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(54) APPARATUS FOR MANUFACTURING SLIDING CLASP FASTENERS

- (71) We, WILLIAM PRYM-WERKE K.G., a German Kommanditgesellschaft, of 5-7 Zweifaller Strasse, 519 Stolberg, Rheinland, Germany, do hereby declare the invention for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—
- 10 This invention relates to a loom for manufacturing sliding clasp fasteners having coupling links woven into the edge of a supporting tape.
- 15 An apparatus for manufacturing sliding clasp fasteners is described and claimed in our U.K. Patent Application No. 1,341,266 and our co-pending U.K. Patent Application No. 12834/72 (Specification No. 1,382,919), but these produce fastener halves individually.
- 20 The present invention aims to provide a loom which can simultaneously produce the two halves of a sliding clasp fastener.
- 25 According to one aspect of the invention there is provided a loom for simultaneously producing the two halves of a sliding clasp fastener comprising a pair of apparatuses, each apparatus being for manufacturing sliding clasp fastener halves which have
- 30 coupling links woven into the edge of a supporting tape; each apparatus including means for imparting a shedding movement to a plurality of warp threads while feeding the warp threads towards a fell, means for
- 35 laying a weft thread between the warp threads and means for incorporating into the tape during weaving a warp thread of plastics material including a rotatable disc rotor having an aperture therethrough eccentrically positioned for passage of the thread of plastics material, a loop-forming mandrel having one end supported substantially on the axis of rotation of the rotor and being of sufficient length to extend to the fell, the rotor being arranged so that as the plastics thread passes through the rotor aperture the thread is fed in a circular motion to the fell about the mandrel and is formed thereby into loops projecting from the tape, and means for rotating the disc rotor so that the circular movement of the plastics thread about the mandrel is synchronised with the shedding motion of the other warp threads and so that it describes at least a substantial part of the outer surface of a cone which is disposed about the mandrel and has its apex in the fell and its base defined by the path of the rotor aperture, the arrangement being such that the projection onto the plane normal to the weaving plane of the limits of the shedding movement of the plastics thread adjacent the fell due to circular motion of the plastics thread from the fell to the path of the rotor aperture overlaps the projection onto the normal plane of the limits of the shedding movement of the other warp threads adjacent the fell, the rotors of the pair of apparatuses being drivable in opposite directions.
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- According to another aspect of the invention there is provided a method of manufacturing a sliding clasp fastener which comprises simultaneously weaving the two

halves of the sliding clasp fastener, the production of each half comprising weaving a supporting tape by imparting a shedding movement to a plurality of warp threads while feeding the warp threads towards a fell and laying a weft thread between the warp threads; and incorporating into the tape during weaving a warp thread of synthetic plastics material, which thread passes through an aperture eccentrically positioned in a rotating disc rotor so that the thread is fed in a circular movement to the fell about a mandrel and is formed thereby into loops projecting from the tape, the circular movement of the plastics thread about the mandrel being synchronised with shedding movement of the other warp threads; wherein the plastics thread is guided so that it describes at least a substantial part of the outer surface of a cone, which cone is disposed about the mandrel and has its apex in the fell; wherein the base of the cone is defined by the path of the aperture in the rotor; and wherein the projection onto the plane normal to the weaving plane of the limits of the shedding movement of the plastics thread adjacent the fell due to the circular motion of the plastics thread from the fell to the path of the rotor aperture overlaps the projection onto the normal plane of the limits of the shedding movement of the other warp threads adjacent the fell, the two rotors for producing respective halves being rotated in opposite directions.

The loom may have groups of apparatuses arranged in such pairs with the rotors of one group rotatable in one direction and the rotors of the other group rotatable in the opposite direction.

By means of this loom complete sliding clasp fasteners can be produced, their fastener halves each having coils which are wound in opposite sense to the coils of the other, on one loom and in a single weaving operation. It is therefore possible to bring those parts of the two fastener halves which have been produced at the same moment into engagement with one another in the loom. This has the advantage that irregularities in the weaving which may be produced, e.g. due to stoppages in the loom, are impressed onto both zip fastener halves at the same place, so that these co-operate later when the zip fastener is joined together. Thus, such flaws are no longer noticeable when the fastener is used. In addition, it is possible to connect the two fastener halves whilst they are still under tension in the apparatus.

Because of the method of operating the loom, it is advantageous to control all the shed-forming rotors by one common rotary drive. For example, a common drive shaft may be used and, by means of toothed

wheels located thereon, may act directly upon peripheral teeth on one group of shed-forming rotors; whereby these rotors are driven in one direction. By interposing one or more further toothed wheels between the toothed wheels on the shaft it is possible to rotate another group of shed-forming rotors in the opposite direction. The height-difference between the two aforementioned groups of shed-forming rotors, which results from the interposing of further toothed wheels in one group, is adjusted so that the vertical distance between the axis of the rotors in the one group and the rotors in the other group is substantially equal to the vertical distance between the respective upper and lower limits of the shedding motion at the same point.

Furthermore, it is preferred to arrange a non-rotating insert in the region of the rotational axis of the individual shed forming rotors. This insert then carries the loop-forming mandrel and has a through passage for an auxiliary thread which serves as an inlay for the finished row of coupling links. The through passage is arranged so that the guiding of the auxiliary thread takes place in the sheet position of the weaving shed. Between the insert and the fell may be arranged a thread guide means for varying the path of the auxiliary thread, whereby the latter can be transferred out of the one extreme sheet position into the other sheet position of the weaving shed.

The thread-guide means can be pressers whose working ends, which serve for guiding the auxiliary thread, are arranged remote from the auxiliary thread and outside the weaving shed when in their non-working position so that the auxiliary thread assumes the position which is determined by the through passage in the insert. The pressers are movable in synchronism with the rotor. The working ends have, for example, notches or grooves in which the auxiliary threads sit during the working stroke thereof. The pressers of each of the two groups of shed-forming rotors which are rotatingly driven in opposite directions to one another, operate in mirror-image manner in relation to one another.

The drawings illustrate an example of the invention. In the drawings:

Fig. 1 is a side view of one part of the loom according to the invention constructed to form a fastener half whose row of coupling links has a right-handed (clock-wise) screw pitch; and

Fig. 2 is a corresponding view of another part of the loom constructed to form a fastener half whose row of coupling links has a left-handed (anti-clockwise) screw pitch.

For producing sliding clasp fastener halves using the part of the loom according

to the invention illustrated in each Figure, a plurality of warp threads 11', 11'' and a warp thread 15 are used. The warp threads 11', 11'' are shed by means of healds 22, 23 to form an upper sheet 19 and a lower sheet 20 (see Fig. 1) in relation to an imaginary central weaving plane WE which is common to Fig. 1 and Fig. 2. A weft needle 17 lays a weft thread in the resulting weaving shed 18. The weaving plane WE is located with reference to the movement of the weft needle 17, the fell 57, and a beat-up reed 30 which is partially broken-away in the drawings. The weft threads are beaten-up by the beat-up reed 30 to form the finished cloth when the reed moves in the direction of the arrow 58.

A row 14 of coupling links is formed from the link-forming warp thread 15 which consists of a strand of synthetic plastics material. The warp thread 15 is rotated about a loop-forming mandrel 16 and is thus coiled to form a row of coils which is later moulded to form the coupling links.

In both Fig. 1 and Fig. 2 the mandrel 16 extends at an angle to the weaving plane WE, so as not to hinder the passage of the weft needle 17. More specifically, the mandrel shown in Fig. 1 remains in the region of the lower sheet of the weaving shed and the mandrel shown in Fig. 2 remains in the position of the upper sheet of the weaving shed.

The two mandrels 16 do not change from the illustrated positions during the weaving and do not pass through the weaving plane WE. Round the end 33 of the mandrel 16, which is located in the region of the fell 57, are looped the coils of the warp thread 15; and this end extends a little way along and into the edge of the cloth. The coupling links are drawn-off continuously from the free outlet-end 33 of the mandrel with the feeding of the finished cloth from the fell 57.

The opposite end 31 of the mandrel is located and secured in the centre of an insert 55 in a rotor 47 which serves for forming a shed with the warp thread 15. The rotor is received in a ring-shaped housing 46, and is in the form of a flat circular, disc-shaped wheel. The housing 46 is secured firmly to carriers 50 by means of a securing plate 48.

A shaft 53 and suitable gearing is used to drive the individual rotors 47. The shaft 53 passes all the way through the loom and carries toothed wheels 52 to actuate each part of the apparatus. The shaft rotates in the direction of the arrow 54. In the formation of a fastener half with left-handed (anticlockwise) screw pitch coil (Fig. 2) this toothed wheel 52 is directly in engagement with peripheral teeth 51 on the shed-forming rotor 47, and sets the latter into rotation in the direction of the arrow 43. In the for-

mation of the fastener half with a righthand (clockwise) screw pitch coil (Fig. 1), a further toothed wheel 80 is included between the toothed wheel 52 and the rotor 47 and is rotated in the direction of the arrow 81 thus driving the rotor in the opposite direction compared to Fig. 2 as shown by the arrow 43 in Fig. 1.

The weaving plane WE shown in Fig. 1 is the same as the weaving plane WE shown in Fig. 2. The ready-woven fastener halves from the two fells thus lie with their rows of coupling links 14 (which are wound in opposite directions to one another) in the same plane. The fastener halves can be aligned with one another by leading them through a guide 75, where heat can be applied to mould the finished rows of coils and form the coupling links.

The different height-position of the axes of the shed-forming rotors 47 in relation to the weaving plane, is brought about by the insertion of the intermediate wheel 80, Fig. 1. The position and the diameter of the intermediate wheel 80 balance-out the height-difference in the arrangement of the two rotors 47 in accordance with Fig. 1 and Fig. 2.

Eccentrically to their rotation axis, the individual rotors 47 each carry an aperture 56 through which is passed the link-forming warp thread 15. In the position of the rotor 47 shown in Fig. 1 and 2, the aperture 56 and therefore the warp thread 15 is located in its lower sheet position 20'. One half-revolution later, the aperture 56 is located in the position 56' which is only drawn in dashed lines in Fig. 1, the position of the link-forming warp thread being the upper sheet position 19' drawn in dash-dot lines in Fig. 1. Thereby the warp thread 15 in each Figure is located alternately above and below the weaving plane WE; whereby it can be woven with the weft thread which is laid by the weft needle 17. Since the weaving shed 18 is formed at the same time at all weaving places, the weft needles 17 are arranged on a common working rod which is movable to and fro to move the needles simultaneously during weaving.

When each rotor 47 rotates, the part of the thread-portion which is located between the fell 57 and the aperture 56 moves up and down. During this movement, the link-forming warp thread 15 in Fig. 1 is wrapped round the mandrel 16 in the direction of a right-handed (clockwise) screw pitch, and the thread 15 in Fig. 2 is wrapped round the mandrel in the direction of a left-handed (anticlockwise) screw pitch.

The insert 55 located in the centre of the rotor 47 carries the end 31 of the mandrel and also has a through passage 59 for an auxiliary thread 60 which is led from the rear side of the rotor to the front side which

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is visible in the drawings. The insert 55 (into which the securing end 31 of the mandrel is set) is of conical shape and the auxiliary thread 60 lies at some distance away from the mandrel. It is therefore possible for a thread guide element in the form of a presser 62 to co-operate with the auxiliary thread without the mandrel 16 also being gripped. The working end of the presser 62 is provided with a notch or groove 64 (as can be seen in particular from Fig. 1) wherein the auxiliary thread 60 sits during the movement thereof. In the parts of the apparatus shown in Fig. 1 and Fig. 2, the pressers are different as regards their shape and mode of working.

In Fig. 1, the presser 62, in the form of a rod which can be raised and lowered in the direction of the double arrow 63, is normally located outside the lower sheet 20' which is determined by the link-forming warp thread 15. This position is shown in solid lines in Fig. 1. In this position, the auxiliary thread 60 is guided by the aperture 59 of the insert 55 and is located in its lower sheet 20'. In the working position, the presser moves into the position 62' which is shown in dash-dot lines in Fig. 1; whereby the auxiliary thread 60 is lifted above the weaving plane WE, for the purpose of forming an upper sheet 19'. Meanwhile, due to further rotation of the rotor 47, the link-forming warp thread also has moved further onwards, into the upper sheet position 19' which is drawn in dash-dot lines in Fig. 1.

In the part of the loom shown in Fig. 2, the presser 62 is in the shape of a bow and is connected to an oscillating shaft 82 on which are also secured other pressers of similar parts of the apparatus which serve for manufacturing a fastener half with a left-handed (anticlockwise) screw pitch. By oscillating the shaft 82 in the direction of the double arrow 63, the presser 62 in Fig. 2 moves between the positions drawn in solid lines and in dash-dot lines. In the working position, which is shown in solid lines in Fig. 2, the presser 62 has engaged the auxiliary thread 60 and has moved it below the weaving plane WE to form a lower sheet. The link-forming warp thread 15 is also located in the lower sheet position because of the position of the aperture 56 in the rotor 47.

When the link-forming warp thread 15 comes into the upper sheet position (not shown in Fig. 2), the presser 62 moves to its non-working position which is shown in dash-dot lines in Fig. 2. In this position, the auxiliary thread is released. The working end of the presser 62 is located outside the weaving shed formation and above the upper sheet position of the different warp threads. The auxiliary thread is then directed by the guide 59 in the insert 55 into

its position above the weaving plane WE, where it forms its upper sheet.

The arrangement of each of the parts of the loom shown in Figures 1 and 2 is such that in each case the projection onto the plane normal to the weaving plane, viz the plane of the paper, of the limits of the shedding movement of the plastics thread 15 adjacent the fell 57 due to the circular motion of the plastics thread 15 from the fell 57 to the path of the rotor aperture 56 substantially overlaps the projection onto the normal plane of the limits of the shedding movement of the warp threads 11, 11' adjacent the fell 57.

In the parts of the loom in accordance with the invention and shown in the drawings, a rotary device 40 has the task of compensating for intertwining between the auxiliary thread 60 and link-forming thread 15 behind the rotor disc. The link-forming warp thread 15 is led around the mandrel 16 in a direction corresponding to the direction of rotation 43 of the rotor 47 and is led around the auxiliary thread 60 to form coils with left-handed (anticlockwise) or right-handed (clockwise) screw pitch. However, as a result of this undesired intertwining can occur (in the opposite direction) between the link-forming warp thread and the auxiliary thread 60. This intertwining is prevented by the rotary device 40.

For the purpose of simplifying the drive, the rotary device 40 in each part of the loom is arranged at the same level as the other devices. The rotary device 40 has a supply reel 67 for the auxiliary thread 60, and a further supply reel for the link-forming warp thread 15 is arranged outside the right-hand edge of the drawing. The supply reel 67 is pushed onto a hollow shaft 69 rotating in the direction of the arrow 68 which indicates the direction in which the warp thread 15 runs. In each case, the link-forming warp thread 15 is drawn through the hollow bore 78 of the shaft. Fixedly connected with the hollow shaft 69 is a wind-up bow 70 which is led-round in the direction of the arrow 71, synchronously with the rotation of the rotor 46. As can be seen, the direction 43 in which the rotor rotates, and the direction in which the associated wind-up bow 70 turns, are the same. The auxiliary thread 60 is led through a hole 72 in the bow, and afterwards runs through an eye 73 of a thread tensioning device which is provided with a spring 66. A reel brake 76 prevents over-run of the reel 67 during rotation thereof.

In the part of the loom shown in Fig. 1, the positions of the auxiliary thread 60 on its wind-up bow 70 and the corresponding positions of the warp thread 15 are shown in correspondingly-depicted manner. When the thread 15 is located in its lower spread-out position, then the wind-up bow 70 lies at

the upper apex-point of its rotational motion, as shown by the solid lines; whereas one half-revolution later, the position is reversed, as can be seen from the dash-dot lines drawn to indicate this position.

Instead of the described arrangement of the supply reels for the link-forming warp thread 15 and auxiliary thread 60, it would be possible to provide a reversed arrangement of the thread reels; since the compensation for the unwanted intertwining in the region of the thread infeed is merely a question of a relative rotation between the two threads.

WHAT WE CLAIM IS:—

1. A loom for simultaneously producing the two halves of a sliding clasp fastener comprising a pair of apparatuses, each apparatus being for manufacturing sliding clasp fastener halves which have coupling links woven into the edge of a supporting tape; each apparatus including means for imparting a shedding movement to a plurality of warp threads while feeding the warp threads towards a fell, means for laying a weft thread between the warp threads, and means for incorporating into the tape during weaving a warp thread of plastics material including a rotatable disc rotor having an aperture therethrough eccentrically positioned for passage of the thread of plastics material, a loop-forming mandrel having one end supported substantially on the axis of rotation of the rotor and being of sufficient length to extend the fell, the rotor being arranged so that as the plastics thread passes through the rotor aperture the thread is fed in a circular motion to the fell about the mandrel and is formed thereby into loops projecting from the tape, and means for rotating the disc rotor so that the circular movement of the plastics thread about the mandrel is synchronised with the shedding motion of the other warp threads and so that it describes at least a substantial part of the outer surface of a cone which is disposed about the mandrel and has its apex in the fell and its base defined by the path of the rotor aperture, the arrangement being such that the projection onto the plane normal to the weaving plane of the limits of the shedding movement of the plastics thread adjacent the fell due to the circular motion of the plastics thread from the fell to the path of the rotor aperture overlaps the projection onto the normal plane of the limits of the shedding movement of the other warp threads adjacent the fell, the rotors of the pair of apparatuses being drivable in opposite directions.

2. A loom according to claim 1, wherein the rotors are connected to be driven by a common rotary drive mechanism.

3. A loom according to claim 1 or 2, wherein each rotor is in the form of a cir-

cular disc having peripheral teeth meshed with the teeth of a drive gear.

4. A loom according to claim 1, 2 or 3, wherein the horizontal axis of the rotor of one apparatus of the pair is above the horizontal axis of the other apparatus of the pair.

5. A loom according to any one of claims 1 to 4, wherein each rotor has an insert in which the supported end of the mandrel is journaled, the insert including an aperture through which an auxiliary thread for the loops is fed to the fell.

6. A loom according to claim 5, wherein each apparatus includes a rotatable guide means for rotating either the plastics thread or the auxiliary thread about the other upstream of the rotor.

7. A loom according to claim 6, in which the said guide means is synchronised for rotation with the rotor.

8. A loom according to claim 6 or 7, in which the said guide means comprises a bracket rotatable about a supply bobbin to withdraw the plastics thread or auxiliary thread from the bobbin, said bracket being connected to a hollow shaft through which the other thread can pass.

9. A loom according to any one of claims 5 to 8, wherein each apparatus includes thread-guide means connected to raise and lower the auxiliary thread substantially between the opposite sides of the weaving shed synchronously with the shedding movement of the plastics thread.

10. A loom according to claim 9, wherein each thread guide is a presser whose thread-engaging end is movable out of the weaving shed on the side of the weaving shed in which the associated rotor axis lies.

11. A loom according to any one of claims 1 to 10, wherein each apparatus includes a weft insertion needle to lay the weft thread between the warp threads.

12. A loom according to any one of claims 2 to 11, wherein each apparatus includes means for forming a coupling head on each loop.

13. A loom substantially as herein described with reference to and as illustrated in Figures 1 and 2 of the accompanying drawings.

14. A method of manufacturing a sliding clasp fastener which comprises simultaneously weaving the two halves of the sliding clasp fastener, the production of each half comprising weaving a supporting tape by imparting a shedding movement to a plurality of warp threads while feeding the warp threads towards a fell and laying a weft thread between the warp threads and incorporating into the tape during weaving a warp thread of synthetic plastics material, which thread passes through an aperture eccentrically positioned in a rotating disc

the upper apex-point of its rotational motion, as shown by the solid lines; whereas one half-revolution later, the position is reversed, as can be seen from the dash-dot lines drawn to indicate this position.

Instead of the described arrangement of the supply reels for the link-forming warp thread 15 and auxiliary thread 60, it would be possible to provide a reversed arrangement of the thread reels; since the compensation for the unwanted intertwining in the region of the thread infeed is merely a question of a relative rotation between the two threads.

WHAT WE CLAIM IS:—

1. A loom for simultaneously producing the two halves of a sliding clasp fastener comprising a pair of apparatuses, each apparatus being for manufacturing sliding clasp fastener halves which have coupling links woven into the edge of a supporting tape; each apparatus including means for imparting a shedding movement to a plurality of warp threads while feeding the warp threads towards a fell, means for laying a weft thread between the warp threads, and means for incorporating into the tape during weaving a warp thread of plastics material including a rotatable disc rotor having an aperture therethrough eccentrically positioned for passage of the thread of plastics material, a loop-forming mandrel having one end supported substantially on the axis of rotation of the rotor and being of sufficient length to extend the fell, the rotor being arranged so that as the plastics thread passes through the rotor aperture the thread is fed in a circular motion to the fell about the mandrel and is formed thereby into loops projecting from the tape, and means for rotating the disc rotor so that the circular movement of the plastics thread about the mandrel is synchronised with the shedding motion of the other warp threads and so that it describes at least a substantial part of the outer surface of a cone which is disposed about the mandrel and has its apex in the fell and its base defined by the path of the rotor aperture, the arrangement being such that the projection onto the plane normal to the weaving plane of the limits of the shedding movement of the plastics thread adjacent the fell due to the circular motion of the plastics thread from the fell to the path of the rotor aperture overlaps the projection onto the normal plane of the limits of the shedding movement of the other warp threads adjacent the fell, the rotors of the pair of apparatuses being drivable in opposite directions.

2. A loom according to claim 1, wherein the rotors are connected to be driven by a common rotary drive mechanism.

3. A loom according to claim 1 or 2, wherein each rotor is in the form of a cir-

cular disc having peripheral teeth meshed with the teeth of a drive gear.

4. A loom according to claim 1, 2 or 3, wherein the horizontal axis of the rotor of one apparatus of the pair is above the horizontal axis of the other apparatus of the pair.

5. A loom according to any one of claims 1 to 4, wherein each rotor has an insert in which the supported end of the mandrel is journaled, the insert including an aperture through which an auxiliary thread for the loops is fed to the fell.

6. A loom according to claim 5, wherein each apparatus includes a rotatable guide means for rotating either the plastics thread or the auxiliary thread about the other upstream of the rotor.

7. A loom according to claim 6, in which the said guide means is synchronised for rotation with the rotor.

8. A loom according to claim 6 or 7, in which the said guide means comprises a bracket rotatable about a supply bobbin to withdraw the plastics thread or auxiliary thread from the bobbin, said bracket being connected to a hollow shaft through which the other thread can pass.

9. A loom according to any one of claims 5 to 8, wherein each apparatus includes thread-guide means connected to raise and lower the auxiliary thread substantially between the opposite sides of the weaving shed synchronously with the shedding movement of the plastics thread.

10. A loom according to claim 9, wherein each thread guide is a presser whose thread-engaging end is movable out of the weaving shed on the side of the weaving shed in which the associated rotor axis lies.

11. A loom according to any one of claims 1 to 10, wherein each apparatus includes a weft insertion needle to lay the weft thread between the warp threads.

12. A loom according to any one of claims 2 to 11, wherein each apparatus includes means for forming a coupling head on each loop.

13. A loom substantially as herein described with reference to and as illustrated in Figures 1 and 2 of the accompanying drawings.

14. A method of manufacturing a sliding clasp fastener which comprises simultaneously weaving the two halves of the sliding clasp fastener, the production of each half comprising weaving a supporting tape by imparting a shedding movement to a plurality of warp threads while feeding the warp threads towards a fell and laying a weft thread between the warp threads and incorporating into the tape during weaving a warp thread of synthetic plastics material, which thread passes through an aperture eccentrically positioned in a rotating disc



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5 rotor so that the thread is fed in a circular movement to the fell about a mandrel and is formed thereby into loops projecting from the tape, the circular movement of the plastics thread about the mandrel being synchronised with shedding movement of the other warp threads; wherein the plastics thread is guided so that it describes at least a substantial part of the outer surface of a cone, which cone is disposed about the mandrel and has its apex in the fell; wherein the base of the cone is defined by the path of the aperture in the rotor; and wherein the projection onto the plane normal to the weaving plane of the limits of the shedding movement of the plastics thread adjacent

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the fell due to the circular motion of the plastics thread from the fell to the path of the rotor aperture overlaps the projection onto the normal plane of the limits of the shedding movement of the other warp threads adjacent the fell, the two rotors for producing respective halves being rotated in opposite directions.

15. A method substantially as described herein with reference to Figures 1 and 2 of the accompanying drawings.

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