Sept. 2, 1969 V. SVATY 3,464,458

METHOD AND APPARATUS FOR TENSIONING A SLACK WEFT THREAD

Filed March 18, 1968 2 Sheets-Sheet 1

Fig. 1

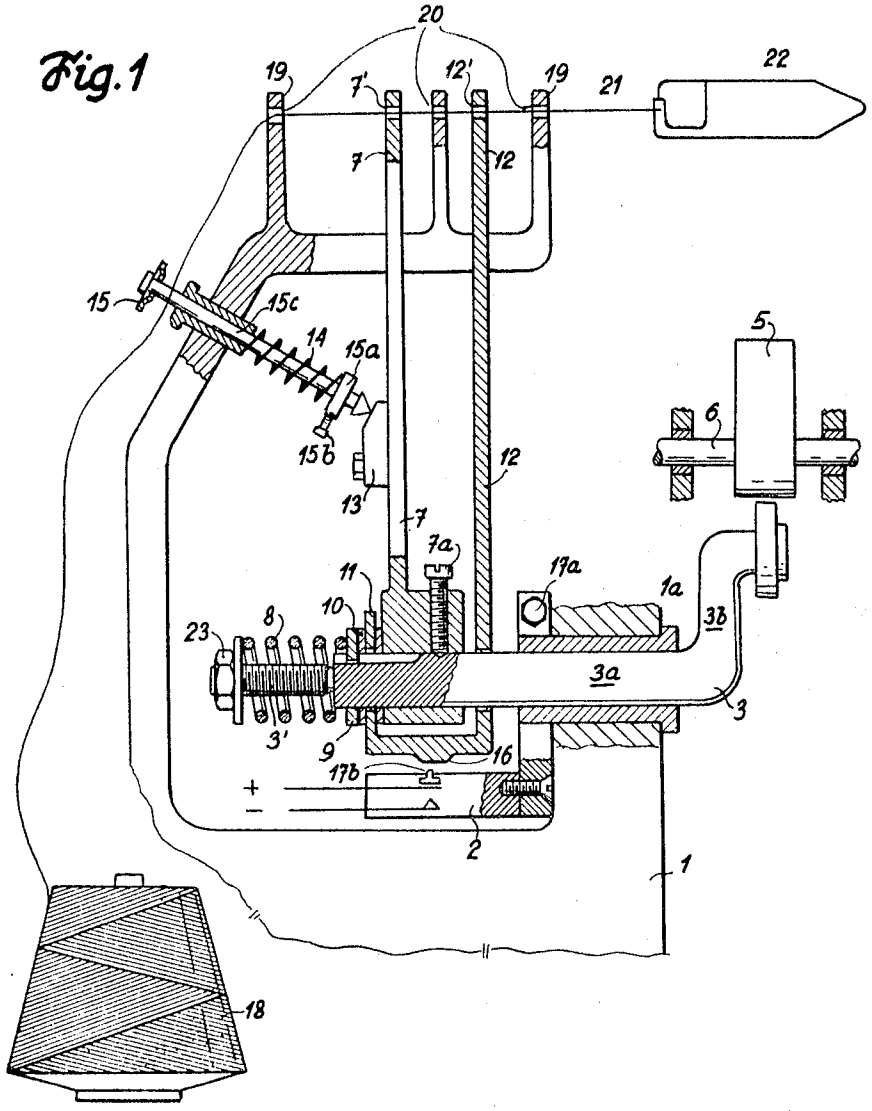

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Fig. 2

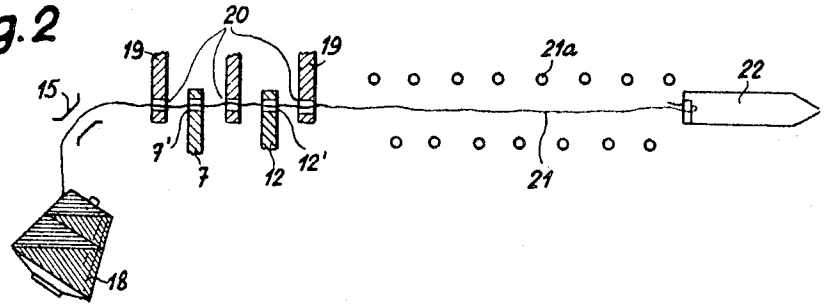


Fig. 3

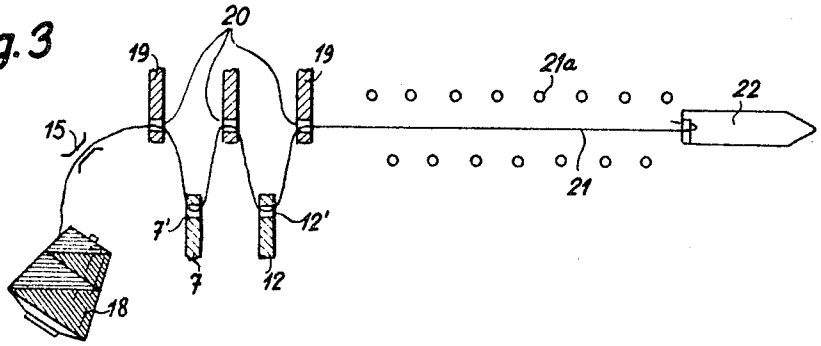
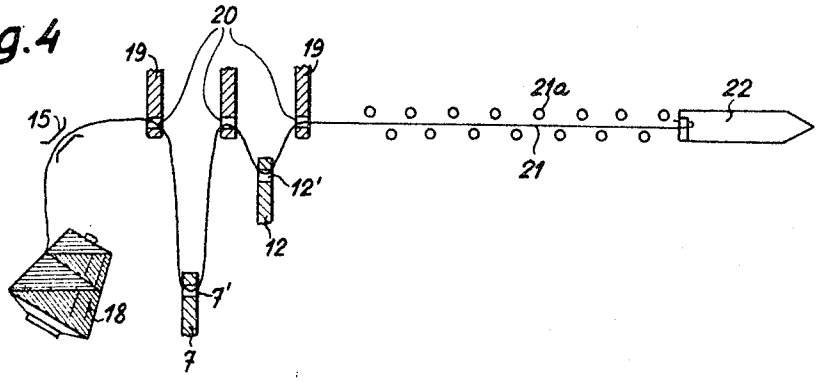


Fig. 4



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METHOD AND APPARATUS FOR TENSIONING A SLACK WEFT THREAD

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U.S. Cl. 139—194 10 Claims

ABSTRACT OF THE DISCLOSURE

A positively driven first loop forming lever and a yieldable second loop forming lever form loops in an inserted slack weft thread so that the same is tensioned. The loop forming levers are frictionally connected so that the second loop forming lever is moved by the first loop forming lever to a breakage indicating position if the weft threads break.

BACKGROUND OF THE INVENTION

The present invention is mainly concerned with looms of the type in which a weft thread is inserted into the warp shed by a gripper shuttle which clamps the end of the weft thread and carries no bobbin. In looms of this type, the weft thread is slightly slack after the picking of the gripper shuttle or other weft inserting member. The slack is caused on the one hand by the inertia of the weft thread which tends to continue its movement after the stopping of the weft inserting member, and on the other hand by the rebound movement of the weft inserting member which usually cannot be stopped closely behind the fabric selvedge, and thus has to be returned to the end of the warp shed. Consequently, after each pick, it is necessary to tension the weft thread and to remove its slack by retracting the weft thread at the side from which the weft inserting member was picked. A retracting lever acting on a portion of the weft thread located outside of the warp shed is used for performing this function in prior art apparatus.

Generally, there are two methods for tensioning the weft thread by lever mechanism. In a first arrangement of the prior art, a lever is positively oscillated at a predetermined stroke and has an eye receiving a portion of the weft thread extending from a tensioning brake to the warp shed. During a first part of the stroke of the oscillating lever in one direction, the tensioning brake is closed and the weft thread is tensioned so that its slack is removed. Thereupon, during the continuation of the stroke of the lever, an additional length of weft thread is pulled through the tensioning brake from a crosswound supply bobbin. The distance which the eye of the level moves is greater than the length of the slack which has to be taken up. This construction has the advantage that the tensioning lever and its drive means operate very reliably, but there is the disadvantage that the lever stroke must be substantially greater than required, and that an independent weft thread stop motion is required for stopping the operation in the event of a weft thread breakage.

Another arrangement according to the prior art overcomes this disadvantage by providing a retracting lever having an eye for the weft thread and being biassed by a spring to move until the slack of the weft thread is removde and the same is sufficiently tensioned. A switch can be arranged in the path of movement of the spring biassed lever, so that the same actuates the switch in the event of a weft thread breakage in which case the lever is not stopped by the tensioned weft thread. This arrangement requires a small stroke of the retracting

tensioning lever, but a disadvantage of this construction is that the tensioning lever must be of a light-weight construction to be operated by the spring, and even then it is difficult to prevent disturbing influences on the weft thread tension caused by the inertia of the tensioning lever.

SUMMARY OF THE INVENTION

It is one object of the invention to overcome the disadvantages of known arrangement for tensioning a slack inserted weft thread, and to provide efficient and reliably operating apparatus for this purpose.

Another object of the invention is to provide a method for tensioning a slack inserted weft thread within a very short time.

Another object of the invention is to provide an arrangement by which an inserted weft thread is reliably tensioned, while at the same time, the condition of the weft thread is checked, and a weft thread breakage indicated.

Another object of the invention is to simultaneously form two loops in a weft thread for rapidly tensioning a weft thread portion inserted into a warp shed.

With these objects in view, the present invention is concerned with a method and apparatus for tensioning a slack weft thread extending between a supply bobbin and a weft inserting means after insertion into a warp shed.

In accordance with one method of the invention, the point of the weft thread between the supply bobbin and the warp shed is held by a friction brake, and the portion of the weft thread between the held point and the warp shed is alternately guided through stationary thread guides, and unyieldably and yieldable loop forming levers.

The unyieldable and yieldable loop forming means form first and second loops in the free portion of the weft thread whereby the portion of the weft thread in the warp shed is tensioned and slack removed therefrom. Thereupon the unyieldable means are moved away from the guides to increase the size of the first loop and to reduce the size of the second loop while the yieldable loop forming means yields and is moved by the tensioned weft thread towards the guides unless the weft thread breaks whereby the slack is first eliminated from the weft thread whereupon the weft thread is checked for a breakage by the yieldable loop forming means since the same is not moved toward the guide in the event that the weft thread is broken.

An apparatus according to one embodiment of the invention comprises drive means, preferably including a shaft having a cam follower and a rotating cam for oscillating the shaft; means for supplying a weft thread; first loop forming means positively operated by the shaft to form a first loop in a portion of the weft thread between the supply means and a warp shed into which the weft thread is inserted; second loop forming means; and an overload clutch, preferably a friction clutch, connecting the first loop forming means with the second loop forming means for movement together so that the latter forms a second loop in the weft thread whereby the same is tensioned and the slack is eliminated from the weft thread portion in the warp shed.

In accordance with the invention, the overload clutch transmits only a predetermined limited force so that upon further operation of the first loop forming means and further increase of the tension of the warp thread, the clutch slips and the second loop forming means yields, whereby the first loop is increased and the second loop is reduced in size. However, in the event that the weft thread breaks, and releases the second loop forming means, the same is moved by the first loop forming means through the clutch to a breakage indicating position operating, for example,

a switch which produces a breakage indicating impulse or signal.

In the preferred embodiment of the invention, the loop forming means respectively includes first and second levers. The first lever is secured to the drive shaft and oscillates with the same and the second lever is connected by the overload clutch with the first lever for oscillatory movement. Stationary guides guide the weft thread to and from the eyes of the first and second levers. The oscillating shaft moves the first and second levers together away from the guides for forming first and second loops, but during further movement of the first lever away from the guides, the clutch slips and the second lever yields to the tensioned weft thread and is moved by the same toward the guides unless the weft thread breaks and the first and second levers, connected by the clutch, move together away from the guides until the second lever arrives in the breakage indicating position and actuates the switch.

As explained above a friction brake holds a portion of the weft thread between the first lever and the supply bobbin. The first lever has a cam portion for actuating the friction brake to hold the weft thread while the first and second levers form loops in the weft thread. The position of the breakage indicating means can be adjusted so that the same is actuated by the second lever in different positions and different time periods after a thread breakage.

Due to the provision of two levers, two loops are simultaneously formed so that the weft thread is very rapidly tensioned. The second lever of the invention, serves to check the weft thread for a possible breakage.

The novel features which are considered as characteristic for the invention are set forth in particular in the appended claims. The invention itself, however, both as to its construction and its method of operation, 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.

BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 is a schematic side elevation, partially in section, illustrating one embodiment of the invention; and

FIGS. 2–4 are fragmentary schematic side views illustrating successive operational positions of the apparatus of FIG. 1.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring first to FIG. 1, a support **1** includes an arm carrying three guides **19** provided with eyes **20** through which a weft thread **21** supplied by a supply bobbin **18** passes to a weft inserting means in the form of a gripper shuttle **22**. Before the weft thread enters the eye of the first guide **19**, it passes through a tensioning brake **15** which is loaded by spring **14** whose pressure can be adjusted by securing a plate **15***a* by a screw **15***b* to different places of a movable cam follower shaft **15***c* operated by a cam **13** on a first loop forming lever **7** whose hub is fixedly secured by a screw **7***a* to a portion **3***a* of a shaft **3** turnably mounted in a bearing bushing **1***a* and having a crank arm **3***b* with a cam follower roller **4** cooperating with an eccentric cam **5** rotated by a shaft **6** in synchronism with the loom main shaft so that shaft **3** is cyclically oscillated together with the first loop forming lever **7** whose eye **7'** is located between two thread guides **19**.

A second loop forming lever **12** has an eye **12'** located between two guides **19** so that the weft thread alternately passes through a stationary eye **20**, and eyes **7'** and **12'** of the loop forming levers **7** and **12**.

Loop forming lever **12** has a hub portion mounted on the shaft portion **3***a* for free turning movement and including a portion **11** located between two clutch linings **10**, one of which abuts the hub of loop forming lever **7**,

while the other abuts a clutch plate **9** mounted on the shaft portion **3***a* for axial movement, but non-turnable. Shaft portion **3***a* has a threaded extension **3'** on which an adjusting nut **23** and a washer are mounted. A coil spring **8** abuts the washer and the clutch plate **9** so that, depending on the adjusted position of nut **23**, the clutch **9** to **11** can be adjusted to transmit different maximal torques from the hub portion of loop forming lever **7** to the hub portion of loop forming lever **12**.

By oscillation of shaft portion **3***a* about its axis, loop forming lever **7** will be positively oscillated since it is secured by screw **7** to shaft portion **3***a*, whereas loop forming lever **12** will be oscillated due to the transmission of torque from the hub portion of lever **7** to the hub portion **10** of lever **12**, and it will be understood that if angular movement of lever **12** is blocked, the friction clutch will slip.

A switch **2** is mounted on adjustable means **17** which can be turned about bushing **1***a* and clamped by operation of threaded means **17***a* in different angular positions to bushing **1***a* so that switch actuator **17***b* is placed in different positions relative to an actuating projection **16** on the hub of loop forming lever **12**. In a certain angular position of lever **12**, actuating projection **16** will engage switch actuator **17***b* and close switch **2** which is connected into the circuit of a weft stop motion for indicating a weft thread breakage and stopping the loom, if desired.

OPERATION

Referring now mainly to FIGS. 2 to 4, at the moment of the insertion of the weft thread **21** into an open warp shed **21***a*, loop forming lever **7** and loop forming lever **12** have their eyes **7'** and **12'** aligned with the eyes **20** of the guides **19**. Cam **13** on lever **7**, see FIG. 1 has operated brake **15** to release the weft thread **21** which is carried by the weft inserting gripper shuttle **22** through the warp shed to the other side of the loom while weft thread is unwound from the supply bobbin **18**. Due to inertia of weft thread **21**, and a small return movement of weft inserting gripper shuttle **22**, the weft thread **21** is slack, as shown in FIG. 2.

As soon as the pick of the shuttle has been completed, cam **5**, acting on cam follower roller **4**, on shaft **3**, turns the same together with loop forming lever **7** to the position of FIG. 3. Due to the angular movement of lever **7**, its cam **13** releases the cam follower shaft **15***c* of brake **15** which frictionally clamps a portion of the weft thread adjacent supply bobbin **18**. Since friction clutch **9**, **10**, **11** connects lever **12** with lever **7** for angular movement, levers **7** and **12** move in synchronism, first to the position shown in FIG. 3 and form first and second loops with the guides **20**, tensioning weft thread **21** in warp shed **21***a* and taking up all the slack of the same.

The warp shed closes in the position of FIG. 4 and holds the straight and tensioned weft thread **21**. Drive shaft **3** is further turned by cam **5** and loop forming lever **7** continues its stroke away from thread guides **19** increasing the tension in the weft thread portion located outside of shed **21***a*.

Friction clutch **9**, **10**, **11** has been adjusted by screw **23** to transmit only a limited torque. Consequently, when the tension of the weft thread becomes sufficiently great, the friction clutch slips and the tension of the weft thread passing through eye **12'** of loop forming lever **12** is sufficient to pull lever **12** out of the position of FIG. 3 toward and into the position shown in FIG. 2, so that the size of the loop formed by lever **12** is decreased to the same extent as the size of the loop formed by lever **7** is increased. If desired, loop forming lever **7** can be operated to continue its stroke to draw weft thread from supply bobbin **18** so that a sufficient length of weft thread is available for the next pick after loop forming lever **7** has returned to the position shown in FIG. 2 aligned with the eyes **20** of the stationary guides **19**. A spring, not shown, urges crank arm **3***b* and cam follower **4** toward

cam 5 so that when a low portion of cam 5 becomes operative, shaft 3 is turned with lever 7 in a return stroke, taking along lever 12 whose return stroke may be limited by a stop portion of support 1.

In the event that a weft thread breakage occurs, lever 12 is not pulled from the position of FIG. 3 to the position of FIG. 4, since no tensioned weft thread passes through its eye 12'. Consequently, while loop forming lever 7 moves in its loop forming stroke from the position of FIG. 3 to the position of FIG. 4, friction clutch 9, 10, 11 is operative and lever 12 is turned together with lever 7 away from thread guides to a breakage indicating position, not shown, in which its actuating projection 16, see FIG. 1, engages switch actuator 17*b* and closes switch 2 which actuates the weft stop motion of the loom and indicates the weft thread breakage.

It will be seen that the slack of the weft thread is removed within a very short time period due to the fact that two loops are simultaneously formed by levers 7 and 12. At the same time, lever 12 acts as a checking element for the weft stop motion, checking during every slack removing operation, whether the weft thread is broken or not.

It is evident that depending on the kind of weft thread which is being used, the weft thread must be tensioned to a different extent, which is accomplished by adjusting the tensioning brake 15 by shifting the adjusting means 15*a*, 15*b* for varying the tension of the brake spring 14.

The maximum torque transmitted by overload friction clutch 9, 10, 11 is also adjusted in accordance with the desired thread tension by turning of adjusting nut 23 on the threaded portion 3' whereby spring 8 is tensioned or relieved.

By turning support 17 of switch 2 on bushing 1*a*, the relative position between switch actuator 17*b* and actuating portion 16 of loop forming and checking lever 12 can be adjusted so that switch 2 is operated in different angular positions of lever 12. In this manner, the time at which an impulse is transmitted by switch 2 after a thread breakage can be adjusted. Weft stop motion switch can be operated even before loop forming 7 finishes its stroke moving lever 12 away from the guides 19 after a weft thread breakage.

It is a substantial advantage of the invention that lever 12 not only participates in the tensioning of the weft thread by forming a second loop but also checks the weft thread for a possible weft breakage.

The possibility of adjusting the checking time by turning support 17 of switch 2 is particularly important for high-speed looms, since the loom has to be stopped in the event of a weft thread breakage before the beat-up of the broken weft thread.

It will be understood that each of the elements described above, or two or more together, may also find a useful application in other types of arrangements for tensioning a slack weft thread inserted into a warp shed, differing from the types described above.

While the invention has been described and illustrated as embodied in a method and apparatus for removing slack from an inserted weft thread and for checking the weft thread for a possible breakage, it is not intended to be limited to the details shown, since various modifications and structural change may be made without departing in any way from the spirit of the present invention.

Without further analysis, the foregoing will so fully reveal the gist of the present invention that others can, by applying current knowledge readily adapt it for various applications without omitting features that from the standpoint of prior art, fairly constitute essential characteristics of the generic or specific aspects of this invention and, therefore, such adaptations should and are intended to be compresended within the meaning and range of equivalence of the following claims.

What is claimed as new and desired to be protected by Letters Patent is set forth in the following claims:

1. The method of tensioning a slack weft thread extending between a supply bobbin and a weft inserting means after insertion into an open warp shed, comprising holding a point of the weft thread between the supply bobbin and the warp shed; guiding said portion of the weft thread between said point and said warp shed alternately through thread guides, and unyieldable and yieldable means; moving said unyieldable and yieldable means away from said guides and forming first and second loops in said portion of said weft thread whereby another portion of said weft thread located in said open warp shed is tensioned to remove slack therefrom; closing said warp shed; and moving said unyieldable means further away from said guides to increase the size of said first loop and to reduce the size of said second loop by causing said yieldable means to yield as the tensioned weft thread forming said second loop moves towards said guides and should the weft thread break the tension is eliminated from said weft thread forming the loops and weft thread breakage is indicated.

2. Apparatus for tensioning a slack weft thread inserted into a warp shed, comprising means for supplying the weft thread; drive means; first loop forming means positively operated by said drive means to form a first loop in a portion of said weft thread between said supply means and said warp shed; second loop forming means; and an overload clutch connecting said first loop forming means with said second loop forming means for movement together so that the latter forms a second loop in said portion of the weft thread whereby the same is tensioned and slack is eliminated from the weft thread portion in the warp shed, said overload clutch transmitting a predetermined limited force so that upon further operation of said first loop forming means and further increase of the tension of said warp thread, said clutch slips and said second loop forming means yields whereby said first loop is increased and said second loop is reduced in size, and should the weft thread break said second loop forming means is released so that the same is moved by said first loop forming means through said clutch to a breakage indicating position.

3. Apparatus as claimed in claim 2 wherein said drive means includes an angularly oscillating shaft; wherein said first loop forming means includes a first lever secured to said shaft and having an eye for guiding said weft thread; wherein said second loop forming means includes a second lever connected by said overload clutch with said first lever for oscillatory movement and having an eye for guiding said weft thread; comprising stationary guides for said weft thread for guiding the same to and from said eyes of said first and second levers, said oscillating shaft moving said first and second levers together away from said guides for forming said first and second loops, while during further movement of said first lever away from said guides, said clutch slips and said second lever yields to the tensioned weft thread and is moved by the same toward said guides unless the weft thread breaks and said first and second levers, connected by said clutch, move together away from said guides until said second lever arrives in said breakage indicating position.

4. Apparatus as claimed in claim 3 wherein said overload clutch is a friction clutch, and including means for adjusting the same to slip at a predetermined weft thread tension.

5. Apparatus as claimed in claim 3 wherein said second lever is mounted on said shaft freely rotatable on the same; and wherein said levers have hub portions connected to each other by said clutch.

6. Apparatus as claimed in claim 3 including a friction brake for holding a portion of said weft thread between said first lever and said supply means; and wherein said first lever has a cam portion for actuating said friction brake to hold said weft thread while said first and sec-

ond levers form loops in the weft thread and eliminate slack from the same.

7. Apparatus as claimed in claim 3 comprising a switch means operated by said second lever in said breakage indicating position to produce an impulse announcing the weft thread breakage.

8. Apparatus as claimed in claim 7 including a stationary support; and adjustable means movably mounted on said support and carrying said switch means so that the position of the same in relation to said second lever can be adjusted whereby said switch means can be operated by said second lever in different breakage indicating positions and different time periods after a thread breakage occurs.

9. Apparatus as claimed in claim 3 wherein said shaft has a cam follower arm; and wherein said drive means include a rotary cam cooperating with said cam follower arm for oscillating said shaft and said first lever in a predetermined cycle so that said first lever moves away from said guides for forming said first loop after insertion of the weft thread into the warp shed.

10. Apparatus as claimed in claim 2 including brake means for holding a portion of said weft thread between said supply means and said first loop forming means; and wherein said brake means is actuated by said first loop forming means to hold the weft thread during the formation of said first and second loops whereby slack is eliminated from the weft thread portion in the warp shed.

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