. C is the bottom guide, and is narrower than the upper one. D is the wire spring, E the porcelain brake. and F the wire holding the brake. G is the bobbin, H the weft, I the glass ring, and J the spring. At the opposite side, K is the glass ring, L the spring, M the weft guide, N the shuttle eye, and O the weft outside the shuttle.

*Beat-up Arms.*—There is no crank shaft to beat up the weft, but is done by beat-up arms. In Fig. 410, A is the pivot of arm B, and C the connecting plate for the handrail. D is a fixing point for the bottom cross rail holding the base of the reeds. The arm is slotted at F, and the dotted line G indicates the centre of circle H, and proves that the slot is elliptical. In the next diagram, a part is added at

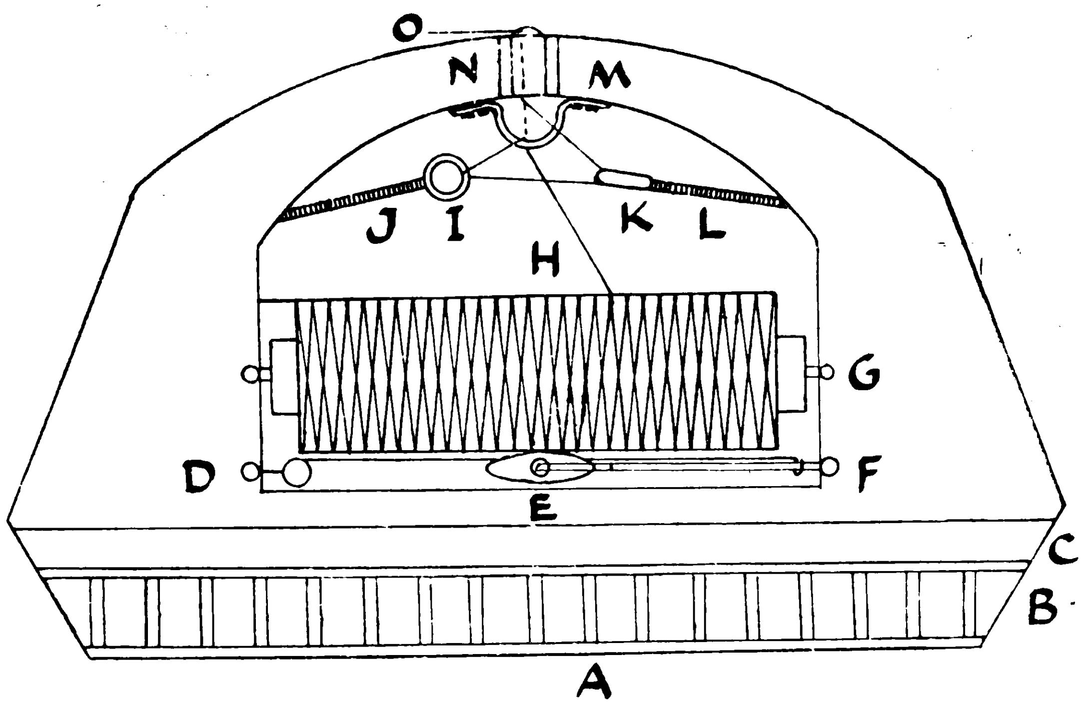



Fig. 409. Bottom View of Boxwood Shuttle.

I, that fits into the curve. It has five bores, but the centre one was in use. On the inner side of the arm is the beat-up disc and the pin from the disc passes through die I, and held in position by a flat-headed nut. The cogged disc turns half way, and then turns back. It beats up the weft going forward, and lets the shuttles pass through the sheds once every full journey.

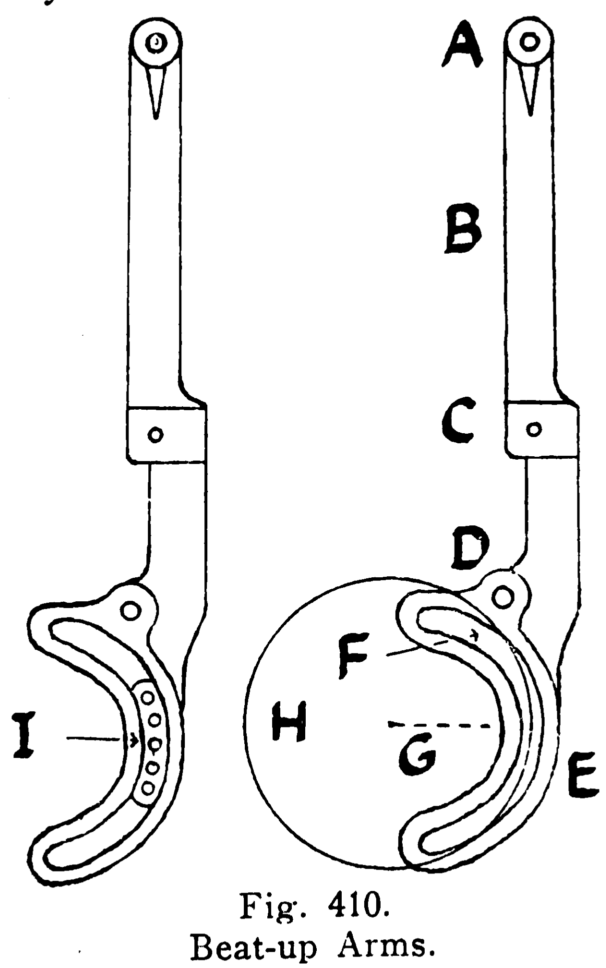



Fig. 410.
Beat-up Arms.

In Fig. 411 both diagrams are lettered alike. The one on the right shows the arm at its back centre, and the die F near the slot bottom. The die moves to within ⅜ inch of the top and bottom of the slot. At F in the sketch on the left, the die has ascended to almost the limit of the slot.

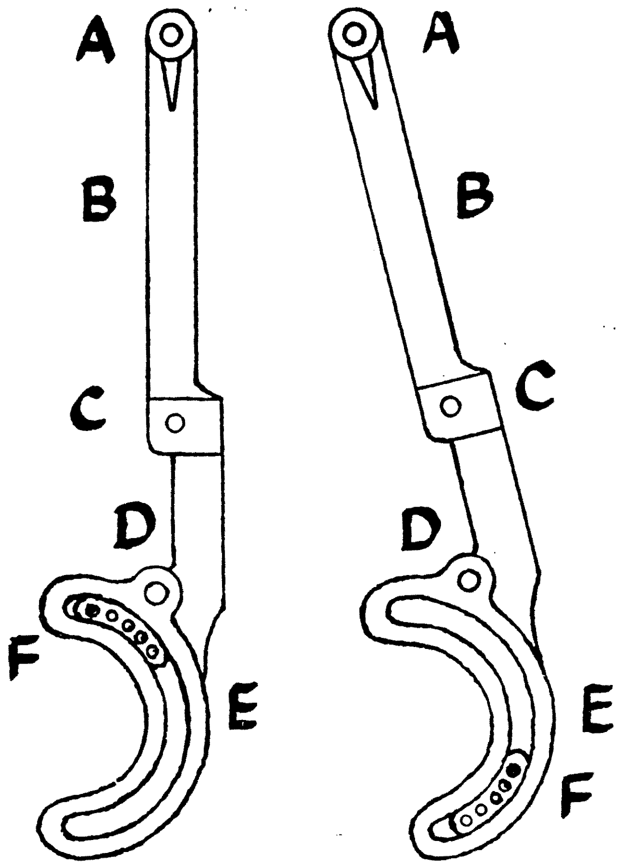



Fig. 411.
Beat-up Arms Showing Movement of Dies.

When the beat-up arm is at its back centre, it is 5½ inches from a breast beam casting, and the shuttle has advanced over an inch. During the back dwell, the shuttle advances over three inches, and when the beat-up arm begins its forward move, the shuttle completes its traverse of six inches. The arm accelerates as it moves forward, but there is little or no dwell at its front centre.

The size of the shed with beat-up arm at back centre is 1⅝ inches at the reed front. Each reed has only 12 dents.

*Take-up Motion.*—This is seen on the left in Fig. 406. Attached to the beat-up arm is a connecting bar secured to a long take-up lever three feet long having 15 bores in it. It carries the pushing catch that turns the ratchet wheel, its holding catch being in front. The ratchet wheel has a pinion wheel at its side, and the latter meshes with an intermediate in front. This also has a pinion, and runs the wheel on the take-up emery roller, the latter having a circumference of 6 inches and a length of 50 inches.

Above the emery roller in Fig. 406, are a set of frames, each with a roller covered with emery or paper. They have a diameter of $1\frac{7}{16}$ inches, and a breadth of $1\frac{1}{2}$ inches. By means of a threaded rod and wing screw, pressure is brought to bear on the roller and woven structure. To keep the ribbon flat on the breast beam, a small wooden roller is held down by springs. The ribbon descends from the breast beam to go underneath the long emery roller on its way to the collecting box. The gauge point is the picks per inch. The speed of the loom is 190 picks per minute. The electric motor has 0.5 h.p. and has 750 revolutions per minute.

## Hall's Drop Box Loom.

For all fancy checking, a drop box or a "circular" are an absolute necessity. The circular box has a quicker movement and is run usually at a higher speed, but the drop box in a number of ways is more reliable. Four boxes at either end of the loom is equal to almost any emergency. At Fig. 412 is Hall's type of eccentric motion for 4 shuttles. The loom is fitted with inside tappets which have already been explained, and also a top roller motion.

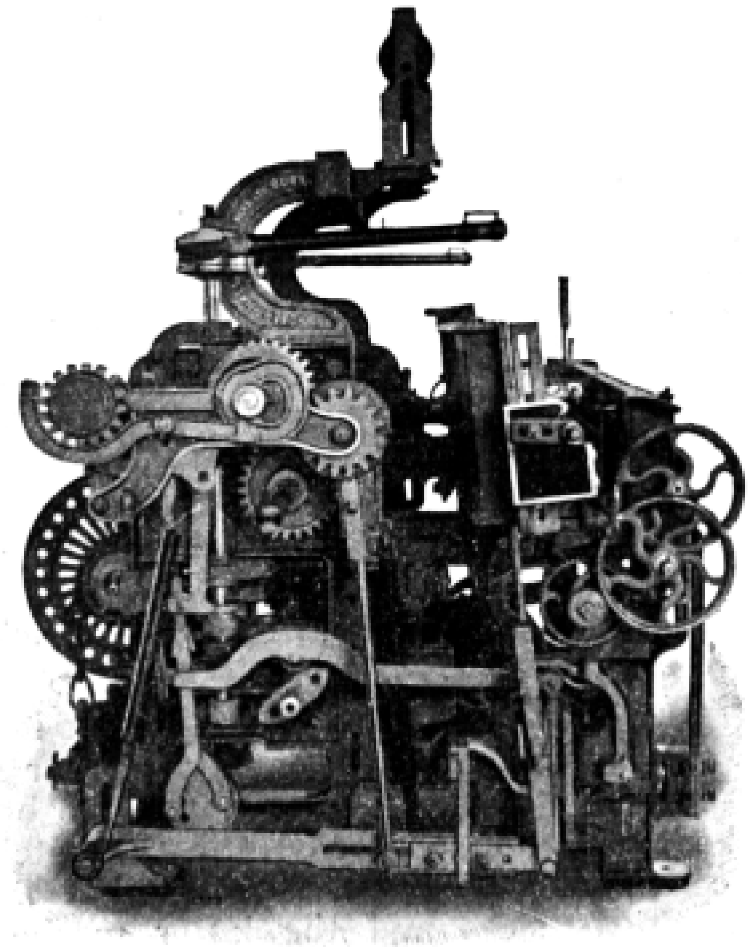


Fig. 412.
Hall's Drop Boxes at Both Ends. Pick and Pick Loom.

The picking is the overpick with a clutch arrangement which is governed by the tappet seen at the end of the low shaft, the bowl lever above it, and the two catches that pass through it. The shaft of the disc passes to the opposite side of the loom where it performs the same service as the one shown.

The picking, like the boxes, is controlled by the box lags. In the circular box loom, it is the perforations that bring about a change in the box, but in this loom it is the blanks. A hole in the cards makes the loom pick from the right, but a blank makes it pick from the left on a right-hand loom. The boxes at either end are independent of each other, and are controlled by their own lags.

There are three positions on the lags, the centre blank being for the picking. The blank on the right of it is for the lifting of the second box, and on the left of it the third box, and when both positions are blank, the 4th box is lifted. The boxes are lifted and lowered by means of segment wheels. One half turn of the back wheel raises the box, and the other half lowers it.

The letting-off is by chains and weight lever, and the taking-up is the Pickles motion. The reed space is 36 inches, and the speed of the loom 110 r.p.m.

# LANCASHIRE TOWEL LOOMS.

## Hall's Automatic Cross Border Dobby Loom.

This loom is presented at Fig. 413. The reed space is 36 inches, and the speed of the loom 100 p.p.m. The dobby levers are long ones from the ends of which double

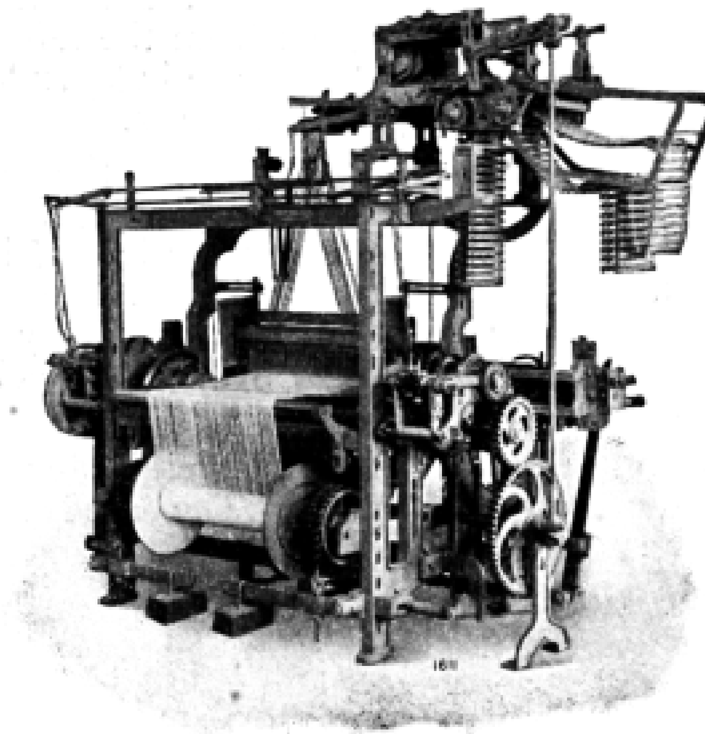


Fig. 413.
Hall's Automatic Cross Border Dobby.

bands connect them to the top of the heald shafts. There are a double set of feelers, the outer ends of the inner ones being **V**-shaped, to allow the front **V**-shaped ends of the outer ones to dovetail into them. There are two barrels for lags to actuate the feelers, the outer one being used to weave the body of the cloth, and the other to weave the cross border. There is also an indicating barrel which actuates a lever that is underneath the pawls that turn the shaft lag barrels. When the lever is made to move forward, the front pawl is placed out of action, and the other comes into play, but when the lever is moved backward, then the inner pawl comes into service, and the outer one is placed out of action. There are a given number of repeats either of the design or lags for the body of the cloth, and a similar arrangement for the cross border, the indicating lags being pegged and set to bring each lot into play at the right time.

The loom has the underpick motion with inside fittings, and has a plain box at one end, and a two or four drop box at the other. The two box is limited for the cross border to have only one colour, but with the four box, it may have three, or different kinds of weft to the ground. There is only one warp beam which is braked by chains and weight levers.

## Hall's Turkish Towel Loom.

In some respects, this loom works on a similar principle to the cross border dobby, but the mechanism is more elaborate. At Fig. 414, the front of the loom is shown, and reveals that the dobby levers and their gearing with the

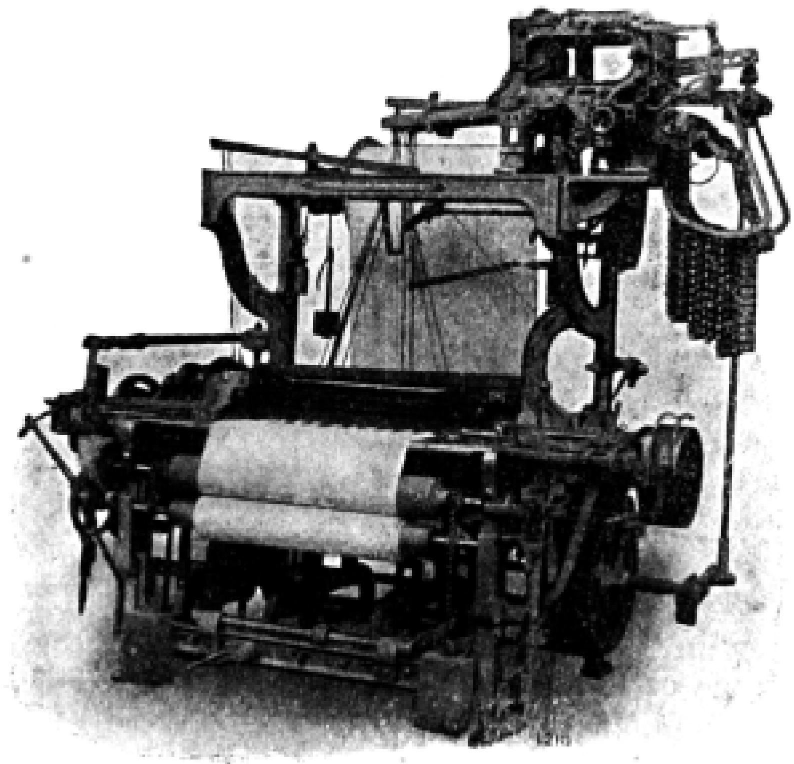


Fig. 414.
Hall's Turkish Towel Loom. (Front View).

heald shafts are the same as the previous example. The lag barrels are also operated the same way, but there is a vital difference in the warp and weaving.

It will be noted there are two warp beams, which are better seen in Fig. 415. The bottom beam is for the ground, and is kept under good tension. The top one is for the pile, and is only lightly weighted, so as to readily respond to the making of loops in the cloth. These threads destined for loops pass under a smooth steel bar beyond the back rail of the loom. The loops are not formed by pile wires as

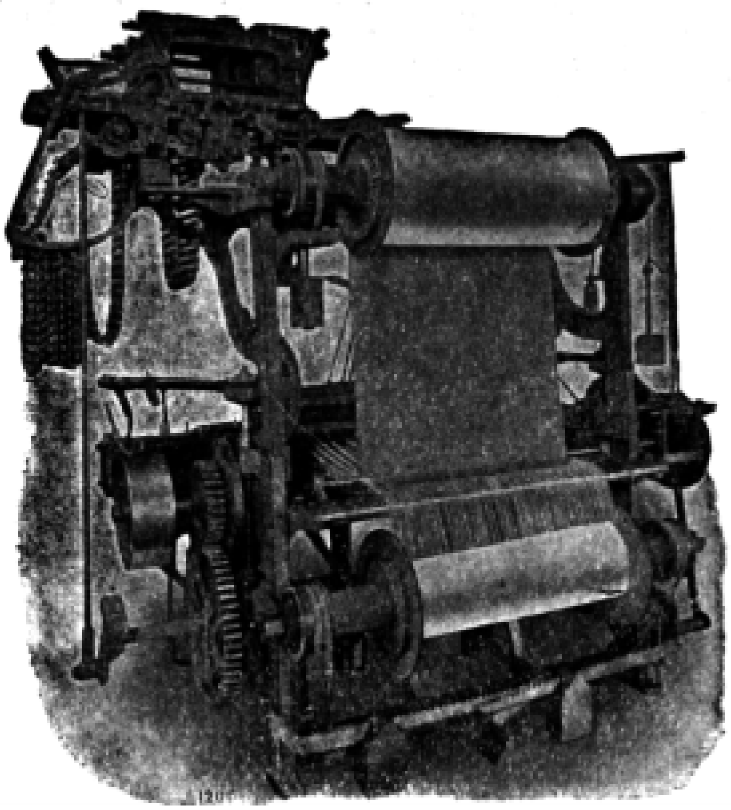


Fig. 415.
Hall's Turkish Towel Loom. (Back View).

is used in the making of plush, but by an arrangement which lets the loose reed go back for a definite number of picks, and leaves a space between the last pick and the next series. When the loose reed is then made secure for the beat up, the space left is closed up, and by being closed up, the pile warp is drawn forward and the loops are formed. These kind of fabrics are classified as 3, 4, 5, or 6 pick terry or Turkish fabrics according to the number of picks made to form one series of loops. The majority of these textures are of the 3 pick order, but those above, have the advantage of making a firmer foundation for the pile.

There may be a drop box at one end, or both ends, but whether one or both, they are governed by flat steel cards somewhat similar to those used for a circular box loom. The reed space is 36 inches, and the speed 145 p.p.m.

## Butterworth and Dickinson's Terry Towel Loom.

Fig. 416 gives an excellent representation of the above mentioned loom, and is a concentration of many ingenious ideas. The dobby is the "Globe" make, and the product of the firm. There are three lag barrels to operate the feelers, each set taking a special part in the weaving of a towel. Though a three-barrelled dobby, it will weave with one, or with two, but when all three are brought into ser-

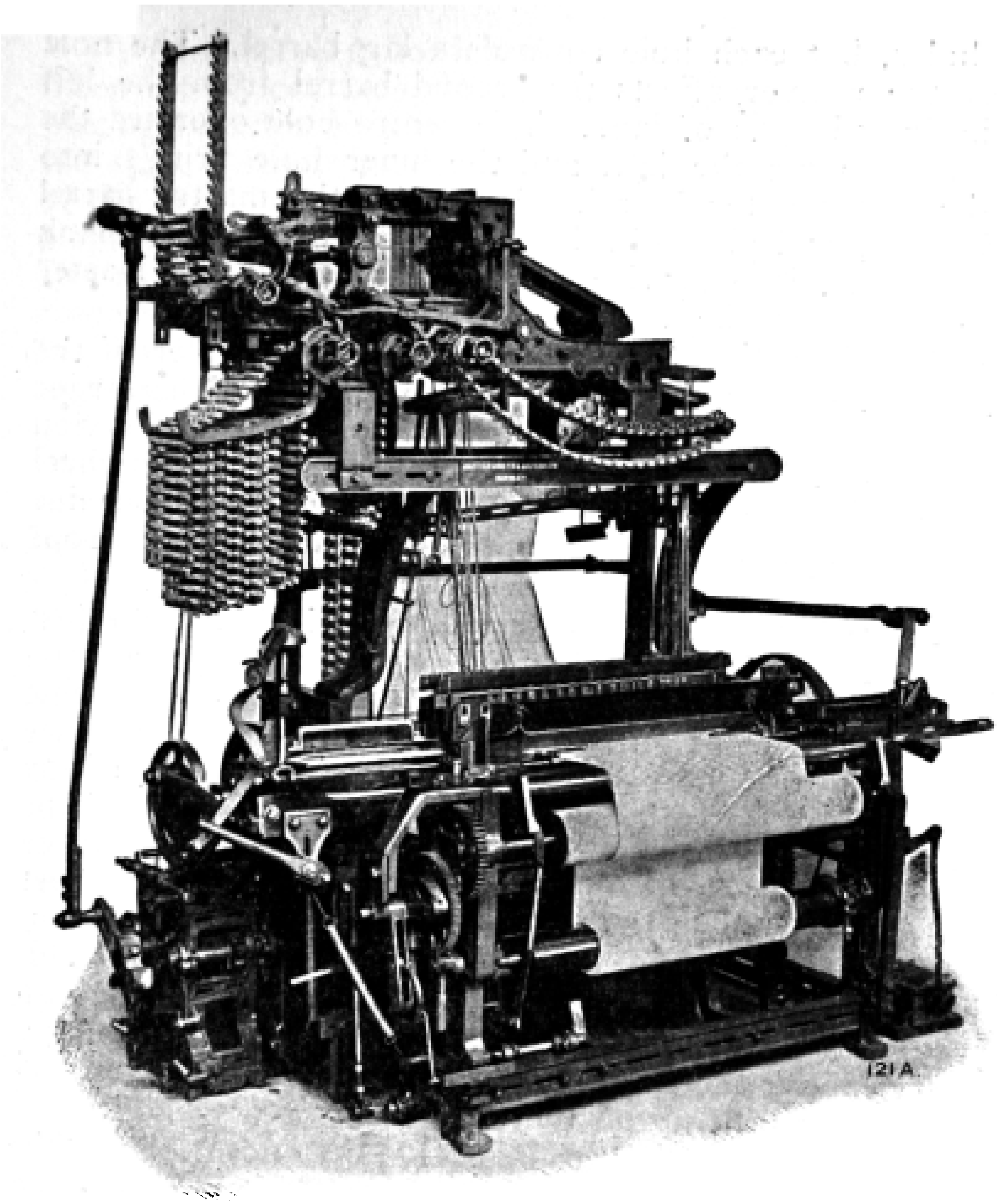



Fig. 416.
Butterworth & Dickinson's Terry Towel Loom with Four Drop Box Motion.

vice, it means the saving of much pegging and many lags The design for a bordered towel is divided into sections, and the one requiring the least number of lags is placed on the top barrel and the upright rack. The largest section weaving the body of the towel is placed on the bottom outside barrel where there is most room, and the third section is placed on the inside barrel. One repeat of each section is pegged, and on the last pick of each section, a peg is inserted to operate the first jack in the dobby. As the bottom catch is drawn forward, the front of the balk comes in contact with a pin on a lever, and on the lever is the catch that turns the master-barrel, this being the one carrying the lags on the loom front. A lag on the master barrel has only three holes, but each hole controls a lag barrel. The hole nearest the weaver affects the second barrel from the left with its long length of lags. The centre hole operates the 3rd cylinder from the left, and the inner hole brings into play the upper outer barrel. A peg on the master barrel lifts a catch, and places its barrel out of action. A blank brings a catch into service. On each lag on the master barrel there must be two pegs.

Each catch wheel is in two sections, the smaller of the two being the one used for turning the barrel. The larger one behind has also a catch which only comes into action when the other is lifted, but all it does is to turn the wheel a half cog distance so the pegs do not touch the under side of the feelers. It so remains until the master barrel drops the other catch on the small wheel.

The pile is formed by means of a swivelling cam just below the breast beam, which operates underneath a bowl on a bell crank lever attached to the loose reed case. The amount of movement imparted to the reed case determines the length of pile, and can be regulated by the height of the cam. When the sley moves forward, the bowl rides over the cam, and the sley is thrown back, which leaves a space between the fell of the cloth, and the pick of weft just inserted. The sley is fixed by raising the swivelling cam, for then the bowl passes under it, and the sley is firmly held, and in pushing the picks up to the fell of the cloth, the gap disappears, and the pile is formed. When producing a three-pick terry fabric, the sley is thrown back for two picks, and makes the firm beat up on the third pick.

This is demonstrated at Fig. 417. A and B shows the sley leaning back at the bottom which makes room for the float pile at I and J. At C, the sley is held firmly as explained,

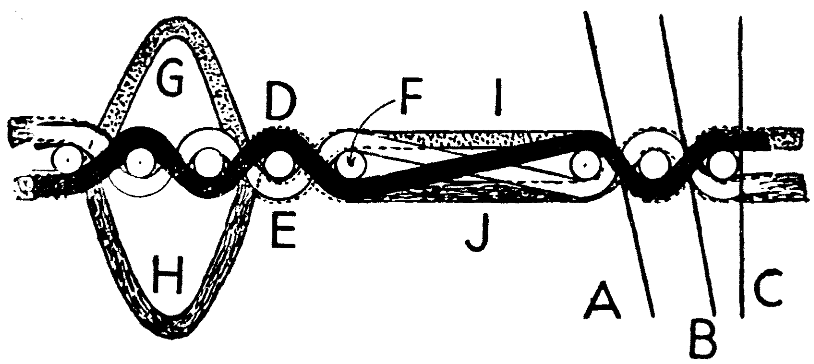



Fig. 417.
Side View Terry Pile Fabric.

and when pushed to the fell of the cloth, the floats I and J are formed into loops like G and H. At D and E are the two ground threads, and at F is the representative pick for the series shown.

When weaving bordered towels, plain or level tabs are often introduced into the border designs. This entails the placing of extra weight on the pile warp beam to bring it to the same tension as the ground warp, and also the fixing of the sley during this process. This is achieved by raising a spring-loaded lever to a stationary position by the dobby. In this way, pressure is placed on an auxiliary weight lever connected to the collar on the warp pile beam. The end of this lever is also connected to the cam controlling the sley, so it is held in its fixed position when weaving these plain portions. On completing the picks required, the extra weight lever is released by the dobby, and the loom automatically resets itself for terry weaving. The pulling catch on the take-up motion can also be lifted by a dobby jack every 2, 3, or 4 picks when required, and in this way, the number of picks in any part of the towel may be increased.

The loom is provided with a fringing motion. This consists of an eccentric on the tappet shaft, and a wrought iron bar connection to a fringing lever carrying a pawl which engages with the taking-up motion. This pawl is held out of contact with a catch wheel by a metal guide controlled through levers from a dobby jack. When a fringe is required, the dobby releases the metal guide, and allows the pawl to engage with the catch wheel which is firmly connected to the double wheel of the taking-up motion. The degree of movement given to the pawl from the eccentric, accelerates the rate of take-up, and the length of fringe is determined by the number of picks through which the lever controlling the guide is raised by the dobby.

Fringing without weft can only take place when only three colours are being used, for the swell of the fourth box is packed out. When the change is made to this box, the loom is kept running without shuttle traverse whilst the fringe is being formed, and during this period, the weft hammer lever is lifted by a dobby jack. A hand fringing arrangement is provided for the convenience of the weaver.

The number of towels woven is registered on a numbered dial on the top rail of the loom, one cog being turned by the dobby on the completion of every towel.

The four box motion is controlled in the same way as the same firm's pick and pick silk loom. Page 514.

## Wilson & Longbottom's Terry Towel Loom.

This is a very ingenious loom and has a special motion for regulating the amount of terry warp let-off to make the pile.

*Dobby and Outer Lags.*—In Fig. **418**, A are the feelers, 16 pairs being used to operate the shafts, and four pairs are used for other service.

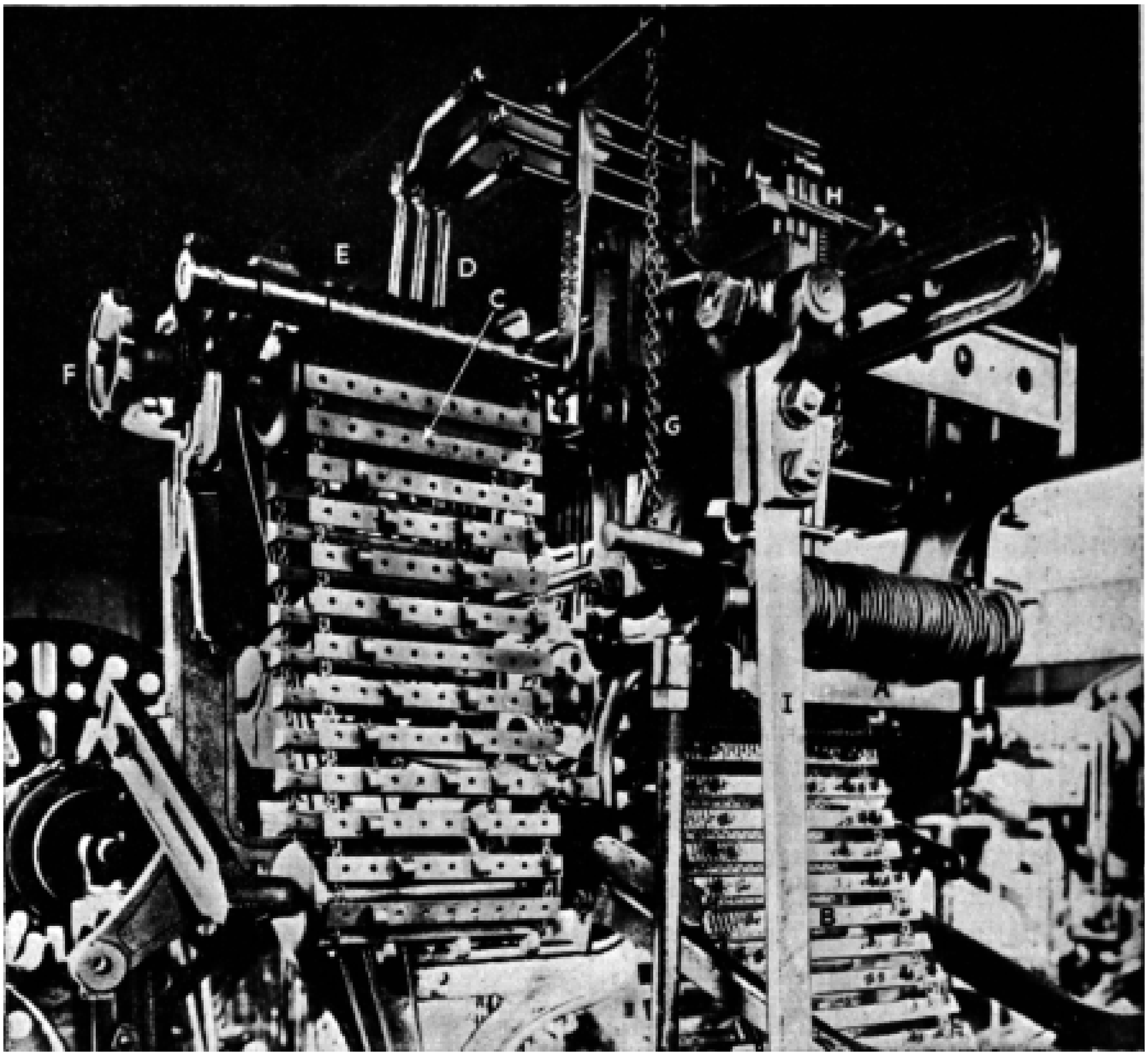



Fig. 418. Wilson & Longbottom's Terry Towel Loom Dobby End.

Two feelers operate each shaft, the odd numbers controlling the bottom catches, and the even ones the top catches.

Shaft lags B are grooved and bored in two rows, the first being for odd feelers and the back row for even ones. The wooden pegs have flat sides and rounded tops.

The cylinder is turned every other pick.

The last eight holes in these lags operate as here detailed.

*Action of Back Feelers.*—The 17th pair actuate a shaft jack at A in Fig. **419**. This jack has a long wire attached, and at the bottom, is fixed to a lever. When the corresponding dobby catch is drawn forward, the lever turns a cross shaft that is the fulcrum of the lever.

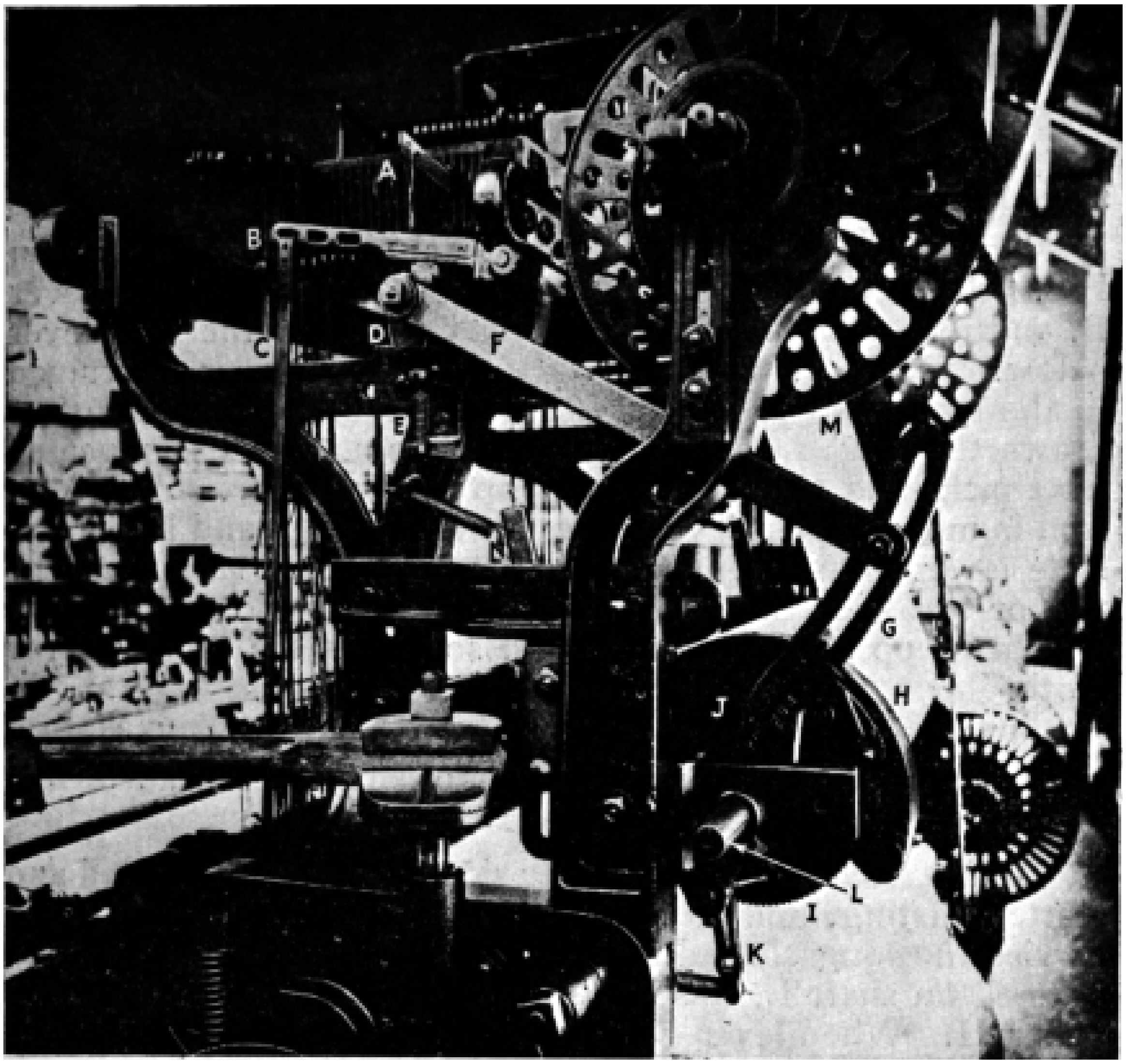



Fig. 419. Baize Covered Roller for Terry Let-off.

At the other end of the crossshaft is a collar with a cut upon it. By the shaft being turned, the collar is brought in contact with a suspended catch on a long lever. Above the lever is a strong spring that is confined by an upper casting. By the lever being lifted, it is against the strong spring, and as the long lever is connected to the brake chain on the ground warp beam, additional force is brought to bear upon it, so that for two picks, it is stationary during the insertion of the pile picks, but is eased for the ground pick.

The 18th pair of feelers lift the pawl from the take-up ratchet wheel, so no winding of the cloth takes place during the insertion of the pile picks.

The 19th set brings into operation the fringe motion, the fringe being made between the woven towel and the one to make. This done by a clutch that is moved in contact with a wheel always in motion when the loom is running. On the sprocket wheel coming in contact with the wheel governed by the clutch, the warp is automatically wound forward without weft for 1½ inches. The clutch wheel is then taken out of contact, the take-up pawl is dropped, and weaving resumed.

The 20th pair of feelers control the cross shaft above the warp. This carries a curved lever with springs attached, the springs pulling the cross shaft back after service.

Towards the end of the cross shaft is a cam at D in Fig. 419. By means of the cam, the cross shaft raises lever B, and its attendant strap C that is coupled to the slide lever below. On being lifted, it causes the bowl lever fulcrumed to the sword, to pass underneath the slide lever, which then draws the reed rack back at the bottom. This is repeated next pick, and there is then a gap in the fabric. When the cam is moved back, lever B and strap C drop, and lower the slide lever. On the third pick, the bowl lever runs over the top of the slide, holds the reed firm in its closed position, and beats up all three picks, and so forms the loops on the cloth.

The cam D under lever B in Fig. 419 is steadied in its service by spring E being applied to a hammer head on the under side of the tappet.

*Baize Roller*.—On the outer side of cam D is a fluted and slotted casting, and to this is bolted the long lever F, that carries the long slotted lever G. The curved casting is fulcrumed on shaft L, this being the shaft of the baize covered roller H. When lever B is raised by the tappet, the turning of shaft D makes bar F and slotted lever G move downward.

On G is a pin connected with a slide on the outer side of the shield J, that half covers the ratchet wheel I.

Inside the shield are 10 catches that are graded in height, so that only one catch out of the series is a pusher of the ratchet wheel. The grade is so the let-off on the terry beam by the rotation of baize roller H, can be set to a fine pitch. The pitch is set by fixing the connecting lever F to the slotted casting G. After the slide has been moved forward, it is pulled back by a spring attachment to the slide lever G.

On the outer side of the ratchet wheel is the spring brake K, that prevents excess movement of the ratchet wheel. If a deeper pile is needed, the connecting lever F is set lower.

The pile beam is only lightly tensioned, and goes directly to the baize roller from the beam, passes over a steel roller above the baize roller, and then descends to pass under a pressure roller, that rests in a pair of release levers, the top of one being at N, Fig. 419.

After giving way when the pile is pushed forward by the reed, it is brought back by the spring shown.

*The Outer Lags.*—In Fig. 418, these lags are on the left. They are flat-faced with a single row of holes. Commencing from the right:—

1. This affects a lever that controls a tippler at the loom front. When moved, one cylinder is put out of action, and another brought into play. This is visible in Fig. 420.

2. A peg here influences the 17th pair of feelers, and lift the lever that tightens the ground warp during the insertion of the terry picks, when the bottom of the reed is drawn back.

3. A peg here lifts the pawl for the take-up motion, so that for two picks, cloth winding is suspended.

4. This operates the fringe motion.

5. Here lies the control of the baize covered roller that lets off the required length of terry warp from the beam.

The remaining four places are for the movement of the four boxes, and are on the left.

A peg in the 8th outer hole lifts the 2nd box; the 7th peg raises the 3rd box; the 6th peg pulls up the 4th box. There is a separate mechanism for each box, so that the 9th peg brings the 1st box into play.

The boxes are controlled by tongues somewhat after the Hodgson principle.

*Lag Cylinders.*—In Fig. 420 is presented a full view of the loom. A is the lag cylinder wheel that turns one lag forward every other pick by the pawl on the dobby lever. This wheel is in charge of both sets of lags at D and E. In addition, there is another set of lags indicated by cylinder wheel B. This only operates when a plain border has to be woven with coloured weft. When this occurs, cylinder A is put out of action and cylinder B comes into play. The lags on B are flat-faced and the wooden pegs actuate the inner set of feelers that dovetail into the outer set.

As soon as the plain coloured border is woven, the tippler is altered in position, the inner cylinder stopped, and the outer one takes charge.

*Overpick and Take-up Motions.*—The ordinary overpick is applied at both ends of the loom, but the pickers are different. For the plain box on the right, the picker is vertical, but for the drop box it is horizontal.

The take-up motion is at H, and follows the ordinary

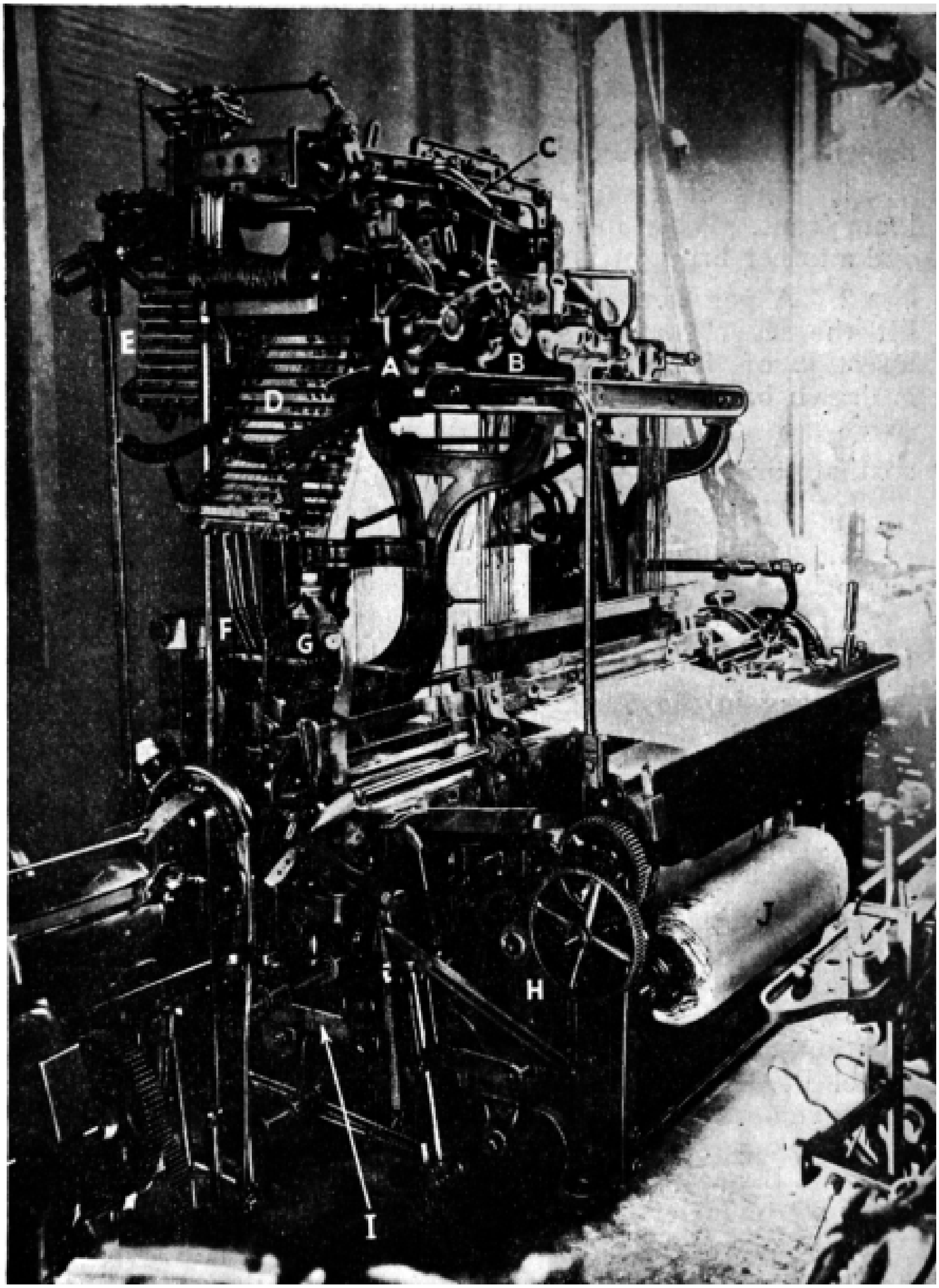



Fig. 420.

pendulum lever worked by a rod from the sword. The gauge figures for change wheel calculation is 1209. The picks per inch are divided into these figures, and the answer is the number of cogs for the change wheel.

At I is the duplicate lever to the one at the opposite side of the loom. Both apply pressure to the ground warp beam during the insertion of the two pile picks.

*Width and Winding of Cloth.*—The terry pile cloth being woven on the loom was 30 inches wide, but the reed space was 34 inches. In the arrangement for the cotton varnished healds, the front two shafts were limited to the inner border; the 3rd and 4th shafts were for pile, and the other three for ground.

The wound cloth on beam is at J.

The speed of the loom is 175 picks per minute.

# CAUSES OF WARP AND WEFT BREAKAGES IN COTTON WEAVING.

When a cotton thread breaks during weaving it is either through weakness or violence. The place of breakage, and the appearance of it are clues to a remedy.

There are four main places. (1) Back shed. (2) Healds. (3) Reed. (4) Front shed.

(1) *Back Shed.*—Full drag on warp leaving beam. Full tension at healds. Weakest threads break near back rest, those stronger in front of lease rods; the stronger still at healds. When broken in this stretch indicates poor materials; inadequate slashing; improper setting of loom parts.

*Inadequate Slashing.*—Experience the best guide as to quality and quantity of ingredients. Undersized decreases resistance. Reduce picks and tension and time shed late.

*Oversized.*—Threads stick together, or are too brittle. Eased by damp cloth on back shed. Slasher marks made by breakdown of machine. Sections baked, and others oversized. Paraffin for baked section if weavable, and hot water for oversized.

*Defective Lease Rods.*—Grooved by thread friction and have cutting action on warp. They hold knots and break threads. Wooden lease rods to be covered with tin.

*Mechanical Parts.*—Negative brake motion to be free from rust, chains oiled, or powdered with graphite, and ropes rubbed with block blacklead. Back rest conveying threads to healds to be level with breast beam for soft warps and timing late. Rest to be above breast beam for weft faced fabrics woven right side up and below it for warped faced fabrics. For hard wefted fabrics, shed timed soon if possible. Back rests are aids to good weaving.

Fig. 378 gives parts when shed closed, and Fig. 377 represents the open shed. To carry this matter further, Fig. 421 is for weft faced fabrics. Warp A passes in front of lower rail B, over rail C, and then goes forward at D to the lease rods and healds. E and F are the lease rods, and G the back shed. By this arrangement, the most tension is placed where there is most warp this being on bottom shed.

Fig. 422 is for a warp faced fabric. Here again the most pressure is where there is most warp, this being on the

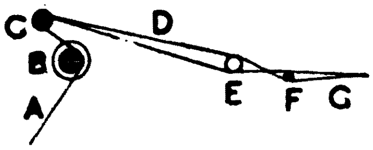



Fig. 421.

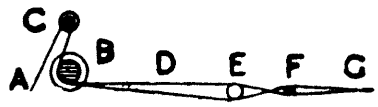



Fig. 422.

top shed. Both fabrics are woven right side up. The lease rode are inserted as experience decides.

*Breakages at Healds.*—In cotton weaving, the bulk of healds are varnished cotton. The varnish has to be evenly spread and adequately dried, or lumps stick to heald eyes and damage warp.

When healds not deep enough, the insides of shafts chafe warp. This most likely to happen when using a large number of shafts. Shafts of lesser depth take their place.

Breakages increase when weaving terry towelling with soft condenser yarns.

To curtail expenses, a higher set of healds used for a lower set, and healds left vacant. These add friction on threads, and with fancy drafts and colours, add labour and anxiety to weavers. If warp be wider or narrower than width of healds, more tension is placed on outer threads, and much the same applies if the healds are wider or narrower than warp. Inadequate setting of the heald shafts is a fruitful source of warp breakage.

Shed timing is something to be carefully considered. On high setted warps, it is advisable if woven by tappets, to have them so they can be altered in timing, so the healds are not crossing at the same time. This specially applies to poplins with plain weave. The drafting has to be 1, 5, 2, 6, 3, 7, 4, 8. Instead of a $\frac{1}{3}$ dwell it is better with a half dwell.

*Chafing by Reed.*—A reed pitted with rust wears threads down quickly. It is got rid of by soaking a little waste in paraffin, and applying it to the defective place. Fine emery cloth, looped on each reed, and gently rubbed, improves matters.

When warps are sized, part of the size accumulates on the reed wires and decreases the spacing, and many threads are broken. A moderate dose of paraffin, and rubbing the reed with a piece of carding, scrapes off the sizing.

For long wearing, metal pegs in shuttles are better than wood. If the metal pin works out at the back of the shuttle, it will soon do damage. To prevent pins working through, the punch used to knock pins out should be less in diameter than the pin.

A common practice in the cotton industry is the weaving of fabrics containing say 40 threads per inch. It is woven in an 80's reed, with one thread per dent. When so woven, it adds a smart appearance, but unless in good condition, the friction by so much metal, rubs down the weaker threads.

*Breakages in Front Shed.*—Usual shed size is that when crank is at back centre, the top shed threads first clear the top of shuttle front. It does not always apply, for in heavy plain cloth, the shed contracts, and has to be increased. To get picks in better with less weight the warp is passed over two stationary back rails.

Heavy sized warps of 120 per cent. are difficult to weave in wet weather, as the size becomes softer and rolls into lumps by the friction of passing shuttles, and some stick to shuttle race. These force shuttle upward, and multiply breakages. In wide cotton looms from 80 to 120 inches wide, and weaving cotton blankets, sheets, etc., with weft from 4's to 9's counts, many threads are broken when hard cops are used. These chafe the warp when the weft is beaten up, but it is eased when timed later.

*Threads Broken by Shuttles.*—Damage to warp by shuttles is considerable, if they do not run evenly. Right and wrong fittings are shown at Fig. 423. A, handrail, B, reed, C, going part, D, shuttle. Bevel of shuttle not in

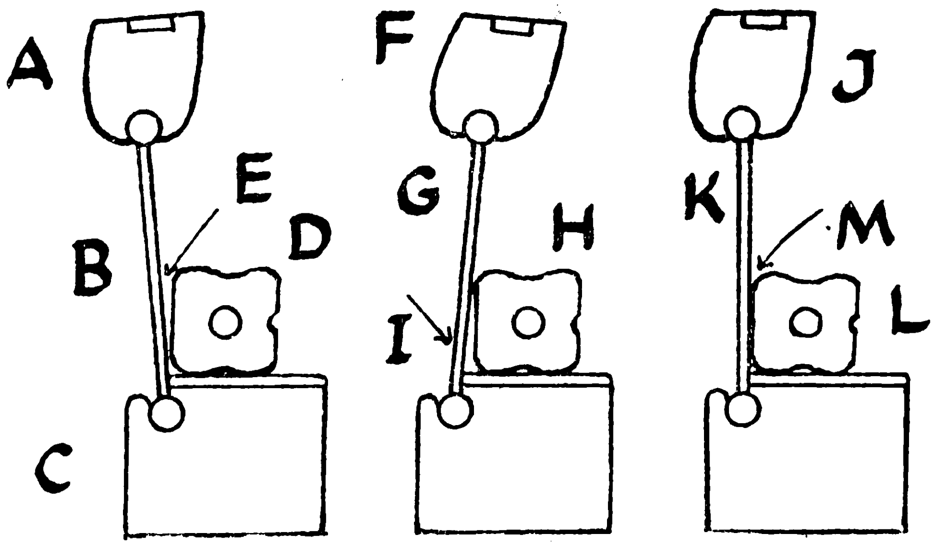



Fig. 423. Fitting Reed to Shuttles.

line with reed, and shuttle race, hence gap at E, and shuttle can be pushed back at top. Leather packing is placed between sword top and handrail. At F, handrail is too far forward. A gap at I, and shuttle can be pushed inward at bottom. The back of handrail cut to give correct bevel as at L and M, with G as handrail and K reed. No loom should run until bevel M is secured.

*Worn Shuttles.*—The shuttle at Fig. 424 is a non-kiss shuttle. The wearing is common to all shuttles. A and B are original lines of shuttle, but back and front wear off and leave humps C and D.

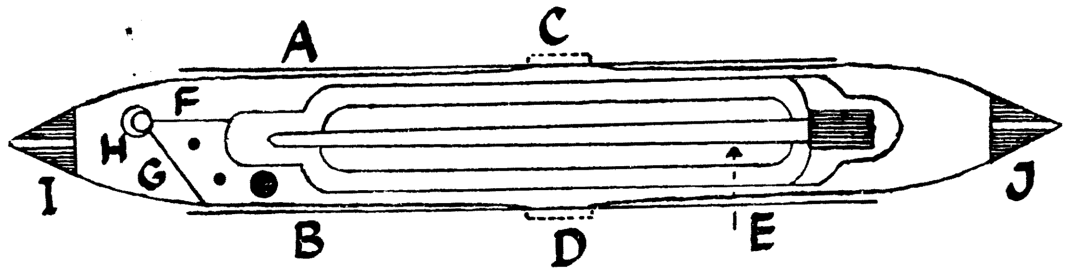



Fig. 424. Shuttle Wearing Back and Front.

The area C has to be carefully filed off to make shuttle run straight. D is seldom interfered with. E is spindle for cops, F and G are cuts for hand threading, and I and J tips.

Fig. 425 shows front of same shuttle. Areas A and B are areas worn, and C the bottom area forming hump. This has also to be filed off to secure good running. D is

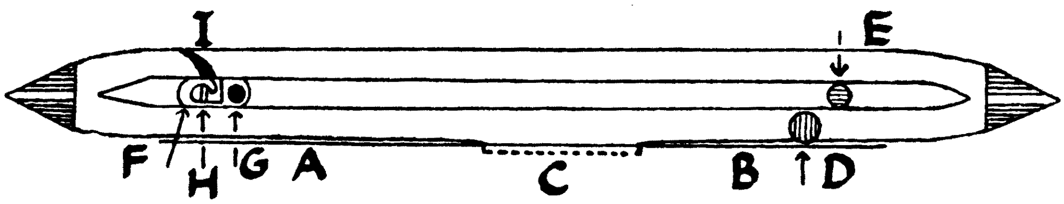



Fig. 425. Shuttle Wearing at Bottom.

hard wooden peg to hold spindle block, and E another peg to hold spindle. F is small plate riveted at G, and H guide pin to aid hand threading. I is sidecut.

## Causes of Weft Breakages.

*Tender Yarns.*—Weft usually less twist than warp, and lower in quality. Weakness due to poor materials, or spun to a too high count, or for lack of twist. Requires minimum drag, and to stop ballooning an extra pin placed across shuttle near eye.

*Soft Nosed Bobbins.*—In spinning by lifter motion, soft noses made by heart-shaped lifter having point blunted. A new tappet needed. By force of pick, a soft nose collapses, but if not too bad, a decreased picking power on the right will make improvement. A further aid is to bore a small hole through the picker parallel with dent made by shuttle tip. It then acts as a cushion.

*Snarls.*—Blemishes on weft due to slack winding. Snarls occur most when more twist than ordinary is put in, as for voiles and crêpes. Snarls hinder adjacent coils, and will break or stretch them. If snarls gets into cloth, they are difficult to get rid of. Curls are distinct from snarls. Made by too little drag on weft, defective checking, and too late timing of shed.

*Broken Cops.*—Some manufacturers purchase weft from spinners, and has to be packed and sent a considerable distance. Careless packing, or violent motion, or severe pressure lead to damaged cops. When not carefully skewered, inner coils may be damaged.

## Weavers' Mistakes.

*Skewering and Packing.*—A too hasty skewering of cops adversely affects the inner coils. A worse habit is the packing of the curved spring on the spindle to keep the cop in position.

*Faulty Shuttling.*—A tumbler weft fork only requires one knock, and it is out of order. When shuttling, the crank has to be at back centre. In stopping loom, it is foolish to let tongue bang on frog, for that is the way to a shuttle trap.

*Oiling Spindle Block.*—Only a drop or two is required, for too much soaks into wood and loosens shuttle tip. A loose tip can make a bad smash. As soon as spindle feels weak, it is ready for repair, for a single lift when weaving will cause considerable damage.

*Alteration of Brushes.*—Most shuttles have a brake brush, and in a pair, the brake has to be equal. The weaver is justified in picking off dirt or stray weft, but not in cutting the brush, for that makes uneven selvedges.

## Misfits of Loom Parts.

Weft broken or cut during weaving when certain parts are not fitted properly. This is demonstrated in Fig. **426**.

*Plain Box.*—Weft cutting is one of the bugbears of an overlooker's calling, and all the more so because it cannot be seen. A blow hole inside box front has to be filed, and emery papered. A worse thing is weft dropping in box. To prevent it, the inside of box front to be made fit to shuttle front.

Fig. **426** illustrates A, wooden shuttle guide; B, box back; C, cuts at end of going part; D, box bottom; E, shuttle. As going part is at front centre shuttle front all about vertical. F is box front leaning outward at top as shown by lines G.

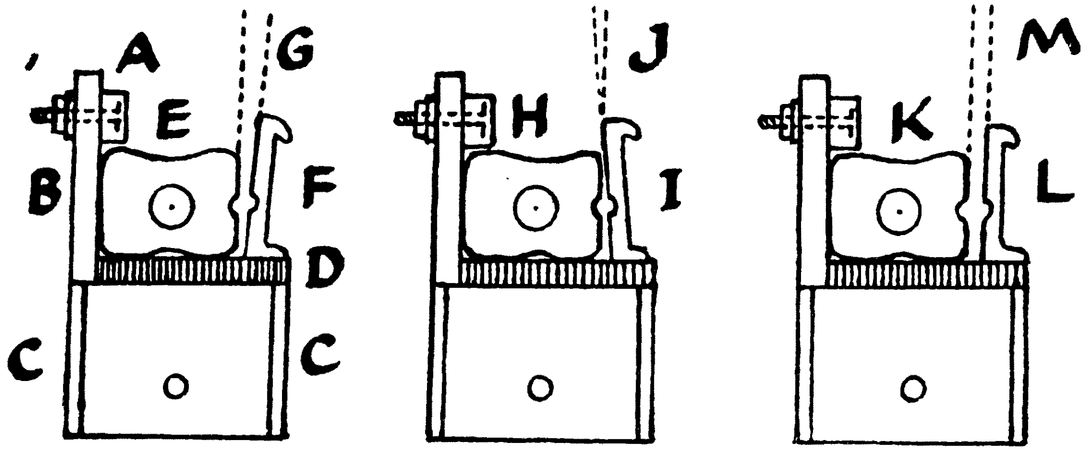



Fig. 426. Fitting Box Front to Shuttle.

In second sketch, box front leans inward at J. Box front altered by tapered cardboard packing under feet of box. In the first, packing inserted at front; in second, at back. Both then fit like K, L and M. This fitting required for both boxes when shuttles are new.

*Temples Too Near Reed.*—In weaving heavy goods, temple to be well forward, but not to touch reed. The head would wear the wires. It should be examined with crank at dead front centre.

*Harsh Picking.*—Most usual time when picking noses are new. Curve of nose too prominent, and nose end to be rounded off. Shuttles not to bind in box. If pick too strong, weft sloughs, and cone stud may be broken.

*Breakage by Wearing.*—On box looms with turned up shelves at front, shuttles worn in different way to those in plain boxes. Fig. 427 shows how weft is severed.

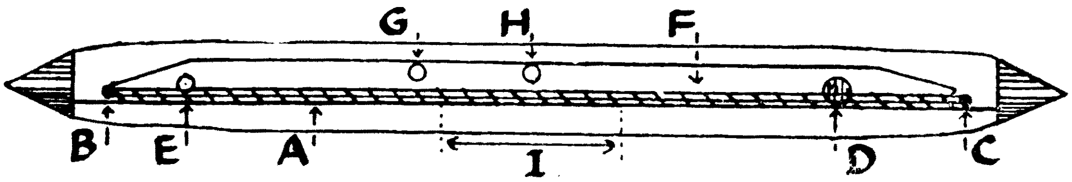



Fig. 427. Preventing Weft Cutting by Band.

The bottom front of the shuttle is cut away for the shelf to hold it. By forcing back the box swell and lifting stop rod, both ends of shuttle outside area I become worn. It allows the weft to drop between shelf and shuttle. To prevent it, two pieces of mule spindle band A are pegged at B and C, so that if weft drops, it is beyond shelf.

In Fig. 428, lettering is same. What is different is that instead of using mule spindle band, a frayed thrum that is twisted, takes its place. It is for stronger weft or weft hard twisted. It is at A, and pegged at B and C.

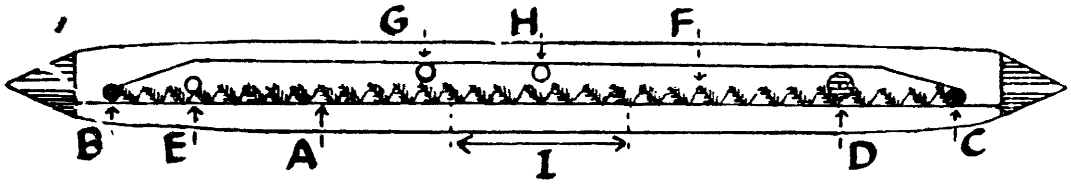



Fig. 428. Preventing Weft Cutting by Thrum.

*Cracked Shuttles.*—When cracked at back, the weft gets in and is broken. If a straight crack, it may be pressed both

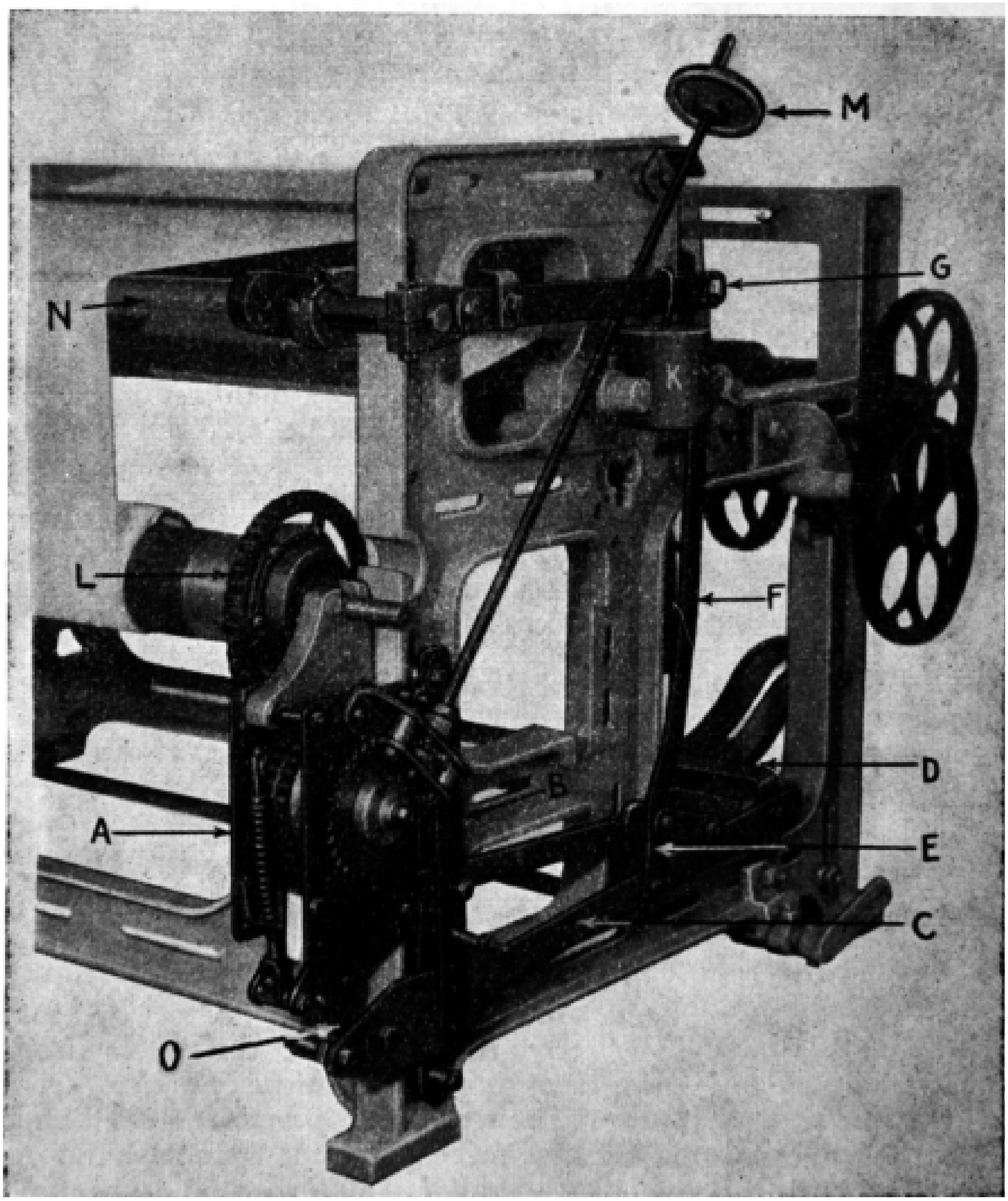



Fig. 428a. Bradley Prize Medal Let-Off Motion.

ways and rubbed with fine sand paper. It is more liable to be cracked after humps are filed off. One way it is cracked is when loom bangs off with shuttle partly in box. A damaged weft feeler will also injure the weft.

*The Bradley Warp Controller.*—This device consists of the well-known " Gold Medal Kinetic Brake " which is positive in action, and automatically controls the desired tension of the warp from start to finish. It is presented at Fig. 428a. The whole mechanism has recently been improved. All the principal parts are in a self-contained and easily fitted unit. To remove and replace the warp beam, the only requirement is the removal and refitting of a short roller chain and a beam hook. The illustration shows the motion fitted to a test loom.

A is the brake unit containing the brake drum, brake bands, operating levers, load spring and lever, spear lever, beam bracket, and the enclosed beam controlling gears with bevel gear transmission. This is attached by two bolts to the loom frame along with damper unit B.

The reciprocating lever C is attached by a pivot pin to the sley sword bracket D, and is allowed a free traverse of one inch. Midway on C, is the adjustable T lever E, which induces the oscillation of the back bar N, and connects it by drop rod F to the back bar and tension lever G. Adjustment is provided to permit the setting of warp level. The handwheel M on the inclined shaft enables the weaver to operate the warp beam from the front of the loom.

A notched bar lever (not shown) carries a weight which performs a duty similar to the one shown at K on lever G. which determines the tension at which the warp will be woven.

The unit A is provided with a drive sprocket and chain that couples it to a larger chain wheel attached to the warp beam. The other end of the beam is held by a hook and bracket attached to the loom frame.

The only provided adjustments are that of the tension weight, the load spring opposite A, and the T lever E. Full instructions are here briefly summarised.

All moving parts must have free action on assembly.

The reciprocating lever C must move about one inch, and not touch the spear lever when in its lowest position, but give full movement to it when in its highest position. When weaving is in progress, the reciprocating lever C will float about mid position, and is correct. If the lever does not float, the load spring has to be tightened steadily until the desired effect is obtained. The spear lever is moved to and fro every pick, and two movements are transmitted to the beam by means of the interposed kinetic brake, which is a variable self regulating gear that always drives the beam at the correct speed to keep the warp at constant average tension. The actual tension is determined and maintained by the position of weight K. The higher the value of the weight, and the greater the tension on the fabric.

The frictional contact brake L must not be lubricated.

The device can be fitted to suit any kind of weaving, from the finest rayon, to the heaviest asbestos brake linings, and gives equal satisfaction. Full instructions are supplied to purchasers. The patentee is Messrs. William Bradley and Co., Textile Engineers, Beacon Works, Addingham, near Ilkley.

# YORKSHIRE AND LANCASHIRE LINEN LOOMS.

The well-known firm of Messrs. Wilson & Longbottom, Nelson Foundry, Barnsley, have recently made two new linen looms. One is for weaving plain cloth, and the other for twills. With the exception of the mechanism for working the shafts, the looms are similar in construction.

Every part has been well studied, and adapted for the work it has to perform.

As a preliminary, the teeth of all the wheels are cut out of solid metal to secure strength, evenness, and long service. The crank, low shafts, top roller motion, electric motor and grooved pulleys all run in ball bearings. Fig. 429.

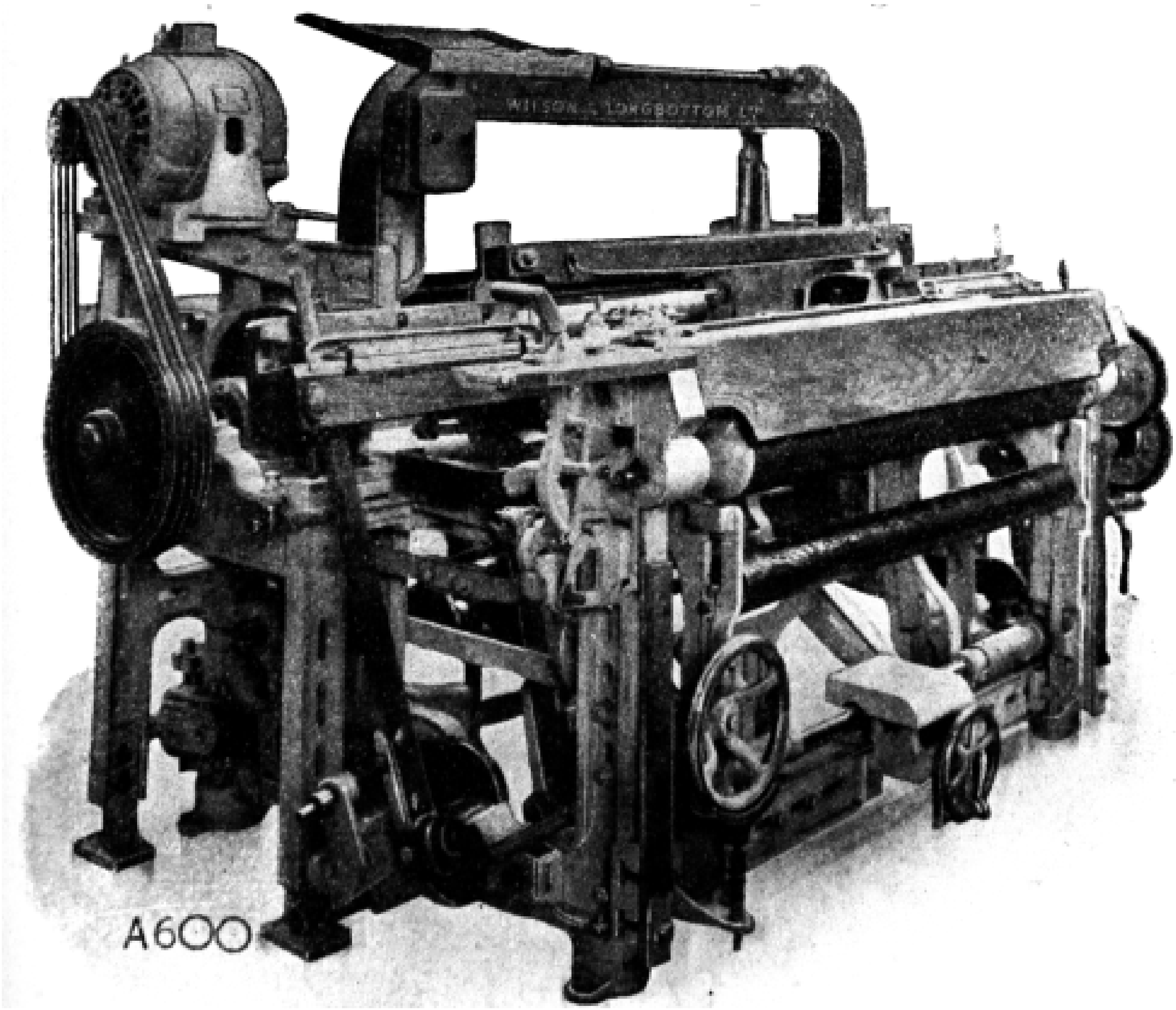



**Fig. 429. Wilson and Longbottom's Plain Loom for Linen.**

The loom has a speed of 180 picks per minute, and the reed space is 45 inches.

*Top Roller and Tappet Motion.*—Except for being in ball bearings, the top roller motion is of ordinary make. For plain weave, the threads are drafted on four shafts, 1, 3, 2, 4, the first two being lashed together, and likewise the back two.

The tappet countershaft is below the low shaft, and is run with a pair of equal wheels. The tappet operating the two back shafts is a $\frac{1}{4}$ inch larger in diameter than the other. Though the twilling loom was fit up for the weaving of 2 and 2 twill, it could be made to weave quite a number of other weaves occupying 3 or 4 shafts, either straight gait, drafted, or coloured.

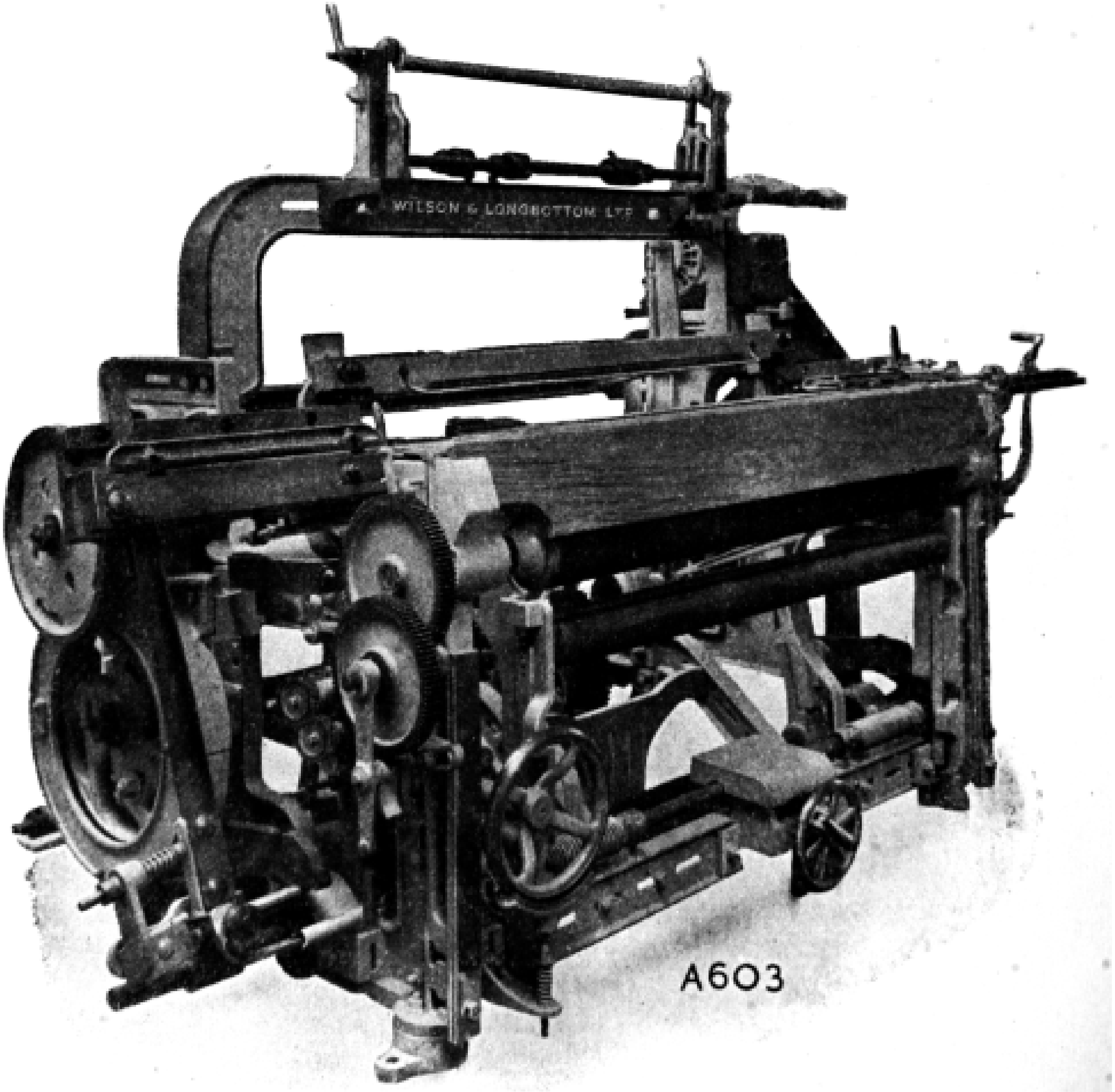



Fig. 430. Wilson and Longbottom's New Twill Loom for Linen.

*Outside Underpicks.*—This is seen in both Fig. 429 and Fig. 430. The wooden picking shaft is parallel to the outer loom frame.

The metal sheath that embraces the back part, is fulcrumed on a powerful stud bolted to a slotted bracket for adjustment. The picking neb is doubly bolted to the shaft, and is depressed from behind by a picking bowl that has a diameter of $2\frac{3}{4}$ inches. As linen is spoilt by oil, this kind of pick is better than the overpick.

The bottom of the upright picking stick is doubly bolted to a metal sheath, and on the inner side is the projecting arm that is pressed down by the picking shaft for picking. This style is seen on the left in two illustrations. Though not as springy as looped leather, it is more reliable. To check the incoming shuttle, the picking stick is held forward by the pressure of a bulb-nosed spindle, having on it an open spiral spring, the strength of it being regulated by a setscrewed collar seen best in Fig. 430. After picking, the stick is brought back by a leather and spring.

The shuttle begins to move out of the box when the crank has just passed its bottom centre, and its stroke opposite the shuttle guide on the box back is only $2\frac{1}{10}$ inches. It is quick and short, but can be set earlier.

*Let-Off Motion.*—The warp beam flanges in Fig. 431 have a total depth of 22 inches, and as they hold a long length of warp, it decreases cost of preparatory preparation. The warp beam is tubular steel, with slotted holes for holding starting knots, and has the let-off wheel with 20 cogs. There is no sagging of the warp beam, and there are no gudgeons. The beam is rotated by a worm that is moved by a casting bolted to the foot of the sword. It operates a lever that carries two let-off catches that push a 40 cogged wheel on the let-off shaft. One catch has to be half a cog ahead of the other to give the most equal delivery of warp. The let-off shaft is braked by its handwheel on the left having spring pressure applied to its brake pad.

The casting associated with the let-off catches has a long arm parallel with the let-off shaft. Towards the back, the arm carries two projections. The outer one is thick and acts as a counter weight to bring the casting back after the let-off has taken place.

The inward projection has on it a hooked part that is setscrewed to a vertical rod. At the top, the threaded rod is

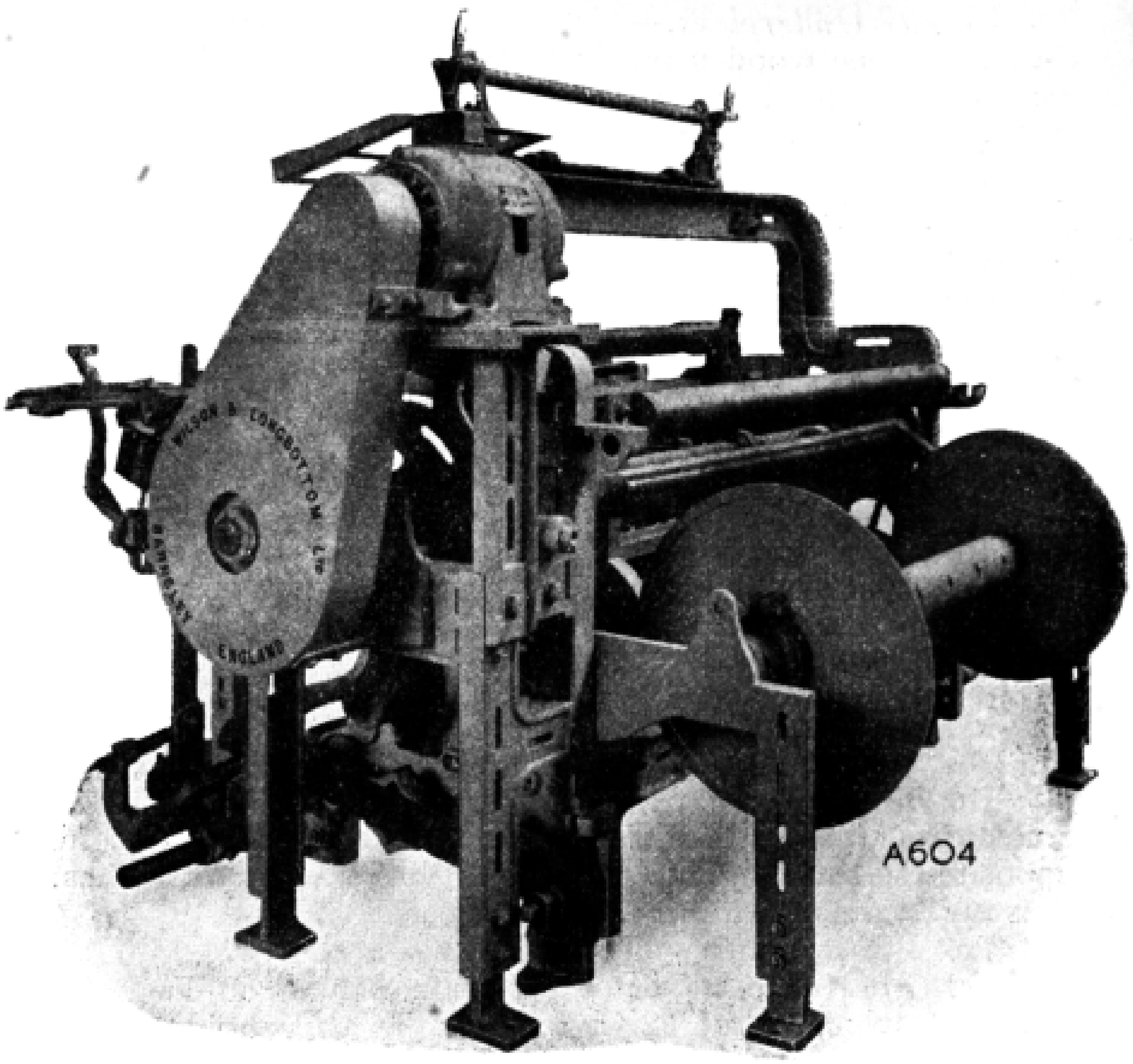



Fig. 431.
Back and Driving End of Wilson and Longbottom's Linen Loom.

connected to the inner rocker back rail of the loom. A pair of locknuts fix the working length of the rod. At the bottom, the rod is hooked round the bottom of the inside weight lever. By the oscillation of the inner back rail, the outer one is responsive.

The outer rail has a short arm projecting towards loom front. It is notched on its under side to hold a spring that assists in bringing the rail back after rocking. The ends of the two rails are circular to make them responsive to the beat up of the weft.

*Crank Arms.*—The centre of the crank arms are solid, but towards either end are slotted to receive cotters and gibs. There is a short metal strap at either end so that each can receive individual attention.

In weaving plain linen, good cover is difficult to obtain owing to the stiffness of the yarn, and particularly with low counts. The usual way is to elevate the outer back rest to tighten the bottom shed and slacken the top one. The weft is then forced more to the surface.

Burst weft is found more in fine damasks owing partly to the lack of elasticity in the weft, but is improved by using as fine a reed as possible with the wires well bevelled.

*Take-up Motion.*—This is after the style of the Pickles motion, but with modifications. The prime mover is a rod secured to the sword that passes through a slotted lever and operates the pulling pawl. The pawl pulls the ratchet wheel when the going part advances, and is pushed forward when the going part recedes. The important thing is to get the correct leverage. The usual setting is to have the point of the pawl in the centre of the cog upon which it rests when the crank is at its back centre, and to let the holding catch drop when the reed is a half-inch from the cloth fell. Fig. 429.

On same shaft as ratchet wheel is a standard wheel with 40 teeth, this being used when the loom takes up one tooth per pick. When two cogs have to be taken up every pick, the 40 wheel is substituted by one having 20 cogs. The standard wheel meshes with the change wheel, the last named being on the same stud as standard wheel No. 2 with 20 cogs. As the stud is bolted to a curved and slotted casting, it is readily adjusted to the diameter of the change wheel.

The second standard wheel turns the intermediate wheel having 86 teeth, and on its inner side, the intermediate has a pinion cast to it bearing 15 cogs. This small wheel turns the take-up roller wheel with 90 teeth and so completes the series. The circumference of the steel strip covered take-up roller is 15.7 inches.

*Weft Fork Action.*—When weft fails, the hammer head connected with the bayonet of the tumbler weft fork, pulls back the fork, but the mechanism associated is different. The shaft holding the weft fork passes through a circular projection on a slide, so that fork and slide are forced back together. At the base of the slide is a lever fulcrumed at its centre, and its inner part is moved back by the slide. On the upper part of this section is a threaded hook, that has charge of another lever in front. The bottom of the front lever is fixed to a cross rod, and at its opposite end, the cross rod has a lever with a projecting pin that elevates the pulling pawl on the ratchet wheel, and prevents the take-up of the cloth at the same time the loom is stopped.

To prevent any excess run back of the ratchet wheel, a run-back catch with a slotted body, holds the wheel after a run-back distance of one cog. When the ratchet wheel takes up two cogs at a time, the run-back catch is set for two teeth.

When necessary, the weaver can use a handle seen on the right in Fig. 429. The bottom arm of the handle carries a chain that contacts with a casting that lifts both take-up pawl and run-back catch out of action, and the cloth can then be let back.

Additional action due to the weft fork is, that when the lever at the base of the weft fork slide moves back the outer part of the lever swings forward. In front of the outer part is a double fingered casting. Its vertical arm is forced forward, and its horizontal arm elevated. As this contacts with a sloping part of the set-on handle seen on the right in Fig. 429, the handle is thrown back and stops the loom. The loom is set in motion when the set-on handle is pulled towards the operative.

The loom brake can be pushed away from the brake wheel by moving a lever in front of the set-on handle. This enables the going part to be easily moved as desired.

*Shuttle Boxes and Swells.*—The metal box bottoms are cut out to admit the squares on the bolts for nut and bolt fixing of the box front. A prudent overlooker does not "nip" his shuttles in the boxes, and thus makes picking easier, and both parts and shuttles last longer.

The box swells are made of wood, and have a gentler action on shuttle and weft than metal swells. The box swell finger is malleable iron, and its base is on a projection on the stop rod, and quickly altered by its setscrews.

The front of stop rod tongue is exceptionally broad, being $2\frac{3}{4}$ inches, but tapers towards the back. It prevents buckling and wears much longer. The frogs are held well forward by a strong circular bar that passes through the loom frame, and is held forward by a straight steel plate bolted near the foot of the loom.

*Cloth Winding.*—The cloth passes from breast beam to the steel strip covered take-up roller, under and over a steel roller on top of the take-up roller and thence to the cloth beam. The last named is turned by frictional contact with the take-up roller. The gudgeons of the roller rest in curved brackets at the top of a pair of cogged racks. The racks are visible in Figs. 429 and 430.

, The cogs on the racks mesh with wheels on a cross shaft. These wheels have circular projections on their inner sides. The wheels and collars have a powerful open spiral spring between them. In the centre of the cross shaft, and seen in Figs. 429 and 430, is a plate that covers a train of wheels, that are operated by a folding handle in front. By this arrangement, the cloth beam is elevated to come in contact with the take-up roller, and automatically forced downward by the increasing diameter of the cloth on the beam. The handwheel is also made use of to lower the cloth beam until its gudgeons are opposite openings in the rack guides. The loaded beam can then be removed, and an empty one take its place.

*Safety Measures.*—In Fig. 431 the motor wheel and crank wheel are well covered with sheet metal. The loom driving wheels are also protected by a cast iron casting. The temples on the loom were of the two roller type with risen projections. The rollers were 4½ inches long. The temple casting was mounted on a flat bar fixed to curved flat springs bolted to the cross rail of the loom. Both temples were bolted to the same bar. In case the shuttle is ever trapped between reed and temple, the temple and springs give way and prevent damage.

# NEW DEVELOPMENTS.

## The "Mordale" Bobbin Stripper.

This invention is to assist in meeting the shortage of juvenile labour in the weaving sheds, to reduce the quantity of bobbins, and to promote production. It is the patent of Messrs. E. Gordon Whiteley, Beech Works, Worrall Street, Morley, Leeds. When bobbins are discharged on an automatic loom, a certain amount of waste is left on, and this has to be got rid of before the bobbin is again filled with weft.

As an example of usefulness, a 7 inch bobbin holding 34 skein weft, weaves four inches of cloth, 72 inches wide, the picks per inch being 40. Each full bobbin holds 160 picks of weft, and as the speed of the loom is 130 picks per minute the weft is woven off in $1\frac{1}{4}$ minutes. If loom efficience is 95 per cent. then for an 8 hours day:—

$$\frac{4 \times 60 \times 8 \times 95}{5 \qquad\qquad 100} = 365 \text{ bobbins per day.}$$

This is doing useful service at little cost. The diagrams illustrate the process. When a bobbin is discharged from the shuttle, it falls base first into the hopper at the top in Fig. 432. The hopper fits underneath the shuttle box when the going part is at its front centre, and is therefore quite free from the motion of the picking stick.

The interior of the hopper is lined with cloth to do no injury to bobbin, but to act as drag on weft. The hopper narrows rapidly to its base to guide the bobbin, and is brought in contact with the dabber roller C. After a short pause, the roller C is lifted to the position outlined, and the bobbin then slides down the chute. On roller C descending, the weft is pressed against the bottom nip roller A and is conveyed between nip rollers A and B. From its position at the bottom of the chute, the weft is unwound until exhausted, and then falls into its receiving box. The pulled off weft falls behind and below the nip rollers, and the bobbins are discharged at the front. All three rollers have smooth surfaces, and are 4 inches wide.

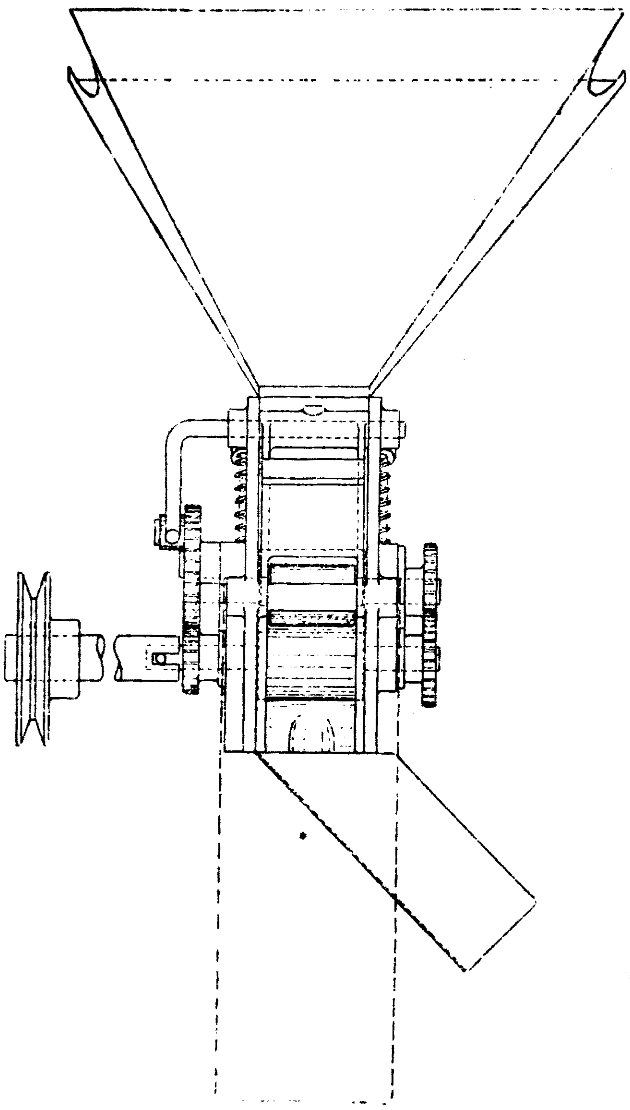


Fig. 432a.
Mordale
Bobbin
Stripper
(Front View).

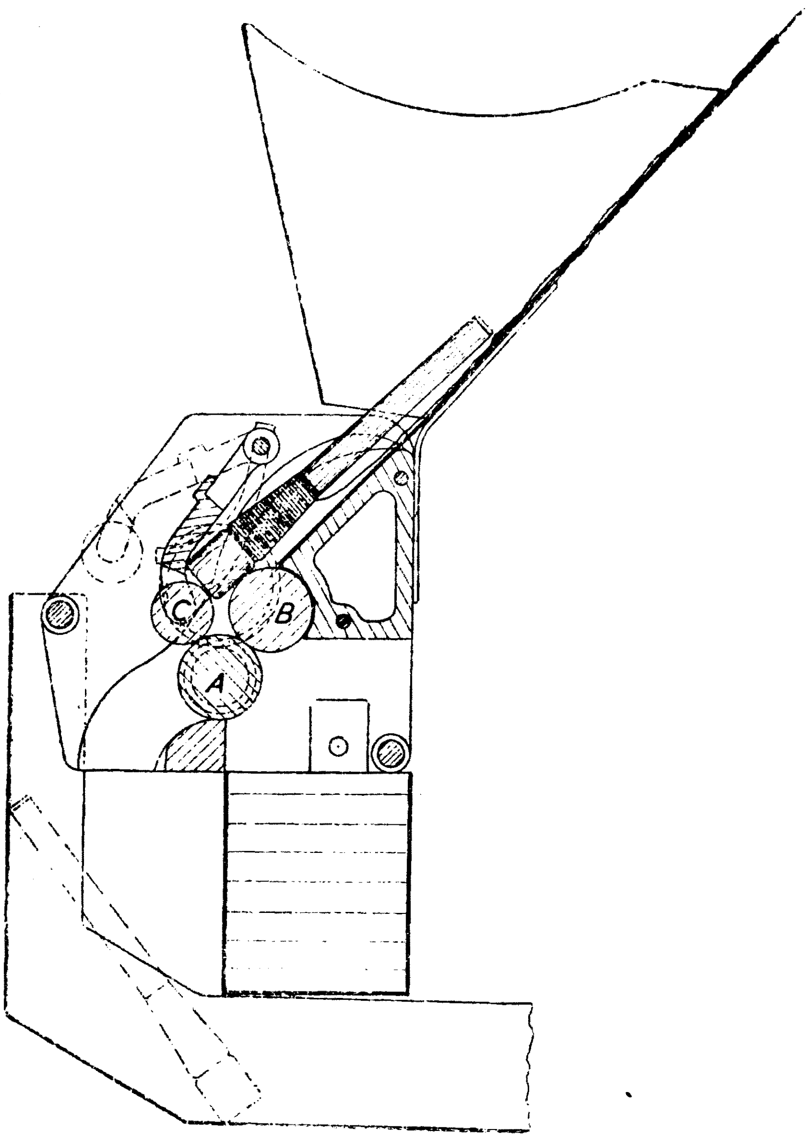



Fig. 432.
Mordale
Bobbin
Stripper
(Side View).

Reference may now be made to Fig. 432a. On the left is the grooved driving wheel that is coupled to another driving wheel on the low shaft by means of a link V-rope. The shaft that passes through the grooved pulley holds the bottom nip roller A, and on the left of the roller is the small wheel having 12 cogs that mesh with the larger wheel above having 24 cogs. On the outer side of the larger wheel is lifter that comes in contact with a bowl at the bottom of the cranked shaft shown on the left. The upper straight part passes through the upper part of the machine, and on it are the two arms that hold the dabbing roller C. It is by these means that the dabbing roller is raised every other pick, and the weft bobbin released. On the right are seen the two equal wheels attached to the nip rollers. It will be noticed there is an open spiral spring on the outer sides of the roller box. These springs apply pressure to the shaft of the nip roller B, and in case the weft should coil round either nip roller, the upper nip roller would be lifted. This will seldom occur owing to the smoothness of the rollers, but if so, the lapping is then cut off.

## Dracup's Improved Reversing Motion For Jacquards.

In past years, much trouble and expense have been caused by new weavers, and the forgetfulness of experienced ones, trying to reverse the card cylinder when too near the needles. This has caused damage to the cards, cylinder, and points of the needles. A cylinder cannot be safely reversed unless the crank is at or very near its back centre, for then the card cylinder is well away from the needles.

To make the reversing mechanism "foolproof," Messrs. Dracup have invented the new mechanism seen at Fig. 433. Before explaining the patent, it may be as well to mention that the jacquard is run by a roller link chain at B, on the strong toothed wheel A, a similar driving wheel being on the crank shaft. At C is the connecting shaft to the slotted gear wheel that carries the connecting rod to the lever on the griffe shaft. The slotted wheel by means of an intermediate, actuates the ordinary wheel F and the sprocket wheel G that is secured to it.

By a short roller link chain, the sprocket G turns the one at the end of the shaft on which are the eccentrics that move the five sided card cylinder I.

## The Reversing Mechanism.

This is seen on the left. At J is the small but broad wheel at the end of shaft H, and has 26 teeth. It meshes with pin wheel K with 52 teeth, and on its inner side, K has two pins at equal distances apart, and two segment ribs.

The pins slide alternately into the slots in the star wheel, and turn it one section, and the ribs keep the star wheel M steady after turning. Fig. 433a.

The star wheel has five sections and is loose on the shaft of the card cylinder. It carries a stud, and on this is a blunt pointed V-shaped holder that drops between pins on a pin cylinder, the latter being secured to the shaft of the card cylinder. It keeps both cylinder and star wheel firm after turning. Above the star wheel is a two armed lever. The sloping up arm N has a wire attached, with a handle at the bottom for the weaver's use.

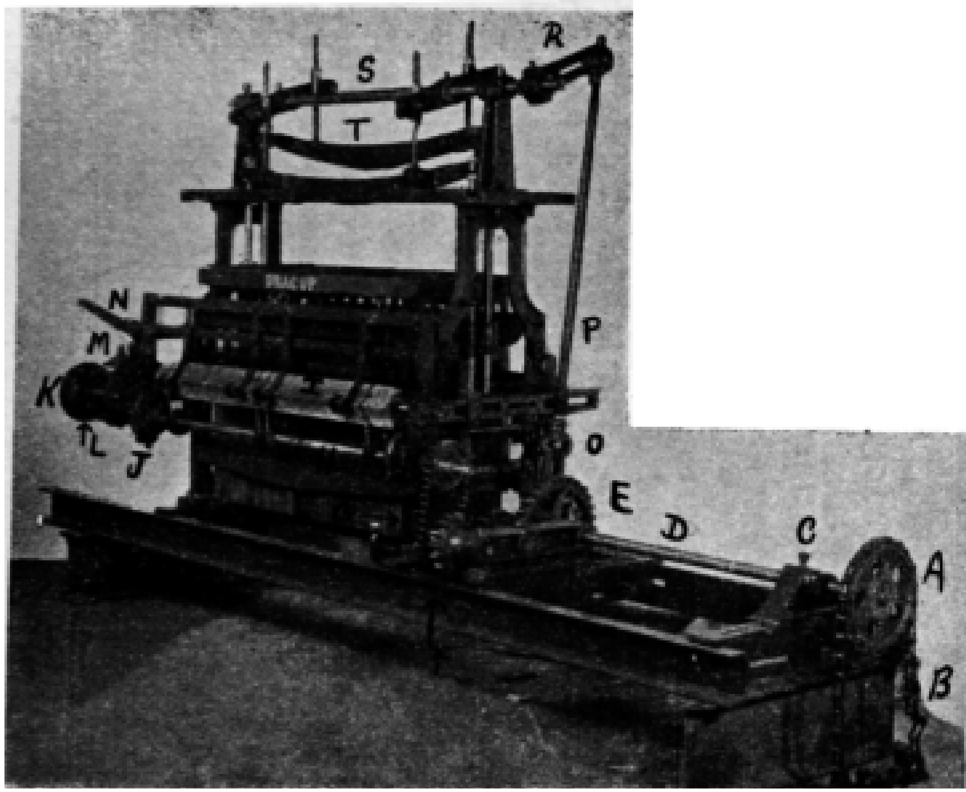



Fig. 433.
Dracup's Improved Reversing Motion (From Driving End).

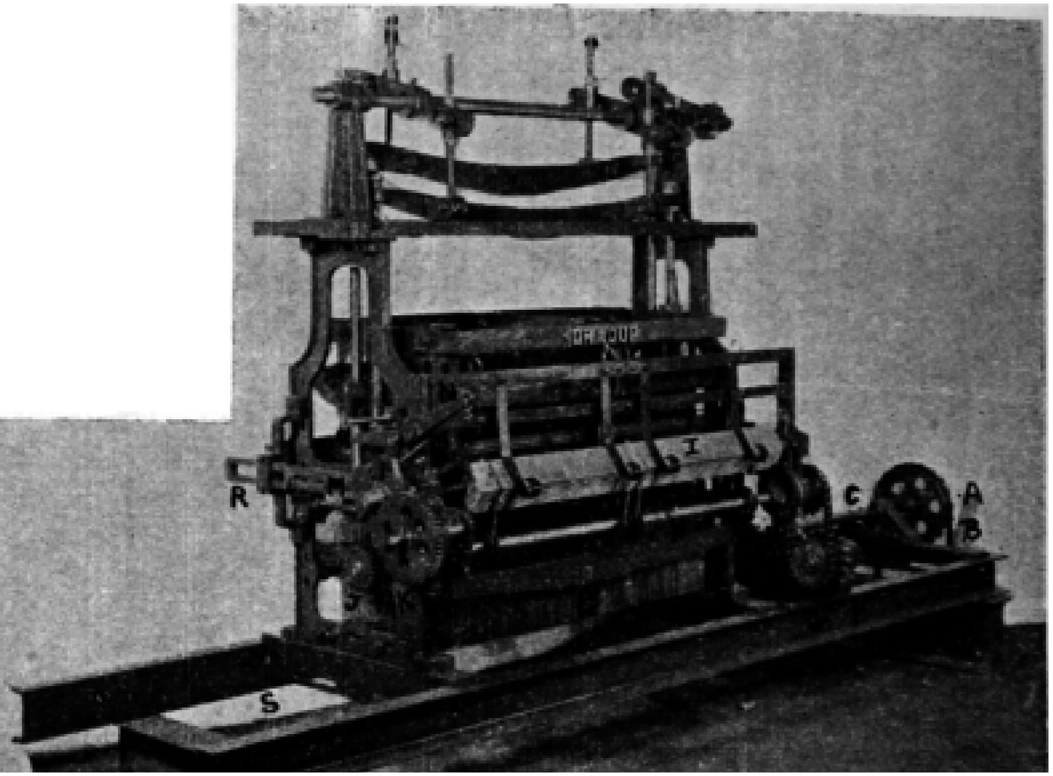



Fig. 433a.
Dracup's Improved Reversing Motion (From Reversing End).

At the back of the horizontal arm O is a hooked catch, the hooked end resting on the pin cylinder.

When the weaver pulls the handle mentioned, the hooked catch turns the pin and card cylinder one section backwards, and in this way the weaver can take out the number of picks required.

This cannot take place, however, unless the card cylinder is well away from the needle points, for the stop bar P which is on a fixed part of the jacquard framework prevents the lever from rising, and the hooked catch cannot turn the pin and card cylinder. In this way, much damage is averted, and less time wasted. Occasionally, the overlooker has to set the cards for the weaver, and has also to arrange new sets. This does not require the turning over of the loom, for a split pin through the shaft that carries the pin wheel is taken out, and the pin wheel is pulled out of contact with the star wheel. The card cylinder is then at liberty to be turned in either direction. The small wheel that meshes with the pin wheel is made broad so the pin wheel need not lose contact with it, and the correct timing is thus preserved.

Two other matters may be mentioned. The chief shafts of the jacquard are served with screw cap grease cups. These are filled with grease, and the cap screwed on a little. As the grease becomes worn off at the bottom, the cap is turned down, to make the grease contact with the shaft. This not only saves repeated oiling, but prevents warp and cloth being soiled by oil, for oil is difficult to get rid of in most cloths, but most of all in rayon pieces.

The other idea is, that the jacquard is mounted on a gantry, which can be elevated or lowered to bring the warp into the best position with the shuttle race. This is a much more ready way than having to adjust shedding rods and top levers.

# FAULTS AND REMEDIES IN LINEN WEAVING.

In certain aspects, cotton and flax are somewhat similar.

(1) Both are of vegetable origin.

(2) They require a humid atmosphere to weave them.

(3) Warps have to be sized, and some of the ingredients are the same for both.

(4) The preparations for both are carded or combed.

(5) Several beams go to form a weaver's beam.

(6) Many faults in cotton yarns are also in flax.

There is a marked difference between the fluffy bolls of cotton with an average staple length of two inches, and the long and sturdy stalks of flax.

For strength, it is flax; for fineness it is cotton. For healthy humidity in weaving shed, there has to be a difference of four points in the wet and dry bulbs, and the dry has to be higher than the wet. The air cool and moist in summer, and warm and moist in winter.

*Strength of Line and Tow Yarns.*—Flax divided into two classes, line and tow. Line is fine and longer; tow, coarser and shorter. Line fibres up to 18 inches; tow, 9 inches and shorter. Line will spin to 200's lea; tow to 80's lea. Hackled flax is line; carded flax is tow, but both from same stalks.

Line yarns. 10's lea has breaking strength from 56 to 76 oz.; a 50's lea from 15 to 22 oz.; a 100's lea from 9 to 13 oz.

Tow yarns. 10's lea, 46 to 56 oz.; 30's lea from 20 to 27 oz.; 50's lea from 16 to 19 oz.

*Preparations for Weaving.*—When in hank form, transferred to bobbins, and these placed in creel, passed through reed, and wound on beam. When yarn not to be dressed, warp passed through starch bath, and after drying, is brushed clean. To make warp stronger, basis of size selected from sago, farina, flour, or maize starch. To one of these is added chloride of zinc, and chloride of magnesium, with addition of tallow.

*Faults in Flax Prior to Weaving.*—These give a good idea of what overlookers have to contend with.

*Beaded Yarn.*—(1) When fibres not thoroughly hackled, they curl instead of being straight, and are a hindrance in weaving.

(2) On wet spinning, hot water troughs become dirty by scouring the threads. Extracted gum and loose fibres picked up by threads. To avoid this, troughs systematically cleaned.

(3) Lumps formed when water too hot or too cold. When too hot, too much pectin extracted, and yarn weakened. Threads inadequately prepared if passed through bath.

(4) Worn rollers in spinning fail to hold yarn evenly, and parts pass through without adequate drafting. Lumps are thus formed, and are a weakness, and when tension applied, many break.

Warp breakages in linen more frequent than cotton. One of the things done for improvement is to retain the best trough water, filter it, and dip a clean cloth in it. Surplus water squeezed off gently, and cloth spread on back shed. Water containing pectin bind fibres, and weaving improved.

*Dirty Yarns.*—Dirty troughs make dirty yarns. Hackling pins soiled by dew-retted flax. Oil smears come from spinning machinery that must be oiled, but surplus wiped off. Ordinary oils turn flax black. During weaving, smearing has to be avoided.

*Harsh Yarns.*—If starch not properly boiled, particles adhere to threads and have a cutting action. Harshness felt by fingers combing warp. These lumps softened by a wet cloth dipped in clean water and applied to back shed. Wax rollers may be placed where yarn leaves beam.

*Neps.*—Short fibres in ball form made during carding. Held more firmly by twist. If only slightly held, weaving puts many on floor.

*Slubs.*—More in tow yarns than line yarns. Thick places that have defied carding and twisting. In quality fabrics, these blemishes removed on back shed during weaving. When in warp and weft, sometimes looked upon as a novelty in lower quality. In the weft many can be caught by tight brushes.

*Stiff Yarns.*—Poker-like threads made when sizing mixture is too thick, and lubricating part too small. A damp cloth prevents many threads breaking. A good aid is to lash a pair of lease rods on back shed, one above and the other below warp.

*Variation of Twist.*—Twist in all yarns vary, and increase as diameter decreases. Most twist when thread thinnest, and least where thickest. The two extremes of twist are both against good weaving. A variation from 2 to 3 per cent. not likely to spoil, but danger above it. A soft twisted warp woven better with late timed shed.

## Weaving Problems.

*Ballooning Weft.*—Linen weft has to be confined to the shuttle. Flies out when slowing down in box, and easily smeared with spindle oil. Instead of more brush, another check pin retards it. An additional way is to loop soft cord on check pin, and peg down beyond spindle block, the cord to be towards back of shuttle. Underpick is better for not smearing.

*Burst-Weft.*—In fine damasks, weft broken or damaged when beaten up. Such places only small but cloth spoilers. An old reed ought not to be used, for edges too sharp for fine linen. Reeds better with a little more bevel. More pectin left in weft to make it more pliable. Less danger when shed timed late when possible.

*Looped Selvedges.*—Though selvedge cut off when cloth is for personal adornment, if badly woven, it gives impression of poor quality. Loops formed if held when it should be free. More brake in shuttle, or longer length of check, or pick weakened a little. By shedding a little sooner, curls are kept down. If selvedges woven from cheese, it must be adequately braked.

*Looped Cloth.*—This much worse than loops in selvedge and must be stopped. If shed can be timed early, weft trapped sooner and cannot spring back. If repaired healds or harness leave heald eye higher, when lifted, the drag is against previous pick.

Hard or thick places in weft do not readily bend to the weave, and are forced by the beat up into ugly loops. When such places numerous, the weft is wetted or steamed to make it more pliable.

*Poor Cover.*—Linen does not lend itself to cover like woollen, for what loose fibres there be, are somewhat parallel with thread. What cover can be obtained is by elevating back rest above pitch of breast beam. Warp tightened on bottom shed and slackened on top. Weft then forced more to surface, and being softer than warp, cloth fuller and cover more pronounced.

# THE LURE OF COTTON AND RAYON MIXTURE YARNS.

One of the most effective methods of making ladies' dress fabrics more distinctive, is by the introduction of coloured or novelty yarns.

The more tender yarns are safer used as weft rather than warp, as there is much less danger of any part of them being injured.

When the extra yarns are of solid colour, they are used sparingly, but it is the more common practice to have the coloured yarn twisted with another, as the colour display is then halved after twisting, and about quartered when woven.

Producers of fancy yarns are constantly experimenting to achieve new combinations or novelties, but are influenced by what has become fashionable for the time being.

However well a novelty yarn may look when made, it must be weavable and durable, for if not well constructed, the weakest parts may be ruptured, and spoil the cloth.

Moreover, if the yarn be a knop, slub, boucle, or snarl, it is difficult to make good after been woven. When fancy yarns are smaller or thicker than the ground threads they have to be woven from a separate roller, so the rate of speed in relation to the warp beam can be regulated. If the fancy yarn is too slack, it will hang down in the front shed, and curl in the cloth, but if too tight, they may crack during finishing. Tightness is detected by passing the hand edgewise along the cloth between the breast beam and the cloth fell. When ridges are felt, the tension on the roller has to be decreased.

The chief ideas associated with extra roller work are explained, and commence on Page 366.

When the knops or slubs are large, the eyes of the healds have to be large enough for them to pass through, and usually such healds are better on a separate shaft. Such yarns must also have reeds extracted, or specially made, or they cannot be woven. The missing wires coincide with the warping plan. The necessity for more space is obvious if reference is made to the snarl yarn at No. 8 in Fig. 435.

The set of fourteen yarns, are some of the latest examples from Messrs. William Hutchinson (Yarns) Ltd., Holybrook Mills, Greengates, Bradford.

No. 1 in Fig. 434, is a woollen twist yarn with long cotton knops. It may be used for either yarn dyed or wool dyed goods. The knops are 2/5 inch in length, are four inches apart, and the final twist is nine turns per inch. It is a combination of three threads, with nut brown and white woollen twisted together. The green outer thread is twofold cotton. The knop does not bulge much, so that ordinary healds will suffice. The counts are fours worsted.

No. 2 is a " Fibro " slub yarn with viscose snarls, and is used in fabrics that are to be piece dyed. As it is not over strong, it is used for weft only, and for dress goods. In the structure, there are seven snarls in 3 inches. The white " Fibro " is twofold, and the fine denier viscose yarn makes the snarls. The counts are 6¾ cotton counts.

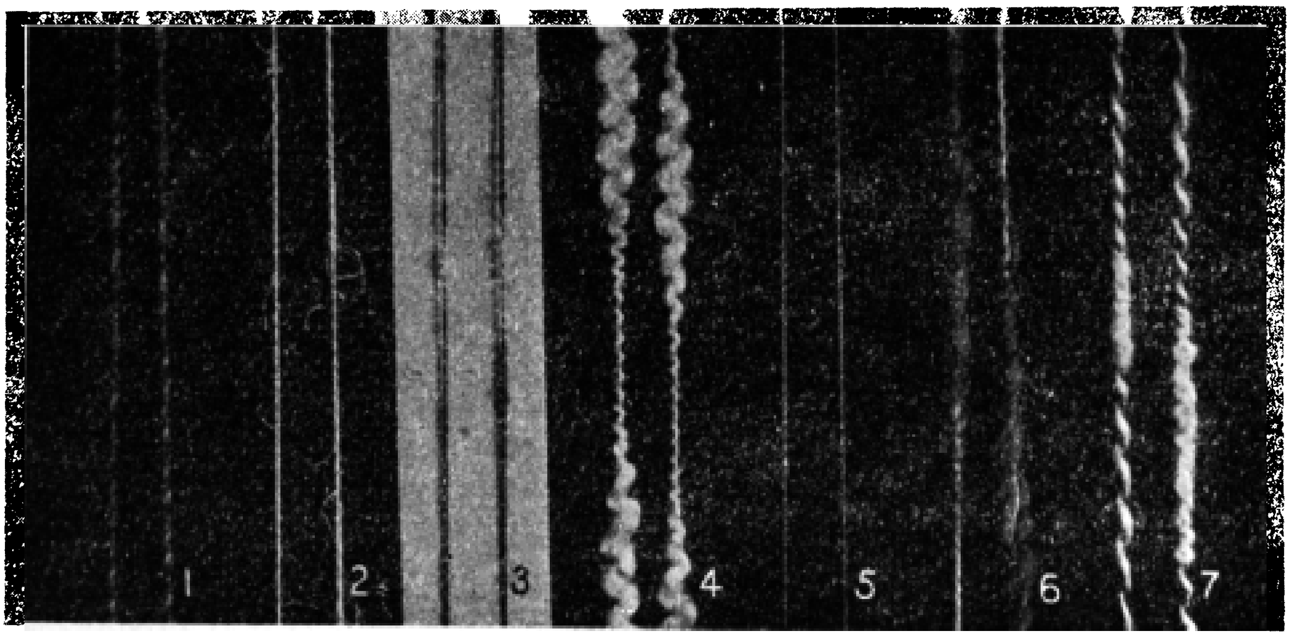



**Fig. 434.**
Rayon and Cotton Mixture Yarns.

No. 3 is 8's cotton counts. The black cotton carries the white viscose spots, which are consequently well displayed. This yarn is specially made for warp stripe effects for dress goods. The spot is a ¼ inch long, and three inches apart.

No. 4 is a " Fibro " flaked spiral yarn, and used in high class piece-dyed casement fabrics. The flakes taper at either end, and are one inch long, and ¾ inch apart.

In all, there are five threads. Two are twofold cotton, and the other is a single cotton, on which the "Fibro" is placed. It is then held in position by the other two twofold threads. All the threads are white.

No. 5 is an acetate and viscose cloud yarn. It is normally produced undyed, and the two colour effect is obtained by the different dyeing properties of the components. In the combined threads, a section shows all red for ⅝ inch, owing to the closeness of the wrapping, and similar length of red and white in variable twist. The counts are 8½ cotton.

No. 6 is a worsted and cotton spiral slub yarn. The cotton slubs are fast to cross dyeing with woollen dyes. The slubs are 2 inches long, and taper at each end, and the colours are scarlet and light blue. The distance between the slubs is 5¾ inches. The two yarns forming the main structure are twofold worsted and the resultant counts are 3½'s worsted.

No. 7 is 2's cotton counts. It is a cotton spiral yarn with long knops, and yarn dyed before twisting. It is intended as weft for casement fabrics. The knops are 1 inch long, and 2½ inches apart. The red brown twist is twofold cotton, and the other a single twist cotton.

No. 8, Fig. 435, is a cotton group snarl yarn, the snarl being of large size for effects purposes in dress goods. Large heald eyes and missing wires in the reed are required to weave it.

The group snarls are 1 3/10 inches long and 9 inches apart. There are two threads of twofold cotton twisted round a core of two threads of twofold cotton.

When the snarls are pulled out, they are 14 inches long, and made with two threads of twofold cotton. If the combined threads should break the weaver has then to arrange the snarl at about the same place it would have occupied before the breakage. The counts are 1's cotton.

No. 9 has two colours of elongated knops of mercerised cotton, the colours being blue and red. Each knop is ½ inch long, and spaced every three inches. They are made more distinct by being placed on a light background in the illustration. The counts are 10's cotton.

No. 10 is a dull viscose multiple knop yarn. The component yarns are all dyed before doubling, and can be supplied in any colour combination. The colours used are yellow, light blue, scarlet, black and white. A repeat occurs every two inches. There are two threads twisted round each other, one been made with three threads, one being white, another black, and the other light blue. The other is also a combination of three threads, one white, another yellow and the final red, the whole series are rayon, and the counts are 2's cotton.

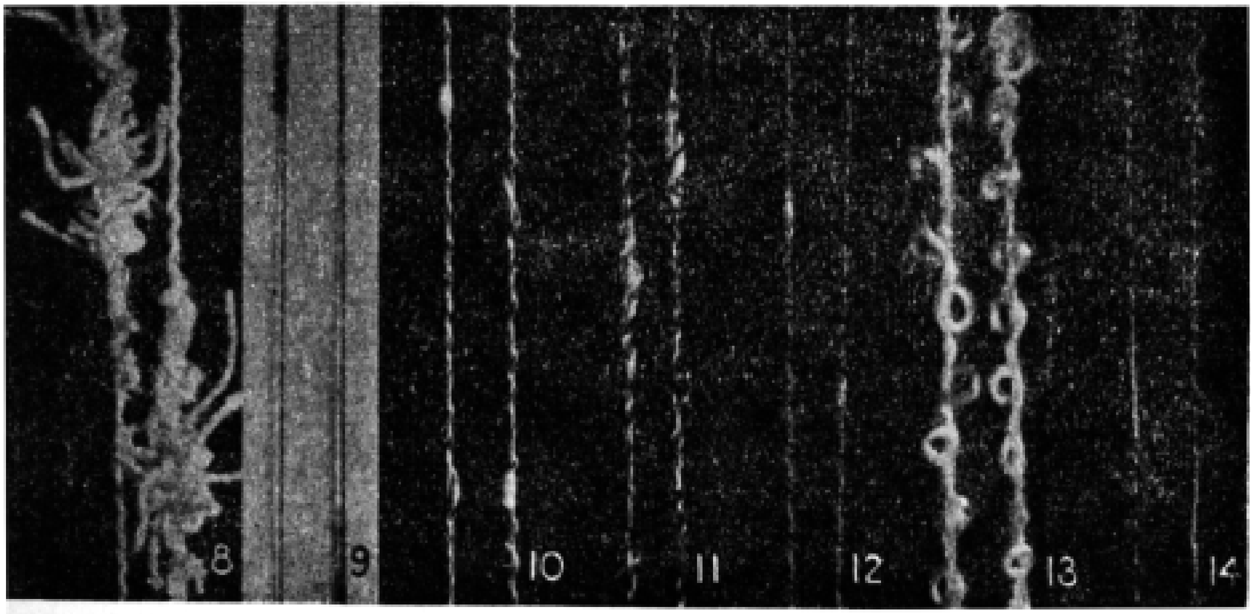



Fig. 435.
Attractive Novelty Yarn.

No. 11 is for machine knitting. It is a viscose knop yarn, the knops alternating red and white, and the distance between each is 1 inch. In all, there are four threads. Two white and a red one form the core, and the knops, and another white one is the binder. All are viscose, and the counts are 2½'s cotton.

No. 12 is a " Fibro " and mohair loop yarn. The looping thread is a mixture of mohair and bright " Fibro " so as to produce a two colour effect after dyeing. This yarn is chiefly used for hand knitting purposes. There are six loops per inch. The binding yarn is twofold worsted, and has 20 turns per inch. The mohair and " Fibro " are very strong, and reliance is placed on the worsted to keep the loops intact. The counts are 1¾'s worsted.

No. 13 is a wool spun yarn with a black cotton core and white rayon spots. The cotton is dyed fast to wool cross dyeing before twisting, and the twisted yarn is wool dyed. It is constructed for machine knitting. The distance between the white spots is 3 inches. The black and white twist yarns have 20 turns per inch, and the blue woollen outer thread has 6 turns per inch. The black is twofold cotton, and the white is viscose rayon.

No. 14 is a wool boucle yarn with viscose rayon slubs. The viscose is dyed fast to cross dyeing with wool, and the twisted yarn is wool dyed in hank form for hand knitting. The bright blue knops are a ½ inch and then 7 inches apart. The red is twisted round the blue with 8 turns per inch. Two threads of red form the core, and around the twofold a single yarn is wrapped. The blue viscose yarn is the outer binding thread, and is also used for knop making.

# RAYON AND "FIBRO" DEVELOPMENTS.

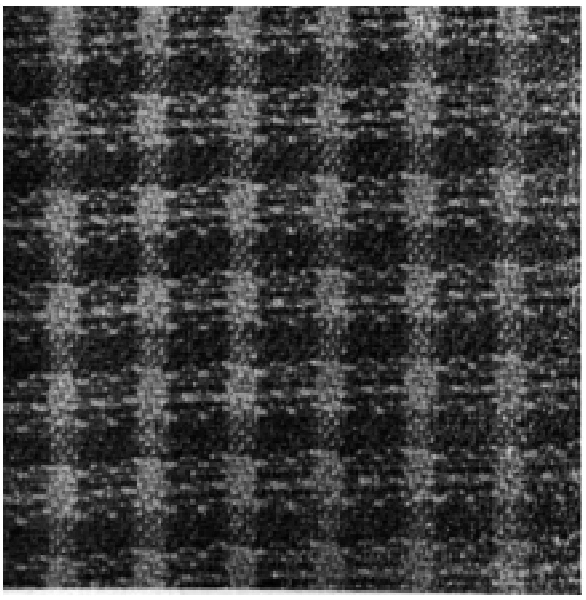
Rayon industry has developed far beyond inventors' intentions. After countless experiments, two chief kinds are viscose and acetate, the former from wood pulp, and the latter wood pulp mixed with cotton linters. Both kinds used separately, for some time, because some dyes did not act alike on both. Within limits, this effect made use of in producing two colour effects in same cloth, and became commercial success.

Formerly, it was considered a spoilation of yarns and cloth if its lustre interfered with. This modified by crêpe twisting, delustring, and making " Fibro."

Mixing " Fibro " with other textile commodities became more popular, when " Fibro " cut to average length of other fibres.

Some of these aspects illustrated in the few patterns displayed by courtesy of Messrs. Courtaulds Ltd.

Fig. 436, is a small, neat, and clean looking fabric in pink and white and piece dyed. Handle rough but durable.



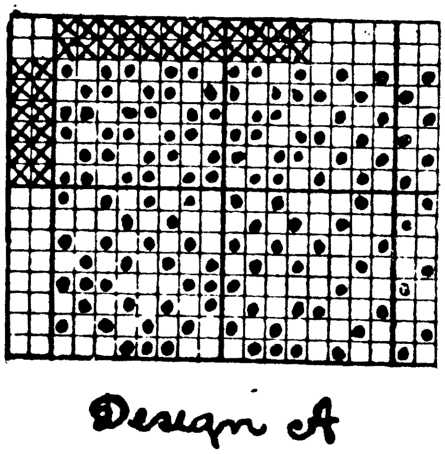


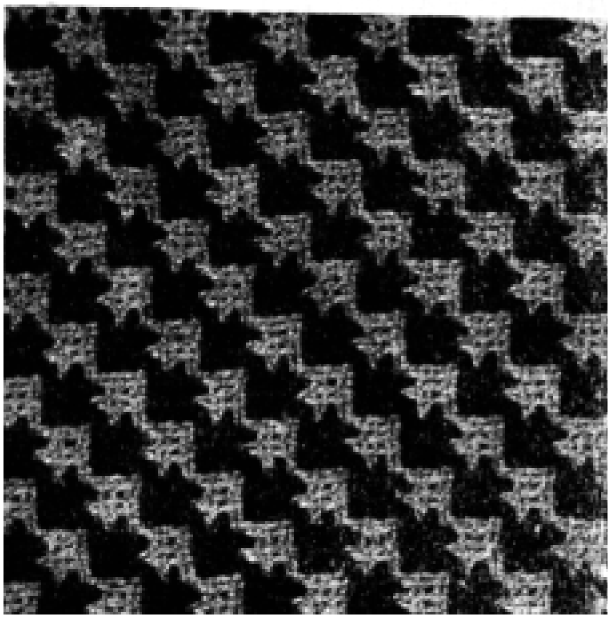

Fig. 436. Fig. 437.

Worsted and " Fibro " Mixture Cloth.

Warp 12 pink, 6 white, 58 threads per inch. Weft 6 pink and white, 44 picks per inch.

Pink yarn 2/40's worsted and made from 80 per cent. wool and 20 per cent. " Fibro " scribbled together. White yarn 2/24's cotton counts and all " Fibro." A repeat of weave and warp and weft plans are given. Design 437.

Fig. 438 is a hopsack effect in brown and white, and cloth has soft handle.



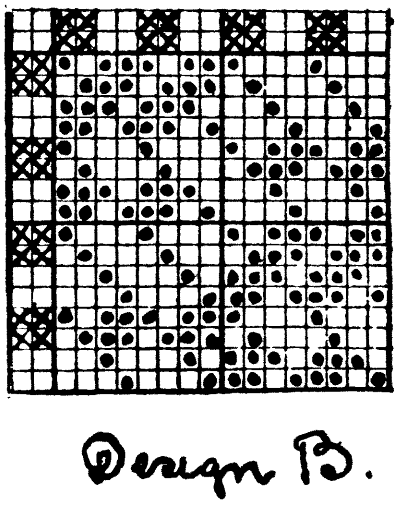



Fig. 438. Fig. 439.

Worsted and Viscose " Fibro " Fabric.

Warped and wefted 2 nut brown, 2 white, with 44 threads and 46 picks per inch. Brown warp and weft 2/36 worsted, and white " Fibro " 2/24's cotton counts, made from viscose staple fibre. Weave given, and cloth and piece dyed. Design 439.

Fig. 440 made from 596 denier viscose ratin yarn and 540 denier seraceta yarn, warp and weft being alike.

Warped 4 white 4 black to 40: 12 white 12 black = 64.

Wefting 16 white, 16 black, 8 white, 8 black = 48. Threads 42 and picks 36 per inch. Warp and weft three-fold. Inner two-fold slackly twisted, for an 8 inch thread of one gives a 13 inch length of the other. A binder thread holds slack twist in position, and gives it a boucle effect. The weave presented, Fig. 441.

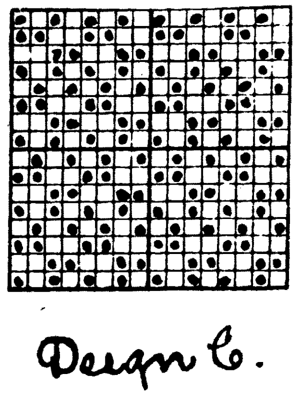


Fig. 440. Fig. 441.
Made with Viscose Ratin Yarns.

Fig. 442 is a much more elaborate cloth than appearance suggests.

Warp. 58 brown, 58 cream with 116 threads per inch.

Weft. 28 brown, 36 cream with 70 picks per inch. Brown warp 100 denier viscose, and cream warp 100 denier seraceta, and cream weft same.

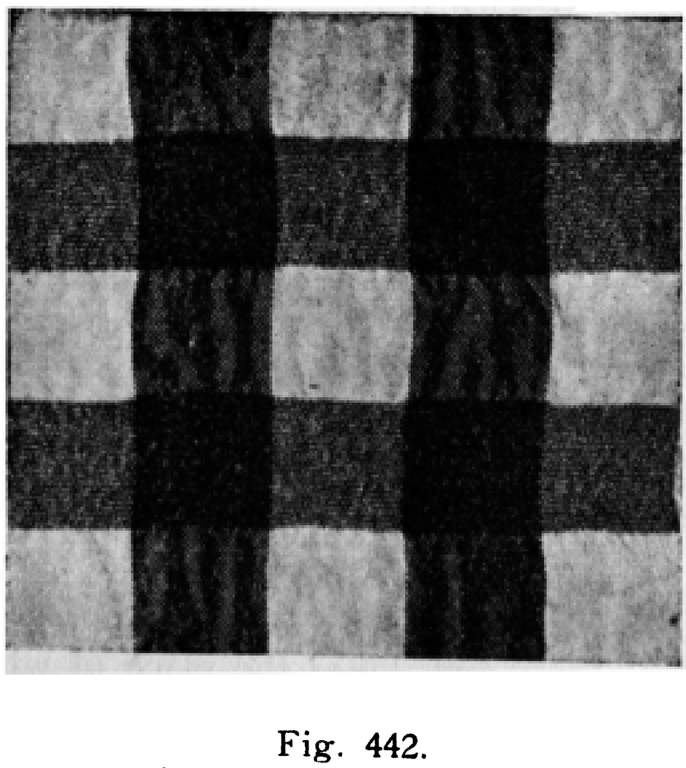


Fig. 442.
Crinkled by Crêpe Yarns.

Brown weft crêpe twisted with 55 to 60 turns per inch. Four picks right twist, 4 picks left twist. Yarns equal to 1/20's cotton counts. Actual proportions in fabric are 37.2 per cent. acetate, 23.5 per cent. viscose, 39.3 viscose staple fibre. Because of crêpe twist and different shrinking qualities the fabric is crinkled. Plain weave and piece dyed.

Fig. 443 is 100 per cent. viscose fabric, and has an elaborate warping and wefting plan.

*Warped.*

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| White | 65 | — | — | — | — | — | 144 |
| Saxe blue | 12 | — | — | — | — | 12 | |
| Bright yellow | 4 | — | — | — | 4 | — | |
| Light red | 8 | 8 | 8 | 8 | — | — | |
| Peacock green | 4 | 4 | 4 | — | — | — | |

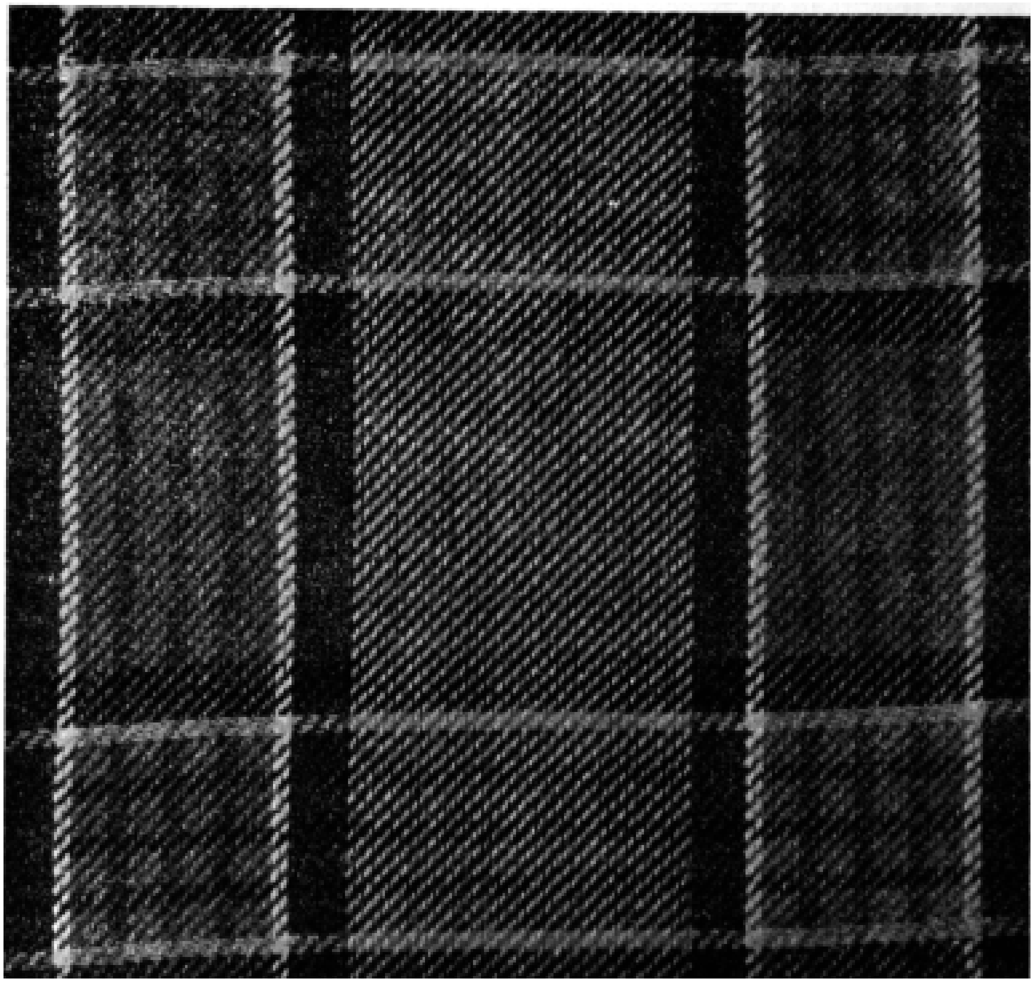


Fig. 443. Viscose Cloth.

In the weft, rose pink takes the place of white in warp, and the wefting is then the same. Threads 54, picks 52 per inch. Yarn dyed. Handle of cloth soft and smooth.

Fig. 444 is built with 100 denier viscose, and 100 seraceta in warp and weft. The proportions are 71.13 per cent. acetate and 28.87 per cent. viscose.

Fig. 444. Viscose and Acetate Texture.

The warp and weft plans are too elaborate to give, for the repeat of the warp is on 334 threads, and the colours are white, black, salmon. There are 130 threads per inch, and 70 picks, the weft having same colours as warp. The yarns were yarn dyed, and very lustrous. The repeat of the weft is on 176 picks.

# LANCASHIRE SILK AND RAYON LOOMS.

## Butterworth and Dickinson's Drop Box For Silk.

This loom is well represented in the illustration at Fig. 445. It has a 24 shaft negative dobby, the feelers being served by two lag barrels and a pattern chain in the same way as the terry loom already explained. The picking is

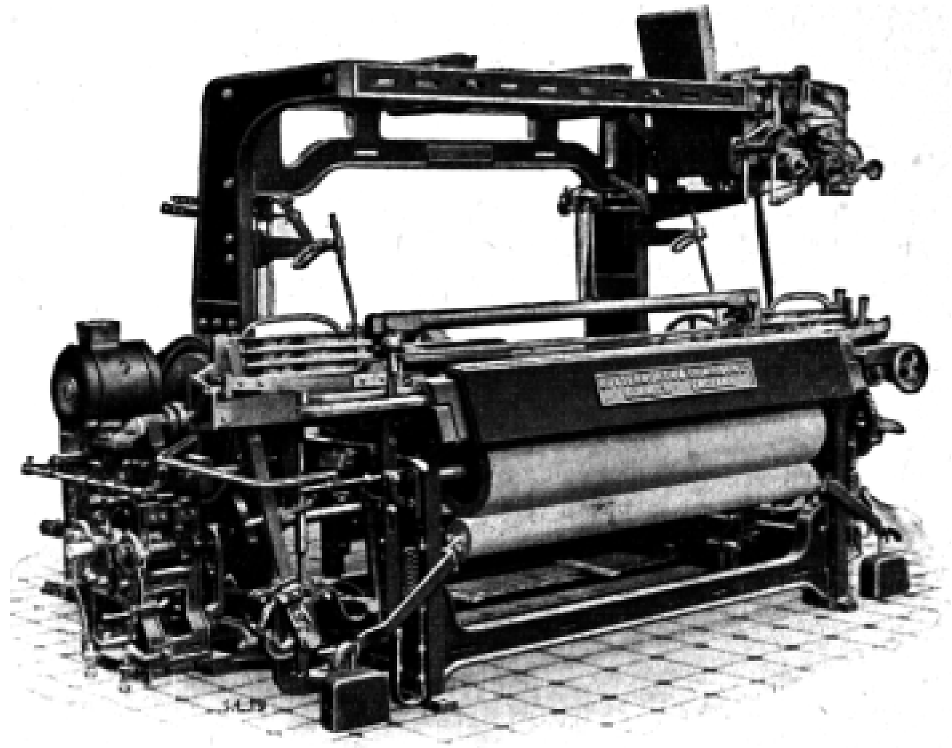


Fig. 445.
Butterworth & Dickinson's Pick and Pick Silk Loom.

the underpick, but has the addition of a safety device. Towards the base, and behind each stick is a catch, these catches being controlled from the swells of the boxes that are level with the shuttle race. If a peg should be broken or missing, or the weaver misplace the lags, it would be possible for two boxes to be level with the shuttle race, each box having a shuttle in it. Under these circumstances, both catches would be raised, and both picking levers lifted at the same time, and when the loom turned over, it would be stopped by the weft fork.

The pickers are of buffalo, work horizontally, are slotted for the picking stick to pass through, and are regulated by a spindle and slide. On the box rod is an escape motion to prevent damage to box and shuttle if the latter is ever trapped between the shuttle board and box. The handle associated with it enables the weaver to bring any box level with the shuttle race. A feature of the box shelves is that the front edges slope back at an angle of 45 degrees, are well rounded off and polished, so as to do no injury to the shuttles. The box back slides are made of brass, and the bearings of the box swells are lined with metal to increase durability.

The boxes are raised and lowered by selection fingers moving segment wheels that mesh with star wheels. One finger and segment wheel controls the second box, and the other the third box, and when both are placed for lifting at the same time, the fourth box is brought into use. Connecting rods couple the star wheels to the lifting lever that holds the box rod. The selection fingers are influenced from the dobby so that healds and boxes work in unison.

The loom is fitted with two weft forks near the selvedges, so that broken picks are detected quicker.

The taking-up motion is indirect, and the cloth beam is pressed to the take-up roller by levers and weights. The take-up roller is covered with fine emery cloth, and is positively driven through worm gearing, and the picks per inch are influenced by the change wheel.

The reed case is constructed of metal, and can be arranged to take any kind of sley. The reed can be oscillated at the beat up to impart a rolling action to the weft instead of a blow. The framework for holding the sley is furnished with adjustable rods. These rods at their upper ends are connected to brackets fixed to the loom frame, and their lower ends to the reed case. As the sley moves forward, the bottom of it is held by the rods at an inclined angle. The amount of reed movement is determined by the working length of the rods. The loom may be driven in various ways, but the one illustrated is by electric motor with fibre pinion for silent running, and geared to a heavy balance wheel mounted on the crank shaft. A clutch plate studded with circular corks slides on keys on the crank shaft when moved by the setting on handle. This method is so efficient, that the loom is started at full speed when the crank is about at its front centre. There is a full pick and no mark left in the cloth.

## Butterworth and Dickinson's Rayon Loom.

As will be seen from the illustration at Fig. 446, this loom has a " Globe " 16 shaft, 3 barrel dobby, but the loom

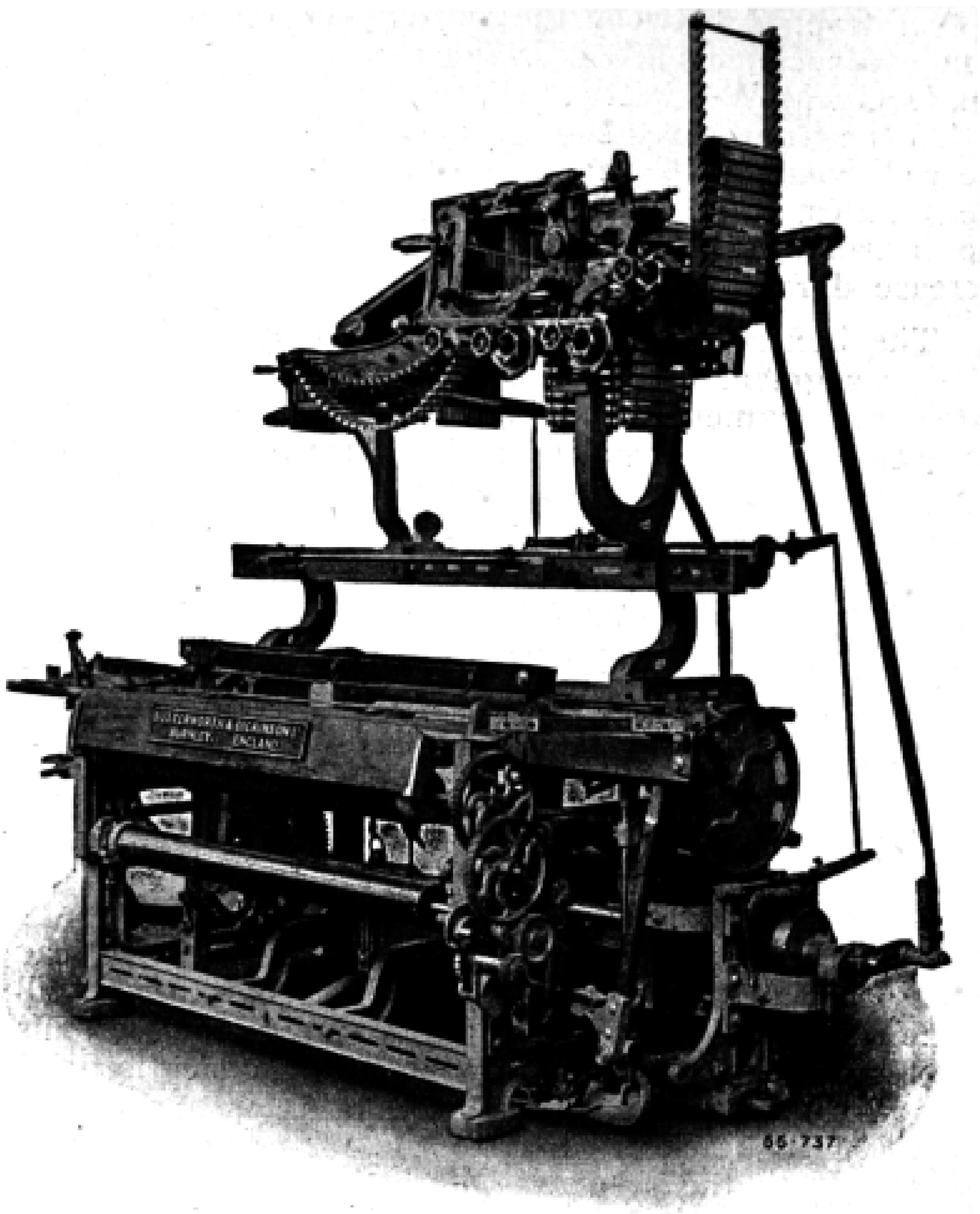


Fig. 446.
Butterworth & Dickinson's Two Box Rayon Loom.

frame is made so it can be fitted with plain roller shedding motion for inside tappets.

The picking is the underpick, all the parts being outside the loom frame, and easy of access. The wooden picking lever extends the full depth of the loom, and is fulcrumed at the back. On its upper surface is a raised bowl which is depressed by the nose of a cam on the low shaft. A canvas or leather strap is fixed to the heel of the picking stick, and encircles the front end of the picking lever. When the lever is depressed by the picking nose, the picking stick is thrown forward, and the shuttle is propelled across the loom. By raising or lowering the fulcrum of the picking shaft by its regulation screws, the amount of pick is adjusted.

*Outside Under Pick Motion.*—A side view of this is presented at Fig. 447. This kind of picking is employed in weaving jute, flax, cotton, velvet, plush and silk. It has one advantage over the overpick motion, for fabrics are in less danger of contamination by oil. It is also more resilient than the ordinary underpick, the picking shaft being wood instead of steel. At A is the low shaft, to which the picking lever, B is keyed. The picking lever is slotted, so the picking bowl C may be made to pick sooner or later if found necessary. On the same loom, however, the bowl is bolted to the bottom driving wheel, which greatly adds to the labour of the wheel.

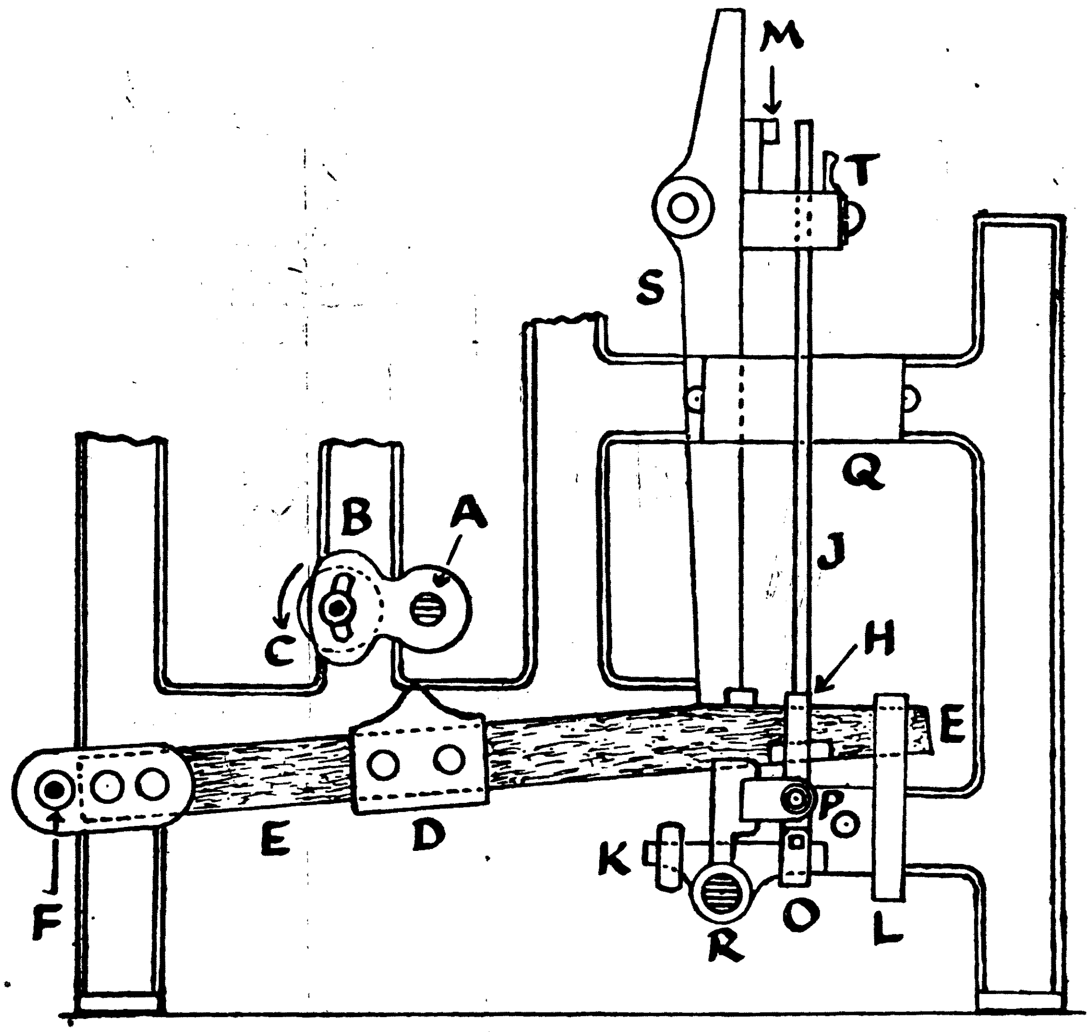



Fig. 447.
Outside Under Pick Motion (Side View).

At D is the picking neb or plate, which is strongly bolted to the wooden picking lever E. Some picking nebs are slotted in their bolt holes, but if so, they should be packed for increased security. The picking lever E is fulcrumed at F, the fulcrum being capable of alteration vertically. For the weaving of the majority of fabrics the fulcrum is fixed opposite the centre of the stroke of the lever. The front of the lever passes through the guide L.

At H is the metal sheath to which the upright picking stick is bolted. At K is the rocking rail. At O is the pulling back strap to bring the picking stick back after picking. At P is the buffer spring that holds the picking stick forward to check the incoming shuttle.

The part Q is a broad strap to check the forward movement of the picking stick. The picker and shuttle guide is at M on the top front of the box back, and T is the box front.

The front view of this arrangement is at Fig. 448. Here again, A is the low shaft, with B the picking lever, and C the bowl. The part D is the top of the picking neb on the wooden lever E.

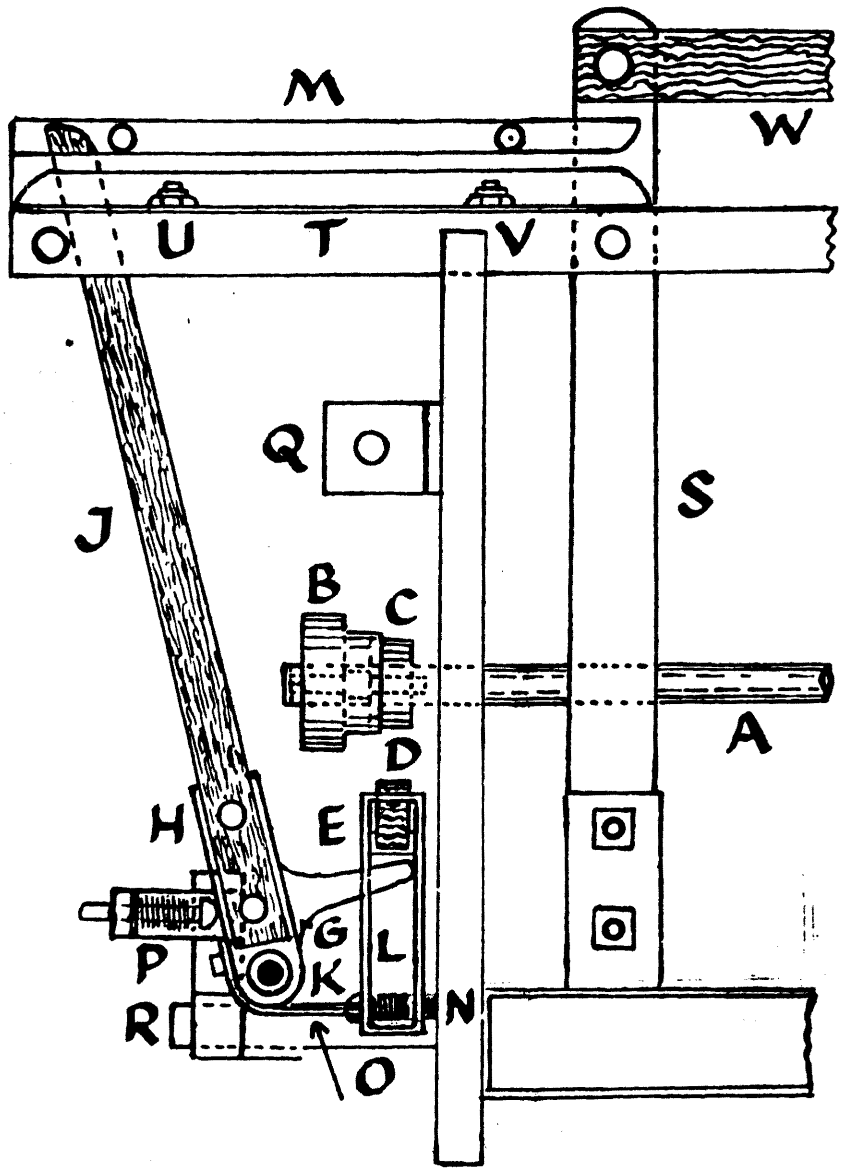



Fig. 448.
Outside Under Pick Motion (Front View).

It will now be better realised, that when the bowl comes in contact with the picking neb, the picking shaft is depressed, and forces down the arm G, and so brings the picking stick forward to throw the shuttle.

The metal sheath H, and stick J, are fulcrumed at K, and spring P holds the stick forward to check the shuttle. The spring N and strap O pull back the stick after picking.

The part Q is the end of the forward check strap. At M is the shuttle and picker guide, and T, the shuttle box front with its feet at U and V, with the handrail at W.

A variation of this kind of picking is to have the front of the picking lever through a looped leather attached to the picking shaft. This gives a "softer" pick, but much more subject to wearing and variation.

The take-up motion is the Pickles type with machine cut wheels. The beam wheel and small pinion may have helical cut teeth as shown, or the more usual type. The cloth is passed round the taking-up roller, which may be covered with either emery cloth, rubber, or steel strip. The fabric then passes over a smoothing bar and goes to the cloth beam, the latter being driven by a frictional arrangement from the taking-up roller. The cloth roller may be taken out, and a fresh one inserted without disturbing the fell of the cloth. The boxes are raised and lowered as detailed for the silk loom. There are, however, two swells to each box. The inner one is the longer of the two, and is held in position by a light flat spring, and lifts the stop rod in the ordinary way, but by means of a wooden bowl on the stop rod finger. When picking is about to take place, the swell pressure is removed. The checking of the shuttle is performed in two ways.

(1) On the outer part of the long swell is the shorter one which dovetails into the other. At the back of it a metal bowl presses against it for a good part of the top traverse of the crank, and is away from it for most of the bottom half.

The easing lever to which the metal bowl is attached extends beyond the inner end of the box, and here, its rounded end goes through a slotted casting, and is fitted with a small bowl that runs on a race behind the sword. This easing lever is fulcrumed on the same stud as the other part of the checking arrangement. A plate which is fixed to the outerside of the crank arm carries the regulation setscrew which curtails the movement of the easing lever, and imparts movement to it. The pressure is applied to the outer box swell when the shuttle enters the box, and withdrawn when the shuttle emerges from the box.

(2) The other part that checks the shuttle is seen on the right in the illustration. It has been named a "posi-

tioner," and is fulcrumed on a stout pin carried on the box fender behind the lay. A rubber fits on its upright shaft, and takes the shock of the shuttle. Above and below the rubber is an angle plate which pushes the shuttle outward when the box moves in changing its position, and thus keeps the tip of the shuttle free from the face of the picker. The positioner is connected by strap and buffalo strips to a stud on the breast beam, the stud being movable. The loom is served with a clutch drive, has a reed space of 47 inches, and an approximate speed of 160 p.p.m.

## Messrs. White & Sons Ltd. Silk and Rayon Loom.

As set forth in the illustration at Fig. 449, it is a square dobby with 40 dobby jacks, but the back four are used to control the 4 × 4 drop boxes. It is also made 4 × 1 drop box.

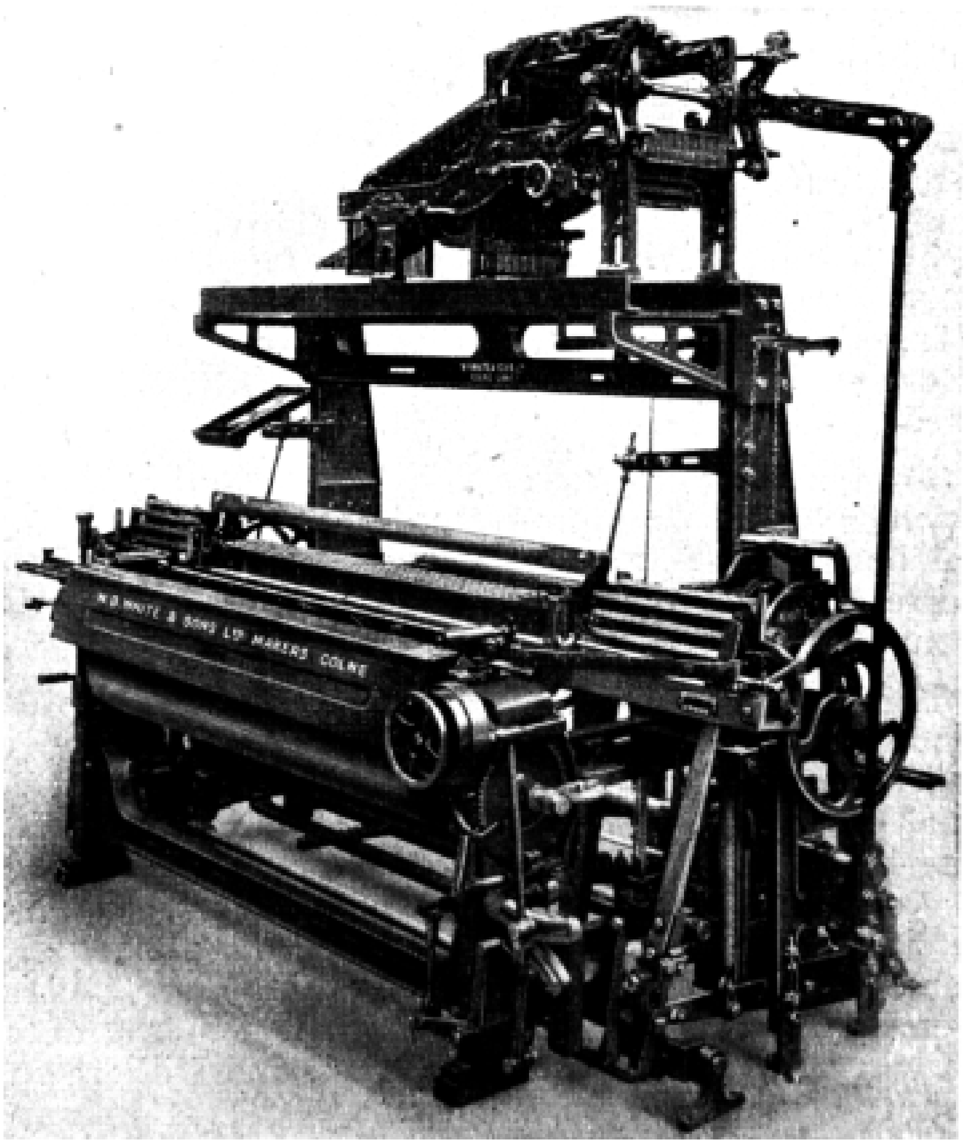


Fig. 449.
Messrs. White and Son's Ltd. Silk and Rayon Loom.

*Construction of Dobby.*—The dobby jacks are made so that flat rods can be hooked on, and attached to notched shaft jacks that pass through grates.

The balks in the dobby swing on circular projections on the dobby jacks, and the catches associated work on the ball and socket principle. As the dobby is a negative, the catches have only one cut on the under side.

When the draw bars are at their full back traverse, the cut points on the catches should have a clearance from the edge of the draw bar of $\frac{3}{16}$ inch.

The bottom catches are moved by fingered feelers, and the upper ones by needles.

The pegs in the lags, and the height of the cylinder has to deposit the catches fully on the draw bars. The lag cylinder has 8 grooves. It is turned every other pick by a pawl bolted to the lower arm of the main dobby lever. The push of the pawl has not to exceed turning the cylinder beyond bringing the operating lag to its dead top centre.

The draw bars are actuated by the shedding lever seen on the right on the low shaft. It is this lever that sets the timing of the shed. It is timed early to make smart pieces, and get the picks in easier. It is timed late to ease the weft drag on the warp, and prevent excess warp breakages with poorer yarn.

Equal sheds are achieved when the shedding lever and the centre arm of the T lever behind the dobby are both dead level.

*Outside Underpick.*—The wooden picking shaft is outside the loom frame. On its upper surface is the anti-friction bowl that is depressed by a tappet nose on the low shaft every other pick. The tappets moves clockwise.

For the weaving of silk and rayon, a looped strap at the base of the upright picking stick gives a resilient pick to the shuttle, and has a good effect on the weft. The crank gives a forward sweep to the going part of 5 inches.

On completing the pick, the stick is pulled back by a spring at the base, and the picking shaft is pulled up by a strong spiral spring. The shuttle is given an " up and off " delivery of $\frac{3}{16}$ inch.

*Negative Let-Off.*—Ropes are used to brake the warp beam, and their frictional sides are given a dressing of French chalk. When the weaver notices any jerky movement of the beam the ropes have to be cleaned, and a fresh dressing of chalk applied by the overlooker.