Finding the Pick.—When the weft has broken or run off, the pick is found with the loom standing. The engine is first disconnected with the crank, and the cylinder hand wheel turned in the opposite direction to the one when weaving. When the starting pick is found after pulling back, all that is needed is to put the clutch box in order, and the loom is ready for weaving.

Standardized Parts.—All the wheels are machine cut, and as the jack and segment wheels are placed in alternate positions, they are double the strength owing to the extra amount of space allotted to them. All the parts are fitted with exactitude in the machine shop, and seldom require any attention except oiling. All similar parts are interchangeable, and every part is standardized.

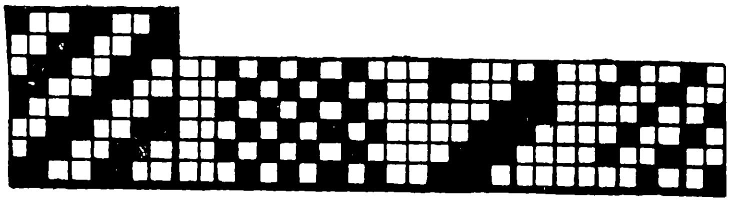


Fig. 38. Fig. 39. Fig. 40. Fig. 41.
Designs for Leeming Dobby.

Lag Making.—The method of lag making is shown from Figs. 38 to 45. Fig. 38 is a 2 and 2 twill, but to weave it on a Leeming dobby, the design has to be altered to peg for change as at Fig. 39. To do this, the last pick is compared with the first one, and dots put down for every change. When this is done it produces Fig. 39 and is plain weave.

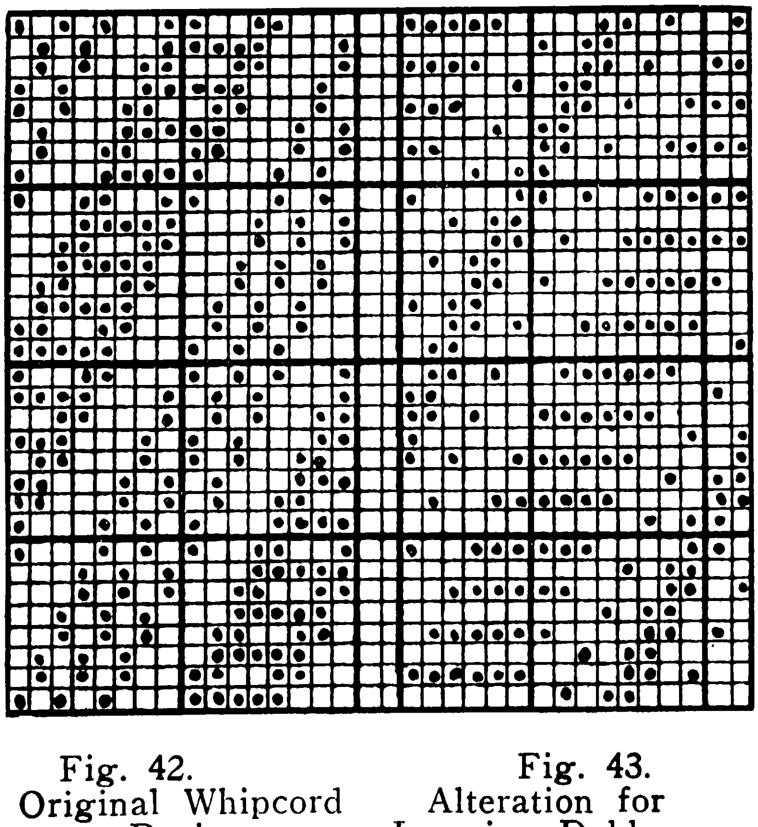


Fig. 42. Original Whipcord Design.

Fig. 43. Alteration for Leeming Dobby.

Fig. 40 is a 3 and 3 twill, but becomes a 2 and 1 twill when altered as at Fig. 41. More elaborate plans are given. At Fig. 42 is a 16-shaft whipcord on 32 picks, and the correct

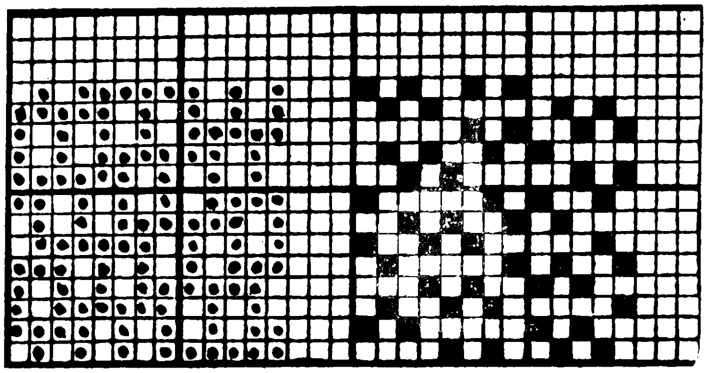


Fig. 44. Corkscrew Design. Fig. 45. Altered for Leeming Dobby.

pegging plan is at Fig. 43. Fig. 44 is a 13-shaft corkscrew weave. One may be led to suppose it would require 26 lags, but only 13 are needed as given in Fig. 45.

HATTERSLEY "V" DOBBY.

This dobby is so named owing to its construction. It is employed on at least ten different looms made by the Hattersley firm, and has won the reputation of seldom making wrong lifts.

The weft mixing dobby coating loom is given at Fig. 46. It is fitted up to 40 shafts, has a reed space of 76 inches and a speed of 125 picks per minute.

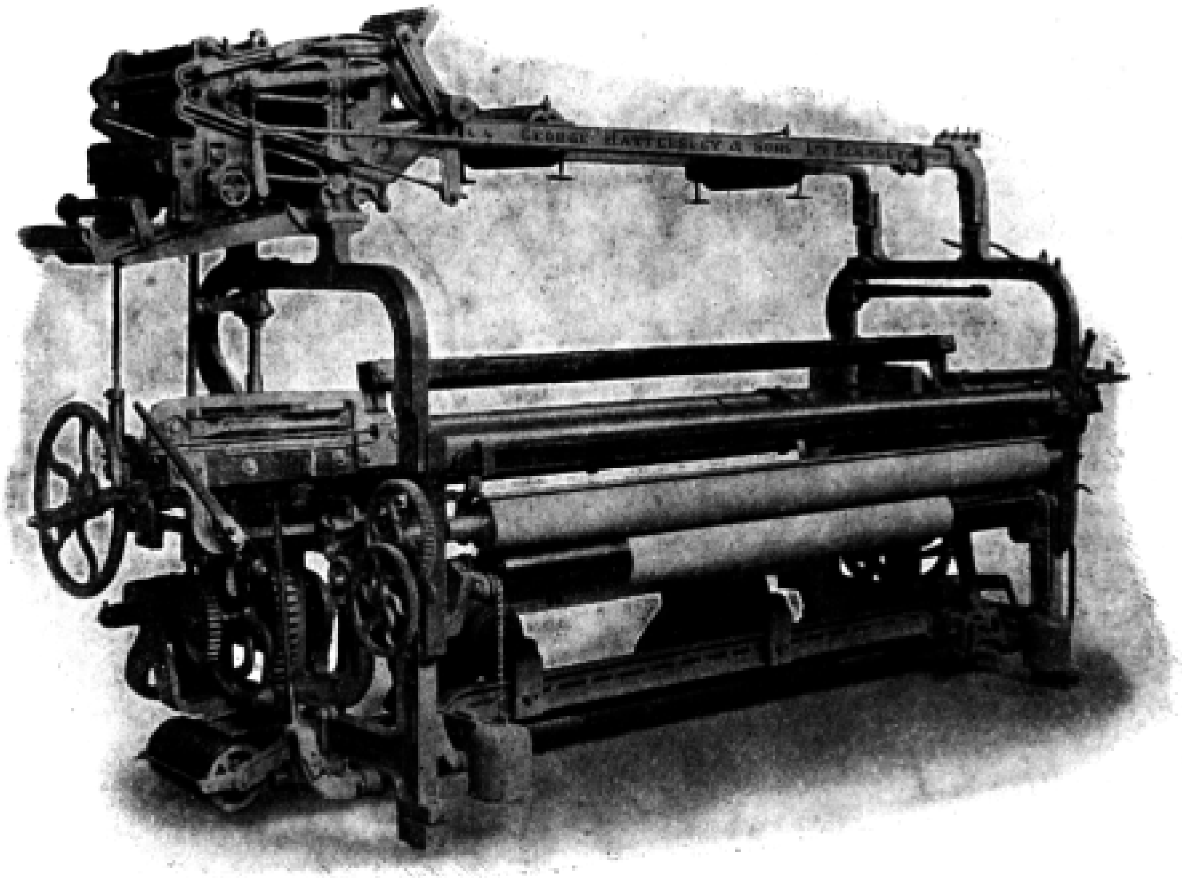


Fig. 46.
Hattersley Weft Mixing Coating Loom.

Dobby.—An outline of the dobby is given at Fig. 47.

The dobby levers A are somewhat bow-shaped, and are hooked on to the strong bar B. The upper and lower arms are notched for shed adjustment, and the centre arm C has the button upon which the balk oscillates. At D is the balk, and on its pins at the front of both ends are the catches E. Slots are made for the easy working of the catches, the largest being at the bottom. The long slot is essential when the upper catch is drawn forward.

Neither catches nor balk can be inserted or extracted without unloosing the setscrews in front of the dobby which keep the jack plates and dobby levers in position. In refixing, care has to be exercised to see that the catches are working in parallel lines through their respective grates.

Any catch that comes off the pin on the balk when working is better discarded, as it is a menace to the safety of the dobby.

Each type of dobby develops faults peculiar to its construction. In this one it is the top catches, which, by the hooks or balk pins wearing, lean too far forward, and cannot rise to be held by the top holding bar. It can be filed shorter in the loom, and remain longer in service. It is easily found by placing all the shafts on the top shed, and putting the shedding rod at its top dead centre.

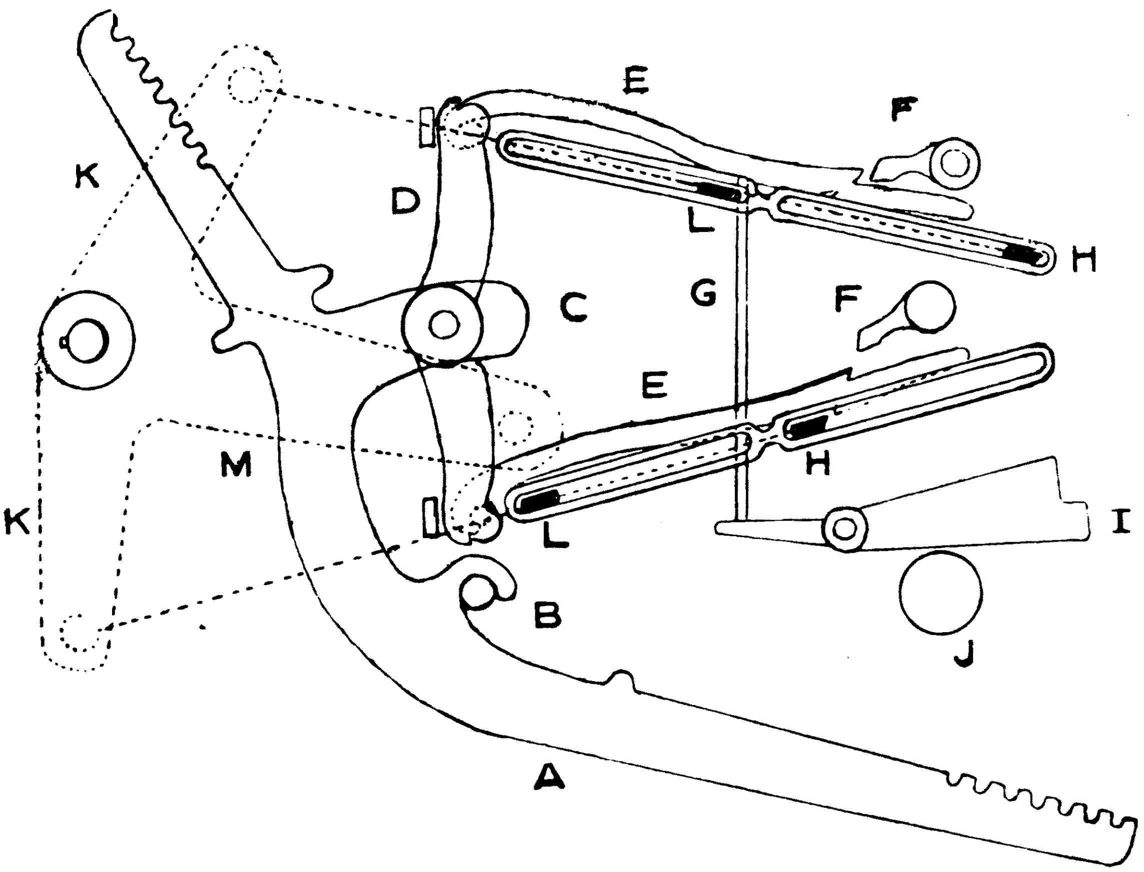


Fig. 47.
Hattersley " V " Dobby. (Front View).

The holding bars F are set so that when the shedding rod is at its dead top and bottom centres, the points of catches should have a clearance of $\frac{3}{16}$th inch. This gives ample room for the catches to change positions.

The needles G operate both the bottom and top catches. It is cranked to give liberty to the bottom catch and provides a shelf for it to rest upon, and the top of it fits underneath the top catch. The needle has to be long enough to elevate both catches so the holding bars F can hold them, and so keep the shaft down, and yet short enough to drop the catches fully on the draw bars when the shaft is needed on the top shed. The important measurements are from the bottom to the top of the shelf, and from the bottom to the top of the needle.

A fresh needle cannot be inserted unless balk and catches are taken out of the dobby. It is then pushed through the upper grate and let fall through the bottom one.

The bottom grate fulfils a threefold purpose: (1) The bottom catches pass through it. (2) The bottom of the needles do the same. (3) The inner ends of the feelers are separated by it.

Draw Bars.—There are two pairs of slots in the engine both front and back, and two pairs of draw bars. The catch bars are at H and the balk bars at L. Each pair are bolted together by a connecting arm, and are the same distance apart, the pitch of the bars is obtained by the balk bars only, and these must just clear the front of the balks when the shedding rod is at its dead top and bottom centres. Having obtained this, the holding bars are then fixed to give the clearance of $\frac{3}{16}$th inch to the catches.

The ends of the balk bars are attached to the main levers of the engine K by adjustable rods, and by these, the pitch of the bars are regulated.

Feelers.—The feeler is at I. It is fulcrumed well forward in its length, which assists in giving it a good drop with little oscillation. The lag pegs come in contact with the outer underside, a peg indicating a shaft lifted, and a blank a shaft down. Wooden pegs are to be preferred to metal ones, for though there is some risk of them falling out in hot weather, they prevent grooves being worn in the feelers.

Cylinder.—This is at J, and has six grooves. It is of the fixed, intermittent, rotary type. Its setting must incorporate three ideas: (1) It must have the same elevation front and back. (2) It must be high enough so the pegs fully deposit the catches on the draw bars. (3) The centre of the pegs must fit into the centre of the feelers.

When the wooden ends become worn, there is too much latitude for the lags. To prevent wrong lifting, the end pegs of groups, and the two sides of single ones may be knife pared to give more room until new ends are fitted.

The cylinder turning wheel is at the back of the engine, and has six grooves as well as the same number of openings for the dolly pin. It is turned by a dolly, and if the pin it possesses is at its back centre when the crank is at its back centre, the cylinder will be correctly timed. The cylinder may be disconnected with the dolly shaft by pulling out a fixing pin. The cylinder is fitted with a check star wheel and finger to keep it steady after being turned.

T *Lever.*—This is at the back of the engine, and is shown at M. It has no long slot as in many makes, reliance being placed on the length of the arm for making a good shed, as well as the notches on the dobby levers. This lever carries the stirrup and shedding rod. At the

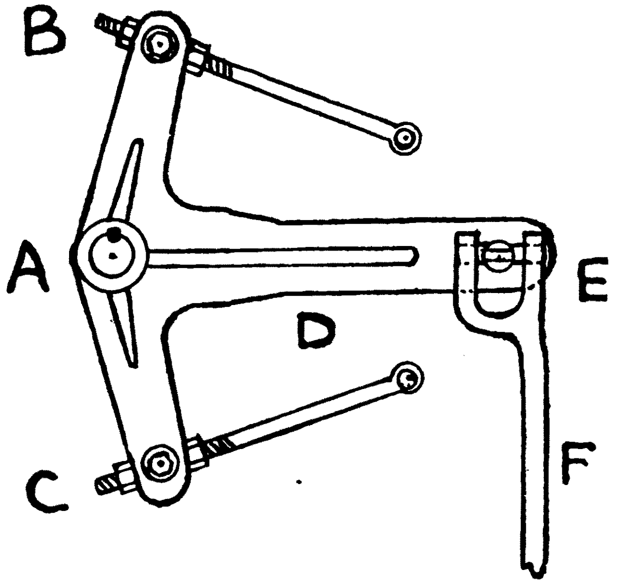


Fig. 48. Shedding Rod and **T** Lever.

bottom it is setscrewed to a slotted connecting arm. It is fixed so that when the connecting arm is in the centre of its stroke, the **T** lever is in the centre of its movement, and gives equal sheds. This is illustrated at Fig. 48. At A is the main shaft of the dobby, with B and C the locknutted connecting rods. D is the long central arm, with E the stirrup, and F the shedding rod. The inner ends of the connecting rods have to be level with each other when the centre arm D is horizontal. Another special point is, that when the shedding rod is at its dead bottom centre the top connecting rod B has to place its draw-bar just free of the front of the balks. The same idea applies when the shedding rod is at its dead top centre.

Eccentric Wheels.—The slotted connecting arm is fixed to a large eccentric wheel at its narrowest part. The long slot in it acts as an escape motion in case anything becomes locked in the engine. This wheel has 50 cogs, and being oval in shape, gives a fairly long dwell to the shed when passing

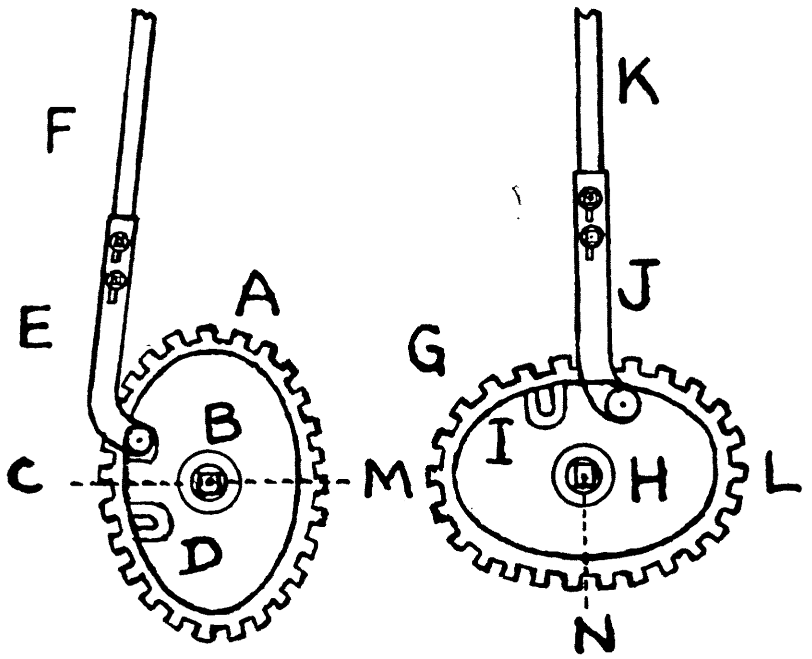


Fig. 49. Eccentric Shedding Wheels.

round the ends of the oval. It meshes with a small eccentric wheel having 25 teeth, and is setscrewed to the outer end of the bottom shaft. By this wheel, the timing of the shed is altered. For most warps, the shedding rod is just past its top centre when the crank is at its back centre.

Fig. 49 gives two views of the eccentric wheels to which the shedding rod F is attached. A is the wheel and B its pivot. C is the line which the bottom of the rod must occupy when the centre arm D in Fig. 48 is horizontal.

There are two slots in the wheel, the one at D being vacant. By these slots, the dwell of the shed may be sooner as fixed, or later by being bolted to the lower slot. E is the slotted arm by which the horizontal position of D, Fig. 48, is secured. At J and K the shedding rod is at its top centre, and the back of corresponding draw-bars has to be just clear of the balks. The same idea applies when the shedding rod is at its bottom centre. L and M are the dwells, and I the extra slot.

The loom is fitted with a worm take-up motion, the gauge point being a tooth per pick.

The letting off is done by friction chains or ropes, and the cloth beam may be removed without stopping the loom.

Timing of Shed.—The shed is timed to suit the kind of fabric being woven. The limit of timing is almost equal to a quarter revolution of the crank. The earliest timing is for the shafts to commence changing just after the crank leaves its back centre. The latest timing is to have the heald shafts level when the reed is against the fell of the cloth. When the timing of the shed is altered, the dolly which turns the lag cylinder must be altered so its pin is at its dead back centre when the crank is at its back centre.

Felt Covered Roller.—This is a necessary addition in those looms where the cloth beam is turned by friction when the yarns are mixed with staple fibre, as the fabric is

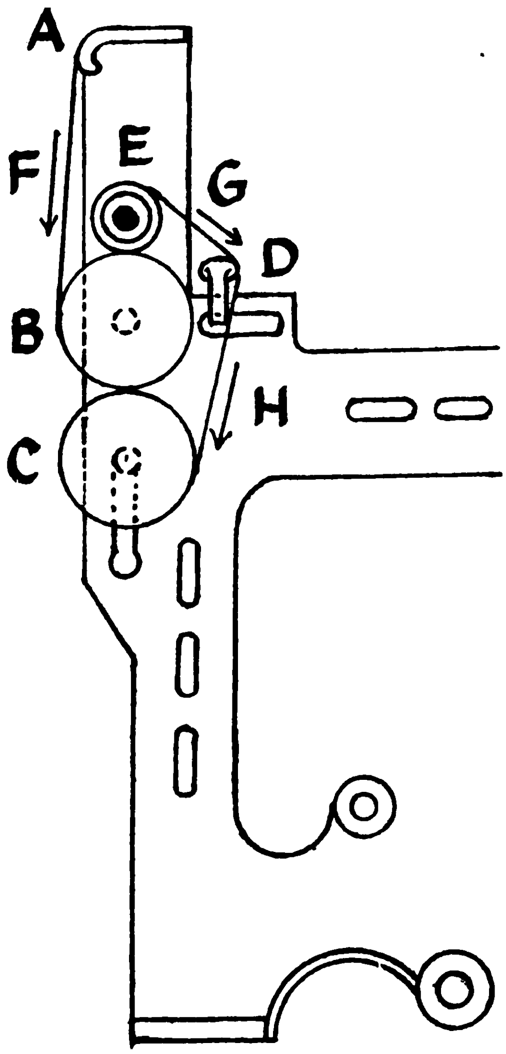


Fig. 50. Felt Covered Roller. Path of Fabric

much more slippery. In Fig. 50, A is the breast beam, and B the take-up roller. C is the cloth beam, and D the ordinary smoother. On top of the take-up roller B, is the felt-covered roller E, which increases the grip on the cloth. The arrows F, G and H, indicate the method of cloth winding.

HATTERSLEY'S DROP BOX LOOM FOR DRESS GOODS.

Messrs. George Hattersley & Sons, of Keighley, have invented a 4 × 4 drop box loom for the weaving of fancy dress goods. It is of the fast reed type with a reed space of 57½ inches, and a speed of 145 picks per minute. It has a negative V dobby capable of working 20 shafts. (Fig. 51).

Engine Jacks.—These are constructed to pass on to a stout bar at the base of the engine by means of a vertical slot. The upper arm has seven notches so the size of the

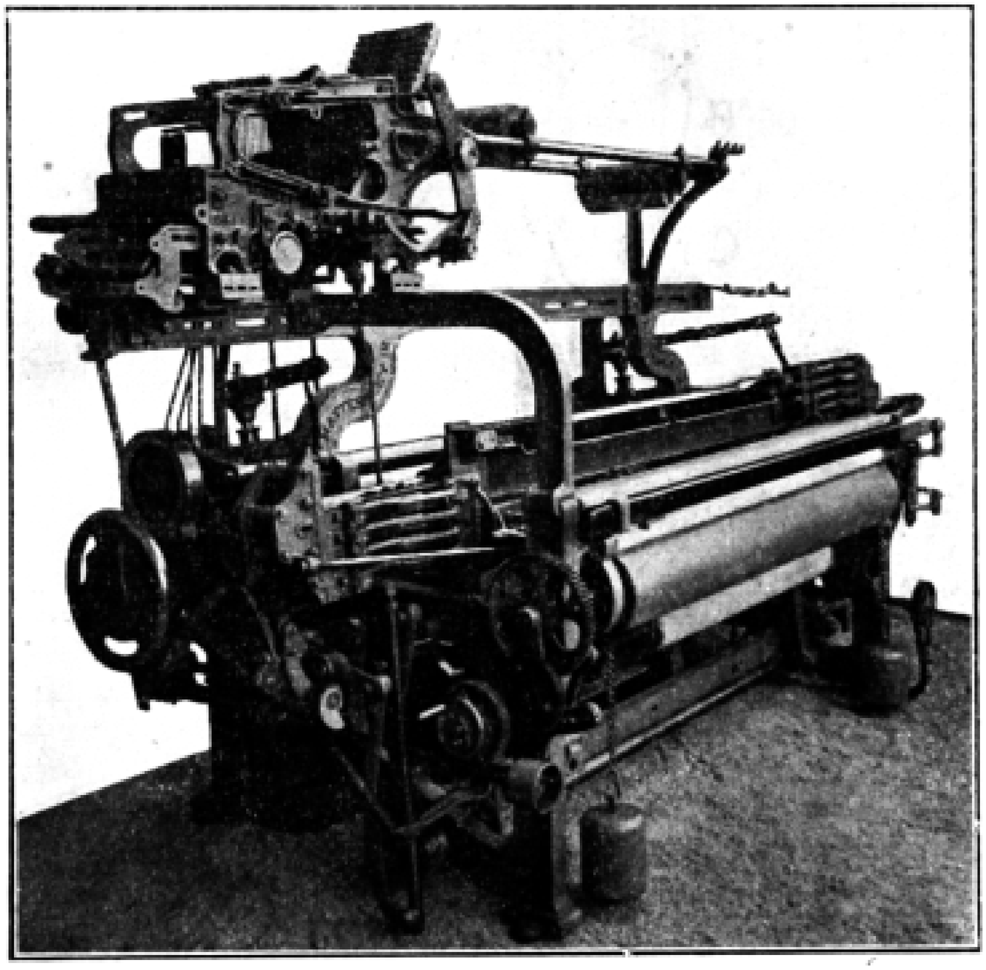


Fig. 51.
Hattersley Drop Box Dress Goods Loom.

shed can be quickly altered to suit the kind of work to be woven. The centre arm is bifurcated to receive the balk which hooks into it. The whole series of jacks are set by jack plates back and front, each plate being regulated by four locknutted setscrews. These screws are adjusted so the catches pass through their respective grates in parallel lines. Both grates are open at the top which facilitates the extraction of any of the balks and catches.

Pulleys for Top Shafts.—The connection from engine jack to the top of the heald shaft is in the ordinary way of streamer, wires, and banded leathers. The special thing is the holding of the pulleys over which the shaft leathers pass. The bar upon which the pulleys are placed fits through castings that are on bright steel bars which take the place of the ordinary top rails of the loom. By this means the pulleys may be altered in their relation to the shaft hooks, but the particular gain is the neat and smart appearance of the loom.

Balks.—The hook at the back centre of its length fits into the divided end of the jack, and owing to this kind of construction, the balk and its attendant pair of catches may be removed without disturbing the jack plates. Each end of the balk is hollowed out to receive the hooked end of the catch, and the pins on it retain the catch. The longest slot in the balk is at the bottom to provide room for the bottom catch when the top one is drawn forward. If ever a catch comes loose during working, it is on the top row, and is due either to the worn condition of the balk pin, or to that of the hook on the catch. It is never safe to attach it again to the balk, as it may come loose again, and do damage to the engine.

Catches.—These are 11 inches long, and with it being a negative dobby, they have only one cut on the underside for the use of the draw bar. The hooked end of it can only be placed on the balk when the balk is liberated from the jack.

The drawbars of the engine are set to suit the cut on the catches, and this is carried out when the shedding rod is placed at its dead top and bottom centres. The connecting rods on the main engine levers are then adjusted so the upper front edge of the draw bar is $\frac{3}{16}$th inch in advance of the edge of the catch cut when raised. This setting is carried out at the end of each draw bar. To give the best possible setting, all the catches should be forward at the bottom when the top draw bar is set, and all the top catches be forward when the bottom draw bar is set.

Feelers.—These are a new pattern. They are $12\frac{1}{2}$ inches long, and pass through grates at either end of their length. The fulcrum is 9 inches from the outer end, and, along with its length and shape, prevents bouncing when it comes to rest. It is curved on its under side to give a steady rise and fall to the catches when actuated by a peg. At its inner end it has two fingers. The upper finger controls the bottom catch, and the lower one has a straight needle upon its upper surface which controls the upper catch.

The needles pass through the back of the top and bottom grates through which the catches pass.

Lags and Cylinder.—The lags are of a new type. They are substantially made, and have a central groove on the face which runs the entire length. On either side of the groove are small countersunk holes in pairs for the reception of the two legs of a metal peg. These holes do not pass through the lag, but are deep enough for the intended purpose. The legs of the pegs are of double thickness at the bottom by the metal being turned up on the inner side. The pegs have a curved top to produce a steady action in the motion of the feelers. After the pegging of each lag, a metal slide is inserted through the centre of the lag and pegs, which effectively prevents any pegs dropping out. This is a special gain over any kind of wooden peg, for in hot weather particularly, the wood contracts, and yards of cloth are too often spoilt on this account, and especially so in double and treble cloths, and fancy designs.

The looped wires which pass through the lags are of reasonable thickness to insure long wearing. In common with all other kinds of lags, the fewer bends there are in long lengths, and the less swinging about, and the better.

Lag Cylinder.—This is fit in three ways: (1) It must be at the same altitude back and front to give an identical lift to all the feelers. (2) The operating lag must be at its dead top centre when it comes to rest, to give and stay so when the maximum lift is given to the feeler. (3) The centre of the peg must be in the centre of the feeler to give the best working and wearing results. The cylinder is checked after turning by the usual method of star wheel, finger, and spring.

Picking.—This is of the overpick order. The shaft of it leans back at an angle of 75 degrees, which fairly coincides with that of the sword and boxes when the crank is at its back centre. This arrangement produces easy picking, and places the least strain on the picker. The cup casting in which the picking shaft rotates rests in a recess on the loom frame and is secured to the framework.

Cone Casting.—This is loose on the picking shaft, and is thrown back every pick by the picking nose, and brought back by a leather and spring. The stud for the picking cone is provided with a good head, but has no thread. The stud shaft is grooved, and passes into the bore through the picking shaft. Another bore in the picking shaft is at right angles to the other, and in this a bolt is placed which fills up the groove in the conestud and holds it secure.

Clutch.—Above the cone casting the picking shaft is square, and on this the clutch is placed. It is provided with a stout leg to fit behind the lug on the cone casting when a pick is required, but is lifted clear of it by the clutch fork when no pick is needed. The correct relation between these two parts is brought about by a regulation screw which passes through a casting on the picking shaft. The head of the screw comes in contact with the loom frame when the shaft is in its stationary position. The working length of the screw is set so that when the head is in contact with the loom frame, and the cone is at the base of the picking nose, the distance between the face side of the clutch leg and the lug on the cone casting is only a good ⅛th of an inch. The less the distance above reasonable passage room, and the better, and steadier is the pick.

A collar and leather with spring attachment draws back the picking stick and shaft after picking.

Bottle Neck Casting.—This is substantially made, with a wing at either side so that it may be held by two good bolts. Such a substantial fixing is required as there is no stay casting at the top of the picking shaft to check the vibrations. As both framework of loom and face of casting are planed, the best possible fitting is obtained along with the rotary freedom of the picking shaft.

Picking Stick Brackets.—These are of the ordinary kind, but the salient points may be mentioned. The bottom one fits on to a square on the shaft which must hold the casting firm, and the square must not pass beyond the upper surface of the casting, or the upper one will be prevented from fitting properly. The bracket must be level at the top so the picking stick neither tilts upwards nor dips downward. Its radiating teeth meshes with those on the upper casting, and by them, the stationary position of the picking stick is determined. This position is, that the stick shall point over the outer end of the box, though this may have to be slightly modified to secure the best working results. The picking stick is only 22 inches long from the centre of the bore to the centre of the strap slot.

Brackets and stick are securely held by a good metal cap and a couple of lock nuts.

Picker.—This is of the horizontal kind, and fits behind the box. It is of buffalo, substantially made, and reversible, and a slot in it provides for leather connection.

It is regulated by a slide at the back of the box, and by the picker spindle. These are set so the back of the shuttle is pushed away $\frac{3}{16}$ths from the back of the box when the shuttle is in contact with the picker at the delivery end, and is lifted up the same distance from the box bottom. At the outer end, the picker is held down by a flat spring, and the spindle is secured by a curved spring at the end of the box.

The picker is brought back after picking by means of a dolly stick and spring. A double spring for this purpose is better than a single one, for then, if one breaks, there is sufficient power to pull the picker out of the danger zone when the boxes move.

Boxes.—These are made of mild steel, and each shelf is well riveted to the vertical plates at either end of the box.

The outer and inner ends of the box fit into slides, the outer slide being at the front, and the inner one bolted to the sword. Whilst the slides must only give the least lateral freedom to the box, the box must rise and fall with ease. The swells are at the front, and are each fitted with a curved spring so as to check the speed of the shuttle on entering the box, and then retain it in its picking position. The swells are easily extracted by the removal of a pin that holds the series, and as they are of a malleable nature, they may be bent to suit the size of new or old shuttles. The least bending is done when a good drop is given to the stop rod tongue when the shuttles are new. The outer slide is fitted with a pair of bowls to keep the tips of the shuttles free from the face of the picker when the boxes change position. These bowls are grooved in the centre so as not to damage the tip end of the shuttle.

It will be observed in the illustration, that the outer slide is made with a rounded projection. This is bored through, and a strong bar is fitted, and is secured at the opposite end to the bearer bracket for the stop rod. This bar strengthens the box end, for there is no box crank, and it nullifies the vibrations set up when the loom bangs off.

The box bottom has a long plate riveted to it, and at the centre of its length, it is formed with a downward circular projector that is threaded inside. Into this part is screwed the long box rod which is secured by a lock nut.

Box Rod.—This rod carries a long and open spiral spring which acts as an escape motion if ever the shuttle is trapped between the shuttle race and the box, for it prevents the box from descending, and the shuttle thus escapes serious damage. The rod passes through a long sleeve at the bottom, from which it emerges. Below the sleeve is a swivel, and on passing through this, the box rod is held by a couple of locknuts. It is by means of the locknuts that the whole series of boxes may be regulated.

The swivel is the means of connecting the box rod to the long connecting arm which couples it to the lifting lever.

The sleeve is held with sliding freedom by an arm fixed to the sword. If it be found that the semi-rigidity of the box is not firm enough, it may be attained by screwing down the locknuts at the top of the open spiral spring on the box rod.

The boxes are raised and depressed by vibrator wheels and semi-toothed cylinders which are fully explained in the Standard Model Loom, and this also applies to the pick finder motion.

Frogs.—These are formed on a different plan to any other make. They are shaped like the letter **S**, and the fulcrum is at the centre of the length. The cut on the frog is at the upper front end, and its stationary position is regulated by a powerful spring which fits between the front bottom of the frog and a casting that holds the spring bolt. Both frogs are set at about the same pitch, though the one at the driving end of the loom may be slightly more forward.

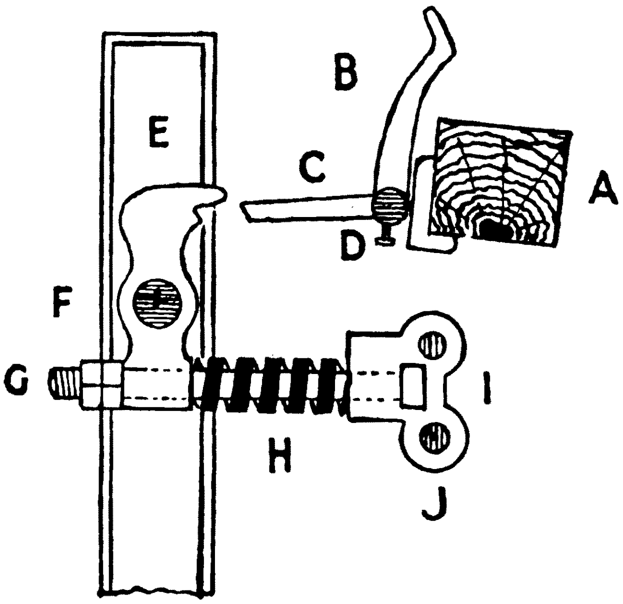


Fig. 52. Spring Frog.

Explanation of Fig. 52.—A is the going part, and B the box swell finger, and C the stop rod tongue, with setscrew at D. E is the upper part of frog with the cut on the under side. The front end of the tongue should be the same shape at cut on frog. The frog pivots on the strong stud at F, bolted to loom frame. Towards the bottom, the frog is bored through to receive the strong bolt G, its head being at I, in casting J, which is doubly bolted to loom frame.

On the long bolt is the powerful spring H.

The setting is done by the locknuts on bolt G until the frog is almost upright. The box swell finger B is unloosed and the going part brought forward until the stop rod tongue is in contact with the cut on frog E. The box swell finger is then set when in contact with the swell head. This gives the best drop to the tongue. Both sides are set alike, but if the one on the driving side is set a little keener, the driving force is got off quicker.

Let Off and Take Up.—The warp is let off by worm and wheel and a pair of catches, the latter being operated by the movement of the sword. As is the law for all double letting-off catches, they must be made and maintained so that one is half a cog in advance of the other.

The taking up of the cloth is also on the worm and wheel principle, the gauge point for the change wheel being a tooth per pick. The circumference of the taking up roller is 21 inches. This size, along with the high fixing of the smoother at the back, prevents the slipping of the cloth. The loom is served with two weft forks.

Driving.—The loom may be driven any way desired. If supplied with an electric motor, the H.P. is 0·75, and the revolutions per minute 960. It is chain driven. The friction driving flange is fitted with 62 circular discs made of cork which give excellent gripping power and a quick release. The rim of the brake wheel is 1½ inches wide and is almost encircled by a leather lined metal strap.

Box Lag Pegging.—It is arranged for a right hand loom to be first hole on right for picking; second for second box on right; third for third box on right; fourth for third box on left; and fifth for second box on left. Two pegs for either end lift the fourth box at their respective end.

Fig. 53. Hattersley's Standard Model Loom. (Front View Parallel Drive).

THE HATTERSLEY STANDARD MODEL LOOM.

This is the first power loom to be standardized in every part, and is different in many respects to any other kind of loom. For the weaving of fancy woollens and worsteds of medium and heavy weight, it is unsurpassed. Each part is constructed of that kind of wood or metal which is best fitted for the service it has to perform. As the loom is constructed in different widths, the speed varies according to the reed space as follows:—

Reed space.	Picks. per minute.
84 inches ...	... 110
90 ,, ...	... 105
100 ,, ...	... 90

The Dobby.— It is a V dobby which is noted for seldom making wrong lifts. It controls 28 shafts which provides

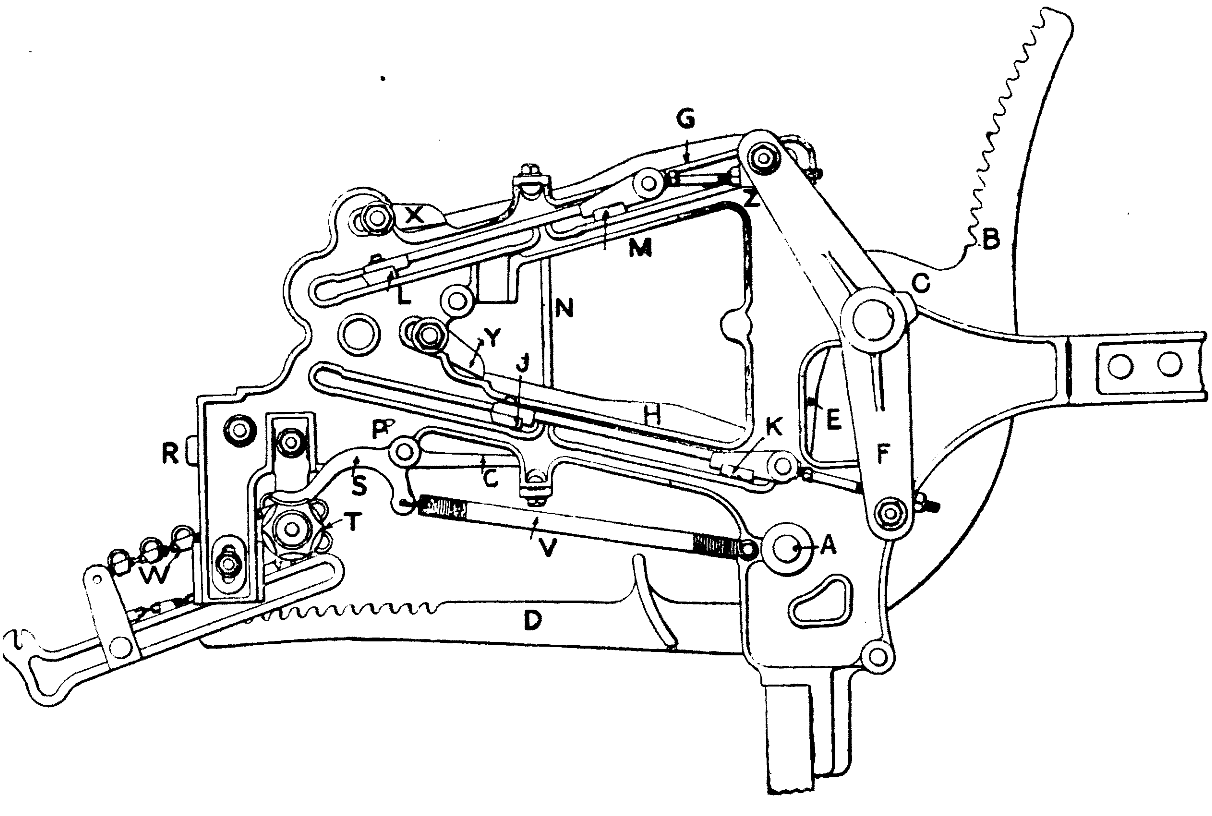


Fig. 54.
Dobby for Hattersley's Standard Model Loom.

a good range for the fancy trade. The dobby is shown at Fig. 54. At A is the strong bar which passes through the lower part of the engine, and on this bar, the hooked ends of the engine jacks are placed. The bar is prevented from turning or working out by a fixing setscrew at either end.

Engine Jacks.—The upper and lower arms of the jack are at B and D. They are notched so the size of the shed may be readily altered. Fibrous warps weave better with a larger shed, for it parts the loose fibres better. Tender warps need the least possible shed to ease the pressure.

The streamers in the notches are usually arranged in tiers of four each, and commence at the third notch nearest the fulcrum. They are placed in the same numerical notch on both arms to give an almost identical movement to the heald shaft, which works on the open shed principle, and gives a minimum traverse to warp and healds.

The centre arm of the jack is at C, and on it is the circular button upon which the balk E oscillates.

All the jacks are kept in their working positions by four lock-nutted setscrews at the front and back of the engine, which apply pressure to a jack plate. The fixings of the setscrews must allow the catches to work in parallel lines through their respective grates.

Balks.—Only a small part of the balk is seen at E. They are made of cast iron with a hole in the centre of their length to pass on to the button on the jack.

They are slotted top and bottom with a pin across the opening, and on each pin is placed the hooked end of a catch. The balk's longest slot is at the bottom to give freedom to the catch when the upper part of the balk is drawn forward. The back of the balk is made with a pair of tapering spurs, so that after being drawn forward, they cannot catch on adjacent balks.

Catches.—There are a pair of catches to each balk, each being 19½ inches long. The upper part of the bottom catch is at H, and the arrow G is on the top catch. Each catch has an upper cut which is seized by the holding bar X or Y, when the corresponding shaft has to be on the bottom shed. There is also a cut on the under side which is made use of by the draw bar J or L when the shed is needed for the top shed.

The catches have three points of interest. (1) Unless the hook on the catch is badly worn, it cannot be put on or taken off the balk pin unless the balk is liberated from its jack. This is done by slackening out one set of regulation setscrews. (2) The natural position of the catches when out of action is for the bottom row to drop back, and the top row to lean forward. When the hooked end of the catch and the balk pin becomes worn on the upper series, the catch then fails to clear the holding bar X, and a wrong lift is made. The shaft making the wrong lift is easily found by an examination of the wrong lift pick, and is confirmed by the elevation of all the shafts by the bottom draw bar, and leaving the shedding rod at its dead top centre. The offending catch may be made fit by filing until it gives a clearance of $\frac{1}{8}$th inch of the holding bar without being taken out of the engine. (3) If the catch is ever separated from the balk when working, it is better discarded, for it is a menace to the safety of the engine.

Needles.—The needle N is kept in position by passing through two grates. It is cranked to provide a shelf for the bottom catch, and then is straight, and fits underneath the top catch. One needle controls a pair of catches. The two important measurements are from the bottom to the top of the shelf, and from the bottom to the top of the needle, and, being standardized, they are reliable. Balks and catches may be taken out of the engine without disturbing the needles.

Feelers.—The bottom of the needle N rests on the upper and inner end of the feeler O which is 16 inches long. It is fulcrumed at P which is $9\frac{1}{2}$ inches from its outer end at R. The part R is what projects through the grate that has vertical slots which keep the feelers in position though allowing them to rise and fall with vertical freedom. The part R is thinner and less in depth than the feeler on its inner side of the grate, for the outer depth is only $1\frac{1}{4}$ inches, whereas the inner one is $3\frac{1}{4}$ inches. As the feeler drops of its own weight, its structure is admirable for the purpose, and prevents the bouncing of feeler and needle. As the feelers are actuated by wooden pegs, the feelers last as long as the loom.

Shaft Lags.—The lags are grooved across the face width with a hole through the centre. The latest kind of pegs are made from beech wood which are very durable, and have an oily nature. They have a rounded top to give a gentle rise and fall to the feelers, and also have flat sides. Their structure answers a double purpose. Their flat sides enable the peg to penetrate the groove in the lag and prevent them turning, and also, that even when the cylinder ends become worn, the peg is prevented from actuating two feelers. The lags are at W.

Star Wheel and Finger.—The star wheel T has 6 curves which correspond to those on the lag cylinder. This wheel is the means of setting the cylinder so the operating lag is at the top centre of the cylinder when it comes to rest. By the curved finger S and the pull of the spring V, the cylinder is firmly held until another lag is required.

Setting of Cylinder.—It is set to attain a threefold object. (1) It must be at the same elevation back and front to impart a similar lift to every feeler. (2) After being turned, the lag must come to rest at the dead top centre of the cylinder to impart a maximum lift to the feelers. (3) The pegs must have their centres opposite the centres of their feelers. The shaft cylinder is made of wood, but the box cylinder is of metal, and can be set independent of each other.

Draw Bars.—These work in pairs, and move in long slots, and are at J and L. The back bars K and M push back the balks to their resting positions, and assist in forming the bottom shed. The upper pair as well as the bottom ones are held together by a connecting casting, and the same applies to those at the back of the engine. There is one common setting for these bars though they have to be adjusted at four places. This is, that the connecting rod indicated at G shall be so set, that the back of the pushing back bars K and M are just clear of the front of the balks when the balks are in contact with their stay bars at the back of the engine. The connecting rod G passes through a double bored casting Z, which is bolted to the main engine lever F. To fix with safety, the locknuts on the connecting rods are slackened, and the shedding rod set at its dead top centre, and the adjustments mentioned are then carried out. The shedding rod is then placed at its dead bottom centre, and the bars adjusted like the top ones.

Holding Bars.—The bars X and Y hold back all the catches that are raised by the feelers. Each bar is on a long stud that spans the engine, and reposes in a long slot. Each bar is fixed when the attendant catches are at their full back traverse, and the upper points of the catches are $\frac{1}{4}$ inch away.

A peg on the shaft lag tilts a feeler, and deposits the responsive catch on the draw bar which draws it forward, and elevates the corresponding shaft. A blank allows the feeler to come to rest, and in so doing elevates the needle and catch. The catch is then held by the holding bar, and the corresponding shaft is placed on the bottom shed.

Eccentric Shedding Wheels.—The movement of these assist both shed and shuttle. The movement of the shafts are slow at the beginning and the end, and quickest in the centre. The crank movement is $4\frac{7}{8}$ from front centre to bottom, $2\frac{5}{8}$ from bottom to back centre, $2\frac{5}{8}$ from back to top centre, and $4\frac{7}{8}$ inches from top to front centre.

The Overpick Motion.

The picking is on the overpicking system, but in many respects, differs from well known types. Fig. 55 gives the main parts. At A is the low shaft to which the picking boss is secured by a key in a sunk keyway which prevents any

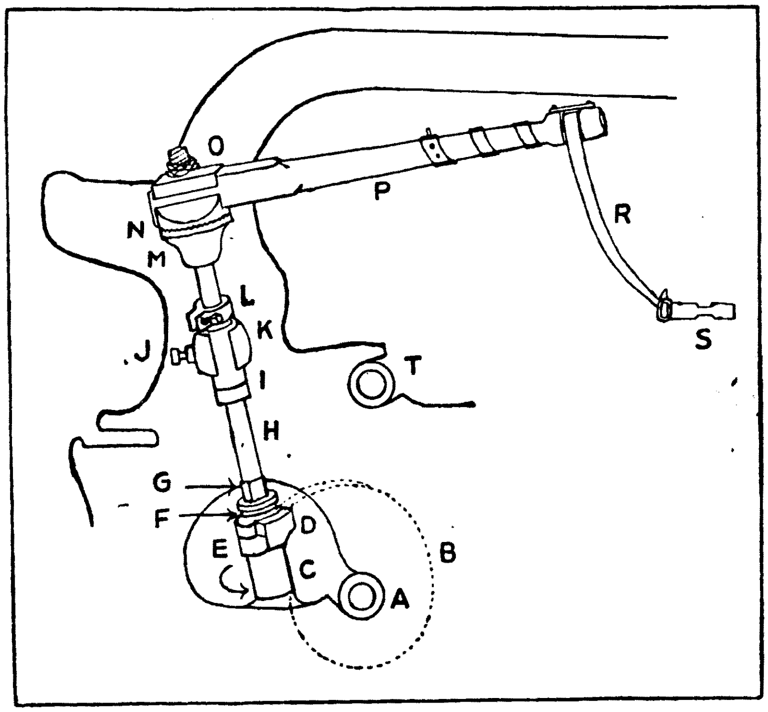


Fig. 55.
Picking for Hattersley Standard Loom.

slipping of the boss. On its face side it has radiating teeth which mesh with those on the shell nose. The boss is best set when the outer side of the picking nose end is level with the outer end of the picking cone when nose and cone are at the limit of their forward traverse. The wearing of both is then at their best.

Shell Nose.—The shell and nose B are in one casting, and a long slot allows of it passing on to the low shaft. The outer rims of boss and shell have to be level with each other. This gives the right sweep to the nose, and its setting must conform to moving the shuttle out of the box when the crank is at its bottom centre. Only two bolts are required to hold the shell nose to the boss, for the teeth on both give additional holding power, and make possible, a very precise timing. When the nose becomes worn, its picking power is weakened, but its curve at the front may be deepened which increases its force, and, if found expedient, it can be set a little further forward. In this way it remains in service until practically worn through.

Picking Shaft.—This is indicated at G (Fig. 55), and is only 31 inches long. Contrary to most overpick motions for woollen and worsted weaving, it is placed outside the framework of the loom. The bottom of the shaft enters a cup bolted to the inner side of the loom, and at J it passes into a barrel-shaped clutch which is part of the loom framework. It is this clutch that determines the position of the cup, for the clutch is a fixture, whereas the cup is movable and must be set to make the shaft rotate with ease.

The picking shaft is secured to the clutch by the metal sleeve H being pushed up from below, the countersunk hole in the sleeve being made use of by the locknutted setscrew K. As the barrel clutch stands further out and further back than the cup at the bottom, the shaft is made to lean in two directions. It leans outward and backward, each of which gives advantages to the picking.

When the picking shaft requires to be taken out, the picking strap S is unloosed, the setscrew K slackened which lowers the sleeve, the two springs uncoupled, and it is ready.

Cone Casting.—The cone casting C is loose on the picking shaft, and on the opposite side to the one shown, it stands forward and is made square. It is hollow at the back, and has a hole through the centre for the passage of the cone stud. The hollow at the back is for the reception of a strong square nut which takes the threaded end of the cone stud. The stud has a large square which is used by a spanner, and when braced up, the face side of the square is level with the square on the cone casting. The outer shaft of the stud is for the cone which is held by a stout washer and a pair of locknuts, the cone being given rotary freedom. Towards the bottom and inner side of the cone casting are two threaded holes, either of which may be used by a setscrew with leather and spring attached. As the cone and casting are thrown backward by the shell nose every revolution of the crank, it is brought back by the pull of the spring. The top part of the casting is flat, and has a stout rim, which, in one place, terminates in a strong, flat faced lug. This lug is made use of by the leg of the picking clutch.

Picking Clutch.—This is at E, the circular groove at its upper end being used by the two ends of the picking fork to elevate or depress it. It is square through its centre to fit on to the square on the picking shaft F. The stout leg on it is at D. When no pick is required, the picking clutch is elevated so the leg is quite clear of the cone casting. When picking has to take place, the picking clutch is made to descend until body up to the cone casting, and the leg and shaft are then turned by the rotation of the shell nose.

Regulation Collar.—The stationary position of the leg D is set by the regulation collar L. This collar is keyed to the shaft G, and the lock-nutted setscrew upon it controls the position of the shaft and the picking clutch, because the inner end of it comes in contact with a part of the loom framework. The best working position is for the leg to slide down with only a clearance of ⅛th inch. There is then no jerking at the commencement of the pick, and the full force of it is spent in sending the shuttle across the loom.

The collar underneath the sleeve H has a leather and spring attached to pull back the shaft and stick after picking.

Picking Stick Castings.—These are built, fit, and set like the ordinary overpick and have already been detailed. It is to be preferred that the picking shaft be a little longer than shown in the drawing so that a small bracket may be used to keep the shaft steady during picking. This bracket is bolted to the framework.

Picking Stick.—The hickory picking stick R is a short one to meet the requirements of the picker T which fits behind the box. As the picking shaft leans backward, the stick is tilted upward at an angle of 75 degrees, which practically coincides with the slope of the sword and boxes when the crank is at its back centre. This leaning backward causes the stick to rise 5½ inches from its base. By leaning outward, the stick makes an upward sweep when picking of 1½ inches from its stationary position.

This results in an acceleration of the power of the pick, and the movement of the shuttle. It also prolongs the service of the shell nose.

Picking Strap.—The strap S may make the power of the pick futile by being too long, but its pitch is obtained by making it begin to move the shuttle out of the box when the crank is at its bottom centre. When the stick and strap are set properly, then the strap ought to pull the picker within a couple of inches of the buffer. There is then correct timing and no binding.

Picker.—This is presented at T, and is of the horizontal kind. Being of buffalo, it ought to be well seasoned for long wearing. It can be used for either hand of loom, and may be reversed at the same end. It fits behind the box, and the spindle can be regulated at its inner end to give the correct throw to the shuttle. The spindle is supplemented by a slide which is so set, that it is a little higher at the inner end than the outer one for shuttle control.

Sword and Shuttle Race.—These are depicted at Fig. 56. The sword at A is solid, and more substantial than the ordinary slotted sword. In consequence, it offers more resistance to the shock of knocking-off and gives more power to the beating up of the weft. It is perpendicular when the crank is at its front centre, and, being at right angles to the fell of the cloth, is at its maximum power when the full beat up takes place. At B is the shuttle race, which

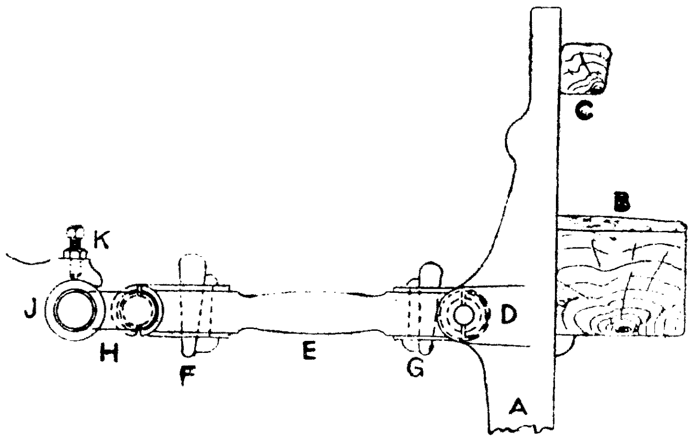


Fig. 56.
Beating Up. (Hattersley Standard Model Loom)

slopes downward a little from the front when the crank is at its front centre. The angle formed by the shuttle race and sley is almost a right angle when the reed is against the fell of the cloth, but becomes a pronounced **V**-shape when the crank is at its back centre. This is an excellent aid to keep the shuttle in its proper course through the shed, for the **V**-shape is the most pronounced when the speed of the shuttle is greatest.

Now the angle formed by the shuttle back and bottom ought to coincide with the angle formed by the sley and shuttle race, for without this, there can be no reliable run of the shuttle, nor long wearing of them. As the bevel is standard for the loom, it must also be standard for the shuttle maker. Any order given for shuttles for these looms should include the "Hattersley bevel."

The upper ends of the swords are slotted so the handrail C may respond to the different depths of sleys.

Crank Arms.—Instead of this being hollow as ordinary, it is solid except at the ends where it is slotted to receive the cotters and holders at G and F, Fig. 56. The extreme ends are curved to fit to their respective bushes and there are also recesses into which the lugs on the bushes can find lodgment to prevent them turning. It is practically impossible for these arms to be broken owing to their construction, and to the greatly improved structure of the frogs. In place of the ordinary long and short strap of metal on most looms, there are two short ones on this, with a pair of holders and cotters at each end. The holders face each other, for the metal straps are drawn in opposite directions and independent of each other. The main force of beating up the weft is placed on the front bush on the crank arm, and the back bush on the sword pin, so the metal straps have the comparatively easy task of bringing the going part back from the fell of the cloth. When the slots in the metal straps cannot be cottered further, the bushes D and J may be packed with hard leather tapered off at the ends, which extends the metal straps and are thus kept longer in service.

As the greatest crank arm movement is at H, the bushes here are made of gunmetal bronze, but at the sword pin D, they are cast iron.

Gunmetal Bushes.—There are no pedestal brackets on this loom to hold the crank and bottom shafts, for a better and handier system has been introduced. The framework of the loom has been made with sloping slots, and into these, the crank shaft and low shaft are placed. A gunmetal bronze bush at J is then slided on to the outer end, and fits into the groove in the framework. The inner bore of this bush is grooved in spiral formation and in two directions, which make the grooves cross each other. These grooves retain surplus oil, and continue to lubricate the shaft for a considerable time. On its outer side it is countersunk, and this accommodates the lock-nutted setscrew K, which prevents any movement of the bush.

Movement of Going Part.—The reed moves 7¼ inches, and so provides adequate room for a large shuttle to weave bulky bobbins of woollen weft. The same shuttle is available for other yarns by the substitution of another kind of spindle. The sweep of the crank imparts an excellent momentum to the going part for the beating up of the weft, and though light-weight fabrics are adequately woven, heavy cloth is well within the range of its capabilities.

Stop Rod Tongue.—Fig. 57 gives a good idea of the entirely new type of knocking-off arrangement. At A is the shuttle race and B the box swell finger, the swells being at the front of the box. The finger is in two sections. The bottom part is setscrewed to the stop rod, but the upper one is pivoted to the lower one and is pressed forward by a highly tempered spring which is doubly setscrewed to it, its bottom end being in contact with the lower section. The spring makes the upper section rigid enough to respond to the motion of the box swell, and imparts responsive movement to the stop rod tongue C.

As shown in the drawing, the blunt point of the tongue is at the top, whereas in most cases it is at the bottom. The length of the tongue is sufficient for the prevention of any ends being broken out if ever the shuttle is trapped in the shed when the loom bangs off.

Style of Frogs.—The frog is at D, and is pivoted on the powerful stud E, which is bolted to the loom frame. The top of the frog resembles the sole of a boot, the toe being where the stop rod comes in contact with it. The hollow heel is made use of by the helical spring F, and the stud G which passes through it. The frog is set by the lock-nuts at the top of the heel, its proper pitch being that when no shuttle is in the box that frog and tongue end meet full face together.

Bottle Bracket.—This is indicated at H, and is doubly bolted to the loom frame. Its upper end is bored through for the passage of the long bolt G, and the neck of it receives the bottom part of the spring F. This bracket is a fixture, and has to withstand the downward pressure of the frog when the loom bangs off. What is of even more vital importance is the best possible fitting of the stud E, and its firmness of holding as it has to withstand the greater shock.

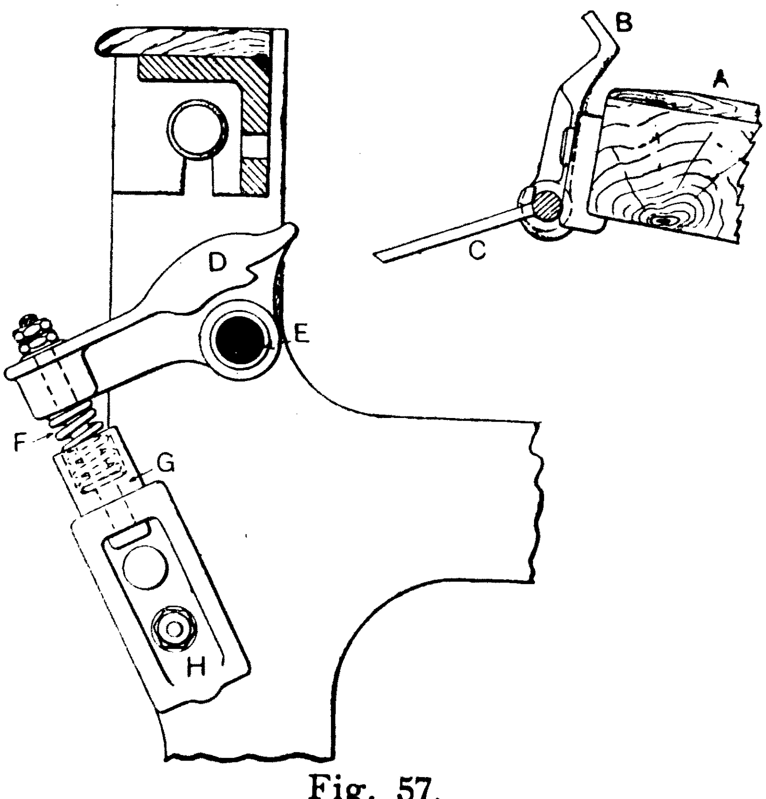


Fig. 57.
Frog. (Hattersley Standard Model Loom).

Movement of Parts.—This system has several important advantages:—

(1) The frog, stop rod tongue, sword pin, and crank arm are in a direct line with each other. In almost all other makes of looms, the frogs are on the outer sides of the swords, so that when the loom comes to a sudden stop, the blow imparts a sudden twist to the swords and sometimes snaps them.

This twisting action cannot occur in the Standard Model Loom, and as the sword is solid, there is much more strength to withstand the shock.

(2) When the sword is at its full forward traverse, it is perpendicular. This being so, the end of the stop rod tongue is well in advance of the sword and passing through the downward arc of a circle. It is in accord with the movement of the frog when struck by the tongue, for though the downward movement be small at the toe, it is much more so at the heel, and the greater the pressure at the heel and the greater is the resistance of the powerful spring. As soon as the blow has spent itself, the spring presses back the frog to its normal position.

(3) The resiliency of the spring greatly reduces the force of the impact, and a minimum of pressure is applied to the loom frame. It may be rightly termed a soft blow rather than a jarring shock.

(4) In some looms that have fast and loose frogs, the force of knocking-off elevates one or both swords, and if an early discovery is not made, a serious shuttle trap is likely to be made the first time the shuttle stops in the shed when the loom comes to a sudden stop. The rising up of the swords in this loom is almost impossible.

Letting Off Motion.

The chief parts of this motion are outlined in Fig. 58. It incorporates several new ideas in a catch let off arrangement.

The Pusher.—This is at A, and is doubly setscrewed to the side of the sword. Its flat and vertical face is 5 inches long, which gives sufficient surface for the curving sweep of the sword, and for any changed position of the bowl B.

Bowl Lever.—This is the right angled lever C which is fulcrumed at D. The bottom part is slotted for 2½ inches so the bowl may be set for the kind of warp to be woven.

Fabrics, as far as picks are concerned, may be divided into coarse, medium, and fine and the range may vary from 30 to 120 per inch.

If the cloth to be woven has only a small number of picks per inch, then the letting off of the warp must be rapid, and the bowl is set at the top of the slot. When the picks are numerous, the movement of the letting off catches has to be slight, and the bowl is fixed in the bottom of the slot. For

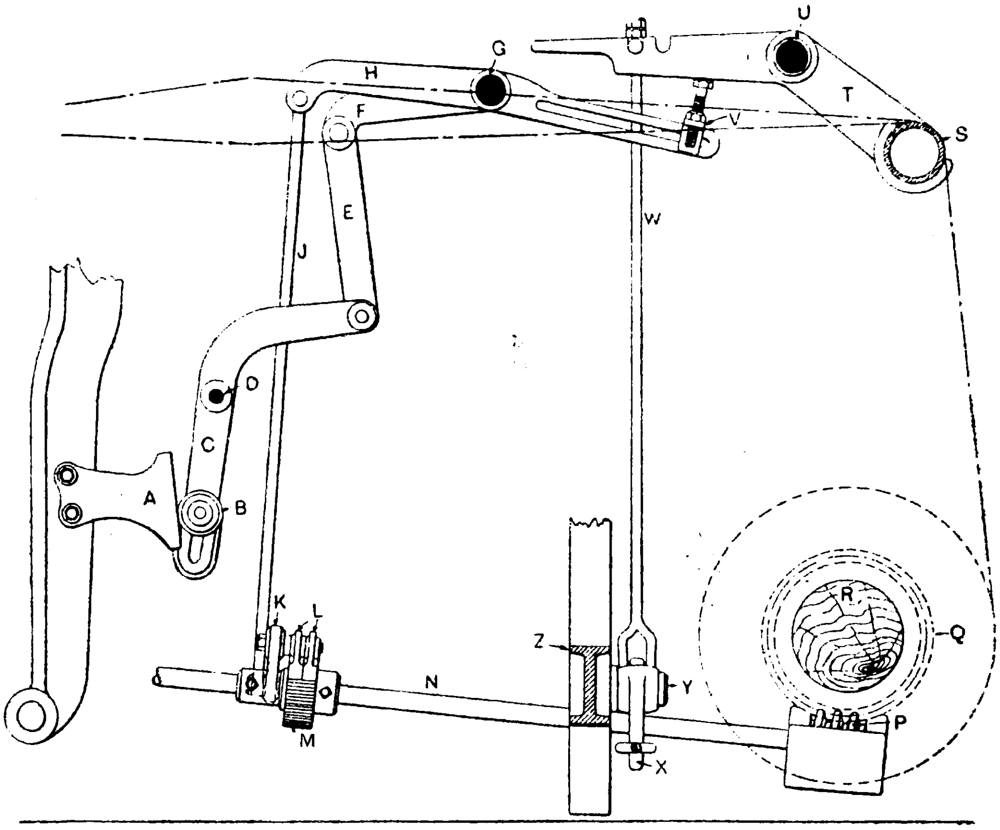


Fig. 58.
Hattersley Letting-off Motion.

a medium number of picks it is set at the centre. As the bowl is free to turn on its stud, it gives the best wearing to the contact surfaces.

Lifting Lever.—The bowl lever C is attached to the lifting lever E at its base. Like C, the lever E is one of right angles, and is fulcrumed at G. At its elbow is the lifting stud F which passes underneath the rod lever H.

When the pusher A forces back the bowl lever C at the bottom, the upper part of it is elevated, and this raises the lifting lever E along with the stud F. This in turn pushes up the lever H which carries the long rod J. The bottom of J is secured to the catch lever that oscillates on the letting off shaft N, and in this way, the letting off wheel is turned.

Rod Lever.—The rod lever H performs a double function, for it lets off the warp, but is constructed with a long slotted arm at the back. This is made use of by the small bracket V which carries a lock-nutted setscrew, which, by means of the slot, can be moved several inches. The bracket V regulates the standing position of the rod lever H, and determines the amount of movement imparted to the catches. If the screw be let out, then the opposite side of the lever is elevated, and the stud F is all the longer in coming in contact with the lever H, and in consequence the movement of the catches is curtailed. The opposite effect to this is obtained when the screw is turned down.

The fixing position of the bracket is significant. If it be placed at the end of the lever as shown, then the least movement is given to the lever H and to the back rail lever T. This position is suitable for fine worsted warps, for they are all the smarter woven when under good tension. The opposite to this takes place when the bracket is moved to the opposite end, for the tension is then much more flexible and in keeping with the successful weaving of tender warps.

Letting Off Wheel and Catches.—The letting off wheel M is keyed to the letting off shaft N, but the catch lever K has rotary freedom. The letting off catches L are on the same stud, and are each weighted at the bottom to keep the point end in constant contact with the wheel. The invariable method for the best letting off of the warp is to have one catch half a cog ahead of the other. When almost at the same pitch, the wheel remains stationary too long, and then, when it begins to move, it does so with too much vigour. The standing of the wheel creates a heavy bar in the cloth, and the too vigorous action makes a light one.

The letting off wheel and catches are perhaps better seen in Fig. 59. Here, the letting off shaft is at A, with B and C the collars to keep the parts in position. At D is the catch lever which is rotated by the connecting rod E. The let-off lever carries the catch stud H, the catches being at F and G. It will be noted that the catch on the right is a little longer than the other, the actual distance being half a cog, and for the reason already mentioned. The letting off wheel I, is keyed to the shaft A, the wheel being of fine pitch, having 40 cogs to give a sensitive response to catch movement. The catches are weighted on the back arm to keep them in constant contact with the wheel. In this make there is no shield.

Worm and Beam.—When the letting off wheel is made to turn, it actuates the worm P, and this rotates the cogged wheel Q which is setscrewed to the warp beam R, which is also held by the head of a setscrew in the beam collar, and passes into a groove on the inside of the wheel. The warp beam wheel is set clear of the loom frame, and the centre of its cogs opposite the centre of the worm. Fig. 58.

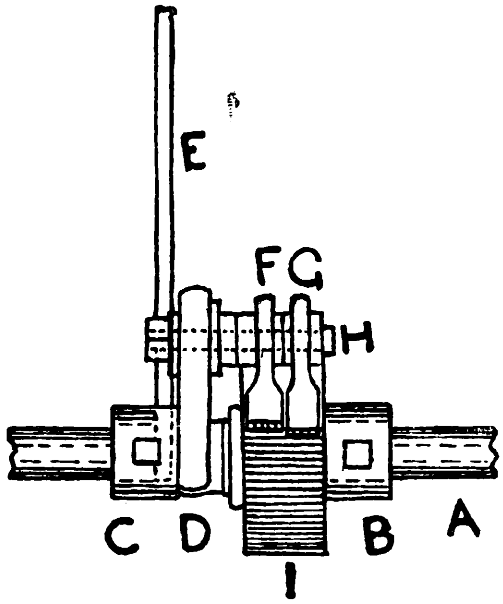


Fig. 59. Hattersley Shaft Motion.

At the front of the loom, the letting off shaft N carries the brake wheel with its rope and weight, the latter effectively checking any excess of movement. When the weaver has been combing out, the warp may have to be rewound a little on the warp beam, but following that, the rope and weight must be replaced or otherwise the cloth will be woven with less picks per inch.

Swing Rail Lever.—The lever is at T, and has its fulcrum at U, with the swing rail at S. At the upper and inner end are two notches, either of which may be used by the wing casting on the vertical rod W. The one occupied in the illustration gives the most movement to the back rail when the weft is beaten up, and the position is appropriate for coarse cloth or tender warp yarns. The other notch is better for fine work and greater tension.

The wing casting must be placed in a similar notch at either end of the loom, though the most important end is where the warp is let off. Fig. 58.

The connecting rod W is looped at the bottom, and is hooked on the notched right angled lever Y. The bottom arm of this lever carries the horizontal connecting rod X, which couples the lever to a similar one at the other end of the loom.

The lever Y is the weight lever, though the arm that carries the weight is not shown in the drawing. The more weight there is on the lever, and the less is the movement of the swing rail lever, with a consequent decrease in the letting off of the warp. For the weaving of tender warps, the less weight there is, and the better, consistent with getting in the required picks per inch.

The setting of these parts are important. The stud U upon which the swing rail T is made to move, must be set so the swing rail S is one inch below the height of the breast beam. This results in the warp being a little tighter on the top shed than the bottom one. It prevents the threads from hanging down when on the top shed, and eases the pressure of the warp on the shuttle race. As the loom is fitted to take two warp beams, the other swing rail lever is set so the top of the swing rail is one inch above the other. The upper swing rail is then keeping its warp free from pressing on its companion.

When two beams are employed to weave a cloth, the beam placed in the top rack is usually the backing beam, and the one in the bottom rack the face beam.

The other setting is that of the wing casting on the swing rail lever. It is regulated by lock nuts which are fixed so the upper part of the swing rail lever has a slightly downward dip when the pressure of the warp is applied to the swing rail. Its oscillation is then above and below the dead level. Both pairs of vertical rods are set to produce this effect.

There is a final point. In the weaving of tender warps, it is a decided gain when there is only one beam, to place the beam in the bottom rest, for this gives a longer stretch of warp. The tension is then distributed over a longer length of yarn, and broken threads are appreciably decreased.

The Taking-Up Motion and Reversing.

Fig. 60 gives the positive taking-up motion, along with the method of reversing. The long shaft which runs along

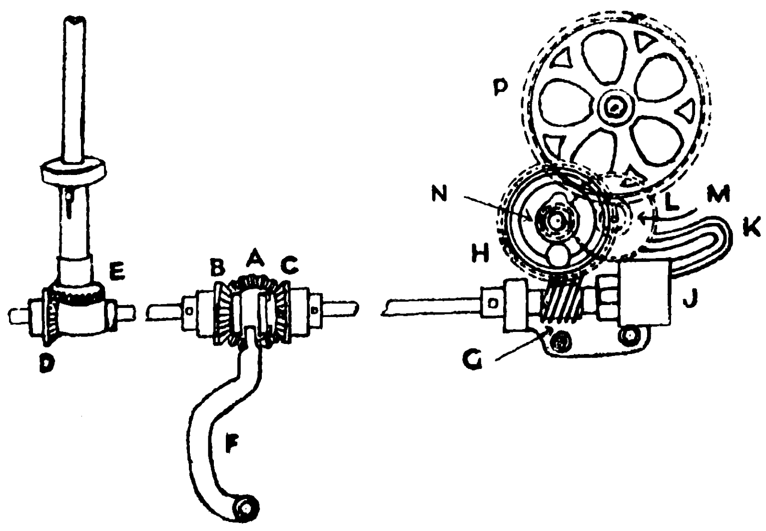


Fig. 60.

Taking-up Motion. (Hattersley Standard Model Loom).

the outer width of the loom is turned by a double wheel at A. This wheel is doubly setscrewed to the end of the low shaft, and by it the timing of the shed can be altered. If the timing be altered either sooner or later, the position of the two bevel wheels B and C have also to be adjusted to suit the new condition, for these wheels control the weaving and reversing of the two lag cylinders. The alteration is carried out as follows: The loom is first placed with its shedding rod at its bottom centre, and the two collars which hold their respective wheels to their common driver are released. The wheels are then slided out of contact with the driving wheel and collar. On each wheel at the face side is a lug, and this is the part made use of by a cut on the reversing collar.

The reversing rod is then set for reversing, and the dolly pin must then be just clear of the turning wheel. The front lugged wheel C is then placed with its lug against the cut on the collar, and outer collar then brought up and secured. The dolly is now moved so the pin is just clear of the turning wheel at the opposite side, which is done by hand. The lug on the wheel B is then brought in contact with the cut on the centre collar, and the outer collar then fixed. Whatever be the timing of the shed, the timing of the cylinder has to be the same as explained.

When the taking-up shaft is turned for weaving, it rotates the taking-up worm G. Into this gears the fine pitched taking-up wheel H having 52 cogs. In front of this is the disc which is provided with a handle and a release pin. When the release pin is in one of the holes, the taking-up wheel is a fixture, but when pulled out, the wheel remains stationary, but by means of the handle, the cloth may be tightened up or slackened out as required. This is a very handy method for the weaver, and also for the overlooker to pull forward the twistings. Behind the taking-up wheel is the standard wheel having 22 cogs which fits at the end of the boss to which the disc is connected. The standard wheel is securely held by two small pins projecting from the end of the boss, which enter recesses in the wheel, the wheel being then secured by a nut. The outline of this wheel is given at N.

Into the standard wheel meshes the change wheel L, the gauge point being a tooth per pick. It is the common practice to put on a change wheel with one cog less than the picks per inch so the cloth may be taken up a little quicker, and the piece prevented from bumping. The change wheel L fits in front of a lever which swings from the shaft of the perforated roller wheel P, and is pinned and bolted to the stud which passes through the bottom end of the arm. On the same stud, and behind the change wheel is the pinion wheel M with 12 teeth. The bottom of the arm is constructed so it can be bolted to the curved slot K, this slot making it possible to adjust the change wheel in proper relation with the standard wheel.

For cloth which has few picks per inch, the standard wheel with 22 cogs is changed for another standard wheel having 44 cogs. This takes up the cloth twice as fast, and whatever change wheel is used, it only allows half the picks to the number of cogs in the change wheel. If the change wheel has 60 cogs, then there will only be 30 picks per inch.

The large wheel P, which has 80 cogs is setscrewed at the end of the perforated roller shaft, this wheel being turned by the small pinion wheel M. To prevent the slipping of the setscrews, flats are made on the shaft.

Dolly Shaft Gearing.—At the back end of the taking-up shaft is the bevel wheel D which meshes with the bevel wheel E at the bottom of the dolly shaft S. The wheel E is made circular above the teeth and is hollow for the reception of a strong, open spiral spring. On its rim at T is a **V**-shaped inlet which is made use of by an outstanding **V** on the sleeve V which is also hollowed out to receive the spring. At its upper end it is slotted at W, and into this is placed a slide attached to a collar which is made to press upon the spring.

If the lags ever become locked, the sleeve V comes out of contact with the wheel section T, the slot W allowing of this taking place. By this escape motion, further damage is prevented. When the cause of the trouble has been removed, the sleeve may be twisted by hand until the **V** sections come together.

Box Lags and Feelers.

A line drawing of a box lag is given at Fig. 61. It is constructed with grooves across the breadth of the lag, and with a hole through for the leg of the peg. For a right hand loom A is the place that regulates the picking. When a

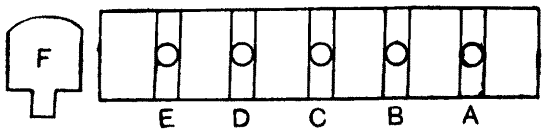


Fig. 61.
Hattersley Standard Loom Box Lag.

peg is inserted, it makes the loom pick from the left hand side, and a blank throws the shuttle from the right. The other four holes are for working the boxes, for B and C control the boxes on the left, and D and E those on the right. When B is pegged, the third box is lifted on the left, but when C is pegged and B is a blank, then the second box is raised on the left. If both B and C are pegged, then the fourth box on the left is elevated.

A peg in D lifts the second box on the right, but when D is blank and E is pegged, then the third box rises on the right. When both D and E are pegged, then the fourth box on the right is brought into service. The inner holes of the four are for second boxes, and the outer ones for third boxes at their respective ends.

The peg F has a circular leg to pass into a hole in the lag, but has flat sides to fit to the bottom of the groove which prevents the peg turning. As these pegs are a little longer than the ordinary circular peg, a better action is given to the box vibrators, and as the base of it is longer there is little danger of the leg being broken.

The cylinder and box feeler are outlined at Fig. 62. There are five feelers to correspond with the five holes in the box lags.

At A is the six grooved cylinder which is on the same shaft as the shaft lag cylinder. Though one is independent of the other, both are usually set alike. The operating lag is made to come to rest when dead level at the top of the cylinder. This imparts the highest elevation to the curved part of the feeler at B, and gives the lowest depression to the opposite arm F, the fulcrum of the feeler being at C.

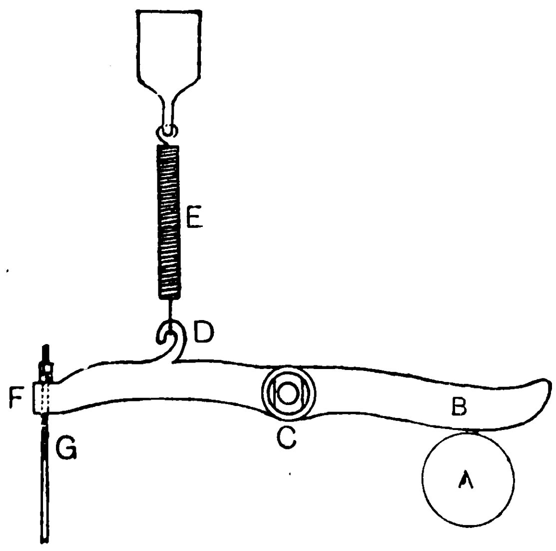


Fig. 62.
Cylinder and Box Feeler.

The end of the arm F is bored through, and finds place for the connecting rod G, which, at the bottom, is attached to the vibrator lever. As the feeler is negative in action, the spiral spring E is connected to the hook D to bring it to its resting position when a peg is succeeded by a blank. The pull of the spring has not to be too strong or unnecessary wearing will take place to the box pegs, neither must it be too weak or the rising and falling of the vibrator will be adversely affected. The rod G is set to keep the underside of the feeler just clear of the cylinder.

Vibrator and Wheels.

The mechanism controlling the boxes is presented at Fig. 63. At the bottom of rod J, which is the same as G in Fig. 62, is the looped casting which fits to a button on the vibrator lever H. By means of the rod, the vibrator lever is raised and lowered in response to the turning of the box lags.

Vibrator Lever.—This lever has three bosses, and its fulcrum is at the centre of the wheel F. The centre boss is used by the vibrator wheel E, and the front one is for the looped casting shown. The outer end of the lever is V-shaped, and passes through a grate I shown in the

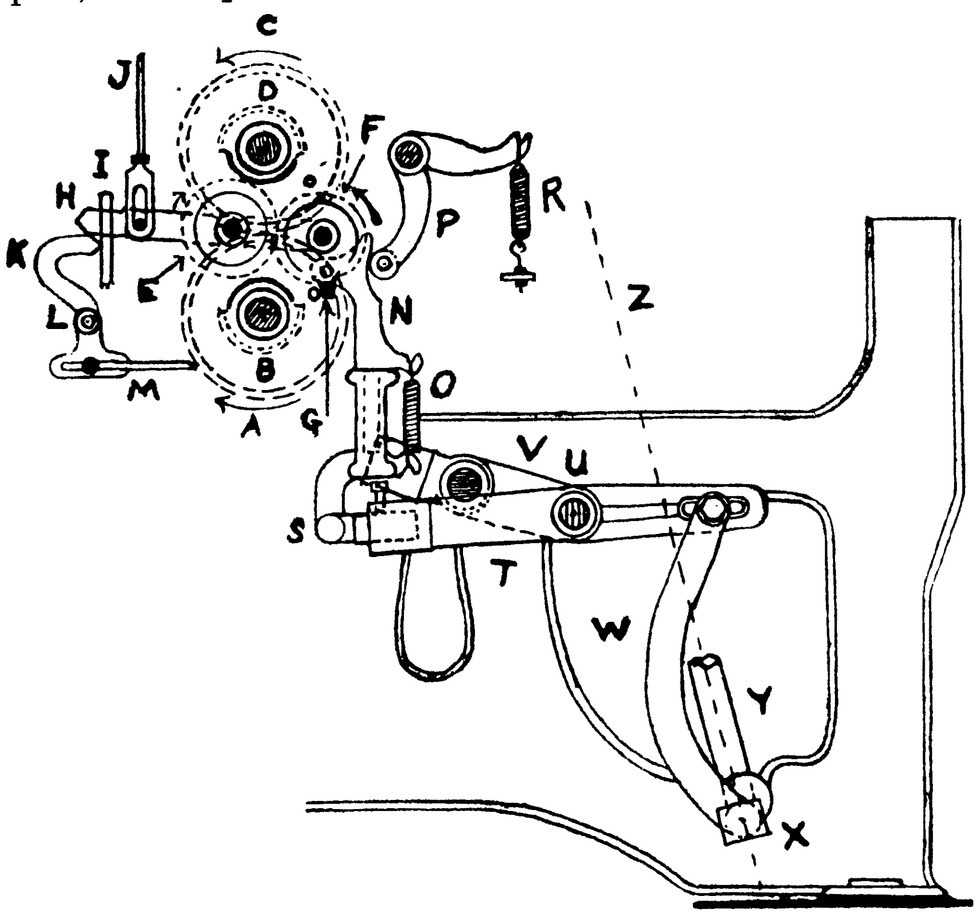


Fig. 63.
Box Motion for Hattersley Standard Model Loom.

diagram, a lock knife K operates in front of the grate I, passing underneath the levers that are elevated, and over those that have been dropped. Its fulcrum is at L.

Wheels and Cylinders.—The vibrator wheel E has a series of 10 cogs in one group and the same number in another, but the spaces between them are unequal. In one part there is a gap equal to one cog only, but the other gap is equal to four cogs. These spaces serve a particular purpose. As this wheel is on the boss of the vibrator lever, it is moved up or down by the rod J. When a peg drops the rod, the lever and wheel descend, and the wheel is then brought into contact with the revolving semi-toothed cylinder B, which has 11 cogs. The first cog on the cylinder B enters the gap in the vibrator wheel, and begins to push the last cog in the other section. The wheel rotates until the last cog on the cylinder follows the last cog on the wheel. The turning of the wheel now comes to an end, and so long as pegs follow each other in the box lags, the wheel will remain stationary owing to the gap of four cogs in the wheel, which enables the cylinder to pass without affecting it.

When a blank follows a peg, however, the vibrator lever ascends, and the wheel is then turned by the top cylinder D, having the same number of cogs as the bottom one, but rotating in the opposite direction.

The bottom segment wheel B raises the box, and the top segment wheel C depresses it.

It takes 5/9ths of a revolution of the crankshaft to make a change in the boxes.

The cogs on the vibrator wheel mesh with those on the connector wheel F. This wheel has 18 cogs in an unbroken series, but there are two extra things that have to be noted. (1) The wheel is furnished with a long tooth G which comes in contact with a stay bar top or bottom which terminates the movement. (2) It carries a button, and on this the connector N finds lodgment. By the turning of these substantially made wheels, the boxes are elevated or depressed.

Lock Knife.—The lock knife K is **V**-shaped at the front; is fulcrumed at its centre; is slotted at the bottom, and is moved by a cam that is cast to the inner end of the bottom cylinder. No alteration of the cam can take place, but if the cylinder be set right, the cam will be correct. The pitch of the knife, however, can be regulated in two ways.

(1) It must rest evenly between the raised and depressed vibrator ends when against the grate.

(2) It must give a clearance of at least $\frac{1}{8}$th inch to the points of the vibrators when thrown back by the cam. The distance is regulated by the slot at the bottom, for it is here that rod M connects the lock knife to a bowl lever which is kept in constant contact with the cam by the pull of a powerful spring. The timing of the lock knife is entirely dependent on the cam, and is as follows:—The lock knife begins to move outward when the sley is within half-an-inch of its back traverse, and when the crank is at its back centre, the knife is at the limit of its outward movement. As there is practically no dwell at this point, it moves inward as soon as the crank leaves its back centre, and by the time the crank has advanced $1\frac{1}{2}$ inches, it is resting against the grate. The inward dwell is a long one, for the knife must remain against the grate during the whole period the vibrator wheels are being turned which is slightly more than half a revolution of the crank.

Wheel Connector and Slide.—The connector is in three parts. The upper one at N fits on to the button of the connector wheel. The back of it is curved, and against a bowl lever P with spring attached applies pressure to press it home. The back is so curved that the bowl lever only moves $\frac{5}{8}$th inch, which gives the least possible wearing along with efficient service. Below the curve is a hook, and on this a spring O is placed which connects it to the bottom casting as shown. The upper part N is made with a leg $4\frac{3}{4}$ inches long, and at its base is a square lug. This leg fits into a long slot in the bottom casting, the two parts being kept together by a slotted plate which is held by four screws to the bottom section. The slots and the leg form an escape motion, for if anything becomes locked with the boxes, the vibrator wheels are turned, and the leg of the connector moves in the slots without doing injury to other parts. When the obstruction has been removed, the connector will slide back to normal. The bottom of the connector is pinned to the slide S, the shaft of which enters a recess in the lifting lever T. This slide is a very handy means of altering the leverage of the boxes without disturbing the first box. If the slide be tapped out, the leverage is decreased, but if knocked in, it is increased. Both slide and slide pin are held by setscrews which are no worse for being examined occasionally.

Lifting Levers and Boxes.

There are two levers for each box which are shown at T and V. At U is the chief fulcrum, this being a powerful stud bolted to the loom framework. The short lever V elevates the third box, whilst the long lever T which is fulcrumed at U controls the second box. When both work in unison, the fourth box is elevated. The cranked connecting arm W couples the long lever T to the swivel at the bottom of the box rod which passes through the sleeve Y.

If reference be now made to Fig. 53 it will be noted that the boxes are constructed with swells and curved springs at the front. As the swells are malleable, they may be hammered to suit the dimensions of old or new shuttles so the stop rod tongue may give a good clearance to the frog. Each box is $1\frac{13}{16}$ inch deep, and the swells are so shaped that the shuttle moves $13\frac{1}{2}$ inches into the box before coming in contact with the swell. Whilst this has the small disadvantage of being longer before commencing to depress the stop rod tongue, it has the gain of decreasing the risk of the shuttle being trapped between the shuttle race and the box.

The largest shuttle used is $16\frac{1}{4}$ inches long, so that it only has to advance $2\frac{3}{4}$ inches after first touching the swell to be quite clear of the shuttle race.

There is the further advantage, that the shuttle is quite free from the swell for three inches before the picker reaches its full forward traverse. When the boxes are not undergoing a change, they may be tested in their relation to the shuttle race at any part of the movement of the crank, but the best place is to apply the test when the crank is well towards its back centre.

If Fig. 53 be examined it will be found that the leverage of the box may be altered at three places.

(1) At the bottom of the box rod which passes through the sleeve Y. It is here that the long box rod is held by a couple of locknuts. By these nuts, the whole of the boxes may be brought lower or raised higher. It is here that the first box is made level with the shuttle race before making an examination of the other boxes.

(2) At the top of the connecting arm W. When the stud at this place is moved nearer the front of the loom all the boxes are elevated, but when moved backward they are depressed. Any alteration to this stud has to be followed by an alteration to the locknuts at the bottom of the box rod.

(3) The leverage of the individual boxes is regulated by their respective slides. In this connection there is one special point. It sometimes occurs that the second and third boxes are accurately set, but when the fourth is brought

into play, it may be either too high or too low. Suppose it was too high, then the leverage to the third box would have to be decreased a little, and the one to the second box increased. This is known as " halving " the leverage. The reverse of this is carried out if the fourth box is too low.

The quickest method of testing the boxes is to have a set of lags made which raises each box in turn, and drops them the same way. The picking motion is put out of gear and the test may be carried out with or without shaft lags.

Planning Box Work.

Though these are positive boxes, and have little or no vibration, it does not follow that any method of working the boxes will do so long as the pattern is correct. Careful planning brings its own reward. Several ideas are worth bearing in mind.

(1) It is better when possible, for the box to rise and the loom to pick than it is for the box to fall and the pick to follow. This specially applies to negative boxes, but is no worse for being carried out with positive boxes. The reason is that when pickers become worn, the hole made is the shape of the shuttle tip and has a tendency to hold the shuttle. Sometimes two and even three boxes have to change the same time as one, and it is therefore safer to plan for a pull up than a push down. When the head of the picker is fairly well worn, it may be made easier for box changing by being gouged out, or reversed.

(2) There is the balance of the boxes to consider. Suppose all four boxes are required at either side, it is much easier for the loom to make one box rise when the other falls, for this balances the weight. This is not always possible, but when it can be applied, it is an all-round working advantage.

(3) It is best in any kind of box loom to skip as few boxes as possible. Though the standard loom is very reliable in either lifting or falling, it is obvious there is less risk in moving one box at a time than three. It is even a gain at times to introduce an extra shuttle to prevent too great a change. The elimination of all unnecessary risk is what all prudent overlookers desire to achieve.

This loom is also made with 6 rising boxes at either end of the loom.

Box Plan.—The worked out plan at Fig. 64 incorporates the points already mentioned. The wefting plan is 36 black, 6 red brown, 6 white, 6 dark green, 6 white, 6 olive, 6 light grey = 72 picks. To prevent a 3 rise or fall, the second box from the top at both ends are left vacant. All the

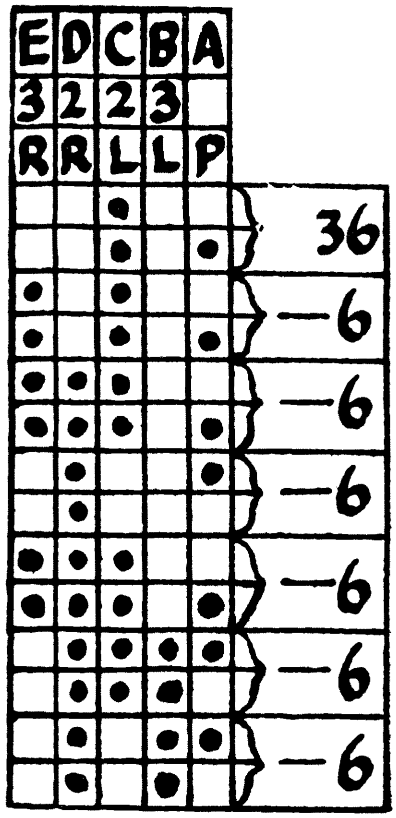


Fig. 64. Box Plan for Four Shuttles.

shuttles on the right can then be run into the second box on the left, and all the shuttles on the left can be run into the 2nd box on the right. The shuttles are placed:—

Right box Black 1, Red 3, White 4.
Left box Green 1, Grey 3, Olive 4.

The picking plan is for a right hand loom, and the top line of picks is the first pick. The line A from top to bottom is for picking, the boxes being numbered and the left and right hands are indicated. When the fourth box is needed at either hand, the 2nd and 3rd holes are pegged. This is a very interesting study, and there are no rises or falls of three boxes.

Driving of Loom.

The driving of the loom is by friction plate, and takes one of two forms according to the arrangement of the mill shafting. If the mill shafting is parallel to the sides of the looms then the driving is at right angles with bevel wheels. Fig. 65. The other form is that of parallel driving by a spur wheel when the mill shafting is parallel with the width of the loom. Fig. 53.

The right angled drive has friction plates with a diameter of 16 inches, the driver having circular holes equi-distant from each other to accommodate the circular cork discs. These discs are little affected by oil, damp and friction, and have a good gripping surface.

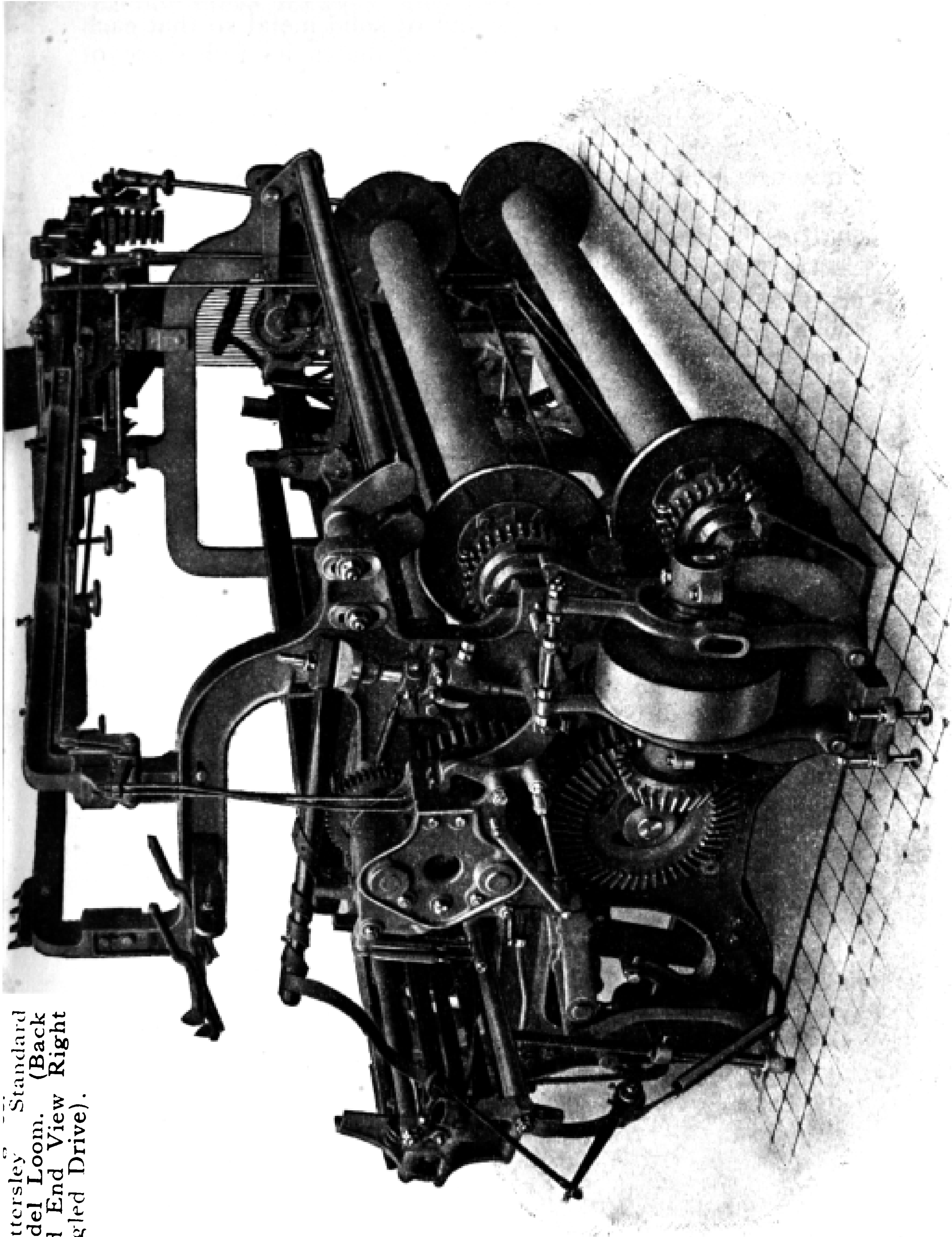
The diameter of the belt pulley is 13 inches and is 3 inches wide for the straight running belt. At the back of the driving flange is the groove for the clutch fork which is operated by the setting on handle. A cap fits inside the groove, the cap being made with a projection at either side which pass into the openings in the clutch fork. The fork has its fulcrum close to the floor, and its pitch is regulated by two pairs of nuts at its upper extremity. The pitch has to be set so the weaver has no difficulty in setting the loom in motion, but must be set keen enough to prevent the slipping of the driving flange. If the belt be moderately tight and in good running condition, it is a good indication that the driving flange should be set a little keener if the loom is running at a reduced speed.

Brake.—The brake is attached to the same mechanism as that which sets the loom in motion, but moves in the opposite direction. When the discs on the driving plate are just touching its companion, then the brake should be just clear of the flange. This setting gives full liberty to run as soon as touched by the discs, and at the same time applies the brake in the least possible time when the loom bangs off, or is stopped in the ordinary way. Such a setting reduces the severity of the blow on the frogs, and unnecessary force to the swords. The power of the brake is tested by trying to turn the balance wheel when the loom is standing, and the crank at its back centre.

The shaft that carries the driving flanges is two feet long, and at the front is the driving bevel wheel which is secured to the flat faced boss of the driven flange by three stout setscrews. The bevel wheel has 26 cogs, but it is not a change wheel. Its teeth must be parallel, and be almost body up to the bevel wheel on the low shaft to give the maximum strength and wearing.

The number of teeth in these wheels are an excellent arrangement. The wheel on the low shaft has 50 cogs and the other 26. There are therefore 13 revolutions of the 50 wheel and 25 revolutions of the 26 wheel before the same cogs are in contact with each other.

Main Driving Wheels.—These have four special advantages.



Hattersley's Standard Model Loom. (Back and End View Right Angled Drive).

(1) All the teeth are cut out of solid metal so that each tooth is at its strongest, and contributes its full share of service.

(2) The back of the bevel wheel and the front of the bottom wheel are machine-turned to make a perfect fit. They are held together by four bolts, the borings of each being exactly alike. Only the inner wheel is keyed to the shaft.

(3) The driving wheels are eccentric, and are so arranged in the fixing, that the quickest speed is reached when the weft is pushed to the fell of the cloth, and makes it a good wefting loom.

(4) The eccentric wheels impart an accelerated force to the picking, and for this reason the picking straps may be left slacker, the picking is steadier, and the parts wear longer.

Checking Motion.

This is presented at Fig. 66. The bearer bracket A is bolted to the inner side of the breast beam, and provides the fulcrum for the checkstrap lever at H, and the resting place for the holding catch E. At B is the rod moved by the setting on handle, and is underneath the breast beam. When moved in the direction of the upper arrow, the collar C takes the checking lever D with it, and places the catch E in contact with the back part of the strap lever F at G, the fulcrum of the lever being at H. By being so held, the lever

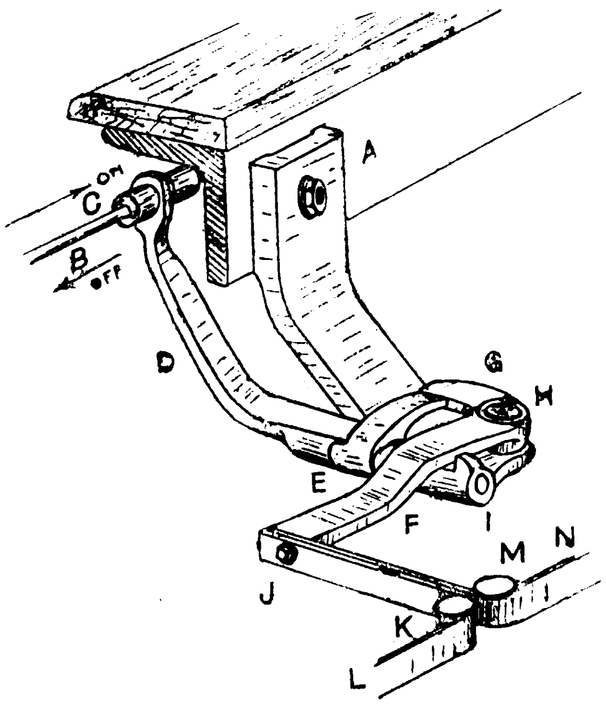


Fig. 66.
Checking Motion.

cannot move forward, and as the going part recedes, the straps L and N are drawn up, and in this way the checking of the shuttle takes place. The length of the straps are determined by the fixing point on the checking buffalo. The strap rollers K and M are part of a casting corkscrewed to the under side of the going part, and move with it. The terminal of the straps is at J at the end of the strap lever F. When the loom is put out of action, the catch E is drawn away from contact with the arm G, and the lever F can then move to the check limit at I, and both the checking straps are then slack. The checking only comes into action when the loom is set in motion, so that the shuttles may be pushed to their outer limit in the boxes, and the full force of the pick is applied to every shuttle.

Pick Finder Motion.

The Standard loom is fitted with an ingenious pick finder motion. If the weft breaks or runs off, the pick finder comes into play, automatically finds the pick, and stops the loom. The whole is completed in four revolutions of the crank, as follows:—

(1) When the weft breaks or runs off in any one of the shuttles employed, the picking at both ends of the loom is put out of action, but the lag cylinder moves forward for that part of the revolution of the crank.

(2) The pick finder now pushes the reversing collar from the weaving to the reversing side, and there it remains for two revolutions of the crank which turns back two shaft lags.

(3) The reversing collar is now pushed back to the weaving side for one revolution of the crank, which brings the shafts lags one forward.

(4) The loom is automatically stopped, the pick is found to be open, and the mechanism assumes the position from which it started as soon as the loom is set on for weaving.

The mechanism which performs this wonderful operation may now be explained in detail by the aid of the drawings.

There are three groups of castings called into play: (1) Those attached to the breast beam; (2) Those influenced by the wheel on the low shaft; (3) Those on the reversing shaft underneath the engine.

Weft Forks.—The three groups of castings are introduced to their quota of service by the weft forks. There are two forks, the distance between them being 38 inches, or in other words, they are each 19 inches from the centre length of the shuttle race. As they are 19 inches nearer the boxes than a centre weft fork, the prongs are perpendicular when the crank is at its back centre, so as to escape being molested by the passage of the shuttle. They act in much the same way as an ordinary weft fork.

Breast Beam Castings.—Fig. 67 gives the group attached to the breast beam. A and B are the two feelers

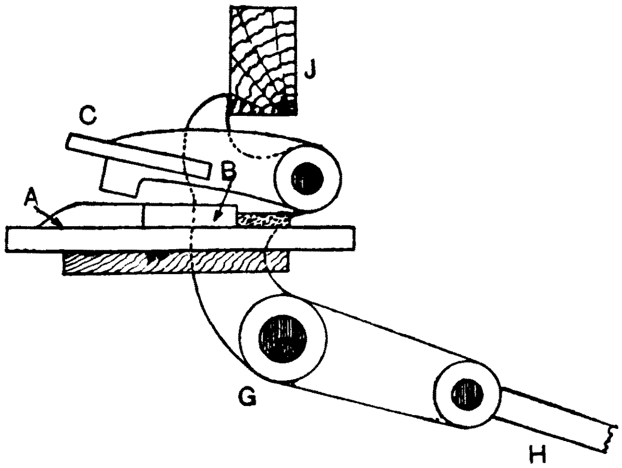


Fig. 67.
Picker Finder Breast Beam Castings. Out of Action.

placed side by side, their respective parts being shown by the vertical dividing line. When the loom is standing, both feelers are level at the front, and the lid C with its lug on the underside is raised as shown in the sketch. This lid is influenced by a swallow-tailed casting, the fulcrum of it being at the neck. A rod passes through the tail, whilst a wing is used to raise or drop the lid when the setting on handle is used. At G is the fulcrum upon which the connector casting oscillates, and J is the wooden block which limits the backward movement of the connector casting after it has been in action. At H is the connecting rod which links the breast beam casting with those associated with the low shaft.

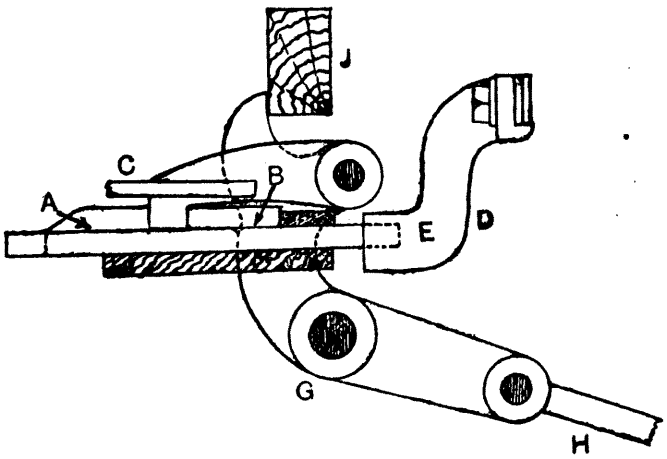


Fig. 68.
Pick Finder with Striker in Action.

Fig. 68 shows the same castings as the previous drawing, but with the addition of the striker D on the weft fork. When the loom is set in motion, the striker D pushes back the outer of the two feelers, and leaves a gap between the two. As the lid C has been released by the swallow-tailed casting, the lug drops between the two feelers as shown, but the inner feeler B remains forward at E. The striker D continues to come opposite the pushed back feeler A but only slightly touches it.

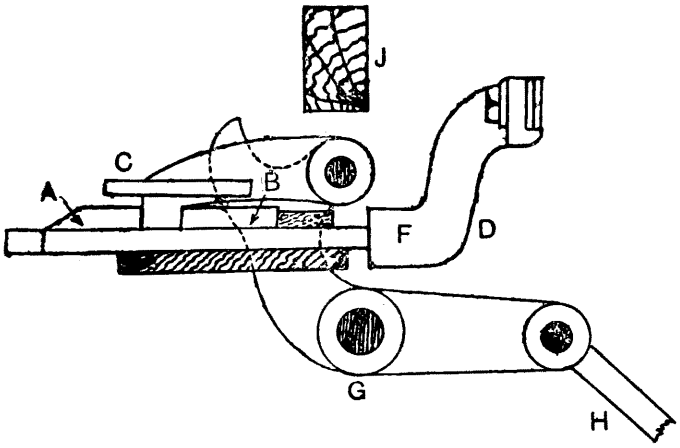


Fig. 69.
Pick Finder with both Feelers Pressed Back.

When the weft breaks or runs off, the catch holds the cut on the weft fork, and the traverse of the striker is curtailed. This brings it opposite the inner feeler B, so that both feelers along with the lid C are forced back as given in Fig. 69 by the cranked end F of the striker D. This push also moves the upper part of the connecting casting G, elevates its lower arm, and raises the rod H.

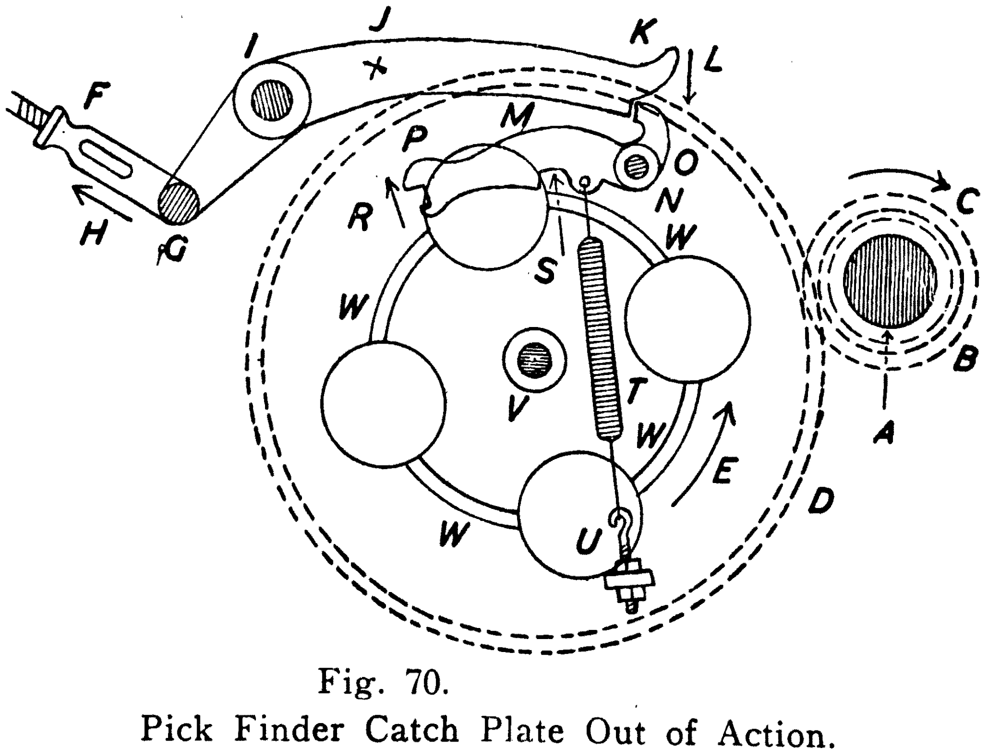


Fig. 70.
Pick Finder Catch Plate Out of Action.

Pick Finder in Weaving Position.—This is outlined in Fig. 70, and in second group of castings. A is low shaft; B clamp wheel; C its movement. D is spur wheel that runs when loom working, and makes one revolution to the clamp wheel four. It rotates as arrow E, but pick finder not affected until weft fails. When weaving, rod F moves as arrow H, and lowers holding lever K like arrow L, and cut on K holds tail O on key-shaped lever M, and its head is elevated as arrow R. In this position, the pick finder is out of action. N is pivot for key catch. Spur wheel and catch plate rotate on shaft V.

In some makes, rod F is fixed to a pin at J, and catch K is pulled up to bring pick finder into action.

Pick Finder in Action.—When weft fails, weft prongs drop into their grooves, and weft fork slide is held by tippler. This curtails traverse of striker, which comes in contact with inner feeler, presses it back, and brings pick finder into action. In this case, rod F is pushed down, and lever K is elevated as at L. The tail O on key-shaped lever M is then free, and spring T on hook U pulls it down. On its under side, key lever has cut at S on under side, and allows rib W on right to enter and hold it. All ribs W are part of spur wheel D. The bottom jaw of key head is shorter than top one, and enables it to clear rib W in front. The key head only holds this rib if the going part is made to go back from any cause of stoppage during pick finding.

When the pick finder has run its course, the usual thing is to find the open pick on terminating its fourth revolution. It is near this termination that rod F is pulled up, and lever K drops, seizes the tail O, and elevates the key head as at R, Fig. 70.

The special thing is the timing. It is set by set-screws on clamp wheel B. When inner feeler on breast beam is pressed back owing to weft failure, the crank is then at its front centre. The key-shaped lever then drops and the rib W on spur wheel D should then be just behind the forward cut S on M. This brings the motion immediately into action.

Function of Control Plate.—The catch plate is Fig. 70 and 71, is fixed by cross bolts to the control plate at Fig. 72, a small space being left between the two. Both plates move at the same time. As seen, the control plate is a heart-shaped tappet that moves as arrow E. On top is bowl lever G, pivoted on H, carrying bowl L, and has rod J attached at I.

When the key lever is held by a rib on spur wheel D, the movement of the heart-shaped tappet forces bowl L out

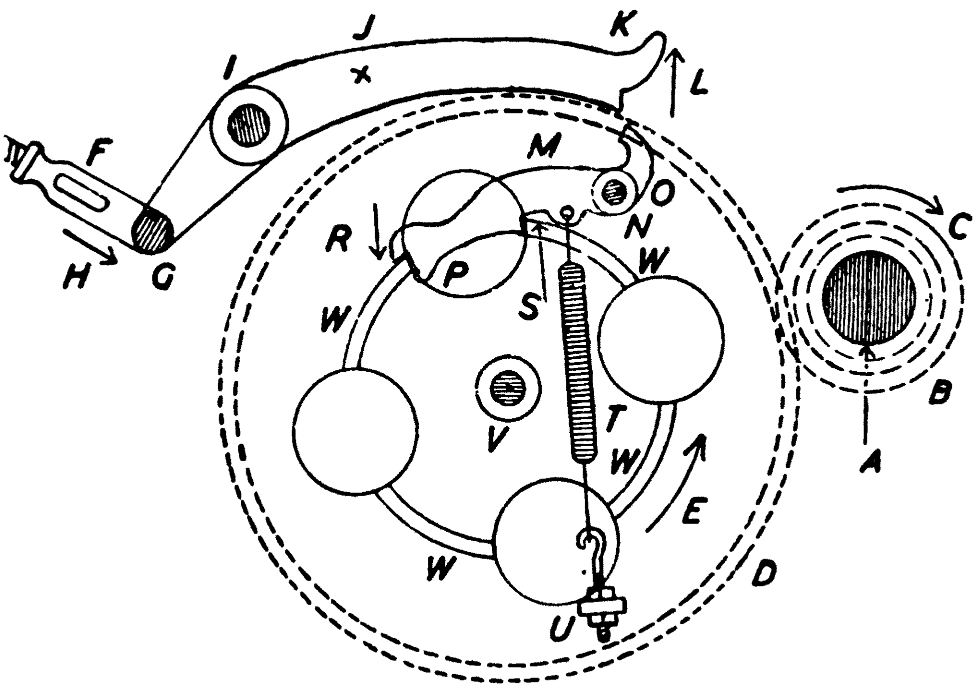


Fig. 71. Catch Plate in Action.

of its cavity at M, and gives the first lift to connecting rod J. This rod is connected to the cross rod at the back base of the dobby.

The first lift of bowl is from M to N, and puts picking out of action, but the lags are moved forward one lag for that turn of the crank.

The second lift follows immediately from N to O, and causes collar on take-up shaft to move from weaving to reversing, and there it remains for two revolutions of the crank and two lags are turned back.

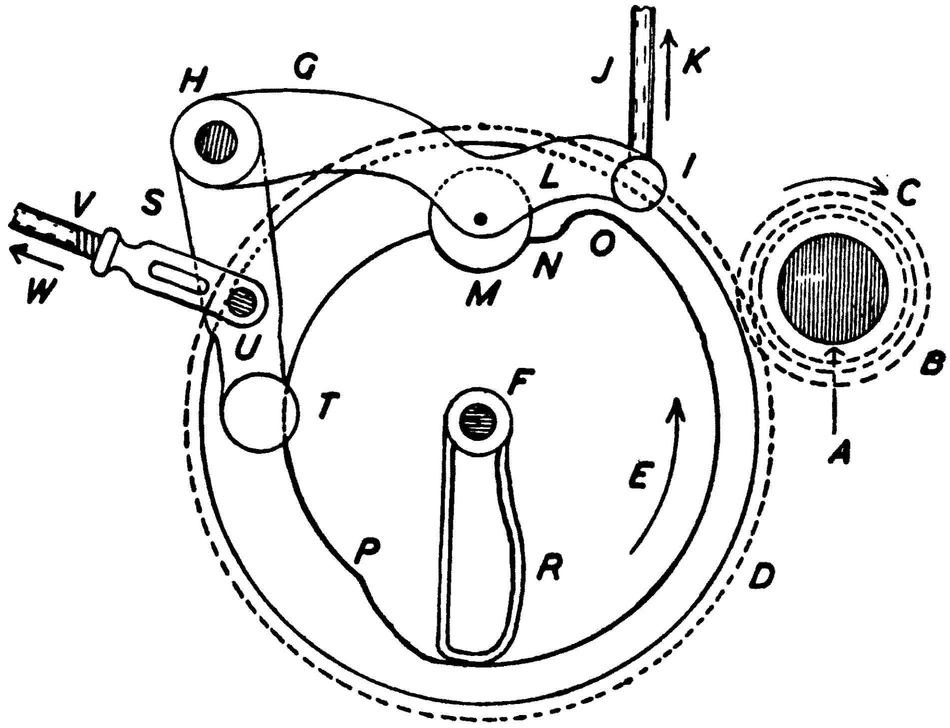


Fig. 72. Control Plate out of Action.

Bowl lever G then makes its first drop to P, and switches collar from reversing to weaving position, and turns one lag forward. Whilst traversing this section, finger R cast to the plate contacts with circular end of **T** on lever S, swinging on pin H, and is forced back. On the lever is pivoted U, carrying rod V and moved as arrow W, and as V is connected to set-on handle, the loom stops. Prior to loom stopping, bowl L slips into cavity M, and pick finder is out of action. The control plate revolves on fulcrum F.

Use of Reversing Handles.

If the pick finder gets out of order, and the overlooker is busy, the weaver finds the pick by using the reversing handles at Fig. 73. A is pivot for both handles, and to reverse, both handles may be pushed over at same time, the short handle B moving to C, and its pin from 1 to 2. This places picking out of action. Long handle D is moved from

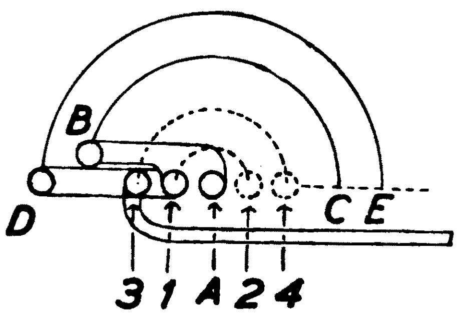


Fig. 73. Reversing Handles.

3 to 4, and shaft and box lags are reversed in action. When open pick found, the long handle is overcentred from E to D, and pin from 4 to 3. This makes the lags move forward when crank turns, and the weaver finds the open pick again, and the short handle is moved from C to B, and its pin from 2 to 1. This places the picking into action.

Effect on Picking Forks.—In Fig. 74 is shown how the picking is put out of action. F is the fork nearest lag end of loom, with G its pivot. Its vertical arm is slotted at H, and carries stud I upon which lever J moves. Rod L moves upward where short reversing handle is used, and passes from B to C, and this conveys K from 1 to 2, and lengthens the distance between picking forks F and P, and both are then out of action.

When the long handle is turned from D to E, the lever J descends from 2 to 3, and the picking remains out of action, but the reversing collar is pushed from weaving position to reversing. At N is the swivel through which the connecting rod passes, and locknuts regulate its working length. Vertical arm P is slotted at O, and the pivot fork is at R.

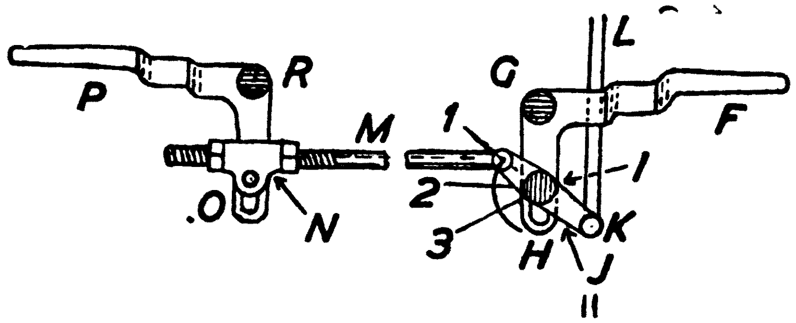


Fig. 74. Reversing Action on Picking Levers.

Reversing Shaft Castings.—These are presented at Fig. 75, and here, rod D is the same as rod J in Fig. 72. When the inner feeler is pushed back by the striker in Fig. 69, rod D in Fig. 75 is forced upward by the bowl lever on the heart-

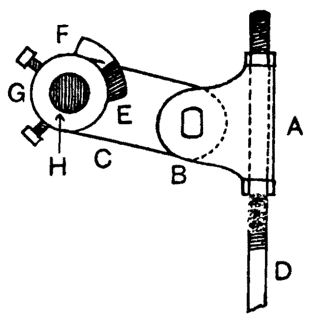


Fig. 75. Reversing Mechanism.

shaped casting in Fig. 72. Rod D passes through swivel A and is locknutted. B is where the swivel is setscrewed to lever C, but is free to move, and C is also free on shaft H.

On lever C is lug E, which is set body up to lug F on collar G. By this means, shaft H is turned by the pick finder motion.

Cross Shaft Castings.—These are depicted at Fig. 76. A is the reversing rod used by the weaver, and is attached to lever B, with position 1 for weaving, 2 for picking out of action, with lags for moving forward, and 3 for reversing lags without picking.

Cross shaft C has five sets of castings, and lever B is the first.

The second set is the one already explained at Fig. 75, and the three positions are the same as for Fig. 76.

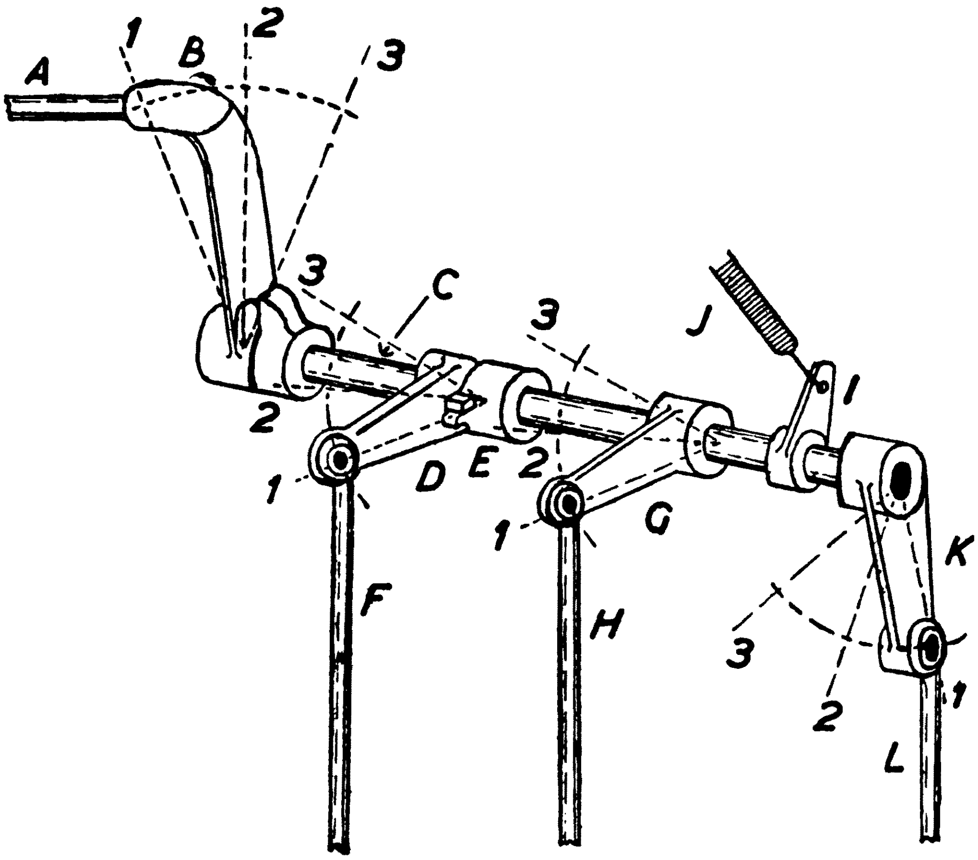


Fig. 76. Cross Shaft Castings.

The third casting is G with rod H that regulates the picking, and gives the same sequence of movements as detailed.

The pick finder is only positive when rods F and H are lifted. The function of lever I and spring J brings shaft and rods back to their weaving positions when the pick finder finishes.

The fifth casting is at K, and its rod L moves the reversing collar on the take-up shaft. The numerical positions act as mentioned.

Effects on Reversing Collar.—When the loom is weaving, collar K in Fig. 77, contacts with bevel wheel H that has lug I fitting body up to lug J on the collar. Rod E, pinned at D, is on arm A, and arm B fits between the flanges on collar K, the lever moving on stud C. The collar slides on saddle key L on take-up shaft F. The bevel wheel is positioned by collar G.

Take-up shaft F turns dolly shaft P as arrow, the dolly being at O, and its pin R rotates cylinder wheel S at its bottom end. The timing of the cylinder is *not* according to the position of the crank, but by the shedding rod when at its dead bottom centre. When at this spot, the pin has to be just clear of the cylinder wheel as shown. The shaft of the cylinder is at T, cylinder at V and direction at W.

Alterations when Reversing.—When rod E is lifted, collar K is moved to its reversing position in Fig. 78. The collar lug J is now in contact with lug I on bevel wheel M, the bevel being positioned by collar N. When shedding rod at bottom centre, dolly pin is just clear on cylinder wheel

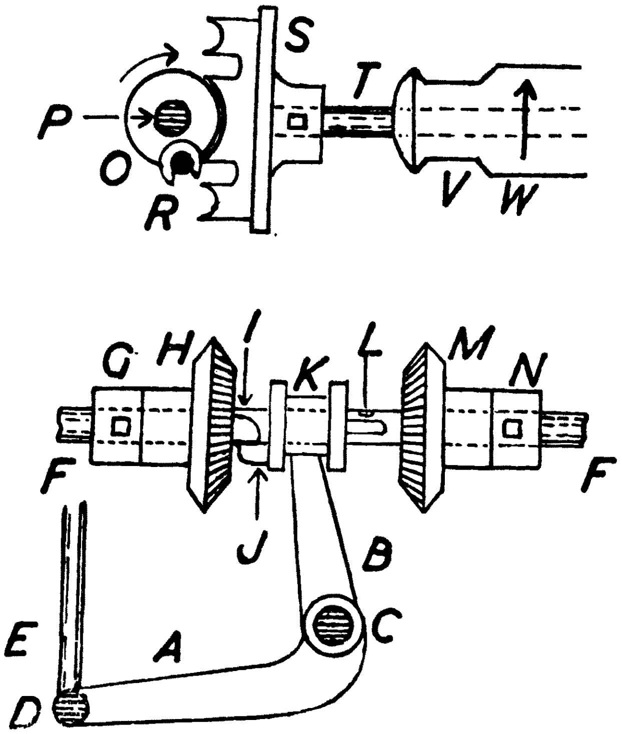


Fig. 77. Reversing Collar in Weaving Position.

S, and cylinder V now turns as arrow W. In case the timing is upset, the quickest way is to set reversing handles for reversing, and turn loom over on pick, and place shedding

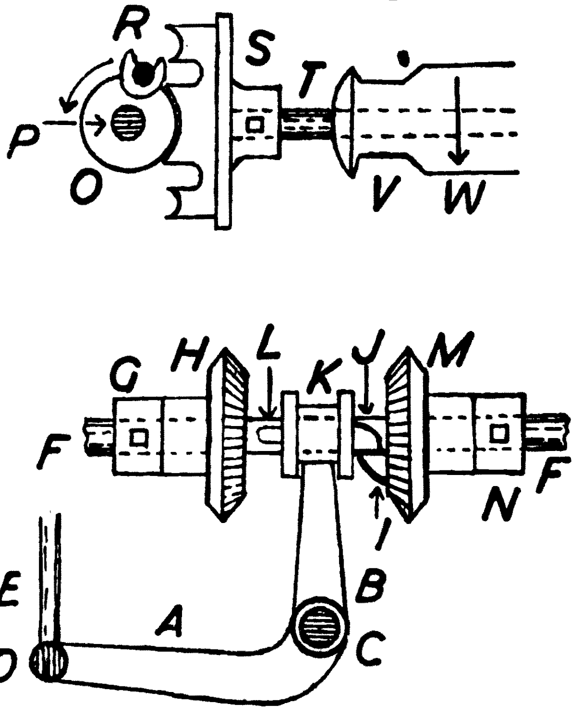


Fig. 78. Reversing Collar in Reversing Position.

rod at bottom centre. Collar N can then be removed and wheel M set in contact with driving lug on bevel M with dolly pin as at R. The reversing handles are then set for weaving, and the dolly can then be turned *by hand*, and if correct, it should be as at R, Fig. 77, but if not, the collar G is undone, and H moved so its lug I contacts with lug J on reversing collar K.

HATTERSLEY'S AUTOMATIC BOBBIN CHANGING LOOM.

This new development has been attached to their Standard Model Loom.

Fig. 79 reveals the front and right hand view. Fig. 80 presents the underpick motion for the right side of a right-hand loom. A is the low shaft, and B, a section of the shellnose for picking. On its inner side it has radiating

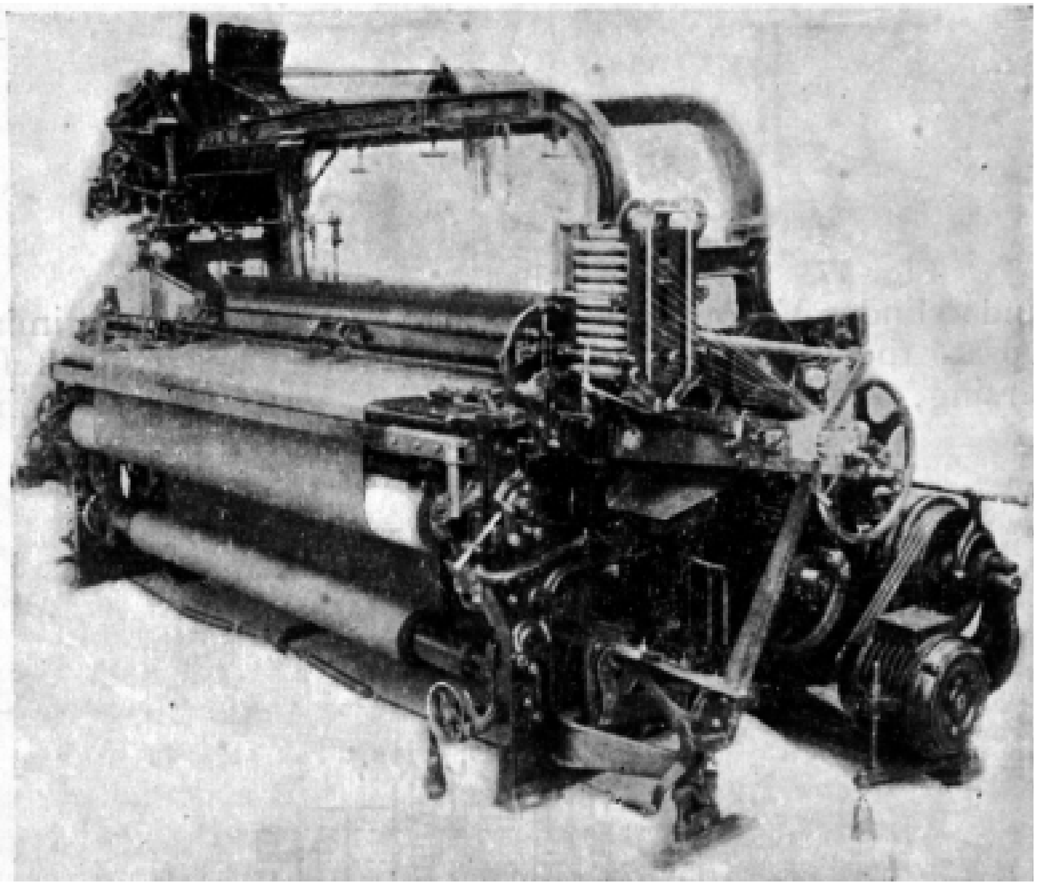


Fig. 79.
Hattersley's Automatic Bobbin Changing Loom.

teeth to mesh with similar teeth on the boss. Nose C forces the bowl D and lever E to move every revolution of the crank.

Picking arm E is inside loom, is fulcrumed and keyed to stout shaft G, the inner end of the shaft turning in bracket F.

The diameter of bowl D is 2½ inches, and its bore 1⅛ inches, and is case hardened. The bowl stud is part of a pear-shaped casting, setscrewed to head of the picking arm. The arm is on a square shaft, and below its hollow square it is split, bolted, and locknutted, and is firmly held. It is made of malleable iron.

The neb casting H is on the same shaft as the picking arm, and both are brought back after picking by spring J attached at I.

Picking Catch.—This too is malleable iron, and is on the casting secured to the picking shaft N. The catch is moved by a finger pivoted at L, the catch top being at M. The finger is moved from the other end of the loom, is taken out of contact with the picking neb on one pick, and drops of its own weight for picking the next.

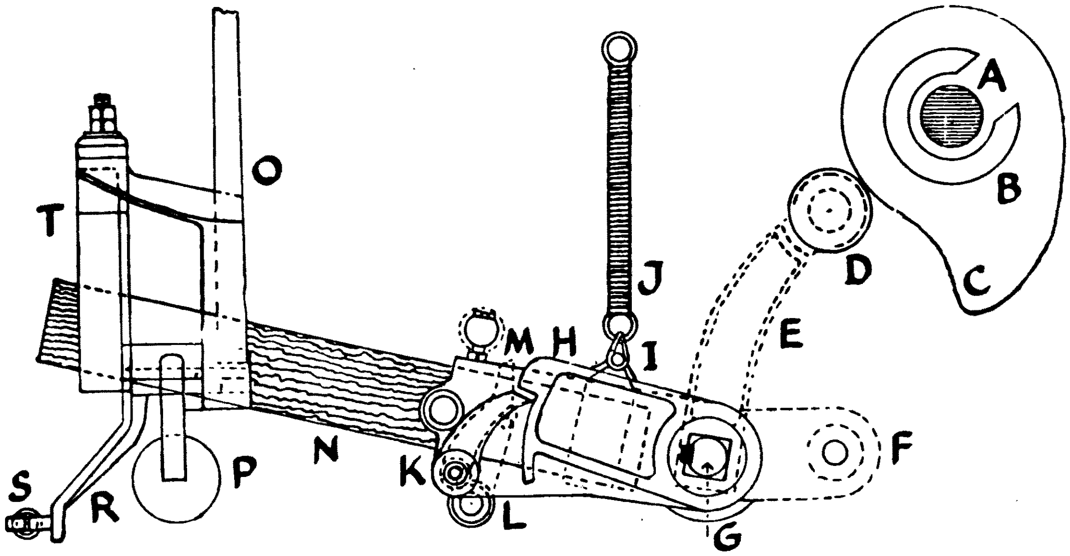


Fig. 80. Left Hand Underpick Motion.

Two special points are:—(1) When catch dropped for picking, there must be a clearance of the neb of a quarter inch. (2) The angle of the cut on neb and picking face of catch has to fit each other for good wearing.

Wooden Picking Shaft.—This is at N, and at the back, is bolted to a malleable sheath. At front, it passes through the guide T. To prevent excess movement, it is pulled up after picking by spring pressure, and the head of a locknutted setscrew is set to prevent it. O is back part of the picking stick, and P the rocking base, and R, the arm attached to the sheath, and S, the strap for spring for stick return.

Picking on Left Hand.—This is lettered like Fig. 80. Here, I influences the catch regulators for the picking. At U is the pivot for lever V that is coupled to the vibrator wheel that operates the boxes. W is the fulcrum for lever T, and X the connecting rod that moves lever on stud L. This lever operates finger M and catch K. Behind fulcrum W is the pin for rod Y, and regulates finger and picking catch at opposite end of loom. When lever T is as in Fig. 80, loom picks from right, but when arm V is raised, it picks from left. If anything goes wrong with the picking, the escape lever comes into play, and places both ends out of action. This is for Fig. 81.

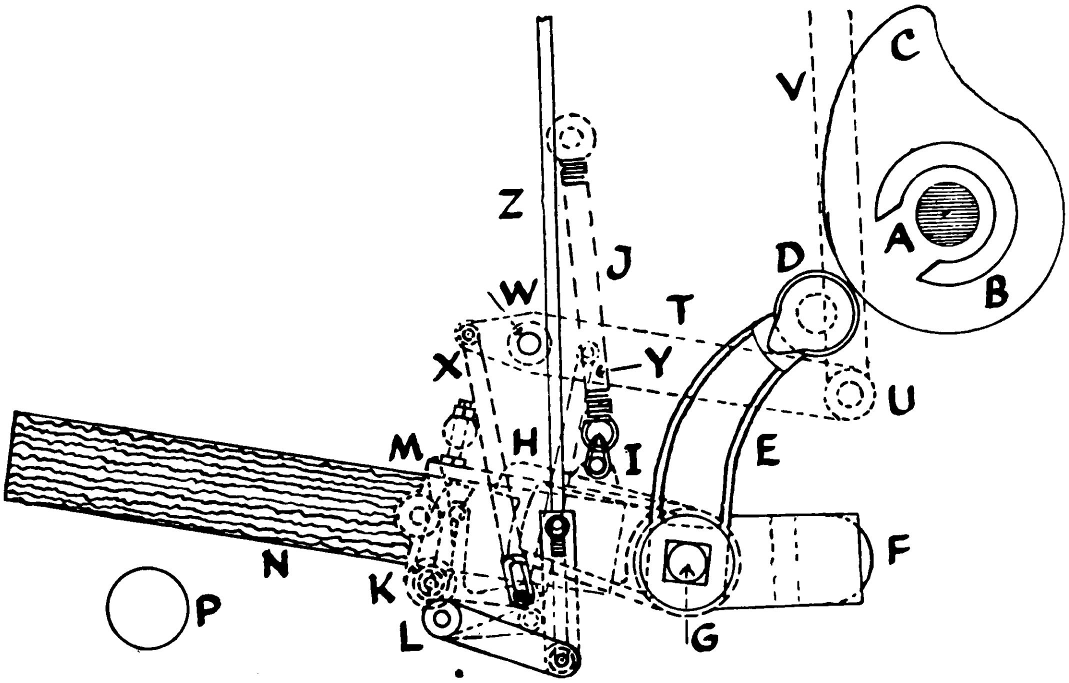


Fig. 81. Right Hand Underpick Motion.

Front View of Picking Parts.—In Fig. 82 A is the bolt connecting B to sword and the fender C. The pivot D is for picking stick. Its malleable sheath is at E, and is continued at F, and bolt G holds picking strap H. Inside the strap is the end of picking shaft I. Arm J finds place for doubled

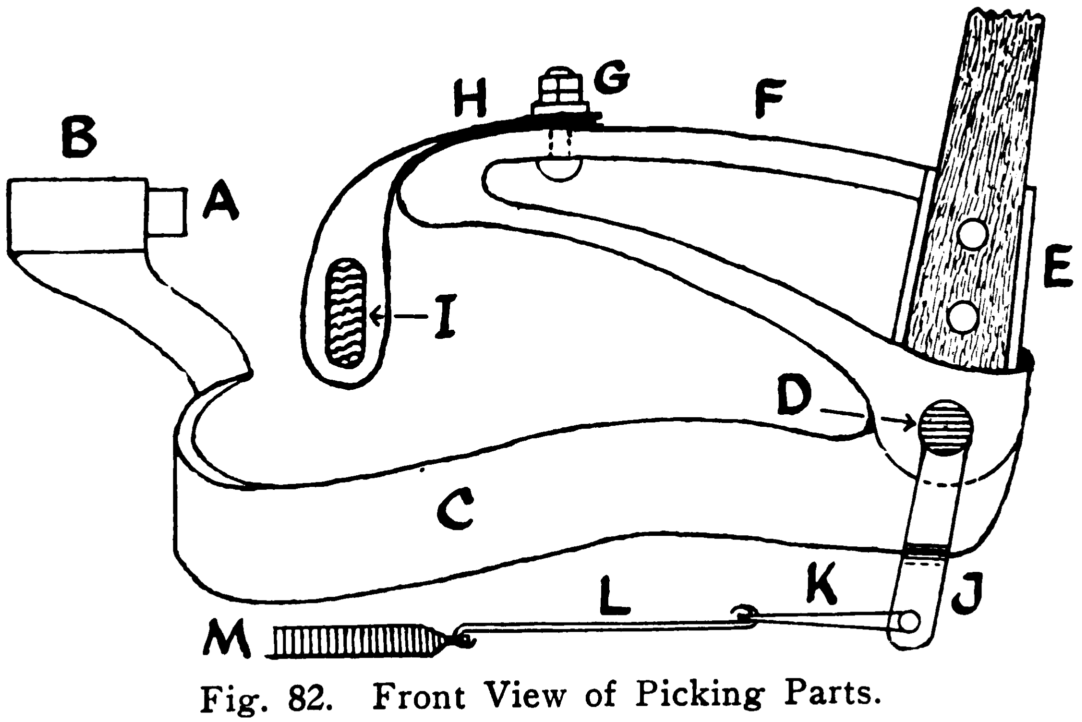


Fig. 82. Front View of Picking Parts.

leather K and spring M to return the stick. The box lags do not control the picking, for it is now done by a small positive tappet, and a link chain on sprocket wheels at the dobby end. Picking stick begins to move shuttle out ot box when crank is at its bottom centre. The going part has a forward run of 7¼ inches.

Prime Mover for Bobbin Changing.—This is an electric current brought into play by a pimple on a brass flap in the shuttle. As soon as the pimple contacts with a metal bush on the weft bobbin, it raises a vertical rod at the driving end of the loom, and by this simple means, the mechanism for bobbin transfer is brought into action.

The magazine holds four rows of bobbins, each row having eleven. Each of the four boxes at the dobby end has its own row. All the bobbins may be of the same colour, but each row may have its own colour.

The actual transfer takes places in the fraction of a second when the crank is at its front centre.

Three Legged Tappet Lever.—In Fig. 83, A is pivot, and B the bowl that runs in the groove of the positive tappet above crank shaft. The bottom leg C is shaped like a Wellington boot, and D is the heel that assists in bringing

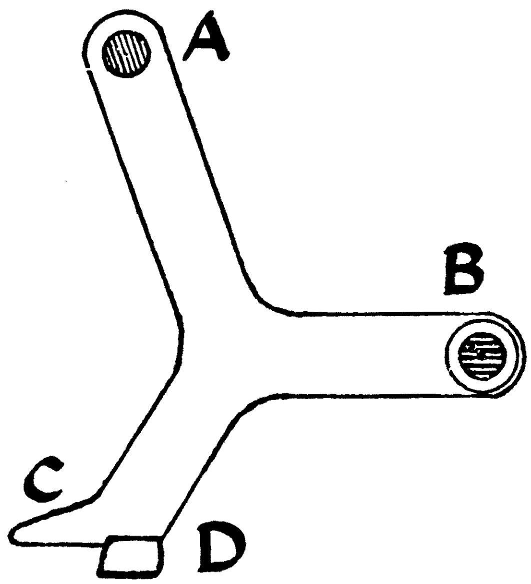


Fig. 83. Three Legged Tappet Lever.

the transfer mechanism into play. The bottom leg is pushed forward when loom is going to pick from driving end, and is brought back when loom is going to pick from opposite end. This double movement is due to the shape of the tappet which is on the inner side of the large wheel having 64 teeth. This meshes with another below on the crankshaft having 32 cogs. The tappet wheel turns clockwise.

The forward movement begins when the crank leaves its back centre. No other part of the changing mechanism moves until the electric current operates.

Affiliated Levers.—These are demonstrated at Fig. 84, A is the vertical rod lifted by the electric current, and by being raised, the aluminium shelf B is also elevated. In the diagram, the shelf is out of action, for boot lever C is in its forward position, and has cleared the shelf. When the shelf is elevated by rod A the heel contacts with the shelf end, and is forced forward. The sloping lever D is pivoted near its centre, and carries a couple of rods at its upper end. E is the rod bearing a spring, and this pushes the lever back. F is the connecting rod between levers D and G, the latter being fulcrumed at H. Lever G has two rods. The spring

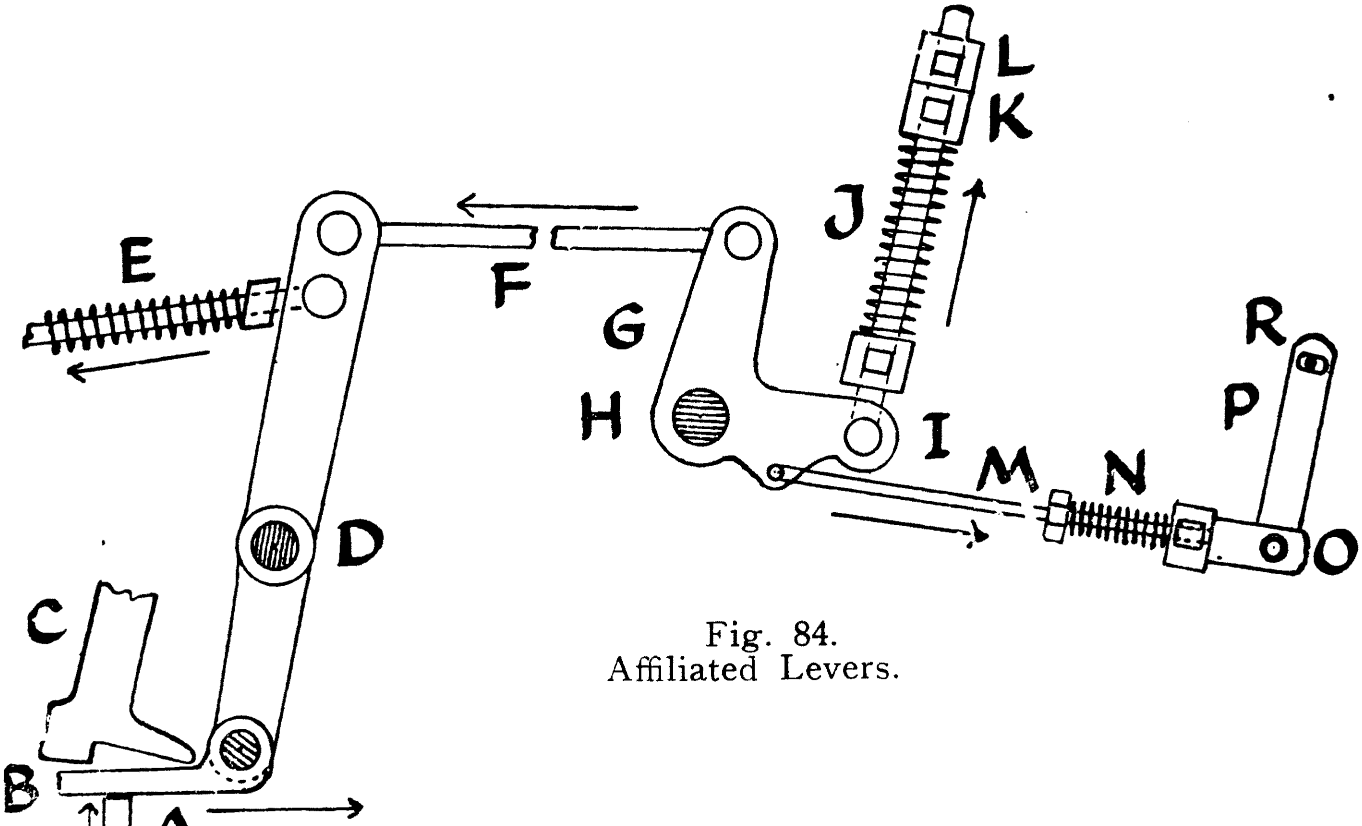


Fig. 84.
Affiliated Levers.

rod is pivoted at I, with J the spring rod. K is the end of the selection bar that lifts the brass slides, and L the small setscrewed collar that prevents any slipping of the under collar. Connecting rod M links levers G and P, and the latter, when pushing to the right as suggested by arrow, releases the curved bar that holds bobbin ready for transfer. The springs impart resilience to the movement. O and R are pivots.

Inner Part of Magazine and Slides.—Here, A, Fig. 85, is the framework of magazine that is a foot wide, and holds four rows of bobbins. Total length of bobbin is $8\frac{3}{4}$ inches, and the weft occupies 7 inches. The metal bush is $1\frac{1}{2}$ inches long, and the head bears three rings.

At B and C are the bars for support, and D and E are slots for the slide rod that carries the lifting plate that operates the slides. Part F is the innermost slide, for the drawing is a front inner view of the magazine and G is slotted bottom of brass slide and carries the pin at the end of the curved bar that holds a row of bobbins. On this, and all the slides are two lips like H and I, and it is these that are actuated by the lifting plate. The upper lip is for lifting, and the lower one for depression.

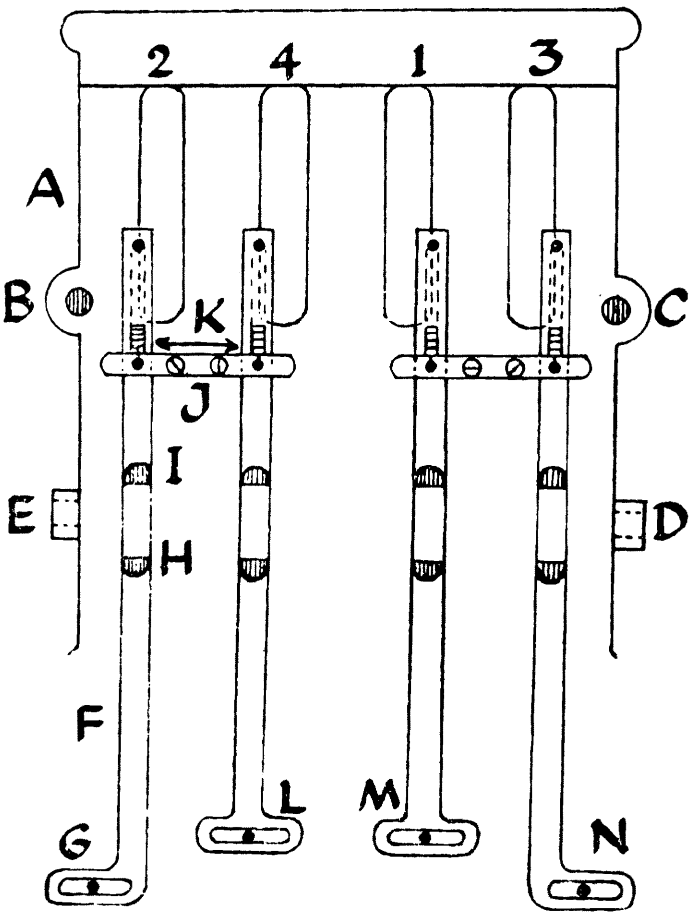


Fig. 85. Slides in Magazine.

The setscrewed plate J holds two slides, and has a couple of knobs to hold the small springs K, and near the top, each slide has a spring that pulls the slide down after elevation. The two inner slides M and L are alike, but slides G and N are longer, and their slotted ends are in opposite direction. All lips on the slides are level when at rest.

When a slide is elevated, the bar holding the bobbins is tilted, and allows the bottom bobbin to descend to the central position in the magazine ready for transfer.

Lever, Slide Rod, and Lifting Plate.—These parts are outlined in Fig. 86. Rod A is governed by position of the drop boxes, and are adjustable to give the exact push to collar D, and lifter plate H. The rod is pivoted on lever B, fulcrumed at C, its upper part resting on the grooved collar D, on the square part of collar D, this being on the square part of rod E. The square part is 6 inches long. F is the same collar as K in Fig. 84. The lifting plate H has four lift-

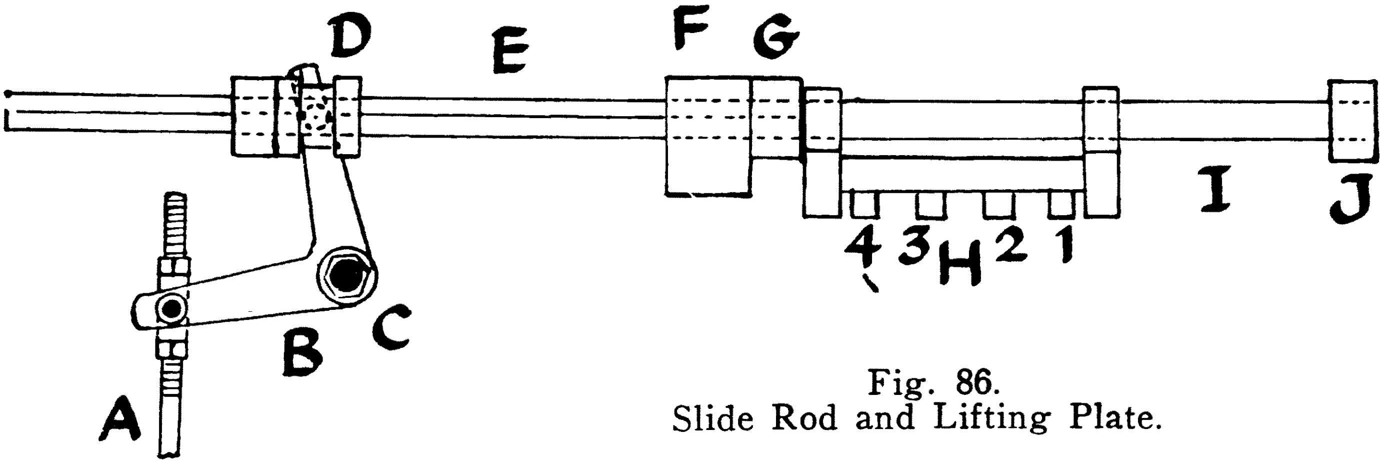


Fig. 86.
Slide Rod and Lifting Plate.

ing fingers. The actual distance from centre to centre are: Fourth to third $1\frac{1}{4}$ inches; third to second $2\frac{1}{4}$ inches; second to first $1\frac{1}{4}$ inches. When operating the slides, the lifting plate moves in an arc, and the push given to it corresponds to the lift of the boxes.

The round part of rod is $7\frac{1}{2}$ inches long, and J is the outer collar through which it slides. The slide rod and plate move so that only one brass slide can be lifted at a time.

Connection to Shuttle Feeler and Weft Cutter.—This is outlined in Fig. 87, and is behind the slide rod in Fig. 86.

It is a peculiar shaped casting as seen at A, pivoted at B, and carrying three rods. The spring rod C brings the casting back after action. At D, rod E is secured, and moves

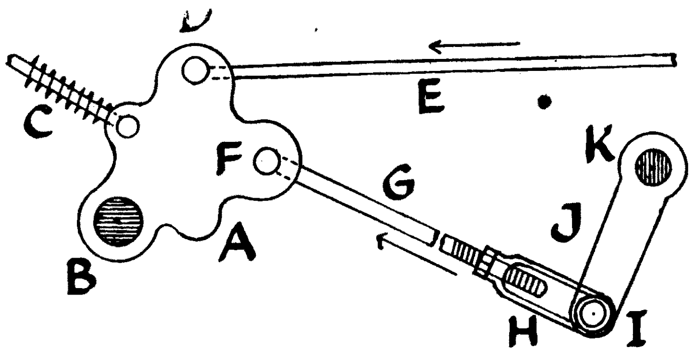


Fig. 87. Shuttle Feeler and Weft Cutter Control.

arrowward. The same rod is at A in Fig 88, and there it is secured to the brass casting B. At F, Fig. 87 is the pin for rod G which carries swivel H, pinned at I, and controls the one-armed lever J fixed to rod K. By turning rod K, lever J moves the shuttle feeler forward to " feel " if the shuttle is fully in the box for bobbin transfer. If not, the feeler is held back, and the loom ceases to run.

Battery Latch and Transfer Hammer.—This important mechanism is at Fig. 88. Here rod A is the same as E in Fig. 87. When rod A is drawn to the right, the brass casting B goes with it, and also the vertical arm of right angled lever E pivoted at F. On its horizontal arm is connecting rod G with its swivel at H, and held by slotted lever I, this being the upper part of the battery latch L. By lifting lever E, the battery latch is elevated at its V-shaped front at K, so as to come in front of the bunter in front of the going part. The forward stance of the battery latch is set by locknutted setscrew M. It has to be set accurately so sufficient pressure is applied to transfer hammer O to push out the spent bobbin in the shuttle and insert a full one.

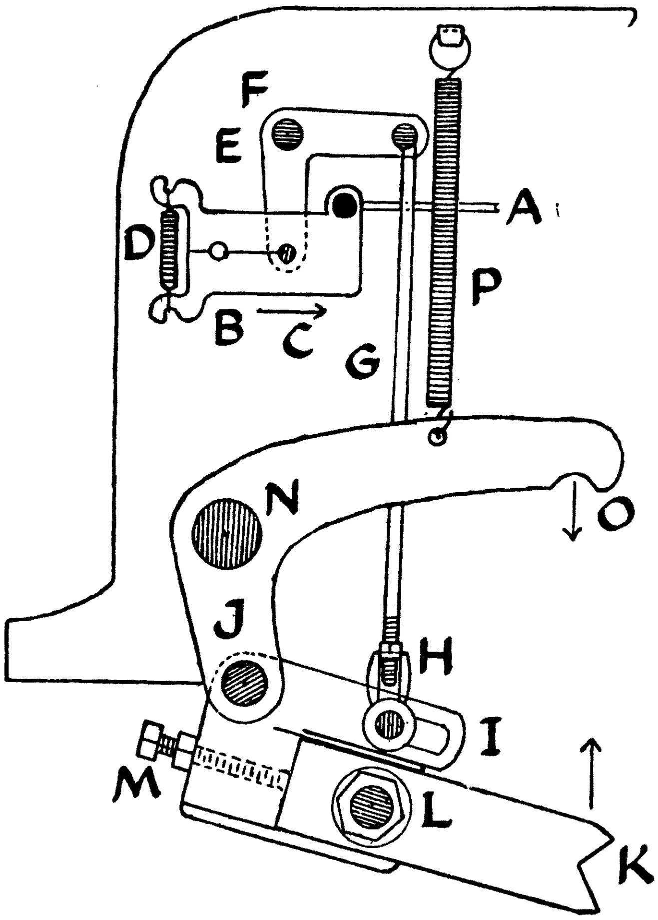


Fig. 88. Battery Latch and Transfer Hammer.

The battery latch swings on stud J, and transfer hammer is strongly bolted at N. The curved part O is very smooth so as to do no injury to the weft. It must be mentioned that the brass casting B is split at the back, and the two parts are held together by spring D.

Shuttle Feeler and Weft Cutter.—Fig. 89 gives an outline of the parts. The casting resembles a ladle. A is a part of the breast beam to which the notched casting B is bolted. The rod C is the same as K in Fig. 87. By twisting the rod, the shuttle feeler is brought forward, and this pulls the point of F out of notch B, pulls down weft cutter G, and throws forward the finger E. These three parts are fulcrumed at H. As the shuttle feeler goes forward, the finger E comes in contact with the head of the locknutted setscrew J on front of going part I, and pushes the finger back. This closes the cutter G that cuts the weft on the right, and holds it on the left.

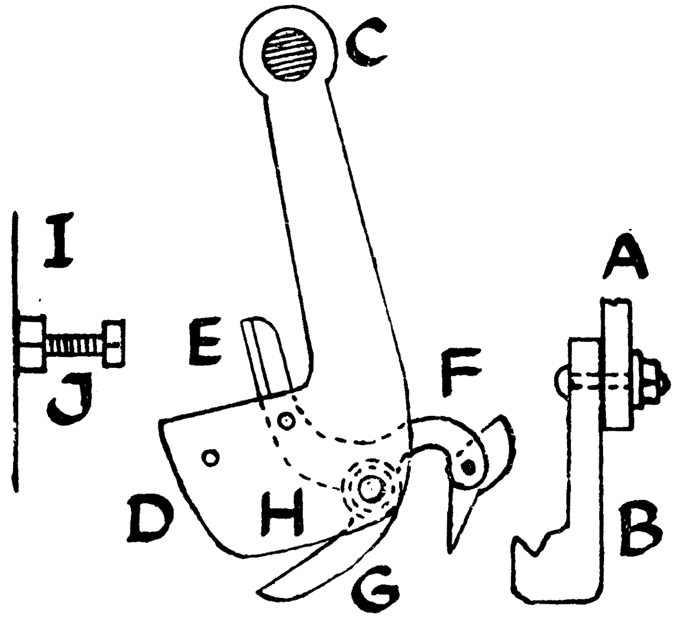


Fig. 89. Shuttle Feeler and Weft Cutter.

Check of Shuttle and Wear of Picker.—The checking of shuttle in plain box has to be so there is no run back, that all three rings on the bobbin head are seized by the jaws of shuttle when transfer takes place. This is secured by a large screw with a gas thread on it that passes through a casting. At its front is a knobbed head that comes in contact with the back of the picker head. The shaft associated with the knobbed head has an open spiral spring upon it, and takes the shock of the incoming shuttle.

As the head of the picker wears, the tip of the shuttle advances further into the box, and if not attended to, would get out of transfer range. The knobbed head can be screwed forward to meet the worn condition.

A groove in front of the threaded casting allows a setscrew to penetrate, and prevents the casting from turning by the vibration of the loom. This idea is far ahead of leather packing on the picker spindle. This loom, with reasonably good work, can weave up to 50,000 picks a day.

THE DOBCROSS WHIP PICK. BOX LOOM.

The Dobcross Hollingworth and Knowles loom is one of the most widely known power looms used in the medium and heavy woollen and worsted industries, and its universality and efficiency are generally recognised. It is used with minor adaptations for goods so diverse as tropical suitings and heavy blankets. It produces costume cloths, suitings, and overcoatings, as well as army and police uniform cloths.

The majority of these looms are belt driven from a main shaft, but owing to the increasing demand for electric driving, it is fitted up for this kind of driving as effectively shown at Fig. 90.

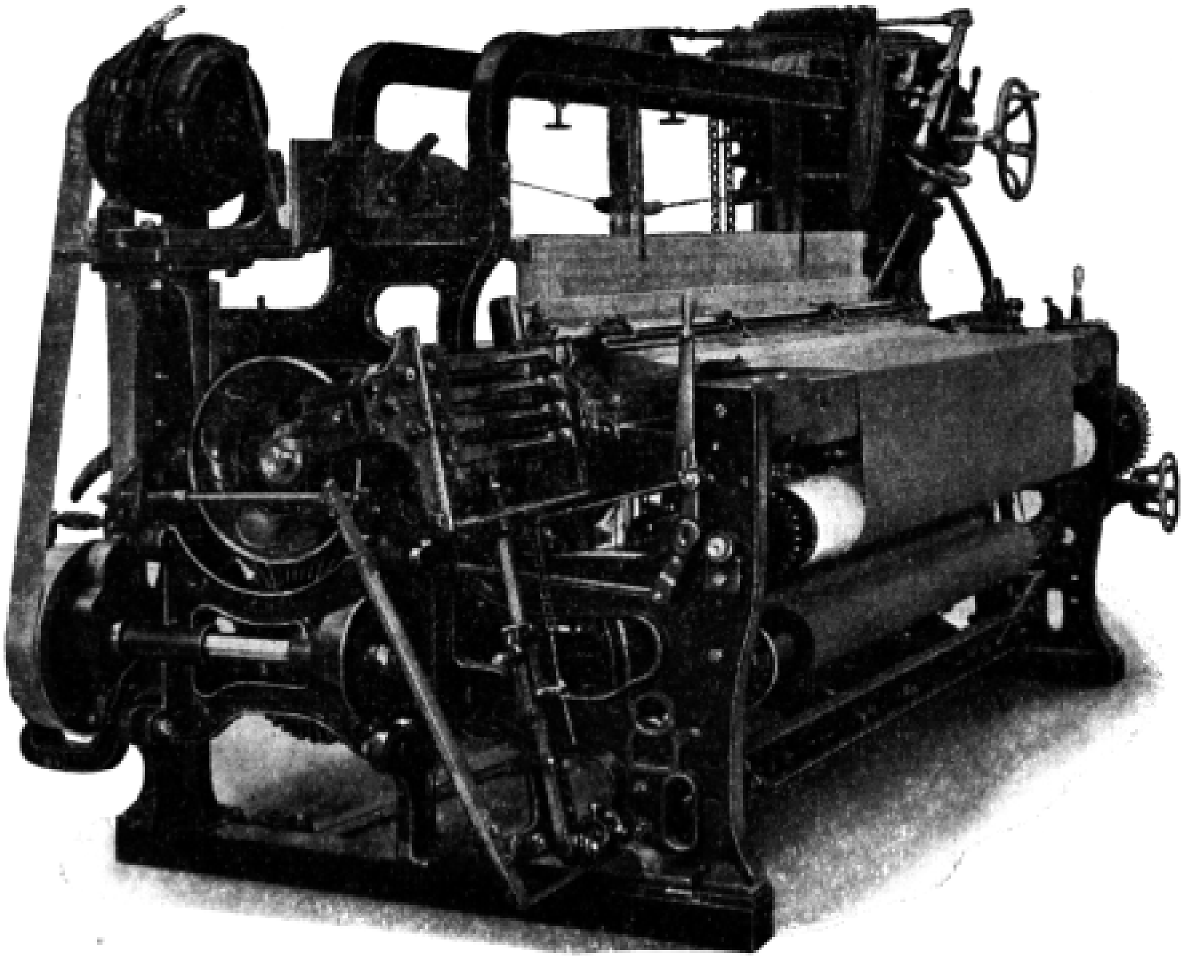


Fig. 90.
Dobcross Drop Box Loom. (Electric Drive).

System of Shedding.

The dobby is made to take 16 shafts for the coarser and heavier work with stronger made parts, or with 24 or 36 shafts for the more elaborate designs, and usually lighter weight fabrics. The usual reed space is 90 inches.

The method of forming the shed was unique when first introduced, and has never been surpassed. This is effectively demonstrated in a very simple manner. If a straight line be drawn, and a semi-circle placed on the baseline, the latter may be divided into six equal parts. A series of straight lines may then be drawn from base to summit. It will now be realised that whilst the base lines are at equal distances, the spaces on the semi-circle are unequal, and interpreted in terms of speed are slow, medium, fast, medium, slow. This is how the shed in the Dobcross loom is formed, for whether the heald shafts be up or down, they ascend and descend as described. The warp threads reach their greatest tension at the slowest speed, and pass at their quickest speed when the tension is most relieved. The details of the dobby may now be given.

Dobby Jack.—At Fig. 91 A is the right-angled jack which is pivoted on the bar C at the base of the dobby. Its

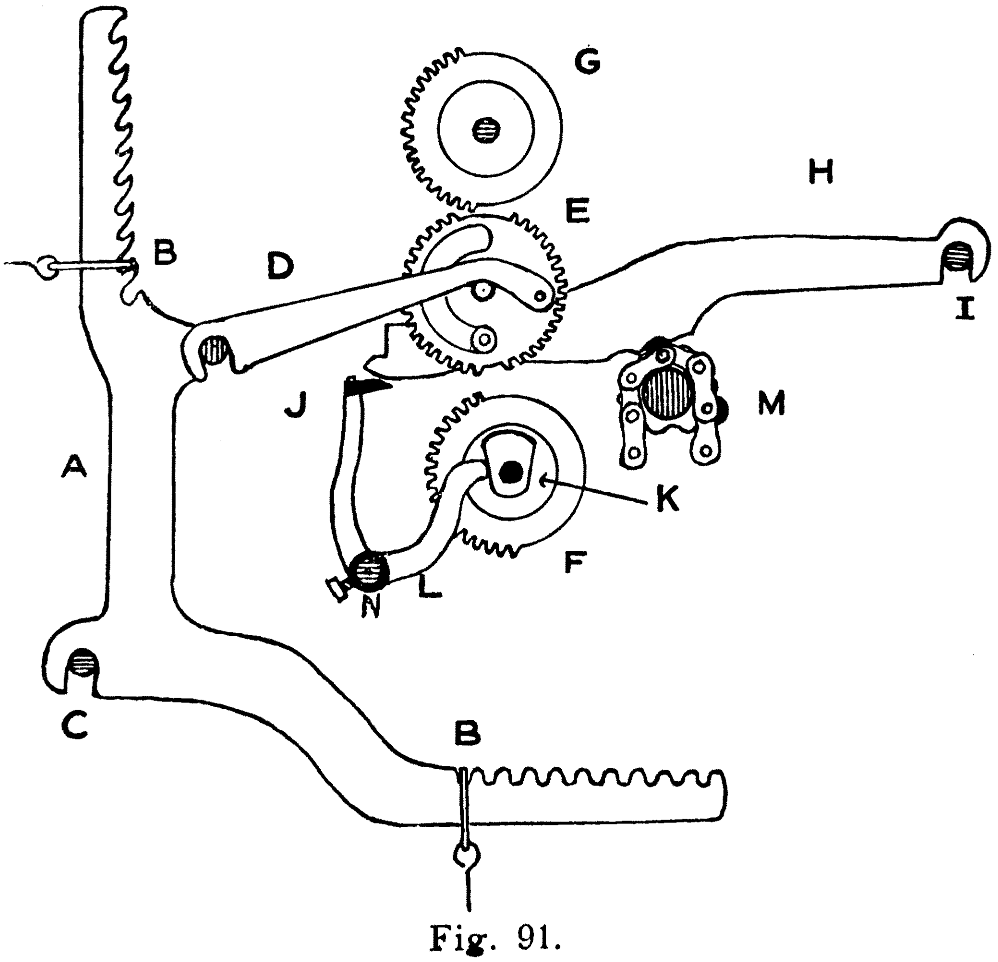


Fig. 91.
Dobcross Dobby.

upper and lower arms are notched for the rapid altering of the size of the shed. On purpose to give the longest service to the healds, the streamer B on the upper arm is placed one notch higher than the bottom arm, so the healds are a little slacker on the bottom shed. For light weight work, only one set of pulleys need be fitted to connect the bottom jack arm with the under-motion jack, but for heavy work, two sets of pulleys are better, as broader leather straps can be used. These pulleys are set half width distance with each other, and open spiral springs on the shafts at the front of the series of pulleys imparts less friction and more flexible movement to the pulleys. The centre arm of the jack has a button at either side for the bifurcated end of the connector D to link it to the vibrator wheel, E.

Connector.—The latest style is made of thin steel plates held together by five rivets, and opened out at either end and slotted. The outer end passes on to a button at either side of the wheel E, and gives a straight pull and push.

Vibrator Wheel.—The centre of the wheel passes on to a case hardened button on the vibrator lever H, the button being a little thicker than the wheel, so that when riveted with a washer, the wheel has rotary freedom. When carrying out repairs at this place, light blows are better than heavy ones. The wheel is furnished with a semi-circular slot, the ends of it coming in contact with a button on the lever which terminates the rotation of the wheel in both directions. The outer rim has two series of teeth, with gaps between the series. The top gap is equal to four teeth, and, when brought opposite the cylinder top or bottom, the cylinder passes without molesting it, and the corresponding heald shaft remains stationary. The bottom gap is only equal to one tooth, but enables the leading on tooth of the cylinder to pass in, and begin pushing the last tooth in the opposite set to those about to be turned by the teeth of the engaging cylinder. Both groups of teeth on the wheel have 17 cogs, but the cylinders which turn them have each 19, so that the last cog on the cylinder follows the last cog on the wheel. The cylinders are made of chilled metal. A connector weight rests upon the upper surface of all the connectors, and assists in pressing them home, and prevents rebound.

Vibrator Lever.—This is at H. It is open slotted at the outer end, and passes on to the bar I, where all the series are kept in position by a cap passing over the top. By means of a long lever which is cast with the cap, and fits snugly at the back inner end of the dobby, the cap can be turned so that any vibrator can be liberated from the engine. In the latest build of lever, the contact with the bowls on the lags M is secured to the lever by a trio of rivets. The three curves on its under side are to first raise the lever steadily, then keep it at its highest altitude, and then lower the lever gently until the lever rests at the bottom of the inner grate through which it passes.

Another special part is the small end that protrudes through the grate. When the lever is lifted by a bowl, the lock-knife J passes underneath, but when lowered, it passes over the top and holds it down until the wheel E has been fully turned by the operating cylinder.

When the small end is worn, it is better dispensed with, for when there is too much play between the top of it and the under side of the lock-knife, the wheel becomes too shallow in mesh with the bottom cylinder, and may injure its teeth.

Lock-knife and Cam.—The lock-knife J is a flat piece of steel, which tapers downward at the front. It is setscrewed to a movable framework at the back base of the dobby, and is fulcrumed at the bottom. On the same shaft is the cranked finger L, which receives its motion from the cam K on the shaft and in front of the bottom cylinder. The cam, by means of the finger, moves the lock-knife in and out. It is moved outward to allow the vibrators to change positions, and moved inward to prevent those at the bottom from rising up when the wheel is being turned. The cam and lag cylinder have to be timed to give the best working results to both. The lag cylinder must not begin to push up the vibrators until the lock-knife is clear of the ends of the levers, and the lock-knife has not to begin to cover the ends of the levers until they have changed positions. If the bowls begin to lift the levers too soon, then the ends of the levers and lock-knife soon become badly worn.

Lag Cylinder and Bracket.—

(1) The cylinder must be at the same elevation back and front to give an identical lift to all the operating vibrators.

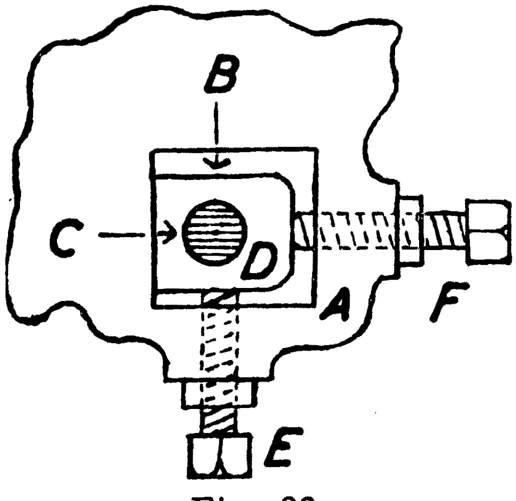


Fig. 92.
Cylinder Bracket.

(2) The altitude has to make the teeth of the vibrator wheels mesh well with the cogs on the top cylinder, but not to bind.

(3) The centre of each bowl has to be opposite the centre of its respective vibrator. When the sides of the bowls and the ends of the bushes become worn, the cylinder can be adjusted so that all wire or band packing can be placed between bushes at the back end of the lags.

For Fig. 92, A is part of dobby frame. B the square for cylinder bracket D. C is shaft of cylinder. E is setscrew for altitude for cylinder, and F for its security.

Escape Motion.—The driver of the lag cylinder is a 16-toothed wheel at the front of the top cylinder. It meshes with an intermediate wheel which may be called the timing wheel for the cylinder, for it gears into the cylinder wheel having 96 cogs. There are therefore 6 revolutions of the driving wheel to one of the cylinder wheel, the cylinder having 6 sections. The escape motion is at Fig. 93. At A

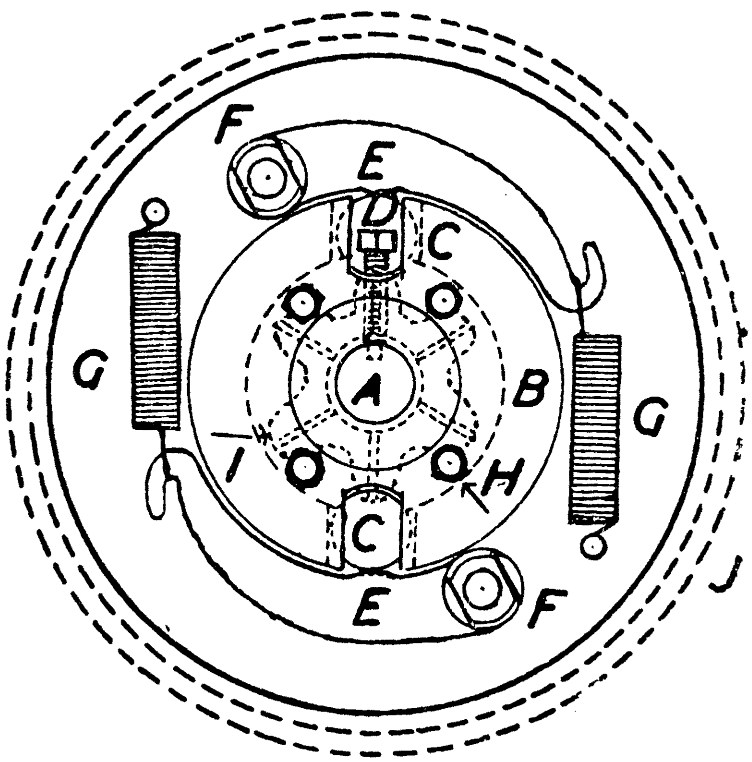


Fig. 93.
Dobcross Loom. Lag Cylinder Escape Motion.

is the shaft of the cylinder, the 6 ends of it being divided to receive the cylinder blades which fit into narrow grooves in the body of the cylinder shaft. Between every two blades, the bowls on the lags fall as the cylinder revolves. At B is the front plate and boss which is secured to the shaft of the cylinder by the setscrew D, and to the face plate behind by four small setscrews shown. Between the two plates are the circular discs C which rest in cavities in the back face plate, and by the levers E fulcrumed at F and the springs G connect the wheel J to the cylinder A. If the cylinder from any cause becomes locked, the discs are forced out of their cavities, and the cylinder remains motionless. When the obstruction has been removed, the discs are easily lodged in their holding places.

Shaft Levelling.—The Dobcross dobby is an open shed mechanism, but at times, all the shafts are required on the top shed. This is done by the aid of the cranked handle A, Fig. 94. This is fulcrumed at C, and fixed to the lifter B, which is triangular. When the handle is pressed down as

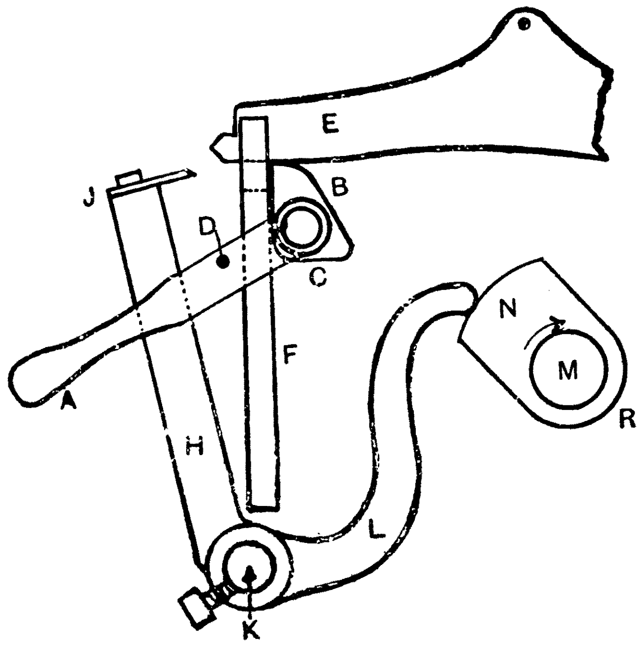


Fig. 94.
Shaft Levelling.

demonstrated, the long side of the triangle B is placed uppermost, and lifts all the vibrators E, so that the top cylinder can engage with all vibrator wheels that need to be turned. One turn of the large hand wheel in front of the bottom cylinder is sufficient to raise all the shafts to the top shed. The hole D in the handle is for one end of the spring which keeps the handle in or out of action. In this diagram is shown the lock-knife J on the framework H, with the cranked finger L setscrewed to the shaft K. The cam that moves finger and lock-knife is setscrewed to the shaft M. Its outer dwell imparted to the lock-knife when the vibrators are changing positions is at N, and the inner dwell when the lock-knife is holding down the ends of the vibrators is at R.

Reversing.—When picks have to be pulled out, they may be combed out, or extracted a pick at a time by using the reversing mechanism. This is demonstrated at Fig. 95. The first thing to be done is to pull down the clutch fork F, for by so doing, the clutch box is disconnected with the dobby. The clutch box is in three sections. The bottom part of C is a bevel wheel which gears into the bevel of the double wheel B, all of them being actuated by the spur wheel A on the crank shaft. At D is the centre section of the clutch box which is both keyed and setscrewed to the upright shaft Y. At E is the cap with its circular groove at

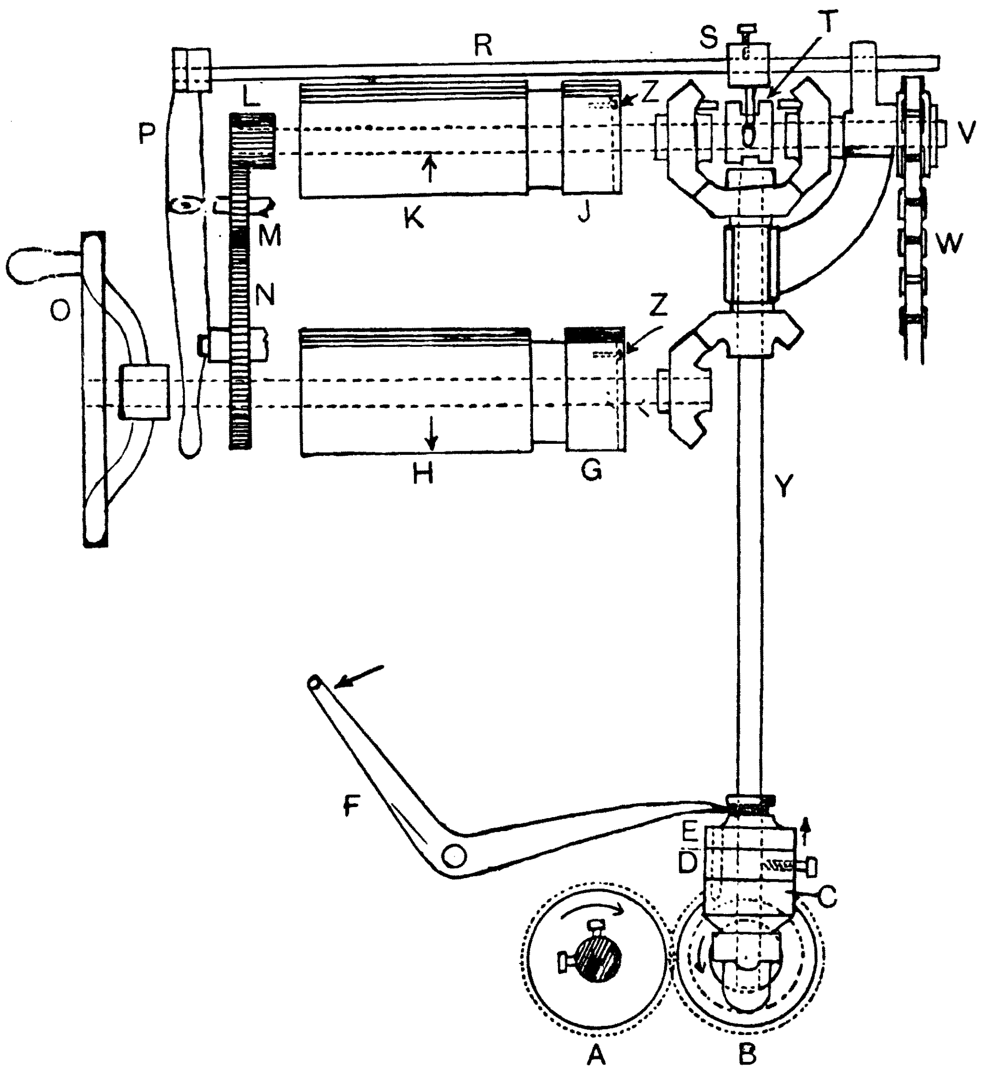


Fig. 95.
Reversing Arrangement.

the top to receive the ends of the clutch fork F. The cap carries a pin which is shown in outline on the left, which, when the cap is down, goes through the centre section, and penetrates the bottom one. When the cap is lifted, the pin is lifted clear of the bottom section C, and the dobby is then uncoupled from the crank.

The next thing is for the weaver to pull the long handle P towards her, for, as this is fulcrumed just above its centre, it moves the rod R to the right, and as the clutch casting

S goes with it, the clutch T is moved from contact with the bevel wheel on the left to the one on the right. The hand wheel O is then turned in the same direction as when weaving, and the shaft lags are reversed in motion.

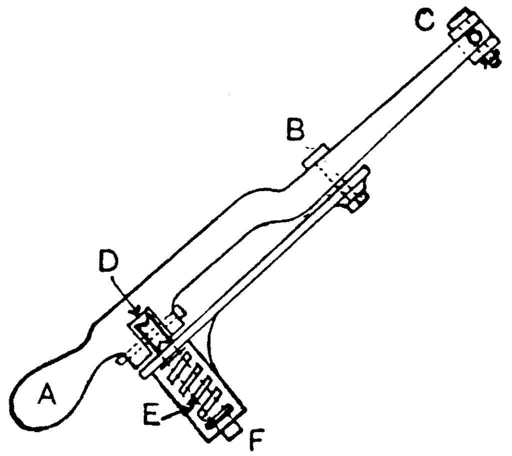


Fig. 96.
Reversing Handle.

The reversing handle is better seen at Fig. 96. Here, A is the lower end of it with the fulcrum at B, and the top rod connection at C. The handle bowl is in the recess at D, which depresses the spring pin F when pulled in either direction by the weaver. At E is the coiled spring that exerts pressure against the head of the pin, the top of which is inverted **V** shape to rest in the centre of the bowl.

Whip Pick.

The picking of this loom is the underpick motion.

Picking Boss.—This part is keyed to the low shaft by a key in a sunk keyway. The key must not go beyond the face side of the boss, or the constant push of the picking tappet may drive it out. The fixing of the boss has to be, that the picking bowl fully fits on the rim of the picking shoe. The boss has only one open slot to accommodate the single leg of the picking tappet, this leg being a strong and solid one 2 inches wide and $1\frac{3}{8}$th inches deep. The picking side of the leg should fit full face to the picking side of the boss, so the whole side of the leg takes the full weight of the pick, as at J. Arrow I is direction of picking tappet.

Picking Tappet.—In Fig. 97 the head of the picking tappet D is slotted to receive the stud of the picking bowl F. Both bowl and stud are case hardened to withstand wearing. At G is the locknutted setscrew which sets the position of the bowl stud which is braced up by a couple of locknuts. At E is the bottom shaft on which the picking tappet slides, and H is the substantial leg referred to.

Picking Shaft and Shoe.—The picking shaft is at A, and in one make, is $1\frac{1}{4}$ inches square, except at both ends where it is round to penetrate the bearer brackets back and front, the back one being at C. By wearing, this part of the shaft lets the shoe sink lower, and as the depression of the shoe is decreased, the power of the pick is weakened. To make up the loss, the shaft is taken out, the picking shoe and arm taken off, and the shaft placed so the worn part is at the top. The arm and shoe are then placed and fixed in their respective positions.

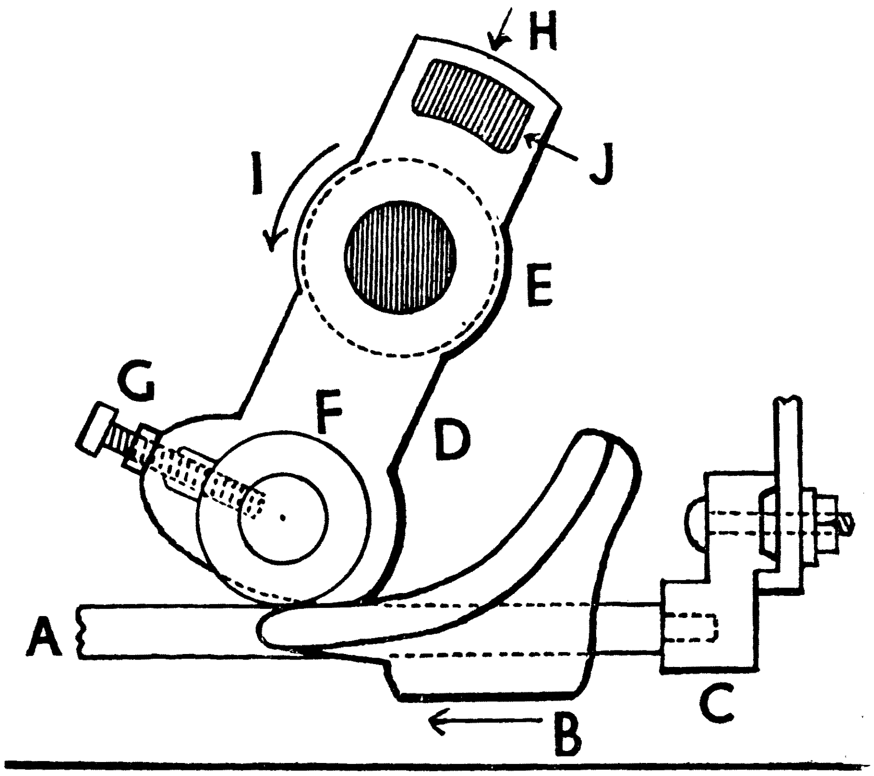


Fig. 97.
Dobcross Picking Tappet and Shoe

When the shoe becomes worn, the vigour of the pick is weakened but it may be partly or wholly restored by fixing it a quarter inch forward in the direction of the arrow B. As the shoe continues to wear, the process may be repeated until it has been moved forward an inch. It is then in its final stage of service. The further forward the shoe is placed, and the more violent is the pick. As to whether it is safe to continue may be judged by placing the hand on the guard of the speed change wheel. If the bump be too violent, it is better to replace the shoe rather than break cogs out of the driving wheels.

Picking Arm.—The arm is in two parts. The back one is doubly setscrewed to the picking shaft, and is toothed at the front so as to mesh with similar teeth on its companion casting. Both brackets are slotted for adjustment—the back one horizontally, and the other vertically, and both are bolted together. The upper front of the front bracket is open slotted for the reception of the picking stick bottom which is doubly bolted to it. The top of the stick at the back comes in contact with a leather pad on the framework at J, Fig. 98. The connection between stick and picker is by picking strap W, the picker being at K. The strap is first secured to the picker and then wrapped round the stick at H, its place being maintained by a couple of wire pegs. The working length of the strap has to begin to pull the shuttle

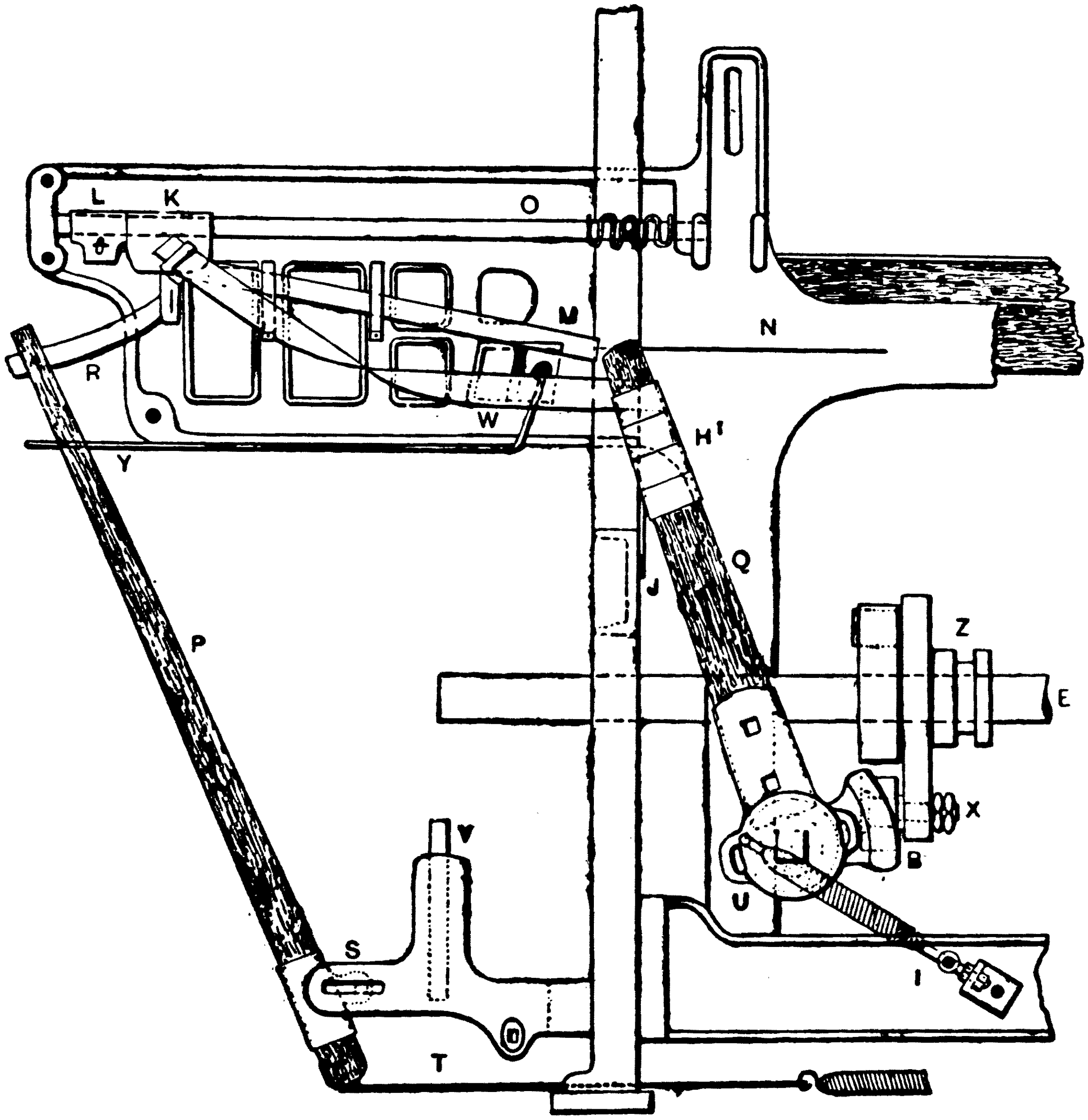


Fig. 98.
Dobcross Picking Stick and Checking. (Back View).

out of the box, when the crank has just passed its top centre. The minimum standard for strap W is 50 inches long and $1\frac{4}{5}$ inches wide. The picking stick after picking, is brought back by the pull of the spring I, and the picker is brought back by being connected to the pulling back stick P which is fulcrumed at S, and kept in position by the wire guide Y, and attached to the leather and spring at T.

The forward movement of the picking stick is limited by the picker on the spindle O coming in contact with the buffer on the spindle. The forward movement of the pulling back stick is terminated by coming in contact with a rubber behind the box.

On the spindle and behind the picker is the buffalo checker L, which is connected to the strap M and the checking wire N. These parts are controlled by the checking motion in the centre of the loom front.

Beating up.—The crank arms are capable of fine adjustment at both ends. The metal straps are served by **T**-shaped castings. The top of the **T** is placed vertically in a hollow part of the arm, and the fixing bolt passes through. The shaft of the **T** is horizontal and threaded, and into it passes a gas threaded screw bolt through a bore in the crank arm. This screw bolt is screwed moderately tight to draw the metal strap and holding bolt forward, and the latter is then braced up. The sley is held at the top by a hand rail, but at the bottom is a movable rack which is drawn forward by screw bolts in front of the going part. These bolts are best braced up a bit at a time to give uniformity of pressure.

The beating up of the weft is aided by the warp passing over a swing rail at the back of the loom, which is drawn inward at the beat up of the weft, and swings back again as soon as the reed recedes from the fell of the cloth. This system adds flexible weight and drag to the beat up, and makes it an excellent wefting loom for heavy weight fabrics.

Letting-off.—The unwinding of the warp is effected by a rod connected to the back of the sword, the opposite end of the rod being coupled to the double quadrant A, Fig. 99.

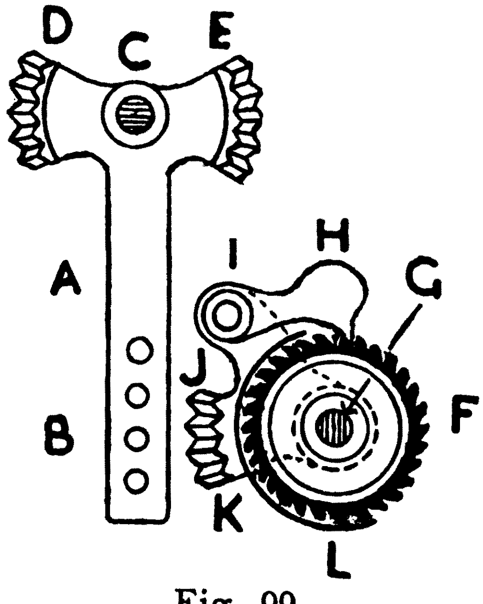


Fig. 99.
Letting-off Quadrant.

It is fulcrumed at the top centre C and has 5 teeth D and E at the end of either arm which engage with those on the quadrant which carries the letting-off catch H. There are a pair of these quadrants and catches. Though the double quadrant and its catches are made to move the same distance every revolution of the crank, the amount of warp let off varies, because the shield L restricts the operation of the letting-off catches. The shield is connected by a rod to a lever which is influenced by the swing of the back rail. When the rail moves in by the beat up of the weft, the shield sinks a little, and exposes more teeth to the catches, and when the rail moves outward again the shield advances. The standing position of the shield is controlled by lock-nuts on the threaded connection rod. F is let-off wheel and G shaft.

Taking-up Motion.—This is a positive motion, and run by a driving chain on a sprocket wheel at the back of the top

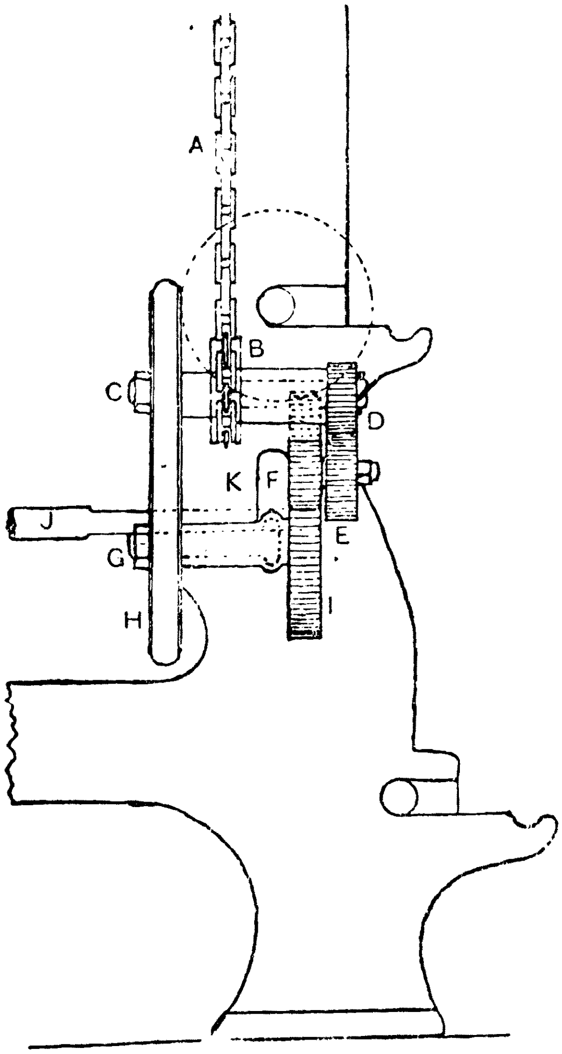


Fig. 100.
Dobcross Positive Taking-up Motion. (Back Part).

cylinder. The chain A, Fig. 100, passes round the sprocket wheel B on the stud C. This wheel is fixed to a sleeve at one end, and the pinion wheel D at the other. When the chain wears, it can be lowered by the stud C. The chain wears best when only moderately tight, and should be kept well oiled. The change wheel is at E, the gauge point being a tooth per pick. Behind it is the pinion wheel F that meshes with the wheel I on the stud G. The spur wheel K is keyed to the taking-up shaft J which extends the full width of the loom. The casting H has a curved slot so studs C and G may be set with exactitude. The taking-up section at the front of the loom is at Fig. 101. Here, J is the same taking-up

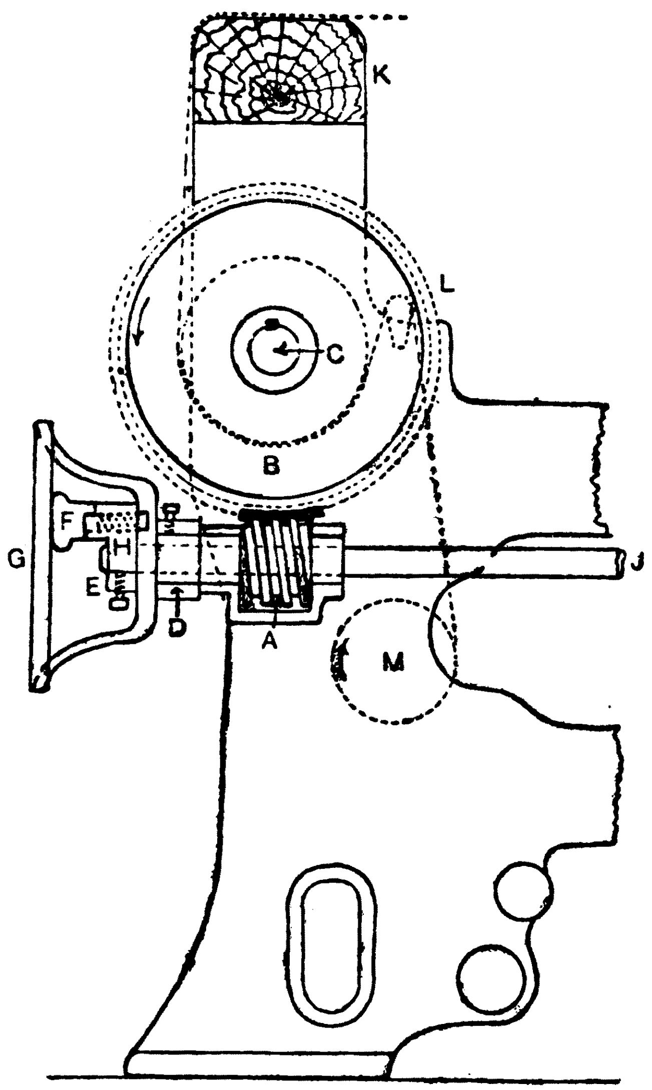


Fig. 101.

Dobcross Taking-up Positive Worm Motion. (Front Part).

shaft as in the previous illustration. On the shaft is the worm A into which gears the teeth of the large taking-up wheel B on the taking-up roller shaft C. The taking-up roller is given in outline.

Setscrewed to the sleeve of the worm is the handwheel G. To fix the handwheel to the taking-up shaft J, a small bracket E is setscrewed to the shaft, and carries the knob F.

The knob has a short spring on its shaft at H, and when weaving, the shaft of the knob penetrates one of a series of holes in the face plate of the handwheel as presented in the drawing. When the piece requires to be slackened, or the warp drawn forward, the knob shaft is pulled out of contact with the hand wheel, and the taking-up shaft remains stationary, but the perforated roller may be turned in either direction. The path of the cloth is shown in dotted lines. It passes over the breast beam K, round the bottom of the perforated roller, over the smoother L, and finally on to the cloth beam M. Fig. 102 gives the details for the winding on of

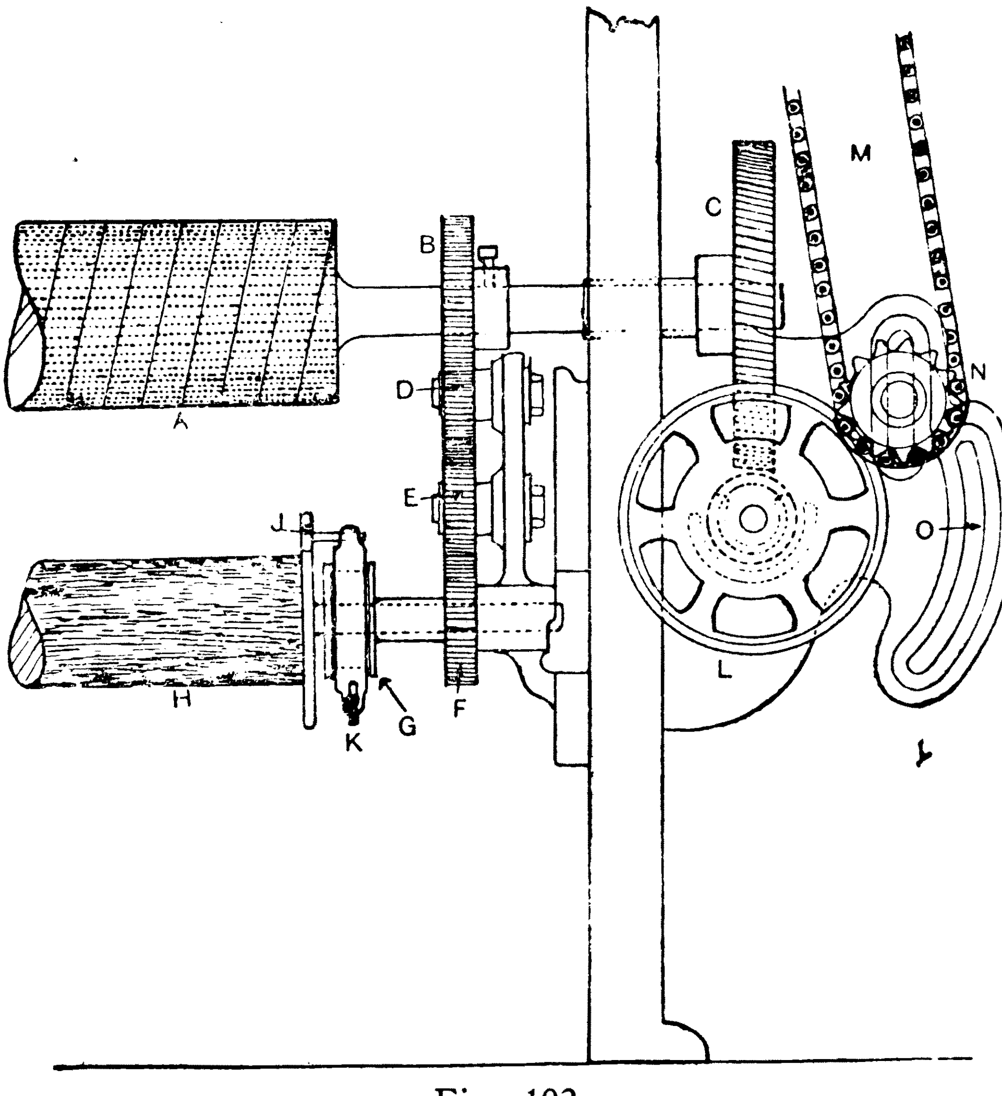


Fig. 102.
Dobcross Take-up with Cloth Roller. (Front View).

the cloth. At A is the perforated roller with the driving wheel B on its shaft, and C on the outside of the framework the taking-up wheel. At D and E are two intermediate wheels with 15 teeth each, but the bottom wheel F of the series has only 14 cogs. This wheel is sleeved, and carries the friction pulley G which is bored to receive the pin at the end of the handwheel J on the cloth beam H. On the pulley is the friction clip with its spring and wing screw K. By regulating the screw, the cloth may be wound on tighter or slacker, but is made keener as the cloth increases in weight and diameter. At L is the hand wheel, M the taking-up chain, N the sprocket wheel, and O the slotted casting.

Box Motion.—The drop boxes are made of mild steel, and are presented at Fig. 103. Each shelf is riveted at C to the framework of the box A and B as well as at the back. The malleable swells are at D, the series being held at the outer end by the long pin E. Each swell is provided with a curved spring G, by which the speed of the shuttle is

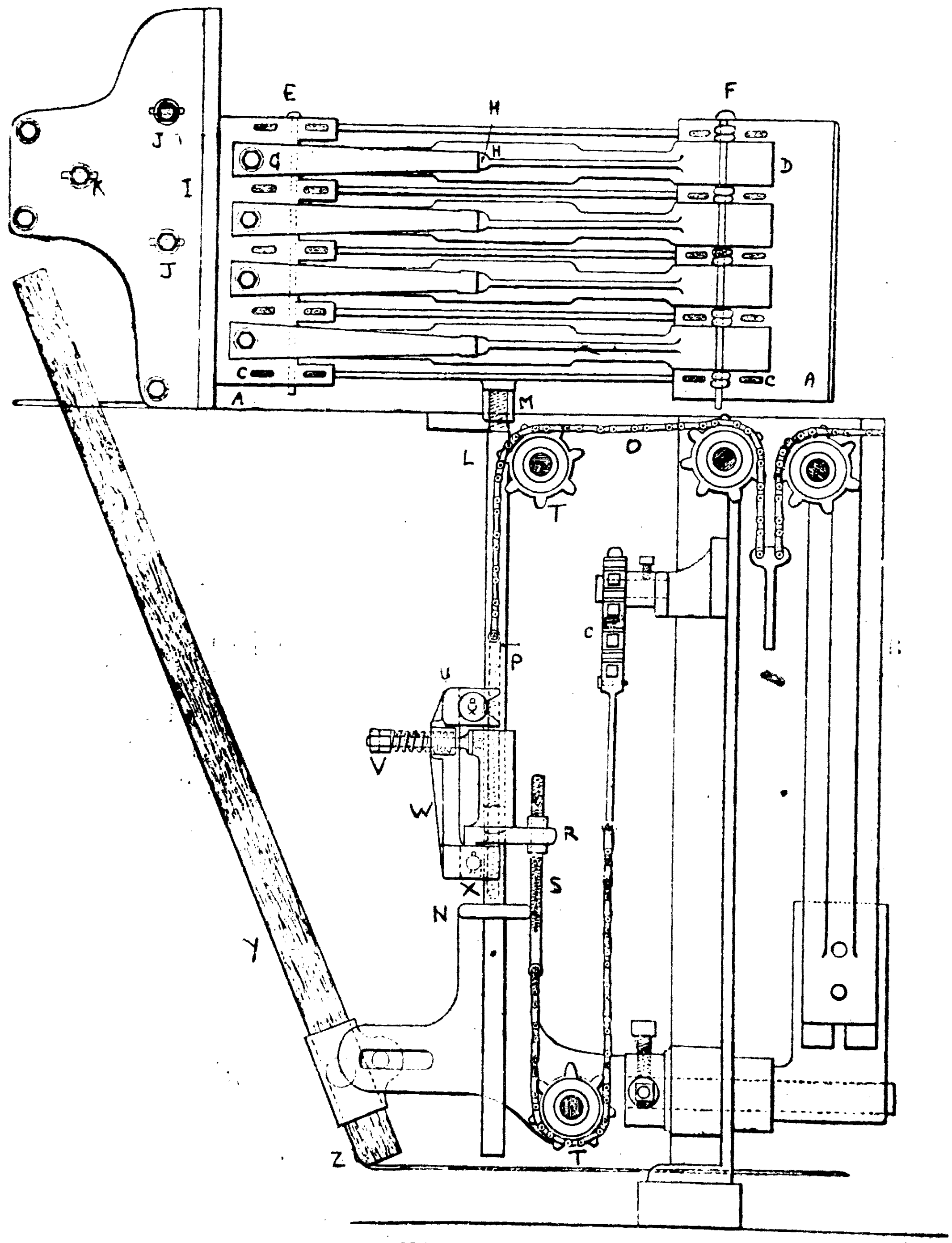


Fig. 103.
Dobcross Positive Drop Box Whip Pick Loom.

checked in the box, and flexibly held in its picking position. Spring and swell meet at H, and the swells are also served by the stay pin F.

The box moves vertically in slides, the inner one being setscrewed to the front of the sword, and the outer one being at I, and setscrewed to the frame work of the box.

The box should only have the least lateral freedom, but easily slide vertically. To the two bolts J, the bowls are fixed that keep the tips of the shuttles away from the face of the picker, and at K is the bolt that holds the casting containing the rubber that fits behind the picker. At L is the box rod, which, at the top, enters the threaded nipple M underneath the box. Below this point the box rod is square, and passes through the guide N on the upper part of the pulling back stick bracket.

As shown in Fig. 103, the chain O is fixed for the bobbin changing mechanism. For ordinary box work, the chain passes straight forward.

Escape Motion.—On the rod is the escape motion W to which is locknutted the lifting chain O, with the threaded rod P at the end, and the pulling down chain S, which passes through the holder bracket R. Whenever the lifting chain requires adjustment, the pulling down rod must be altered at the same time. The open link chains pass over sprocket wheels T, and in this way the chains are little worn.

The escape motion is fulcrumed at X, and the spring casting W carries the small bowl U at the top which fits into a groove on the shaft of the box. A pin passes through the opening in the spring casting W, and on it is the spring V which keeps the bowl in contact with the box rod. When the box is locked by a trapped shuttle, the bowl is forced out of its groove, and the box remains stationary. At Y is the pulling back stick, and Z the lower part of the stick with strap attachment.

Box Control.—The four boxes at either side of the loom are controlled by four levers behind the dobby. These are brought into service by bowls on the box lags which actuate vibrators and wheels in the same way as for shaft lifting. The cylinders G and J, Fig. 95, that turn the vibrator wheels are adjustable by setscrews Z. Their teeth may be set level with the cylinders controlling the heald shafts, but they may be set 4 or 7 cogs behind. The shed has to be set to suit the kind of work to be woven, but when so altered, the box cylinders must be adjusted to give the same timing as before the alteration took place. Whatever be the timing of the shed, the boxes must begin to change when the crank is at its bottom centre, and come to rest by the time the crank has reached its top centre. From that there can be very little variation.

The plan for box lag making is that the picking is on the first inside position, followed by the second and third boxes on the right side of a left hand loom, and the fourth and fifth positions are for the third and second boxes on the left side of the loom. Two bowls in the second and third position lift the fourth box on the right, and two bowls in the fourth and fifth position lift the fourth box on the left side. A bowl makes the loom pick from the left hand box, and a blank makes it pick from the right hand. The box connectors are made with a slot and pin for the divided end of a small arm to pass in. The upper part of the arm has spring pressure applied to it to force the connector home and prevent rebound. Each connector is fitted with a slotted slide so that the leverage to the boxes may be suitable adjusted.

Pick Jack and Slides.—Being a pick and pick loom, the picking slides or tappets are influenced by a pick jack and its spring rod. The upper part of the pick jack takes the end of the dobby connector, and its lower arm has on it the spring rod that passes through the end of the lever attached to the picking tappet. Strong and open spiral springs are placed on the rod above and below the arm on the picking tappet, the springs being confined by setscrewed collars. When in action, the picking slide has to fit body up to the boss, but when out of action the picking bowl must be quite clear of the shoe.

Making Box Lags.—Though the arrangement for using the boxes is a positive motion, it is better for safety, and for easy working, to lift or depress one box at a time rather than two, or two instead of three.

Three examples are presented.

Fig. 104 illustrates the best way of mixing weft, using three shuttles in two boxes at either end of the loom, and taking a pick from each shuttle in rotation. All three examples are for a right hand loom, and each one commences at the top, and the picking is on the right.

A bowl is for picking from the left, and a blank from the right.