Aug. 22, 1967 WONG CHING MAN 3,336,952

LOOM SHUTTLES

Filed June 7, 1965 2 Sheets-Sheet 1

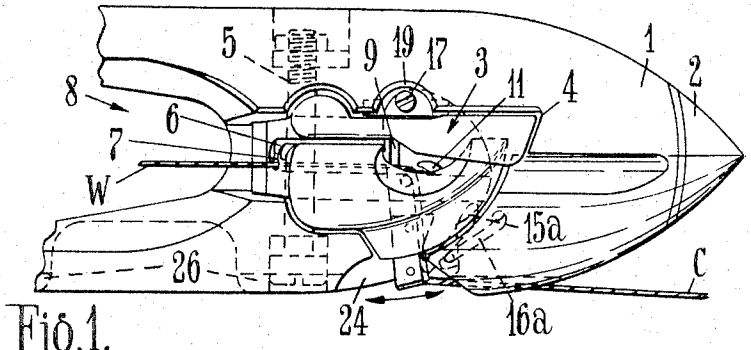

Fig. 1.

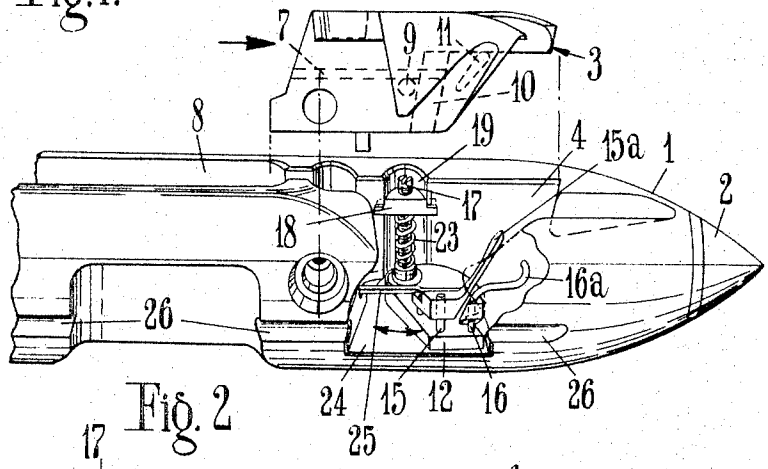

Fig. 2

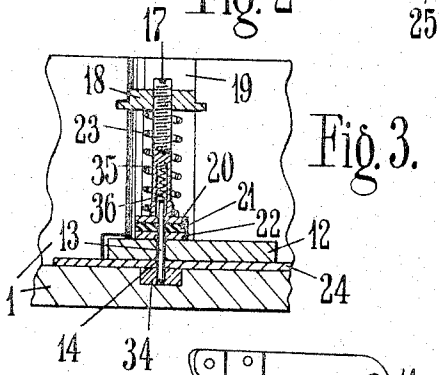

Fig. 3.

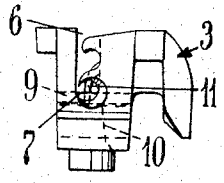

Fig. 4.

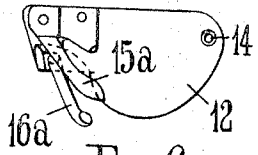

Fig. 6.

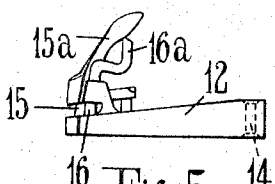

Fig. 5.

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LOOM SHUTTLES

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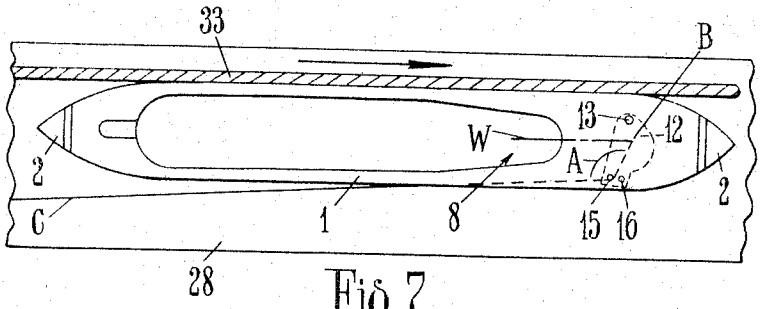
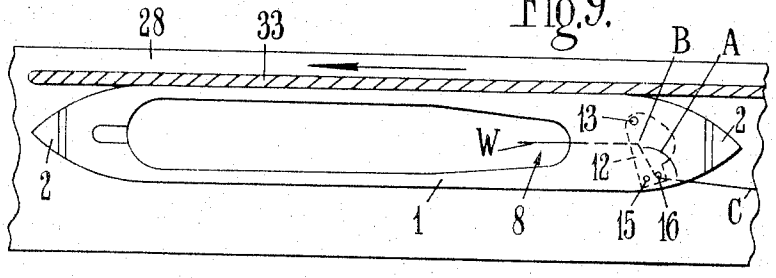


Fig. 7.

Fig. 9.



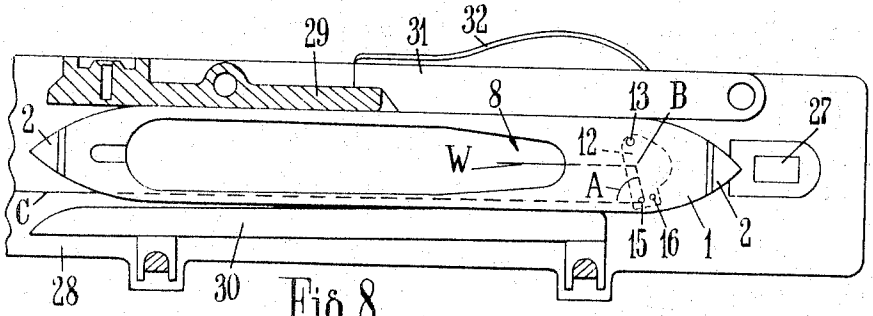
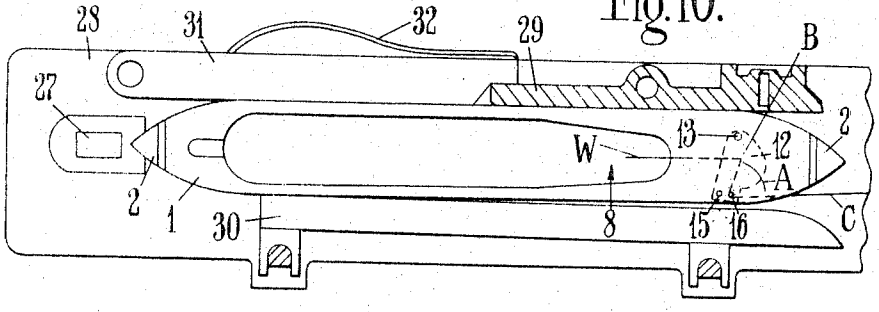


Fig. 8.

Fig. 10.



United States Patent Office 3,336,952
Patented Aug. 22, 1967

3,336,952

LOOM SHUTTLES

Wong Ching Man, Hong Kong, assignor of one-third to Wong Ka Hung, Hong Kong

Filed June 7, 1965, Ser. No. 461,673
4 Claims. (Cl. 139—215)

The present invention relates to an improved shuttle for a loom and in particular to a shuttle incorporating an automatic weft tension adjusting mechanism.

The velocity of motion of a shuttle passing back and forth across the shed of a loom between opposing shuttle boxes to lay a weft yarn is subject to extreme and rapid change with the maximum change in velocity of the shuttle occurring during its initial acceleration and final deceleration at the beginning and end of each traverse of the shuttle through the shed. The velocity of lead-out of weft yarn from a shuttle is of course equivalent, or directly related to, the velocity of the shuttle as it moves across the shed trailing the weft yarn behind it.

In shuttles employed, heretofore, the drag exerted on the weft led out through the internal thread passages and eye of the shuttle remains substantially constant and it has been observed with such shuttles that variations in shuttle velocity give rise to momentary changes in tension applied to the weft yarn being laid across the shed by the shuttle. It has been noted for example that a weft yarn being led out from a shuttle is momentarily subject to its greatest tensile loading, and is more liable to break, during the initial acceleration of the shuttle at the beginning of its traverse of the shed. Furthermore it has been observed that the weft yarn led out from, and trailing behind, a shuttle moving across the shed of a loom does not normally lie in a straight line but rather falls in an arc or curve, the extent of which is determined by the weight of the yarn and the effective tension applied thereto during the final stages of the laying of the weft. In normal shuttles known heretofore the tension applied to the weft yarn falls to its minimum when the shuttle decelerates and stops after its traverse of the shed and consequently the arcuate length of weft governed by such tension and which is subsequently beaten up into the warp is often in excess of that desirable to produce an evenly woven cloth.

Accordingly it is an object of the present invention to provide an improved shuttle for a loom which will automatically adjust the tension in the weft yarn to compensate for velocity changes to which the shuttle is subject when in use.

The present invention is directed to a loom shuttle having a body provided with a recess therein adapted to receive a weft yarn pirn, a threading block mounted in a further recess in the body adjoining the pirn recess, and an automatic weft tension adjusting mechanism comprising a yarn guide member pivotally mounted for swinging movement on either side of a rest position defined as the position of the yarn guide member and the center of gravity from the yarn guide member is a vertical plane containing the point of suspension of the yarn guide member so that when the yarn guide member moves away from its rest position due to the inertia of the yarn guide member when the shuttle is accelerated or decelerated a force due to gravity pulls on the yarn guide member to return the yarn guide member to its rest position, and means in said block and on said yarn guide member to direct weft yarn being drawn from the shuttle along an angular path which is changed by movement of the yarn guide member relative to the shuttle to vary the drag imparted to the weft yarn and the tension applied to the weft yarn, drawn from the shuttle when the shuttle moves forwardly and rearwardly.

In order that the operation and construction of a shuttle in accordance with the present invention may be fully understood a preferred embodiment thereof is hereinafter described by way of example with reference to the accompanying drawings in which:

FIGURE 1 is a plan view of one end of the shuttle showing the general arrangement of the threading block and automatic weft tension adjusting mechanism;

FIGURE 2 is a perspective view of the end of the shuttle shown in FIGURE 1 with the threading block exploded and part of the body of the shuttle shown in chain dotted outline to show details of the mounting of a pivoted yarn guide member forming part of the automatic weft tension adjusting means;

FIGURE 3 is a fragmentary portion of the shuttle in side elevation and part section showing further details of the pivoted mounting for the yarn guide member shown in FIGURE 2;

FIGURE 4 is an end elevation of the threading block viewed in the direction of the arrow shown in FIGURE 2;

FIGURE 5 is a side elevation of a pivoted yarn guide member forming part of the automatic weft tension adjusting mechanism shown in FIGURES 1 and 2;

FIGURE 6 is a plan view of the pivoted yarn guide member shown in FIGURE 5;

FIGURE 7 is a diagrammatic plan view of the shuttle and part of the shuttle race showing the position of the pivoted yarn guide member and weft yarn lead-out during movement of the shuttle in one direction as indicated by the arrow;

FIGURE 8 is a diagrammatic plan view of the shuttle and part of the shuttle race and shuttle box at one end thereof showing the position taken up by the pivoted yarn guide member and weft yarn lead-out at the end of the movement of the shuttle shown in FIGURE 7;

FIGURE 9 is a diagrammatic plan view of the shuttle and part of the shuttle race showing the position occupied by the pivoted yarn guide member and weft yarn lead-out during return movement of the shuttle as indicated by the arrow;

FIGURE 10 is a diagrammatic plan view of the shuttle and part of the shuttle race and the opposing shuttle box at the other end thereof showing the position taken up by the pivot yarn guide member and the weft yarn lead-out at the end of the return movement of the shuttle shown in FIGURE 9.

The shuttle body **1** is formed of a suitably hard wood with a medal nose cap **2** mounted at each end in the well known manner. As shown most clearly in FIGURES 1 and 2 one end of the body **1** of the shuttle is provided with a threading block **3** which is preferably formed of bronze or like suitable metal and is retained in a complementary shaped recess **4** formed in the wooden body **1** of the shuttle by means of a bolt **5** as shown in FIGURE 1. The block **3** has a top entrance slot **6** leading to a wider longitudinal yarn guide channel **7** which is open at one end to a cop or pirn recess **8** formed in the body **1** to receive a cop or pirn (not shown) in a well known manner. The bottom wall of the channel **7** at the other end thereof remote from the cop recess **8** is intersected by a transverse hardened steel pin **9** to provide a runner for the weft yarn.

The block **3** has an internal wall portion **10** forming a continuation of one of the sides of the slot **6** which extends downwardly and forwardly to one side of the axis of the channel **7** and a yarn masking or retaining horn **11** is mounted thereon as shown.

An automatic weft tension adjusting mechanism is located in the recess **4** below the block **3** and, as shown most clearly in FIGURE 2, this mechanism comprises a yarn guide member **12** of substantially semi-circular out-

line in plan form (see FIGURE 5) pivotally mounted at one end on a pin **13** which is seated at one end in a metal base washer **34** recessed into the floor of the housing (see FIGURE 3) with the upper end of the pin **13** upstanding to pass through a hole **14** in the member **12**.

The free end of the member **12** remote from the pivot **13** is provided with a pair of upstanding closely spaced yarn guide pins **15** and **16** which are disposed at a weft yarn lead-out exit on one side of the shuttle to correspond to, or constitute, the eye of the shuttle. The member **12** is formed of a metal, such as bronze, which is of sufficient weight or mass so that due to its inertia it will swing about pivot pin **13** relative to the shuttle body **1** when the latter is accelerated or decelerated in the course of it normal weft laying operation as hereinafter described.

The member **12** is retained on its pivot pin **13** by means of a screw **17**, which passes through a nut member **18** recessed and fixed into a groove **19** in a side wall of the recess **4**.

Metal washers **20** and **22** preferably of bronze and mild steel, respectively, with a resilient washer **21** of rubber or like material interposed therebetween, are mounted on the pivot pin **13** between the upper surface of the member **12** and the adjacent end of the bolt **17**. This latter end of the screw **17**, as shown most clearly in FIGURE 3, has a blind bore **35** to receive the upstanding end of the pin **13** protruding above the washers **20**, **21** and **22**, and a small compression spring **36** is located in said bore **35** to exert a light axial loading on the pin **13** to retain same seated in the base washer **34**.

A compression spring **23** helically coiled around the screw **17** is located between the upper metal washer **20** and the nut **18** to exert a predetermined loading on the member **12** through the washers **20**, **21**, **22** to regulate the swing thereof about pivot pin **13** as required.

The floor of the recess **4** and the washer **34** beneath the member **12** is preferably overlaid with a metal plate **24** through which pin **13** passes. This plate **24** provides a smooth flat surface to facilitate free movement of the member and the latter may be retained in its plane of movement by a bar **25** fixed to the shuttle body **1** to extend longitudinally of the recess **4**.

The weft yarn W, when drawn off and unwound from a cop or pirn located in recess **8**, is led from the shuttle (as shown in FIGURE 1) by passing through channel **7** and then turning downwardly around runner pin **9** and outwardly beneath the lower edge of wall **10** to pass outwardly of the shuttle between guide pins **15** and **16** on the free end of the pivoted yarn guide member **12** where it finally runs in a longitudinal weft guide groove **26** in the external side wall of the shuttle during movement of the latter.

Referring now to FIGURES 7–10 which are diagrammatic views showing the positions assumed by the yarn guide member **12** and the weft yarn during one traverse and return movement thereof through the shed of a loom, B indicates a point on the weft yarn path where it passes downwardly over pin **9** and outwardly beneath the lower edge of wall **10** in block **3** as hereinbefore described, C indicates a point on the path of the trailing weft yarn led out from the shuttle and A denotes the angle (hereinafter referred to as the "lead angle") subtended between sections of the weft yarn lying between points B and C and passing round a guide pin **15** or **16**. It has been found in practice with the arrangement thus described, that an increase in the lead angle A results in a decrease in the drag or frictional resistance imparted to the weft yarn being withdrawn from the shuttle and conversely that a decrease in the lead angle A results in an increase in the drag imparted to the weft yarn. Orthodox parts of a normal loom are also illustrated in these figures and these include pickers **27**, parts of the shuttle race **28**, front and back walls **29** and **30** of opposing boxes together with shuttle swells **31** and shuttle swell springs **32** and part of the reed **33**.

As the shuttle **1** is projected from a shuttle box in one direction under the impulse of a picker **27**, it is rapidly accelerated to move across the race **28** and the yarn guide member **12**, due to its inertia, swings about its pivot **13** relative to the shuttle towards the trailing end thereof as shown in FIGURE 7. In this position of the member **12** the lead angle A of the weft yarn passing round guide pin **15** is increased to reduce the drag imparted to the weft yarn and thus reduce the tension applied to the trailing portion thereof during acceleration of the shuttle. The shuttle continues to move across the race **28** with a gradually reducing velocity until it approaches the opposing shuttle box where it is subjected to a rapid deceleration by a shuttle swell **31** as it enters the shuttle box to come to a final halt therein and the member **12**, due to its inertia, swings about its pivot **13** towards the leading end of the shuttle to take up the position shown in FIGURE 8. In this position of the member **12** the lead angle A is decreased to increase the drag imparted to the weft yarn and thus increase the tension applied to the trailing length thereof laid across the shed at the end of the transverse of the shuttle.

A similar action takes place during the return movement of the shuttle where, as can be seen in FIGURE 9, during the initial acceleration of the shuttle the member **12** takes up a position to increase the lead angle A of the weft yarn passing around guide pin **16** to reduce the drag imparted to the weft and thus reduce the tension applied thereto and where, as can be seen in FIGURE 10, during the deceleration of the shuttle as it approaches the end of its return traverse of the shed the member **12** swings to a position to decrease the lead angle A which in turn increases the drag imparted to the weft yarn and increases the tension applied to the trailing length thereof laid across the shed.

It will be clearly apparent from the foregoing that the weft tension adjusting mechanism hereinbefore described functions automatically so as to reduce the tension applied to the weft yarn being laid by the shuttle across the shed of a loom during the initial acceleration of the shuttle at the beginning of its traverse of the shed, and to increase the tension applied to the weft yarn laid across the shed during the deceleration of the shuttle at the end of its traverse of the shed.

The mechanism thus compensates for those velocity changes in a shuttle most likely to produce uneven weft tension with resultant defects in the weaving of the cloth.

The shuttle illustrated and shown in FIGURES 1 to 3 of the accompanying drawings as an exemplary embodiment of the present invention is of a type employed in an automatic pirn changing loom and the threading block **3** is constructed in accordance with well known practice to facilitate automatic threading of the shuttle with each pirn change. To this end the guide pins **15** and **16** on the pivoted yarn guide member **12** are provided with beaks or horns **15A**, **16A** to facilitate lead in of the weft yarn between the guide pins during threading of the shuttle. It will be appreciated, however, that an automatic weft tension adjusting mechanism in accordance with the present invention may be readily adapted for use in conjunction with other forms of threading block such as may be employed on shuttles adapted for use in looms having a manual pirn change.

I claim:

1. A loom shuttle including a body having a recess therein to receive a weft yarn pirn, said body having a further recess adjoining said first mentioned recess, a threading block mounted in the further recess and an automatic weft tension adjusting mechanism comprising a yarn guide member pivotally mounted for swinging movement on either side of a rest position defined as the position of the yarn guide member when the center of gravity of the yarn guide member is in a vertical plane containing the point of suspension of the yarn guide

member so that when the yarn guide member moves away from its rest position due to the inertia of the yarn guide member when the shuttle is accelerated or decelerated, a force due to gravity pulls on the yarn guide member to return the yarn guide member to its rest position, and means in said block and on said yarn guide member to direct weft yarn being drawn from the shuttle along an angular path which is changed by movement of the yarn guide member relative to the shuttle to vary the drag imparted to the weft yarn and the tension applied to the weft yarn drawn from the shuttle when said shuttle moves forwardly and rearwardly.

2. The loom shuttle as claimed in claim 1 wherein said means in said block and on said guide member comprises passages therein defining a path for the weft yarn from the pirn recess to the pivoted yarn guide member and said latter is provided with guide pins thereon defining a path for the weft yarn from the block around said guide pins to the exterior of the shuttle body, said path of the weft yarn from the block to the pins of the yarn guide member subtending an angle with the path of the yarn drawn from the shuttle during laying of a weft across the shed of a loom, and said angle being changed by movement of the yarn guide member relative to the shuttle.

3. A loom shuttle including a body having a recess therein to receive a weft yarn pirn, said body having a further recess adjoining said first mentioned recess, a threading block mounted in the further recess and an automatic weft tension adjusting mechanism comprising a semi-circular outline yarn guide member pivotally mounted for swinging movement on either side of a rest position defined as the position of the yarn guide member when the center of gravity of the yarn guide member is in a plane perpendicular to and containing the point of suspension of the yarn guide member so that when the yarn guide member moves away from its rest position due to the inertia of the yarn guide member when the shuttle is accelerated or decelerated a force due to gravity pulls on the yarn guide member to return the yarn guide member to its rest position, said block having passages therein defining a path for the weft yarn from the pirn recess to the pivoted yarn guide member,

said yarn guide member being retained in said further recess by means of a screw co-axial with its pivotal mounting and mounted in adjustable screw-threaded engagement with a nut fixed to a wall of said recess, said yarn guide member also having a pair of upstanding closely spaced pins located on the free end of the yarn guide member remote from its pivotal mounting, said guide pins defining a path for the weft yarn from the block around said guide pins to the exterior of the shuttle body, said path of the weft yarn from the block to said pins subtending an angle with the path of the yarn drawn from the shuttle during laying of a weft across the shed of a loom, and said angle being changed by movement of the yarn guide member relative to the shuttle to vary the drag imparted to the weft yarn and the tension applied to the weft yarn drawn from the shuttle when the shuttle moves forwardly and downwardly.

4. The loom shuttle as claimed in claim 3 wherein two metal washers with a third washer of resilient material interposed therebetween are located on the shaft between the surface of the yarn guide member and the retaining screw, and a compression spring is arranged on the screw between the uppermost metal washer and the nut to exert a predetermined loading on the yarn guide member and regulate its swinging movement about the shaft.

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MERVIN STEIN, *Primary Examiner.*

ROBERT R. MACKEY, *Examiner.*

J. LEE CHI, *Assistant Examiner.*