United States Patent

Furst

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[45] **Oct. 31, 1972**

[54] WARP KNITTING MACHINE

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[73] Assignee: **W. Schlafhorst & Co.**, Monchengladbach, Germany

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[52] **U.S. Cl.**.....**66/86**

[51] **Int. Cl.**.....**D04b 23/00**, D04b 27/00

[58] **Field of Search**.....66/83, 84, 85, 86

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Attorney—Curt M. Avery, Arthur E. Wilfond, Herbert L. Lerner and Daniel J. Tick

[57] **ABSTRACT**

Warp knitting machine having a zone wherein knitting needles are disposed and means for supplying warp threads to the needles, includes a device for filling a weft to the warp threads having a plurality of holder members located in the vicinity of respective weft reversal locations disposed at opposite lateral edges of a fabric web being knitted by the machine, thread guide means movable along a continuous travel path and cooperating with the holder members for making the weft ready by looping the weft about respective holder members at opposite weft reversal locations, the holder members at each of the weft reversal locations being mounted so as to be displaceable successively in direction toward the needle zone.

13 Claims, 9 Drawing Figures

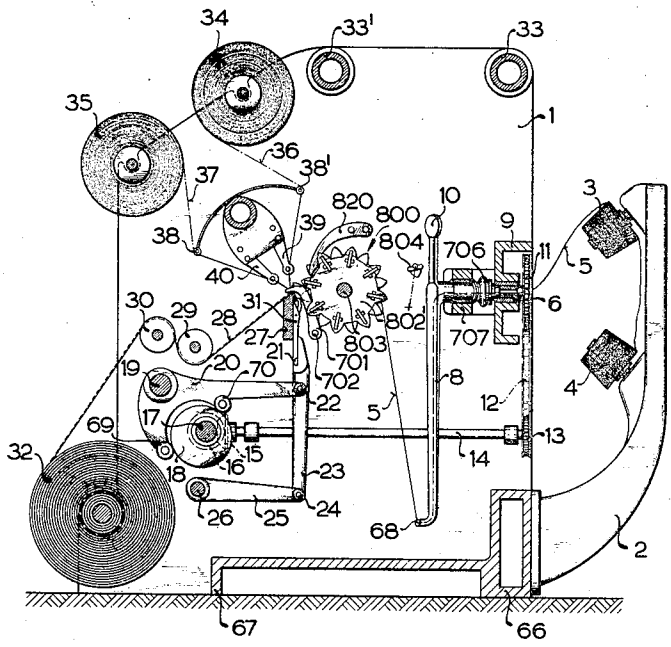


FIG.1

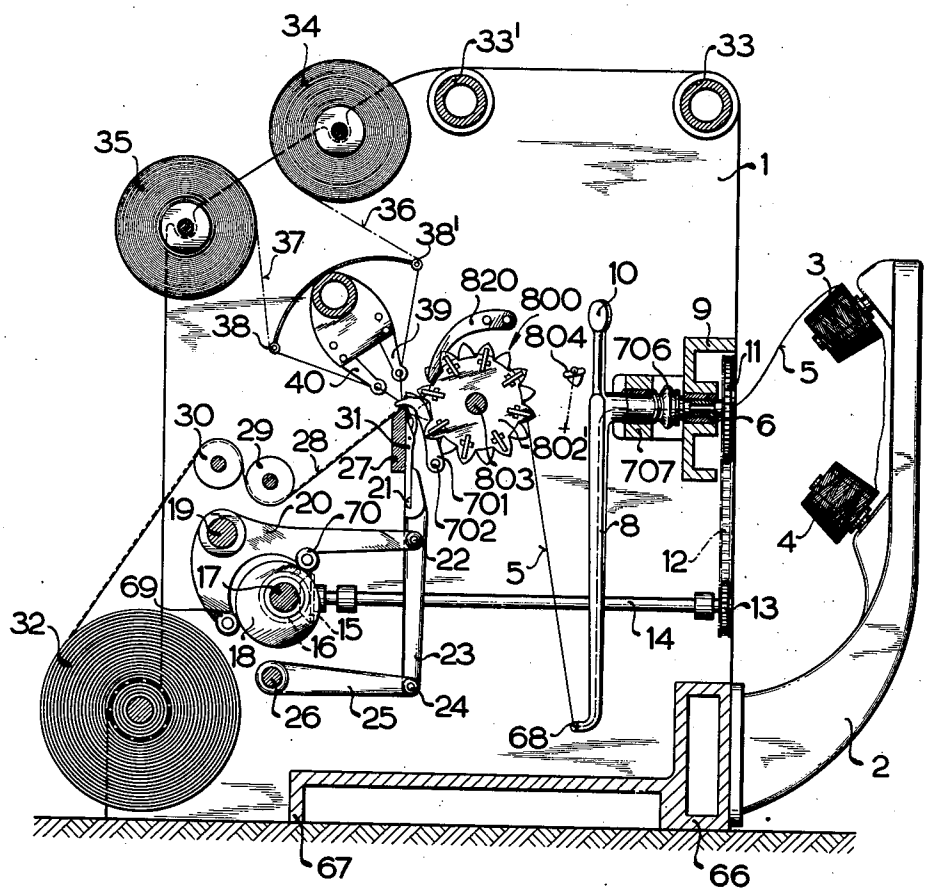

34
33'
33
35
1
36
38'
37
820
800
10
3
38
39
804
706
9
11
5
40
6
30
29
28
31
802'
27
803
707
21
701
19
20
70
8
4
702
22
5
12
69
17
13
32
15
14
18
16
23
26
25
24
68
2
67
66

FIG. 2

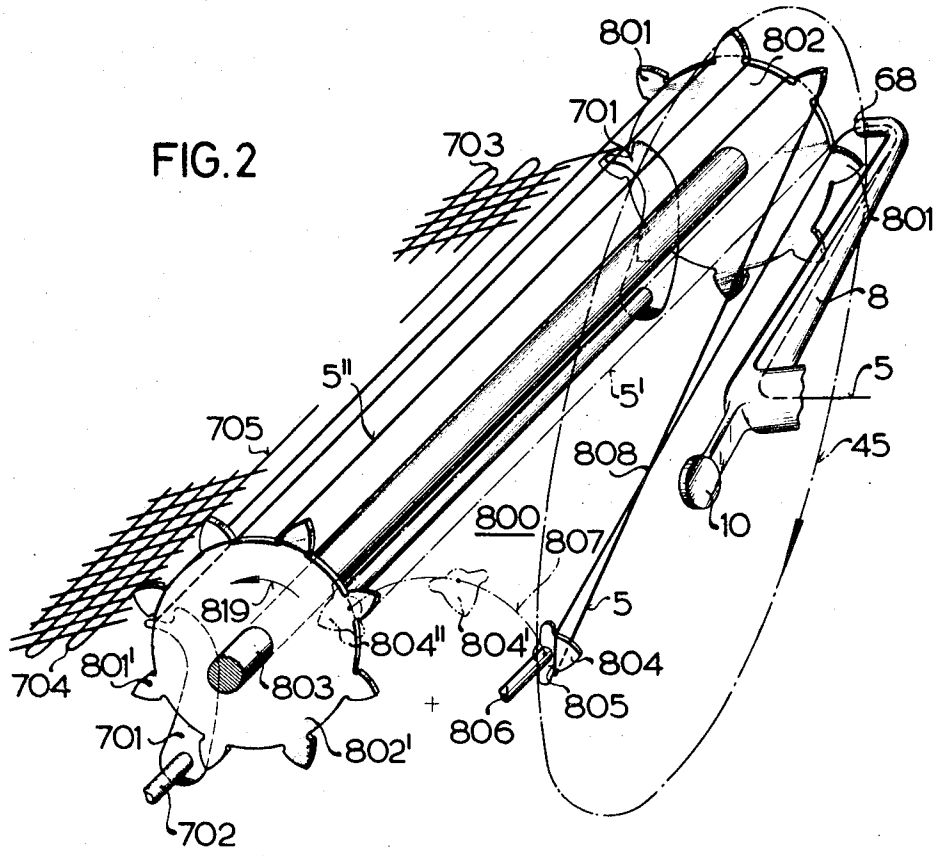

801
802
68
701
703
801
8
5
5'
5''
705
808
45
800
807
10
819
5
804''
804'
804
704
801'
803
805
806
701
802'
702

FIG.3

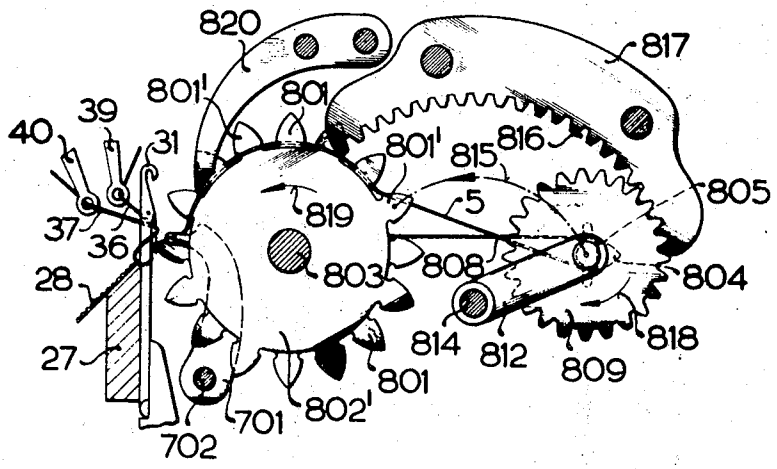

820
817
801'
801
39
40
31
801'
815
816
805
819
5
37
36
803
808
804
28
814
812
809
818
27
801
802'
701
702

FIG.4

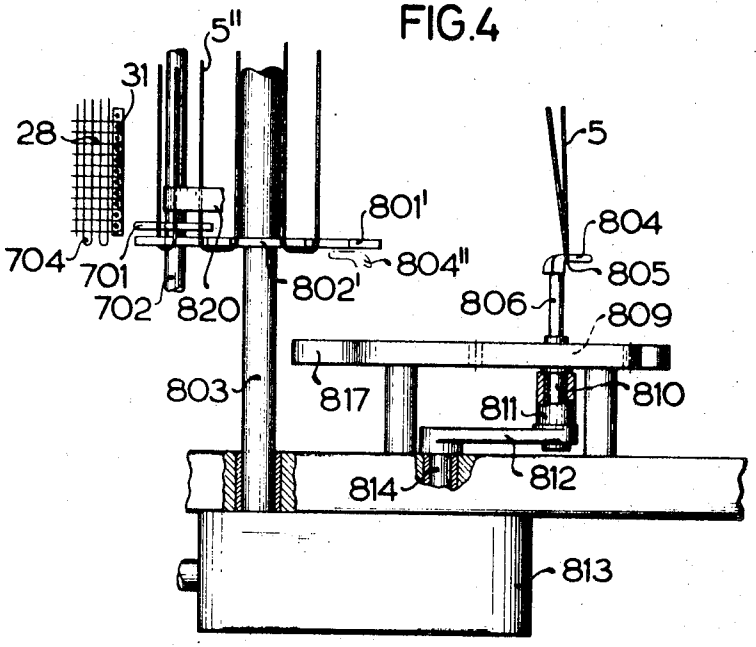

5''
31
28
5
801'
804
704
701
804''
805
702
820
802'
806
809
803
817
811
810
814
812
813

FIG.5

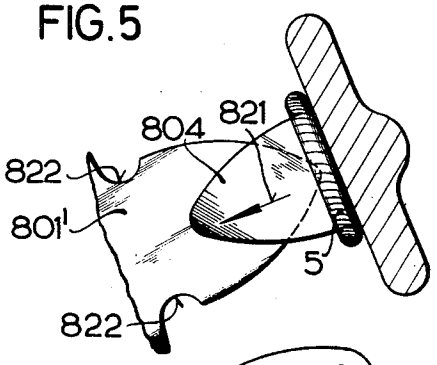


FIG.6

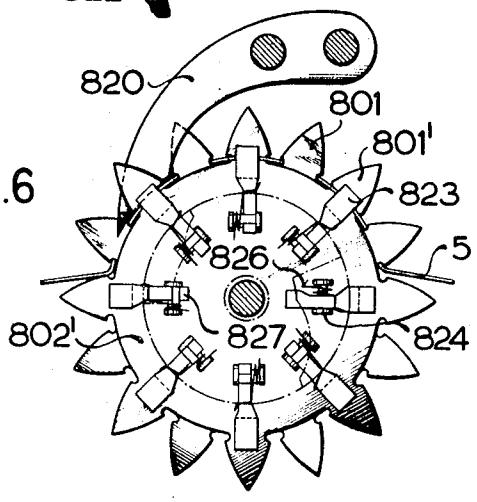


FIG.7

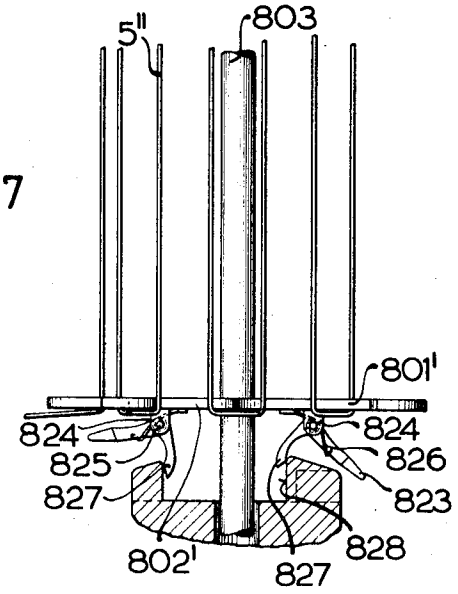


FIG.8

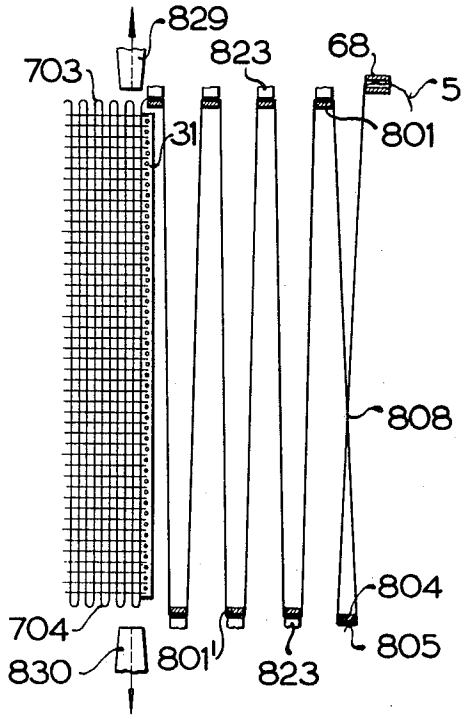
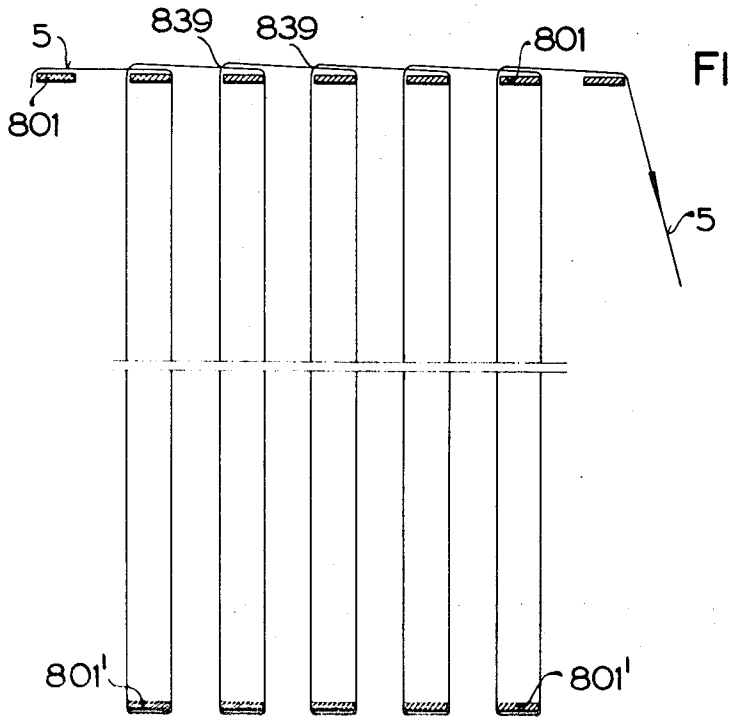

829
703
823
68
5
31
801
808
804
805
704
830
801'
823

FIG.9


5
839
839
801
801
5
801'
801'

WARP KNITTING MACHINE

My invention relates to warp knitting machine, such as Raschel knitting machine especially, having a device for filling a weft, wherein the weft is made ready by a thread guide displaced along a travel path continuously over holder members that are located in the vicinity of respective weft reversal locations disposed at opposite lateral edges of a fabric web being knitted by the machine.

Very high operating and thread speeds can be attained with such machines. The breaks in the weft which are increased due to these high speeds greatly reduce the net efficiency of the machines however, because it is no longer possible to stop instantaneously all of the machine elements taking part in the knitting operation. If only a single weft were to remain or if the knitting tools were to swing through once without forming a stitch during only one further weft-extending motion after a resulting stoppage due to a weft break, a defective and unusable fabric web would result.

It is accordingly an object of my invention to provide warp knitting machine which affords weft filling therein at very high weft-filling speeds and to permit an unbroken knitting operation even during the phase of the machine wherein it is slowing down to a standstill.

It is another object of my invention to provide warp knitting machine with functional reliability of weft filling which is much improved over heretofore known machines.

With the foregoing and other objects in view, I provide in accordance with my invention, in a warp knitting machine having a zone wherein knitting needles are disposed and means for supplying warp threads to the needles, a device for filling a weft to the warp threads comprising a plurality of holder members located in the vicinity of respective weft reversal locations disposed at opposite lateral edges of a fabric web being knitted by the machine, thread guide means movable along a continuous travel path and cooperating with the holder members for making the weft ready by looping the weft about respective holder members at opposite weft reversal locations, the holder members at each of the weft reversal locations being mounted so as to be displaceable successively in direction toward the needle zone.

So many weft lengths can be taken up by these holder members in a continuously wound line that, when weft feed is interrupted between the supply coil or bobbin and the thread storage device thus formed, no weft will be missing in the fabric web being knitted, in spite of the longer period necessary for the machine to slow down before stopping because of its faster operating speed. When the machine has finally stopped, the end of the weft still located in the thread storage device can then be tied to the end of a weft extending from the supply coil or bobbin, and the thread storage device proper can be filled with the required length of weft.

Various locations in the vicinity of the knitting zone of the machine are suited for mounting the holder members which serve as the storage elements. If the holder members are located within a space between the thread guide and the knitting needles and, as aforementioned are mounted so as to be displaceable in the direction toward the needle zone, a simple and reliable delivery of the stored wefts to the knitting tools is possible by means of conventional stitching combs or the like. In accordance with a further feature of the invention therefore, all of the holder members at one weft reversal location or lateral edge of fabric web are displaceable in common about an axis disposed laterally to the width of the fabric web.

In accordance with another feature of the invention, the holder members are each weft reversal location or lateral edge of the fabric web are secured on a rotatable disc.

Since the holder members must reliably hold the weft firmly from the supply thereof to the delivery thereof, in accordance with a further feature of the invention, each of the holder members is provided with a thread clamp and/or contour means for preventing the thread from sliding off the holder member. Instead of individual thread clamps, the threads looped around the holder members can also be held firmly in common by a disc or the like which is resiliently biased thereagainst.

When the holder members are continuously subjected to a continuous weft by means of a thread guide displaced along a travel path, weft lengths are produced which cross one another from the holder member located at one weft reversal location to a holder member at the other weft reversal location. Such so-called weft loops are not suitable for transfer at the knitting tools. It is therefore necessary to provide an uncrossed parallel feed of the wefts to the knitting tools.

In order to feed the wefts in a desired parallel position to the knitting tools, an opening of such crossed wefts or threads into a hairpin-shaped wound thread position can be achieved in an advantageous manner by providing a thread feeder at least at one of the weft reversal locations or lateral edges of the fabric web, which cooperates with the holder members for opening the loop of the weft applied thereto by the revolving thread guide.

The thread feeder serving as loop opener is constructed, in accordance with yet another feature of the invention, as a thread guide member displaceable from the thread guide to the holder members. The untwisting of the weft loop to a hairpin-shaped wound thread layout is effected in a region between the revolving thread guide and the holder members which serve as storage members. The weft can also, however, be continuously wound initially so that the weft lengths are crossed, and the thread loop thus formed can then be opened shortly before delivery of the weft to the knitting tools by means of a thread guide member located in this region. The weft loop is opened by a respective thread feeder by turning the latter about an angle of approximately 180° in one direction. A thread feeder is provided at each of the weft reversal locations or lateral edges of the fabric web. The angular path traversed by the thread feeder for opening a weft loop can be reduced in half for the individual thread feeder with opposite rotation of the thread feeders.

In accordance with an especially advantageous embodiment of the invention, I provide a thread feeder which is rigidly connected to a rotatable shaft of a planet wheel meshing with the inner toothing formed on a stationary member.

In order to feed the weft in the desired parallel position of the knitting tools, a hairpin-shaped storage of the wefts parallel to the needle zone is effected in accordance with my invention by placing the weft continuously in the manner of a looped cycloid around more holder members in the vicinity of the one weft reversal location or lateral edge of the fabric than in the vicinity of the other weft reversal location or lateral edge of the fabric. With such placement of the weft, thread feeders serving as loop openers are obviated. With a hairpin-shaped storage of the wefts parallel to the needle zone, it is necessary that when a weft length is delivered to the knitting needles, the knitting operation should not be disturbed by the next-following weft length. This is advantageously effected in accordance with a further feature of my invention by providing in the weft delivery position of each holder member, a locking member cooperating therewith for holding fast the next-following weft length.

Other features which are considered as characteristic for the invention are set forth in the appended claims.

Although the invention is illustrated and described herein as embodied in warp knitting machine, it is nevertheless not intended to be limited to the details shown, since various modifications and structural changes may be made therein without departing from the spirit of the invention and within the scope and range of the equivalents of the claims.

The construction and method of operation of the invention, however, together with additional objects and advantages thereof will be best understood from the following description of specific embodiments when read in connection with the accompanying drawings, in which:

FIG. 1 is a diagrammatic view partly in section of a Raschel knitting machine constructed in accordance with my invention;

FIG. 2 is an enlarged perspective view of part of FIG. 1 showing thread storage device with holder members serving as storage members and with a yarn feeder;

FIG. 3 is a side view of FIG. 2 including an actuating mechanism for the thread feeder which serves as loop opener;

FIG. 4 is a top plan view of FIG. 3;

FIG. 5 is a much enlarged fragmentary view of a holder member with a thread feeder according to FIG. 2;

FIG. 6 is an enlarged fragmentary side elevational view of FIG. 3 showing details of the holder member;

FIG. 7 is a top plan view of FIG. 6;

FIG. 8 is a view similar to FIG. 2 in a different phase thereof with the thread feeder omitted; and

FIG. 9 is a schematic view of the laying of the weft about the holder member of FIG. 8.

Referring now to the drawings and first, particularly to FIG. 1 thereof, there is shown a warp knitting machine, such as a Raschel knitting machine, having a projecting arm 2 secured by connecting member or crosspieces 66 and 67 to a frame side wall 1. A pair of cross wound bobbins or cheeses 3 and 4 are carried by the arm 2, and the threads wound thereon are connected in a conventional manner for the purpose of affording continuous unwinding of a weft 5 therefrom. The weft 5 is guided from the cheese 3 through a tubular shaft 6 and through a thread guide 68 located at an outer or free end of a rod 8 bent like a crank. The tubular shaft or rotary bearing 6 is integral with the rod 8, which is pivotally mounted thereby in bearings provided in a cross-piece holder member 9 that is secured to the side wall 1. The crank-like rod 8 is provided with a counterweight 10 at the other end thereof opposite the free end at which the thread guide 68 is located.

The crank-like rod 8 is driven through a transmission system which includes a first sprocket or chain wheel 11, a chain 12 and a second chain wheel 13 that is mounted on a shaft 14. The shaft 14 receives its driving power through a bevel gear 15 mounted thereon and meshing with another bevel gear 16 fixed to the main drive shaft 17 of the Raschel knitting machine. The main drive shaft 17 carries a cam 18 by means of which a lever 20, carrying follower rollers 69 and 70 in engagement with the surface of the cam 18, is pivotable about a pivot shaft 19. The lever 20 is connected by an articulating joint 22 with a carrier rod 23 which supports a needle bar 21 and raises and lowers the latter in accordance with the motion imparted thereto by the rotating cam 18. The carrier rod 23 is connected at its lower end, as viewed in FIG. 1, through an articulating joint 24 to a pull lever 25, which is rotatably mounted on a pin 26 extending from the side wall 1. A cutting plate 27 is fixed to the side wall 1 and extends transversely thereto. Material 28 which has been knitted in the Raschel knitting machine of the invention is withdrawn from the needles 31 by rotatably mounted feed rollers 29 and 30 suitably driven, for example, through non-illustrated transmission mechanism from the main drive shaft 17, and is wound on a beam 32. At the upper part of the side wall 1, as viewed in FIG. 1, traverses 33 and 33' are mounted transversely to the side wall 1. Furthermore, partial warp beams 34 and 35 are rotatably mounted in the upper part of the side wall 1, and warp threads 36 and 37 lead therefrom, respectively, through spring seesaws or rocker arms 38 and 38' and through the eye needles 39 and 40 to the needles 31 which, in the illustrated embodiment, are constructed as latch needles. Other types of needles, for example pointed needles or the like can also be used. Adjacent the needles 31, there is a switch comb 701 pivotally mounted on and driven by the shaft 702 in a known manner. A rotatably mounted shaft 803 with a disc 802' and holder member 801, 801', serving as storage members, which together form a thread storage device 800, are located between the needles 31 and the rod 8 bent like a crank. The disc 802', as viewed in FIG. 1 is located in front of, and hence obstructs, a corresponding disc 802 (note FIG. 2).

FIG. 2 shows the thread storage device 800 in perspective view and depicts especially clearly the thread storing operation in the given embodiment. In the vicinity of the edges 703 and 704 of the fabric web being knitted, holder members 801 and 801' are provided on the respective discs 802 and 802' which are mounted on a shaft 803 extending parallel to the width 705 of the fabric web. The discs 802 and 802' are fixed against rotation relative to the shaft 803 and are rotatably driven therewith stepwise in the direction of the arrow 819. A weft 5 extending from a supply coil or bobbin 3 or 4 passes through the hollow, revolving crank-shaped rod 8 and is made ready by means of the thread guide 68 provided at the free end opening of the

rod 8 which travels on a circular travel path 45 so as to alternately deposit the weft 5 over the holder member 801 and 801'. In order to transfer the web 5 to a holder member 801', a thread feeder 804 is passed along the dot-dash line 807 while it simultaneously turns approximately 180° about its axis 806 and accordingly assumes the positions shown in phantom at 804' and 804''. Due to this movement, the crossing point 808 of the weft 5 is eliminated, the weft loop 805 being opened and the weft 5 being oriented so that it extends parallel to the width 705 of the fabric web or to the needle zone. The completion of the transfer operation of the weft to a holder member 801' is represented by a dot-dash line 5'. The weft 5' already taken up by the holder members 801 and 801' produces as illustrated in FIG. 2 an alternating continuous hairpin-shaped storage of the weft. In the embodiment shown in FIG. 2, it is moreover apparent that the crank-like rod 8 describes a travel path 45 that is not parallel to the axis or shaft 803 nor thereby to the thread storage device 800, but rather displays an offset or shaft with respect thereto to permit the rod 8 to pass the weft 5 both around the holder member 801 as well as around a thread feeder 804 which is located spaced from the holder member 801'. The deflection or deviation in the mounting of the tubular shaft 6 which produces this offset or shaft is attained by means of an elastic connection 706, in the form of a bellows-like rubber tube, for example, and a bearing 707 which is connected to the transverse support 9 and extends at an inclination thereto, as shown in FIG. 1. In contrast to the embodiment shown in FIG. 1, a modification in accordance with my invention is to have the crank-shaped rod 8 pass the weft along a travel path that is disposed parallel to the thread storage device 800 by providing another thread feeder at the side of the thread storage device 800 located opposite the thread feeder 804. In such a case, the turning angle required for the individual thread feeder to eliminate the crossing point 808 of the weft is cut in half. In FIG. 2, there can be seen between the discs 802 and 802', both outer members of a conventional stitch comb 701 mounted on its shaft 702. In addition, instead of arranging the thread guide 804 as shown in FIG. 2, it can be arranged instead so that the opening of the individual thread loops, and consequently the elimination of crossing points of the weft, can be effected in a region located between the thread storage device 800 and the starting edge 705 of the fabric web.

Further details of the schematically shown features of FIG. 2 are illustrated in FIGS. 3 and 4 which are side elevational and top plan views, respectively. FIGS. 3 and 4 show a drive mechanism for effecting the movements of the thread feeder 804 which is seated on the shaft 806 and which is rigidly connected through the shaft 806 to a planet wheel 809 acting as a pinion. A shaft portion 810 located on the opposite side of the planet wheel 809 from the shaft 806 is rotatably mounted in a bearing bushing 811 of a crank 812. The crank 812 is driven by a suitable transmission 813 through a pivot or journal 814. When a weft 5 has been placed as a loop 805 about the thread feeder 804, the crank 812 moves about the pivot 814 along a circular arc 815 in direction toward one of the holder members 801'. Due to the simultaneously occurring rolling motion of the planet wheel 809 along the inner teeth 816 of a stationary segment 817, the thread feeder 804 executes a rotary movement in the direction of the arrow 818, so that when it reaches the holder member 801', the crossing point 808 of the weft 5 has opened and the weft can be uncrossed and delivered to the holder member 801'. The holder members 801' are provided with wefts in this manner while the holder members 801 are directly subjected to the revolving rod 8 that is bent in the form of a crank. The holder members 801 and 801' rotating stepwise with the shaft 803 in the direction of the arrow 819, carry the wefts to the needles 31, and the stitching comb 701 delivers the individual weft downstream therefrom where it meshes with the warp threads 36 and 37. During the transfer of a weft through the stitching comb 701, the next following weft is held fast by a stationary locking member 820.

In FIG. 5 it is shown especially clearly how the thread feeder 804 is delivered with a weft 5 in the direction of the arrow 821 to a holder member 801' and is located at a position just before its position at 804'' in FIG. 2 wherein the transfer to the holder member 801' occurs. The holder member 801' is provided with recessed or notched contours 822 so that it has a shape much like that of an Indian arrowhead, the recessed contours 822 providing added security against the possibility of the weft sliding off the respective holder member.

As shown in FIGS. 6 and 7, the holder members 801 and 801' are provided with auxiliary thread clamps 823 which are pivotally mounted on respective pivot pins 825 secured in respective bearings 824 that are fixed to the discs 802 and 802', respectively. The clamps 823 are biased by respective torsion springs 826 against the weft looped about the respective holder member and slide with their squared-off ends 827 over a cam member 828 as the thread storage device 800 revolves. The cam member 828 is of such construction as shown in FIG. 7, that both in the take-up position of the weft 5 through the thread guide 68 and the thread feeder 804 as well as in the delivery position of the weft at the knitting tools, the squared-off ends 827 of the thread clamps 823 are raised so high that the weft can be freely inserted and released respectively.

In FIG. 8 there is shown how a weft 5 can be placed around the holder members 801 and 801' without requiring recourse to a thread feeder. The holder members 801 and 801' are located directly and exactly opposite one another in the embodiment of FIG. 8 and are disposed in a circle about the periphery of the rotatable discs 802 and 802', respectively. A weft 5, coming from a supply coil or bobbin 3 or 4 is passed through the hollow revolving crank-shaped rod 8 and, by means of a thread guide 68 formed by the opening at a free end of the rod 8, is made ready over the holder members 801 and 801' on the circular travel path 45 of the thread guide 68. The tubular shaft 6 of the crank-shaped rod 8 is disposed exactly at right angles to the shaft 803.

In the schematic view of FIG. 8, the type of weft placement or distribution about the individual holder members shown in FIG. 8 is illustrated again especially clearly. The circularly disposed holder members 801 and 801' of FIG. 8 have been projected onto a plane in order to provide a simplified plan view. The weft 5 is continuously placed, beginning at the holder members 801, initially around two of those holder members 801

and, in the further course of the arrows, as indicated, is then placed around a holder member **801'** and thereafter, again around two holder members **801**. It is readily apparent that, with such a weft placement about the holder members, no crossing occurs of the weft lengths between the opposite holder members of the respective discs **802** and **802'**. The crossing points **839**, forming behind the holder members **801**, offer no disadvantage to the parallel release or delivery of the wefts to the knitting tools. The course or disposition of the weft in the embodiment shown in FIGS. **8** and **9**, presents a type of looped cycloid in which the loops are made up only of parallel straight lines instead of geometrical curves.

With such a weft placement or disposition, several wefts can be placed simultaneously around the holder members instead of only one. Moreover, different wefts can be placed, for example alternately, over more than two holder members **801** and one or more holder members **801'** in the thread storage device **800** in any desired interrupted sequence to produce different patterns. An uncrossed parallel disposition of the wefts around the holder members **801** and **801'** is always assured when each weft is placed around more holder members in the vicinity of one of the lateral edges of the fabric web than in the vicinity of the other lateral edge of the fabric web.

I claim:

1. In a warp knitting machine having a zone wherein knitting needles are disposed and means for supplying warp threads to the needles, a device for feeding filling wefts to the warp threads comprising means for making the weft ready outside the needle zone and guiding the weft to the warp threads, said make-ready means including a plurality of holder members located in the vicinity of respective weft reversal locations at opposite lateral edges of a fabric web being knitted by the machine, a single thread guide cooperating with said make-ready means for making the weft ready, said thread guide being movable always in the same direction along a continuous travel path between said weft reversal locations and intercepting said holder members at said weft reversal locations, respectively, so that the wefts are looped about respective holder members at the weft reversal locations, and means for successively displacing said holder members at each of said weft reversal locations in direction toward said needle zone.

2. Warp knitting machine according to claim **1**, wherein said holder members are tooth-shaped.

3. Warp knitting machine according to claim **1**, wherein said holder members are pin-shaped.

4. Warp knitting machine according to claim **1**, wherein all of the holder members at each weft reveral location are displaceable in common about an axis disposed parallel to a line extending between said weft reversal locations at both edges of the fabric web respectively.

5. Warp knitting machine according to claim **4**, wherein the holder members at each weft reversal location is secured to a rotatable disc.

6. Warp knitting machine according to claim **1** including a thread clamp cooperating with each of said holder members.

7. Warp knitting machine according to claim **1**, wherein each of said holder members is formed with a recessed contour for preventing a weft looped thereon from sliding off the same.

8. Warp knitting machine according to claim **1**, including a thread clamp cooperating with each of said holder members, said holder members being formed with contours for preventing a thread looped thereon from sliding off therefrom.

9. Warp knitting machine according to claim **1**, wherein at least at one of said weft reversal locations, at least one thread feeder for opening a weft loop of the weft supplied by said traveling thread guide means is disposed for cooperating with the respective holder members.

10. Warp knitting machine according to claim **9**, wherein said loop-opening thread feeder is formed as a thread guide member and is displaceable between said thread guide means and the respective holder members.

11. Warp knitting machine according to claim **10**, wherein said thread feeder is fixedly mounted on a shaft and is rotatable with said shaft, and including a planet wheel also mounted on said shaft and having teeth meshing with an inner toothing formed on a stationary member.

12. Warp knitting machine according to claim **1**, wherein said thread guide means is revolvable between the plurality of holder members at both weft reversal locations disposed at opposite lateral edges of the fabric web for continuously depositing weft in the former of a looped cycloid thereon, and including means for placing the weft around more holder members at one of said weft reversal points than at the other.

13. Warp knitting machine according to claim **1**, wherein the weft is made ready on said holder members in lengths successively displaceable toward said needle zone and wherein, in delivery position of one of said weft lengths to said needle zone, a locking member cooperates with each of said holder members for holding fast the succeeding weft lengths.

* * * * *