May 5, 1964 — Y. JUILLARD — 3,131,728

SELVEDGE FORMATION

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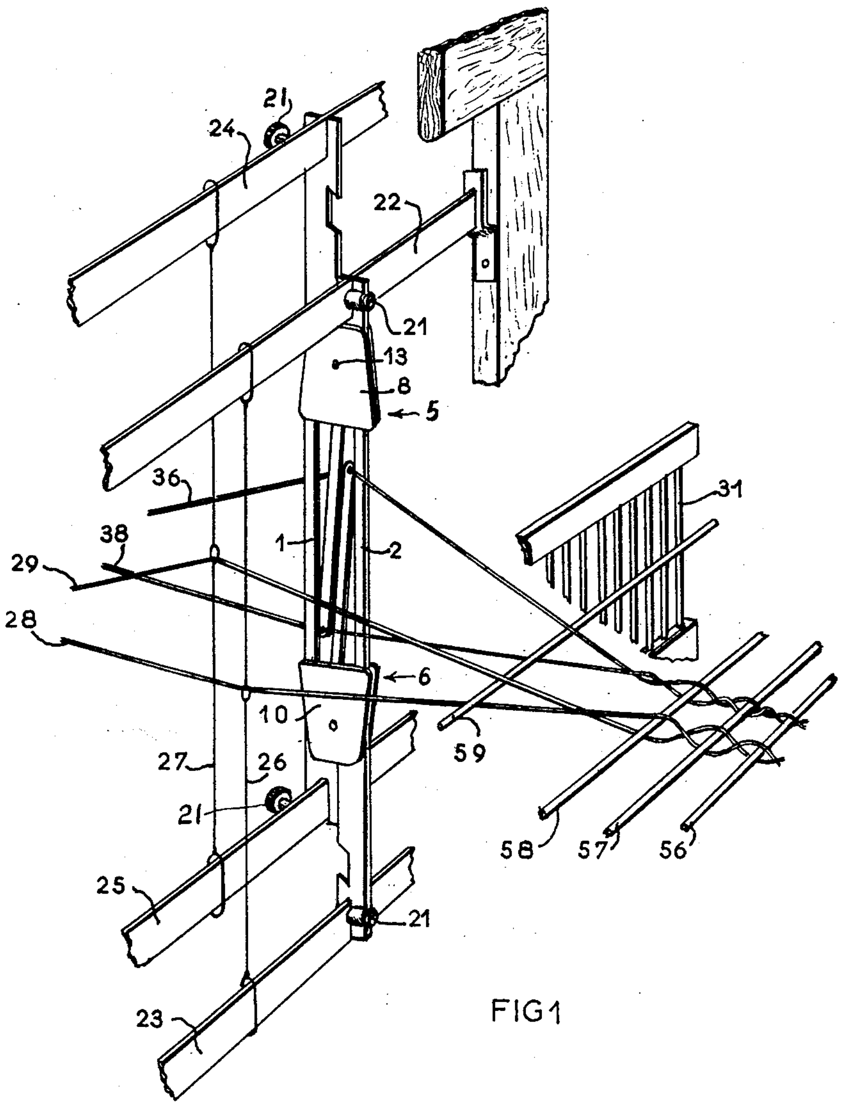

FIG 1

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FIG.2

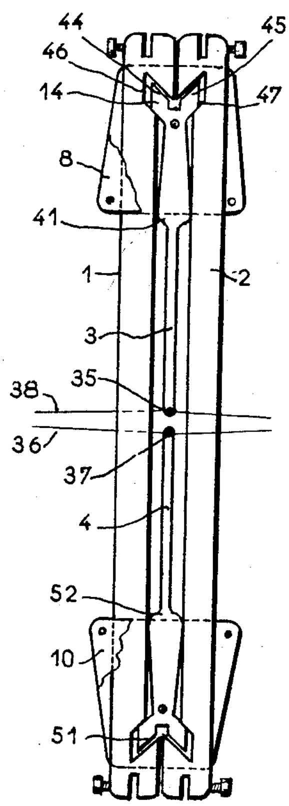


FIG.3

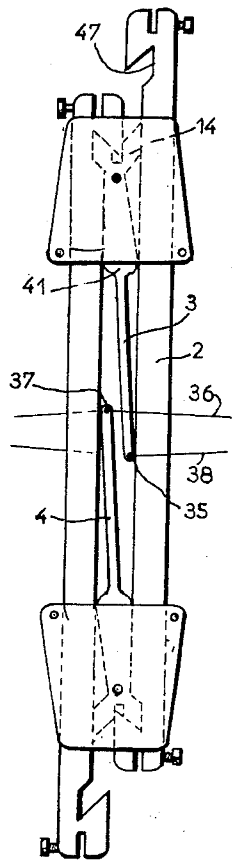


FIG.4

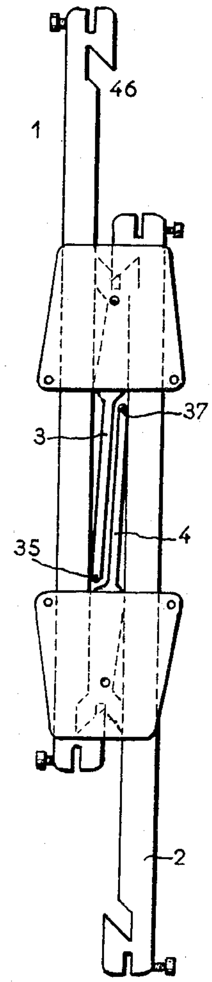
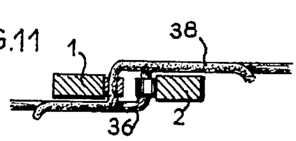


FIG.11



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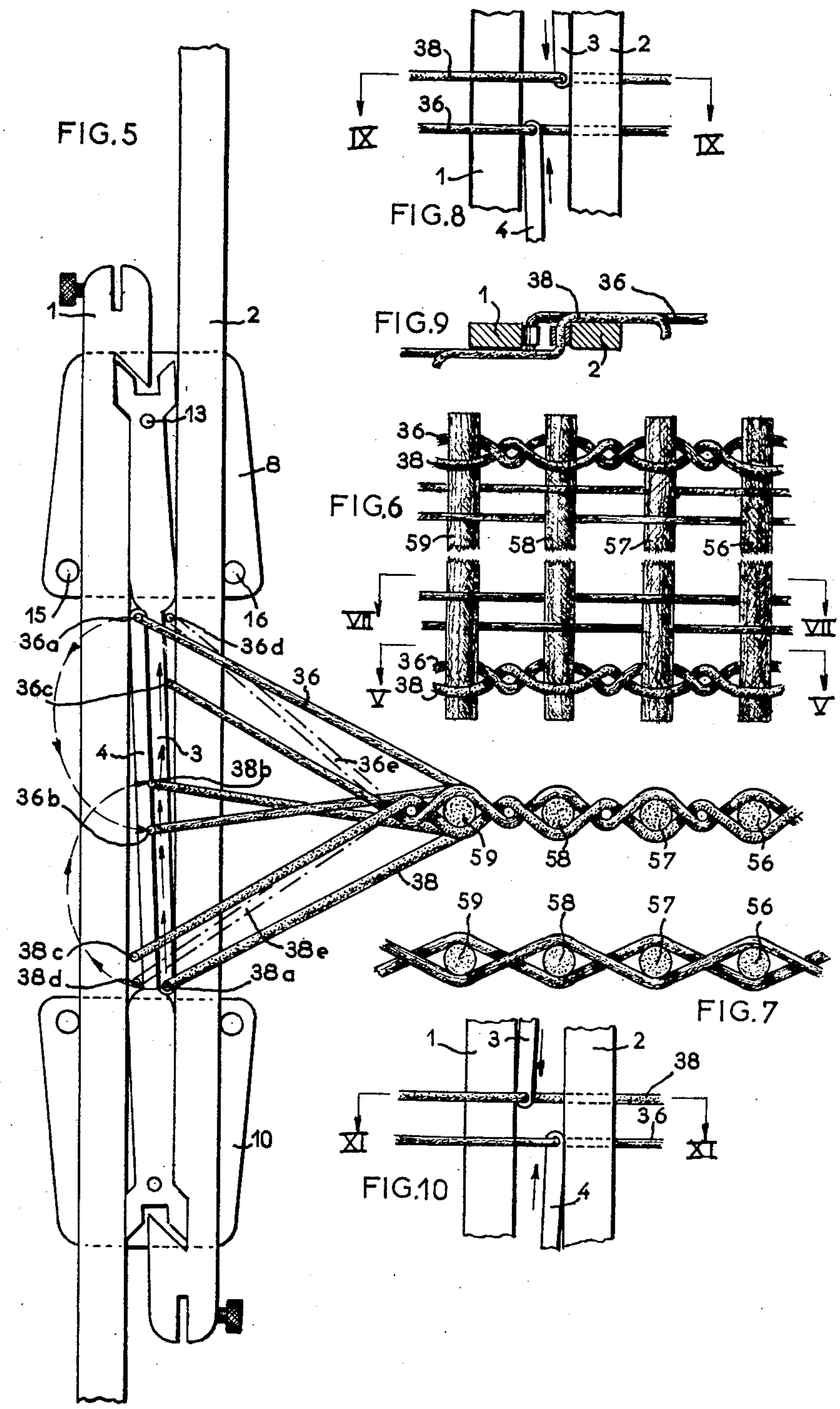

United States Patent Office

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3,131,728
SELVEDGE FORMATION

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8 Claims. (Cl. 139—54)

This invention relates to a method and means of forming selvedges on woven fabric, and more especially to an improved method of forming a false selvedge in a weaving frame of the shuttle-less type.

Objects of the invention includes the provision of an improved selvedge-forming method and means having one or more of the following advantageous features: Formation of a strong, uniform and symmetrical selvedge pattern in which the selvedge threads are interlocked without requiring undesirable crossover between the selvedge threads adjacent to the thread feeding bobbins; formation of such a selvedge pattern wherein each of a pair of selvedge threads remains continually on a related surface of the fabric; possibility of exerting high clamping pressure on the selvedge threads about the end portions of the weft shots to provide a positive restraint for the warp yarn along the sides of the fabric and achieving this result without requiring the exertion of damagingly high forces during the selvedge-forming operations and/or complicated operating mechanism; relative simplicity of the kinematic motions involved and consequently simplified and inexpensive structure of the driving mechanism and the system as a whole; ready adaptability as an attachment to existent weaving frames.

The invention is directed to a method of forming a fabric with a selvedge thereon, which comprises the steps of shedding warp, shooting weft through the shed, looping a first (so called overshot) selvedge thread over and looping another (so called undershot) selvedge thread under each pick of weft after it has been shot through the shed, and then intertwining both selvedge threads whereby the selvedge thread that was looped about one weft pick inwardly of the fabric is looped about a succeeding weft outwardly of the fabric and vice versa, both selvedge threads being subjected to substantially symmetrical and reverse motions on opposite sides of the fabric throughout said looping and intertwining steps.

The invention is also directed to a selvedge forming system in or for a weaving frame having means for shedding warp and means for shooting weft through the shed, which system comprises a pair of thread guides reciprocable generally normally to the plane of the fabric, means for feeding a pair of selvedge threads to the respective thread guides to be guided therethrough into a selvedge zone of the fabric, means for reciprocating said guide members in synchronism with the shedding and shooting means so as to loop said respective selvedge threads over and under a common pick of weft shot by said shooting means, and means for intertwining the selvedge threads subsequent to each looping of them.

The above and further objects and characteristics of the invention will be more clearly understood from the ensuing particular description of an exemplary form of embodiment, illustrated in the accompanying drawings wherein:

FIG. 1 is a simplified perspective view of a selvedge forming system with related parts of a weaving frame of a shuttle-less type on which the system is mounted;

FIGS. 2 to 4 are side views of the selvedge-forming system per se in various operating phases thereof;

FIG. 5 shows the same system on a larger scale as well as a part of the fabric on which a selvedge is being formed, the latter being shown in section on the line V—V of FIG. 6;

FIG. 6 is a plan view of the fabric shown in FIG. 5, said fabric being broken away to show both selvedges on the opposite sides of it;

FIG. 7 is a section on the line VII—VII of FIG. 6;

FIG. 8 shows part of the system of FIG. 5 in a different operating position;

FIG. 9 is a section on line IX—IX of FIG. 8;

FIG. 10 is a view similar to FIG. 8 in a different operating position; and

FIG. 11 is a section on line XI—XI of FIG. 10.

Before proceeding with the description of the specific embodiment of the invention, the general form of selvedge which the improved system is intended to produce will first be described with reference to FIGS. 5, 6 and 7. Referring especially to FIG. 6, four adjacent picks or shots of weft yarn are shown at 56, 57, 58, and 59. Along each side of the web of fabric, i.e. extending across the ends of the picks of weft yarn, there runs a selvedge (sometimes termed a false selvedge) made up of two interbraided selvedge threads 36 and 38. Between the two opposite selvedges and parallel thereto there extend of course a multiplicity of warp yarns interwoven with the weft and four such warp yarns are shown in FIG. 6.

Examining the structure of the selvedge pattern into which threads 36 and 38 are formed, it will be seen that the two threads are looped about a common pick of weft, e.g. 56, in opposite directions (one above and one below the weft in FIG. 5), and are intertwined with each other in between two adjacent picks of weft as between 56 and 57. Due to this intertwining, it will be noted that each of the two selvedge threads 36 and 38 continually remains on a related surface of the fabric (except of course for the intertwined portions). Thus thread 36 continually remains on the upper surface of the fabric shown in FIG. 5 and can hence be termed the "overshot" selvedge thread, while thread 38 remains on the under surface of the fabric and can be termed the "undershot" selvedge thread. Further, it can be observed that the selvedge thread that is looped about one weft pick inwardly of the fabric is looped about the next weft pick outwardly of the fabric and vice versa (the terms inward and outward referring to the width dimension of the fabric). Thus considering the lower selvedge in FIG. 6, it is seen that the undershot thread 38 is looped around weft pick 56 inwardly of the fabric (closer to the viewer in FIG. 5) with regard to overshot thread 36, while in the next weft pick 57 this relationship is reversed since the overshot thread 36 is looped about pick 57 inwardly of the fabric (closer to the viewer in FIG. 5), with regard to thread 36.

This general form of selvedge structure is highly desirable because while providing an excellent interlock for the lateral retention of the warp yarn, it averts the necessity of having to cross the selvedge threads at positions adjacent the feeder bobbins, a condition that would result in an increasing tension in the selvedge threads as the selvedge formation proceeds. At the same time, the interlock between the selvedge threads permits a high clamping force to be exerted around the related shots of weft yarn providing positive retention for the warp at the sides of the web of fabric.

However, the systems heretofore used for forming selvedges of the type described have not been satisfactory. Thus in one such system one of the selvedge threads was stationary while the other was intertwined and looped around the stationary selvedge thread and the weft shots during the spread-apart phase of the shed formed between the warp yarns. With such a system it is clear that very high rates of movement has to be imparted to the, other, or movable selvedge thread during the looping operations (if the over-all weaving speed was to be preserved), and this was obviously detrimental to the mechanical operation and service life of the selvedge forming mechanism. Also the resulting selvedge tended towards asymmetry in tension distribution. Other known types of systems have only been able to achieve a selvedge pattern approximating the one described, but differing therefrom in that each of the two selvedge threads was alternately looped around the weft shots over and under the fabric (rather than continually remaining on one surface of it) so that a much looser bond was had.

The improved selvedge forming system of the invention now to be described achieves the selvedge pattern thus specified without any of the drawbacks of such prior systems.

Referring to FIG. 1, part of the heddle harness of a conventional shuttle-less loom is shown as comprising lower heddle bars 23 and 25 and upper heddle bars 22 and 24, with heddles 26 and 27 being stretched between bars 22—23 and 24—25 respectively. A conventional reed is shown at 31. It is here assumed that the harness of the loom is arranged e.g. for a plane weave pattern so that the two pairs of heddle bars 22—23 and 24—25 are reciprocated vertically in opposite directions, i.e. in 180° phase displaced relationship. It is to be understood however that the heddle harness shown merely constitutes one form of system present on a conventional weaving frame able to serve as a prime mover for the selvedge forming mechanism of the invention, but that the motion of said mechanism may in fact be derived from any other means as will be clearly evident from the ensuing description.

In this embodiment, then, the selvedge-forming system of the invention is mounted across the upper and lower heddle bars. The system comprises a pair of parallel spaced strips 1 and 2 having their upper and lower ends slotted and provided with set screws 21 for firmly securing the strips to the heddle bars as shown, or to any other reciprocable means from which the system is to derive its movement. The strips 1 and 2 are of generally rectangular cross section, and are generally coplanar. The strips are retained in this coplanar, spaced, parallel relation by means of a pair of supports or slider members 5 and 6 (see e.g. FIG. 2) each made up of a pair of parallel spaced flanges 8 and 10 respectively. Considering for example the upper slider or support member 5, the two flanges 8 of it are retained in spaced assembled relationship so as to enclose both strips 1 and 2 between them, by means of three pins 13, 15 and 16. The pins 15 and 16 interconnect the flanges 8 exteriorly of the outer surfaces of strips 1 and 2 and may serve as abutting means for guiding said outer surfaces during the relative reciprocation of the strips as presently described. The third pin 13 interconnects the flanges 8 in a central portion of them and further extends, between the flanges, through a hole formed in a related needle member described later. The strips 1 and 2 at their upper and lower ends are provided with enlarged portions projecting into sliding engagement with each other as shown. Thus it will be clear that the two strips 1 and 2 are free to reciprocate vertically with respect to each other under the action of the heddle bars (or other means) to which they are attached, while retaining their vertical, parallel spaced relationship owing to the manner they are mounted in the sliders 5 and 6.

Formed at the inner side of each strip 1 and 2 adjacent to each enlarged end portion of it is an angled notch, the upper notches being designated 46 and 47 respectively for each of the strips 1 and 2. The notches are so angled, as shown, that when the two strips are positioned at a common level in their intermediate or neutral position (as in FIG. 2), the upper notches 46 and 47 combine to form a V, while the corresponding lower notches combine similarly to form an inverted V symmetrically.

A pair of needle members 3 and 4 are pivoted to the slider members 5 and 6 respectively between the flanges of said members and between the strips 1 and 2 by means of the pins such as 13 as above described. The needle members 3 and 4 each have a narrow elongated end portion extending towards the other needle member and formed with an eye near its end, 35 and 37 respectively. Beyond this straight thin portion in the direction towards the needle pivot, the needle is formed with a symmetrical enlargement 41, 52 respectively, which has rounded sides as shown engaging the inner sides of the strips 1 and 2 and gradually tapering inward toward the pivot member 13. Beyond this pivot the needle presents two outwardly angled extensions such as 44, 45 or "tail-fins" adapted to engage freely into the corresponding notches such as 46, 47 in the strips.

Referring again to FIG. 1, a first (overshot) selvedge thread 36 is shown threaded through the eye of the lower needle member 4 and a second (undershot) selvedge thread 38 is threaded through the eye of the upper needle member 3. The two selvedge threads are shown as extending from the needle eyes towards the shots of weft yarn 56, 57, 58 of the fabric being woven in the selvedge zone to provide a selvedge thereat as will be later described. Also shown are a pair of warp threads 28 and 29 threaded through eyes of the respective heddles 26 and 27 to be interwoven with the weft on reciprocation of the heddle bars according to usual practice.

With the construction described, it will be seen that when the strips 1 and 2 are at a common level in the intermediate or neutral position shown in FIG. 2, the two needles 3 and 4 are in alignment along the general center axis of the system with the eyes of the needles being spaced a short distance apart along said axis, the needles being retained in that position owing to the engagement of both extensions or tail-fins such as 44, 45 of each needle in the related angled notches such as 46, 47 of the strips. When on the other hand one of the strips, e.g. strip 1, is lower than the other as in FIG. 3, the lower upper needle is caused to rock about its pivot by the camming action exerted by the inner surface of the lower (upper) strip 1 (2) against that one of its tail-fins that was engaging the notch in said lower (upper) strip. Thus the extremity of the lower needle is brought into engagement with the inner surface of the lower strip, and the extremity of the upper needle is brought into engagement with the inner surface of the upper strip. The needles are guided in their rocking movements by the rolling engagement of the rounded enlargements such as 41, 52 with the flat inner surfaces of the strips. Considering the position shown in FIG. 3, assuming that the strip 1 continues on its downward course while strip 2 continues to rise, then the extremities of both needles will continue to slide along the inner surfaces of strips 1 and 2 respectively, since the needles are carried upward and downward with the respective strips owing to the engagement of one tail-fin of each needle with the notch in a related one of the strips.

Returning to the neutral position of FIG. 2, it is clear that if the relative movement of the strips is reversed, the direction of rocking movement of the needles is likewise reversed. Hence, if strip 1 is rising and strip 2 falling, as shown in FIG. 4, the lower needle 4 is rocked to have its free end engaging strip 2 (since this is now the lower strip) and the upper needle 4 is rocked into engagement with strip 1 (now the upper strip).

The position shown in FIG. 4 with the two needles overlapping in full is one end position of the system. Starting from this position, as the upper strip 1 falls and strip 2 rises owing to the opposite reciprocation of the heddle bars the overshot between the needles diminishes, i.e. the needles draw apart, until both strips are at a common level (the neutral position of FIG. 2). At this position the needles are separated and both needles are promptly and simultaneously switched to their reversely-rocked positions as explained above and as shown in FIG. 3. As the heddle bars continue their movement the two needles are again moved into overlapping relation but in a relative rocked position reverse from the previous one, i.e. in the rocked position shown in FIG. 3. The needles are again moved into their full overlapping relation in this reversely rocked position, at which time the heddle bars reverse their movement, the needles are drawn apart (their overlap diminishes) until they again reach the neutral position of FIG. 2, switch over, and repeat the cycle.

It will be noted that in each such complete operating cycle of the selvedge forming mechanism, the mechanism passes twice through the neutral position of FIG. 2 at which the two needle eyes **35** and **37** are separated, and that the first time the needles attain this position in a cycle the crossing between the two selvedge threads **36** and **38** is effected in one sense; while the second time the same position is attained in the cycle the crossing between the two selvedge threads occurs in the opposite sense. More precisely, referring to FIGS. 8 to 11, it is seen that the overshot selvedge thread **36** is passed from the rear of the loom along one side the rear strip **1**, then from right to left (looking forward of the loom) through eye **37** of lower needle **4**, then across the opposite or left side of the front strip **2** and toward the fabric. Undershot selvedge thread **38** follows a generally similar path from the rear of the loom along the one side of rear strip **1**, from right to left through eye **35** of upper needle **3**, across the opposite side of front strip **2** and toward the fabric. As the needles are moving past their neutral (separated) position the first time in a cycle, say in the manner indicated in FIG. 8, it is clear from FIGS. 8 and 9 that the lower needle **4** is constrained to pass its overshot thread **36** outwardly of the thread **38** carried by the upper needle **3** (i.e. thread **36** must "climb over" thread **38** over the upper surface of strip **2** as seen in FIG. 9) while as the needles move past their neutral position the second time in the same cycle, in the manner indicated in FIG. 10, FIGS. 10 and 11 similarly show that lower needle **4** must pass its thread **36** inwardly of thread **38** carried by upper needle **3** (i.e. thread **36** must pass "crawl under" thread **38** upon the upper surface of strip **2** as shown in FIG. 11). It is this alternate crossing of the two selvedge threads in reverse senses, i.e. position reversal of the threads in the weft direction at successive reciprocations of the heddle that produces the "intertwine" of the threads and results in the formation of the desired selvedge pattern. This will become more evident from a description of FIG. 5.

In the position shown in FIG. 5 eye **37** of lower needle **4** carrying overshot selvedge thread **36** is occupying an uppermost position **36***a* in a fully overlapped position of the needles. Strip **1** will now begin to rise while strip **2** will begin to fall. On the neutral position being reached the eye of the lower needle assumes position **36***b* while the eye of the upper needle carrying thread **38**, which eye was initially at position **38***a*, assumes a position **38***b* spaced above the lower needle eye. The two selvedge threads **36** and **38** are thus looped around the weft shot **59**. As the needles now switch over and cross each other, the lower needles eye moves from position **36***b* to position **36***c*, while the upper needle eye moves from position **38***b* to position **38***c*. The switchover of the needles has caused the selvedge threads to intertwine beyond the previously looped weft shot **59**. As the needles proceed on their inward course they reach their other fully overlapped position in which the needle eyes respectively occupy positions **36***d* and **38***d*. The selvedge threads are now in the dotted position **36***e* and **38***e*, ready to be looped around the next shot of weft at the next reciprocation of the heddles.

Thus, between successive shots of weft such as **56, 57 58, 59** (also see FIG. 6) the two selvedge threads are intertwined to form an interlock first in one sense then in the other, so that the relative positions of the loops formed by the respective threads about a common weft shot (said positions considered along the length of the weft) are reversed from each shot of weft to the next; moreover, each selvedge thread continually remains on a particular (upper or under) surface of the fabric, except of course for the intertwining portions between the weft.

The selvedge forming mechanism described thus provides a simple means of producing the desired selvedge pattern in a highly desirable manner in that both selvedge threads are simultaneously operated on in symmetrical fashion so that excessively high rates of mechanical displacement are not required and the resulting selvedge is fully symmetrical and uniform in shape and tension as between the two threads. The selvedge threads used may of course be of any suitable type, and it is also evident that two or more threads can be used instead of each of the threads **36** and **38** referred to above. Preferably the selvedge threads used have strong tensile characteristics, e.g. nylon threads, and are operated on under high tension to provide tight interlock between the threads. The high tension combined with the plastic and elastic characteristics of material such as nylon provide an extremely effective interlock between the two threads intermediate the shots of weft, since the characteristics of the yarn enable it to stretch and simultaneously to set somewhat in permanent deformation, greatly enhancing the effectiveness of the selvedge.

It will be apparent that many modifications may be made in the mechanism illustrated and described without exceeding the scope of the invention. While one important advantage of the invention is the simplicity of the mechanism whereby the selvedge forming system can easily be mounted as an attachment of an existing loom to derive movement therefrom, such mounting is not necessarily effected in the manner shown upon the heddle bars; indeed separate operating means may if desired be provided for the mechanism in suitable timed relationship with the shed-forming and weft-shooting operations of the weaving frame. The mechanism itself may assume a variety of forms other than that shown, especially in regard to the means used for causing the intertwining of the two selvedge threads in alternate senses at each cross-over point of said threads between the adjacent shots of weft. Moreover, while the selvedge pattern illustrated and described is such that each loop of the threads encompasses but a single shot of weft yarn, it will be evident that the selvedge threads may be looped simultaneously about more than one weft shot without altering the basic pattern of the selvedge described.

In the ensuing claims, accordingly, the expression "selvedge thread" should be interpreted as readable also over a plurality of threads; and the expression "shot" or "pick" of weft should be construed as readable, where applicable, over a plurality of adjacent shots or picks of weft simultaneously encompassed by the selvedge threads.

What is claimed is:

1. In a weaving frame having warp shedding means and weft shooting means for weaving a fabric, a system for forming a selvedge for said fabric comprising a pair of apertured thread guides, means for feeding an overshot and on undershot selvedge thread through the respective guides, means mounting the guides for reciprocation normally to the plane of the fabric and for position-reversal in the plane of the fabric to reverse the relative positions of said threads in a direction parallel to said weft, means operated in synchronism with said shedding and shooting means for reciprocating said guides between a first relative position in which the overshot thread is above and the undershot thread is below said fabric plane and a second relative position in which said overshot thread is below and said undershot thread is above said plane, and means for reversing the position of said guides in said plane while in said second position to reverse the relative

positions of said threads in a direction parallel to the weft whereby to intertwine said selvedge threads.

2. The system claimed in claim 1 wherein said guide apertures are formed generally parallel to said weft and said mounting means are operative for maintaining said guides in spaced relation in a direction parallel to said warp and include means for reversing the spaced relationship of said guides in said warp direction while in said second position, and means for constraining the guides to retain their spaced relationship throughout each full reciprocation thereof from said second to said first and back to said second position, whereby the spaced relationship of the guides in the warp direction is reversed as from each full reciprocation to the next and the spaced relationship of the looped overshot and undershot selvedge threads in the weft direction is thereby reversed as from one shot of weft to the next.

3. The system claimed in claim 2, wherein said guides comprise a pair of elongated needle-like members having said guide apertures formed in the extremity of each member directed toward the other member, a pair of slider supports mounted for reciprocation toward and away from each other and means for pivoting said needle members in said respective supports at point spaced from said extremities thereof, a pair of parallel spaced side elements slidably received through said supports on opposite sides of the needle members to limit the rocking movements thereof, means connecting said elements with said timed reciprocating means to reciprocate the elements while retained in their parallel spaced relation by said supports, and cooperating camming means on said needle members and side elements for reciprocating the needle members between said first and second positions thereof and for rocking the needle members when at said second positions including means for maintaining the needle members in their rocked positions through a reciprocation thereof.

4. The system claimed in claim 3, wherein said camming means comprise cooperating outwardly angled extensions adjacent the others extremities of the needle members and angled notches in the inwardly-directed surfaces of said elements.

5. The system claimed in claim 4 wherein said camming means further include rounded enlargements on the needle members intermediate said aperture and pivot thereof cooperating with the inner surfaces of said side elements.

6. The system claimed in claim 1 wherein said weaving frame comprises a heddle harness including reversely reciprocable heddle bars, and wherein said guide reciprocating means are connected with said heddle bars for reversely reciprocating said guides in synchronism therewith.

7. The system claimed in claim 3 wherein said weaving frame comprises a heddle harness including two reversely reciprocable pairs of vertically spaced heddle bars, and wherein said side elements have their upper and lower ends connected with the upper and lower heddle bars of the respective pairs.

8. In a weaving frame having means for shedding warp and means for shooting weft through the shed, a selvedge-forming system comprising a pair of thread guide members reciprocable generally normally to said fabric, means feeding a pair of selvedge threads to the respective thread guide members to be guided therethrough into a selvedge zone of the fabric, and means reciprocating said guide members in timed relation with the shedding and shooting means so as to loop said respective selvedge threads over and under a pick of weft shot by said shooting means and including means for intertwining said selvedge threads subsequent to each looping thereof.

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