June 12, 1956 E. PFARRWALLER 2,749,946

WEFT THREAD CONTROL IN LOOMS FOR WEAVING

Filed June 16, 1954 3 Sheets-Sheet 1

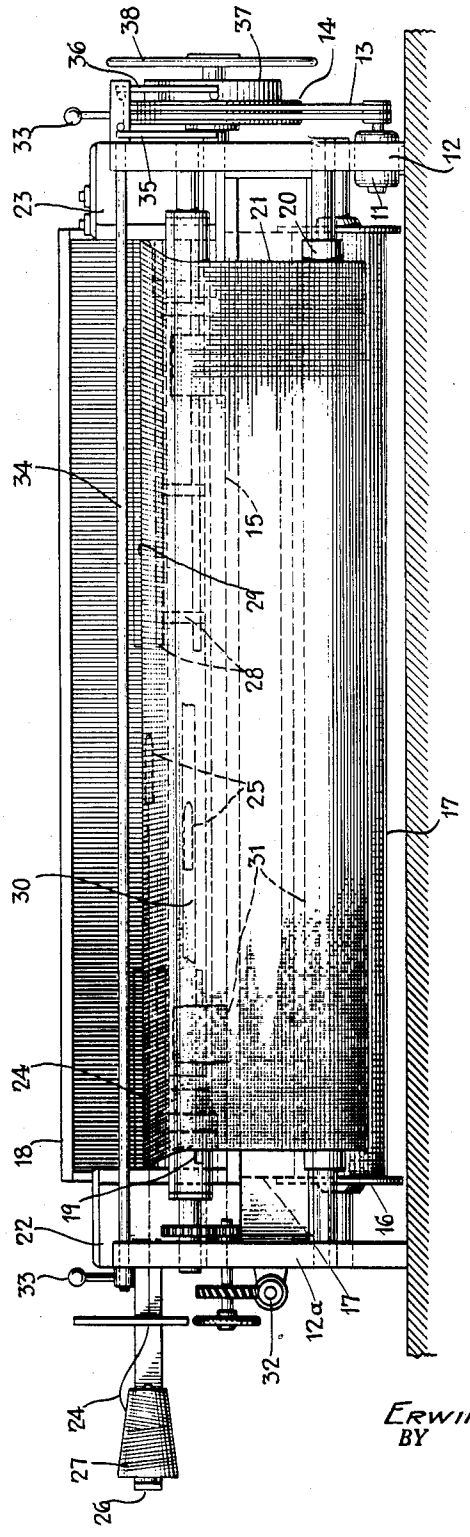


Fig. 1.

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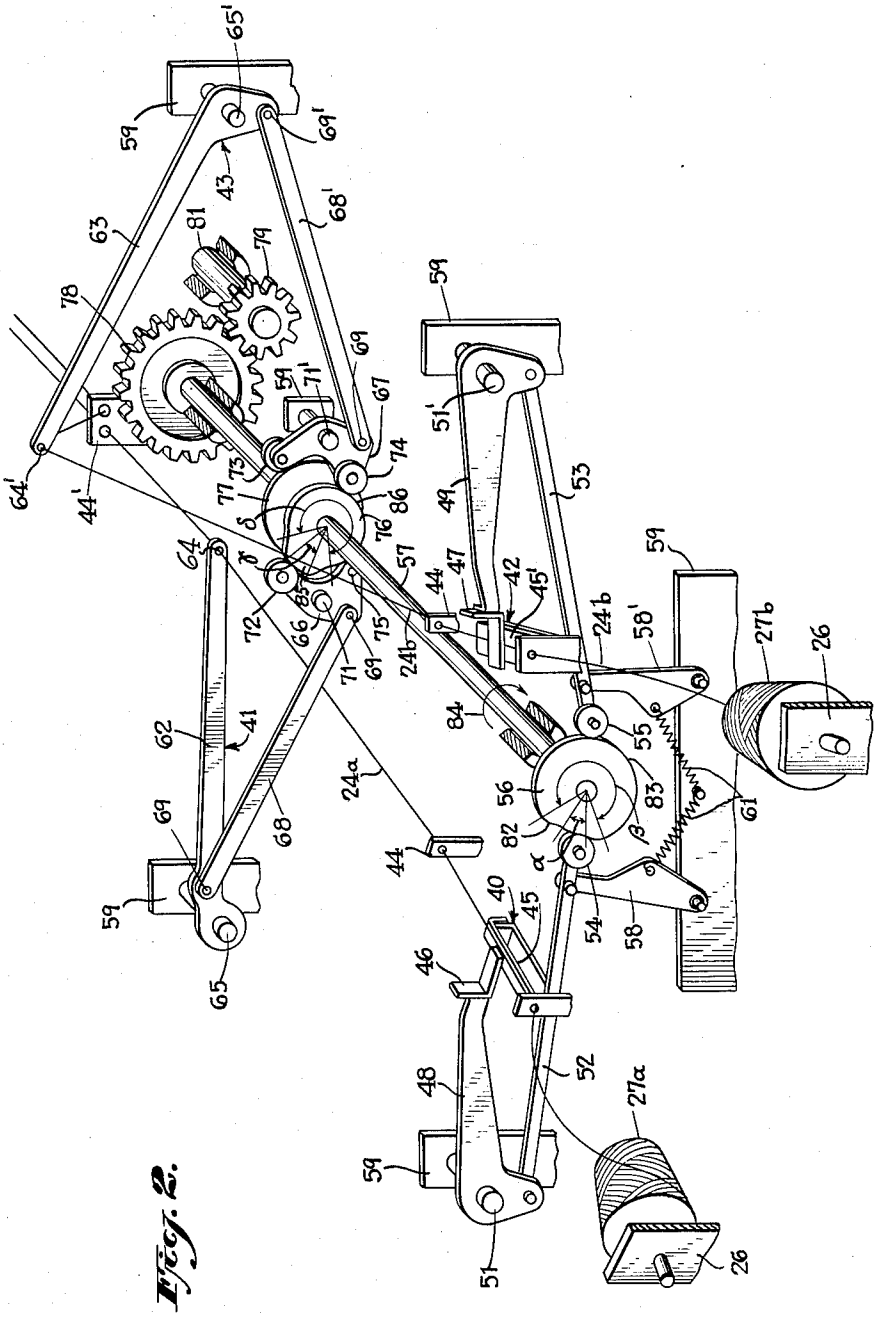


Fig. 2.

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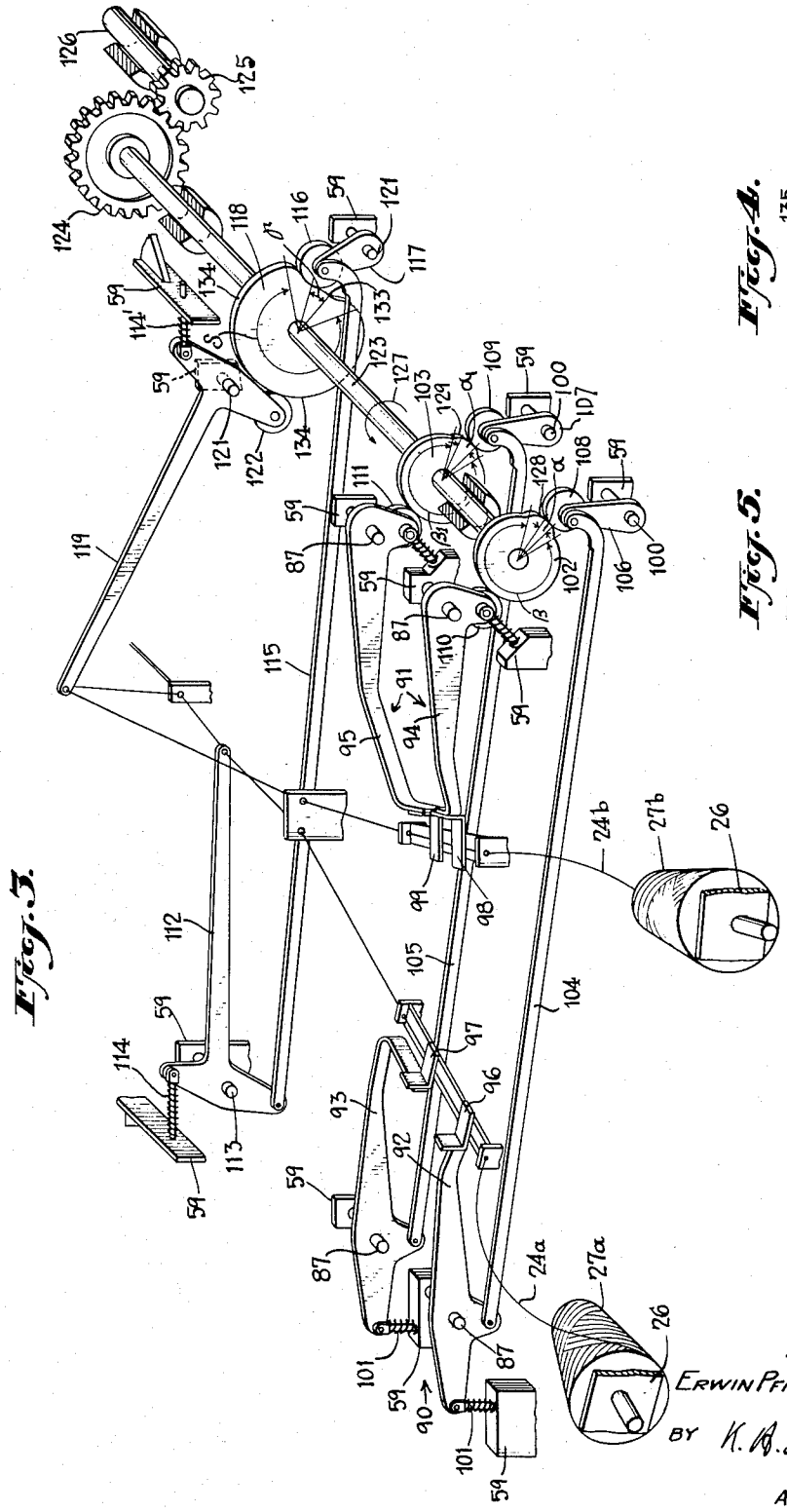


Fig. 3.

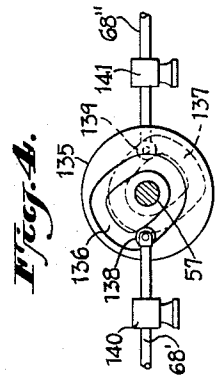


Fig. 4.

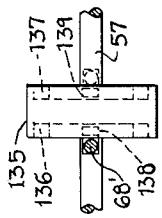


Fig. 5.

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2,749,946

WEFT THREAD CONTROL IN LOOMS FOR WEAVING

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Claims priority, application Switzerland April 23, 1954

9 Claims. (Cl. 139—126)

The present invention relates to a loom for weaving in which at least two weft threads are cyclically inserted, the threads being pulled from separate spools which are positioned outside the shuttle, and separate devices for tensioning and braking being provided for each weft thread.

An object of the invention resides in the provision in a loom as specified in the preceding paragraph of a driving element which is common to all braking devices and a driving element common to all thread tensioning devices, each driving element being provided with a cam surface engaging actuating means which are placed around the element and which actuate the respective devices. The actuating means are preferably disposed at equal angles around the driving elements.

The novel features which are considered characteristic of the invention are set forth with particularity in the appended claims. The invention itself however and additional objects and advantages thereof will best be understood from the following description of embodiments thereof when read in conjunction with the accompanying drawing, in which

Fig. 1 illustrates a gripper shuttle loom having shuttles moving in a circuit, the loom being viewed from the fabric beam end;

Fig. 2 is a diagrammatic perspective illustration of separate thread brake and thread tensioning mechanisms for each weft thread, the thread tensioning mechanisms having a common drive positively actuating the tensioning mechanisms during the thread tensioning as well as during the thread slackening movement;

Fig. 3 is a diagrammatic perspective illustration of a double brake device and a modified thread tensioning device for each of two different weft threads having a common drive positively actuating the tensioning mechanisms during the tensioning movement;

Fig. 4 is a front view of a detail of a thread tensioning mechanism according to the invention;

Fig. 5 is a side view of the detail shown in Fig. 4.

The same numerals designate the same parts in all figures.

Referring more particularly to Fig. 1 of the drawing, the drive of the loom includes a motor **11** which is mounted on a right side shield **12** and which drives a belt pulley **14** by means of a belt **13**. A disc clutch mounted on the pulley **14** and not shown drives the main shaft **15** of the loom. The shaft **15** primarily drives the parts of the loom which must be moved permanently or intermittently during normal operation of the loom. The shaft **15** actuates the warp beam **16** and the warp **17** which moves through the heddles supported by one or a plurality of frames **18**, the latter being actuated by the shaft **15** for opening, closing, and changing of the shed. The shaft **15** also actuates the warp actuating beam **19** and the cloth beam **20** for winding the cloth **21**.

A picking mechanism **22** and a shuttle receiving mechanism **23** are also driven by the shaft **15** by means of

intermediate drives. A weft thread **24** is transferred to a shuttle **25** in the picking mechanism **22**. The weft thread is pulled from a spool **27** supported by a carrier **26** outside the shuttle **25** and is picked by the shuttle **25** through the shed towards the receiving mechanism **23**, whereupon the weft thread **24** is beaten up by means of a lay **28** including a reed **29** actuated by the shaft **15**.

The shuttle **25**, after the weft thread **24** has been disengaged therefrom, is moved onto a return mechanism **30** by suitable means in the receiving mechanism **23**. The return mechanism, driven by the main shaft **15**, returns the idle shuttle **25** below the shed from the receiving mechanism to the picking mechanism.

A drive **32** for a frabric control beam **19** is mounted on a left side shield **12***a* which is connected with the right side shield **12** by means of a box girder **31** to form a rigid frame for the weaving machine.

Control levers **33** and control shaft **34** afford actuation of the above mentioned clutch by means of a linkage **35** and of a brake disk by means of a linkage **36** for effecting starting and stopping of the loom from both sides of the loom. The brake, which is in a housing **37** and mounted on the main shaft **15**, is applied at improper opearting conditions after disengagement of the disk clutch in the belt pulley **14** for immediately stopping the main shaft **15** and all parts driven thereby. The brake in the housing **37** is disengaged in known manner by means of a control lever **33** without engaging the clutch in the disc **14**. Thereupon the disconnected main shaft **15** can be turned by means of a handwheel **38**, for example for setting certain loom parts to assume a desired position relatively to zero position.

In the mechanism which is diagrammatically illustrated in Fig. 2, the weft threads **24***a* and **24***b* are pulled from spools **27***a* and **27***b*, respectively, a brake device and a thread tensioning device **41** being provided for the weft thread **24***a*, and a brake **42** and thread tensioner **43** being provided for the weft thread **24***b*. Both weft threads are guided by stationary thread guides **44** and **44'** and are attached, by a conventional thread transfer device, to a weft thread insertion element, for example a shuttle, not shown. The thread brakes **40** and **42** have yielding brake bands **45** and **45'**, respectively, which cooperate with the brake shoes **46** and **47**, respectively, which are mounted on levers **48** and **49**, respectively, swinging on axles **51** and **51'**, respectively. Rods **52** and **53** are pivoted to the levers **48** and **49**, respectively, the rods carrying cam follower rollers **54** and **55**, respectively, engaging a cam **56** mounted on a shaft **57**. The rods **52** and **53** are supported near the rollers by links **58** and **58'**, which are pivoted to a frame **59** which is mounted on the side shield **12***a*. Tension springs **61** pull the links **58** and **58'** in a direction ensuring engagement of the rollers **54** and **55** with the cam **56**.

The thread tensioning devices **41** and **43** include tensioning levers **62** and **63**, respectively, having eyes **64** and **64'**, respectively, for the weft threads, the levers swinging on stationary axles **65** and **65'**, respectively. The levers **62** and **63** are connected with roller levers **66** and **67**, respectively, by means of connecting rods **68**, **68'** and pins **69**, **69'**, respectively. The roller levers **66** and **67** swing on axles **71** and **71'**, respectively, which are fast on the frame **59**. The lever **66** carries rollers **72** and **75** and the lever **67** carries rollers **73** and **74**, rollers **72** and **74** engaging a cam **76**, and rollers **73** and **75** engaging a cam **77**. The cams **76** and **77** are mounted on the shaft **57** which also carries a gear wheel **78** which is driven by a pinion **79** mounted on a shaft **81**.

The device operates as follows:

The shaft **81** is driven by the main shaft **15** of the loom (Fig. 1), by means not shown, shaft **81** rotating at the

same speed as shaft 15. The gears 78, 79 effect a speed reduction of 1:2, so that the shaft 57 rotates half as fast as shaft 81.

In the position of the parts of the mechanism as shown in Fig. 2, the weft thread 24*a* is connected with a shuttle which has been picked and moves through the shed for insertion of the thread 24*a*. The brake 40 is disengaged since the roller 54 engages the portion 82 of the cam 56. The lever 48 is therefore lifted and the brake shoe 46 removed from the brake band 45 affording free passage of the thread 24*a* through the brake 40.

The cam portion 83 engaging the roller 55 has a greater radius than the cam portion 82. Therefore, the lever 49 is pressed into braking position. The brake shoe 47 assumes a position which is defined by the cam portion 83 and in which the brake band 45′ is downwardly deflected to a predetermined extent, defining the brake pressure. The brake bands 45, 45′ are either held at both ends, so that the brake pressure is the result of the tension forces produced in the band by its deflection, or one end of the bands is held stationary, the other end being yieldingly held by means of a spring, a weight, or the like. The force of the spring is equal to the tension force in the brake band and produces a braking force upon deflection of the band.

The tensioning lever 62 is lowered into a position in which its eye 64 is in line with the thread guides 44 and 44′, so that the thread 24*a* passes through the tensioning device 41 without deflection and resistance.

The shaft 57 rotates in the direction of the arrow 84 through an angle of 180° between two weft insertions. The cam portion 82 moves only through a small angle α, because, if the shuttle 25 has moved through the shed and enters the shuttle receiving station 23, the roller 54 must move from the portion 82 to the cam portion 83. The brake shoe 46 is thereby brought into position for braking the thread 24*a*. The roller 55 remains on the cam portion 83 because the portion 83 extends through an angle β which is considerably greater than 180°.

The tensioning lever 62 is in its lower position during the short time during which the roller 72 engages the cam portion 85, extending through the small angle γ. The cam portion 86 which has a smaller radius than the portion 85 extends through an angle δ which is considerably greater than 180°.

The roller 75 on the lever 66 engages the cam 77 which is formed as a counterpart of the cam 76. Therefore, the movement of the lever 66 and of the tensioning lever 62 is positively controlled in both directions which has the advantage that the movement of the eye 64 is definitely guided by the cams 85 and 86 during the upstroke as well as during the downstroke. The transition from the cam portion 85 to the cam portion 86 and from portion 86 to portion 85 may be shaped differently, if it is desired that the lefting speed of lever 62 be different from the lowering speed.

In the position of the mechanism shown in Fig. 2, the weft thread 24*b* is at rest and is held by a thread transfer device, not shown. The thread 24*b* is braked by the lowered brake shoe 47 and is lifted to its highest position by the lifted tensioning lever 63, so that the thread 24*b* is pulled back from the shed into the thread transfer position and the thread portion between the brake 42 and the thread transfer device is held ready for the following pick.

The threads 24*a* and 24*b* are alternately inserted into the shed. The thread 24*b* is at rest, for example during one-half revolution of the shaft 57. During the other half revolution of the shaft 57, the thread 24*a* is at rest, the brake 40 being in braking position and the tensioning lever 62 being in lifted position.

The rollers 54 and 55 are in diametrically opposed position, i. e. they are 180° apart. The rollers 72 and 74 which engage the cam 76, and the rollers 73 and 75 are also 180° apart.

Instead of a pair of cams 76, 77 a barrel shaped member 135 (Figs. 4 and 5) may be provided, having cam grooves 136 and 137 at its end surfaces for receiving cam follower rollers 138 and 139, respectively. The rollers 138 and 139 are mounted on the ends of rods 68′ and 68″, respectively, which are guided for longitudinal reciprocating movement in bearings 140 and 141, respectively.

In the modification shown in Fig. 3, each of the brake devices 90 and 91 includes two levers 92, 93 and 94, 95, respectively, to whose free ends brake shoes 96, 97, 98, 99, respectively, are connected. The levers 92 to 95 swing on stationary pins 87 which are supported by a frame 59, a spring 101 being provided for each lever for pressing the brake shoe ends of the levers as far down against the respective brake bands as is afforded by cams 102 and 103 cooperating with rollers 108 and 109, respectively, at the ends of rods 104 and 105, which are pivoted to levers 92 and 93, respectively; the cams 102 and 103 also cooperate with rollers 110 and 111, respectively, on the brake shoe levers 94 and 95, respectively. The ends of the rods 104 and 105 carrying the rollers 108 and 109 are supported by arms 106 and 107, respectively, extending from shafts 100 which are supported by the frame 59.

A thread tensioning lever 112 swings on an axle 113 and has three arms. A spring 114 having a stationary end resting against the frame 59 presses against the uppermost of the three arms for pressing the lever 112 as far down as is afforded by the position of a roller 116 which engages a cam 118 and which is mounted on one end of a rod 115 whose other end is pivoted to the lowermost of the three arms of lever 112. The end of lever 115 which carries the roller 116 is supported by an arm 117 swinging on an axle 121 supported by the frame 59.

The thread tensioning lever 119 also has three arms and swings on a stationary axle 121 supported by the frame 59. The lowermost of the three arms of the lever 119 carries a roller 122 which engages the cam 118 and is diametrically opposite the roller 116. The uppermost of the three arms of the lever 119 is connected with one end of a compression spring 114′ whose other end rests against the frame 59, the spring tending to press the lever 119 downward. The cams 102, 103, and 118 are mounted on a shaft 123 to which a gear wheel 124 is keyed, the gear wheel meshing with a pinion 125 on a shaft 126 which is driven by and at the same speed as the main loom shaft 15 (Fig. 1), by means not shown. The pinion 125 has half as many teeth as the gear wheel 124, and the shaft 123 rotates at half the speed of shaft 126 in the direction of the arrow 127.

The operation of the mechanism shown in Fig. 3 is similar to that shown in Fig. 2. In the position shown in Fig. 3 the rollers 108 and 109 engage the cam portions 128 and 129, respectively, which portions extend through angles α and α_1, respectively, causing the brake shoes 96 and 97 to be lifted from the thread 27*a*, so that the latter moves freely through the brake 90.

The tensioning lever 112 is in its lower position when the roller 116 runs on the cam portion 133 which extends through an angle γ, the weft thread 24*a* being inserted into the shed.

The weft thread 24*b* is at rest and held by the brake 91 whose shoes 98 and 99 press against the yielding brake band, the cut-off end of the thread being moved by a thread carrier, not shown, into thread transfer position. The tensioning lever is in its uppermost position, the roller 122 engaging the cam portion 134 which extends through an angle δ.

The difference between the mechanisms according to Figs. 2 and 3 consists in that in Fig. 3 the brake levers 94, 95 and the weft thread tensioning lever 119 are provided with cam follower rollers, whereas in Fig. 2 in-

termediate rods are provided. There are therefore less joints in Fig. 3, and the cams **102, 103, 118** can be arranged on the side of the mechanism instead of in the middle, as is required by the arrangement according to Fig. 2. This has the advantage that the cams can easily be interchanged and different cams can be used for different thread materials.

The angle α is smaller than the angle α_1, so that the brake shoe **96** is lowered first for braking the thread **24***a*. After the roller **109** has run on the cam portion **129** having the greater angle α_1, the shoe **97** is also lowered, increasing the brake effect on the thread **24***a*. This is necessary if the thread must be pulled back from the shed by lifting the lever **112**.

The cam follower rollers may be spaced equally around the driving cams, i. e., two cam follower elements are spaced 180°, and three follower elements are spaced 120°. The follower means may also be spaced irregularly around the driving means, for example, if different threads are used which require different brake periods or if one thread must be braked earlier than another.

If the tensioning element of a thread tensioning device is positively driven only in one direction and is actuated in the other direction, for example, by a spring, the tensioning element may be positively driven for tensioning a weft thread, if, for example, the stroke of the element is greater than the length of thread to be pulled back, and a certain weft thread length must be pulled through the brake to make a certain thread length available for the pick. A spring-actuated tensioning lever may move too slowly in a high-speed loom and may stay behind and not complete the required stroke.

If, for performing a great number of picks per minute, the tensioning lever must be lowered very quickly in order to coordinate its speed to that of the shuttle, a positive drive of the tensioning element is preferred, because actuation by means of a spring would call for a very strong spring requiring considerable power for tensioning the spring during the opposite stroke.

The reduction of the speed of the driving cams relatively to that of the main shaft of the loom corresponds to the number of brakes and tensioning devices in the mechanism.

By providing a suitable configuration of the cams, not only can the sequence or the cycle of the weft threads be controlled, for example, to follow the pattern *ab, ab,* but any desired cycle of two or more weft threads may be performed, for example, according to the pattern *abbaab, abbaab* which is continuously repeated.

While specific embodiments of the invention have been shown and described, it will be apparent to those skilled in the art that various changes, modifications, substitutions, additions and omissions may be made therein without departing from the spirit and scope of the invention as set forth in the appended claims.

What is claimed is:

1. A loom for weaving comprising means for cyclically inserting at least two different weft threads which are pulled from spools arranged outside the shuttle, a thread tensioning and a thread braking device for each weft thread, a driving element common to said tensioning devices, a driving element common to said braking devices, each of said elements including a cam surface, an actuating means for each of said devices, each actuating means including a cam follower means, said cam follower means of the actuating means for said tensioning devices being placed around one of said elements and engaging the cam surface thereof, and said cam follower means of the actuating means for said braking devices being placed around another of said elements and engaging the cam surface thereof the actuating means of each tensioning device including an operating member adapted to impart the thread tensioning as well as the thread slackening stroke to the device, said operating members being positively driven by their respective driving element for imparting the thread tensioning as well as the thread slackening stroke.

2. A loom for weaving as defined in claim 1, said cam follower means being spaced at equal angles around their respective driving elements.

3. A loom for weaving as defined in claim 1, said driving elements being in the form of cam discs having circumferential cams and said cam follower means being in the form of rollers.

4. A loom for weaving as defined in claim 1, said driving elements being in the form of rotund members having axial surfaces and cam grooves in said surfaces, and said cam follower means being in the form of rollers.

5. A loom for weaving as defined in claim 1, said thread tensioning device being adapted to perform a thread tensioning and a thread slackening stroke, each of said driving elements for said thread tensioning devices including two individual cam surfaces, and the actuating means for each thread tensioning device including two cam follower means individually engaging said last mentioned cam surfaces for positively driving said actuating means during the thread tensioning as well as during the thread slackening stroke.

6. A loom for weaving as defined in claim 1, each of said actuating means including a lever and a swing axle therefor, each of said driving elements rotating on a rotation axis, said swing axles and said rotation axis for said tensioning devices being parallel and the swing axles and the rotation axis for said braking devices being also parallel.

7. A loom for weaving as defined in claim 1, each of said actuating means including a lever, and said cam follower means being in the form of rollers individually supported by said levers.

8. A loom for weaving as defined in claim 1, including a shaft for said driving elements, a shaft connected and driven by the loom drive, and a speed reduction gear interposed between said shafts.

9. A loom for weaving comprising means for cyclically inserting at least two different weft threads which are pulled from spools arranged outside the shuttle, a thread tensioning and a thread braking device for each weft thread, a driving shaft common to said thread tensioning and braking devices, a pair of cams fixed to said shaft, a pair of cam followers for actuating each of said weft thread tensioning devices, one cam follower of each of said pair of followers engaging one of said pair of cams and the other cam follower engaging the other of said pair of cams and a third cam fixed to said shaft for actuating the braking device for each weft thread.

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