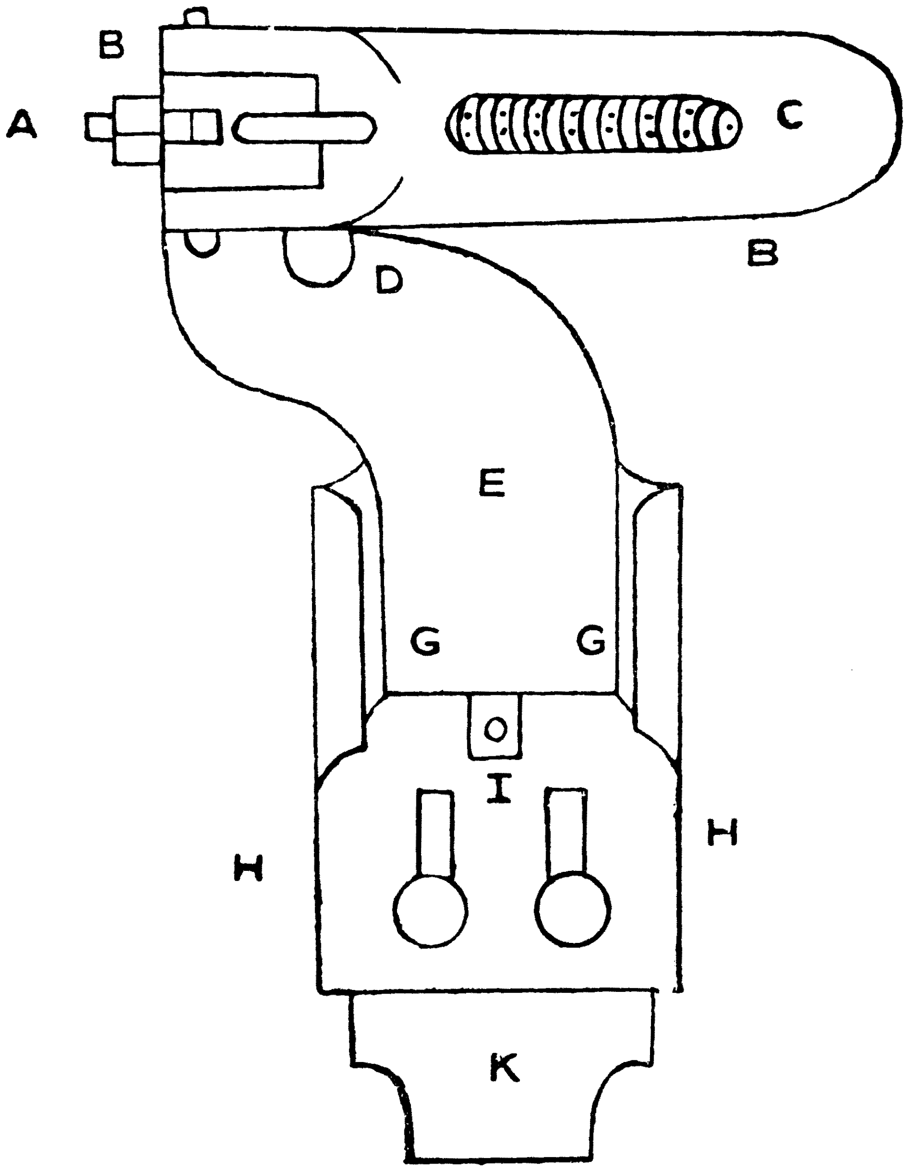

Fig. 213.
Ten Ringed Temple.

but is well covered at the bottom. This covering is very essential, for if the temple dropped on to the shuttle race when the loom was running, many of the pins on the rings would be damaged if improtected.

Advantage of Sloping Rings.—The rings C are made of brass to minimise friction, and are equipped with 24 radiating steel pins. These pins taper to a fine point so as to readily pierce the cloth, but not to damage it. When placed on the boss of the washer, they slope back at an angle of 72 degrees. This backward slope gives three advantages. It prevents the fabric from slipping over the top of the pins: it gradually stretches the piece $\frac{3}{16}$th inch: it gradually allows the piece to contract as when it was first seized.

Function of Cap.—The cap B being semi-circular in shape, covers the top part of the temple barrel, and though riveted to the head of the temple, can be swung back when necessary. It is held down by a wing screw attached to the temple head. The main function of the cap is to force the fabric on to the ring pins, and, when new, the piece is gripped by the pins for $^2/_5$th of the outer surface of the rings.

Regulating Barrel.—The barrel A is bolted to the side of the temple head, and can be adjusted as the head is slotted. The slot allows of a gentle or harder grip being given to the cloth according to whether the barrel is lower or higher in relation to the cap. When the cap is worn at the front, it becomes necessary to elevate the barrel, but the points on the pins must be clear of the under side of the cap or they will either be broken off, or turned into small hooks. Great care is required in fixing the barrel to the head of the temple, for it must fit in the centre of the cap. The cap is so shaped as to give a clearance of $^3/_{32}$nd inch at either side to the points of the pins. Behind the cap is a projection at D, which assists in keeping the cap firm during weaving.

Escape Motion.—Most temples are fitted with an escape motion, so that when the shuttle is caught between the temple and the sley, the temple casting will slide back, and prevent the breaking of the shuttle and the bulging of the sley. This is brought about by a very simple arrangement. The temple casting E is made with a slide at either side, and these fit into a sheet iron plate which is turned over at either side as shown at H. On this plate is riveted the spring I with its knuckle head, the head resting in one of the grooves on the under side of the temple casting. The strength of the spring is sufficient to keep the temple casting in its ordinary working position, but should there be any obstruction at the front, such as a piece of broken bobbin or the shuttle, the spring is forced out of its groove, and the temple casting slides back. The resetting is done very quickly. When the holding spring is weak, sometimes a piece of wood is wedged into the base of the temple casting, but this is very risky, for the temple is hindered in its retreat.

All escape motions for a temple should be made so as to allow the run back to be a little more than the width of the shuttle to secure safety. It must be either that, or for the temple casting to be forced out of position. The part K is the casting to which the sheet iron plate is bolted. The slots shown in the plate give a good range for the setting of the temple, which must just clear the sley when the going part is at its dead front centre, and also be in a parallel line with the fell of the cloth.

On the under side, it is bored to receive the curved end of the threaded regulation hook by which it is elevated or depressed. The under side of the temple barrel must just clear the upper surface of the shuttle race.

The casting K is placed in the centre of a stirrup-shaped casting, both being bored for a pin to pass through to hold them together. The stirrup is setscrewed to a rod held by brackets bolted to the inner side of the breast beam, for by the rod, the temple may be moved over a foot in length.

Fig. 214 is another type of temple which is much favoured for the Dobcross dobby loom. One of the differences

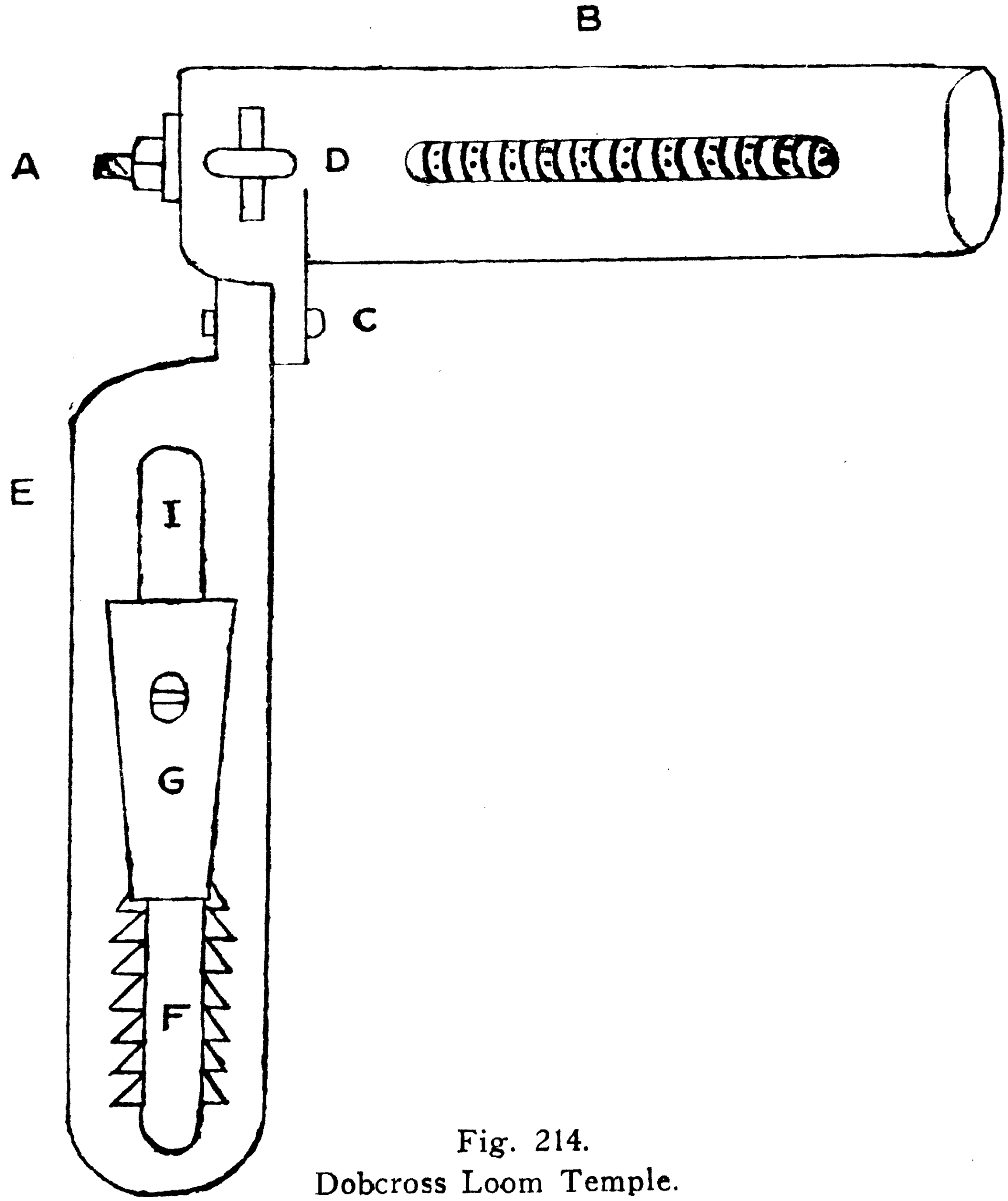

Fig. 214.
Dobcross Loom Temple.

is, that the temple cap and barrel are longer for a special purpose which will be explained later. At A is the end of the temple barrel, and B is the long oblong cap which is held to the head of the temple by the rivet C which gives it swinging freedom. At D is the wing screw that holds the cap over the barrel. The long temple casting is at E which is provided with the long slot I, so that in case of accident it can run back for more than the full width of the shuttle. On the lower part of E are a series of grooves at F, any two of which may be made use of by the end of the tapering spring G. This spring keeps the temple firm during weaving. The screw on the spring G enters the rod casting by which the temple is set to suit the width of the warp and the height of the shuttle race. If anything bulky stays between the sley and the temple, the spring G is forced out of the grooves, and the temple runs back as far as it can be pushed by the sley.

Now the ordinary temple of this make has 10 rings which are quite adequate for most warps, but for tender weft, and with quick interchangings like plain weave, the fabric is very liable to split at the inner end of the temple.

A cloth contracts most at the selvedges, and it follows that the nearer the centre of the cloth is approached, and the less contraction takes place. It is for this reason that the longer temple and cap is used to prevent tearing taking place, and this longer temple has 15 rings. What cannot be woven with 10 rings can be safely undertaken with the longer length and the larger number.

Inclined and Straight Rings.—The temple barrel containing inclined and straight rings works on a similar principle to the tapered variety, for it gives a maximum grip at the selvedge and a minimum one at the inner end. It has a stronger grip on the fabric than the tapered variety, because all its rings are the same size, though leaning at a different angle. The difference in angle is due to the structure of the washers, those at the selvedge having the greater incline while those at the opposite end are perpendicular. By this arrangement, there is little risk of any temple marks showing in the woven structure. This is a very serviceable temple where the general run of cloth is about 20 oz. or upwards, and where the loom is fitted with a perforated roller, as in some makes of the Hattersley and Dobcross looms.

Rings of same Size and Angle.—This structure gives a maximum grip the whole length of the barrel. It is made to take 8, 10, 15 or 18 rings, but the number usually employed is 10. The 10 ringed temple is specially adapted for those looms that have no perforated roller to take the piece before it is wound on to the cloth beam. In this structure of a Dobcross loom, the distance from the back of the temple to the back centre of the cloth beam is 28½ inches, and for the whole of that stretch there is nothing to assist the temple in checking the rapid contraction of the fabric. A temple with a particularly strong grip is therefore a necessity.

Setting of Temple.—Though hints for this have already been given, it will make matters all the more clear to concentrate the points. In the setting, four points have to be observed before weaving operations can be properly undertaken.

(1) The temple barrel A must be set parallel with the shuttle race if there is nothing in the loom, or if there be, it is made parallel with the fell of the cloth. If the inner end of the temple points forward or backward, the ring pins will be working somewhat across in the piece and have a tendency to tear it.

For the temple with the sheet iron plate, the exact pitch is obtained by slackening the two bolts that hold the plate, and then twisting the temple head to the correct position. Before bolting up, a straight edge is placed along the centre of the temple cap, as this magnifies any leaning of the temple.

In the Dobcross temple with the long slot, the adjustment if any is required is by the cranking of the rod of the temple, or by the insertion of leather packing behind one or the other of the bearer brackets.

(2) The temple bearings have to be adjusted so that the under part of the temple clears the shuttle race by at least $\frac{1}{8}$ inch. Any dropping after a good fixing is usually due to the weaver pressing down the temple cap when refixing after combing out. The temple has to be clasped with the hand instead of being pushed downward.

(3) The outer and inner position of the barrel must present a fairly even surface to the cloth, and if there be any divergence at all, it must be a slightly downward tendency at the point of the barrel. If this end points upward, it would raise the warp and cloth at that place, and might cause the shuttle to be thrown out of the loom. Were it to point downward too much, the threads at that place would be subject to unnecessary friction on the shuttle race, and be liable to constant breakage.

(4) The temple must also be set so that when the going part is at its dead front centre, there is a working clearance of $\frac{1}{16}$th inch between the sley and the front of the temple

cap. If set too far forward, the temple bulges the sley, or breaks the reeds, and if set too far back, the selvedge threads are subject to too much chafing.

For every new warp, the clearance of the shuttle race and sley by the temple has to be examined, for in light weight fabrics, the going part has less pressure to withstand, and goes a little further forward, but in heavy work, it is held back to its utmost limit.

Function of Side Spring.—The temple at Fig. 213 with the sheet iron plate has a bent spring screwed to the front of the temple bearer rod. The function of the spring is to prevent the temple head from moving forward when the loom is weaving.

In the making of heavy fabrics, or when the spring end has become worn, the spring pressure is too weak to keep the temple in its proper place. This weakness allows the temple head to move forward every time the going part recedes, and is then forced backward as the going part drives the last pick home. This unnecessary action wears away the sley at least an inch, makes the selvedge difficult to weave, and ultimately breaks the reeds if the fault is not discovered. The spring may be taken off and bent to increase the pressure, or a new one take its place, or an extra one be fixed.

Temple Marks.—This is one of the common faults made by the temple. They are caused by the ring pins forcing the warp threads out of their proper position in the piece.

Heavy cloths are usually free from this defect, but if made, they completely disappear in the subsequent scouring. Light weight fabrics are much more liable to the making of these marks. Providing the temple is properly set, the offending ring may be removed, but if the next one begins to mark the cloth, all the rings but two to hold the selvedge will need to be taken off the barrel before the marks disappear. For the weaving of a light weight fabric, two rings are sufficient to hold it.

Piece Tearing.—Sometimes a ring becomes choked with weft, which is usually due to the weaver not breaking the weft off close to the selvedge after changing the shuttle. The ring will then fail to revolve, or will only do so intermittently, and in this way the piece is torn. The temple barrel has to be taken off and the rings and washers cleaned and oiled, care being taken to keep washers and rings in the same position as before.

Defective Pins.—If one of the ring pins becomes bent by being hit, or by being placed too near the temple cap, it will loop or cut a thread or pick every revolution of the ring. This is usually shown at the back of the cloth. The bent part is either straightened or broken off by a pair of sley pliers, and if necessary smoothed off with fine emery cloth.

Effect of Worn Cap.—When the cap is well worn at the front, it fails to force the fabric sufficiently on to the ring pins, and allows the piece to contract at the fell of the cloth. This is all the more pronounced when weaving heavy cloth, and threads in or near the selvedges are constantly broken. If it can be allowed, the barrel may be elevated, but the best remedy is a well fit new cap.

Slack Sley and Temple.—When temples have been properly set at the commencement of a warp so that the last outer ring grips the woven fabric without making it curl over, it has sometimes to be altered owing to the selvedge curling. This is seldom due to the slipping of the temple, but to the movement of the sley. When warps have been beamed from a warping reel, the threads vary in the winding on the beam. If the sley be slack, the difference in the position of the threads on the warp beam moves the sley, which has to be made firmer to prevent it.

Walker and Bennett's Temple.—This has been given the name of the "Adaptable" temple, as it can be quickly altered in various ways to meet the needs of most textile textures. As presented in Fig. 215, it is very suitable for weaving the heavier type of woollen and worsted fabrics, but is adaptable for cotton, linen, silk and rayon.

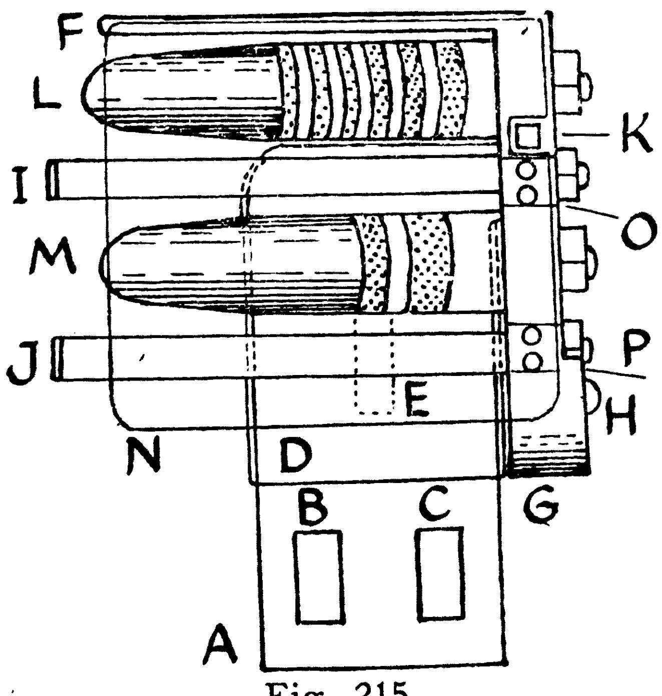

Fig. 215.
Walker and Bennett's "Adaptable" Temple.

Construction, Pressure Lever and Plate.—Fig. 215 shows the top view. At A is the sheet iron plate with its slots B and C, by which it is bolted to the bearer casting, and set to be parallel with the fell of the cloth. D is part of the strong malleable body of the temple, and E the spring that holds the temple forward in its weaving position. F is the steel plate that takes the place of the ordinary temple cap. Its inner side is free from the spikes on the rings on the front barrel. When fixed for weaving, its bottom edge is within $\frac{1}{8}$ inch of the bottom of the washers on the temple barrel. It is rounded off at the bottom so as to do no injury to any kind of cloth. It is an inch deep at its outer end, but only $\frac{1}{2}$ inch at its inner end. Up to the second spiked ring it is straight at the bottom, and gradually tapers upward, and so eases the pressure on the cloth.

The pressure lever and plate are in one piece the lever G extending to the top. It is pivoted on rivet H, and when liberated from the holding setscrew K, can be swung up in the arc of a circle. The pressure lever carries two studs that are screwed into the downward parts of the lever. On the studs are steel bushes at I and J which revolve by cloth pressure, but do not glaze the cloth. Each bush is 3.7 inches long and $\frac{3}{8}$ inch diameter. The screw studs pass through the frame and then held by a nut. As seen, the bush I is between the first and second barrel, and bush J behind the second barrel. They apply pressure to the cloth, and cause the spikes on the rings to have a firmer grip. The distance between the two bushes from centre to centre is $1\frac{1}{2}$ inches. The overall length of the pressure lever is four inches.

Construction of Barrels.—Both barrels L and M are bolted to the main and malleable structure of the temple. The first barrel L in Fig. 215 is 3.6 inches long, and the bossed washers take up 1.6 inches. The two outer brass rings have each 25 rows of diagonally placed spikes, each row having 5 spikes. The third ring has 25 rows and 3 spikes in a row. The other three rings have each 14 rows with two pins in each row. The first rings lean backward at an angle of 75°, the second at 72°, and the other four at 67°.

The second barrel M is about the same length as L, but contains only two rings. The outer ring has 30 rows and 6 spikes in each diagonal row. The second ring has 30 rows with 4 spikes in each row. The outer ring in M, leans backward at an angle of 72°, and the inner one at 67°. The first washer on barrel L has a top width of 0.3 inches, but the first washer on M has a top width of 0.5 inches, and conforms to the contraction of the cloth. The distance between the two barrels is 1.6 inches. The inner tapered end of the first barrel is 1.7 inches long, but on the second barrel it is 2.3 inches long, and has a sharper taper which relieves the pressure on the fabric. The advantages of the sloping rings has previously been detailed.

The barrels and bushes are covered with a transparent synthetic guard at N. Fixed to the guard are two small clamps at O and P. The guard is easily removed and replaced. A small piece is cut out to allow the setscrew K to hold the pressure lever and plate in their weaving position.

Fig. 216 is a side view of the temple and is lettered like Fig. 215. At A is the sheet iron plate with its spring at E, and its turned up sides for the main casting D to slide into.

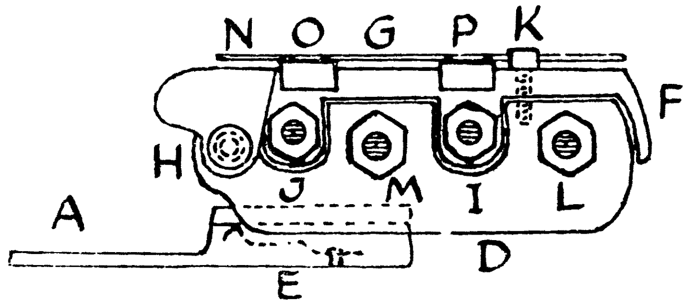

Fig. 216. Side View of "Adaptable" Temple.

If ever the shuttle is caught between reed and temple, the temple slides back and prevents serious damage. At F is the pressure plate and G the pressure lever is underneath the synthetic guard N with its clamps at O and P. H is the rivet for the pressure plate G, and K the setscrew that secures it, M and L are the bolts that hold the barrels, and I and J the nuts that secure the bushes, these latter being part of the pressure plate.

Settings.—There are four.

1. The pressure plate F should be from $\frac{1}{16}$ to $\frac{1}{8}$th inch clear of the reed where the reed is at its front centre.
2. The centre of the first barrel has to be in a parallel line with the cloth fell.
3. The under side of the temple has to be clear of the shuttle race.
4. The outer end of the outer ring on the first barrel must grip the selvedge, and the cloth not to be more than a $\frac{1}{4}$ inch beyond. There is then no curling over of the cloth, and no rings are idle.

Alterations.—As explained, the temple as presented is for heavy woollens, worsteds, cotton duck, sail cloth, linen and jute fabrics.

For lighter weight fabrics, the back temple and bush are taken off, and for lighter goods still, the back temple takes the place of the front one, with only one pressure bush. For the weaving of rayon another barrel is substituted that has only one spiked ring, though here again the second barrel can take the place of the first one, and the inner ring taken off. If desired, other barrels are fitted to suit special work without removing the temple from the loom.

CENTRE SELVEDGE MOTIONS.

The original inventor of this motion is Mr. J. Fairburn, Textile Engineer, Trafalgar Street, Burnley, Lancashire.

The centre selvedge motion is a very necessary adjunct to the fancy worsted trade, and to other textile manufactures when two narrow cloths are woven at the same time in a wide loom.

As far as worsted fabrics are concerned, pieces for this trade are woven in wide looms with a reed space from 76 to 90 inches. In the numerous ranges of patterns issued every season, there is often the same design and the same wefting plan, but the colours of the warp and the warping plan, and even the drafting may be different. In ordering, merchants may request narrow or wide width pieces, and if orders are such that two narrow pieces can be woven at the same time, then a centre selvedge motion will be most useful. Such pieces are known as " split ups." When eventually two narrow pieces are divided, if there were nothing to hold the outer selvedge threads in each fabric where split, the threads could easily be pulled out or disarranged, neither of which is to be desired.

The centre selvedge motion prevents either of these things taking place, because the edge threads on what may be termed the double selvedge are made to weave like a simple gauge crossing. This moving of one series of threads, first to the left and then to the right of adjacent stationary threads, binds the warp and weft together, and makes a secure edge. The mechanism to secure this is shown in the two illustrations.

Fig. 217 gives the side view. The mechanism is made in four depths of needles and traverse which are constructed to meet the position the selvedge motion will occupy, and the depth of shed the threads will be expected to make. The range varies from 3 to 6 inches, but the mechanism in each construction is on the same principle.

Whenever possible, the selvedge motion should be placed at the front, for the threads they weave then make the best shed for the shuttle to pass between. This is not always possible, and it then follows that if placed at the back of the healds, that the more shafts there be, and the bigger must be the vertical traverse of the needles that hold the threads. If the threads make too small a shed, the shuttle may damage them, and the effect in the fabric is spoilt.

What is done is to adjust the motion so the bottom threads are above the shuttle race, but not so the shuttle can pass under them.

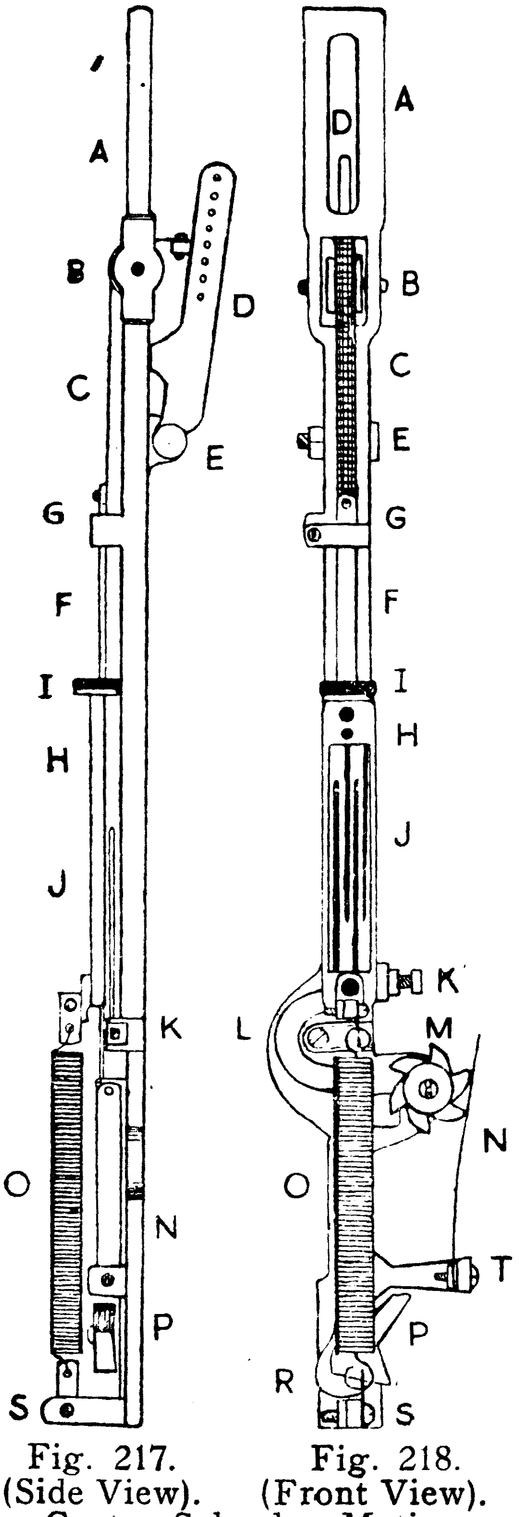

Fig. 217. (Side View). Fig. 218. (Front View).
Centre Selvedge Motion.

In both diagrams the lettering of the parts are alike, but in the side view, some parts are not visible that can be seen in the other, which explains the omitted letters in the first one.

At A (Fig. 218) is shown the long slot at D which has a depth of 4 inches, and as this is where the motion is secured, the slot gives a good length for adjustment.

Method of Setting.—In setting, the threads are passed through the needles and sley and tied tight at the front. The motion is then moved on the angle iron to which it is bolted, until the threads forming the bottom shed are an $\frac{1}{8}$ inch above the shuttle race. At B is the bowl over which the tape C runs that is connected to the pulling lever D, and is fulcrumed at E. The lever D is made with 8 holes, any one of which may be used to couple the lever to the handrail, the outer holes giving the larger movement. The lift imparted to the needles has to be such that the back set of needles change their lateral position, and this is only accomplished when the rubber I, touches, or just clears the guide G when the crank is at its front centre. The quickest setting is to place the crank at its dead front centre, and then adjust the connecting band so the lateral movement of the needles take place.

When the crank is at its back centre, the connecting band or leather is slack, and the lever D rests against the main casting as shown in Fig. 217.

Function of Needles.—At F is the first flat connecting rod which is the means of connecting the tape C to the brass needle case H to which it is riveted. As this case must move up and down at least 4 inches every pick, and being very smooth, it exerts the least friction on the warp at either side of it. The needle case H would appear to have 4 needles, but it has only two, and these have their heads downward. The other two are connected to the rocking shaft L which is indicated by the semi-circular curve, and is fulcrumed at R. The needles are highly tempered and exceedingly smooth, and have pointed ends that are rounded off. Moreover, they are grooved on either side of the eye lengthwise, so as to have a gentle action on the threads.

On every pick, the needle case H is lifted and dropped in precisely the same way, but the upright needles move laterally, though the movement is only $\frac{1}{4}$ inch. This alteration occurs every pick.

In Fig. 218, and commencing from the right, the top needle is 1, the bottom 2, the top 3, and the bottom 4. On the next lift, however, the reading would be bottom 1, top 2, bottom 3, top 4, which is the reverse of the other.

Star Wheel.—The alteration is brought about by the catch P turning the star wheel M when the lever D is pulled forward by the handrail. It will be observed that the turning of the star wheel cannot take place until the needle case is at the upper end of its movement, when the two sets of threads are clear of each other. Behind, and cast to the star wheel, is a small tappet that has 3 rises and falls which coincide with the 6 cogs on the star wheel. The star wheel revolves on a screw stud secured to the framework of the selvedge motion, and the rocking shaft is kept in contact with the tappet by means of the arm T which forms part of the rocking shaft, and the pressure of the curved spring N. This spring performs the double function of checking the motion of the star wheel as soon as turned, and keeping the rocking shaft in contact with the tappet at the back.

When the catch P has turned the star wheel, it is tilted upward by the next cog as it descends, but drops back to its stationary position by its own weight, the heaviest part of it being at the bottom. As the selvedge motion is negative in action, there is need of the spring O to bring it down after being lifted. This spring has not to be a strong one, but one that will stretch well, and has a good recovery. The bottom end is secured to the short arm S, and its upper end is attached to the needle case. There need only be a small margin of pull when the needle case is at its bottom limit.

Setting of Rocker Shaft.—A very special part of the setting has to do with the adjustment of the rocker shaft needles, for these must fit as near the centre of the gaps in the needle case as can be arranged. This setting is obtained by the locknutted setscrew K, for the point of the screw comes in contact with the forward part of the head of the rocker shaft. All four needles must be perfectly straight, and kept so. It is only on rare occasions that the ends of the needles require polishing with fine emery cloth, for when threads break out, it is either for lack of proper needle adjustment, inadequate tension on the selvedge bobbin, or a poor adjustment of the motion. The ends of the spring O, occasionally snap, but that is easily remedied so long as the spring is not entangled in the warp.

It is better when the weaver makes an early discovery when anything is amiss, but usually, there is no pulling back required when the threads have failed to act.

Selvedge Threads.—The threads used for this purpose ought to be of good strength and quality, and are wound on a flanged bobbin so it can be weighted. Two threads are placed through each needle eye, so that 8 threads are essential. They are threaded through the dent next to the warp, and form a very neat edge. Whatever kind of healds are used for warp, space has to be left between the two centre selvedges that is about equal to the full width of the needle case. There is then only a minimum friction on the ordinary selvedge threads.

The selvedge motion from which the diagrams were drawn was one with a needle case lift of 4½ inches, and the length over all was 33 inches.

Chain Selvedge Motion.

Another motion is depicted at Figs. 219 and 220, which is worked by a chain on the doup principle.

Both diagrams are lettered alike, but there are different positions of shafts and threads. The ordinary warp is given in outline and the extra threads are solid.

In Fig. 219 A is the back rail, and B the warp, with C the thick lease rod and D the small one. E and F are the ordinary heald shafts. Then G may be named the doup shaft, and is only a skeleton shaft to weave the outer selvedges. On this, two healds are tied up in the centre for the weaving of the safety edges. Ordinary heald eyes are employed, and are placed at the same pitch as the others. An ordinary doup is really only half a heald, but in this arrangement, it takes the form of a very small and flexible

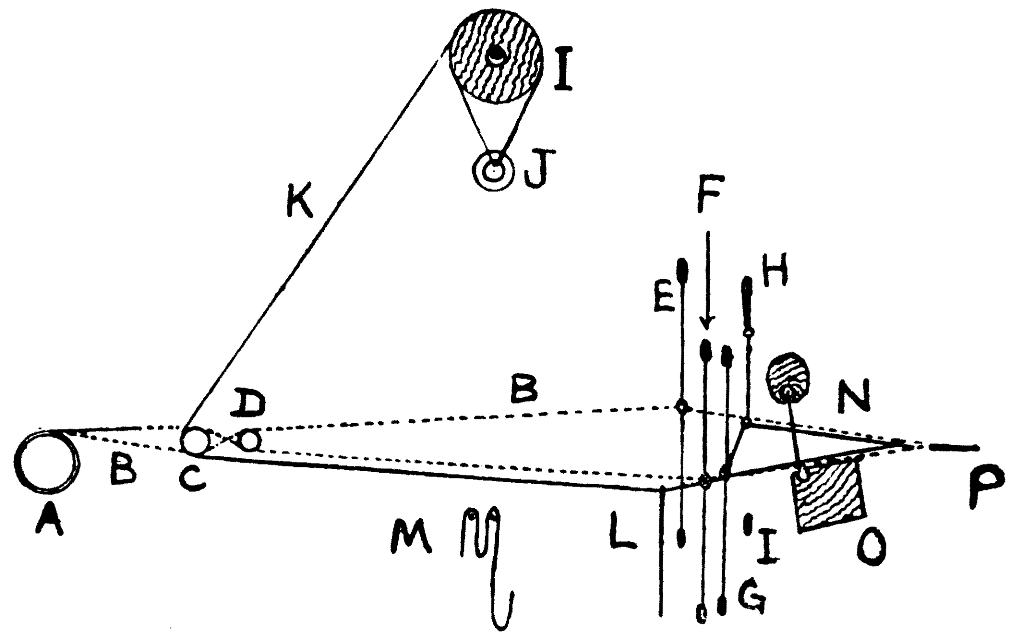

Fig. 219.
Centre Selvedge Chain Motion. (Doup Shaft Up).

chain with a very small ring at either end. It is four inches long, and is suspended from the heald shaft H by a heald band. When the doup shaft G is level with the doup H on the top shed, the bottom ring on the chain is set just below the heald eye on the doup shaft. It is not connected with the heald shaft I, for this is only used for the weaving of the outer edges for the selvedge.

Bobbin and Weight.—The threads which are to be lifted first on one side and then on the other of the stationary threads are wound on a flanged cheese I, the flanges being grooved to hold the weighted brake band J. The weight is only small and has to be experimented with to obtain good results. The distance between cheese and weight has to be short to prevent the weight swinging.

Wire Grid.—Before the threads from the cheese are placed in position, a wire grid is made and fixed to the central support of the crank shaft. As shown, this grid at M is shaped like the letter **M,** the long leg of it being looped for adjustment. The two upper loops receive two threads each from the warp and two each from the cheese. The grid is fixed so that its upper surface is just clear of the underside of the bottom shed, for the angle then formed by the threads is at its easiest for working and is shown at L.

Path of Selvedge Threads.—There are four groups, but only two need be explained, as the other two groups are duplicates and form the other edge of the selvedge.

Two warp threads are passed underneath the back lease C, through the grid L, and then through the reed. They do not pass through any heald as they are stationary threads. The cheese threads K should come from the top of the cheese as shown, for they cannot then come in contact with the weight. They pass behind and below the back lease rod C instead of over the back rail because the lease rod imparts more oscillation to the threads. They are put through the same slot in the grid L, and then enter the heald eye on the doup shaft. As the warp threads pass on the inner side of the doup shaft heald, the cheese threads pass underneath them, and then through the bottom ring in the chain. They then enter the same dent in the sley as the warp threads and are secured for weaving.

Weaving Positions.—In Fig. 219 the chain doup H is lifted and the doup shaft G is on the bottom shed. The necessity for slackness of the cheese threads is apparent, for the doup shaft is holding the cheese threads down, whilst the chain doup elevates them on the right side of the stationary warp threads. The shed is smaller than the ordinary warp, but large enough for the passage of the shuttle. The stationary threads are lifted a little above the shuttle race, and the crossing threads are a little below the top shed.

In Fig. 220 the positions of all the shafts are reversed. The doup shaft is now raised and the doup H is depressed.

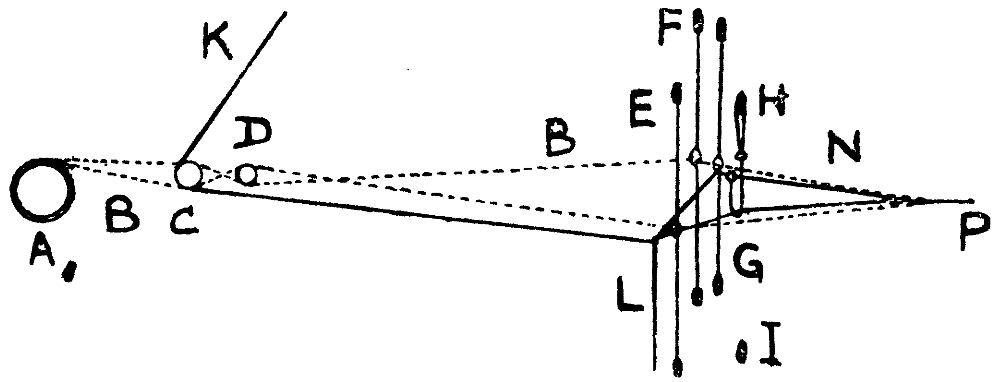

Fig. 220.
Centre Selvedge Chain Motion. (Doup Shaft Down).

The doup shaft has elevated the cheese threads on the left of the stationary threads, and by the doup descending, the chain is looped underneath the stationary threads. The angle now formed by the cheese threads is from the grid to the doup shaft, whereas in Fig. 219 it is from the doup shaft to doup. At O is the going part, N the front shed and P the cloth.

When carefully adjusted, the centre selvedge threads weave just as well as the ordinary warp and a safe edge is made at very little cost. As little weight is required for doup and doup shaft, the ordinary springs on the under motion are substituted by much weaker ones.

WEFT FORKS.

A weft fork that is kept in good order is an excellent aid to any weaver, for it curtails the making of waste, reduces bad setting up places, and promotes production. Though there are a number of very reliable mechanisms which differ in their mode of action, the principle in each case is much the same. These are: —

(1) Two, three or four prongs to come in contact with the weft.

(2) A catch arrangement to come into play when the weft fails.

(3) A mechanism that will stop the loom.

There are four chief styles each of which will be considered.

(1) Tumbler Weft Fork.

Though this is the oldest of the four, its merits are such that it is extensively used to-day. It is most in evidence on tappet looms. An outline of its parts are given at Fig. 221.

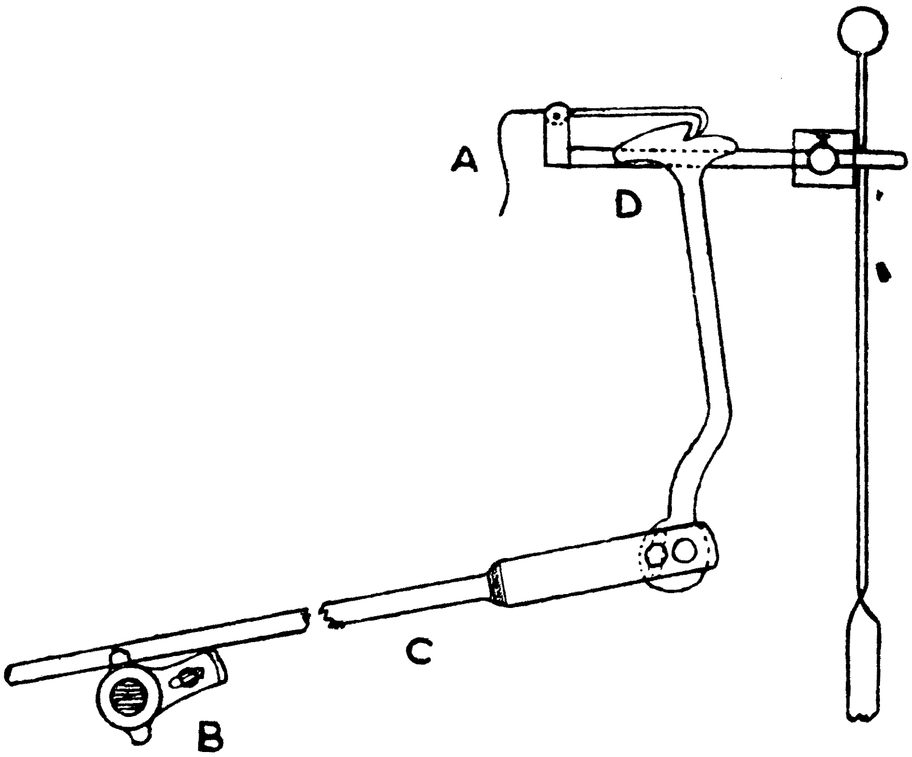

Fig. 221.
Tumbler Weft Fork.

At A are the three prongs which pass through a grate screwed to the end of the sley rack, and at the belt pulley end of the loom. It is usually sufficient if the prongs pass through the grate an $\frac{1}{8}$th inch, though this distance has sometimes to be reduced for tender single twist weft. This distance beyond the grate is when the crank is at its dead front centre. The fork is fulcrumed as shown in the drawing by a screw passing through it, the screw having a fine gas thread, and bridges the distance between the two uprights of the holder. The weft fork must swing freely, but have very little lateral movement, for if so, the prongs might come in contact with the grate, and make the fork of non-effect.

The fork has three settings: (1) The forward setting is that beyond the grate mentioned; (2) Each prong must be in a parallel line with the grate, and fit in the centre of the opening; (3) Its altitude must leave the top of the fork free from the top of the grate, and the bottom of the prongs free from the groove in the shuttle race, both when stationary and tilted. All three settings are obtained by the knob casting which is shown in front of the setting-on handle.

At the opposite end to the prongs is the catch, which is made to slope inward, and rests upon the hammer head D when out of action. It is lifted clear of it when the weft passes between the prongs and the grate, for then, as the going part moves forward, the weft presses the prongs backward and the catch is tilted upward. The further the prongs pass beyond the grate when the going part is fully forward, and the more violent is the action of the fork. All that is necessary is for the catch end to be lifted clear of the hammer head, with a due allowance for a little slacker weft.

The hammer D has also three settings: (1) Its altitude has to be such that the shaft of the fork is about level as shown in the diagram. The prongs are then about vertically parallel with the grate. This position is obtained by the casting into which the rod passes that forms the fulcrum for the hammer shaft, as well as the bayonet C. This casting is bolted to the framework of the loom; (2) The lateral position is obtained by the fulcrum rod which is set so the catch of the fork is in the centre of the hammer head. This cannot always be brought about by keeping the shaft of the fork straight, but as it is of a wiry nature, it can be cranked with the pliers to obtain the central position. (3) The forward position is obtained by means of a curved slot at the base of the hammer shaft, for at the base, the hammer shaft and bayonet are bolted together. The distance between the raised point of the catch on the fork and the edge of the cut on the hammer need not be more than $\frac{1}{8}$th inch. The bayonet C has to be of such a length that when the tumbler B is in the opposite direction to that given in the drawing, the end of it should be a couple of inches beyond. There is then no catching by the tumbler whenever the loom runs back.

The tumbler B which is clamped and setscrewed to the low shaft is in three parts. There is the bottom curved section which is setscrewed at either end to the upper one, and carries the timing setscrew. The second section has a slotted arm, and it is to this that the tumbler is bolted. The tumbler has a rounded upper surface, for it is this that lifts the bayonet every revolution of the low shaft. The height of the tumbler regulates the movement of the bayonet and hammer head. The movement of the hammer head has to be sufficient to pull back the weft fork so the flat lever which holds the knob casting pushes the setting-on handle out of its niche, and so stops the loom. The tumbler must begin to lift the bayonet when the crank is at its front centre.

This kind of weft fork only acts every other pick, and as it is at that end of the loom where the weaver changes the shuttle, care has to be taken to avoid hitting the prongs, for if bent, they may sever the weft, or fail to stop the loom. There is a further point worth including. In very wide warps the utmost room is taken, and so much so at times, that the prong nearest the warp has to be broken off. The weft fork will act with two prongs, but the brake brush in the shuttles may have to be made stronger to make the weft tighter and prevent the loom "slipping off."

Centre Horizontal Weft Fork.

The main parts are presented at Fig. 222 and is the patent of Brook and Pattison. This weft fork acts every

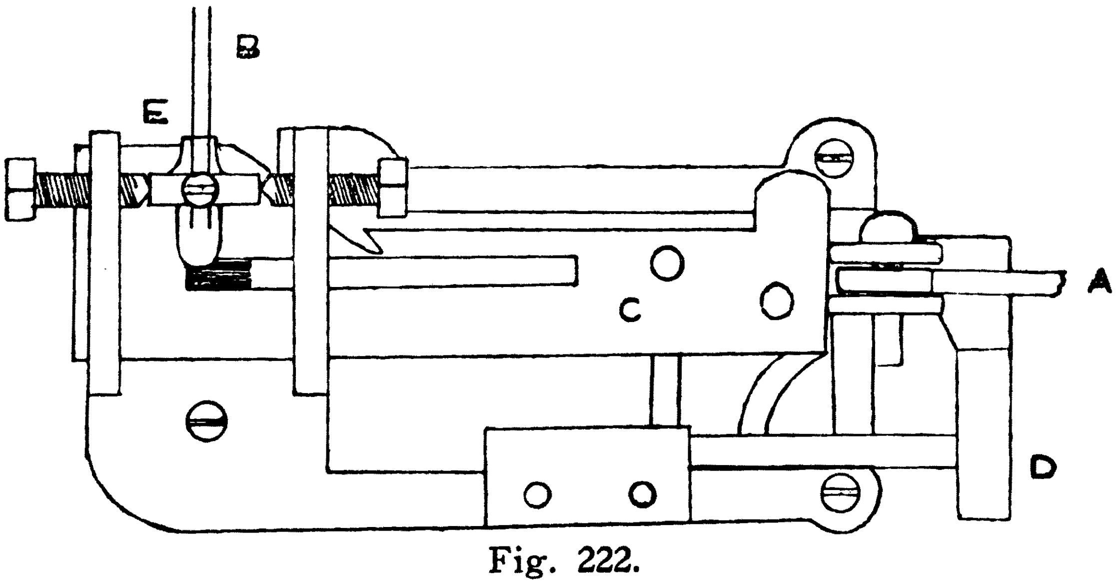

Fig. 222.
Horizontal Centre Weft Fork.

pick, and most of the parts are made of brass to bring friction to a minimum.

At A is the connecting rod which is looped at this end, and is held to the slide C by the pin shown. At the opposite end it passes through a swivel, the leg of which oscillates in a casting corkscrewed to the underside of the breast beam. The rod has a swaged collar about three inches in front of the swivel, and this space is spanned by an open spiral spring which keeps the rod forward when weaving, and the slide takes its full run. The rod gives its best service when 18 inches long, for then the movement of the slide is both steady and efficient. The position of the slide C is set by the casting holding the swivel, which is fixed when the going part is at its back centre. When in this position, a shuttle is placed behind the raised prongs B, the back of the shuttle being against the sley. The prongs have then to clear the top of the shuttle front $\frac{3}{16}$th inch.

To the open brass framework of the slide, the mild steel plate C is riveted. As will be observed, it passes through the two projections which hold a pair of setscrews. The inner centre part of these projections are cut out to let the small bar on the steel plate slide through. The function of this bar is to prevent the tippler E from toppling over, but so that it can rise up on the inclined part of the slide, it is made to taper at the shaded end.

The inclined piece of the steel part of the slide ends in a cut. It is this which seizes the upper part of the tippler when the weft fails, and in doing so, both slide and rod are prevented from going forward. As the going part moves up to the fell of the cloth, the spring on the rod contracts, and brings the part D opposite the knocker-off, and when this is forced backward, the loom is brought to a stop.

The tippler E has two shallow cuts on its face, and in these are placed the two prongs B. These prongs are elevated when the slide is out as shown, and, when set as mentioned, are high enough to miss the shuttle as it passes underneath. As the going part moves forward to the fell of the cloth, they gradually sink into the cut made for them in the shuttle race. When the weft is laid in the shed by the shuttle, the drag upon it holds up the prongs until the cut in the slide has passed the catch on the tippler, and the loom then continues to weave, and the weft slides off the ends of the prongs.

There are several important points in the fixing of the tippler which must be mentioned. The two setscrews upon which it swings are centrally pointed, and while they let it swing free, it has to have the least lateral freedom. The setscrews have also to be set so the prongs fit centrally in the groove in the shuttle race, for if the prongs touch either side, the weft fork is out of order. The prongs have to be free from the back of the groove, and not come in contact with the bottom of it when the tippler is caught by the catch in the slide. This is most likely to occur when the slide is worn, but can be prevented by the prongs being pulled upward a little by the pliers.

When curls appear in the fabric opposite the weft fork, either small brushes are needed in the shuttles even for weaving woollens, or if the curls then continue, the slide should be tested by taking out the connecting pin. A strand of weft is then held across the back part of the groove, and the slide then moved forward with the other hand. If it is then seen that the catch strikes the tippler, the prongs may be bent downward so as to be held by the weft sooner and longer, and it holds the tippler higher.

There are two things that have to be avoided. The first is the slipping back of the casting underneath the breast beam that holds the swivel. The second is the wearing of the holes in the slide through which the connecting pin passes. This can be indefinitely postponed by systematic lubrication. The danger from these two sources is that the slide might come out of the slot on the left in the drawing, and if so, there is a possibility of that part being broken off by the forward thrust of the slide.

Vertical Centre Weft Fork.

This style is presented at Fig. 223. The framework A is screwed to the front of the going part, and is set so the top of it is slightly below the level of the shuttle race. The vertical slide is at B which is kept in position by the two plates C, these being secured to the main framework A. The slide cannot be removed unless these plates are liberated. The bottom of the slide is bifurcated and bored so the top part of the rod D may be held to it by a rivet. At H is the lug which comes in contact with the knocking off mechanism when the weft fails. Above the lug the slide is slotted, but is bridged by metal at the top. It is this bridge that is the means of raising and lowering the tippler that holds the prongs G. This tippler is shaped much like a straight thumb and a bent forefinger, the end of the finger forming a catch. It is this catch that holds the bridge on the slide when the weft fails, and brings the lug H opposite the knocking off mechanism, and so stops the loom.

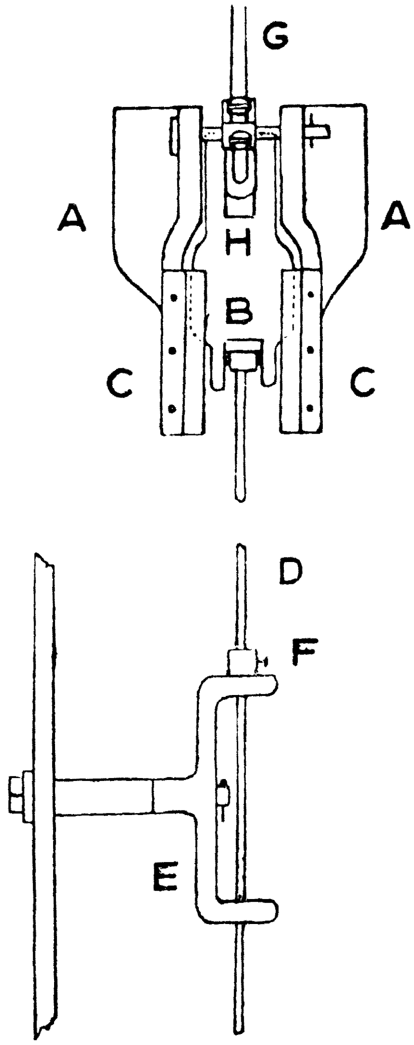

Fig. 223.
Vertical Centre Weft Fork.

The rod D passes through the guide E at top and bottom, the guide swinging free on the stud depicted. On the rod is the collar F, and by it the altitude of the tippler and slide are determined. It is fixed in much the same way as the horizontal centre weft fork, for the crank is placed at its back centre, and the shuttle put against the sley. The rod is then moved so the prongs are $\frac{3}{16}$th inch clear of the top of the shuttle front, and the collar is then secured to the rod on the upper end of the guide.

The tippler is secured to the pin that passes through it, and must be fixed so the prongs are central to the groove in the shuttle race. The points about the prongs set forth in the horizontal weft fork equally apply to this mechanism.

The tippler will fail to stop the loom when the catch end has become worn, or the top of the lug and the knocker off have become rounded off. These can be tested by hand, but if the warp and cloth be in the loom, the warp will have to be slackened for observation to be made.

When weaving, the weft holds the prongs long enough to allow the slide to move out of range of the tippler, and in this way the loom continues to weave.

Hudson's Centre Weft Fork.

Another weft fork that has won extensive adoption is one patented by Hudson's, Great Horton, Bradford. In some respects it is like Brook and Pattison's, but as will be seen by the illustrations, some of the parts are different.

In block 224, Fig. 1 gives the front view. Prior to fixing, the centre of the shuttle race is first found, and an

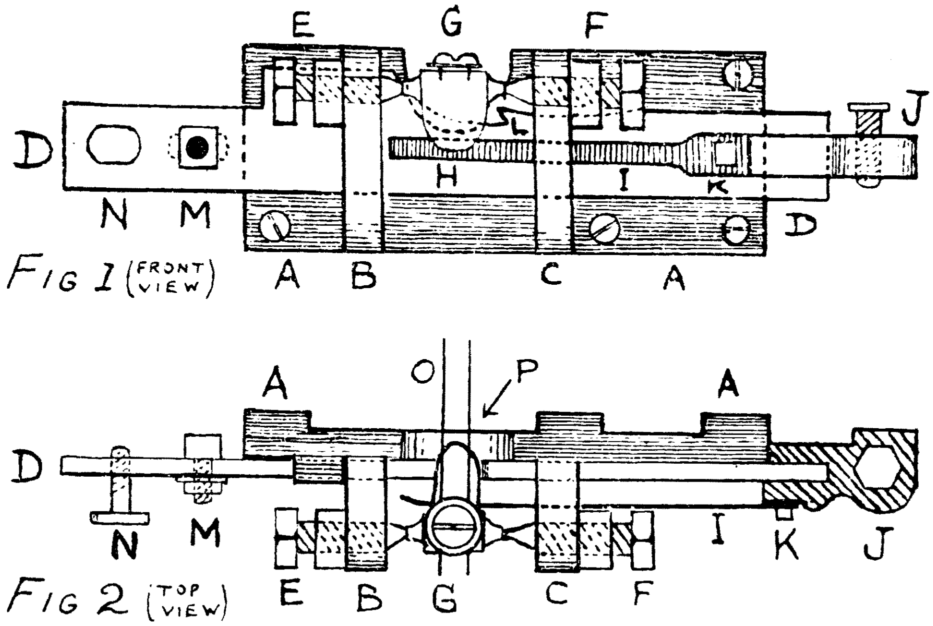

Fig. 224.
Hudson's Centre Fork.

inch is then allowed nearer the box into which the eye of the shuttle penetrates most. At this place, a groove is cut which is $\frac{5}{8}$th inch wide and $\frac{3}{4}$ inch deep. The depth must allow the weft prongs to be free when the notch on the slide is holding the tippler.

The Framework.—This is given at A, and is fixed to the front of the going part by half a dozen screws. Its upper surface is parallel with, and slightly below the shuttle race, and its hollow part at G is directly opposite the groove. There are two slots for the slide D to pass through at B and C, and as these stand forward, their upper ends are bored and threaded, and receive the lock-nutted setscrews E and F which hold the tippler G.

Tippler.—As will be observed, this has a short wing at either side, both being countersunk to receive the blunt pointed ends of the locknuts E and F. The tippler is left with little side play, but must have rotary freedom. On its upper surface are two grooves, and in these are placed the weft prongs O, which are secured by washer and screw. The usual setting is to have the prongs so they just miss the back of the groove, and this gives the longest length which is specially required in the weaving of fibrous warps. The tippler has two fingers, the front one at H, Fig. 1, being pressed against by the small flat spring I so as to keep the back finger P, Fig. 2, in contact with the slide D.

Slide.—This part is coupled to the connecting rod by the setscrew J which cannot come loose to adversely affect the warp. At K, Fig. 1 and 2 the flat spring is held by a small setscrew. The power of the spring may be altered by bending, but whether much or little, the pressure on the tippler must be removed just prior to the prongs coming in contact with the weft. Any spring pressure at this point would make weft curls down the piece. At L, Fig. 1, is the slide notch which seizes the back finger of the tippler when the weft fails. When the notch is worn, it may cease, or only occasionally hold the tippler, and the loom will then continue to run without weft. If so found, the slide has to be taken out and filed.

At M is the stop bolt which is in a short slot, and regulates the height of the weft prongs. This height above the shuttle front is about ⅜th inch when the crank is at its back centre, and the square head of the bolt against the framework. On rare occasions the slide has to be taken out, and this is accomplished by liberating the rods attached, slackening out the framework, and unfixing the stop bolt. At N is the setscrew that secures the knock off peg rod to the slide.

Brake Rod.—(Fig. 225). Figs. 3 and 4 give the front and top view of this rod with its fittings. At A is the right angled casting which is bolted to the breast beam, and to this is attached the slotted brake rod bracket B which regulates the working length of the rod.

As this weft fork is suitable for narrow looms as well as wide ones, the working length of the rod is shorter for a crank sweep of five inches, and longer for one with a sweep of eight inches. Moreover, if a slower movement of the prongs is desired, bracket B is set nearer the going part, but if a quicker one is needed, then it is set nearer the breast beam.

The usual setting is to have the brake bracket parallel with the breast beam, and when the crank is at its back centre, to have the back end of the brake bush D within ¼ inch of the outer end of the brake leather E, which is

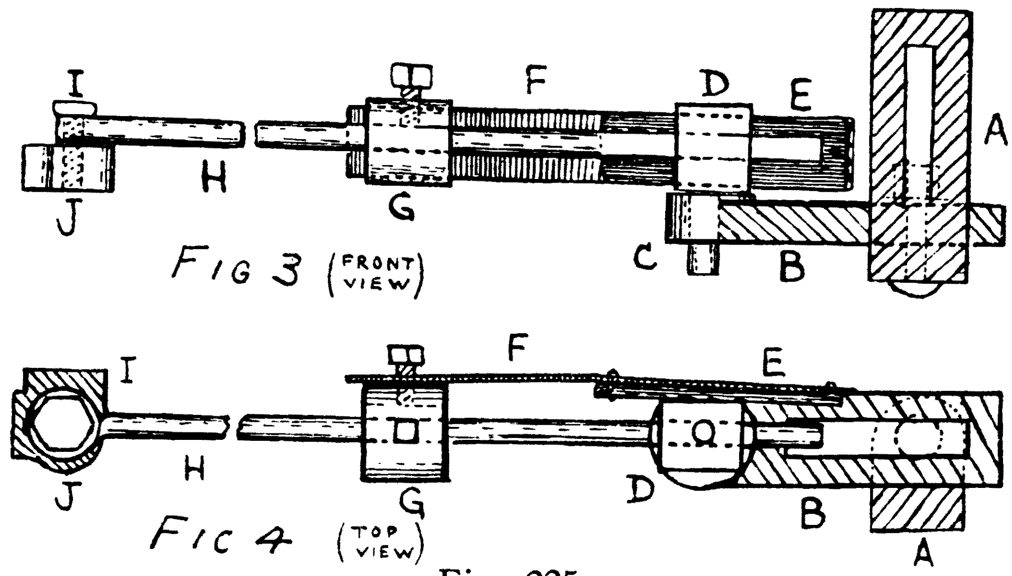

Fig. 225.
Hudson's Centre Weft Fork Brake Rod.

riveted to the flat spring F. At this pitch, the leg C, Fig. 3, on the brake bush D, should easily pass through the bore in the brake rod bracket B. When so set, there is little sliding movement with the brake leather during normal weaving, but as soon as the weft fails, then the notch seizes the back finger on the tippler, and as the going part continues to move forward, the brake rod is forced through the brake bush D for about an inch, and as this action also curtails the rod at the opposite end of the slide, the loom ceases to run. As soon as the weft supply is ready, the motion of the going part draws out the brake rod to its normal working length.

Brake Leather and Spring.—The highly tempered brake spring F is setscrewed to the rod collar G, the collar being setscrewed to the rod so the brake leather E at its outer end is only about ¼ inch beyond the brake bush D. The collar is also set so the depth of the spring is parallel with the side of the brake bush to give full power. The leather must be kept free from oil, for if soaked with lubricant, it will fail to grip the bush and be constantly slipping. The side pressure of the leather may be increased by bending the spring, but it is more reliable when straight. The pressure is weakened when the rod and bush bore become worn.

Extension Rod and Angle Finger.—The rod screw N (Fig. 224) couples the extension rod to the slide. This rod passes through the metal guides for the check strap, and at its outer end, has the knock-off peg bolted to it. This peg works in conjunction with an angle iron which is secured to the knock-off bar that passes in front of the setting-on handle. The angle finger may be vertically straight or cranked, but is set so it is missed by the knock-off peg when the loom is weaving, but is hit by it when the weft fails. The face of the peg has to be level, for if too much rounded off or slanting, it may touch, but slide off the angle finger and so fail in its function. The space between non-contact of the two parts is only small so that to preserve the distance, the setscrew J should be reasonably lubricated. An open spiral spring on the horizontal shaft of the angle finger is held and regulated by a suitable collar, and the stationary position of the finger is attained by a small one-armed lever on the shaft of the finger.

Hudson's First Pick Stop Brake Motion.—To weave rayon successfully, the special need is, that as soon as the weft fails, the loom has to be stopped before the cloth moves forward, and before the reed contacts with the cloth. Both ideas are efficiently carried out by the first pick brake stop motion invented by Mr. Irvin Hudson, Mansion Works, Great Horton, Bradford.

Pendulum and Slide.—These parts are at Fig. 226. At A is the adjustable connecting rod from the weft fork that screws into the slide B, the latter being kept in position by the metal bar C. The slide has a long slot, the part D being deeper than E. At D is the pin screwed to the pendulum

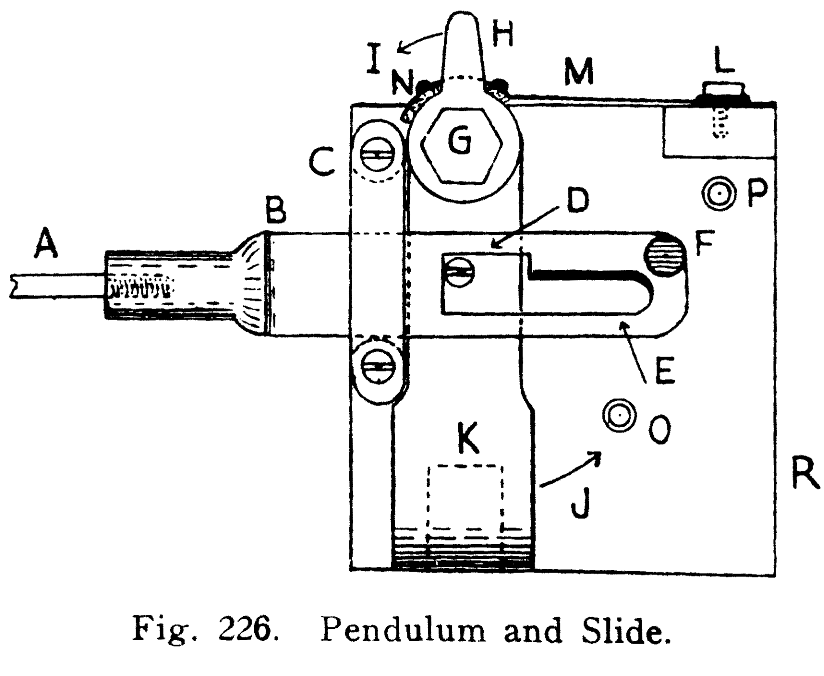

Fig. 226. Pendulum and Slide.

and fulcrumed at G. As shown, the pendulum is ready for pushing to the right by the slide, its lower part moving in the direction of arrow J, and the pointer at the top moving as arrow I. When pushed to its limit, the pendulum exposes the cut K in the going part, and into this a stop lever enters, and the loom continues to weave.

When the pendulum has to be drawn back, the pin D contacts with the right hand end of the upper cut, and at that end it remains when the slide has come to rest. For the slide to come to the position in the drawing, it moves the distance of the deep slot before it affects the pendulum, and this is equal to the distance the weft fork has to traverse from its highest position when the crank is at its back centre, to where the tippler is caught by the cut on the weft fork slide.

When the weft fails, the pendulum hardly moves, and the front bottom of it contacts with the stop lever, and the loom instantly stops.

To prevent excess movement of the pendulum, the spring M that is fixed at L, with its curved opposite end at N, and has a cork brake, applies sufficient pressure. The small knob at F, is used by the weaver to lift the slide above the pin, and make it enter the narrower part of the slot, and puts it out of action for one pick to prevent light places in the cloth.

The bores O and P are for fixing screws.

Brake Motion.—This is set forth at Fig. 227. A is the upper part of pendulum, and B the slide pin that gives it motion. C is the stop lever pivoted at D, and E is the upper part that meets the bottom of the pendulum when the weft fails.

F is the bar that is doubly setscrewed to the stop lever, and at its outer end, carries the locknutted setscrew, the head of which pushes off the set-on handle and stops the loom.

Below bar F is the head of a setscrew, and on it is placed one end of a closed spiral spring H. This draws the stop lever forward as soon as it is liberated. At the base of the stop lever C is the strong pin G that controls the slotted casting I, and the spring rod J.

Spring Rod.—The rod extends almost the whole width of the loom side. At the front, it is setscrewed to the the slotted casting I, and after passing through a bearer casting at the opposite end, its working length is fixed by the setscrewed collar P. It is this collar that controls the forward position of the stop lever C at its upper end E.

In the diagram, the crank is at its top centre. It is at this point in the crank's revolution that the tippler of the weft fork has stopped the progress of the slide, and has only stirred the pendulum A. It is now that the bottom of the pendulum meets the stop lever at E, and forces it back.

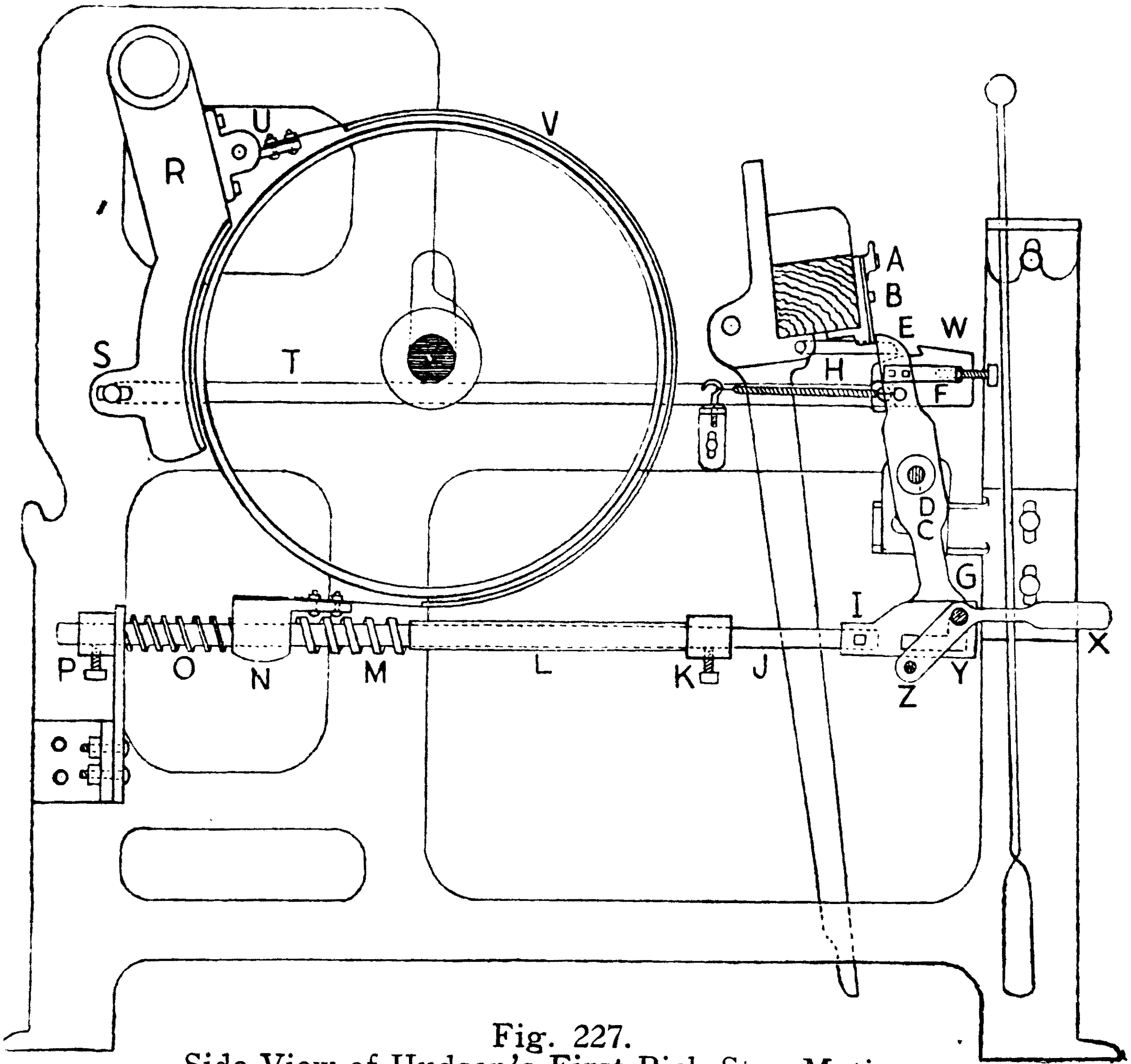

Fig. 227.
Side View of Hudson's First Pick Stop Motion.

In doing so, pin G applies pressure to the upper part of the slot in casting I, and forces the spring rod to the left. This applies the two brakes to the brake wheel.

On spring rod J is a second collar K that determines the amount of space between the inner lining of the brake band V, and the surface of the brake wheel. The nearer the brake band is set to the brake wheel, the quicker the brake is applied, and the sooner the loom is stopped.

A space from $\frac{3}{16}$ to $\frac{1}{4}$ inch is ample. Next the collar K is the bush L that meets spring M, and forces the brake band holder N forward and applies both brakes. Behind holder N is spring O which is much weaker than M, and acts as a cushion spring. Its other function is to put the brake band free of the brake wheel before weaving is resumed.

Ordinary Brake and Brake Band.—The ordinary brake is at R, and at S, the brake rod T is coupled to it. At its opposite end, it is attached to the frog W, and works in the ordinary way. To the upper front face of the ordinary brake R is setscrewed casting U, and on its stud the brake band is secured. The brake band is lined with leather, and supplies quite enough grip to the brake wheel. The two brakes cover two thirds of the surface of the brake wheel.

Measurements taken on a narrow Lancashire cotton loom reset for weaving rayon, showed that when the crank was at its top centre the reed was $7\frac{5}{8}$ inches from the front of the breast beam. When the loom stopped for weft failure the reed was $6\frac{1}{8}$ inches away from the front of the breast beam. The reed had only moved $1\frac{1}{2}$ inches. The stoppage is not a dead stop, and that is all the better for the cogs on the driving wheels. The distance between reed and cloth when the weft fails and the loom is automatically stopped may be increased or decreased by collar P.

Release Lever.—When the two brakes grip the brake wheel, the going part cannot be moved until brake pressure is removed. This is obtained by pushing down the release lever X. This elevates casting I by means of pin Z, and causes stud G to slide into the horizontal part of the slot at Y, and both brakes are removed.

If a part pick is in the open shed, it is pulled out, and the replenished shuttle is placed in the box last used for picking and sent across the loom by the picking strap. When the loom is set in motion, there is no light place in the fabric as the take-up motion has not acted. If from any cause the reed has reached the cloth fell when the loom stops, a delayed action by the weft fork is obtained by pushing the finger H to the left in Fig. 226. This ingenious mechanism has been widely adopted by rayon manufacturers.

ORME'S PICK COUNTERS.

A pick counter is a mechanical aid for registering the number of picks woven in an hour, a day, or week.

There are several ways of working it, but the worm motion is perhaps the most popular. For the dial there are three kinds, the simplest having one row of figures, another, two rows, and the other having three.

Fig. 228.
Messrs. George Orme's Single Pick Counter.

The first is adopted where a weaver has to attend to a group of looms usually of the automatic kind. The second is very useful for the two shift system, and the other for continuous running on weekdays. (Fig. 228).

General Construction.—The worm is placed on the tappet shaft on the outside of the loom, and is encased in a casting into which passes the shaft with a worm wheel at the bottom. The shaft is joined to the clock rod by a universal joint, which gives latitude for the fixing of the clock shaft to a part of the loom which is the freest from vibrations, the shaft being adjustable by locknuts. The first figure on the right is for units, whilst at the opposite end they indicate the 100 thousands. The six figured dial meets the need of practically every kind of loom down to the narrowest width and quickest speed.

Suppose the loom speed was 200 picks per minute, and the usual working week was for 48 hours, then if there were no stoppages at all, the loom could not make more than 200 × 60 × 48 = 576,000 picks for the full week.

No loom ever gives the 100 per cent., and as the clock will register 900,000, there is an amplitude of margin.

Equity of Payment.—Payment for cotton weaving is based on the 100,000 picks, but for the broader looms, slower speed, and more costly cloths made from woollens and worsted, it is based on the 1,000 picks.

By this system, the weaver is paid for the work done up to the time of booking. Under the payment per piece, at times there is a considerable surplus for the following week, though some masters are considerate and pay for half pieces.

There can never be much doubt as to how much ought to be paid, and no suspicion on the weaver's part about weaving a longer length for the same money.

In occasional cases, where combing out has to be resorted to for getting rid of faulty places, the clock may register more picks than is actually in the cloth, but a difference in wages is only fractional. The system is equitable to both master and operative.

Reliability.—A pick counter like that made by the firm of Messrs. George Orme, of Oldham, as shown in the illustration is well made, and can be relied upon by the interested parties to make a faithful record. The record of an hour will give a basic calculation for a piece, or a series. A week's record, or a warp record can be preserved for comparison, and is an account for estimating the efficiency of the loom. The clockwork must not be tampered with, and the only person who should be allowed to set it or reset it is the overlooker.

Incentive.—An observant weaver soon knows what the loom is capable of doing as a maximum, and this is the goal of her daily endeavour. Higher figures mean more money. It is a check against gossiping and laziness, and also acts as a spur to the overlooker to keep every loom in a state of efficiency. The way to keep good weavers is to make it possible for them to have a good average wage.

Fig. 229.
Orme's Multiple Pick Counter.

Shift System.—If there be only two shifts, then the pick counter need not have more than two rows of figures. The mechanism for one set is put out of action to bring the other one into service. The latest development stamps a card, and has a special column for recording time for repairs, and standing for a fresh warp. The three lined dial is for the three shift system of 8 hours each. Each shift has then its own line and record. These counters are the most complicated and most expensive. At the end of the pay period, the records are taken off and the counters are set at zero.

Fig. 229 is for the two shift system, one set being put out of action to let the other operate.

ELECTRIC DRIVING of LOOMS.

Electric driving is the modern method of driving looms. As old factories and weaving sheds are modernised or replaced, the choice is increasingly for electric driving. There are three methods: (1) Line shaft drive (2) Group drive (3) Individual drive.

(1) *Main Group Drive.*—This method utilises one large motor, driving the main shafts either by direct coupling, or indirectly by means of belts, ropes, tex ropes, chains or gears. The looms are then driven from line shafting by the ordinary fast and loose pulley system. The line shaft drive gives concentrated power which is easily supervised.

As with steam engine drive, however, if anything goes wrong, the whole of the dependent machinery has to stand until repairs are completed.

Fig. 230 shows a 450 h.p. chain driven motor for a weaving shed containing 1,000 looms.

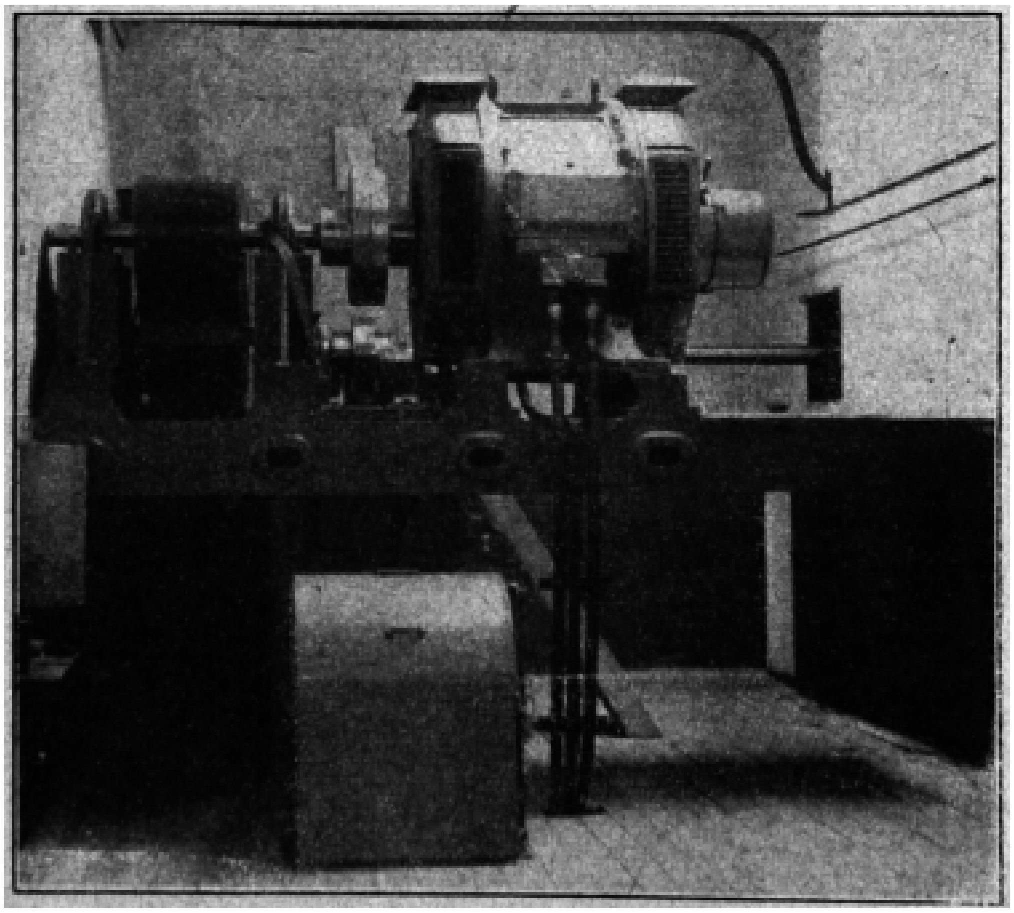

Fig. 230.
Metrovick Motor for Line Shaft Driving.

(2) *Sectional Group Driving.*—This is illustrated at Fig. 231. These motors are usually of the squirrel cage type, and are built to suit the speed required. The one shown is of 10 h.p. and runs 24 looms. It goes at 720 r.p.m., and the connection between motor and shaft is by laminated gears with staggered teeth. When looms are of light construction, this kind of driving is arranged to drive two cross shafts.

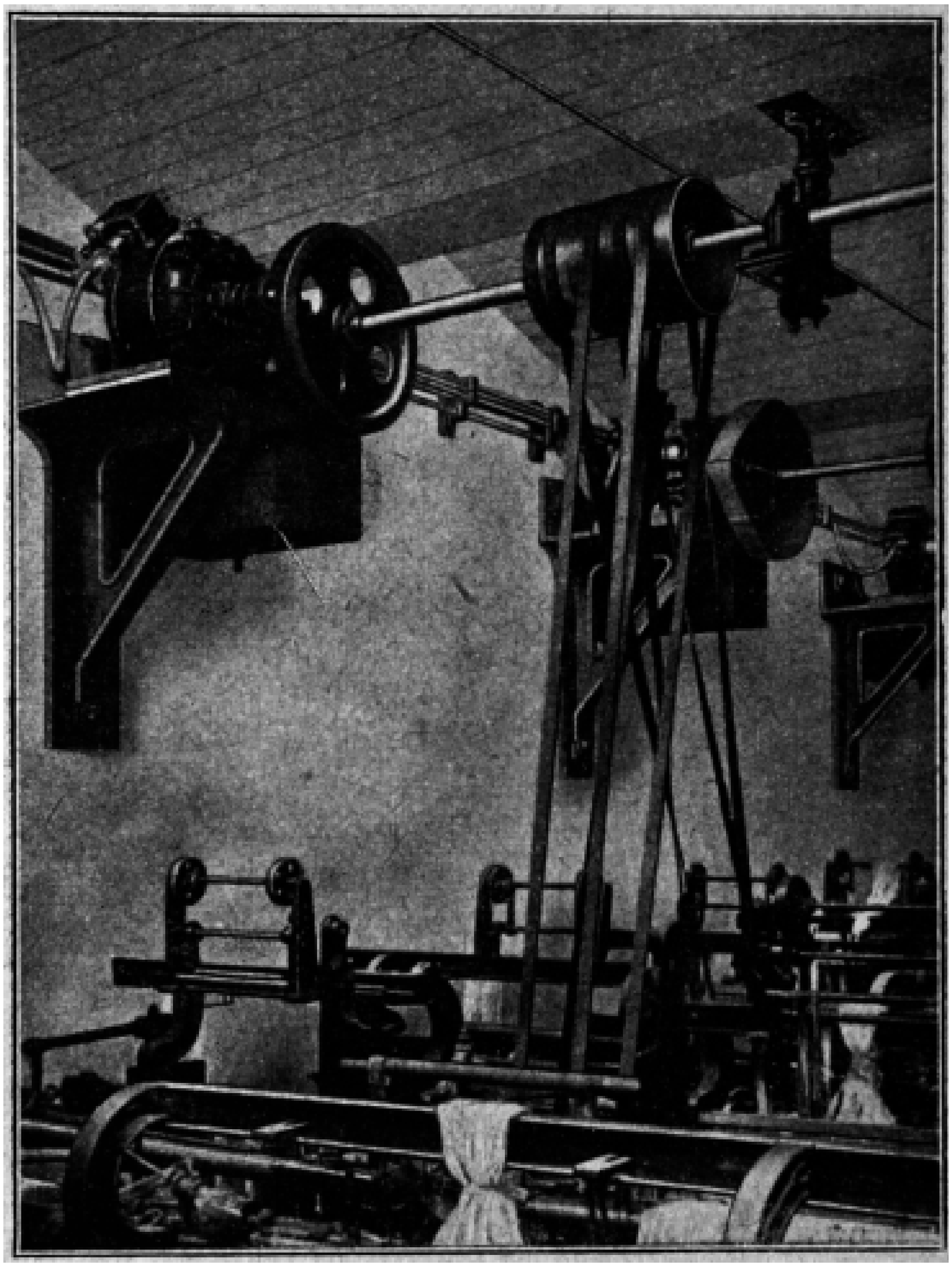

Fig. 231.
Metrovick 10 Horse Power Cross Shaft Motor Group Drive.

The motor is mounted between two shafts and connected to them by chains or vee ropes. This method of driving is often applied to an existing shed, which dispenses with main shaft and bevel gears, though line shafts and belts are required. Such an arrangement improves the lighting, and by considerably reducing vibration, repairs to the roof are decreased.

(3) *Individual Drive.*—The problem for constructing a motor suitable for driving a loom is a very complicated one. Some weaves have heavy and light lifts, then there is the power absorbing effect of picking, the intermittent beating up of the weft, and the different weights of cloth. There is the vital demand for a quick full speed from rest, and the sudden shock of the loom banging off.

In the more complicated looms, there is the additional weight of the rising of one or both boxes, and for the automatic loom, the swift changing of the bobbin. To bring out a motor that could adequately meet these conditions was nothing short of an engineering triumph. The individual drive is largely adopted for new sheds, and also for automatic looms which give better results than when driven from a line shaft. With this drive, all overhead shafting and belts are eliminated, better lighting is obtained, and the construction of a weaving shed is simplified.

Fig. 232 is one of Metrovick's squirrel cage motors of the L type totally enclosed and dust proof. On the left is the protruding shaft to take the driving pulley or pinion. This type of motor is made in five frame sizes, commencing with $\frac{1}{2}$ h.p., and advancing by a $\frac{1}{4}$ h.p up to $1\frac{1}{2}$ h.p. They run at 960 revolutions per minute, but if required they are run at 720 on 50 cycle units. Fig. 233, reveals the details of construction.

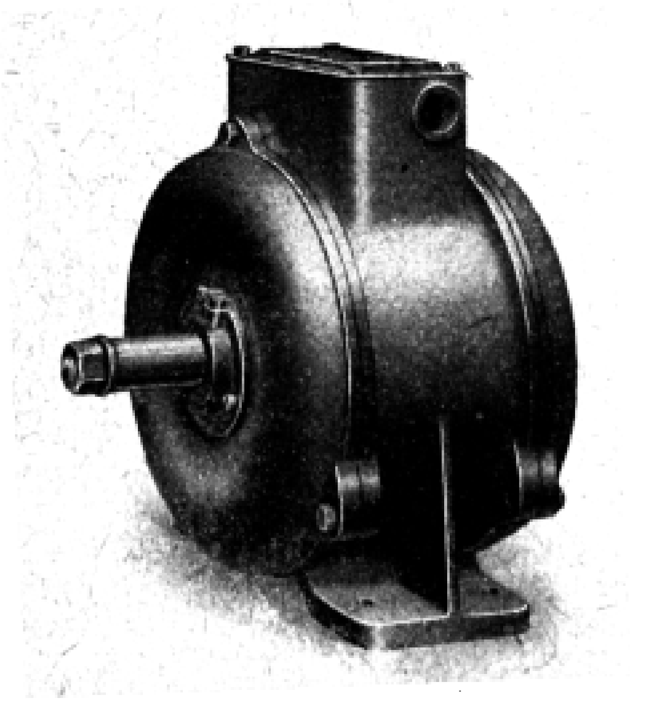

Fig. 232.
Metrovick Loom Motor (L Type)

1. This is the stator frame of cast iron with a machined spigot at each end that assists in ensuring concentricity with an accurate and uniform air gap.

2. The stator core is built up of laminations of specially low-loss steel rigidly held in the frame, and grooved on the inner periphery from the frame spigot.

3. The stator windings are wound with enamelled and cotton covered copper wire, with high insulation value that reduces the risk of breakdown between turns to a minimum. The windings are insulated from the core by a slot lining consisting of high grade insulating materials, and so arranged as to give the most electrical and mechanical strength. The stator windings are impregnated with insulating varnish to make them waterproof.

4. The terminal box is at the top of the frame and gives easy access to the terminals. It is bored for conduit at each end, the unused hole being fitted with a blank plug.

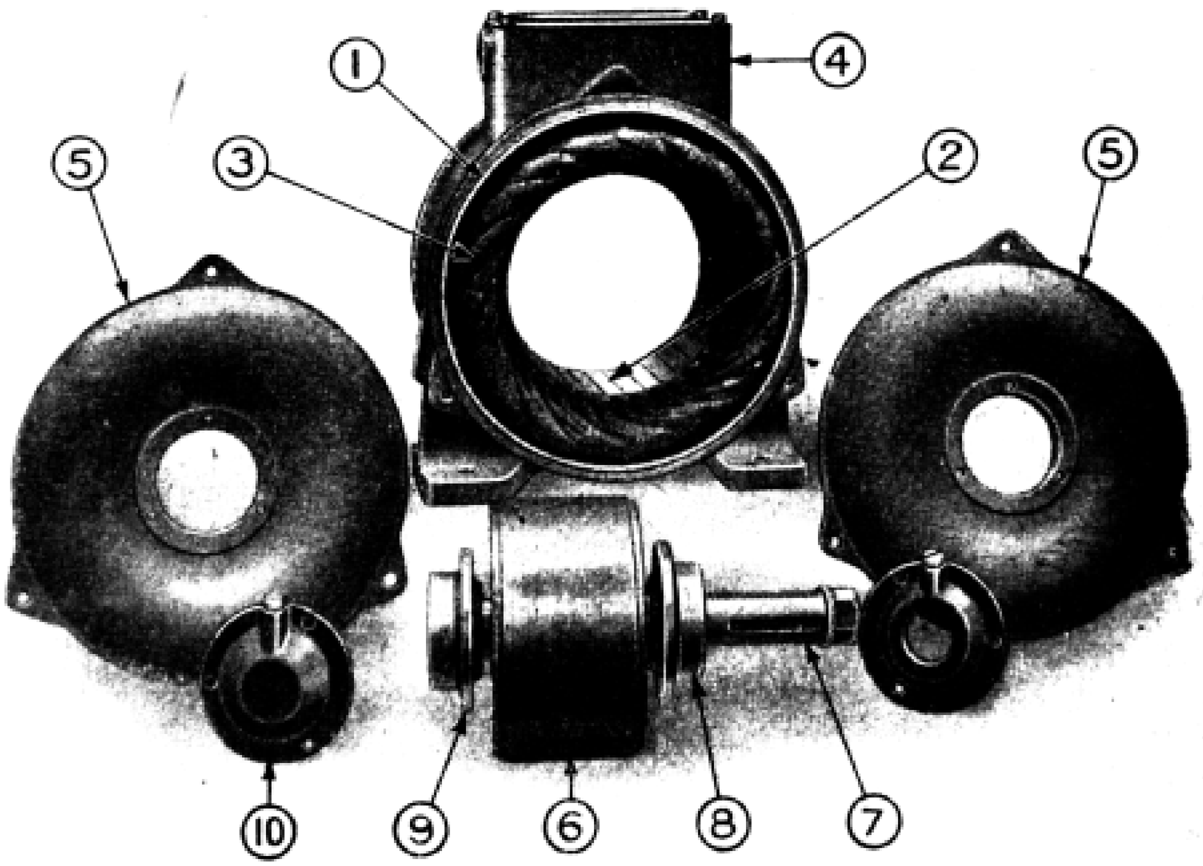

Fig. 233.
Metrovick's Component Parts of Type L Loom Motor.

5. There are shields at both ends. These are substantial castings spigoted into and bolted to the frame, and accurately machined to take the bearings and dust caps.

6. The rotor is of the cast aluminium type, the bars and end rings being cast in one piece by a patent process, thus eliminating joints, and making the motor almost indestructible. This construction supplies a rotor of small inertia and very suitable for running a loom. The rotor core is ground from its shaft after assembly, and ensures true running.

7. The shaft is of high grade steel, and large for the size of the machine. This gives strength where strength is most required.

8. Ball bearings are fitted at both ends. All bearings are lubricated by grease, and will run for long periods without attention.

9 and 10. These are the inner and outer dust caps respectively.

The three kinds of drive are by belt, pinion, and rope, the last named being the most popular.

The brass bushes which surround the motor shaft reduce friction to a minimum, and the steel pinion wheel is cut out of solid metal to give maximum strength to every tooth.

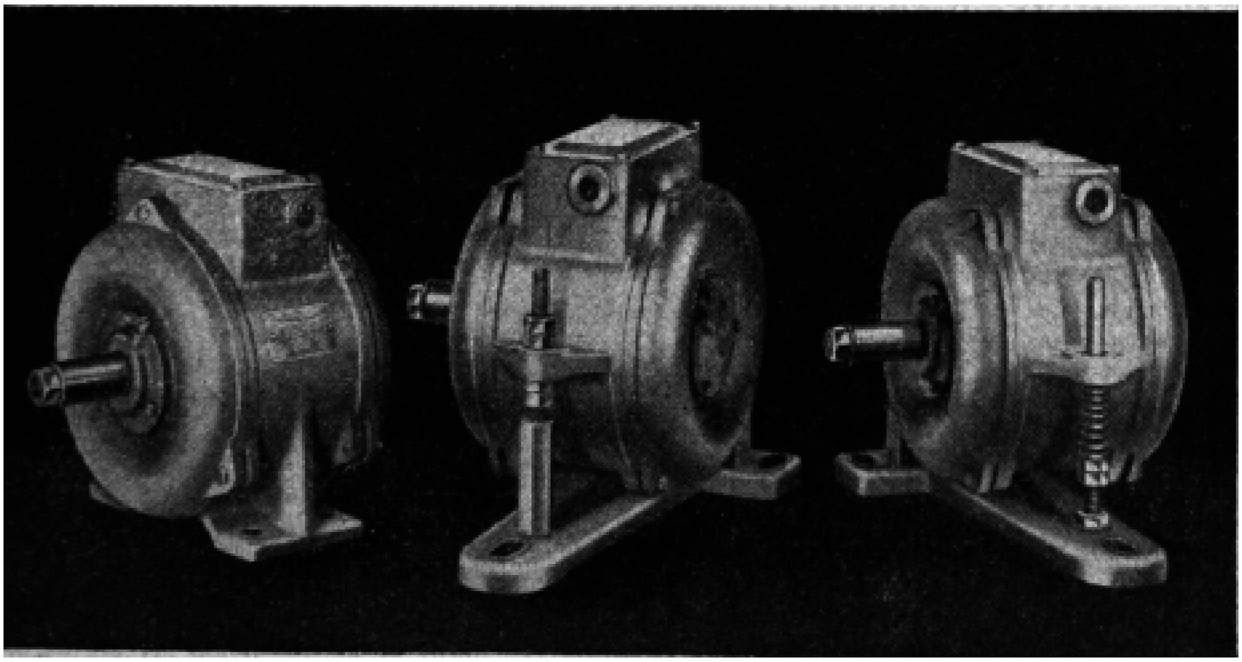

Fig. 234.

Metrovick Loom Motors for Individual Drive.

Back Motor Fittings.—Three of these are presented at Fig. 234. Each of them are of ½ h.p. for driving narrow looms. The driving medium is missing, but they may be fitted with sprocket wheels for chain driving, grooved pulleys for vee ropes, or plain pulleys for belts. The motors are totally enclosed so as to be kept free from dirt and fluff.

The temperature rise of these, and other standard motors do not exceed 35°C. above a surrounding air temperature of 30° C. This is extremely small, and to the decided advantage of the motor. The shafts are fitted with ball bearings which only require lubricating at long intervals.

Another interesting feature is the back fittings of the motors.

The one on the left has two bored feet for rigid fitting, but for alteration in case of a too slack belt. The centre one has a hinged base, and the one on the right a spring base, which are further explained.

Transmitting Power.—The power from a loom motor may be transmitted in four ways: (1) Belt, (2) Chain, (3) Gear, (4) Tex rope.

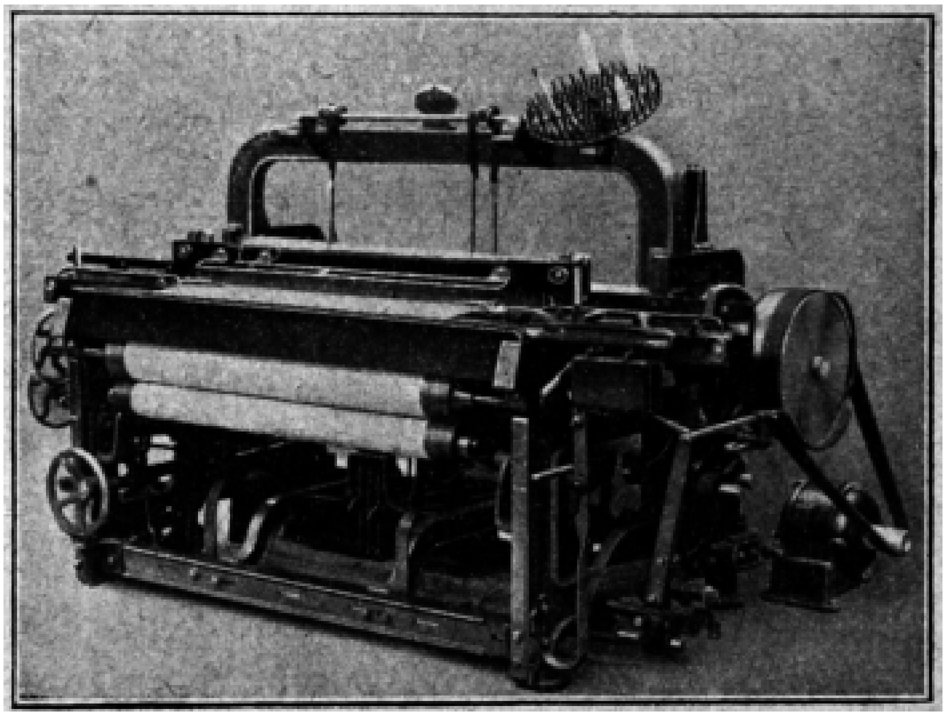

Fig. 235.
Metrovick Belt Drive for Linen Loom.

(1) Belt drive is demonstrated at Fig. 235. This is a linen loom of strong make for plain or twilled goods, but belt driving is equally applicable for other makes of looms weaving other kinds of yarns. When the motor has a spring base like the right hand motor in Fig. 234, it automatically maintains belt tension, but also allows the belt to slip when the loom is brought to a sudden stop. These short belts should be of the best quality, and of the stretchless kind.

(2) Chain driving is shown in Fig. 236. This is done by means of chain connection between a sprocket wheel on the motor shaft, and a large wheel on the crank shaft.

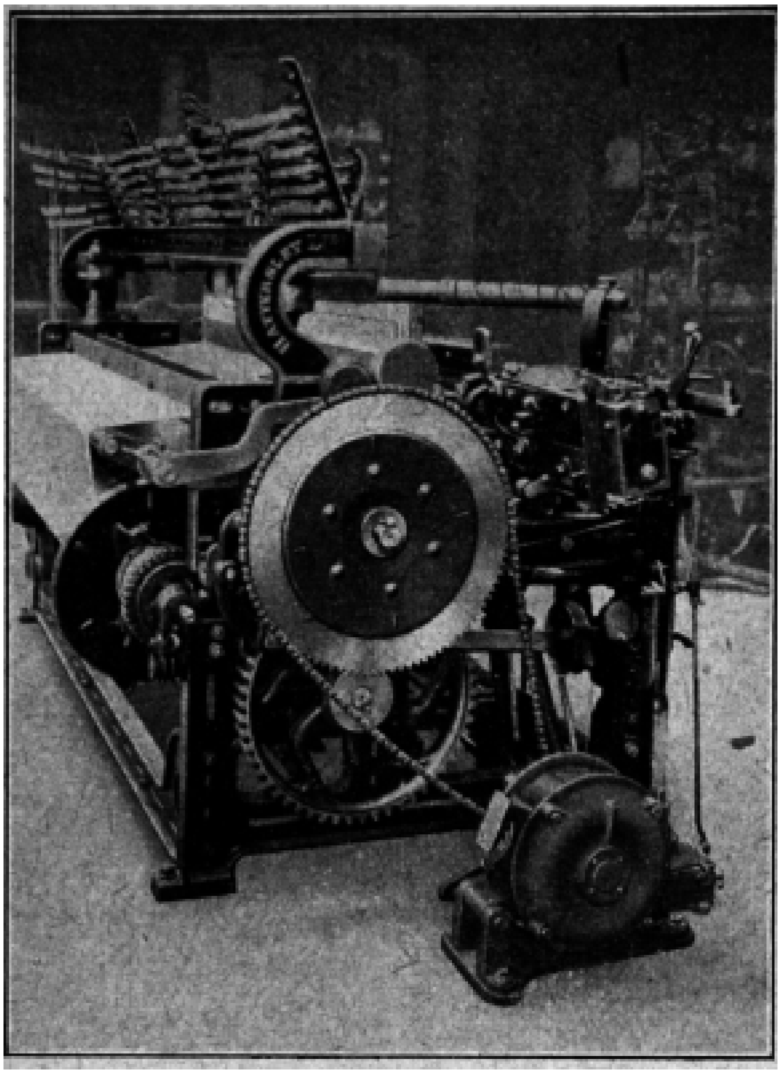

Fig. 236.
Metrovick Chain Drive for Hattersley Tappet Loom.

It is attached to a Hattersley tappet loom, the motor being started and stopped by the setting-on handle.

The motor is mounted on a hinged base, and chain adjustment is provided for by means of locknuts shown on the centre motor in Fig. 234.

The connection between motor and loom is positive, but in order to provide for a certain amount of slip when the loom bangs off, a special type of friction clutch is incorporated in the driven chain wheel.

This kind of drive is preferred in certain classes of silk goods. This is on account of the necessity of obtaining a good first pick when starting. When a loom is set in motion, the motor develops approximately 2½ times full load torque, and accelerates the loom up to speed very quickly. If, however, there is slip in the transmitting medium, part of the motor energy is wasted, the acceleration is slower, and on certain classes of goods, a setting-on mark is left in the finished cloth.

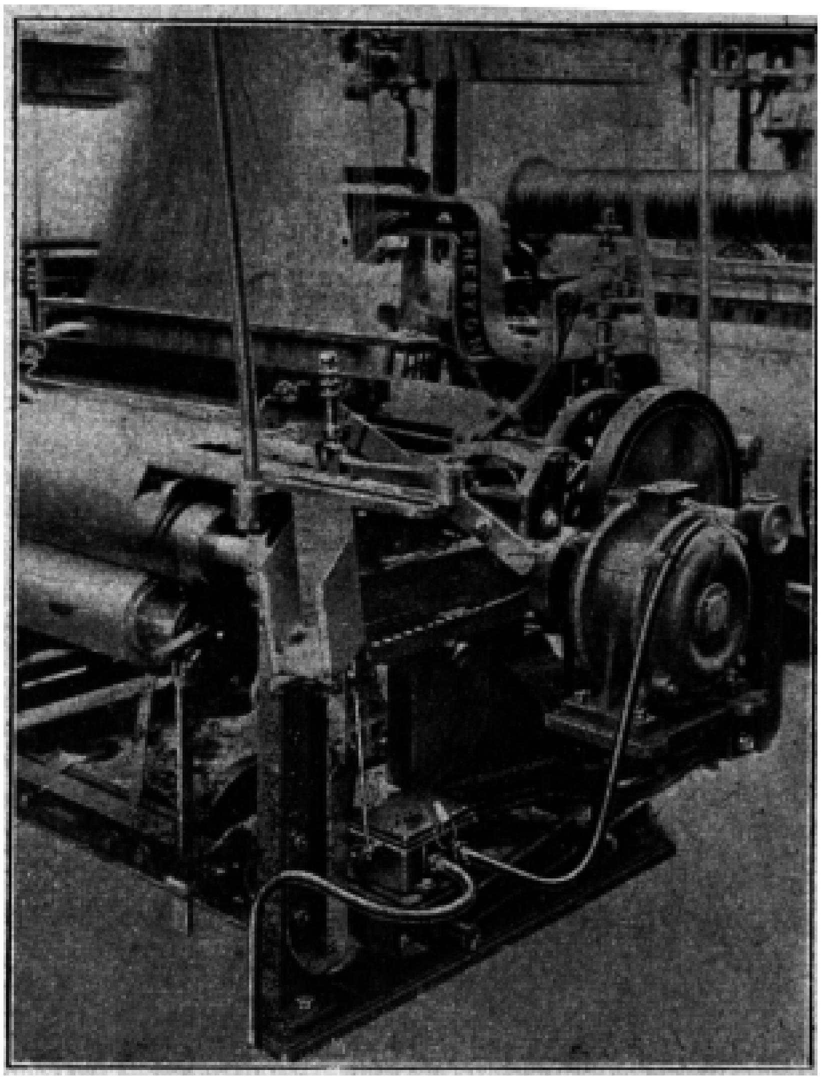

Fig. 237.
Metrovick Combination Clutch Gear Drive for Jacquard Loom.

(3) *Gear.*—The clutch gear drive is seen in Fig. **237**. It is more positive than belt drive, and much cleaner and safer than chain drive. It has a further advantage over the two previous examples, for it is mounted on the loom frame, so that the meshing of the cogs in the two wheels are constant. By the wheels being in direct contact with each other, it is the most positive drive of the three.

In the example given, it is used for a jacquard loom, but generally, it is only used for heavy or slow speed looms.

Loom Switches.—When individual drive is adopted, two methods of control are available.

(*a*) The motor may start and stop with the loom. When so arranged, the starting switch will have to operate several hundred times a day. For such a service, special switches are designed, having provision for lubricating the contacts to avoid mechanical wear. A typical switch is illustrated at Fig. 238.

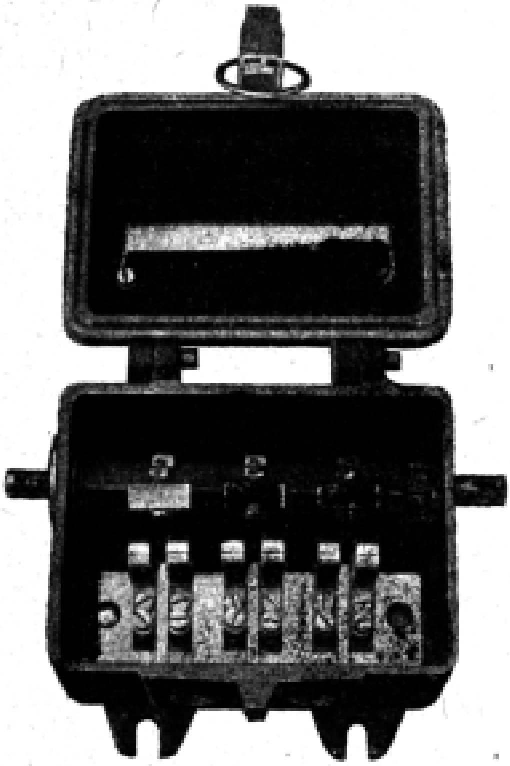

Fig. 238.
Metrovick Switch.

(*b*) The other method is to allow the motor to run continuously, the loom being started and stopped by means of a clutch operated by the starting handle. In this case, the starting gear for the motor is only brought into action occasionally, and so can consist of a single switch, or switch fuse which is operated by hand. Modern practice tends to this method for heavy looms and automatics.

(4) Though each of the three styles mentioned have certain advantages, the texrope drive is ahead of them all. It is an ideal drive for short centres. In Fig. 239 is shown as applied to two tappet looms. It will be noted there are only two ropes from motor to loom pulley, and this connection is sufficient to run the loom successfully. On some looms there are four ropes. If, after long service one of the ropes gives way, the loom can " carry on " until

a convenient time for repairs to be carried out. It is the invention of Messrs. Frank Wigglesworth & Co., Ltd., of Shipley, who are the original makers.

The belt cores are formed in accurately machined moulds and are endless. The outer wrapper prevents dirt from working into the cord section, and water has no detrimental effect upon it. What has to be avoided is oil, and as no lubricant is required, there is little fear of this accumulating. The working face of the rope is somewhat **V**-shaped at the sides, but is flat at top and bottom. The

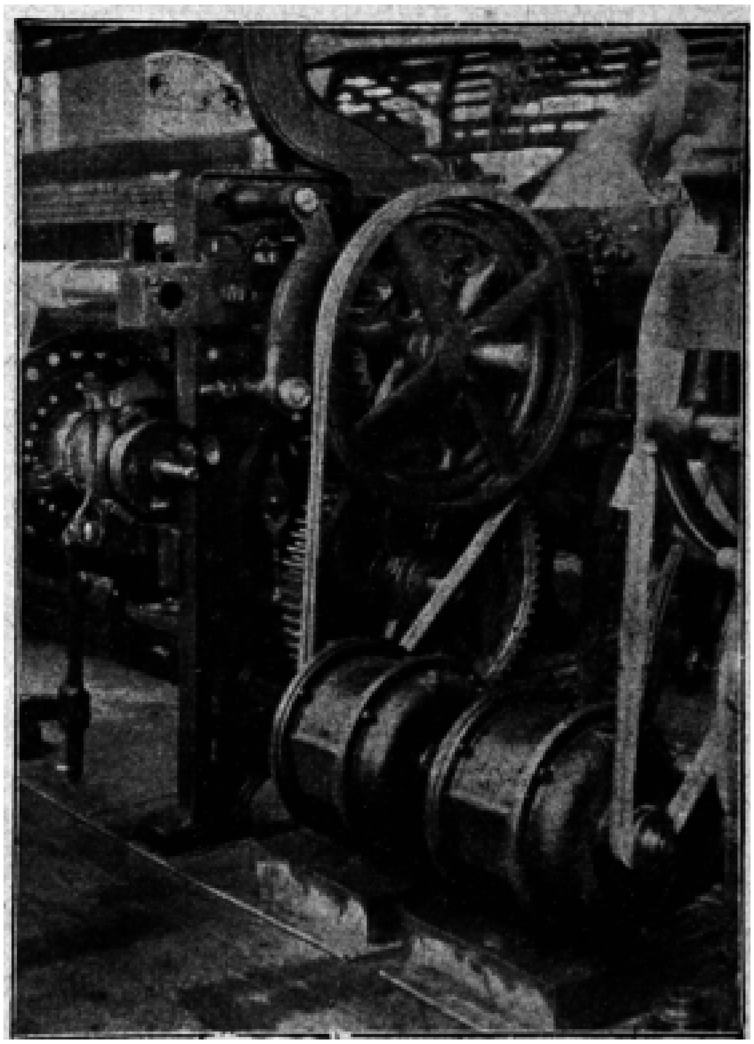

Fig. 239.
Wigglesworth's Texrope Driving for Looms.

rope does not fit body down to the pulleys, for the grooves in the pulleys are less than the rope, so the sides drive instead of the bottom. The drive is silent, and absorbs vibration and shock. It is a safe and simple transmission of power, and is quickly installed. It is applied to machines low as ¼ h.p., and as high as 2,000 h.p.

The grooved pulleys in which the ropes run are perfectly balanced, and are made to achieve a vibrationless movement. It is to this reliable seating for the ropes that assists in giving long service.

Fig. 240' presents another type of motor for tappet looms. At the back, it will be observed that the motor case is fitted with a rod that passes through a bore, is threaded at either end, and a strong spring is placed at either side of the

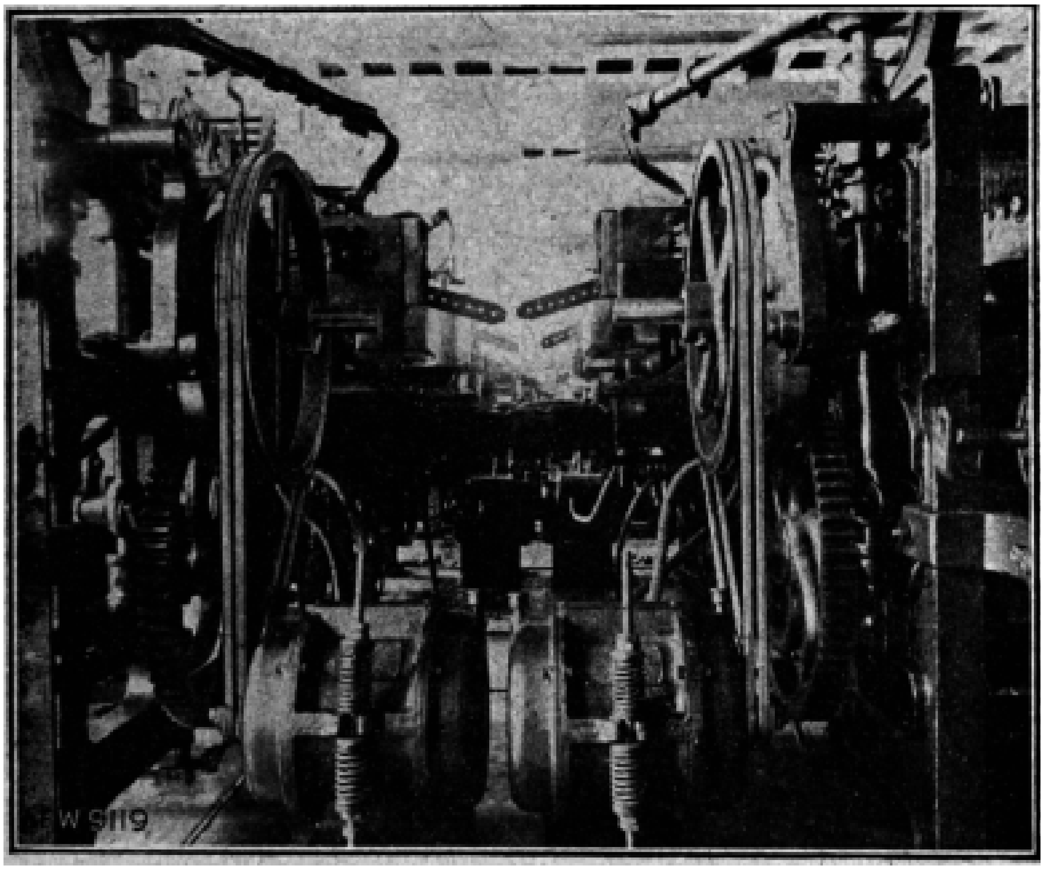

Fig. 240.
Wigglesworth's Texrope Drive for Tappet Looms.

bore. The strength of the two springs is secured by lock-nuts. This method is superior to a rigid motor, for when the loom knocks off, the shock of the quick stop is mainly absorbed by the springs, whereas with a rigid motor, it has to be taken by the tex ropes which are driven deeper into the grooves of the driving pulleys.

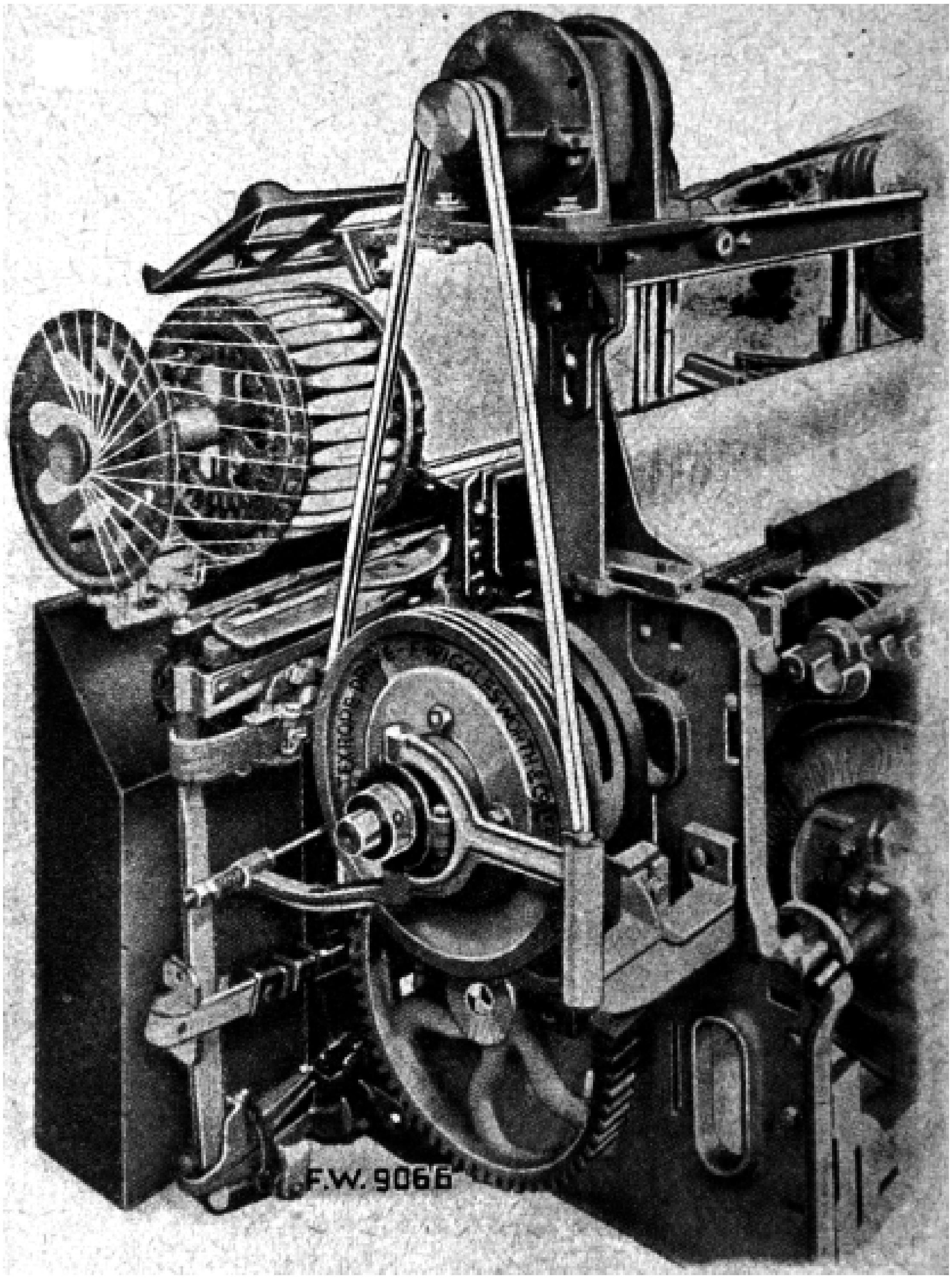

Fig. 241.
Wigglesworth's Texrope Drive for $\frac{3}{4}$ Horse Power Northrop Automatic Loom.

In Fig. 241, the texrope drive is applied to the Northrop loom, and here again, only two ropes are used. As the Northrop loom is heavier than ordinary, and as the bobbin changing has to be carried out in the fraction of a second, it speaks well for the constancy and power of the texrope drive when it runs such a loom successfully.

It is superseding the chain drive because it is cleaner, cheaper, noiseless, less dangerous and unaffected by dust and fluff.

The firm of Messrs. Mather and Platt's, of Manchester, are another firm who have made a special study of the requirements for spinning and weaving. Their first instalment was erected over 45 years ago, and since then they have supplied plant totalling over a quarter million horse power.

Fig. 242 gives one style of electrical motor driving for a weaving shed. The motors are mounted for group driving outside the weaving shed, and two line shafts are driven

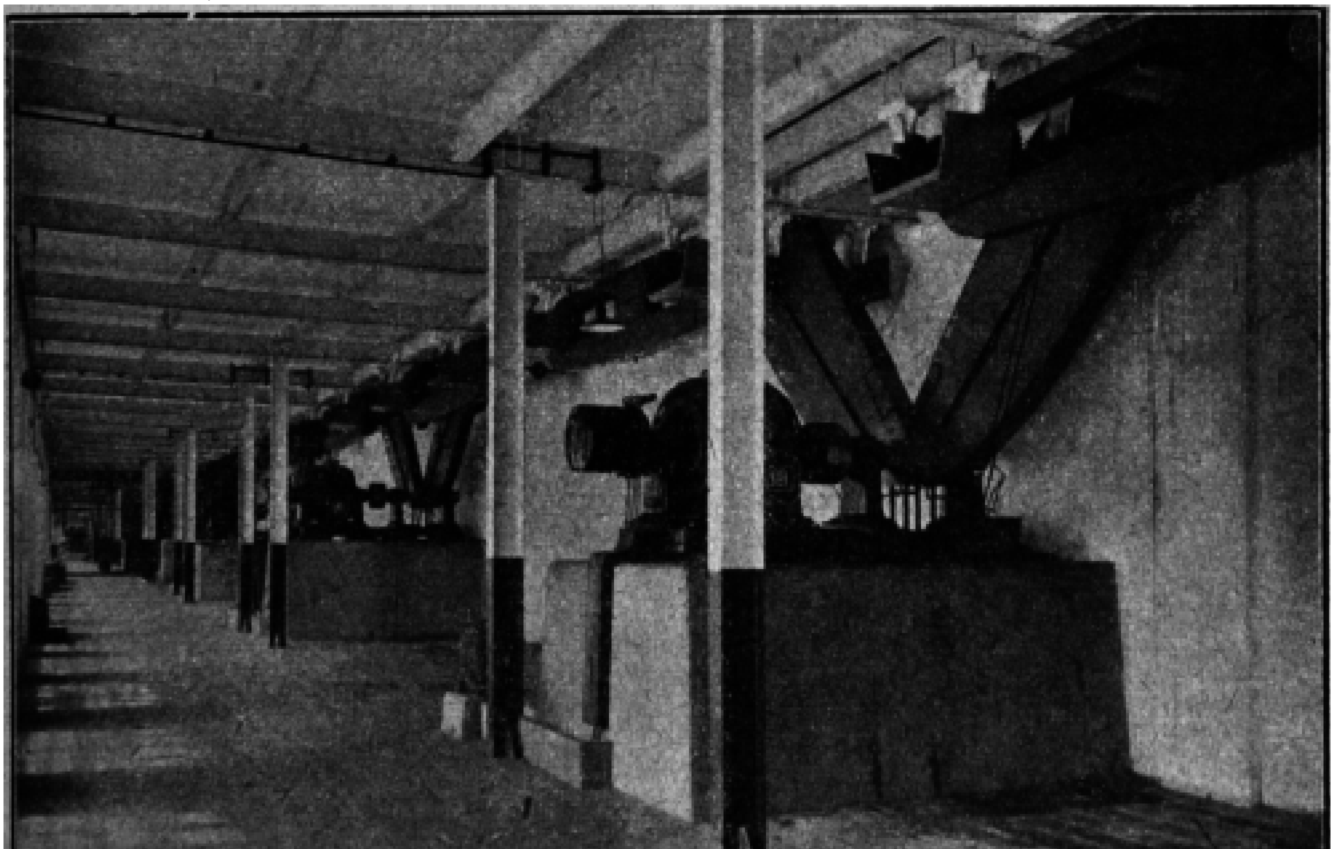

Fig. 242.
Mather and Platt's Motor Alley Way. Chain Gearing for Weaving Shed.

by the same motor. The motor is coupled by link chains to sprocket wheels on the mill shaft, and in this way, the motor speed is transmitted without slipping. As the chains are run in oil, the the wearing of them is brought to a minimum, and the noise considerably deadened.

By being outside the weaving shed, any surplus lubrication has no chance of getting near looms or fabrics.

Further, the motors are built to the horse power and speed suitable for the work they have to do. In case of repairs after a long period of service, only one section of the weaving shed is affected.

Fig. 243 presents another kind of group driving. In this example, each line shaft has its own motor inside the weaving shed. The looms are weaving heavy goods by the aid of Woodcroft tappets.

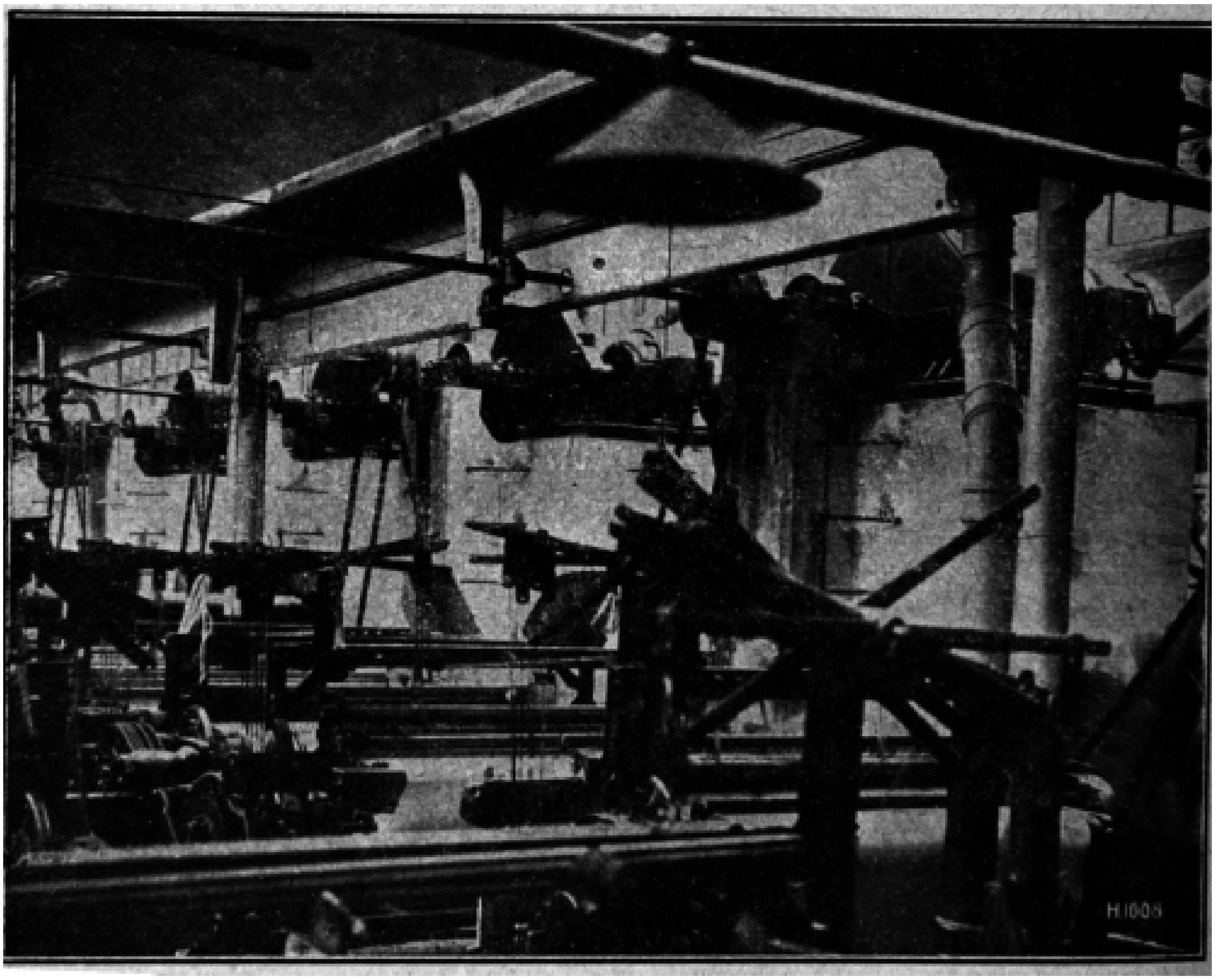

Fig. 243.
Weaving Shed run by Mather and Platt's Electric Motors.

Fig. 244 gives a fine view of the individual drive, each loom being independent.

More floor space is taken up with this arrangement, but the horse power of each motor is in accord with the requirements of the individual loom. Wide looms with heavy work, demand more power than narrow looms weaving light weight goods.

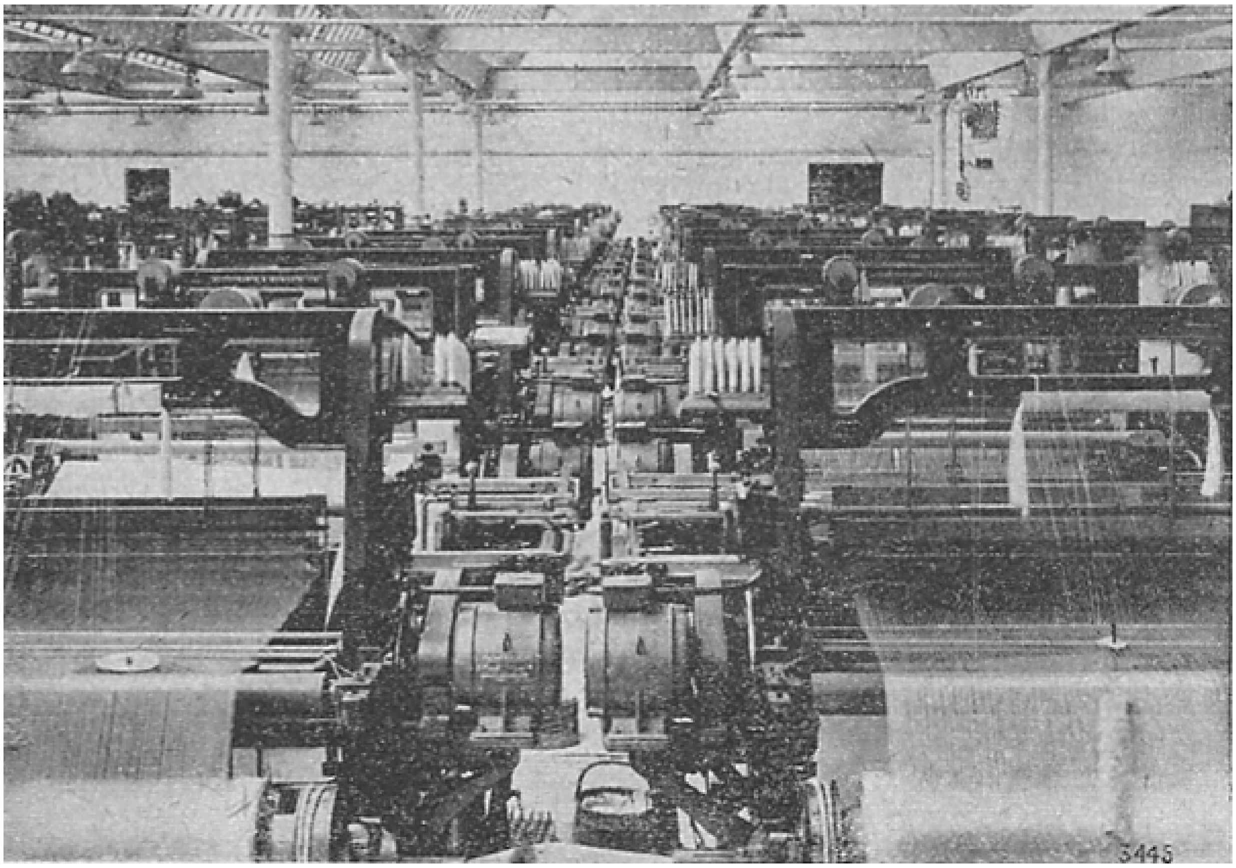

Fig. 244.
Mather and Platt's Individual Drive on Butterworth and Dickinson Looms.

The two rows of looms shown are by Butterworth and Dickinson of Burnley.

In this arrangement, the looms are gear driven, the wheels being guarded by sheet iron.

Here again, no slipping can take place, but it is a wise precaution in case of knocking off, to see that the loom brake is in the best condition. This greatly assists in diminishing the shock to the driving wheels.

PROBLEMS OF THE LOOM.

Whatever kind of loom or looms a weaving overlooker has to manage, fresh problems arise almost every day, and these can only be overcome by patient investigation, keen observation, commendable experiment, and the spirit of determination to master difficulties. Where several overlookers are employed, one may assist another in perplexity, but to obtain self reliance, every problem has to be fought to a finish. The following defects which develop during weaving are amongst the many things a weaving overlooker has to tackle.

Power looms are constructed so that certain parts can be altered to the requirements of different kinds of warp and weft.

Timing the Shed.—Fig. 245 illustrates the cycle of the crank by arrow A, and the theoretical timing of the shafts on the half dwell principle. B is the crank shaft, which is at its back centre C. D is top centre; E front centre; F bottom centre. Each quarter of the cycle is divided into eight equal parts at H, and its full traverse at G. The shed begins to change when the crank is at its top centre at D, and has fully changed at bottom centre F. The change takes place between I and J. The half circle formed by the two quarters K and L are for the shuttle to pass through the shed. This kind of timing is very seldom used in the weaving shed.

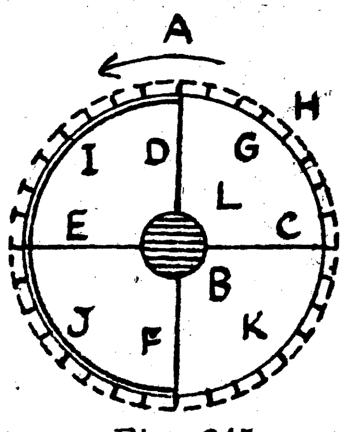

Fig. 245.
Theoretical Timing.

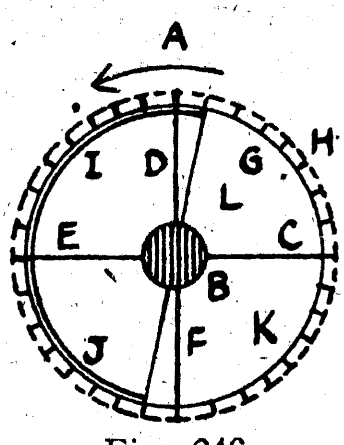

Fig. 246.
Late Timing of Shed.

Late Timing.—This is at Fig. 246. Timing for any kind of warp is limited to rather less than a quarter of the crank's cycle at C and D. In this case, the crank moves seven points in the quarter circle before the shaft begins to change and is therefore late timing. It is very suitable for poor quality warps, because much less friction is placed on the warp when beating up the weft, for the threads are only slightly crossed when the reed is in contact with the cloth. Useful for plain cloth weaving, and for weaves with quick changes such as warp and weft ribs and hopsacks.

Ordinary Timing.—It is named " ordinary " timing because it is applicable for many fabrics, that have gradual shaft changes.

Most worsteds have a clear cut finish, to show weave and colour, and this is obtained by the shed being timed soon, or moderately soon along with good tension. Moderately soon is the central position between late and early timing as in Fig. 247. The lettering in all four diagrams are alike. By the shafts changing earlier, the threads are well crossed before the crank reaches its front centre at E. This prevents the weft springing back after the beat up and is done in the space I and J.

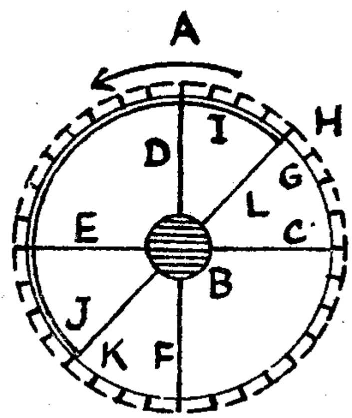

Fig. 247.
Ordinary Timing.

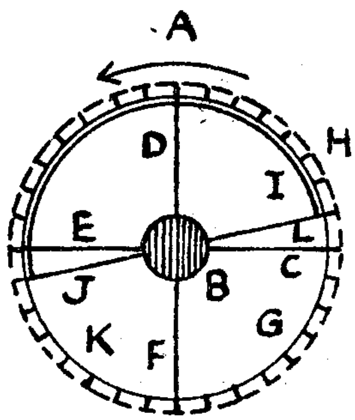

Fig. 248
Early Timing.

Early Timing.—By making the shafts change soon after the crank leaves its back centre, at C, in Fig. 248, the weft is trapped earlier, and is well held at the beat up by the crossed threads. Without such early timing, cloths like corkscrews could not be woven with satisfaction, for the face of the cloth would have numerous curls.

How Timing is Altered.—This is demonstrated at Fig. 249 and is a six shaft weave in a tappet loom. The crank shaft is at A, and B the timing wheel held by setscrews C and D. F is the balance wheel keyed to the crank shaft, and moves as inside arrow. G and H are intermediate wheels cast together, and connect timing wheel B to tappet wheel N on low shaft J. The intermediates follow arrow I.

If shed has to be timed sooner, timing wheel B and intermediate wheel G are blocked at the top, and setscrews C and D are unloosed. The balance wheel is then turned as at arrow M, the setscrews refixed, and the blocking material removed.

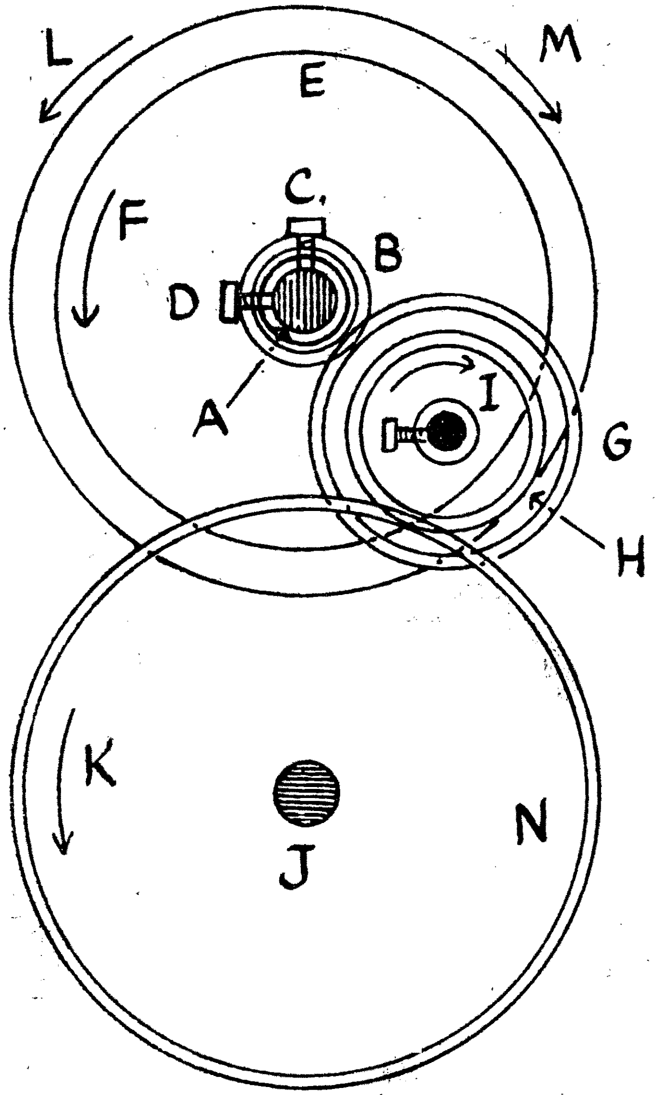

Fig. 249. Altering Shed Timing.

If the shed has to be timed later, the balance wheel is turned as at L. Before commencing to weave, the balance wheel should be turned slowly to judge the timing.

Negative dobby timing is illustrated in chapter "Faults in Fabrics," under sub-head "Curls."

Positive Dobby Shedding.—The diagram at Fig. 250 is a Hattersley positive dobby with eccentric wheels. A is the small timing wheel on low shaft B. It is a double wheel, for bevel wheel C meshes with bevels on the take-up shaft. The small eccentric A works with the large eccentric F on stud E, the movements being as arrows D and G.

On the upper front, bevel F has two slots, each being at an equal distance from the centre line H. To one of these slots, the bottom of the shedding rod is bolted. If fixed at J, the shed is timed sooner, but if at I, it is later. This makes a difference of six cogs, and as the wheel F has 60 teeth, and represents two picks, the difference of six cogs are equal to a quarter of the cogs used for a single pick.

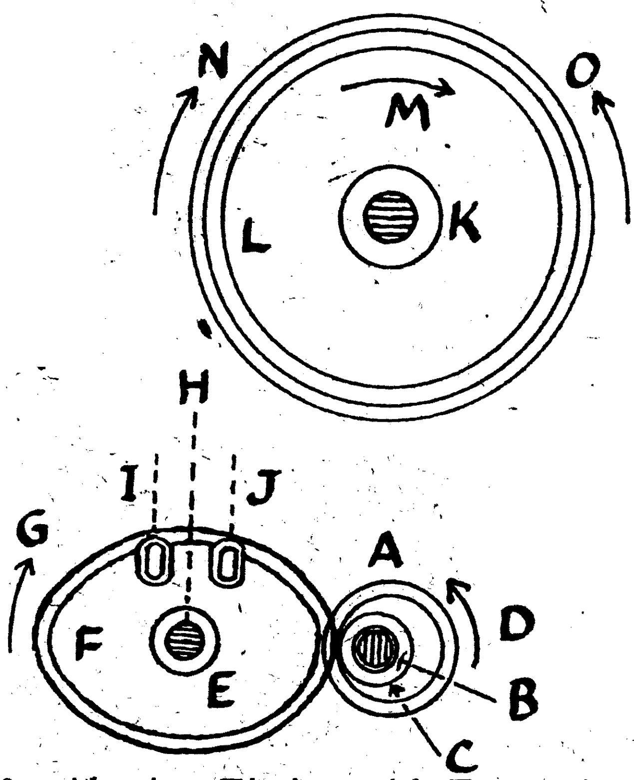

Fig. 250. Altering Timing with Eccentric Wheels.

The two slots indicate early and late timing, without recourse to timing wheel A. If neither of the slots produce what is required, then the timing wheel supplies the means. The balance wheel L is keyed to crank shaft K and turns as arrow M.

To make the alteration safely, the slots should be at the bottom to prevent the wheel slipping, and the eccentrics blocked top and bottom. The setscrews for eccentric A are then unloosed. If the timing has to be earlier, the balance wheel is turned back as at O, but if later, it is turned forward as at N.

Though the eccentric wheels allow more dwell to the shed, the shafts change more rapidly than when circular driving wheels run the loom.

Dobcross Timing.—The Dobcross crank moves bottom half first towards loom front, and therefore anti-clockwise.

In Fig. 251 the timing wheel is at D on crank shaft A, and held by setscrews B and C. When timing is moderately soon, it will weave most warps without further alterations.

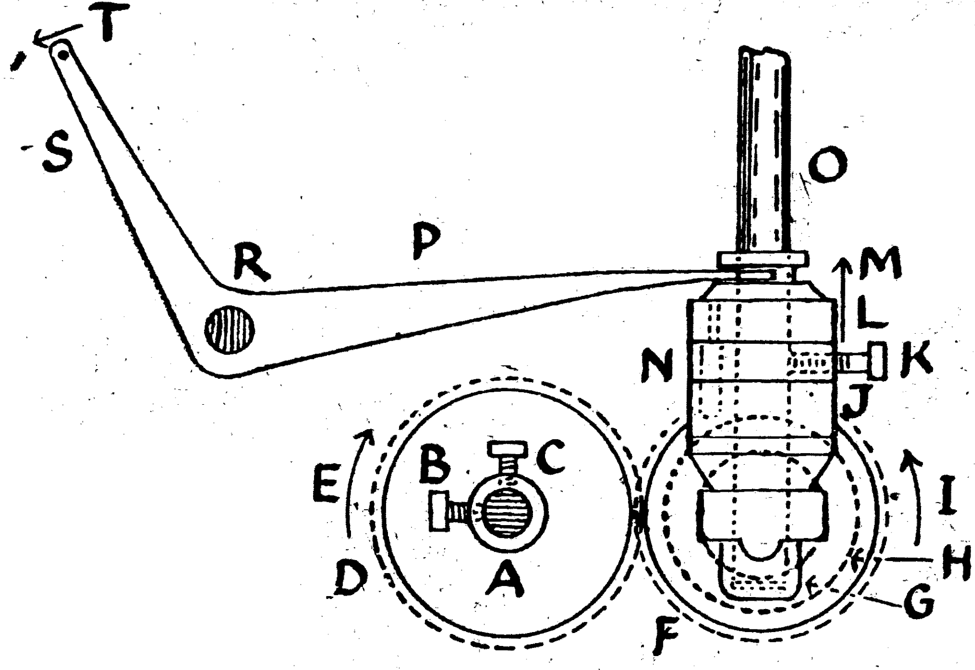

Fig. 251.
Dobcross Timing.

If the shed is required sooner, the driving wheels are blocked, setscrews B and C unloosed, and the balance wheel turned towards the loom front. If later, it is turned away from the loom front.

Jacquard Timing.—See Jacquard loom.

Knocking-Off—Causes.

The sudden stoppage of the loom may be brought about by a large number of causes. What is first looked for is some defect at that end of the loom from which the shuttle made its last traverse. In the overpick, it is the picking strap that is first tried for pitch, for it ought to begin to move the shuttle out of the box when the crank is at its bottom centre. If later, then the strap may need tightening up, but the picking stick may be loose, or the shell have shifted. The weaver regulates the strap, but the overlooker attends to loom parts. The first thing the overlooker does as a rule is to try the strap, but if at the right pitch, he draws the going part forward to examine the stop rod tongue in relation to the frog. The parts are shown at Fig. 252. The crank B is at its top centre, and the stop rod tongue G is almost in contact with the frog M. When the shuttle is fully in the box, the tongue should clear the top of the frog a good ⅛th of an inch. There are two things to attain it. (1) The box side L may be slackened and

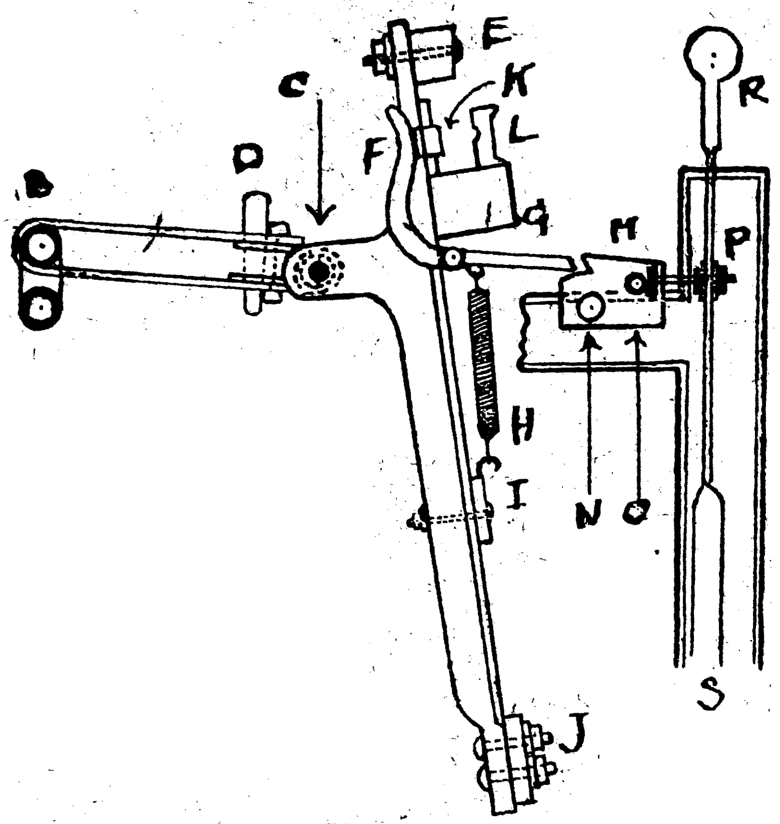

Fig. 252.
Sword and Frog.

pushed in a little, for this will force back the box swell K rather more, and lift the tongue higher. (2) The box swell finger F may be too far away from the head of the box swell, and may require resetting. It should be pressing against the swell when the tongue is at the bottom of the cut on the frog. These two points need supplementing. (3) The closed spiral spring H connects the hook on the stop rod with the casting I bolted to the sword. The spring should have sufficient power to prevent any rebounding after the shuttle has entered the box. To aid it, a regulation strap is fixed behind the box swell finger F so as to give only slight play to the finger when the shuttle is fully in the box.

The sudden knocking-off of the loom may crack the cast iron bushes on the sword pin at C. A very valuable aid for the safety of the loom is to have the cranked knocking-off bolt P in contact with the finger O on the frog when the setting on handle R is in its weaving notch. As soon as the frog M is forced forward by the tongue G coming in contact with it, the setting on handle is forced off. At N is the circular projection for the brake rod. At E is the hand rail, and S is the lower part of the setting on handle. If the picking shell A, Fig. 258 has shifted, it can be immediately discovered by turning the loom over, for if the strap is found to be the right length, and the stick is secure, and the timing late, it is a good indication. To reset, the crank is placed just a little in advance of its bottom centre, and the picker is then lashed to the outer end of the box. The shell is then slackened, and pulled forward to its limit. Each of the four holding bolts are tightened up a little at a time to achieve a uniform pressure

If the pick has become too weak at one end of the loom, the shuttle emerges sluggishly from the shed. The power of the pick may be increased by deepening the curve of the nose, or by a new one, the nose being at B, Fig. 258.

A loose box front, a broken buckle, a cracked picker, or worn out leather or spring that returns the picking shaft after picking are contributory causes that make the loom bang off.

Knocking-Off—Effects.

Some looms are much more sensitive than others, but the less any loom comes to sudden stoppages and the better. The chief effects of the loom banging-off are here detailed.

(1) *Rising of sword.*—As the fulcrum of the stop rod tongue in most looms is above that of the frog, the tendency of sword is to move upward by the sudden impact. If this takes place, and an early discovery fails to be made, a serious shuttle trap is likely to occur the first time the

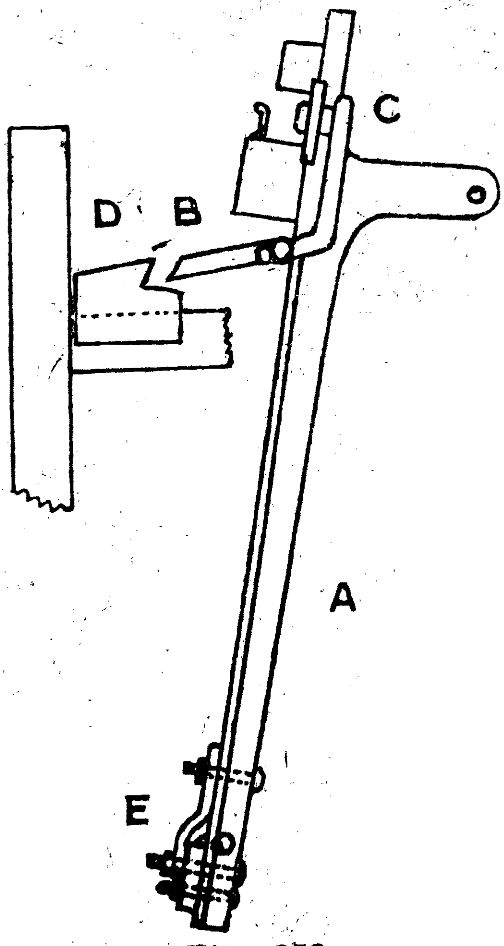

Fig. 253.
Preventing Rising of Loom Sword.

shuttle is trapped in the shed. If the sword is subject to this complaint, steps have to be taken to stop it. A small block of wood may be placed underneath the bottom bolt in the sword foot. A more effective plan is given at Fig. 253. At A is the sword, and B the stop rod tongue, and C the box swell finger. The part D is the fast frog which rests against the front part of the loom frame. The sword foot is at E, and it is here where the alteration is made. A flat wrought iron bar is bent and bored so as to take the top bolt in the sword foot and another bolt that fits through the bottom of the first available slot in the sword. This makes the sword incapable of rising, and, so long as the brake motion is in order, there is no increase of danger.

(2) *Broken Sword.*—In the majority of looms, the stop rod tongue B, Fig. 253, is on the outside of the sword A, so that when the loom comes to a sudden stop, the sword is subject to torsion strain. If the twisting effect is excessive, it may break the sword at the upper end of slot A, Fig. 254 on one side, and the lower end of slot B on the other. The broken sword may be plated with wrought iron back and front, but the more desirable thing is to prevent breakage. The special points are:—(1) To remove the driving belt as speedily as possible from the fast to the loose pulley, (2) To have the brake in the best possible condition. (*See* Fig. 189).

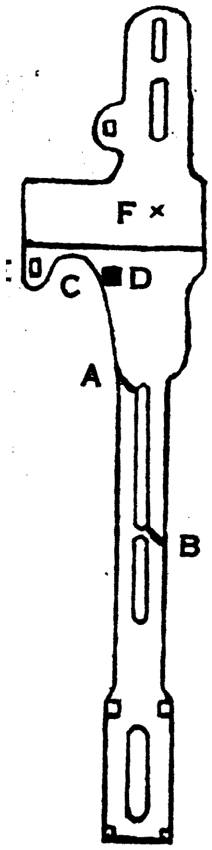

Fig. 254.
Sword Breakage.

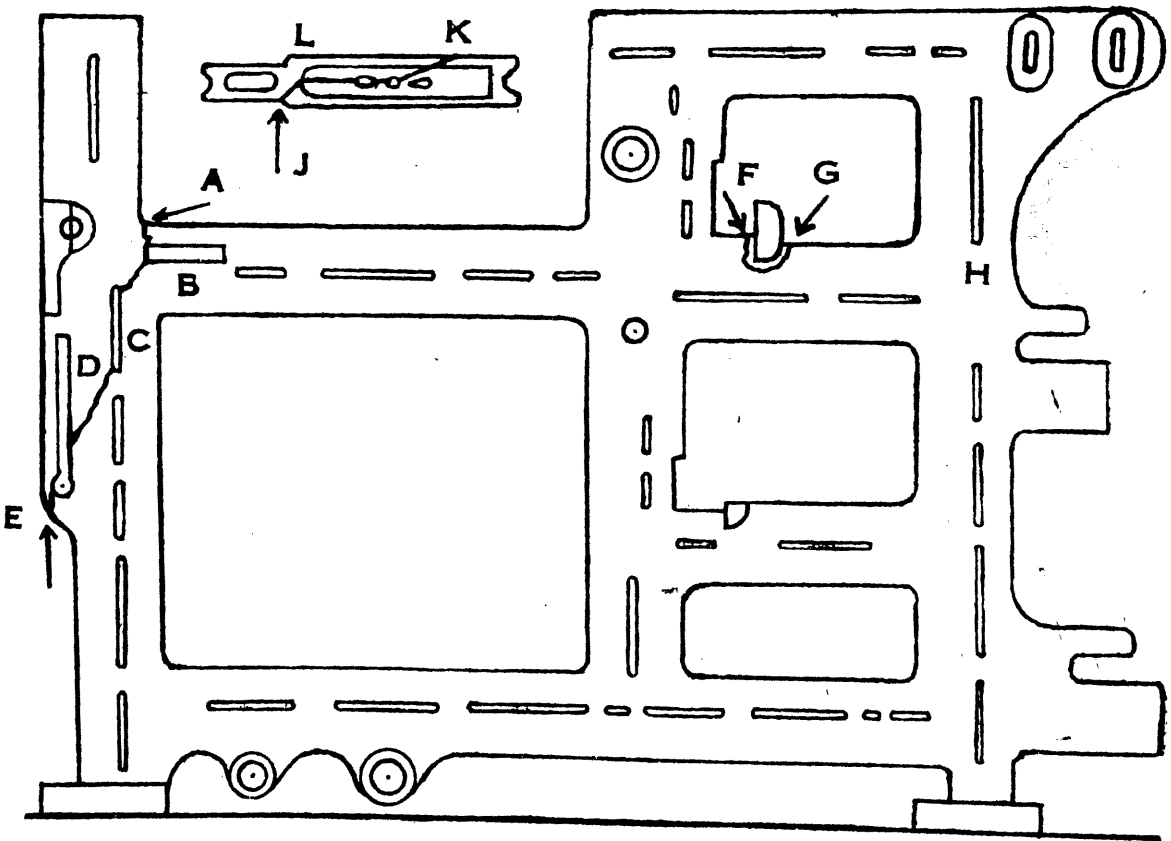

Fig. 255.
Loom Frame Breakage.

(3) *Broken Crank.*—When a crank is broken, the banging-off of the loom is only a contributory cause. The breakage is brought about by the long continued torsion strain in the weaving of heavy cloth. A tighter belt, and the cottering up of the crank arms are valuable aids to the weaving of heavy goods.

(4) *Loose Pedestal Brackets.*—These brackets hold the crank shaft to the loom frame, and for the service they have to perform, ought to be made fit at their best. If not firm, they can be packed with sheet iron which is bent at either end to prevent it getting out. If both brackets have to be packed, the insertion must be at the same side as the other. The test is made, by placing the crank at its front centre, and then measuring from the front of the breast beam to the sley, and as near to the swords as possible. Both measurements should be alike.

(5) *Broken Loom Frame.*—This is the most serious breakage that can occur to a loom, and there are two places where the breakage occurs. The least expensive of the two is the back support of the pedestal bracket G, Fig. 255 which may be due to the loom violently banging-off when this bracket is loose, and either the frog or brake are out of order. The shock has then to be taken by this bracket and its back support. When broken, it cannot well be repaired, but a wrought iron bar may be used as a prop which is bolted to the back part of the loom H. The more exact is the boring of the bar, and the better held is the broken frame.

The brake plays a very important part in preventing such breakage and is given at Fig. 256. At A is the brake wheel which is keyed to the crank shaft. At B is the brake which is fulcrumed at the top. The position of the stout

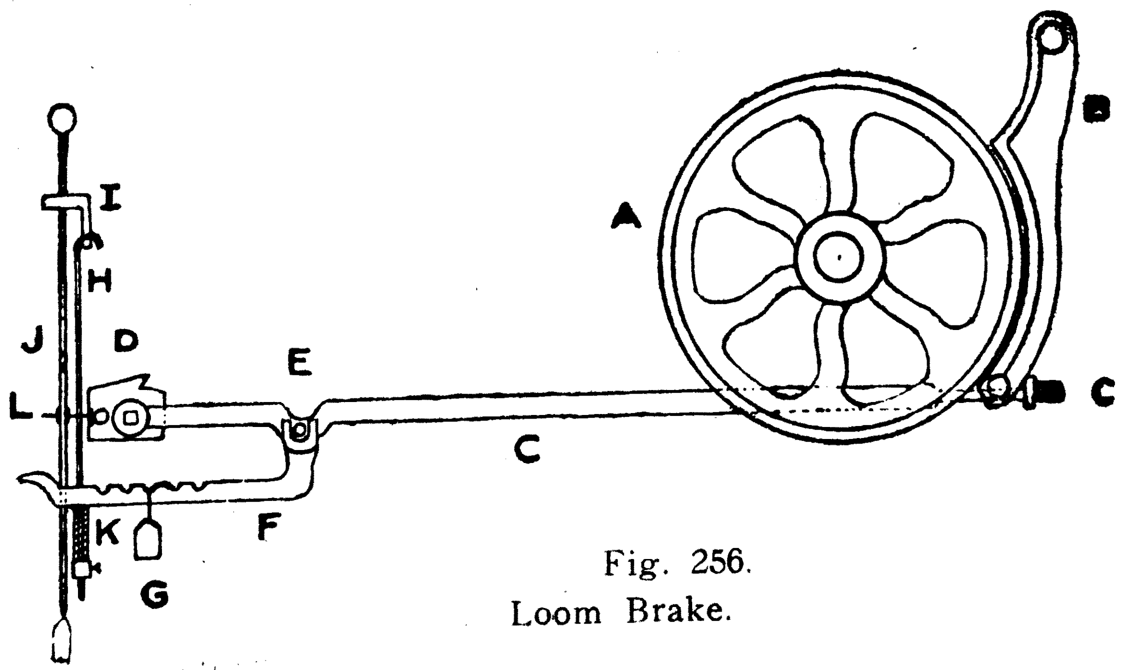

Fig. 256.
Loom Brake.

stud that holds it is very important, for if too far away, the brake only comes in contact with the brake wheel at the bottom end, and so loses part of its power. If the stud is too far forward, then the brake comes in contact with the wheel at the top, and there is grave danger of the brake being broken the first time the loom bangs-off. The length of the brake becomes leverage against its own safety. The brake must be made to fit fully to the wheel. The brake rod at C passes through a casting bolted to the bottom of the brake, the length of the rod being regulated by lock nuts. This length is that when the loose frog is just clear of the loom frame, the brake is then in full power on the wheel. The flat part of the rod is at C and is placed on the side of the frog D. At E is the brake pin for the weight lever F, which carries the weight G. Through this lever passes the rod H connecting tumbler I to the lever and by means of the spring K, the brake and lever move the brake rod and brake away from the brake wheel when the loom is set in motion, but as soon as the loom bangs-off, the setting on handle is forced out of its notch, the tumbler drops, and the weight and lever assist in bringing the brake into action in the least possible time. At J is the setting-on handle, and L the cranked knocking-off finger.

The larger and more serious breakage is to the front of the loom frame. This cannot well take place to an ordinary tappet or dobby loom if the frog and brake are in good order as detailed, but if by some oversight it should be broken, it can be repaired by a boiler plate cut to a brown paper pattern. This serious breakage is illustrated in Fig. 255. The crack begins at A, passes down to the end of slot

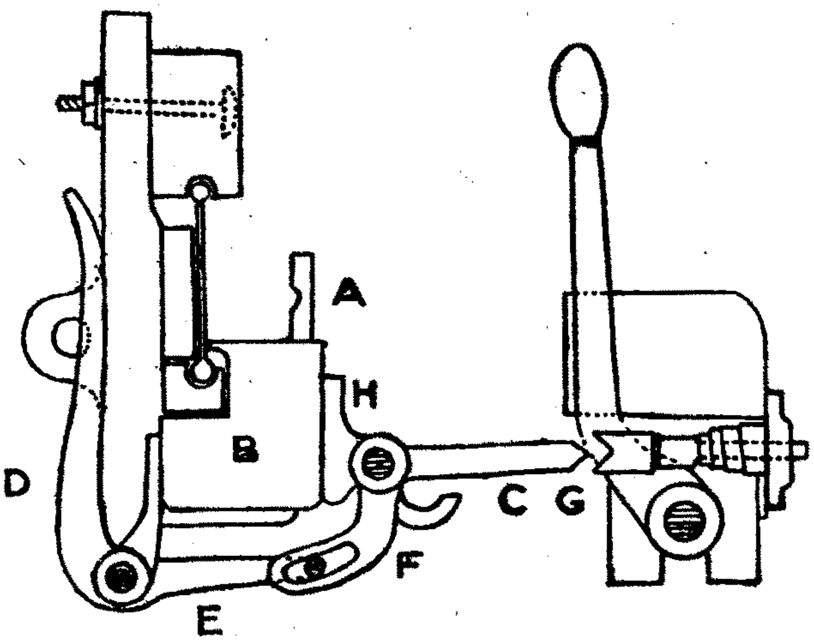

Fig. 257.
Dobcross Stop Rod Tongue and Frog.

B, and through the bottom of slot C, joins with slot E, and passes out at E. When the crank arm L is broken it is usually at J and K.

In the Dobcross plain loom and the older type of box loom, the trigger has to be in contact with the back of the setting-on handle so that as soon as the trigger is forced back by the stop rod tongue, the belt is travelling off the fast pulley. This is illustrated at Fig. 257. At A is the front of the box and B the movable sley rack. At C is the stop rod tongue pointing directly to the V-shaped front of the trigger, the coiled spring behind it keeping it forward. At D is the box swell finger, with E its bottom arm, the pin on it passing through the slot of the casting F setscrewed to the stop rod. When the shuttle enters the box, the box swell is forced back along with the finger D. This movement sinks the stop rod tongue C and it passes underneath the trigger G. When the shuttle fails to box, the mechanism remains as shown and the loom is brought to a stop.

The long, open spiral spring on the setting-on rod ought to be tested after a few years service, for if it is materially reduced in power, it will be all the longer in getting the belt off the fast pulley.

(6) *Stiff Running Loom.*—The frequent banging off of a loom that has a pair of driving wheels at each end of the loom leads to it running stiffly. The cause is that one of the wheels has shifted on its key bed, and the cogs have become locked. When the loom runs easily, both the wheels on the crank shaft are the drivers, for the teeth of the top wheel are pressing against those on the bottom one. When the cogs are across, however, all the driving has to be done by one pair of wheels, for at the opposite end, the cogs of the bottom wheel are binding against the front of the cogs on the top wheel instead of at the back.

The remedy is made by knocking out the key on the bottom wheel, and filing the key way a little wider on that side where the wheel has to be thrown.

Defective Picking.

Some defects in the plain loom overpick have already received attention in the previous sections, and need not be repeated.

Overpick.—(Fig. 258). The upright picking shaft E breaks in two places. (1) By the square. It is this square that holds the bottom of the two toothed brackets J controlling the picking shaft. When broken at this place, either the picking strap has been too tight, or the shuttle has been too tight in the box. It is much better to have flexible spring power to slow down the speed of the shuttle, and retain it in its picking position, than to do so by rigid box pressure. If there be an insufficient lift imparted to the stop rod tongue when the shuttle is reasonably slack in the box, recourse must be made to some other means than tightening up the box front. Either the box swell finger is away from the head of the box swell, or the pin of the swell, or the hole in it is worn.

(2) *By the Cone C.*—When the shaft is cracked by the cone stud hole, the picking nose has most probably been bearing down on the cone instead of giving it an outward push. This can take place when the picking nose is too hooked, or the cone worn too small. Both suggest the improvement. What has been found of value is that instead

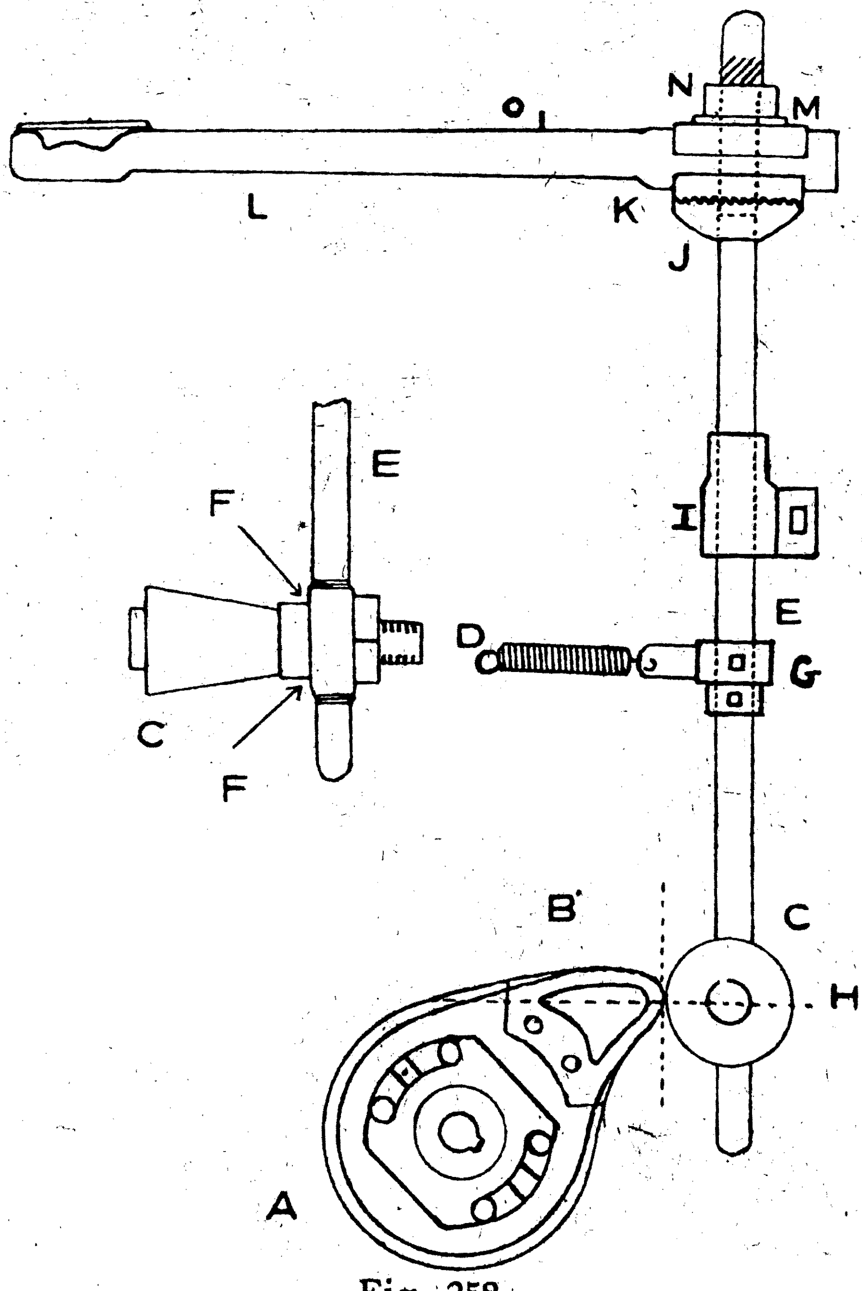

Fig. 258.
Overpick Motion for Plain Loom.

of the shaft being made circular through which the bore is made, it is much better to have it oblong, for then there is no line of least resistance.

Cone Stud.—When the cone stud D is broken, the nature of the break gives a clue to improvement. If it be as if cut through most of the way like as cut with a knife, the collar F behind the cone has not been made to fit properly to the shaft, and the stud has been subject to springy action. If the stud has the appearance of being torn from together, then the stud has probably been loose for some time.

It does sometimes occur that the hole in the picking shaft is too low, for then the nose gets too far over the cone. The position of the hole should be that the centre of the picking stud H be parallel with the end of the nose when the nose end is at the centre of the cone. One is then at right angles to the other as demonstrated by dotted lines.

Bouncing Picking Stick.—When the loom is running, some picking sticks never come to rest. This is chiefly due to lack of balance between the picking cone and picking stick. If the stick be moved forward one cog, the balance is better maintained, and much of the bounce disappears. On rare occasions, it is the shell that is worn into a deep groove into which the end of the cone enters, and is forced out again by the rotation of the shell. The rise from the groove may be made less abrupt by filing, but a new shell is better.

Hattersley Catch Pick.—The picking catch W, Fig. 203, is made with a long pin Y which fits through a curved groove O in the picking arm. If the face of the catch X does not fit with the cut on the cam R when picking takes place, then the catch is thrown upward, and the pin is broken off by coming in contact with the top of the slot. The catch is of no further use until repaired. To prevent the jumping of the catch, the slope of the cut on the cam has to be maintained as when new, and the face of the catch made fit full face to the cam. The force of the forward finish of the picking stick is deadened by the stick coming in contact with a good quality rubber 6 inches long and $1\frac{3}{16}$th inches thick at T. The leather buffer H on the spindle has to coincide with the rubber T.

Hattersley Clutch Pick.—Reference is here made to the one with two legs. (Fig. 259). After a fair amount of wearing, the clutch comes out of contact with the bottom casting E when it should pick, and a dummy pick takes place. This is due to the rounding off of the two picking sides of the clutch legs and those contact sides on the bottom casting. A temporary improvement may be made by applying French chalk, or other gritty substance to the legs, but as soon as ever convenient, the two picking sides of the bottom casting have to be cut straight with a small chisel. This can be done when no warp is in the loom, and there is then no need to take out the picking shaft.

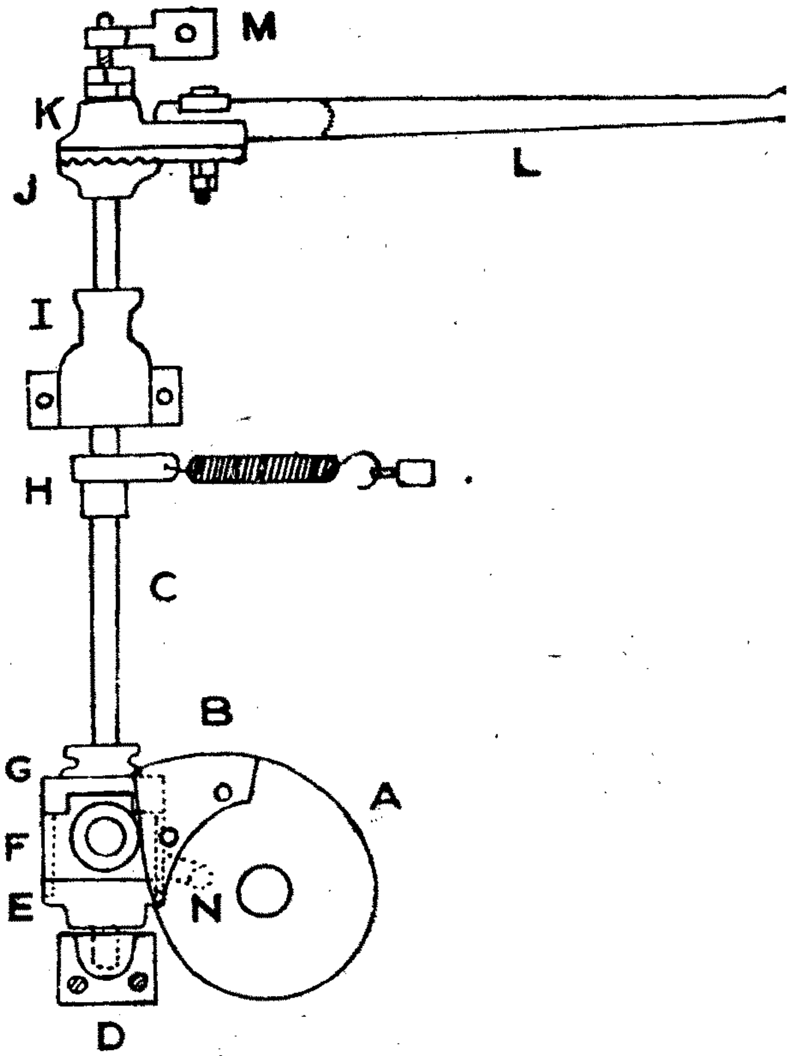

Fig. 259.

Overpick for Hattersley Box Loom.

Dobcross Picking.—This has a strong underpick motion, and is brought about by a bowl which makes a circular sweep depressing a picking shoe E (Fig. 260) fixed to a horizontal shaft with suitable connections to the picking stick. If the loom bangs off, the first thing tried is the timing of the pick. As the crank in this loom goes bottom half first, the picking commences when the crank has just passed its top centre. If later than this, the thick strap that passes round the picking stick will need tightening up. Weak picking is often due to the wearing of the shoe, which has to be advanced ¼ inch so as to receive more depression.

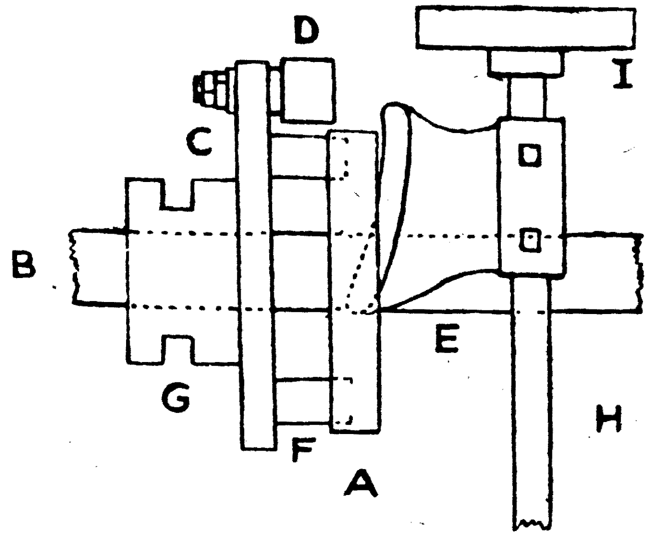

Fig. 260.
Dobcross Picking.

As the shoe E continues to wear, it may be moved forward four times, $\frac{1}{4}$ inch each, but at the last move, it is at its final stage of wearing. The further forward the shoe is placed, and the more sudden is the picking. This kind of picking is detrimental to the driving and change wheels. If the hand be placed on the guard of the change wheel, and a bumping sensation is felt every time the loom picks from one end, it is better to discard a picking shoe than have cogs broken out of the driving wheels. Sometimes the picking shaft at the back and bottom is worn, and the pick is weaker on that account. Power lost in this way may be restored by taking the shaft H out, and refitting the shoe and picking arm, after turning the shaft half way round. The picking bowl needs to be well lubricated to prevent rapid wearing of bowl D, stud, and shoe.

Shuttle Running.

If a shuttle is to run its proper course from box to box, there are several important points that will have to be attained and maintained. These may be set forth as follows:

(1) That the angle formed by the back and bottom of a new shuttle must coincide with the angle formed by the shuttle race and sley. (Refer Fig. 193). This is not a right angle, but is slightly **V**-shaped. The **V** becomes more pronounced as the going part recedes from the cloth until its maximum is reached when the crank is at its back centre. When a new shuttle is placed on the shuttle race and against the sley, it ought not to be able to be tilted against the sley, or be pushed in at the bottom.

(2) The sley for every fresh warp should be tested from end to end with a straight edge, and also any additional pieces that may be used to fill up the gaps at either end.

Any hollows or protrusions are liable to force the shuttle out of the path of safety.

(3) The delivery of the shuttle whether " box or plain " must be so arranged, that when the shuttle is against the picker at the inner end of the box, that it is drawn away from the box back for $\frac{3}{16}$th inch, and also lifted from the box bottom the same distance. Such a delivery tilts the shuttle a little downward and inward at the end which first enters the shed, and this materially assists in keeping it in its true course across the loom. These points may be termed the three fundamentals.

Though they be secured, there are other factors that must receive attention if the shuttles are to work with satisfaction. If a weaver hears a shuttle make a clattering noise as it enters the box, she will know something is wrong.

Ends that have feltered in the front shed, and especially so in quick changing weaves, may cause the shuttle to be thrown out of the loom.

Slack Crank Arms.—When these are too slack, they impart a shaking motion to the going part and shuttle. If this has been going on for some time, it will be found that the back of the shuttle has developed vertical ribs. If the cottering has reached its limit, the outer bushes at the crank and sword pin may be packed with hard leather, for then the metal straps will continue longer in service. Both ends should combine firmness with freedom. The ordinary crank arm is at Fig. 261. A is the outer bush and B the crank. At C is the lug and recess, and D the crank arm. The long metal strap is at E. At F is the short metal strap, and H and

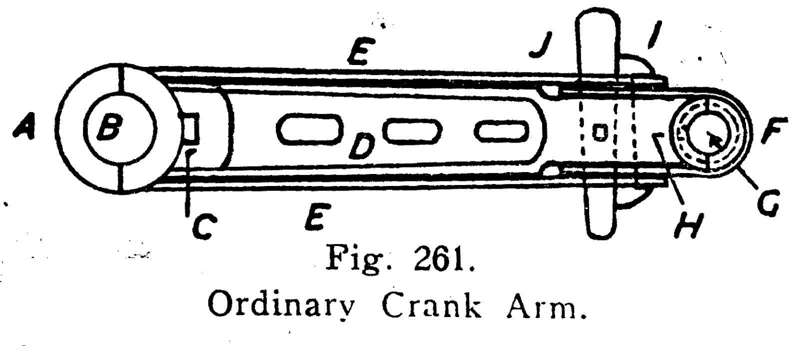

Fig. 261.
Ordinary Crank Arm.

I the two bushes on the sword pin. The holder is at J and the cotter at K which is driven downward to tighten up both straps.

Fig. 262, has been named the " Adamant " by the patentee, Mr. Arnold H. Stow of Wilsden, Bradford, and has met with much favour by manufacturers. The half bush A is brass, and is flanged at either side. Half bush B is brass, but has only one flange at the opposite side to the one shown. C is the lug for it to be held in position.

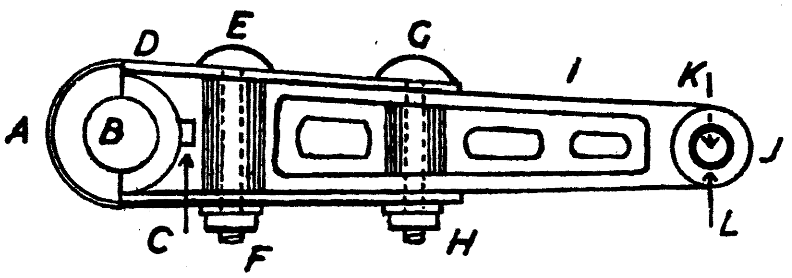

Fig. 262.

There is only one metal strap as at D, and this is slotted in two places top and bottom to receive the fixing bolts E and G. These bolts pass through the more solidly made parts of the crank arm, and are held by self-locking nuts at F and H. All four slots extend to the left to take up the slack made by wearing. At I is the arm, and at the end J, there are no half flanged bushes. They are substituted by a circular brass bush L, that is driven tightly into the bore of the crank arm. The bore K through the brass bush, is for the sword pin to pass through. When the sword pin is worn, it may be turned half way round and held by a setscrew, or replaced.

Fig. 263 is made for the Hattersley Standard Model Loom. A and B are the flanged gun metal bronze bushes on the crank shaft, the inner one having a lub to prevent them turning. C is the cotter and D the gib for holding the short metal strap E, the surplus of the slots being on the left. F is the crank arm that is solid in the centre, but slotted vertically towards both ends for gibs and cotters to pass through.

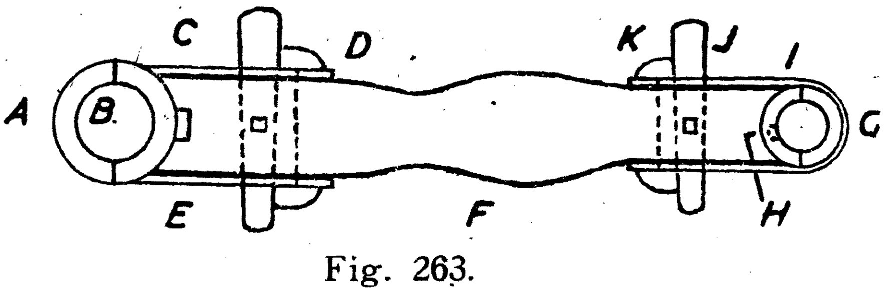

Fig. 263.

The bushes for the sword pin are cast iron and are at G and H. As I is the other metal strap, with its cotter at J and gib at K, the surplus of the slots are on the right.

This style reduces the length of the metal straps, the holding power is doubled, and is more readily adjusted.

Fig. 264 is the Northrop crank arm, with A and B the brass bushes for the crank. At C, top and bottom is the metal strap, which is turned at right angles at the ends. An almost similar strap, but with extra thickness at G, embraces the sword pin and bushes.

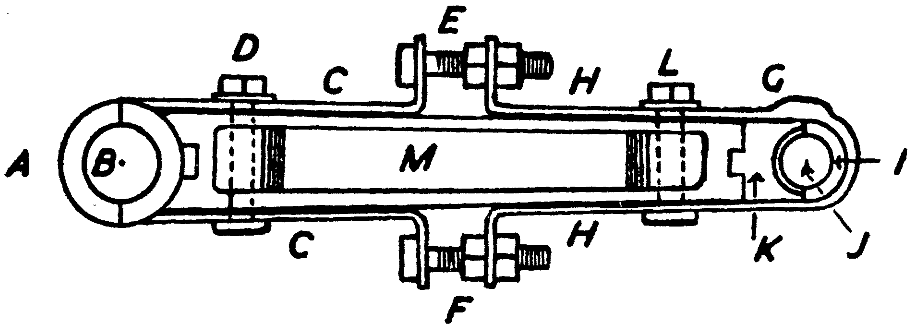

Fig. 264.

The two metal straps are bolted together at E and F, the bolts being locknutted. Only the slightest lateral play is conceded to crank arm M, and then, the holding bolts D and L are braced up by the spanner.

The outer flanged bush on the sword pin is at I, and the opening at J is for the sword pin. The locking casting K is indicated by the arrow. The crank arm is solid, but is thicker where the holding bolts pass through.

Improved Northrop Shuttle Eye.

A side and top view is given at Fig. 265, and at A is the circular leg that passes through the bottom of the shuttle, and B the chief screw bore to hold it in position. C is another bore which is cut into to allow the weft a passage through the casting and to pass outside the shuttle. A third bore is from the back of the shuttle, and is to tighten the spring pressure on the weft, the spring being at D.

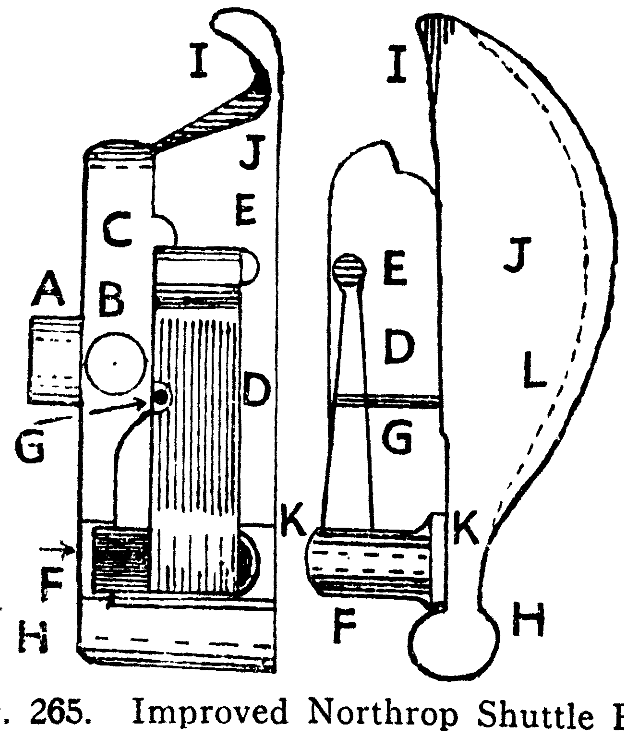

Fig. 265. Improved Northrop Shuttle Eye.

At E is the riveted pin for the spring D, the end of the spring being at F. It is semi-circular with a rounded top that comes in contact with a steel plate K, which is doubly riveted to the brass or main copper casting. G is a riveted pin that passes through both parts of the spring D. At H is the rounded end of the casting, the shuttle being gouged out to let it slide downward. At I is the rounded lip of the main casting that enables the weft to pass downward in the self threading process. J is the main casting to which the small steel plate is riveted. Both figures are lettered alike. The contour of the shuttle eye is made to suit the warp twist in one make, and weft twist in the other. At L is the sloping down side of the main casting. This and others are Mr. P. Tyler's patent, High Street, Kingswood, Wotton-under-edge, Gloucestershire.

V Rope Construction.

The usual size for the running of a loom is $\frac{1}{2}$ wide, and $\frac{11}{32}$ inch thick. The vital parts in the construction of the rope are demonstrated at Fig. 266. At A is the outer rubber which has sufficient flexibility to withstand bendings without injury. It is the outer part of the rope that expands the most. It also keeps the cords in their correct positions. These series of cords are shown at B, and do the actual work of driving the loom. There are 25 cords in each of the eleven rows, each row being laid in parallel lines at, and above the pitch line. This prevents twisting in the grooves when running. At C is the bottom rubber, which is heat resisting. It is tough but pliable, and easily bends over the small motor pulley.

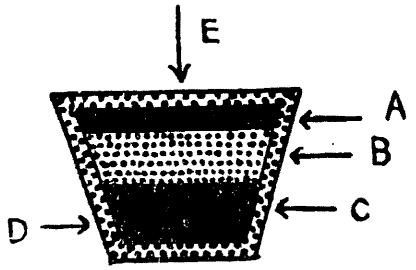

Fig. 266. Construction of "V" Rope.

At D is the inner cover which reinforces the outer cover, and effectively prevents moisture, dust and dirt from reaching the central drive cords at B. At E is the outer cover. This is a rubber impregnated fabric which gives excellent resistance to wear, and maintains the same co-efficient of driving friction for a long term of service.

The ropes are manufactured individually in metal moulds, and are then vulcanised under pressure. The accuracy of the moulds ensures that all the V-ropes from the same mould are identical in width, length, thickness and angle. Each rope is thus compelled to give its full share of service for the driving of the loom.

Worn Shuttles.—By the style of their delivery as well as having to force back the box swell, shuttles become worn at front, back, and bottom. The back and bottom are the most important. If a straight edge be applied, it will be found they have become bow-shaped. Such a shape is against good running. By the judicious application of a moderately coarse file, the back and bottom may be filed straight, or slightly hollow. Both should be the same size when finished off. Such filing away may have to be followed by an adjustment to the boxes. (*See Fig.* 191).

Dropped Boxes.—In box looms, whether controlled by chains or levers, the boxes drop a little below the shuttle race. The delivery of the shuttle is thus adversely affected as well as the entrance into the box. Such dropping causes marks or chippings to be made on the shuttle, and ought to act as a warning to the weaver. Before any further weaving takes place, the boxes have to be reset by the overlooker. When some kinds of chains are used for the movement of the boxes they have at times to be packed to get the correct altitude for all the boxes, or they may be turned over.

Weft Cutting.

This is one of the worst things an overlooker has to contend with. A plain loom is even worse than a box loom, for the shuttle front is well covered by the box front, and the actual process cannot be seen. The speed too, often eludes the sharpest eyes.

What has proved of great value in a plain loom is to make the box front slope at the same angle as the shuttle front. This is the most effective way of preventing the weft from dropping between the box and shuttle front, and being cut as the shuttle is being forced out of the box. This is a simple but very effective remedy. It has to be carried out for both boxes, and then the shuttles wear evenly at both sides of the loom. To get the correct slope of the box front, the feet of it are packed with tapering cardboard which is put in front or back to secure the desired effect. Fig. 193.

Weft Fork Cut.—The side weft fork is liable to be knocked by the weaver when changing the shuttle. The knock bends one of the prongs, and brings it in contact with the grate through which the prongs pass. Such contact severs the weft. The length of weft from the selvedge gives a good indication which prong requires attention, but the spot may also be found by drawing the going part forward. Any sharpness can be smoothed with emery cloth. (*Refer* Fig. 221, Page 304).

Box Loom Shuttles.—In boxes with open fronts, the shuttle is held in the box by the turned up front part of the shelf. As the shuttle must force back the box swell, it is worn away most, well towards both ends. It is at these places that the weft drops between the box and shuttle, and is severed as the shuttle is propelled from the box. The dropping is prevented by pegging a small strip of a frayed and twisted thrum along the front of the shuttle.

In these boxes, it is the removal of a fruitful source of weft cutting when the rod and bushes at the front entrance of the box are substituted by a shaft top leather. (Box, Page 397, Figure 301. Shuttles, 485-6, Figs. 427 and 428).

Weft Breaking.

This is different from weft cutting. It may be distinguished by an examination of the severed end of weft. When cut, all the fibres are practically cut straight, but in breakage, there are differences in fibre length. Breakage occurs in many ways. The shuttle spindle may have dropped, and the drag be too severe when the weft is nearing exhaustion. The spindle might be too slack and vibrate vertically, and the weft be broken as it lifts. It may be too slack horizontally and the weft coils are forced against the inner sides of the shuttle. At times the pot eye is cracked and damages the yarn. Sometimes the shuttles are so worn at the bottom, that more bulky weft than ordinary protrudes through the bottom, and is rubbed on the shuttle race.

Careless spinning results in the weft being too bulky for the shuttles, and to save the expense of rewinding, the inner sides of the shuttles have to be scraped to make room for the weft. Smooth weft like worsted, combined with bulky weft like those on Universal Winder bobbins, makes the weft fly out of the shuttle. This is caught at various places and broken. The " flying " has to be checked, and this is done by a double strand of loom cord being placed on the shuttle pin near the eye, and the cord then pegged down at the opposite end of the shuttle.

A cracked shuttle may hold the weft, but by pressing the cracked side inward, and rubbing it with fine sand paper, the shuttle may last for some time longer. Rough pickers are sometimes responsible.

Weight of Fabrics and Make of Loom.

Some looms are only made to weave light or medium weight cloths, but occasionally the heavier cloth has to be woven, and from start to finish, it is a struggle for overlooker and weaver to get the work done. The warp has to be placed over two back rails, the loom belt tightened up, the shed enlarged, the shuttle front top rounded off, and there may be also need for a pair of new picking noses. The crank arms may need cottering up or packing, and it is quite likely that when all points have been attended to, that the loom will bang off many a time a day because the work is too heavy for the loom.

If the loom has a rigid handrail, it is nothing unusual for the inner top sides of the swords to be broken off.

If the loom is served with a centre weft fork, and a wooden hand rail, a continued weaving of heavy cloth has broken the shuttle race in the centre where it springs the most.

Whenever possible, such weaving should be avoided.

Worn Sleyrack.

The reeds of sleys are square cut at their ends, and when the covering of paper has worn off, the constant force required to beat up the weft gradually scrapes away the bottom of the rack behind the shuttle race. This wearing away occurs most in the centre, and in course of time, it becomes so hollow, that when a heavier cloth than ordinary has to be woven, the sley is forced out of the handrail. To meet the situation, the place nearest either temple where the sley can be moved upward can be marked on the cloth. Strong brown paper of the length between the marks may be folded, and the folds then decreased towards either end. The whole length of paper is then curved, and inserted in the bottom of the rack. The handrail is then secured, and the sley again tested for firmness, and any further alteration then made.

Wrong Lifting.

Quite a number of things are responsible for the shafts not lifting according to the design, and each make of loom has its own particular causes.

Hattersley " V " Dobby.—This is one of the best dobbies ever invented for reliability. The feelers have practically no bounce when a peg moves away, and the lags and pegs are so made that no peg actuates two feelers.

When a wrong lift occurs, it is one of the top catches that makes it. This is brought about by the wearing of the hook on the catch that connects it to the balk, as well as the balk pin (*Refer* Fig. 47). The structure of the dobby makes the bottom catches fall back when the bottom of the balk is against its rest bar, but the top ones lean forward. When catch and balk are worn, the upper cut on the catch extends beyond the holding bar that holds the catch back when the corresponding shaft is needed on the bottom shed, and this makes the wrong lift.

The defect can be immediately discovered by placing all the shafts on the top shed when the bottom draw bar is forward, and the shedding rod at its dead bottom centre. The catch can be filed shorter without disengaging the balk, and thus be made to wear much longer.

Dobcross Dobby.—After considerable wearing, the bushes on the shaft lags become worn at the end, and this gives the bowls too much liberty. One bowl may then engage two vibrator levers H and so make a wrong lift. The bushes may be packed with band to make all the bowls be directly opposite their respective levers. To this end, the cylinder K can be arranged so the packing is done away from the bowls. (Fig. 267).

Another cause is when the vibrator does not work freely in the two grates through which it passes. The shaft then remains on the top shed when it ought to be on the bottom one.

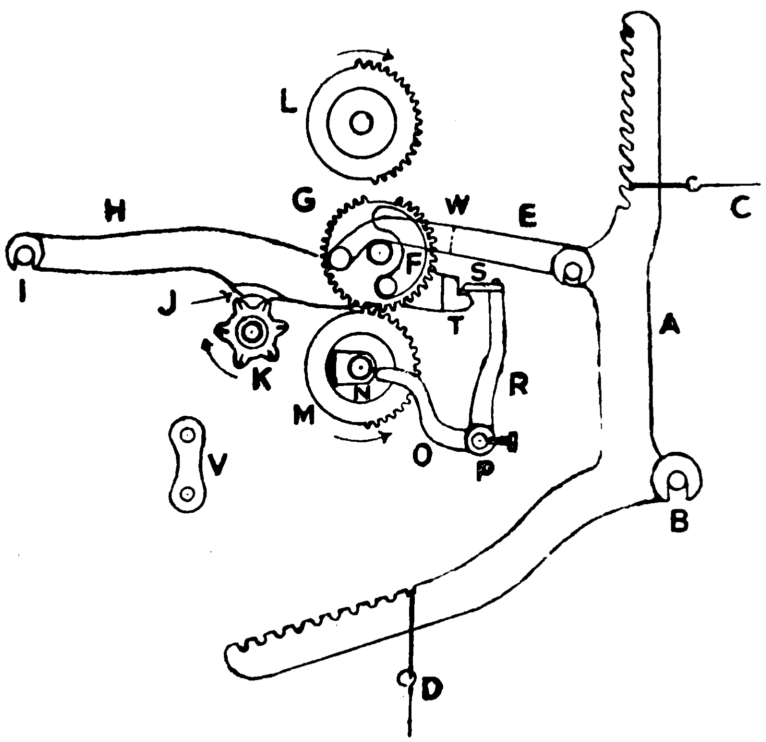

Fig. 267.
Dobcross Dobby.

When the lever does not drop easily, it is either bent or twisted, or the connector E is out of line.

The worst aspect of wrong lifting is when one or both of the semi-toothed cylinders have their teeth damaged, L and M, Fig. 267. If the top cylinder is affected, the vibrator lever and wheel have been lifted too high, or the vibrator wheel has been of harder metal than the cylinder. If the bottom cylinder has sustained injury, then either the harder wheel is the cause, or the end of the vibrator lever which fits through the inner grate is worn so it is not held firm enough by the lock knife S. The shallow meshing of the cogs begins the spoiling process.

In the Dobcross loom nothing requires more careful setting and more frequent observation than the cylinders.

Lag Faults.—A lag or lags that have become too short in length are better broken up, for they allow pegs to touch two feelers instead of one. Cracked lags, unless the holes are packed, cause pegs to drop out. Short pegs may be discovered by holding each lag of a set level with the eyes. All pegs should be tested for firmness before the set is placed on the loom. This saves much fruitless labour as well as expense in waste. Elongated loops and links cause the lags to catch on the top of the cylinder, and either compel the engine to make a wrong lift or the connection is torn asunder.

Timing of Lag Cylinder.

This may be said to be a fixture, but different looms have different timings, and in some cases, and under certain conditions, it is one that is easily overlooked. Unless the cylinder is timed and set correctly, the engine is unable to do its work properly. Occasionally the lags become entangled, and the wrench may dislodge the dolly, or in case of a negative dobby, it may alter the leverage.

Negative Dobby.—The catch that turns the cylinder is bolted to the bottom arm of the front engine lever. It turns the cylinder as it moves forward, and completes the turn at the end of its forward stroke. It has neither to be excessive nor short, but of the two, it is better to be a little short as the star wheel and spring behind the engine will complete the turn. If excessive, then the operating lag is forced past its dead top centre, and causes the feelers and needles to sink, and then rise again when the cylinder moves back. This is very bad setting, and wears the points of the star wheel. The quickest way of setting is to place the shedding rod at its dead bottom centre, and then fix the turning wheel with the bottom of the cog against the turning catch.

Square Dobby.—This make of a Hattersley loom has two dolly pins to operate the turning wheel, and two to reverse it. It is the usual practice to have the dolly with its pins level with the width of the loom. By practice, however, it is found that better results are obtained when the dolly is set a little in advance. The bounce of the feelers is less pronounced, and if a leather covered lag be placed underneath the outer ends of the feelers which is slightly higher than the ordinary resting position of the feelers, there is a marked reduction in wrong lifting.

Dobcross Dobby.—In this loom, the lags are in continuous motion when the loom is running, the cylinder turning in fixed castings at either end. In either the old style or the new, a fresh lag should not begin to push up the vibrator levers until the lock knife has cleared the ends of the levers. To have it timed a little earlier would not make the engine lift the shafts wrong, but would badly wear the ends of the levers T and lock knife S in a short time. Fig. 267.

The lock knife is moved by a cam on the shaft of the low cylinder at the front of the engine, and imparts an outer and inner dwell to the lock knife. The outer dwell of $\frac{1}{4}$ of its revolution gives ample time for the levers to change their positions, and the inner dwell of half a revolution of the cylinders is essential to hold down the vibrators whose corresponding shafts are required on the bottom shed.

In connection with the lags, it may be here stated that old and new side links V, as above, will not work in harmony, and if a length be held up for inspection it will be at once seen how wavy they are in appearance, and how different are the spaces between the lags. Worn side links are the means of breaking the blades of the cylinder by throwing the weight of lifting the vibrator levers on to the blades, instead of the ends of the cylinder.

Hattersley Standard Loom.—(Frontispiece). The dolly on this loom has only one pin, but it has important work to perform. Not only has it to do the ordinary work of turning the shaft and box lag cylinders, but it must move in response to the pick finder motion. It is timed by the shedding rod, and there are two timings. (1) The one for weaving on a right hand loom has to be at its right hand centre when the shedding rod is at its dead bottom centre. (2) The one for reversing has to be at its left hand centre when the shedding rod is in the same position as before. The ordinary weaving and the automatic pick finding then works in harmony. (*Refer* Fig. 65).

Ordinary "V" Dobby.—The timing of the lags for this dobby is to have the dolly pin at its back centre nearest the observer when the crank is at its back centre. This is the correct timing whatever be the timing of the shed. When the timing of the shed is altered, the position of the dolly pin is altered with it. Before restarting weaving, however, the dolly pin must be brought back to its former position by altering the bevel wheels that are influenced by the reversing collar. (*Refer* Fig. 47).

Letting-Off Catches.

For the positive letting-off motions, there are three styles.

(1) This has only one letting-off catch, but the wheel it turns has fine teeth. It is the fineness of tooth pitch that makes it effective in the even letting-off of the warp. Any jumping of the catch leads to light and heavy bars being made the weft way of the cloth. The blunt point of the catch has to be kept in good condition, for the catch wears the wheel, and if the cogs are to be kept a good shape, the catch must be kept in good trim. If the wheel be considered as a circle, then the catch has to operate in the upper right hand quarter of it, and the nearer it oscillates at either side of the centre of that quarter and the better.

If the catch at any time shows signs of jumping, and the catch point be in good condition, then a leather strap with a weight attached may be passed over the back of the catch to keep it down. Though this plan makes the catch and cogs wear a little quicker, it prevents uneven pieces being made.

(2) Let-off and reverse catches are on the same stud, and are **V**-shaped into one another (Fig. 296). Each catch end is in two sections for the blunt part slides on a raised part of a shield which covers part of the letting-off wheel, whilst the other on passing beyond the shield, turns the wheel. In time the letting-off catch becomes blunter and shorter, and it is the shortness more than the bluntness that causes barry places to be made in the cloth. The sharpening up of the blunt point is quite in order, but the catch stud must be placed a little lower if the wheel is to be turned efficiently. The lowering of the catch stud has not to be excessive, or the **V** parts of the two catches will be opened out and quickly worn, and the catches become useless. The letting-off wheel is a double one, for one section is for weaving with the cogs pointing backwards, but those for reversing point forward.

(3) Double catches are used on most positive letting-off motions. In every case, these are arranged so the back catch is half a cog ahead of the front one. When both operate too near together, the wheel remains stationary too long, and then when it does begin to move, it does so with too much vigour. The standing makes a heavy weft bar in the cloth, and the too vigorous action a light one. An occasional examination when commencing a fresh warp may be a very profitable transaction. (*See* Fig. 297).

Quadrant Letting Off Catches.—The fitting of these catches on the Dobcross loom is an important matter, for if not properly adjusted, the woven fabric cannot be as even as should be. (*See* Fig. 99).

It is not enough that the arm of the quadrant be vertically straight when the crank is at its top centre, though this is the proper setting. It is the catches that need attention. The front catch should be half a cog behind the other, when the back one is at the base of a cog. This setting gives the best letting off of the warp.

To have the catches at the same pitch when in the position stated, is to cause the letting off wheel to be too slow, and then too fast in movement. When too slow, a small dark bar is formed in the cloth, and when too rapid, a light bar is made.

The best test is not at the loom, but at the bench. Both catches should be placed on a pin that will just slide through the bore of the catches. The pin is then held parallel to the wheel, and the back catch placed at the base of a cog. The front catch point should then be in the centre of the cog upon which it rests.

Positive Taking-Up Motion.

Most plain looms are fitted with the ratchet positive taking-up motion, the gauge figures being 3,600. The number of picks per inch is divided into those figures, the quotient giving the number of cogs required in the change wheel. It is customary to put on a change wheel with one cog more than the calculation to take up the cloth a little quicker. The ratchet wheel has to be turned with precision or small bars appear in light weight fabrics, but they are not likely to be detected in heavy ones.

There are five points in the working of the ratchet, the neglect of any one being to the detriment of the fabric. (Fig. 268).

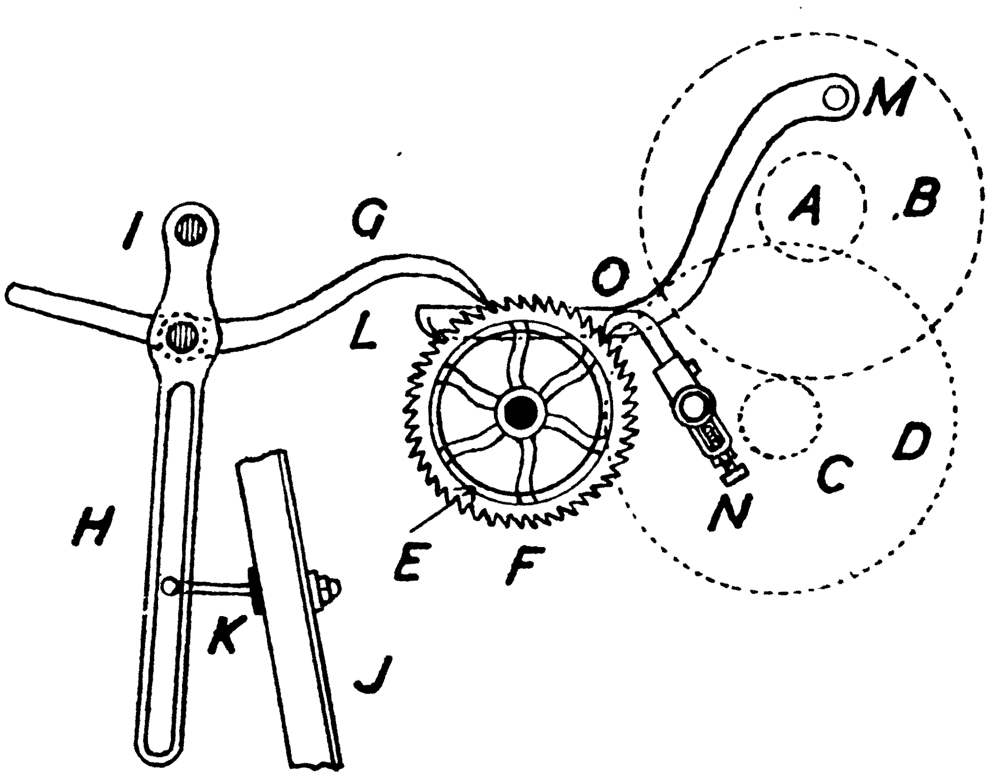

Fig. 268.
Positive Taking-up Motion.

(1) The holding catch L which drops of its own weight, should be so free as to readily seize the first cog on the slight run back after turning. To this end, the finger on the same rod but at the opposite end of the loom has to be clear of the knocking-off bar in front of it, for only by such a clearance can the holding catch work as expected.

(2) The pushing catch G has to be in the centre of the cog upon which it rests when the crank is at its back centre. This insures a good drop when the going part goes back, and an adequate start.

(3) The leverage imparted to the catch G must be such that the holding catch drops over the cog when the sley is within an inch of the cloth.

(4) When two cogs are taken up at a time when few picks per inch are to be woven, the starting place is as before, but the holding catch must now drop over the second cog when the sley is within an inch of the cloth.

(5) When the weft breaks or runs off, the holding and pushing catches are elevated, and it then rests with the running back catch O to hold the ratchet wheel F. This catch is on the front of the wheel, and the shaft of the catch fits into a slide, the working length of the slot being regulated by a locknutted setscrew at its base at N. It can be made to run back one cog for a one tooth take-up leverage, or two cogs for a two teeth take-up.

The taking-up lever is at H and oscillates on the pin I. The lever H is swung to and fro by the cranked rod K. bolted to the sword J. At E is the change wheel on the same stud as the ratchet wheel.

Testing of Boxes.

It is a saving of the weaver's time if the boxes be examined prior to a fresh warp being started. A set of lags can be made and kept for the purpose of raising one box at a time, and dropping them the same way. The lock-nuts at the bottom of any box rod affects the whole of the boxes, but individual levers control one box each. When two work in unison, there is then a double lift or drop. As an example, the Hattersley drop box motion is introduced. (Fig. 269). At A is the rod, the top of which passes through

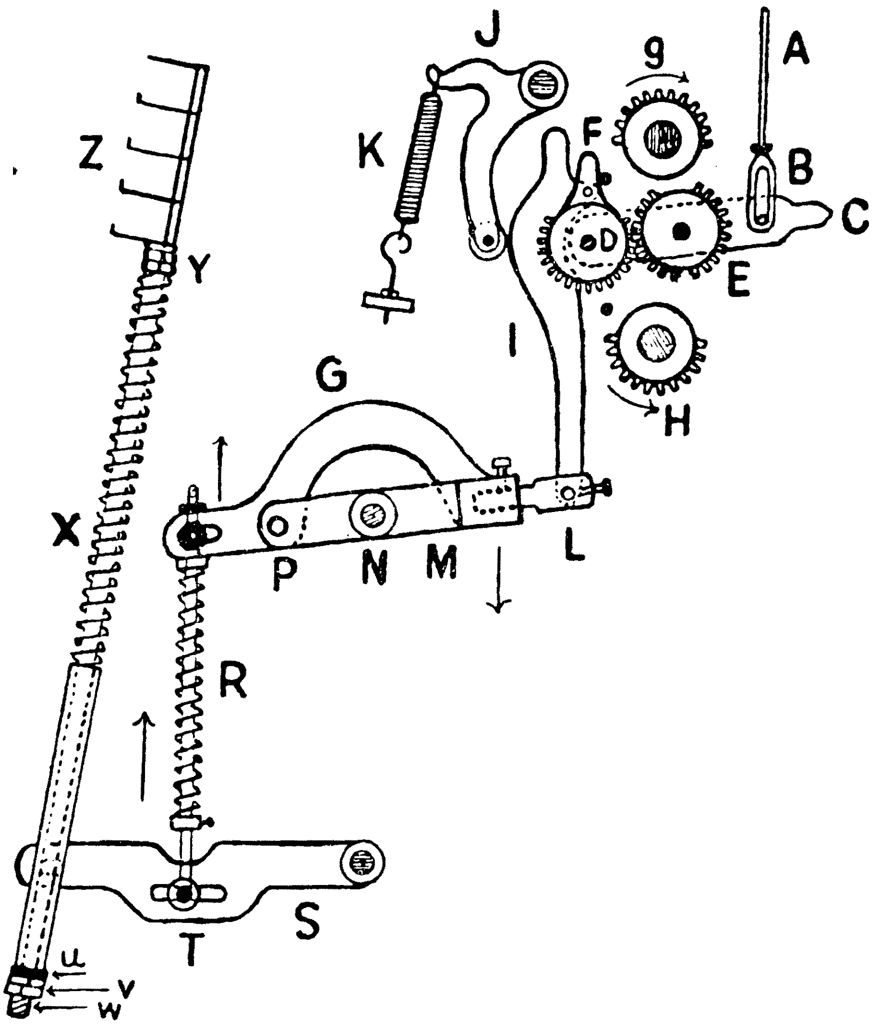

Fig. 269.
Hattersley's Drop Box Motion.

the lag feeler, and is influenced by the pegs in the box lags. At the bottom of the rod is the slotted casting B which fits on a button on the vibrator lever C. The vibrator wheel E which is fulcrumed on the lever C, meshes with the box vibrator wheel D. The wheel E is turned in one direction by the toothed cylinder G to depress the box, but is brought in contact with the bottom toothed cylinder H to raise the box. The connecting arm I is on a button on the wheel D, but at the bottom, is held to the slide L. This slide is one of the means of regulating the leverage imparted to the box, for if tapped out, the leverage is less, but if tapped in, it is increased. There are two slides and two levers to regulate the boxes at each end of the loom. Both slides cannot be shown, but both levers are visible, the one regulating the second box being at G and the one controlling the third box being at M and fulcrumed at N, the other being fulcrumed at P. When both work in unison, then the fourth box is brought level with the shuttle race. There are in all, five places where the leverage to the boxes may be altered.

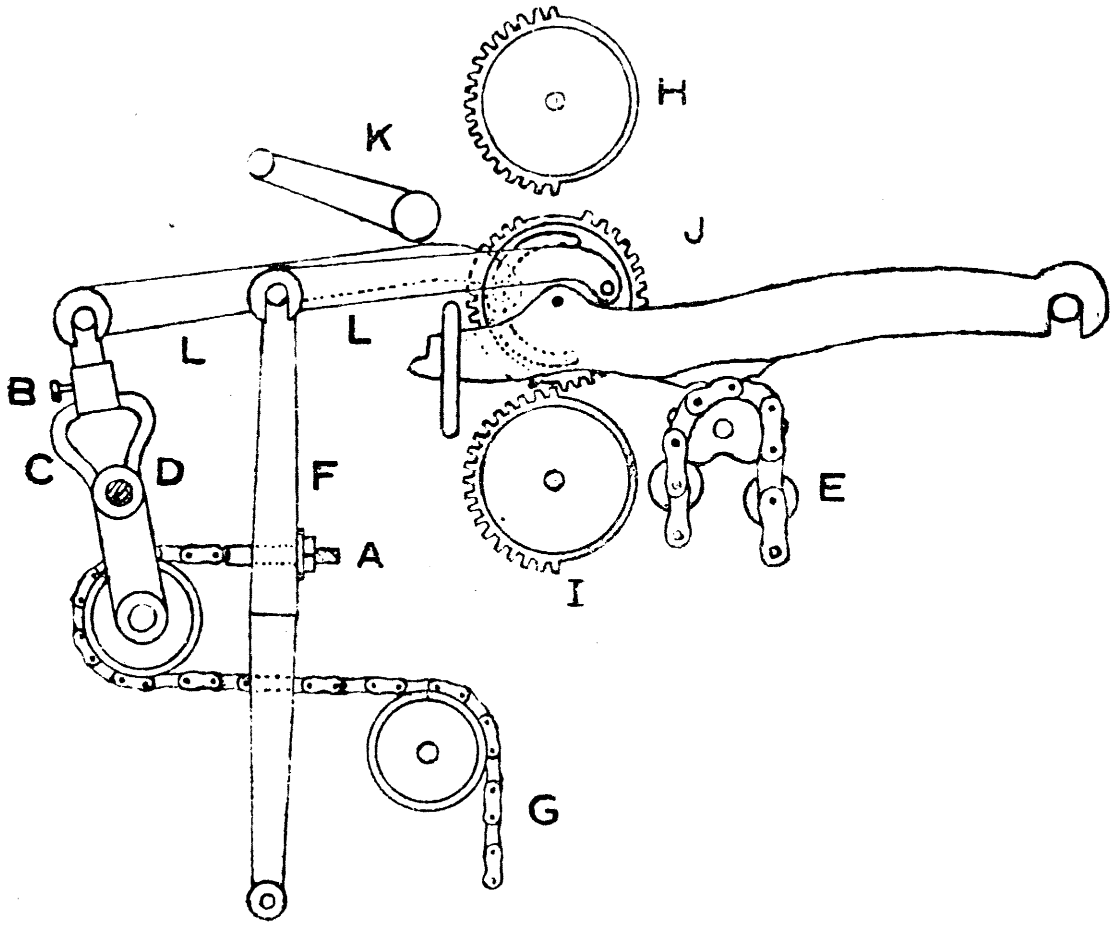

Fig. 270.
Dobcross Box Mechanism.

(1) By the slide mentioned. (2) By the stud at the top of the spring rod R, which is seldom molested. (3) By the stud on the box lever S which is shown at T. When placed nearer the fulcrum, the leverage to all the boxes is increased. (4) By the locknuts V at the bottom of the threaded end of the box rod W. These are used to bring the first box level with the shuttle race. (5) This cannot be seen in the