May 8, 1951 A. S. C. HART 2,552,317

SHUTTLELESS LOOM

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FIG. 1.

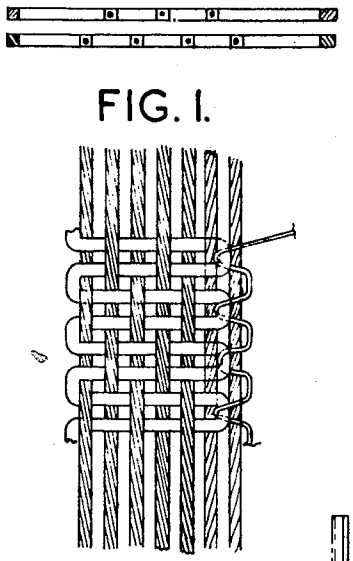


FIG. 2.

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SHUTTLELESS LOOM

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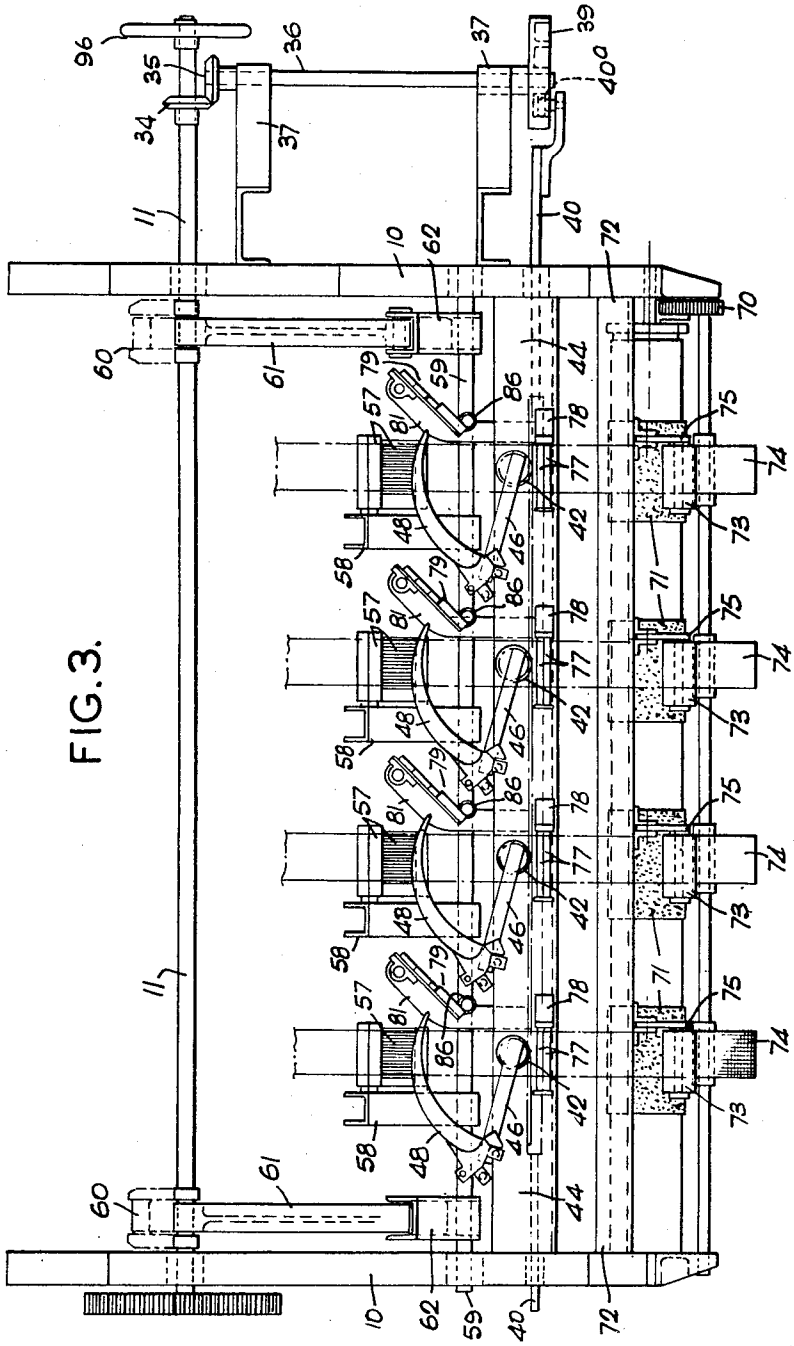


FIG. 3.

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FIG. 4.

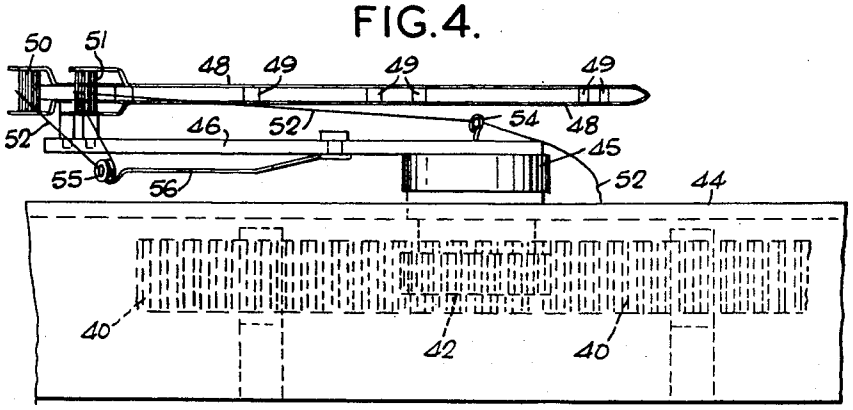
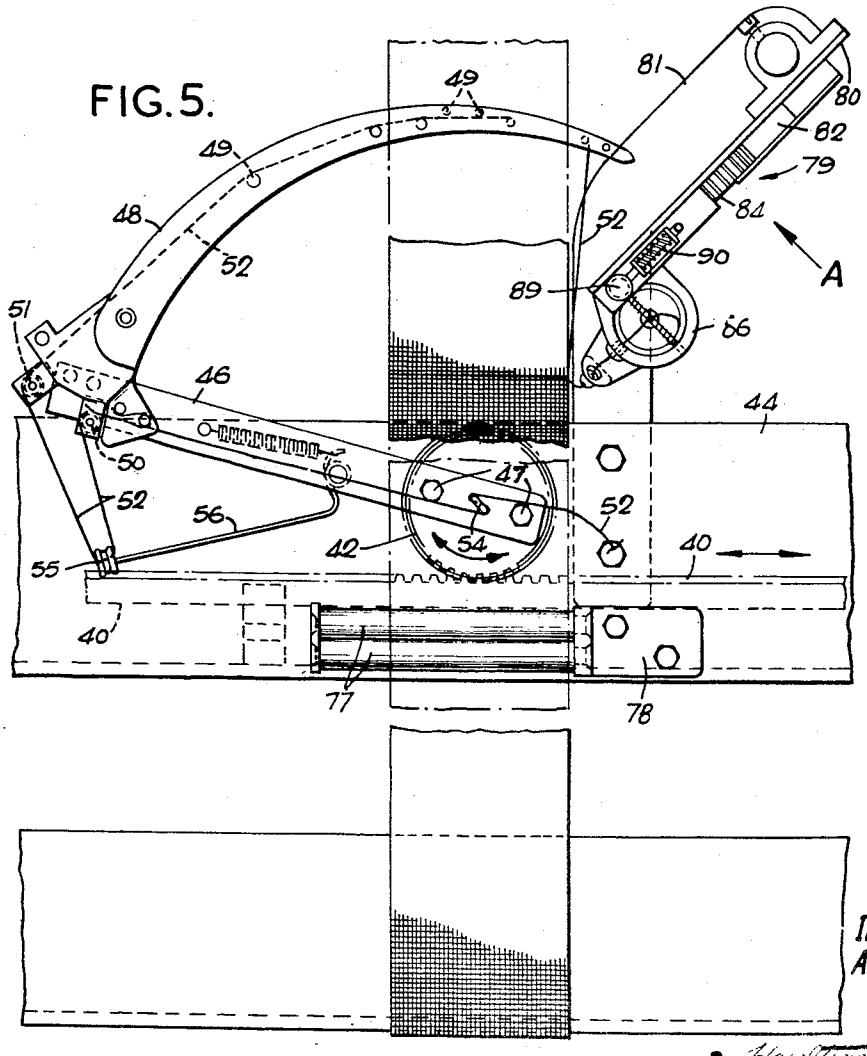


FIG. 5.



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SHUTTLELESS LOOM

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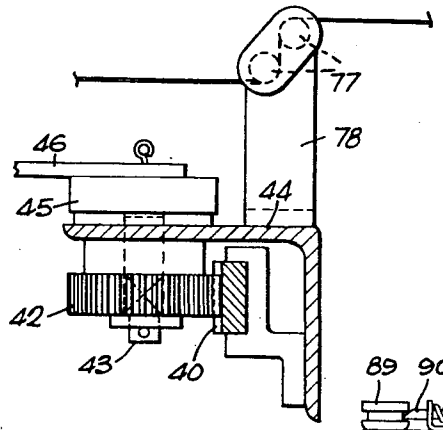


FIG. 7.

FIG. 6.

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FIG.8.

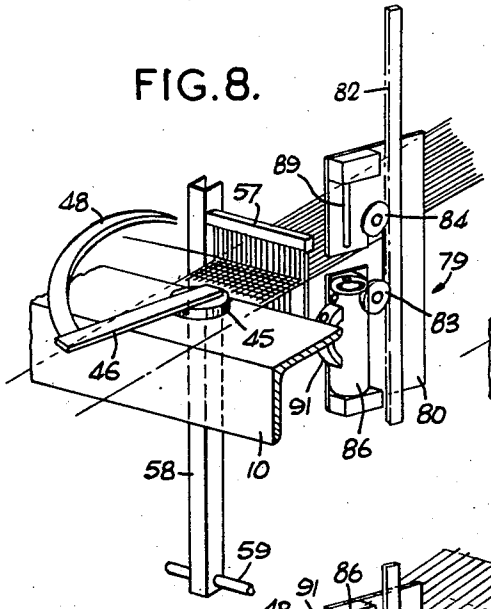


FIG.9.

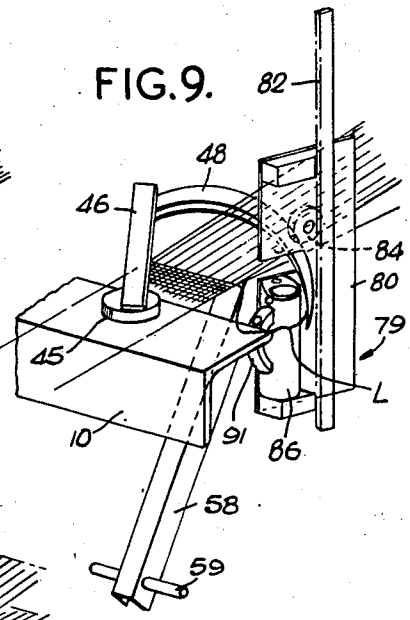


FIG.10.

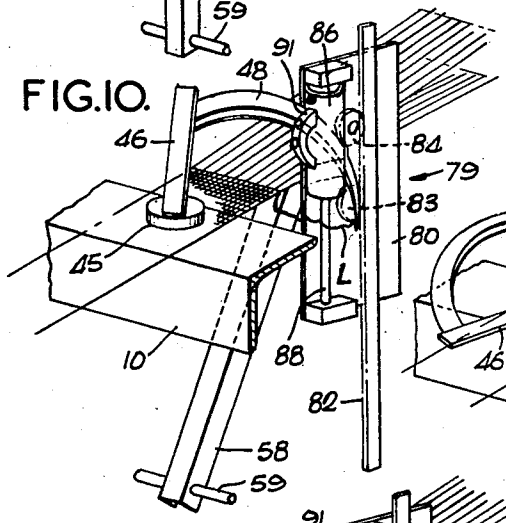


FIG.11.

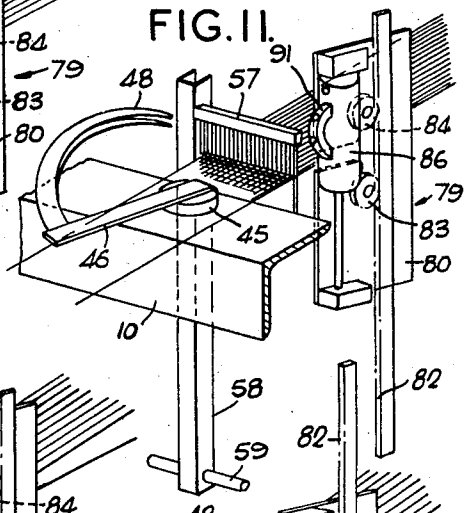


FIG.12.

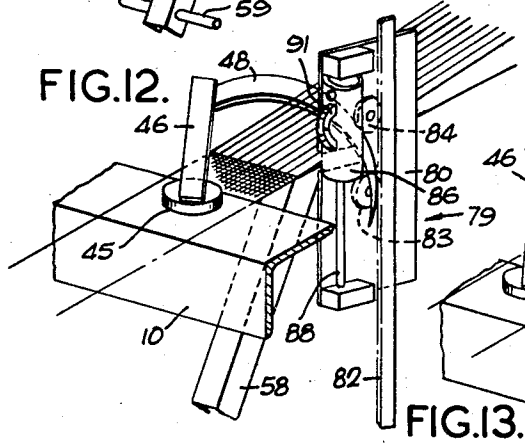
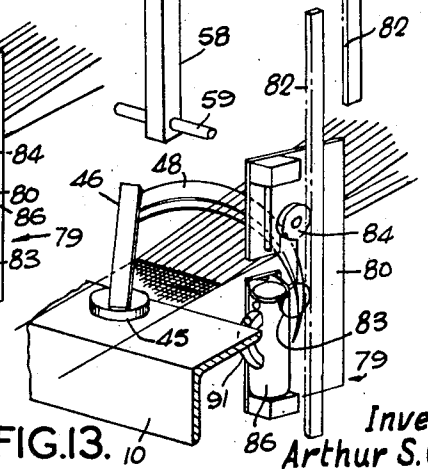


FIG.13.



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Patented May 8, 1951 2,552,317

UNITED STATES PATENT OFFICE

2,552,317

SHUTTLELESS LOOM

Arthur Stanley Colquhoun Hart, Crewkerne, Somerset, England

Application September 8, 1948, Serial No. 48,205
In Great Britain September 19, 1947

8 Claims. (Cl. 139—124)

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This invention relates to methods of and means for weaving fabrics and is concerned more particularly with looms of the shuttleless type.

In looms of the type referred to it has been the general practice hitherto to secure the weft by means of one or more stitching threads but such practice has the disadvantage that in the event of the stitching threads being cut or broken the loose end of the weft may be pulled out with the result that with continued pulling the whole structure of the fabric will eventually be broken up. It is the chief object of the present invention therefore to evolve a method and means whereby a fabric may be woven in a shuttleless loom with a truly woven selvedge edge at each side thereof.

The method according to the invention may be said broadly to consist in laying a pick or shot in the fell of a fabric by passing the weft from a semi-endless supply through an open shedding warp to such an extent as to form a loop at the side of said warp opposite to the point of entry of the weft, passing one or more yarns through the loop so formed, and thereafter drawing said weft through the warp in the reverse direction to lay a further pick or shot in the fell of the fabric and at the same time to disperse said loop. After each complete operation outlined above, the shed may be changed and as the normal beat up occurs the cycle may be repeated, the yarn or yarns being thereby incorporated into the warp as weaving proceeds and a truly woven selvedge edge provided.

In accordance with yet a further aspect of the invention in a loom of the type referred to the weft is carried through the warp from a semi-endless supply by means of an arm or other suitable element movable back and forth in timed relation with respect to the normal beat up reed. Preferably the arrangement is such that when the arm or the like is moved to its full extent in one direction it will project beyond the warp at the opposite side of the latter from which it was introduced and will thereby form a loop in the weft, means being provided operable in timed relation with said arm or the like, whereby one or more yarns may be introduced into said loop at or substantially at right angles to the plane in which the weft is made to conform to said loop.

In order that the said invention may be clearly understood and readily carried into effect the same will be hereinafter more fully described with reference to the accompanying drawings which show one embodiment by way of example and in which:

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Figure 1 shows diagrammatically the construction of the woven fabric produced on a loom according to the invention.

Figure 2 is a side elevational view of a loom constructed in accordance with the invention and shows the general arrangement.

Figure 3 is a plan view of the machine shown in Figure 2 but with certain parts removed in order to illustrate clearly the actual weaving and beat up mechanism.

Figure 4 is a side elevational view of a weft operating arm and appendent mechanism.

Figure 5 is a plan view of the arrangement shown in Figure 4.

Figure 6 is a view of a selvedge carrier looking in the direction of the arrow A in Figure 5.

Figure 7 is a section on the line 7—7 of Figure 5.

Figures 8–13 are somewhat diagrammatic perspective views illustrating the cycle of operations at the weaving point.

It will be appreciated that although a multi-space loom including four weaving units is illustrated and will be hereinafter more fully described the invention is nevertheless applicable to single-space looms or to looms incorporating any other suitable number of units.

Referring to the drawings 10 denotes the main frame of the machine in which a main drive shaft 11 is rotatably journalled, the drive to said shaft being transmitted in any suitable manner such as by a belt or gearing from any suitable prime mover. Driven from the shaft 11 through the medium of gearing indicated at 12, 13 and 14 is a shaft 15 which is also rotatably journalled in the frame 10 and carries at spaced points therealong a number of double-edged cams 16, according to the weave required, of which only one is illustrated in Figure 2, each set being adapted to co-operate with a roller 17 carried by a bar 18. Each bar 18, of which there might be four in number, one for each set of healds, is pivoted at one end about a common rod 19 and is adapted to co-operate at the other end with an arcuate guide 20. Connected to each bar 18 is a link 21 which is in turn adjustably connected to pivoted arm 22 to which the upper end of the normal heald strap 23 is connected. In the embodiment illustrated the four healds are connected in pairs at their lower ends and are anchored by means of the springs indicated at 24 which are themselves securely anchored in any convenient manner. The arrangement above described, which is substantially well-know in itself, is adapted to be operated in the following manner. Upon ro-

tation of the shaft 11 and hence of the shaft 15 the cams will impart a rocking motion to the bars 18 which motion will in turn be converted by means of the links 21 and springs 24 into a vertical reciprocatory motion of the healds such as will produce the necessary changing of the respective warp sheds. It may be pointed out here that each set of warp threads is led from a suitable source of supply (not shown) around guide rollers 25 and 26 to the appropriate weaving point. The shed changing mechanism is, as indicated above, well known, and is standard practice in the art. As is apparent from the drawing the arms 22 are adjustably mounted so that the tension on the healds may be adjusted. In the arrangement illustrated the arms 22 are mounted on a common shaft 27 which may be seated in any one of a plurality of slots in suitable supporting brackets mounted on the machine frame, one of said brackets being indicated at 28.

Also mounted on the shaft 15 is a pair of box tappets 29 each of which is found with a cam track or groove in which a roller 30 carried by a bar 31 is adapted to engage. Each bar 31 which is pivoted at 32 is adapted to support a counterweight 31*a* at or adjacent its rear or outer end. At its inner end, i. e. that end remote from the counterweight each bar supports a cross stay 31*b*, such stay being connected between the two bars 31 and formed with four arms or prongs to each of which a rod 33 is connected each rod being adapted to actuate a selvedge carrier one of which is provided in respect of each weaving unit or head and which will be hereinatfer more fully described. The cross stay 31*b* which, as above indicated, is connected between two bars 31 is conveniently located centrally within the frame work of the loom.

Mounted on the driving shaft 11 is a bevel wheel 34 which is adapted to mesh with a bevel wheel 35 (Figs. 2 and 3) carried by a shaft 36, and thereby, on rotation of the shaft 11, to transmit a drive to said shaft 36 which latter is rotatably journalled in brackets 37 mounted on the frame 10. The shaft 36 carries at its outer end a positive cam or eccentric 39 having a cam track or groove in which a follower 40A mounted on a rack bar 40 is adapted to engage. The rack bar 40 extends across the width of the machine and is supported in the main frame in such a manner as to be capable of axial reciprocatory movement upon rotation of the shaft 36 and of the cam or eccentric carried thereby. The rack bar 40 is adapted to effect operation of the four weft inserting mechanisms which are present in the machine. As will be apparent from Fig. 3 the rack bar 40 is adapted to co-operate with four pinions 42 each of which is adapted, on reciprocation of the bar 40, to impart an oscillatory movement of the weft inserting mechanism associated therewith. Each pinion 42 is keyed or otherwise rigidly secured to a stub shaft 43 (Fig. 7) which is rotatably supported in a bracket 44 mounted on the main frame of the machine. Keyed or otherwise rigidly mounted on the upper end of the shaft 43 and above the bracket 44 is a block 45 to which an arm 46 is rigidly connected as by means of bolts 47 (Fig. 5). Mounted on the outer end of the arm 46 is an arm 48 which is of arcuate form and is hereinafter termed the weft arm. As can be clearly seen from Fig. 4 the weft arm 48 preferably comprises a pair of arcuate plates which are maintained in spaced relationship by means of a plurality of rivets or the like 49. Associated with the arm 48 is a pair of freely rotatable rollers 50 and 51 around which the weft, indicated at 52, is adapted to pass, the weft being led from a source of supply 53 (Fig. 1) through an eyelet 54 on the arm 46, around the tension roller 50, through an eyelet 55 of a resilient compensating device 56, around the roller 51 and thence through the weft arm 48 to the outer end of the latter whence it is passed into the warp. Tension is applied to the yarn as it passes around the roller 50 by means of a butterfly spring (not shown) which serves to press said yarn against the roller.

It will be appreciated that on reciprocation of the rack bar 40 a reciprocatory or oscillatory motion will be imparted to the arm 46 and hence to the weft arm 48. The extent of the motion imparted to the weft arm is sufficient to cause the latter to be moved from a position wherein it is entirely clear of the warp to a position wherein it will be projected through the warp to such an extent that the outer end thereof will project beyond the opposite edge of the latter whereafter it is returned to its initial position, the arrangement being such that on each passage of the weft arm in each direction through the warp a pick or shot will be laid in the fell of the fabric, it being understood of course, that the actuation of the weft arm 48 is effected in timed relation with the changing of the warp shed effected by the heald and the operation of the beat up reed or comb.

Each beat up reed or comb which is indicated at 57 is carried by an arm 58, said arms being rigidly mounted on a common shaft 59 journalled at the lower part of the machine frame. An oscillatory motion is imparted to the shaft 59 to effect operation of the beat up reeds by means of cranks 60 which are associated with the driving shaft 11 and are connected by means of connecting rods 61 to arms 62 also rigidly mounted on said shaft 59 the arrangement being such that on rotation of the shaft 11 an oscillatory motion will be imparted to the arms 62 which will be transmitted to the shaft 59 and thence to the arms 58. By virtue of the fact that the beat up arms and the weft arms are driven from the main driving shaft 11 the timed relationship of their operation is readily maintained.

Mounted on one of the arms 62 is a bracket 63 carrying a pin 64 which is adapted to engage in a slot 65 formed in a pivoted arm 66. The arm 66 is adapted to function in the manner of a pawl and to co-operate with a ratchet wheel 67 the arrangement being such that on oscillatory movement of the arm 62 the step by step rotational movement will be imparted to the ratchet wheel 67. The ratchet wheel is geared, by means of suitable gear wheels indicated at 68, 69 and 70, to a shaft carrying four take-up rollers 71 each of which is preferably formed with a roughened or frictional surface and is adapted to draw off the finished fabric from the appropriate weaving unit. The fabric from each unit is drawn from the weaving point over a supporting surface 72 and round the appropriate roller 71 whence it is led around a further roller 73 to a storage roll 74. The rollers 73 which are preferably weighted are each carried by an arm 75 pivotally mounted on the machine frame, said rollers 73 each being adapted to bear on the surface of the fabric as it passes around the roller 71 in order to ensure sufficient frictional engagement of the fabric

with said latter roller and hence to ensure that requisite movement will be imparted to the fabric. Preferably the rollers 74 are driven, by means of a suitable belt drive 74a and gearing 74b, from the ratchet wheel 67 in order that the fabric may be wound thereon.

In order to assist the passage of each length of fabric from the weaving point and to maintain the desired elevation to clear the path of rollers 50 and 51 on the weft arm the said fabric is caused to pass around fixed rod-like members 77 mounted in brackets 78 on the main frame 10.

In order to provide for the woven selvedge edge of each length of fabric four selvedge carriers hereinbefore referred to are provided. The carriers are designated generally by 79 in Figs. 2 and 3 but one is more clearly illustrated in Figs. 5 and 6. Each carrier comprises a frame 80 which is supported in brackets 81 carried by the machine frame 10. Slidably mounted in the frame 80 is a rack bar 82 to which vertical reciprocatory motion is imparted by means of the rod 33 referred to above. The rack bar 82 is adapted to mesh with pinions 83 and 84, each of said pinions being in turn adapted to co-operate with a rack 85 on a carrier 86. The frame 80 is, as can be clearly seen from Fig. 6 formed with a slot 87 through which the weft arm 48 is adapted to pass on being fully projected through the warp. The arrangement is such that when the weft arm 48 is in its fully projected position a loop will be present in the weft through which the selvedge thread carried by the carrier 86 may be projected. The frame 80 is also adapted to carry two axially aligned rods 88 and 89 disposed one on either side of the slot 87 and the arrangement is such that when the weft arm is in its fully projected position the rack 82 will be operated to impart a rotary motion to the pinions 83 and 84 thereby causing the bobbin carrier to be moved from the rod 88 through the loop in the weft and on to the rod 89. It will be appreciated that upon reverse movement of the racks 82 the bobbin carrier 86 will be returned to its initial position on the rod 88. In order to allow for ready replacement of the bobbin carrying the selvedge thread the rod 89 is preferably removably retained in place within the frame 80 by means of a spring catch 90 co-operating with an annular groove in the head of said rod. Associated with the carrier 86 is a selvedge thread guide comprising an arcuate portion 91 having a pair of guide eyelets 92 and 93 therein, the thread being led from the bobbin through the eyelet 94 and thence through the eyelet 92 and round a resilient tensioning roller 95 having a serrated surface to the eyelet 93, whence it is passed through the loop in the weft.

In order to allow of adjustment of or attention to the machine parts and/or of the warp and weft threads prior to setting said machine in motion the drive shaft 11 is preferably provided with a hand wheel 96 so that the parts may be moved to any degree suitable to requirements without the risk of damage to the machine or to the operator which would otherwise exist if the machine were in full operation.

The actual operation of the machine will be made clear by reference to Figs. 8–13, which illustrate one complete cycle of operations of the various parts at the weaving point.

In the initial stage illustrated in Fig. 8 it will be seen that the weft arm 48 is in a position wherein it is clear of the warp while the carrier

86 is in its lowermost position on the rod 88 carried by the frame 80. At this stage also the beat up comb 57 is fully in the warp shed which is closed and the last pick or shot of the weft is fully beaten up. Upon continued drive of the shaft 11 and resultant movement of the rack bar 40 under the action of the cam or eccentric on the shaft 36 the arm 46 and hence the weft arm 48 will have a clockwise movement imparted thereto by virtue of which said weft arm 48 will be projected through the warp, the shed having been opened, thereby laying a pick or shot in the fell of the fabric as indicated in Fig. 9. In the position shown in Fig. 9 the beat up comb 57 is being retracted from the beat up position by virtue of the motion imparted to the shaft 59 by way of the cranks 60, rods 61 and arms 62 above described, while the carrier 86 is still in its lowermost position. With the weft arm 48 in the fully projected position wherein it projects through the slot 87 in the selvedge carrier frame 80 it will be apparent that a loop of weft thread, which is indicated by L will be present at that side of the warp adjacent said carrier (L is at all times kept taut by the action of the compensator 56). The profile of the cam or eccentric on the shaft 36 is such that the weft arm 48 will be caused to dwell in its fully projected position and during the period of dwell the rack bar 80 of the selvedge carrier is moved downwardly by virtue of the action of the cam 29, arm 31 and rod 33 into the position shown in Fig. 10, thereby causing the carrier 86 to be moved upwardly on to the rod 89. By virtue of the movement of the carrier the selvedge thread is passed through the loop L formed by the weft thread. Following the passage of the selvedge carrier 86 the weft arm 48 is retracted into its initial position as shown in Fig. 11, thereby causing a second pick or shot to be laid in the fell of the fabric and at the same time dispersing the loop L. Simultaneously with the retractive movement of the arm 48 the beat up comb 57 is again moved to beat up the last two picks or shots of the weft, the warp shed again being closed. In the next stage, indicated in Fig. 12, the weft arm 48 is again projected through the warp, the shed being again open, to lay a further pick or shot in the fell of the fabric, the beat up comb 57 being again retracted while the selvedge carrier 86 is still maintained in its uppermost position. With the arm 48 in its fully projected position a loop of weft thread corresponding to the loop L will again be formed and during the period of dwell of said weft arm the carrier 86 is again transferred through such loop and on to the lower rod 88, as shown in Fig. 13, whereafter said weft arm is again retracted to disperse the loop and to lay a further pick or shot in the fell of the fabric which is thereupon beaten up by the comb 57, the parts thus assuming the relative positions shown in Fig. 8, whereupon the cycle will be repeated so long as a drive is imparted to the shaft 11. The make-up of the fabric and the effect of the operation of the selvedge carrier will be apparent on reference to Fig. 1.

It will be appreciated from the foregoing that as weaving proceeds the thread carried by the selvedge carrier will become the selvedge thread of the warp and that the fabric produced will therefore have a true woven selvedge edge. As the warp passes through the loom so also will the yarn from the selvedge carrier and since a comparatively large amount of yardage or yarn may

easily be contained in a small cop or bobbin a proportionate yardage of woven material can be produced before the cop or bobbin needs replacement.

By virtue of the invention it is possible to effect the laying of each or each series of double picks or shots right into the fell of the fabric and to accomplish this without the aid of supplementary levers or other complicated devices. Furthermore, it is possible to weave a fabric with a warp shed very much reduced in physical size thereby reducing the strain on the warp threads and eliminating to a large degree the breakage of such threads during weaving. Again, during each cycle of operations the weft yarn is drawn from the source of supply in two substantially even pulls or lengths corresponding to the entry and withdrawal of the weft arm or arms into and from the warp or warps whereby a more continuous and gentler handling and take-off of the weft yarn is permitted than has been the case with similar machines hitherto.

Finally, by virtue of the invention it is possible to weave a fabric of two or more ply in such a way as to lay the wefts in the fells of each ply simultaneously thereby in the case, for example, of two ply webbing, providing a hundred per cent increase in output over the conventional method of weaving apart from other advantages such as have been enumerated above.

I claim:

1. In a loom having a warp shed changing mechanism, a beat up mechanism and a weft inserting arm operative from one side of the warp to insert a weft thread into successively formed warp sheds in the form of double picks, said warp shed changing mechanism, beat up mechanism and weft inserting arm being operated in timed relationship; means for operating said arm and for inserting a selvedge thread through the double picks at that side of the warp opposite that at which said arm is operative comprising a main drive shaft, a cam driven from said main drive shaft, a rack bar to which a reciprocatory motion is imparted on operation of said cam, a pinion associated with said weft inserting arm and cooperating with said rack bar so that on reciprocation of the latter, an oscillatory motion will be imparted to said arm to project the same back and forth through the warp, a stationary frame disposed at that side of the warp opposite to that at which the weft inserting arm operates and having a slot through which said arm is adapted to pass on projection through the warp, two rods supported on said frame in axial alignment and one at either side of said slot, a carrier element slidably supported on either of said rods and adapted to carry a supply of selvedge thread, rack teeth on said carrier, a pair of pinions rotatably supported on said frame and disposed one adjacent each rod so that each pinion will mesh with the teeth on the carrier element when the latter is supported on the adjacent rod, a rack bar slidably supported with respect to said frame and adapted to mesh with said pinions and means driven from the main drive shaft and adapted to effect reciprocation of said bar in timed relation with the weft inserting arm so that on movement of said bar in one direction or the other the pinions will be driven to effect movement of the carrier element from one rod to the other and thereby to cause the selvedge thread to be passed through the bight of each double pick.

2. A loom as claimed in claim 1 in which means are associated with the weft inserting arm for tensioning the weft thread.

3. A loom as claimed in claim 1 in which means are associated with the carrier element for tensioning the selvedge thread.

4. A loom as claimed in claim 1 in which means are associated with the weft inserting arm for tensioning the weft thread while means are also associated with the carrier elemnt for tensioning the selvedge edge.

5. In a loom of the type in which the weft thread is inserted into successively formed warp sheds in the form of double picks by a weft inserting arm operable from one side of the warp, the combination of means for inserting a selvedge thread through the bight of the double picks comprising a stationary frame disposed at the opposite side of the warp to that at which the weft inserting arm operates said frame including a cut-away portion through which said arm is adapted to pass on projection through the warp, two rods supported on said frame in axial alignment and on opposite sides of the cut-away portion, a carrier element slidably supported on one or other of said rods and adapted to carry a supply of selvedge thread, rack teeth on said carrier, a pair of pinions rotatably supported on said frame and disposed one adjacent each rod so that each pinion will mesh with the teeth on the carrier element when the latter is supported on the adjacent rod, a rack bar slidably supported with respect to said frame and adapted to mesh with said pinions and means adapted to effect reciprocation of said bar in timed relation to the weft inserting arm so that on movement of said bar in one direction or the other the pinions will be driven to effect movement of the carrier element from one rod to the other and thereby to cause the selvedge thread to be passed through the bight of each double pick.

6. A loom as claimed in claim 5 in which the means for operating the rack bar in timed relation with the weft inserting arm comprise a main drive shaft from which a dlrive is imparted to said arm, a cam to which a drive is also imparted from said shaft, an arm to which an oscillatory motion is imparted on actuation of the cam, and means whereby the rack bar is operatively coupled to said arm to be reciprocated thereby.

7. In a loom comprising a warp shed changing mechanism, a weft thread inserting arm operative from one side of the warp to insert a weft thread in the form of double picks, means at the other side of the warp for introducing a selvedge thread through the double picks to lock the same and a beat up mechanism, the provision of a drive mechanism comprising a main drive shaft, a cam driven from said shaft, means actuated by said cam and adapted to operate the shed changing mechanism, a second cam also driven from said shaft, means actuated by said second cam and adapted to impart an oscillatory motion to the weft thread inserting arm to move the same back and forth through the warp, a third cam driven from said shaft, means actuated by said third cam to effect operation of the selvedge thread insertion means, and at least one crank operatively connected to said shaft and adapted to impart an oscillatory motion to the beat up mechanism, the arrangement being such that said shed changing mechanism, weft thread inserting arm, selvedge thread insertion means and

the beat up mechanism will be actuated in timed relation.

8. A loom as claimed in claim 7 in which a take-up roller is provided together with means whereby a step by step rotational movement may be imparted thereto in timed relation with the beat up mechanism, said roller being adapted to effect positive withdrawal of the woven fabric from the loom.

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