United States Patent

[11] **3,578,032**

[72] Inventor **Erwin Pfarrwaller**
Winterthur, Switzerland

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[73] Assignee **Sulzer Brothers Limited**
Winterthur, Switzerland

[32] Priority **Sept. 15, 1967**
[33] **Switzerland**
[31] **12952/67**

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[54] **LOOM HAVING A JACQUARD MECHANISM AND A WEFT CHANGING MECHANISM**
2 Claims, 11 Drawing Figs.

[52] **U.S. Cl.** **139/126**
[51] **Int. Cl.** **D03d 47/24**
[50] **Field of Search** 139/122-
—127

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Primary Examiner—Henry S. Jaudon
Attorney—Pennie, Edmonds, Morton, Taylor & Adams

ABSTRACT: There is disclosed a loom including a weft change mechanism and a Jacquard mechanism for control of weft change as well as warp shedding. The weft change mechanism is coupled through resiliently yielding members to the Jacquard and is provided with a manually operable lever for locking that weft changing mechanism against weft changes called for by the advance of the Jacquard mechanism.

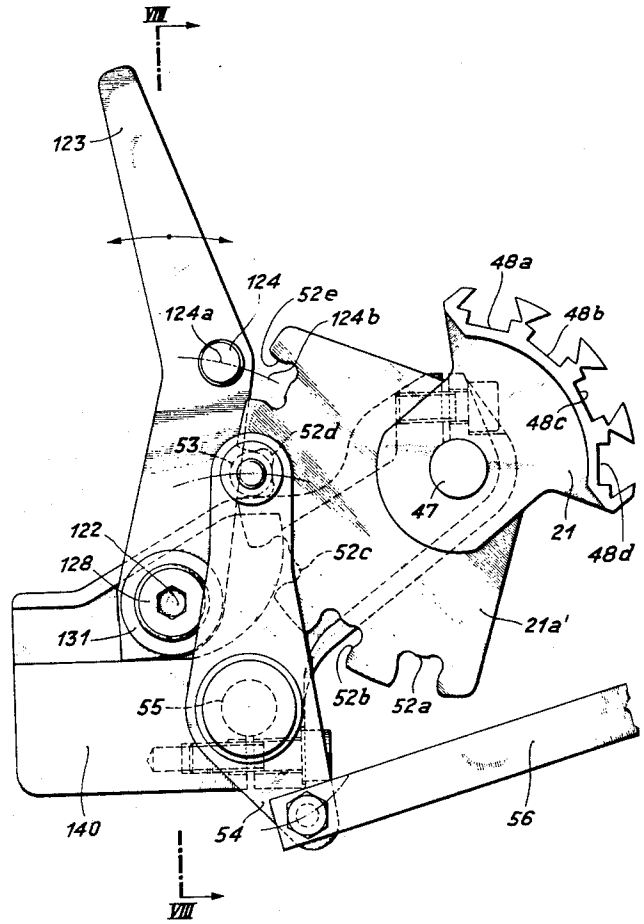


Fig. 1

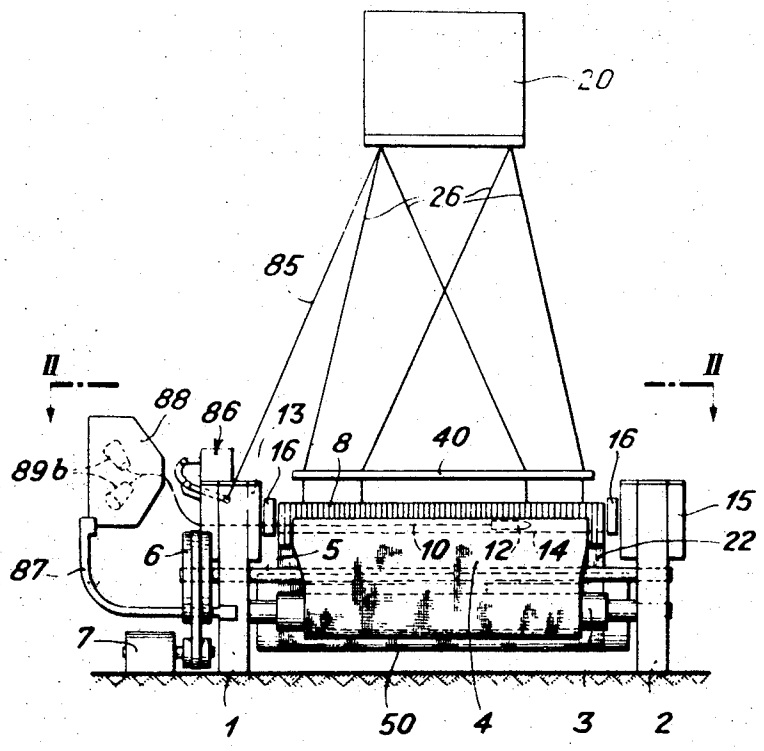
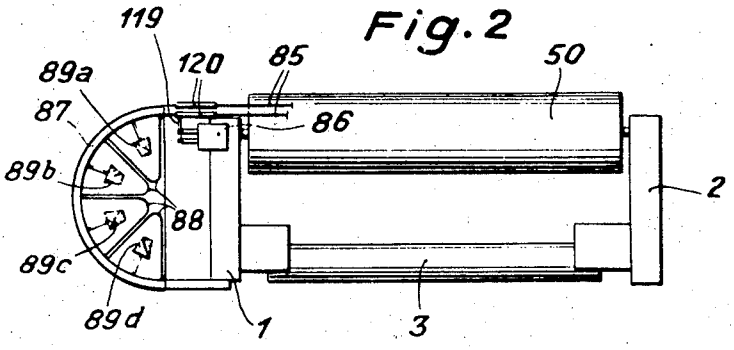


Fig. 2



Inventor:
Erwin Pfarrwaller
BY Pennie, Edmonds,
Morton, Taylor and Adams
ATTORNEYS

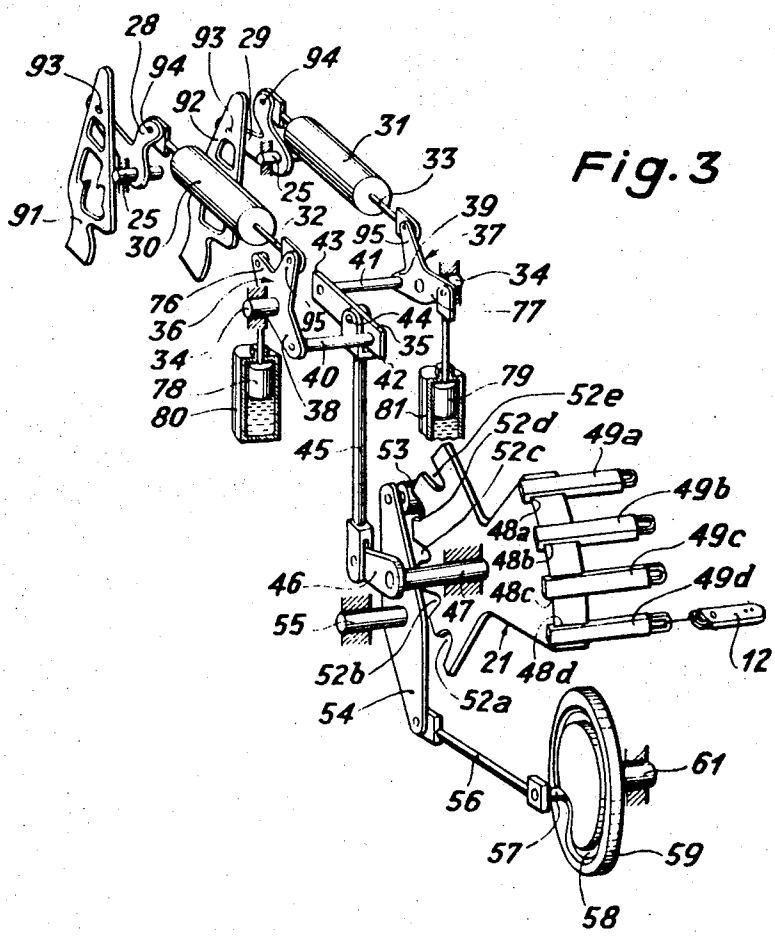


Fig. 3

Inventor:
Erwin Pfarrwaller
BY Pennie, Edmonds,
Morton, Taylor and Adam
ATTORNEYS

Fig. 4

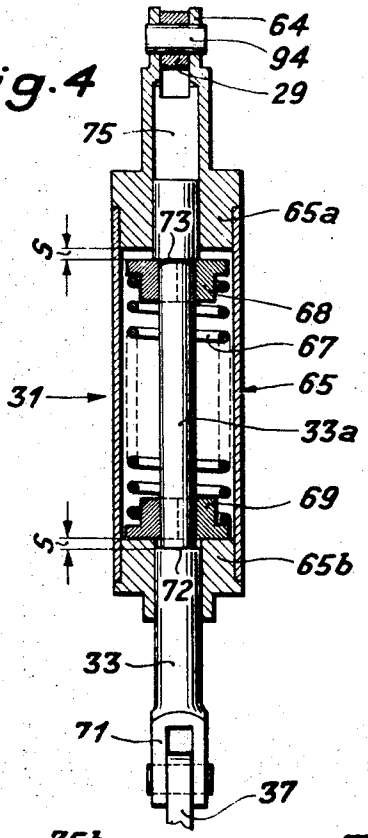


Fig. 5

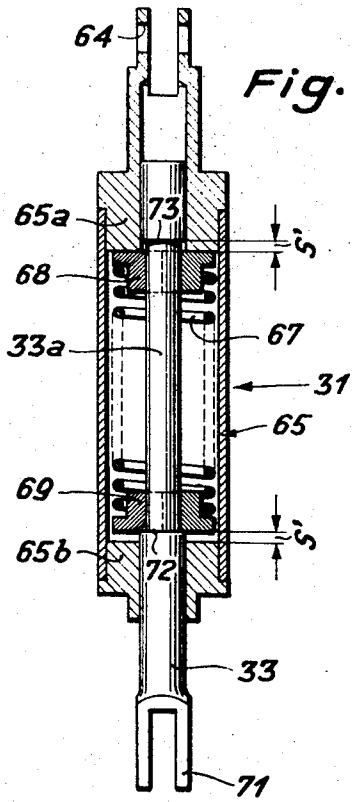
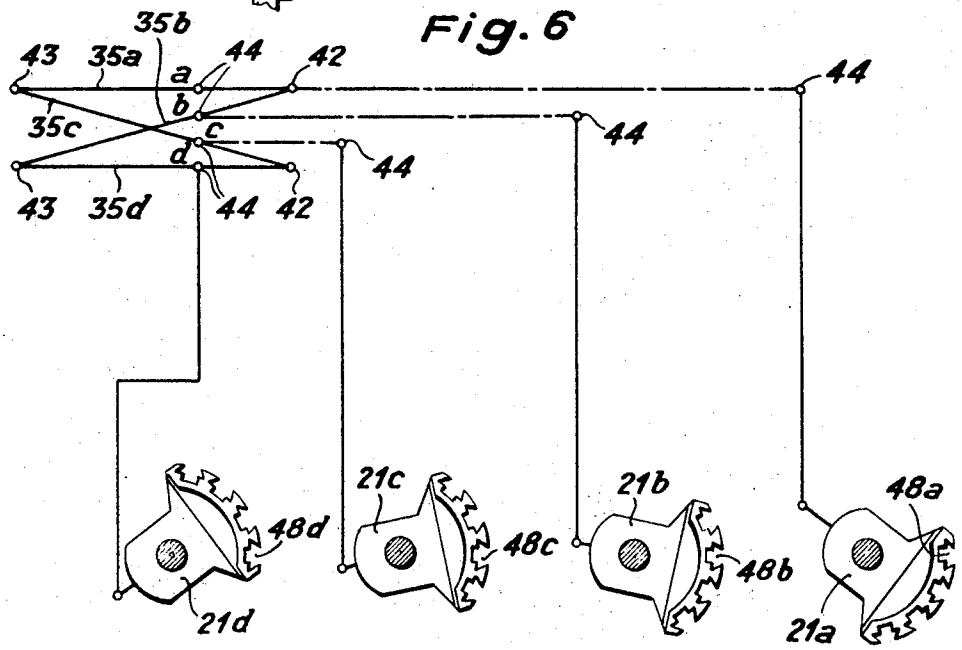


Fig. 6



Inventor:
Erwin Pfarrwaller
BY Pennie, Edmonds,
Morton, Taylor and Adams
ATTORNEYS

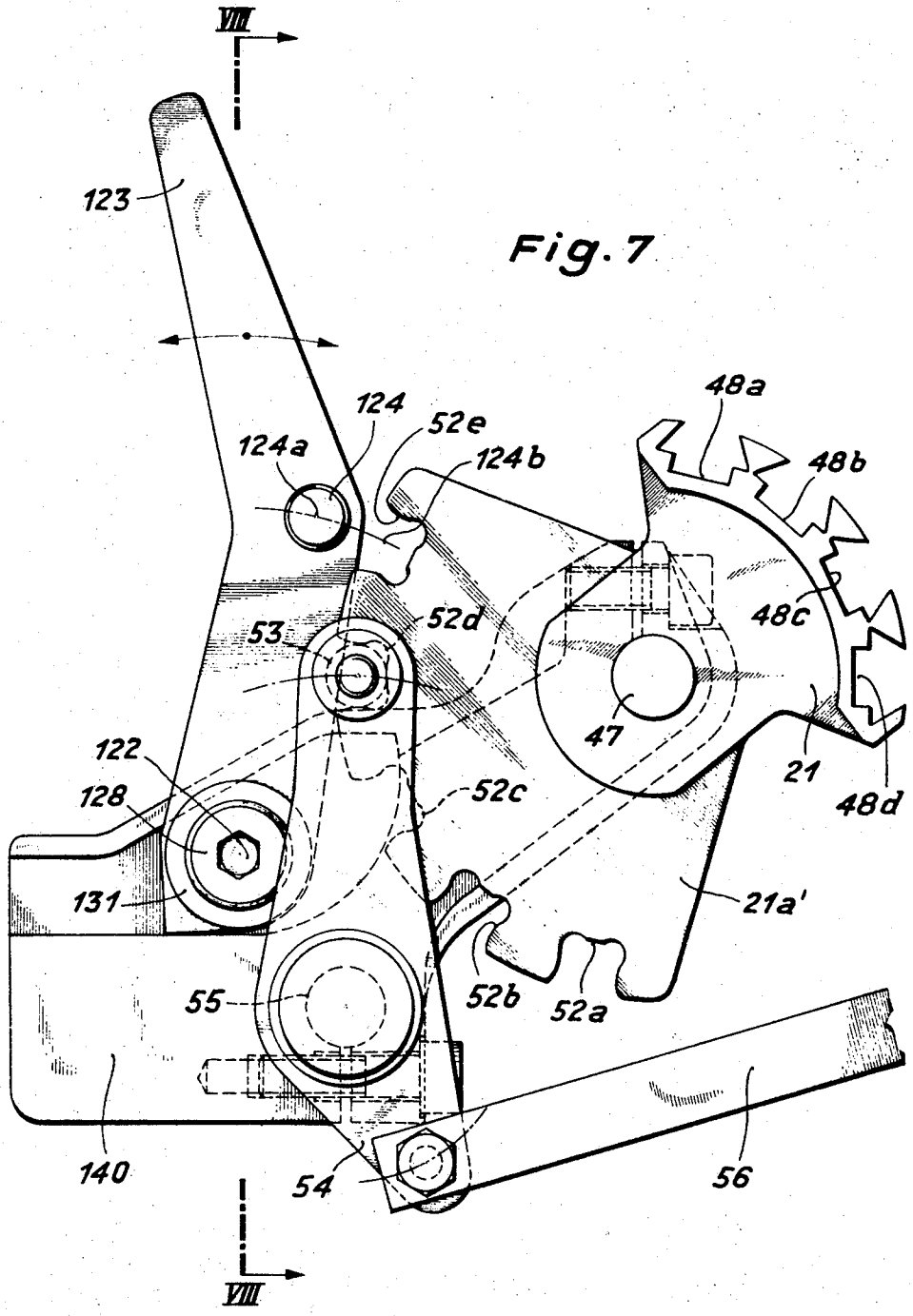


Fig. 7

Inventor:
Erwin Pfarrwaller
BY Pennie, Edmonds, Morton, Taylor and Adams
ATTORNEYS

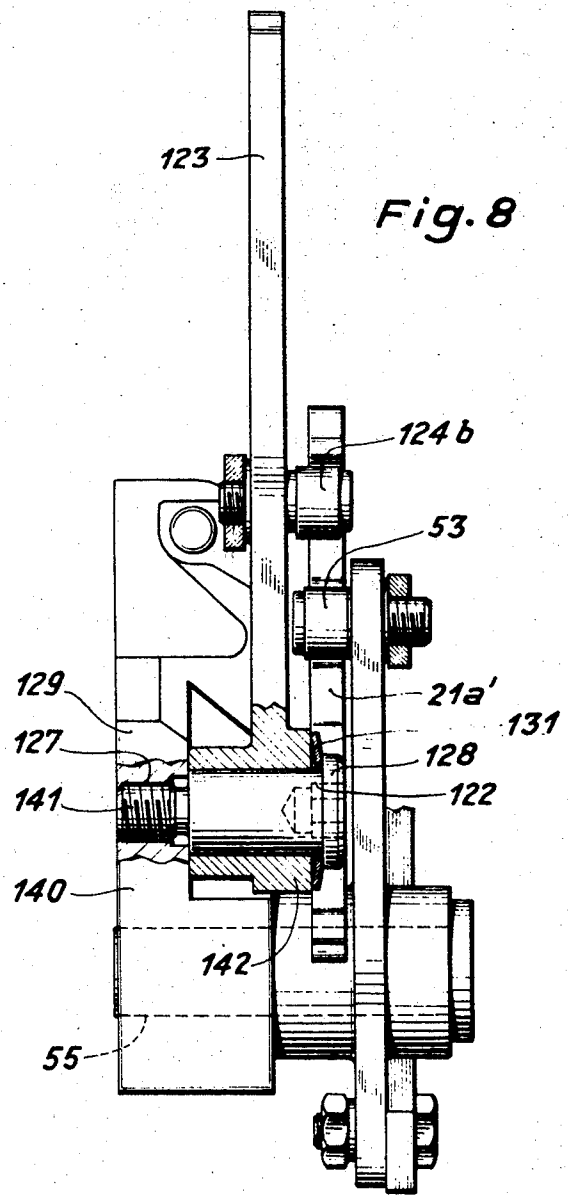


Fig. 8

Inventor:
Erwin Pfarrwaller
BY Pennie, Edmonds,
Morton, Taylor and Adams
ATTORNEYS

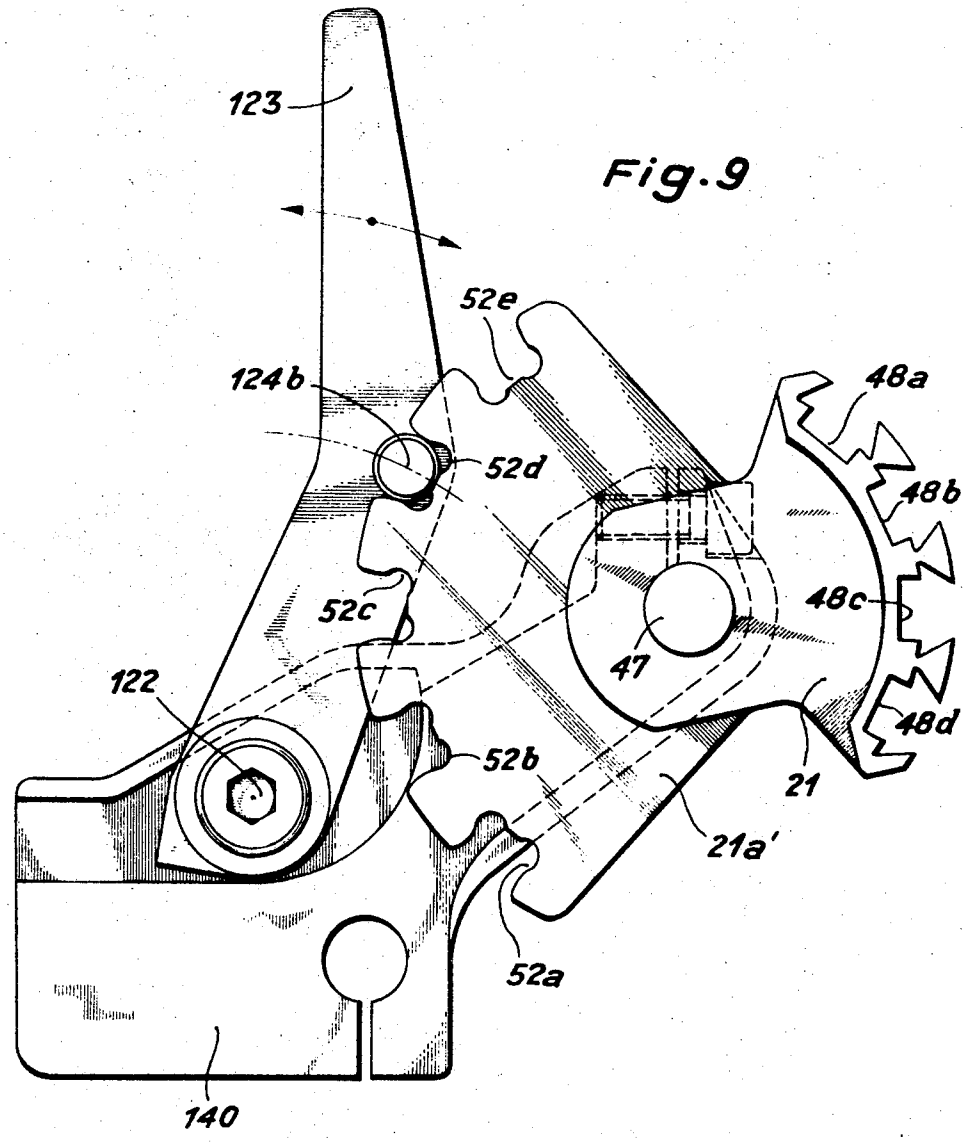


Fig. 9

Inventor:
Erwin Pfarrwaller
BY Pennie, Edmonds,
Morton, Taylor and Adams
ATTORNEYS

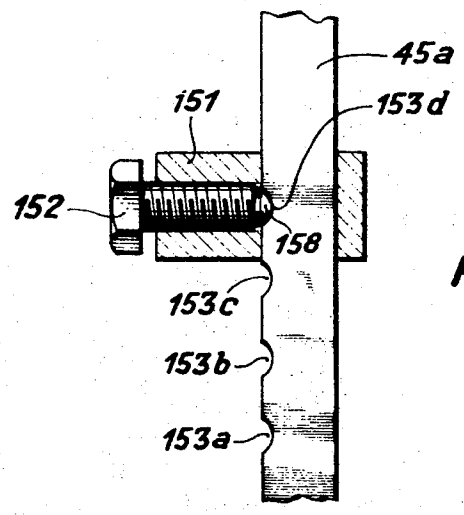


Fig. 10

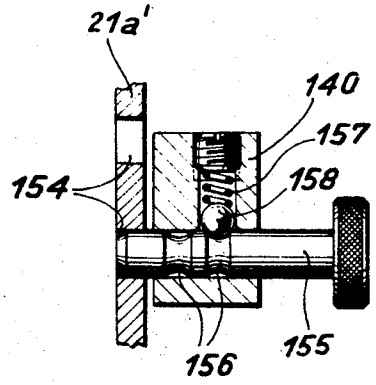


Fig. 11

Inventor:
Erwin Pfarrwaller
BY Pennie, Edmonds,
Morton, Taylor and Adams
ATTORNEYS

LOOM HAVING A JACQUARD MECHANISM AND A WEFT CHANGING MECHANISM

The present invention relates to multiweft looms, i.e. to looms having a weft change mechanism for changing the wefts to be picked and a Jacquard mechanism for shedding. The invention is particularly applicable to such a loom in which weft change is controlled by a Jacquard mechanism, as disclosed in the copending application of Erwin Pfarrwaller and Gerd Schmitz, Ser. No. 723,684, filed Apr. 24, 1968, now U.S. Pat. No. 3,528,459 which is assigned to the assignee hereof. The term "weft change mechanism" is used to refer to a mechanism which enables weft yarns of various kinds, for example of different colors or materials, to be picked into the shed successively in accordance with a program. It will be assumed hereinafter by way of example that the weft-yarn changing is the changing of weft yarns of different colors.

The invention is particularly useful in looms wherein the Jacquard mechanism as a whole can run only forward and, when it is required to "weave out" or clear weaving faults due to weft thread breakage, only the reading mechanism or punched card of the Jacquard mechanism can be shifted or stepped.

Heretofore it has been difficult with such a loom to repeat a particular pick of a particular color associated with a weft thread breakage, for the reason that the card of the Jacquard mechanism must be set back not just by one cycle of operations but by several—as a rule, three. In a Jacquard mechanism, a number of cycles are required until a shed setting corresponding to a predetermined position on the Jacquard card can be set up in the loom.

However, when the card is set back, e.g. by three cycles, in order to repeat a particular pick and when the loom and the Jacquard mechanism run forward together through two cycles, what usually happens is that undamaged wefts are picked, instead of idle picks being made as they would be in the event of a weft thread breakage in a single-color loom. These differently colored wefts are out of place in the shed settings produced when the loom and Jacquard mechanism restart. Consequently, such wefts must be removed from the shed. This causes unnecessary work. Also, since the undamaged intermediate wefts prevent the weft stop motion from stopping the loom, a special facility is required to stop the loom in the shed position corresponding to the unwanted intermediate wefts.

It is an object of the invention to improve the weaving-out of weaving faults, by stepping the loom backward and then forward in order to repeat a pick, in a multiweft loom in which the warp threads are controlled by a Jacquard mechanism.

The invention provides means to interrupt operation of the weft change mechanism which means are operable, for example by hand, independently of the remainder of the loom and in particular independently of the weft change mechanism.

Consequently, after the weft change mechanism and the Jacquard mechanism card have been stepped back by an amount corresponding to a number of wefts, the weft change mechanism can be kept locked while the loom and the Jacquard mechanism are restepped forward through a plurality of picks, for example two, until the shed setting of the faulty weft has been reached and the weft can be repeated. Thus the weft change mechanism does not advance during this restepping as may be called for by the portion of the weft change pattern immediately preceding the faulty pick. Consequently, it is impossible during the restart for undamaged wefts of a different color, which would have to be removed from the shed, to be introduced thereinto.

In a preferred construction, the locking device which permits the weft change mechanism to be so locked comprises a hand lever which has a locking detent such as a roller which cooperates with formations (such instead or notches in a locking sector) movable with a weft selector drum carrying a number of weft feeders adapted to be advanced into the line for picking by a picking member of the loom, e.g. a gripper shuttle.

The loom may also include a locking mechanism having a second detent such as a roller cyclically driven from the loom drive so as to hold the weft change mechanism at the start of each pick in a position which aligns a weft feeder with the picking line, but which thereafter releases the weft change mechanism to permit a change of weft for the next pick if that is called for by the weft change program and unless that is prevented by the locking device of the invention.

The Jacquard mechanism is preferably connected to control the weft change mechanism through a transmission comprising at least one energy storage means for storing the energy produced by control movements of the Jacquard mechanism and for producing an nonpositive drive of the weft change mechanism. The nonpositive drive of the weft change mechanism greatly simplifies locking since the drive for the Jacquard mechanism can then remain in operation during the loom restart—i.e., while the weft selector drum is locked; if the pattern program indicates that the weft selector drum should make a change, the locking facility makes the drive to the weft change drum inoperative.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention will now be further described in terms of a number of nonlimitative exemplary embodiments thereof and with reference to the accompanying drawings, in which:

FIG. **1** is a diagrammatic view in front elevation of a loom, seen from the cloth end;

FIG. **2** is a corresponding plan view on the line II–II in FIG. **1**;

FIG. **3** is a simplified perspective view showing parts of the weft change mechanism of the loom of FIG. **1**;

FIGS. **4** and **5** shown in detail and in section a part of the weft change mechanism in two different positions;

FIG. **6** is a diagrammatic view showing four positions of the weft change mechanism shown in FIG. **3**;

FIG. **7** is a view, in a more detailed form than FIG. **3**, of certain parts of the weft change mechanism of importance to the invention, showing in particular manually operable means to lock the weft change mechanism;

FIG. **8** is a section on the line VIII–VIII of FIG. **7** with some of the parts omitted and in a different position;

FIG. **9**, which shows only the main elements, shows the parts of FIG. **7** in another position; and

FIGS. **10** and **11** show details of modified constructions according to the invention.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring to FIGS. **1** and **2**, the loom has a base with two uprights **1** and **2** between which are disposed a warp beam **50**, a cloth beam **3** with the cloth web **4** wound onto it, guide and tension means (not shown) for the warps **22** and cloth **4**, and a main driving shaft **5**. Outside the upright **1** there is a coupling **6** with a brake and an electric driving motor **7**. Alternatively, the coupling, brake and motor may be on the right side in FIG. **1**. FIG. **1** also shows a reed **8** for beating up the weft **10** and, above the loom, a Jacquard mechanism **20** with pull cords **26** passing through a harness board **40** to form the shed from the warps **22**. One or more pull cords **85** (two in the embodiment illustrated), extend from the Jacquard mechanism to a linkage **119**, **120** which controls a weft change mechanism (in the present case a four-weft mechanism) generally designated **86** in FIG. **1**.

The loom has a bobbin support **87** with screens **88** for limiting the balloon of the yarn. Between the screens there are weft supply bobbins **89***a* to **89***d*. During weaving, weft **10** is drawn from the bobbins in turn and picked into the shed by gripper shuttles **12** running in a shuttle guide **14**. The appropriate weft color, according to the weft thread program, is selected by the four-weft mechanism **86** and passed to the shuttle **12** by components which will be described below. The shuttle **12** is picked by a picking motion **13** and runs to a catching motion **15**. A selvage tuck-in device **16** is provided at each edge of the

warps 22, adjacent the motions 13 and 15. Each device 16 contains a centering device for centering the weft 10 picked, a selvage thread clamp for clamping the weft, and on the picking side, a cutting device to sever the weft. It also includes a selvage tuck-in needle which tucks the free weft end into the next shed, forming a selvage at the edge of the cloth.

The four-weft mechanism 86 contains two lifting plates 91 and 92 (FIG. 3) which can move up and down and whose construction is described in detail in the copending application Ser. No. 723,684 above referred to. These plates are pivoted at 93 to bellcrank levers 28 and 29 rotatable about stationary pivots 25. At 94 the bellcrank levers are also pivotally connected to weft-changing drive energy storage devices 30 and 31 to be further described below. The storage devices 30 and 31 contain springs adapted to move rods 32 and 33. These rods are pivoted to arms 95 of three-arm levers 36 and 37 rotatable about stationary pivots 34. Arms 38 and 39 of the three-arm levers are pivotally connected by pins 40 and 41 to the ends 42 and 43 of a balance lever 35. A link 45 is pivoted to the balance lever 35 at a point 44 which forms a fulcrum for the lever, and the link 45 is also pivoted to a crank arm 46, to whose crank shaft 47 a weft selector drum 21 is attached.

Four shuttle feeders 49*a* to 49*d* are adapted to slide in grooves 48*a* to 48*d* in the selector drum. A device (not shown) shifts them as required towards the shuttle 12 when they are in the picking line.

Five notches or recesses 52*a* to 52*e* are provided in the rear of the drum 21 for two locking rollers 53 and 124. In FIG. 5 there is shown only the roller 53 which forms part of a cyclically driven weft selector locking mechanism. The roller 124, forming part of the locking device of the present invention, is shown in FIGS. 7 to 9 and will be described presently. The roller 53 is mounted on a lever 54 rotatable about a stationary pivot 55. A rod 56 pivoted to the lever 54 carries a pin 57, which engages a control groove 58 in a disc cam 59. This cam is attached to a shaft 61 operated at a speed equal to the picking speed of the loom, i.e. shaft 61 rotates once per picking cycle.

The two weft-changing drive energy storage devices 30 and 31 are identical. Storage device 31 will now be described in detail with reference to FIGS. 4 and 5. A compression spring 67 is supported in a cylindrical casing 65 between two movable spring guides 68 and 69, through which passes a rod 33. The casing 65 is pivoted at 94 to the bellcrank lever 29, and the rod 33 is hinged at its eye 71 to the three-armed lever 37. The rod 33 can slide in a bore 75 in the casing 65. Two shoulders 73 and 72 are provided on the rod against which the spring guides 68 and 69 respectively can bear. These guides are in two parts, so that they can be fastened about the thinner portion 33*a* of the rod, between shoulders 72 and 73. The two portions of each guide are held together by an end coil of the spring 67.

In the pulled-out position shown in FIG. 4, the rod 33 is pulled downwards and outwards relative to the casing 65, so that the spring 67 is compressed downwardly by the guide 68, forced away from the upper portion 65*a* of the casing by action of the shoulder 73. There are equal gaps S between the upper portion 65*a* and shoulder 73 (i.e. guide 68) and between the guide 152 and the shoulder 72. The spring 67 tends to move the rod 33 relative to the casing 65 until the gaps S disappear. For example, the rod 33 may be moved upwards in FIG. 4 by the spring, or the casing 65 may be moved downwards, or the rod and the casing may both be moved towards each other. When S is zero, the force storage means 31 is in a central, inoperative or rest position, in which there is no net force tending to shift the relative position of the rod 33 and casing 65.

In the oppositely stressed position in FIG. 5, the rod 33 has been pushed upwards relative to the casing 65, causing equal gaps S' between the guide 69 or shoulder 72 and the lower portion 65*b* of the casing, and between the shoulder 73 and the guide 68. The gap S' of FIG. 5 is shown as equal to the gap S in FIG. 4. In the position shown in FIG. 5, the spring tends to move the rod 33 in the direction relative to the casing 65 opposite from that in FIG. 4, toward the central rest position. Obviously the position of minimum strain for the spring is that in which the guides 68 and 69 are both seated on their respective casing portions 64*a* and 65*b*, in which event the shoulders 73 and 72 are flush with those casing portions. In the inoperative central position, S' is zero. By pulling on the two ends 64 and 71 of the storage devices 30 and 31 apart or by pressing them together, these devices (hereinafter sometimes called spring cylinders) can therefor be brought out of their inoperative central position into an energy storage position, from which they tend to return to the inoperative central position.

Referring again to FIG. 3, damping pistons 78 and 79 are pivoted on arms 76 and 77 of the three-armed levers 36 and 37. These pistons move in cylinders 80 and 81 containing damping fluid, e.g. oil. As the pistons rise or fall, they retard the pivoting movement of the levers 36 and 37 and therefore the weft-changing movement of the drum 21, particularly in the latter stages of any movement. The top and bottom ends of the cylinders 80 and 81 form stops for the pistons therein.

Each of the two levers 36 and 37 can take up either of two positions, depending on the switching movements of its corresponding one of the cylinders 30 and 31. To these two positions there correspond the upper and lower positions of pistons 78 and 79. Since the distances of the fulcrum 44 on the balance lever 35 from the ends 42 and 43 of this lever are in the proportion of 1:2, four positions 35*a* to 35*d* are possible for this lever, as shown in FIG. 6. Any two adjacent ones of the positions *a* to *d* of the fulcrum are at equal distances from one another. In FIG. 6 there are shown the four positions *a* to *d* of the fulcrum 44, with the corresponding positions 21*a* to 21*d* of the weft selector drum 21 diagrammatically indicated in association therewith.

In FIG. 3, the two pistons 78 and 79 are in their upper positions. The cylinder 30 is in the compressed condition illustrated in FIG. 5 for cylinder 31, with spring 67 of cylinder 30 compressed by forcing of rod 32 into the casing beyond the equilibrium point. Consequently, the cylinder 30 tends to rotate the lever 36 clockwise as seen in FIG. 3. Cylinder 31 is in its pulled-out position as illustrated for it in FIG. 4, and therefore tends to rotate the lever 37 anticlockwise. In FIG. 3, both of these motions have however already proceeded as far as possible, the upper limit of travel of piston 78 limiting clockwise travel of lever 36 while the upper limit of travel of piston 79 limits counterclockwise travel of lever 37. The pins 40 and 41 are thus both in their lowest positions, so that the balance lever 35 is in position 35*d* (FIG. 6) and the drum 21 is in the position 21*d* shown on the left in FIG. 6. The shuttle feeder 49*d* is therefore in the picking line, and the locking roller 53 has entered the recess 52*d* to lock the weft selector drum 21, all as illustrated in FIG. 3.

The lifting-plates 91 and 92 may be driven by the loom, under control of signals delivered from the Jacquard mechanism via cords 85 for weft selection, in a manner disclosed in detail in the aforementioned copending application Ser. No. 723,684.

As can be seen from FIG. 7, the selector drum 21 comprises a locking sector 21*a* which is formed with recesses 52*a* to 52*e* and which cooperates not only with the cyclically operated locking mechanism comprising elements 58, 56, 54 and 53 but also with a manually operable locking device comprising a hand lever 123 pivotable about a stationary pin 122 and a locking roller 124 on the lever 123.

When lever 123 is in the counterclockwise position shown in FIG. 7, with roller 124 retracted from the sector 21*a*, the locking device is inoperative and the weft change mechanism follows the program communicated from the Jacquard mechanism via cords 85 and the structure shown in FIG. 3 of the drawings. If instead the lever 123 is rotated clockwise to the position shown for it in FIG. 9, and which is also illustrated in FIG. 8, the roller 124 will engage in one of the notches 52*b* to 52*e* according to the angular position previously imposed on the sector 21*a'* by the weft change mechanism illustrated in

FIG. 3. It will be noted that the roller **53** of the cyclically operable locking mechanism is engageable with any of the notches **52***a* to **52***d*, whereas the locking roller **124** of the manually operable locking device is engageable in any of the notches **52***b* to **52***e*. Thus the roller **124** is engageable always with a notch in the sector **21***a'* one higher than that engaged by the roller **53**. When the roller **53** is in the notch **52***d*, the roller **124** is engageable with the uppermost notch **52***e*, which can be engaged only by the roller **124** and then only when the shuttle feeder **49***d* (FIG. 3) is in the picking line.

The drum **21** stays locked by the lever **123** in position **124***b* until the lever **123** is pivoted anticlockwise in FIG. 7. Accordingly the drum remains locked notwithstanding retraction of roller **53** from the sector. The pin **141** on which lever **123** is pivoted and which is fixed in an aperture **127** (FIG. 8) in the loom frame **140** has a head **128**. A spring washer **131** is inserted between the head **128** and the hub **142** of the lever **123**, and acts by friction to maintain lever **123** in position.

Operation is as follows. Let it be assumed that a weft thread which the shuttle feeder **49***d* has transferred to the shuttle **12** is broken. The selector drum **21** with its sector **21***a'* will be in the position shown in FIGS. **3** and **7**, in which the shuttle feeder **49***d* is in the picking line. The loom operator removes the broken weft thread from the shed.

The operator then rotates the lever **123** clockwise, as seen in FIG. **7**, from its inoperative position shown in FIG. **7**, overcoming the friction produced by the spring washer **131**, until the roller **124** engages the notch in the sector **21***a'* aligned therewith. This will be notch **52***d* in the case assumed. Then the loom is stepped back by three picks, for example, together with the perforated card of the Jacquard mechanism **20**, in a known manner, e.g. by means of a handwheel. The loom and the Jacquard mechanism are then run forward for two picks. Typically the perforated card of the Jacquard mechanism will be presenting to its sensing or reading mechanism a section calling for the selector drum **21** to take up a position different from the position in which it was when the broken weft thread was picked. Consequently, the Jacquard mechanism **20** will typically call during these two picks of the restart for a position of the selector drum **21** different from that which it is occupying, e.g. for a position in which the shuttle feeder **49***a* is aligned with the picking mechanism, and thereafter, perhaps even on the second of these two picks, for a position in which the shuttle feeder **49***c* is so aligned.

However, the manually controlled locking afforded by the locking lever **123** precludes any shift of the weft selector drum during the restart. The weft change signal originated by Jacquard mechanism **20** travels only as far as the energy storage means **30** and **31** of FIG. **3**. They absorb the weft change drive so that it is not transmitted to the components **33** to **37** and **45** of FIG. **2**. Since the weft thread corresponding to the shuttle feeder **49***d* broke in the shed and has been removed, there will occur during the restart idle picks in which the shuttle **12** passes through the shed without any weft. The weft thread breakage detector stops the loom after each such idle pick. Hence it is possible easily and quickly to return the loom including its weft selection mechanism rapidly and easily to the state of affairs existing just prior to the occurrence of the defective pick.

The rest of the procedure is conventional. A weft thread of the kind corresponding to the broken thread is threaded in, whereafter the lever **123** is returned to the inoperative position shown in FIG. **7**, the faulty weft is repeated, and the loom then continues to run in the desired manner.

According to another embodiment of the invention, the locking device can take the form of a stationary clamping sleeve **151**, shown in FIG. **10**, engageable with a flat link **45***a*, which is placed in stead of link **45** of FIG. **3**. The sleeve **151** contains a clamping screw whose end **158** can cooperate with any of the four recesses **153***a* to *d* in the link.

According to still another embodiment, the sector **21***a'* can be formed with four apertures **154** (FIG. **11**) engageable with a locking pin **155** mounted in the loom frame **140** in order to lock the weft selector drum. The pin **155** is formed with two circumferential grooves **156** engageable with a ball **158** biased by a spring **157**. The pin **155** can therefore be held in either of two positions—the locking position, shown in FIG. **11**, and the free or unlocked position, in which the pin **155** is moved to the right from its position in FIG. **11**.

The locking device can act on any member, such as the member **45** or **46** which is connected to the weft selector drum **21**, **21***a'* in a nonyielding manner, so as to lock the drum for as long as required during restarting and thereby to prevent the weft change signal originated at the Jacquard machine **20** from moving the drum.

The invention can also be applied to looms of kinds other than gripper shuttle looms, such as gripper needle looms or automatic looms employing pirn-carrying shuttles, or to looms using water jet or air jet picking.

The invention is also applicable to looms in which a Jacquard mechanism is used for shedding only, the weft change mechanism being controlled by some other device, such as a pattern chain. In this case too, it is convenient to lock the weft change mechanism during restarting, to insure that intermediate wefts of a different color cannot be picked into the shed before the repeat of the pick of the broken weft thread.

The invention thus provides a loom comprising warp shedding means, weft picking means, weft changing means, a source of weft change signals, a Jacquard mechanism controlling the warp shedding means, and means to arrest response of the weft changing means to weft change signals. The Jacquard mechanism may itself constitute the source of weft change signals. The weft changing means preferably include a drum or first sector, as shown at **21** in the drawings, carrying a plurality of weft thread feeders **49***a* to **49***d* separately alignable with the weft picking means (e.g. shuttle **12**), according to the angular position of that first sector **21**. The arresting means include a second sector **21***a'* rotatable with the sector **21** and notched on its periphery, and a separately pivoted lever **123** carrying a roller **124** which constitutes a stop or pin engageable with the notches of the sector **21***a'*.

In the preferred embodiments illustrated, the weft changing mechanism includes a roller **53** constituting a pin cyclically driven at picking rate into and out of engagement with the notches of sector **21***a'* at a position about the axis of that sector displaced from that of the stop **124**. Moreover, the weft changing means is preferably coupled to the Jacquard mechanism by a coupling including a yielding element or elements as shown at **30** and **31** in FIG. **3**.

While the invention has been described hereinabove in terms of a number of presently preferred embodiments, the invention itself is not limited thereto but rather comprehends all modifications of and departures from those embodiments properly falling within the spirit and scope of the appended claims.

I claim:

1. A loom comprising drive means, warp shedding means and weft picking means both coupled to said drive means, weft changing means, a source of weft change signals, a yielding coupling between said weft changing means and said source of weft change signals, a Jacquard mechanism for control of the warp shedding means, and means operable independently of said drive means, warp shedding means and weft picking means to arrest response of said weft changing means to said signals.

2. A loom according to claim 1 wherein said weft changing means include a first pivoted sector carrying a plurality of weft thread feeders separately alignable with said weft picking means according to the angular position of said first sector, wherein said arresting means include a second sector rotatable with said first sector and notched on its periphery and a separately pivoted lever carrying a stop engageable with the notches of said second sector, and wherein said weft changing mechanism further includes a pin cyclically driven at picking rate into and out of engagement with the notches of said second sector at a position about the axis of the said second sector displaced from that of said stop.

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UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,578,032 Dated May 11, 1971

Inventor(s) Erwin Pfarrwaller

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Column 1, line 71, delete "instead" and substitute therefor --as recesses--.
Column 2, line 33, for "shown" substitute --show--.
Column 3, line 61 for "152" substitute --69--.
Column 4, line 67, for "21a" substitute --21a'--.

Signed and sealed this 19th day of October 1971.

(SEAL)
Attest:

EDWARD M.FLETCHER,JR.
Attesting Officer

ROBERT GOTTSCHALK
Acting Commissioner of Patents