March 13, 1973 E. STRAUSS 3,720,238

ARRANGEMENT FOR MONITORING WEFT THREADS

Filed June 3, 1971 2 Sheets-Sheet 1

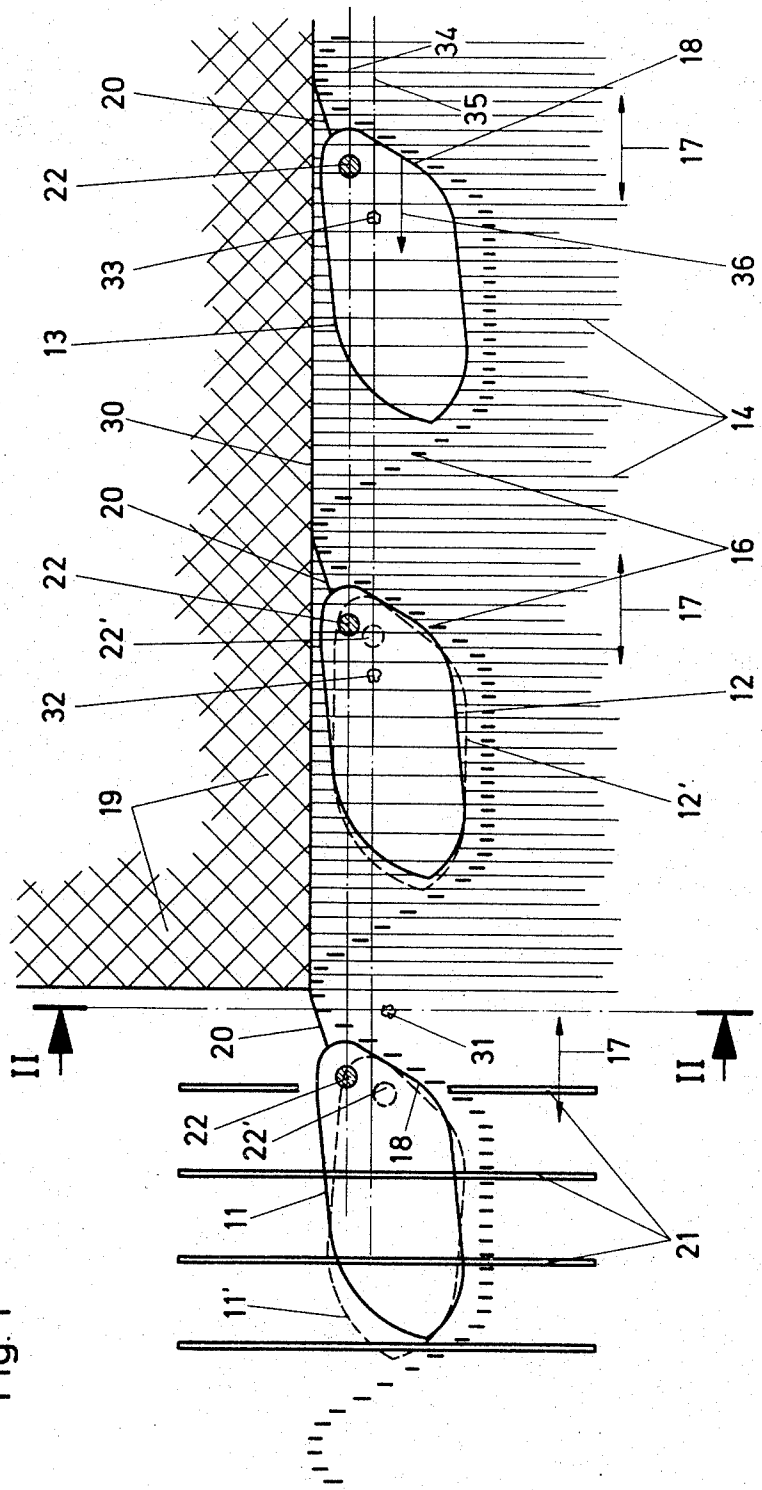

Fig. 1

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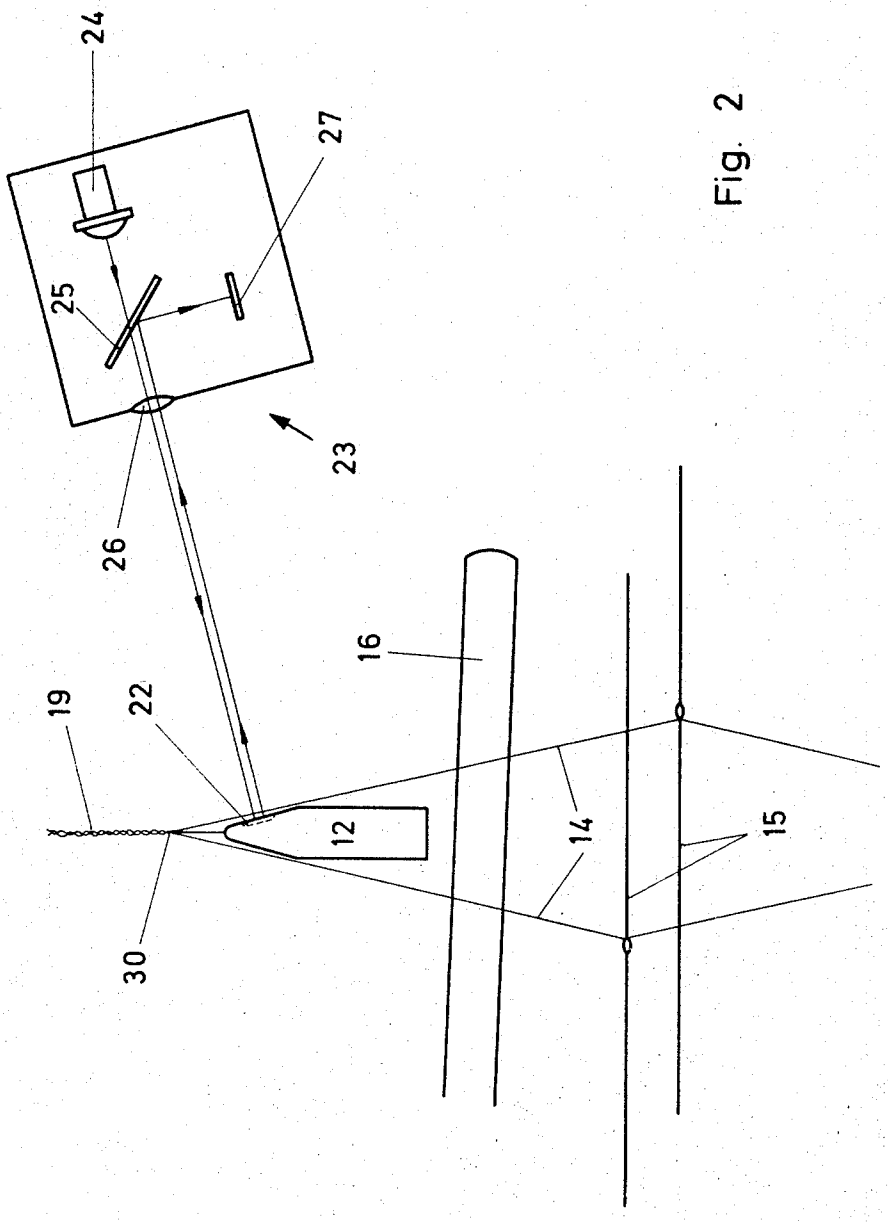

Fig. 2

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ARRANGEMENT FOR MONITORING WEFT THREADS

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ABSTRACT OF THE DISCLOSURE

An arrangement for monitoring the weft threads during their insertion into a shed of a wave-like shed loom by means of a weft-thread inserting element which, during its insertion movement is guided loosely in a guide means in which the difference occurring at a monitoring point between the position of said inserting element when the thread is loose or broken, and the position of said inserting element when operations are proceeding in the proper manner, serves as a criterion for the detection of the presence of a loose or broken weft thread carried by a weft thread inserting element.

The present invention relates to an arrangement, on a wave-type loom, for monitoring the condition of the weft threads during their insertion into a shed by means of an insertion element which during its insertion movement is guided loosely in a guide means, i.e. is guided in a resilient manner or with play between it and the guide means, to provide for a change in position of the insertion element to be detected by an associated monitoring means thereby evidencing the presence of an unwanted defect in weft thread condition.

Many different arrangements are known for monitoring weft threads during their insertion into the shed. In one of these arrangements, the weft thread is detected directly. This detection can be carried out mechanically or by optical means. In the mechanical detection of the weft thread, the position of the thread is interfered with and this can lead to streaking of the finished fabric. In the optical detection of the thread, sensitive equipment is necessary because of the smallness of the thread. The equipment is thus rendered expensive if it is to be sufficiently reliable and durable.

It is also known to detect the thread not directly but indirectly by causing the thread to produce certain actions and then monitoring these actions. In one such arrangement, a mirror occupies one position when a weft thread is present and another different position when the thread is not present. The one or other position of the mirror is determined by means of a light-source and a photoelectric cell. These methods, which operate with the help of certain movements, carry the disadvantage that they require the provision of special means even for producing these movements.

The present invention is intended to avoid these disadvantages and it is characterized in that the difference, occurring at a monitoring point, between the position of an insertion element when a weft thread is loose or broken and the position of said element when operation is proceeding in the proper manner serves as a criterion for detecting the condition of the weft thread, i.e. the presence of a loose or broken weft thread carried by the said insertion element.

The invention will now be described in more detail by reference to an embodiment described herein and presented in the drawings in which:

FIG. 1 is a schematic illustration which shows that part of a loom forming a wave-type shed in which the weft-thread insertion elements emerge from the warp threads; and

FIG. 2 is a schematic view taken along line II—II of FIG. 1 and showing a light ray emitting arrangement.

In the two figures, like reference numerals designate like parts.

Referring to the drawings, the weft-thread inserting elements or shuttles **11**, **12**, and **13** move between warp threads **14** from right to left (see FIG. 1). With the help of the heddles **15** (FIG. 2), the warp threads **14** are caused to form sheds, and the shed opening is greatest at the point where the tip or leading edge of each inserting element **12** and **13** is located, and a shed-change takes place between each two inserting elements or shuttles, e.g. between the shuttles **12** and **13**. The sheds move from right to left at the same speed as the shuttles. The heddles **15** have been omitted from FIG. 1 for greater clarity. The woven material is designated by the numeral **19**.

The shuttles **11**, **12** and **13** are carried and driven by the reeds **16**. A large number of the reeds **16** are arranged side-by-side. The reeds **6** impart drive to the shuttles **11**, **12** and **13** by moving upwards one after the other, as is the case in the zones **17**. During this vertical upward movement of the reeds **16**, they strike the inclined trailing edges **18** of the shuttles **11**, **12** and **13**, so that the latter are driven to the left (see FIG. 1). The shuttles **12** and **13** cannot deflect upwardly since they are retained by the warp threads **14** as can be clearly seen from FIG. 2. Since lateral deflection of the insertion elements **12** and **13** is also prevented by the warp threads **14**, the latter form a resilient guide means for the elements **12** and **13**. The reeds **16** likewise execute an undulatory movement which progresses from right to left.

Prior to entry into its shed, there is passed to each shuttle **11**, **12** and **13** a portion of weft thread of a length which approximately corresponds to the width of the fabric being woven and is such that a short end portion of the weft thread will yet project from the left-hand side of the fabric. The portions of weft thread are brought into each of the shuttles **11**, **12** and **13**, and while the shuttles are passing over the width of the fabric in the shed, said portions of weft thread are drawn from the rear or trailing ends of the shuttles. The weft threads running out of the shuttles **11**, **12** and **13** is designated in each case by the numeral **20**.

Since the shuttles are guided by the warp threads **14**, it is necessary to provide guide means for them after they emerge from the shed. For this purpose, there are provided the guide elements **21**. These are broad-faced elements which are arranged at right-angles to the plane of the drawing of FIG. 1 and which contain openings which are similar to but slightly greater than the greatest cross-section of the weft inserting elements **11**, **12** and **13**. The inserting elements are thus guided by the guide elements **21**, there being certain clearance between the shuttles and said guide elements.

For the purpose of monitoring the condition of the weft threads **20** that are to be inserted into the shed, i.e. of determining whether a weft thread **20** is broken or is not present, a special or detectable portion or means in the form of a ray reflective means or reflector **22** is provided at the rear part of each shuttle **11**, **12** and **13**. The reflectors are respectively positioned in the outwardly facing side-wall of each shuttle and each of the reflectors **22** comprises a recess in the side-wall of the shuttle into which a ray reflecting material has been bonded. A light-rays emitting arrangement or unit **23**, shown only in FIG. 2, is provided to cooperate with the reflectors **22**. Unit **23**, which is adapted to monitor light rays received from reflectors **22**, includes a lamp **24** that provides for a light-beam emitted therefrom to pass through a semi-

translucent plate **25** and a lens **26**, into a path of the shuttles and be reflected by a reflector **22** so as to again pass through the lens **26** onto the plate **25**. A part of the reflected light-beam from this plate is directed thereby to fall on the photo-electric cell **27** and is recorded by the cell. Such optical arrangements are known per se.

When the loom is operating, the shuttles **11, 12** and **13**, as already mentioned, move continuously from right to left in the arrangement shown in FIG. 1. They are continuously driven by the undulatory movement of the reeds **16**. The warp threads **14** form sheds which likewise move from right to left and which have their greatest opening at the point where the leading edge or foremost portion of each shuttle is located. At the location of the trailing edge or rearmost portion of the shuttles, the warp threads **14** have already begun to move into their countershed positions. The shuttles **11, 12** and **13** are thus supported for movement in the sheds.

Each of the weft threads **20** emerging from the rear part of the shuttles **11, 12** and **13** during their insertion movement passes through a thread brake (not shown) provided in each of the shuttles and passes from said brake to the edge of the fabric or the top **30** of the shed, where it is beaten up by the reeds **16** and is woven into the fabric by the shed-change that takes place at the same time. At this moment the weft thread is held fast. Thus, when each of the weft threads **20** is pulled out of the shuttles **11, 12** and **13** through the thread brakes fitted therein, pull is applied to each portion of weft thread **20** between the brake and the top of the shed or fabric beat-up zone **30**. Because of this tensile force, the shuttles **11, 12** and **13** are pressed more firmly against the holding point provided by the warp threads **14** and against the beat-up zone or edge **30**. Since the warp threads **14** are able to yield, the trailing or rear part of each of the shuttles **11, 12** and **13**, in particular is lifted to a greater extent than if this tensile force were not present.

The position of the shuttles or weft thread inserting elements **11, 12** and **13** is therefore different depending upon whether or not a weft thread **20** is running from these elements and is being woven into the fabric. These differences in the position provide a criterion for determing whether a loose or broken weft thread is present by detecting a change of position of the shuttle in which such condition may occur. In the drawing, the shuttle **12** is indicated in a shuttle position **12'**, designated in broken lines which represents the position occupied by shuttle **12** when the thread **20** is defective, i.e. broken, while the shuttle **12**, as shown in solid lines, occupies the position for when operations are proceeding in a proper manner. When there is no weft thread present, e.g., when loose, or broken, the rear of the shuttle drops somewhat so that reflector **22** is moved from a position along dash-dot line **34** into a position along dash-dot line **35**. The changed position of the reflector **22** is designated by the numeral **22'**, If the light-beam from the unit **23** is directed on to a monitoring point **31, 32**, or **33** in the positon **35**, then when no weft thread **20** is present, a ray of light emitted by lamp **24** is reflected when a reflector **22** passes the point **31, 32**, or **33**. By means of the signal thus produced in the photoelectric cell **27**, the loom can be stopped or a warning given.

It will be seen that the monitoring means, comprising the unit **23**, can be fitted at any point along the path taken by the shuttles **11, 12** and **13**, e.g. at the points **31, 32** or **33**. Several such monitoring points could also be provided along this path. If the monitoring point is located at the position where the shuttles emerge from the warp threads **14**, this offers the advantage that control can be exercised over the entire weaving width, since there is hardly any likelihood that a thread, broken at the beginning of the path travelled by the shuttles **11, 12** and **13**, would again come to be correctly woven-in at the end of this path.

When the rear part of the shuttle lifts, said part occupies quite markedly or relatively pronouncedly different positions in the cases of a broken and an unbroken weft thread. It is therefore of particular advantage if the reflector **22** is fitted or positioned in this rear part.

There is no difficulty in locating the monitoring point in such a way that the light-beam is positioned at the point **32** or **33** between the warp threads **14**, since the light from this beam passing through these threads is sufficient to cause the photoelectric cell **27** to respond in a clear manner. It is, however, particularly advantageous to locate the monitoring point in such a way that the light beam is positioned approximately at the point **31**. It has been found that when no weft thread is present e.g. is broken, the shuttles upon leaving the shed move with their rear parts well down, as indicated by the shuttle position **11'** shown in broken lines for shuttle **11**, so that the greatest difference in the position of the reflector **22** occurs as between the case where the thread is broken and that where it is intact at this location **31**.

When the reeds **16** seen in the arrangement illustrated in FIG. 1 move upwards, they apply a vertically upwardly directed drive force to the edge **18** at the trailing end of each of the shuttles. As a consequence of this force, there is produced a leftwardly directed component **36** of the drive force which is indicated on the shuttle **13**. It is obvious that the tensile force caused by the weft thread **20** should not be in alignment with the driving force component **36** extending in the direction in which the shuttles **11, 12** and **13** move. If this were the case, the tensile force occurring in the weft thread **20** would not alter the position of the shuttles **11, 12** and **13**.

It is, of course, also possible to locate the monitoring points **31, 32** and **33**, where the light-beam from the unit **23** strikes, in a position along line **34**. In this case, a signal is produced in the selenium cell **27** each time a shuttle passes through in the correct manner. In this case, the arrangement would be such that the loom is not stopped when signals occur in the proper manner in the light responsive selenium cell **27**, which acts as means to detect the reflected light.

It will be appreciated that the unit **23** provides a light ray source detecting or monitoring means that emits rays to at least one specific monitoring point along the path of travel of the weft thread inserting means or elements.

It further will be appreciated that the invention as illustrated and described is subject to various modifications and changes all falling within the spirit and scope of the invention concepts contained herein.

What is claimed is:

1. An arrangement, on a wave-like shed loom, for monitoring the weft threads during a weaving operation to determine the presence of loose or broken threads by means of a weft thread inserting means which, during its insertion movement, is guided loosely in a guide means in which the position of said inserting means occurring at a monitoring point when not under weft thread tension because the thread is loose or broken, is different from the position of said inserting means when it is under weft thread tension during a proper weaving operation, said arrangement comprising in combination: a weft thread inserting means for the running out of a weft thread towards the top of the shed, said inserting means movable to a different position with respect to the top of the shed when the weft thread tension is diminished by the presence of a loose or broken thread than its position when the inserting means is under weft thread tension, said inserting means having positioned thereon a constantly exposed detectable means whereby said detectable means follows a first path during the running out of the weft thread under tension and a second path when the tension in the weft thread is diminished; and a monitoring means adapted to detect the presence of said detectable means at a monitoring point when said detectable means follows the second path, thereby providing for a positive detection of a loose or broken thread carried by said inserting means.

2. The arrangement of claim 1 in which the inserting means is resiliently guided by the warp threads forming the shed, said weft thread running out from the rear part of said element towards the top of the shed during movement of the inserting means, and the detectable means is positioned in the rear part of the inserting means for determining the position of the said inserting means when the rear part moves away from the top of the shed as a result of a loose or broken weft thread.

3. The arrangement of claim 1 in which the inserting means has an outer side wall and the detectable means comprises a recess in the said wall, and said recess has a light-reflecting material positioned therein.

4. The arrangement of claim 1 in which the monitoring means is positioned so as to be directed towards a monitoring point for said inserting means located at a position where the inserting means run out of the warp threads in the area of the outermost warp threads thereof.

5. The arrangement of claim 4 in which the position of the monitoring point is directly alongside the said outermost warp threads.

6. The arrangement of claim 4 in which a plurality of guide elements for guiding the inserting means emerging from the sheds are positioned adjacent the warp threads on the run-out side of the inserting means, clearance being provided between the said guide means and the inserting element, and the said monitoring point is located outside

the warp threads and directly alongside the outermost of said warp threads being woven.

7. The arrangement of claim 1 in which said detectable means is a ray reflective means operatively connected thereto and said monitoring means is a ray source detecting means that emits rays to at least one specific monitoring point along a path of travel of said inserting means whereby, when said thread in said inserting means is not under tensile force, said reflective means is moved to a position along a path of travel of said inserting means which permits the reflective means to intercept a point of emitted rays for detection of a loose or broken thread carried by said inserting means.

References Cited

UNITED STATES PATENTS

3,433,273	3/1969	Loepfe	139—371

FOREIGN PATENTS

459,098	8/1968	Switzerland	139—12
1,019,724	2/1966	Great Britain.	

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U.S. Cl. X.R.

139—370