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Demuth

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[54] **METHOD OF STOPPING A WEAVING MACHINE AUTOMATICALLY, AND A YARN STOP MOTION FOR PERFORMING THE METHOD**

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[51] **Int. Cl.²** **D03D 51/18**

[58] **Field of Search** 139/336, 340, 349, 353

[56] **References Cited**

UNITED STATES PATENTS

1,786,675	12/1930	Regan	139/349
1,994,595	3/1935	Smith et al	139/336
2,881,807	4/1959	Moon	139/349
2,956,588	10/1960	Pfarrwaller	139/336
2,974,688	3/1961	Pfarrwaller	139/353
2,981,295	4/1961	Paul et al.	139/336

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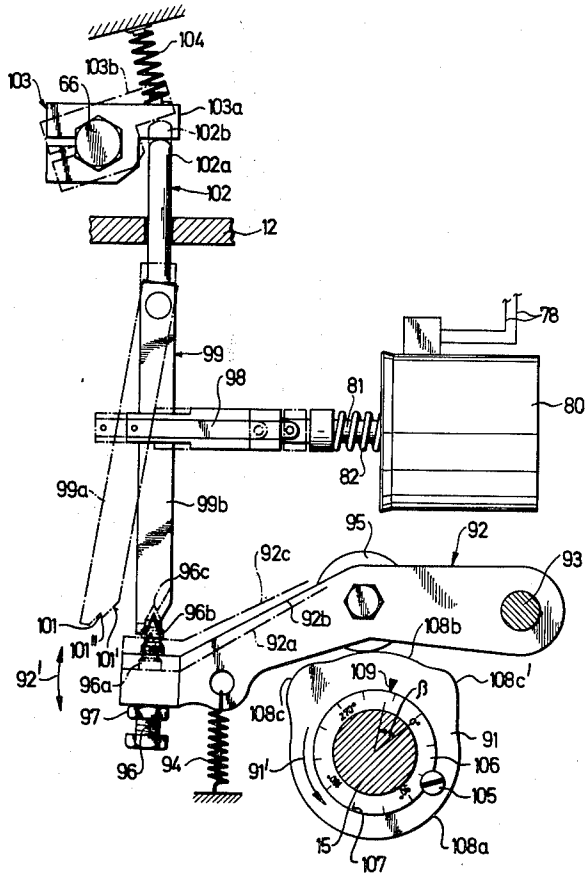
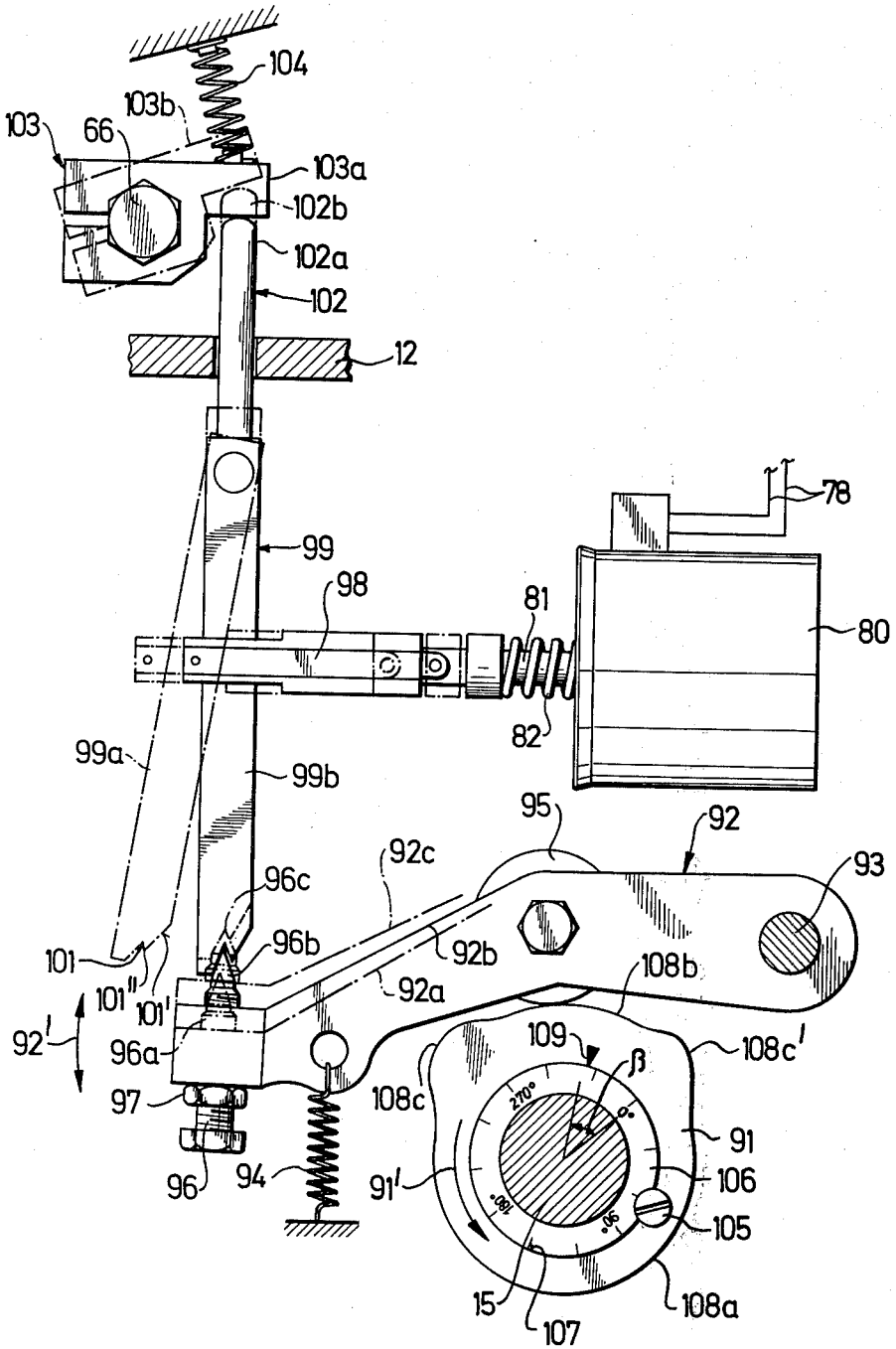
[57] **ABSTRACT**

The yarn stop motion has a latch which is pivotal into an operative position in response to a yarn break. In addition, the latch is movable when in the operative position via a cam arrangement synchronized to the main shaft of the loom. The motion of the latch is such as to activate a loom stop when the main shaft reaches a first angular position and, after restarting of the loom, to again activate the loom stop when the main shaft reaches a second angular position. The angular positions of the main shaft are selected to correspond to an open-shed position of the heald shafts and a later closed-shed position of the heald shafts.

19 Claims, 1 Drawing Figure

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β
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180°
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15
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108a

METHOD OF STOPPING A WEAVING MACHINE AUTOMATICALLY, AND A YARN STOP MOTION FOR PERFORMING THE METHOD

This invention relates to a yarn stop motion and a method of stopping a loom.

As is known, in order to facilitate knotting-up a broken yarn, particularly a warp yarn, and to enable a loom to be restarted after such knotting-up without any interruption in the pattern repeat remaining visible in the end product, various warp yarn stop motions have been used. For example, as described in British Pat. No. 787,697, a warp stop motion has been known which, through the agency of an electromagnet and a cam driven lever, stops a loom at that instant of time in the weaving cycle when the heald shafts are moving during shed changing towards a central position (half-shed position or closed shed) after passing through their end or open-shed position.

As is known, broken warp yarns are simplest to pull in when the loom is in the closed-shed position, since the yarns of both the bottom and top sheds are readily accessible and the yarn tension is at the lowest value. However, in normal weaving the heald shafts are normally moving at their fastest when they pass through the closed-shed position. Thus, if a loom is stopped just at this instant of time as a result of a yarn breakage, the shafts must be braked from maximum speed. This results in the shaft drive experiencing heavy and, in the case of high-speed machines, often excessive stressing. Conventionally, in order to obviate this disadvantage, the looms have generally been stopped at a time when the heald shafts are moving slowly i.e., in the open-shed of half-open shed position despite the disadvantageous position in which the shafts then stop, and the unsatisfactory position of the warp yarns is tolerated.

Accordingly, it is an object of the invention to stop a loom with minimum stressing of the loom parts.

It is another object of the invention to stop a loom in a manner which brings the heald shafts of the loom into a closed-shed position without having to brake the shafts from a maximum speed.

Briefly, the invention provides a method of stopping a loom in which the loom is automatically stopped a first time in response to a signal from a yarn monitoring device at a predetermined angular position of the main shaft of the loom, is thereafter started and then stopped a second time within the same weaving cycle but in a different angular position of the main shaft. The first stop position is made to correspond to a point in the weaving cycle at which a plurality of heald shafts are moving relatively slowly, i.e., near an open-shed position while a reed is being moved back to a normal position. The second stop position is made to correspond to a point in the weaving cycle at which the heald shafts are in or near a closed-shed position while the reed is in a front reversal after beating-up a weft yarn into a fell.

The yarn stop motion of the invention is incorporated into a loom having a main shaft for driving the loom, a loom stop for stopping the loom and a yarn monitoring device for detecting yarn breaks. The yarn stop motion includes a first means which is connected to the yarn monitoring device for stopping the loom in response to detection of a broken yarn in a first angular position of the main shaft as well as a second means for

automatically stopping the loom in a second and different angular position of the main shaft after restart.

Thus, in the event of a yarn breakage or other loss of yarn, a temporary first stoppage of the loom is produced at a time during the weaving cycle when the heald shafts are moving relatively slowly. This considerably reduces mechanical stressing of the shaft drive and of the shafts themselves. Thereafter, the loom is restarted and a final or definitive stoppage is produced before the loom has reached full speed. The final or definitive stop position may be selected to occur at an angular position of the main shaft such that knotting-up of the broken warp yarn and restarting of the machine can occur in optimum conditions, as when the shed is closed completely or substantially completely.

Restarting for the partial revolution of the main shaft between the two stoppages may be initiated either manually or automatically. Further, the loom may include adjusting means for altering the angular difference between the positions of the main shaft in the first and second positions as well as means for adjusting the first angular position.

The yarn stop motion preferably includes a latch which is movable between an inoperative position and an operative position and a means connected between the yarn monitoring device and the latch for moving the latch from the inoperative position to the operative position in response to detection of a broken yarn. In addition, the yarn stop motion has a cam means which is connected to move in synchronism with the main shaft for engaging and moving the latch when the latch is in the operative position in order to activate the loom stop to stop the loom. The cam means is constructed with a cam secured to rotate with the main shaft, a pivotal lever, a cam follower mounted on the lever in contact with the cam and an abutment mounted on the lever for engaging the latch. During operation, as the cam rotates in timed relation with the main shaft, the lever is caused to rise and fall in accordance with the pattern of the cam. At the same time, the abutment on the lever is caused to engage with and, at certain times, move the latch longitudinally of itself depending again on the cam pattern.

The cam is made with a cam pattern of four parts which contact the cam follower in seriatim for each revolution of the main shaft in order to move the pivotal lever and abutment periodically into either an inoperative position or one of at least two operative positions. A first cam part allows the lever to remain in the inoperative position. (In this position, the abutment is out of the plane of the latch so that the latch is free to move between its inoperative and operative positions.) A following raised cam part causes the lever and abutment to be raised into a second operative position in a first angular position of the main shaft. (In this position, if the latch has been in its operative position, the abutment moves the latch so as to activate the loom stop.) A following third cam part allows the lever and abutment to return to a first operative position. (In this position, the abutment, if previously engaged with the latch, allows the latch to move away from the loom stop to permit restart of the loom.) A final second raised cam part causes the lever and abutment to be raised a second time into the second operative position in a second angular position of the main shaft. (In this position, the latch again activates the loom stop to stop the loom.)

The normal inoperative position of the abutment can be such as to be right out of range of the latch, thus ensuring that stoppage of the machine is not triggered in an undesirable phase of the weaving cycle.

Preferably, the free end of the latch is formed with a groove-like recess in which, with the latch in its operative position, the abutment engages in its first operative position to retain the latch in its operative position without shifting the latch lengthwise-i.e., without stopping the machine. This relative position of the latch and the lever arises after reception of a stop signal which may possibly already have triggered a first stoppage of the loom at a first main shaft angular position and which is therefore now being stored in association with a second stoppage in a different angular position while the loom can restart briefly.

However, if the latch is in its normal position at the time when the cam was guiding the lever into its first operative position, the abutment of the lever extends into the path of the free end of the latch and prevents the latch from changing over from its normal into its operative position. Consequently, there can be no immediate stoppage at a time in the weaving cycle when the lever is in its first operative position, despite the arrival at such time of a further stop signal from the yarn monitoring device. Accidental stoppage of the loom is a particular angular region of main shaft rotation, e.g., at a time when the heald shafts are moving very fast, can therefore definitely be precluded.

Preferably, the free end of the latch is formed with a bevel which is on the side of the recess nearer the abutment when the latch is in the inoperative position and which extends to recess and forms therewith a sharp edge. The abutment is also sharp and may be conical or wedge-shaped but in the latter case, the knife edge should extend parallel to the edge between the recess and the bevel to ensure that the abutment either enters the groove reliably or abuts the bevel reliably without moving the latch lengthwise and thus stopping the machine.

In a preferred construction, the latch, when in its operative position, can be moved lengthwise by the abutment to operate the loom stop as the abutment moves from its first operative position into its second operative position. Thus, the latch can trigger the stoppage cycle exactly at the predetermined time i.e., at a particular angular position of the cam or of the main shaft e.g., with the heald shafts in a particular position.

These and other objects and advantages of the invention will become more apparent from the following detailed description taken in conjunction with the accompanying drawing which diagrammatically illustrates only those parts of a yarn stop motion according to the invention which are important for the description and understanding of its operation. It is noted that the other terms and loom parts and their operation during weaving as mentioned in the description will be readily understandable by any skilled person and therefore no further description and illustration is believed to be necessary.

Referring to the drawing, the yarn stop motion is incorporated in a loom of conventional structure having a main shaft for driving the loom, a loom stop for stopping the loom and a yarn monitoring device (not shown) for detecting yarn breaks. The yarn stop motion includes a latch **99** which is pivotally mounted on a latch carrier **102** to pivot from a normal inoperative position **99***a* into an an operative position **99***b*. In addition, a means is connected between the yarn monitoring device (not shown) and the latch **99** for moving the latch in response to the detection of a broken yarn. This means includes an electromagnet **80** which is supplied with electric signals along a line **78** by the yarn monitoring device, an armature **81** which is drawn in against the bias of a compression spring **82** when the electromagnet is energized and a link **98** which connects the armature **81** to the latch **99.**

The latch carrier **102** is movable lengthwise in a guide **12** between a normal position **102***a* and an operative position **102***b;* when thus moved, the carrier **102** produces counter-clockwise movement of a stop lever **103** from a normal position **103***a* into an operative position **103***b* against the opposing force of a compression spring **104.** The stop lever **103** is secured to a stop shaft **66** of the loom which is arranged, when moved anticlockwise as described, to stop the loom in a manner similar to existing stop motions.

In order to move the latch **99** to activate the loom stop lever **103,** a cam means is provided in the yarn stop motion. This cam means is connected to move in synchronism with the main shaft for engaging and moving the latch **99** when the latch **99** is in its operative position. As shown, the cam means includes a cam **91** which is rotatably mounted on a sleeve **106.** The sleeve **106** carries a circular scale **107** and is rigidly secured to the loom main shaft or to another shaft **15** rotating anti-clockwise and synchronously with the main shaft as indicated by an arrow **91'**. The cam means also includes a lever **92** which is pivotally mounted on a stationary spindle **93** and which carries a cam follower **95** in the form of a roller which rolls in contact with the cam **91.** The lever **92** is biased by a tension spring **94** in the direction of the cam **91** to ensure continuous contact between the cam follower **95** and cam **91.** Also, an abutment **96** is carried on the free end of the lever **92.** This abutment **96** is adjustable relative to the lever **92** and is formed by the conical or wedge-shaped termination of an adjusting screw with which a locknut **97** is associated. This abutment **96** is operatively associated with the free end of the latch **99.**

The free end of the latch **99** is formed with a groove-like recess **101** and with a bevel **101'** engageable by the tip of the abutment **96.** In addition, a knife edge **101''** is located between the groove **101** and the bevel **101'** so that the apex of the abutment **96** cannot catch on the end of the latch **99** but either enters the groove **101** or slides on the bevel **101'**.

The cam **91** can be secured in an adjustable angular position relative to the sleeve **106** by a locking screw **105.** The cam position can be read off from the scale **107** by means of a pointer **109** provided on the cam **91.** The braking or rotation angle β can thus be adjusted and serves to adjust the "lead" i.e., the angle of rotation passed through by the main shaft **15** between, on the one hand, the time when the roller-carrying lever **92** is moved into a second operative position **92***c* and, on the other hand, the time when the machine actually stops. In the present example, the angle β is assumed to be approximately 30°. The angle must be found in practice by trial and error since it may vary within limits from one machine to another and even in a single machine, depending upon the angular range concerned.

The track of the cam **91** has four parts over which the roller **95** passes in succession during one revolution of the shaft **15.** These parts are first part **108***a*, at which the lever **92** remains in its normal position **92***a* and a first raised part **108***c* which raises the lever **92** into its second operative position **92***c* at a time when e.g. the shafts are in the open-shed position and therefore moving slowly i.e., at a time which is advanced by the lead angle β. Following part **108***c* is a third part **108***b*, at which the lever **92** remains in its first operative position **92***b*, and this is followed by a second raised part **108***c'* whose position corresponds in the present example to the substantially closed position of the shed and which moves the lever **92** a second time into its second operative position **92***c* for the definitive stoppage of the machine.

The time of the second stoppage can be varied relative to the time of the first stoppage by replacing the cam **91** by another cam whose third part **108***b* extends over an appropriately greater or smaller angle of the cam or by two half-cams which can be rotated relatively to one another. On restarting i.e., upon further rotation of the cam, the lever **92** returns to its normal position **92***a* at part **108***a* and the cycle restarts.

When the lever **92** is in its normal position **92***a* or in either of its two operative positions **92***b* or **92***c*, the apex of the abutment screw **96** takes up the corresponding positions **96***a*, 96*b*, 96*c* respectively. When in its normal position **96***a*, the abutment **96** is outside the range of the free end of the latch **99,** so that the latch **99** is free to be pivoted by the electromagnet **80** between its normal position **99***a* and its operative position **99***b*.

When a stop signal pivots the latch **99** from its normal position **99***a* towards its first operative position **99***b* while the abutment **96** is in its first operative position **96***b* and projects into the path of the free end of latch, the latch **99** strikes the abutment **96** and cannot reach its operative position **99***b*. The machine is not stopped immediately, stoppage occurring only after the lever **92** has returned via its normal position **92***c* while the yarn detector stop signal persists.

However, when the stop signal reaches the electromagnet **80** at a time when the roller **95** is on track part **108***a* i.e., while the abutment is still in its operative position **96***a*, the latch **99** moves into its operative position **99***b*. When the abutment **96** moves into its second operative position **96***c* (corresponding to roller **95** being on the raised part **108***c*) for the first time, the tip or apex of the abutment **96** engages in the groove-like recess **101** at the free end of the latch **99,** so that the latch **99** and its carrier **102** are moved lengthwise into the operative position **102***b* to cause a first stoppage of weaving. Upon further rotation of the main shaft either manually or as a result of an automatic restart of the drive, the abutment first returns to its first operative position **96***b* (corresponding to cam part **108***b*) or remains therein and the latch carrier **102** remains in its normal position **102***a*. The machine remains "on" until the roller **95** runs up on the second raised part **108***c'* of the cam **91** to cause a second and definitive stoppage of the machine.

Since the free end of the latch **99** has a bevel **101'** which cooperates with the nearer side wall of the groove **101** to form a knife edge **101''**, the abutment apex either makes a definite entry into the groove **101** or slides along the bevel **101'** when moving into its first or second operative positions **96***b*, 96*c* respectively even though the latch **99** may for some reason not be exactly in its operative position **99***b*. Consequently, when the abutment tip or apex is in the first operative position **96***b*, there is definitely no movement of the latch **99** nor therefore of the carrier **102.** The stop shaft **66** is thus not operated until the lever **92,** after passing through its normal position **92***a* (roller **95** on cam part **108***a*) is raised into its second operative position **92***c* (roller **95** raised on to raised part **108***c*) while the latch **99** remains (or is again) in its operative position **99***b*.

The yarn stop motion has been described as useful as a warp stop motion; however, the stop motion can be combined just as satisfactorily with other yarn detectors, for instance, a weft yarn detector. In this case, too it may be required, for instance, should a yarn break or be lost, to stop the machine first in a preferred main shaft angular position-e.g., in the open-shed position with the reed pivoted back — so as to be able to withdraw a mis-picked weft yarn. Thereafter, the fault may be cleared and the machine restarted and then stopped, a second time in a second main shaft angular position — possibly the time when the reed is beating up the first newly picked weft yarn into the fall — e.g., so as to be able to check that the new weft yarn has been picked satisfactorily. An automatic control facility of this kind is advantageous particularly in case of varying pattern repeat and with four or six weft looms in which different — e.g., differently colored — weft yarns are picked seriatim in accordance with a predetermined programme. A facility of this kind speeds up the restarting of weaving and helps to prevent a number of weft yarns from being picked after a faulty restart before the fault can be discovered and the machine stopped manually.

What is claimed is:

1. In a loom having a main shaft for driving the loom and a yarn monitoring device for detecting yarn breaks;

a yarn stop motion including a first means connected to said yarn monitoring device for stopping the loom a first time in response to detection of a broken yarn in a first angular position of said main shaft and a second means for automatically stopping the loom a second time within the same weaving cycle in a second and different angular position of said main shaft after restart subsequent to the first stoppage in said first angular position.

2. In a loom as set forth in claim **1** wherein said yarn stop motion further includes an adjusting means for altering the angular difference between said positions.

3. In a loom as set forth in claim **1** wherein said yarn stop motion further includes an adjusting means for adjusting said first angular position.

4. In a loom having a main shaft for driving the loom, a loom stop for stopping the loom and a yarn monitoring device for detecting yarn breaks;

a yarn stop motion including a latch pivotable between an inoperative position and a first operative position, and movable longitudinally thereof from said first operative position to a second operative position, means connected between said yarn monitoring device and said latch for pivoting said latch from said inoperative position to said first operative position in response to detection of a broken yarn, cam means connected to move in synchronism with said main shaft for engaging said latch in said first operative position and moving said latch

longitudinally thereof into said second operative position to activate said loom stop to stop the loom, said cam means including means for preventing pivoting of said latch into said first operative position during the same weaving cycle in response to detection of a broken yarn while said latch is in said inoperative position.

5. In a loom as set forth in claim **4** wherein said loom stop is a loom stop shaft.

6. In a loom having a main shaft for driving the loom, a loom stop for stopping the loom and a yarn monitoring device for detecting yarn breaks;

a yarn stop motion including a latch movable between an inoperative position and an operative position, means connected between said yarn monitoring device and said latch for moving said latch from said inoperative position to said operative position in response to detection of a broken yarn, and cam means connected to move in synchronism with said main shaft for engaging and moving said latch in said operative position to activate said loom stop to stop the loom;

said cam means including a cam secured to rotate with said main shaft, a pivotal lever, a cam follower mounted on said lever in contact with said cam, and an abutment mounted on said lever for engaging said latch; said cam being shaped to periodically move said lever and said abutment to take up either an inoperative position or one of at least two operative positions.

7. In a loom as set forth in claim **6** where in said inoperative position, said abutment is spaced from said latch.

8. In a loom as set forth in claim **6** wherein said abutment is adjustably mounted on said lever.

9. In a loom as set forth in claim **6** wherein said cam has four parts for contacting said cam follower in seriatim for each revolution of said main shaft, said parts including a first part wherein said lever remains in said inoperative position, a first raised part wherein said lever is raised into a second operative position thereof in a first angular position of said main shaft, a third part wherein said lever remains in a first operative position thereof and a second raised part wherein said lever is raised into said second operative position thereof in a second angular position of said main shaft.

10. In a loom as set forth in claim **6** wherein said latch is pivotally mounted at one end and engagable with said abutment at the opposite free end in first and second operative positions of said latch.

11. In a loom as set forth in claim **10** wherein said abutment extends into the plane of said latch in said operative positions thereof whereby when said latch is in said inoperative position thereof, said abutment prevents said latch from moving into said operative position thereof.

12. In a loom as set forth in claim **10** wherein said latch has a groove-like recess at said free end to receive said abutment when said latch is in said first and second operative positions thereof and said abutment is moved into said second operative position thereof whereby said latch is retained in said operative positions.

13. In a loom as set forth in claim **12** wherein said latch has a bevel adjacent said recess on a side facing said abutment and forming a sharp edge with said recess, and wherein said abutment has a sharp edge to project into said recess.

14. In a loom as set forth in claim **6** wherein said latch is longitudinally movable from said first operative position thereof into said second operative position upon movement of said abutment between a first operative position and a second operative position thereof.

15. A method of stopping a loom which comprises the steps of

automatically stopping the loom at a first predetermined angular position of the main driving shaft of the loom in response to a signal from a yarn monitoring device;

restarting the loom; and

thereafter stopping the loom a second time within the same weaving cycle but in a different position of the main shaft.

16. A method as set forth in claim **15** wherein said first angular position corresponds to a point in the weaving cycle of the loom at which a plurality of heald shafts are moving relatively slowly.

17. A method as set forth in claim **16** wherein the heald shafts are located near an open-shed position at said point and a reed is moved back to a normal position prior to beat-up.

18. A method as set forth in claim **16** wherein said second angular position corresponds to a point in the weaving cycle at which the heald shafts are near a closed-shed position.

19. A method as set forth in claim **18** wherein a reed is stopped in a front reversal position after beating-up a weft yarn into a fell.

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