

Aug. 10, 1937.

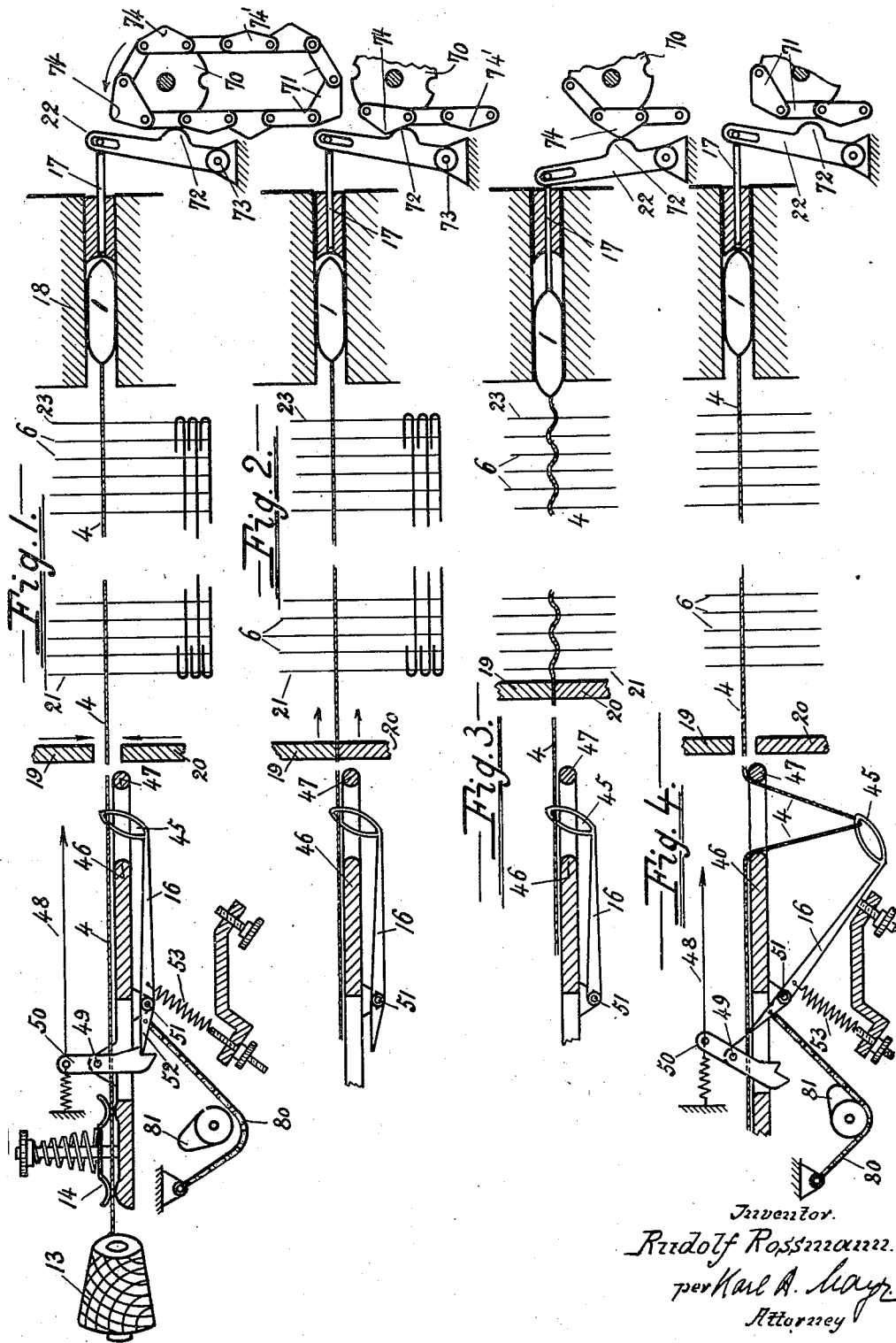
R. ROSSMANN

2,089,620

APPARATUS FOR CONTROLLING THREAD TENSION IN LOOMS FOR WEAVING

Filed Jan. 10, 1935

3 Sheets-Sheet 1



Inventor.
Rudolf Rossmann.
per Karl A. Mayr
Attorney

Aug. 10, 1937.

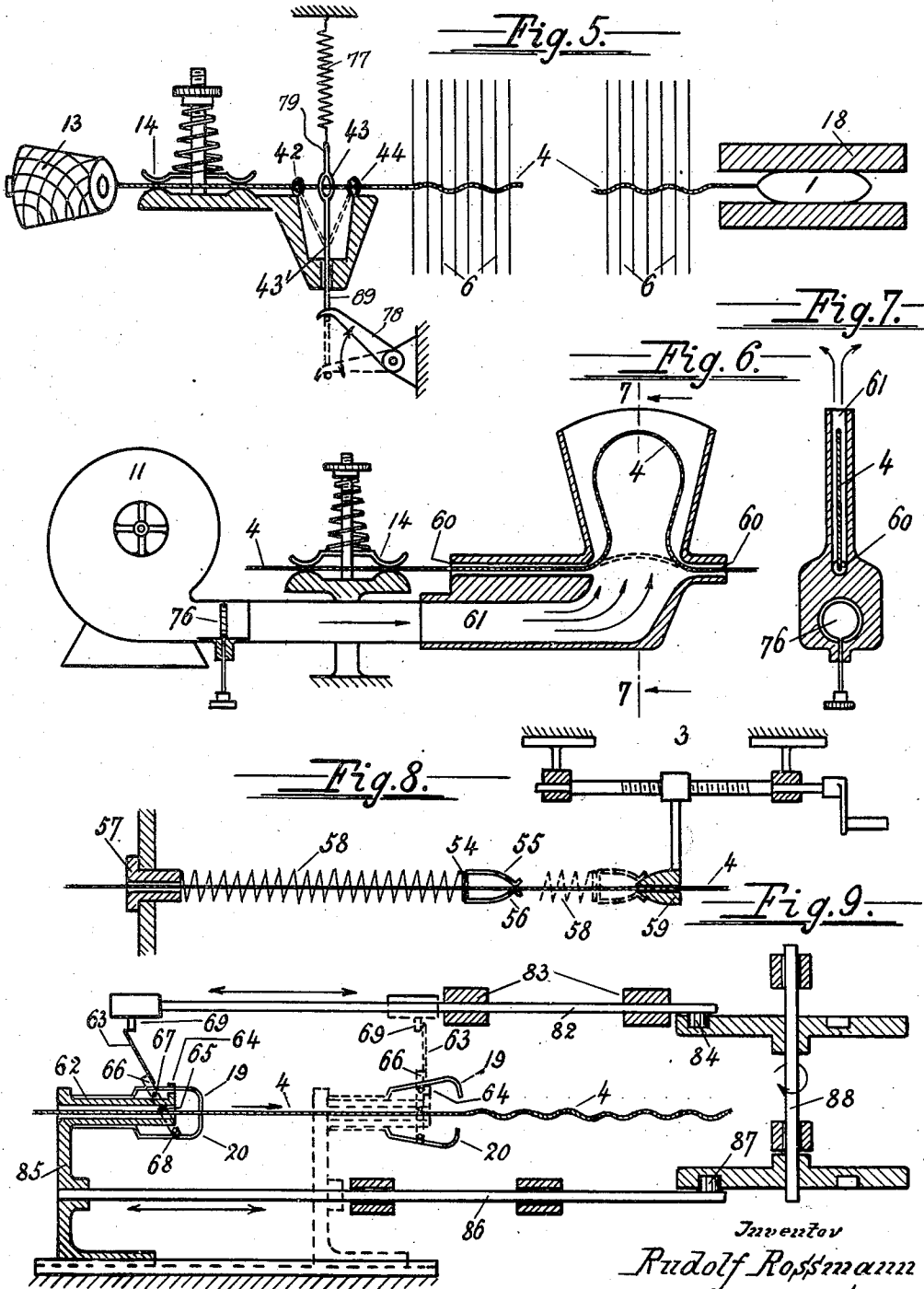
R. ROSSMANN

2,089,620

APPARATUS FOR CONTROLLING THREAD TENSION IN LOOMS FOR WEAVING

Filed Jan. 10, 1935

3 Sheets-Sheet 2



Inventor
Rudolf Rossmann
per Karl A. Mayr
Attorney.

Aug. 10, 1937.

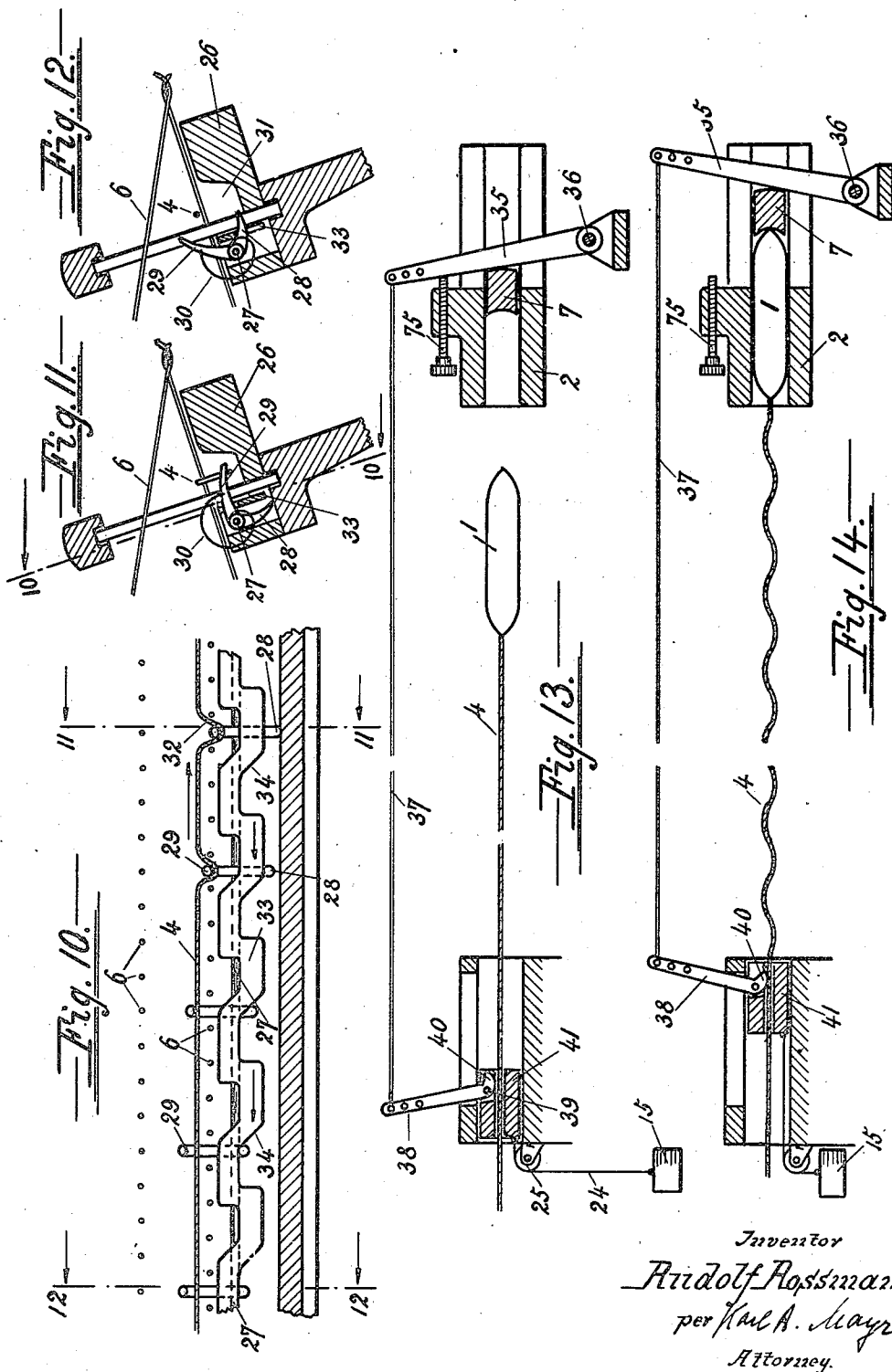
R. ROSSMANN

2,089,620

APPARATUS FOR CONTROLLING THREAD TENSION IN LOOMS FOR WEAVING

Filed Jan. 10, 1935

3 Sheets-Sheet 3



Inventor
Rudolf Rossmann
per *Karl A. Mayr*
Attorney.

UNITED STATES PATENT OFFICE

2,089,620

APPARATUS FOR CONTROLLING THREAD
TENSION IN LOOMS FOR WEAVINGRudolf Rossmann, Winterthur, Switzerland, as-
signor to Tefag Textil-Finanz A. G., Zurich,
SwitzerlandApplication January 10, 1935, Serial No. 1,166
In Switzerland January 17, 1934

8 Claims. (Cl. 139—194)

This invention relates to a method and apparatus for controlling the tension of the weft thread in looms, particularly in looms having gripper shuttles.

In looms operating with gripper shuttles, the conditions of and around the weft thread are different from the conditions in looms operating with shuttles carrying the supply of thread themselves. In the latter case, the weft thread which has left the shuttle rests stationary within the shed, whereas, in the former case, the weft thread flies with considerable speed, namely, practically the same speed as the shuttle has, through the shed. The thread, particularly if heavy and/or stiff material is used, constitutes considerable mass and accumulates great inertia during the weft so that "the thread runs after the shuttle" and too much thread is supplied so that means must be provided to remove the excessive amount from the shed. The mass action of the thread is augmented by the air surrounding the weft thread and which develops a considerable air current during and right after the flight of the shuttle and weft thread through the shed. Further, in looms having gripper shuttles, the weft thread runs off comparatively large bobbins also constituting great mass and inertia. If stiff and/or heavy thread material is used, too much thread may be fed into the shed at certain moments, in other cases great resistance must be overcome in order to pull the thread off the supply bobbins. It is an object of the present invention to provide methods and apparatus which eliminate all disadvantages which are caused by the before stated conditions.

An object of the present invention resides in the provision of a loom for weaving in which the tension of the weft threads is positively controlled, and the shrinkage and character of the fabric can be predetermined by controlling the tension of the individual weft threads.

In looms having gripper shuttles, the tension of the weft threads which are pulled through the warp, sometimes against considerable frictional resistance, is often much greater than in looms in which the weft thread runs off the shuttles. In such cases, gripper shuttles could hitherto only be used for producing fabrics which permit great tension of the weft threads. The present invention has for its object to provide weft thread tension control means by which the tension of the weft threads can be positively adjusted, and any type of fabric can be woven in looms of the gripper shuttle type.

An object of the present invention is the pro-

vision of an apparatus by means of which the length of the weft threads in looms for weaving can be controlled either during or after the weft, i. e., the weft thread is shortened or lengthened during or after the passage of the gripper shuttle through the warp.

Another object of the present invention is to provide an apparatus which assures the lengthening of the weft threads during and after the weft to such an extent that shrinkage of the produced fabric is eliminated.

A further object of this invention is the provision of a control apparatus for adjusting the tension of the weft threads in looms for weaving, whereby the provision of special fabric stretchers is rendered unnecessary or only a gentle pull is sufficient for stretching the fabric to maintain the desired width.

Another object of the present invention is to provide a method and apparatus for adjusting the tension of the weft threads in looms for weaving, whereby a particularly tight fabric can be obtained without increasing the impact of the lay whereby, on the contrary, this impact may be reduced, and the warp threads suffer much less, and breaking of warp threads is substantially reduced.

A further object of my invention resides in the provision of a method and apparatus for controlling the tension of the weft threads in looms for weaving, whereby an adjustable amount of brake action is applied to the weft threads which prevents undesired curling when using much twisted or crape threads and permits faultless weaving of such threads.

Other objects of the present invention will be apparent from the following broad outline of the method and apparatus according to the present invention and will be set forth in the claims and the description relating to the drawings which, by way of illustration, show what I now consider to be preferred embodiments of my invention.

In many cases, it is sufficient if the weft thread is lengthened only on one side of the fabric after the pick is completed. If the thread is elastic, the elongation is instantly distributed over the whole width of the fabric. According to the invention, the shuttle may be allowed to travel beyond the edge of the fabric after it has passed through the warp and then be moved back towards the fabric. In such manner, weft threads are used which are longer by the distance which the shuttle has traveled beyond the warp. In looms having gripper shuttles and thread feeders for feeding the thread to the shuttles, addi-

tional weft thread may also be supplied by said feeders after the pick, for example, by associating an adjustable gripper with the feeder and closing it at some distance from the fabric edge, whereby the gripper grips the thread and carries the feeder towards the fabric and then releases the thread, thus feeding additional thread into the shed. The length of the additional supply of thread is then determined by the distance of the point where the gripper engages the thread from the edge of the fabric. Obviously, a special gripper may be used and operated independently of the thread feeder.

The before described means can be applied to both sides of the fabric. The motion of the gripper located at that side from which the thread is fed into the fabric may be started just at the moment when the weft thread is still moving due to its own inertia, whereby the additional supply of thread is equally distributed over the whole width of the fabric, also when using thread material which is not elastic. This distribution will hereafter be fully equalized by the impact of the lay and by the pressure of the warp threads so that homogeneous texture is obtained having only very little or no shrinkage at all.

When making fabrics in which the weft threads are under great tension, it has been found that the weft thread sustains greater tension when stretched after the pick than when applying great tension during the pick. According to the present invention, for such cases a special weft thread stretcher is provided outside of the shed which may be operated by an adjustable spring and which applies a predetermined tension to each weft thread after the pick. This method is particularly advantageous when the weft bobbins do not operate absolutely equally so that the weft threads may run off more easily at certain times and less easily at other times. In such cases and without applying the present invention, the edge of the fabric has an arched configuration. Such faults in the fabric are completely eliminated if the tension of all the weft threads is equalized by the before mentioned weft thread stretcher. The effect of supplying additional weft thread and weft tension may also be combined which is of particular advantage in most cases. The weft threads are first brought to equal tension after the pick in order to eliminate loops and loosening, and then supplementary thread material of predetermined length is added so that all weft threads have the same length and tension.

In the drawings:

Fig. 1 is a diagrammatic part cross sectional view of a mechanism for maintaining the weft thread under a predetermined tension during the pick, slackening and/or stretching the weft thread after the pick.

Fig. 2 is a diagrammatic view of part of the mechanism illustrated in Fig. 1, however, in another phase of operation.

Fig. 3 shows another phase of operation of the mechanism illustrated in Figs. 1 and 2.

Fig. 4 is a diagrammatic showing of the mechanism shown in Figs. 1 to 3, however, in still another phase of operation.

Fig. 5 is a modification of a detail of the mechanism shown in Figs. 1 to 4.

Fig. 6 is a diagrammatic longitudinal cross sectional view of a pneumatic thread stretcher according to my invention.

Fig. 7 is a diagrammatic transverse sectional

view of the thread stretcher shown in Fig. 6 and taken along line 7—7 of Fig. 6.

Fig. 8 is a diagrammatic showing of a mechanical thread stretcher according to my invention.

Fig. 9 is a diagrammatic showing of a thread gripper mechanism for feeding additional thread or stretching the thread.

Fig. 10 is a diagrammatic showing of a comb type weft thread stretcher according to my invention.

Fig. 11 and Fig. 12 are diagrammatic cross sectional views of a lay equipped with a thread stretcher according to Fig. 10 and showing the stretcher in two different phases of operation.

Fig. 13 diagrammatically shows a mechanism for feeding in additional weft thread after the pick, the figure showing the individual parts in the position during the pick.

Fig. 14 shows the same mechanism as illustrated in Fig. 13, the movable parts being in the position after the pick.

Referring more particularly to Figs. 1 to 4 of the drawings, the weft thread 4 is pulled from bobbin 13 during the pick of shuttle 1. Picking means are not shown as these are not part of the present invention. The weft thread passes through the disc brake 14 which makes the tension of the thread substantially independent of the running off conditions of the thread off bobbin 13. Thereafter it passes the loop 45 of the stretching device 16. 6 indicates the warp threads forming the shed. After the shuttle has arrived at the shuttle receiving box 18 and is held therein by braking means which are not illustrated, the weft thread lays in the shed under equal tension which is substantially due to brake 14. By adjustment of the latter, the tension of the thread during the pick can be predetermined.

After the pick, the apparatus is in the position illustrated by Fig. 1. Right after the pick, jaws 19 and 20 are closed as shown in Fig. 2 and moved towards edge 21 of the fabric into the position shown in Fig. 3. A mechanism which may be used for accomplishing this is shown separately in Fig. 9 and will be described later. On the other side of the fabric, shuttle 1 is pushed towards the fabric edge 23 by means of pusher 22 (Fig. 3). This causes a slackening of the weft thread 4 which can be exactly adjusted by suitable determination of the distance over which jaws 19—20 and shuttle 1 are moved towards the center of the fabric. For smaller fabrics or fabrics of certain character, only the mechanism on one side may be used for slackening, or the jaw moving mechanism and the shuttle moving mechanism may be used alternately or operated according to a certain predetermined program.

The mechanism for pushing back the shuttle in order to slacken the weft threads consists of lever 22, the free end of which engages the pusher rod 17. The lever is fulcrumed at 73 and has a projecting part 72. The latter may be engaged by the projecting parts 74 with which some of the chain links 71 are provided. The chain hangs on chain wheel 70 which is connected to and driven by the driving mechanism of the loom. This connection is not shown as it is not part of the present invention. Whenever a link having a projection 74 comes into contact with nose 72 of lever 22, this is turned counter-clockwise and pushes rod 17 against shuttle 1, whereby the shuttle is moved towards

the fabric edge 23 and the weft thread slackened. The projections of some links may be smaller—74—and other links may not have any projections at all. The slackening of the weft thread is in proportion to the stroke of rod 17 which depends on and can be predetermined by the configuration of links 71. By these means, various characters of fabric can be obtained. For example, a certain part of the weft threads are slackened and produce crimping and craping, whereas others are stretched producing repp. By proper combination of these various characters of weaving within the same fabric, a great amount of varieties of patterns can be obtained.

Additional tension may be applied to the weft thread during or after the pick by the means shown adjacent to the disc brake 14. As before said, the weft thread passes through the eye 45 of the double lever 16/52 which is revolvable around pivot 51. Eye 45 extends into an opening of the loom structure having rounded rims 46 and 47. At a suitable moment, latch 50, which is revolvable around pivot 49 and holds the double lever against spring 53 in a position in which eye 45 extends into the opening, is turned clockwise by means 48 which are not shown in detail and frees double lever 16/52. Eye 45 then snaps downwards taking the weft thread with it and pulling the weft thread into a loop 46—45—47. By proper adjustment of spring 53, the extent of movement of lever 16/52, the size of the loop and the tension of the weft thread can be predetermined. Disc brake 14 takes care that no undesired thread is pulled off the bobbin 13. It is obvious that the jaws 19 and 20 must be open during this action of the thread tensioner 16/52. The double lever is pulled back into starting position by means of chain 80 which is periodically operated by cam 81. This cam is rotatably connected to and operated by the loom driving mechanism. This connection is not shown because it is not part of the present invention.

The just described thread tensioner may also be operated to act as thread slackener and to allow a predetermined additional length of weft thread to pass into the shed. For this purpose, lever 16 and eye 45 are normally in the position shown in Fig. 4. At the moment when an additional supply of weft thread is desirable, the lever is moved counter-clockwise by the means 80 and 81.

Fig. 5 shows a modification of the weft thread control described in the foregoing paragraphs. The thread passes through the three eyes 42, 43 and 44. The eye in the middle—43—is provided with an upward extension 79 which is connected with one end of spring 77, the other end of which is fixed to a stationary part of the loom. Eye 43 also has a downward extension 89 which cooperates with lever 78 which is pivoted to a stationary part of the loom. Lever 78 may be connected to and operated by a moving part of the loom. Such a connection has not been shown as it is not part of the present invention. Eye 43 can be moved downwards against the tension of spring 77 by turning lever 78 in counter-clockwise direction so that the thread is pulled into the loop 42, 43', 44 shown by dotted lines.

Figs. 6 and 7 show a weft thread tensioner operated by a current of air produced by blower 11 and controlled by valve 76. The channel 60 for the weft thread 4 is crossed by the air channel 61, the end of which is flattened as is obvious from Fig. 7. During the pick, the air current

continuously maintains a tension in the weft thread which then forms a small loop as indicated by dotted lines in Fig. 6. As soon as the shuttle is stopped, the weft thread is blown into a larger loop and tension maintained on the thread which would otherwise be loose within the shed and possibly curl due to its own inertia. By adjustment of the air supply to channel 61, the tension of the thread can also be adjusted. This is done by providing valve 76 in duct 61. 10

Fig. 8 shows a mechanical means for maintaining an adjustable tension on the weft thread during the whole pick. It consists substantially of resilient jaw members 55 and 56 mounted on ring 54 and forming a clamp which holds the weft thread 4 and is taken with the thread during the weft; thereby spring 58, which is coiled around thread 4 and connected with one end to ring 54 and with the other end to eye 57 which is mounted to the loom structure and stationary, is elongated and maintains tension on the thread 4. The extent of elongation of the coil spring is limited and thereby the tension applied to the thread is controlled by the stop member 59 which has the shape of an eye through which the weft thread runs and is provided with conical external surfaces facing jaws 55—56. When these jaws, pulled by the weft thread, run against the conical part of stop member 59, the jaws are opened and thread 4 is freed. Thereupon spring 58 pulls back jaws 55—56 which then close again on the weft thread. Stop member 59 is connected to a mechanism 3 which permits its movement in the direction of the weft thread. Thereby the amount of tension applied to the thread can be adjusted. 35

Fig. 9 shows in detail the clamps 19 and 20 already mentioned in connection with the description of Figs. 1 to 4 and, in a schematic manner, a mechanism which may be used for their operation. Clamp holder 62 which may be identical with the thread giver as described in my copending application Ser. No. 736,117 or independent thereof has a longitudinal bore for freely accommodating weft thread 4 and carries the resilient jaw members 19 and 20 which are normally in closed position. The jaw members can be spread apart by means of the latch 66 revolvable around pin 65 and having projections 67 and 68 for engagement with jaw members 19 and 20. As long as latch 66 is in the position shown in solid lines, i. e., inclined to the direction of the thread, the jaws are closed. If it is turned clockwise so that it stands perpendicular to the thread, the jaws are spread apart and the thread is free. This clockwise movement is effected whenever one side of abutment 69 runs against the plate spring 63 attached to the end of latch 66. The jaws close when spring 63 engages the other side of abutment 69. Spring 63 flexes and passes underneath abutment 69 when member 62 moves to the right. At this movement, it pushes thread 4 to the right with the jaws closed feeding additional weft thread to the shed and slackening the thread. Abutment 69 is then also moved to the right and follows member 62 until it touches spring 63 and turns latch 66 clockwise, thereby spreading the jaws apart and freeing the thread. Now member 62 can be moved to the left. While spring 63 passes abutment 69 underneath, a further clockwise movement of latch 66 is prevented by nose 64 projecting from member 62. 65

The mechanism for producing the reciprocating movement of abutment 69 consists of rod 82 mov- 75

ing in bearings 83 and operated by the groove cam 84. In a similar manner, part 62 which is supported by the slide member 85 is driven by a rod 86 which is operated by the groove cam 87. Cams 84 and 87 which are of different configuration may both be connected to a common shaft 88 which is driven by the loom driving mechanism. The latter is not shown as it is not subject matter of the present invention. It is obvious that, by suitably designing and operating cams 84 and 87, the apparatus can be used not only for slackening the weft threads but also for stretching the weft threads. In this case, jaws 19 and 20 are closed when they are farthest to the right and then pull the thread to the left and thereby stretch the weft thread.

Figs. 10 to 12 show a mechanism for progressively applying additional weft thread. 6 are the warp threads in section. 4 is the weft thread. After the weft, arm 29 of a plurality of bellcrank levers 28—29 engages the weft thread and pulls it downwards in between two adjacent warp threads so that loops are formed. This position of the bellcrank lever is shown in Fig. 11. The bellcrank levers are rotatably supported by rod 27 mounted to lay 26. For accommodating arms 29 and the loops of the thread, a longitudinal groove 31 is provided in lay 26. If the longitudinal member 33 which is provided with a plurality of inclined cams 34 engaging arms 28 of the bellcrank levers is moved towards the left, one crank lever after the other starting from the right is turned clockwise and loops 32 are formed in the weft thread in the same succession. Since the right end of the weft is held by the shuttle and by already formed loops, additional loops to the left can only be formed by pulling additional thread from the bobbin which is on the left side. After the loop forming operation is completed, cam member 33 is moved towards the right and the bellcrank levers all turn counter-clockwise into the position shown in Fig. 12 by the action of spiral springs 30, one end of which is connected to rod 27 and the other to arm 29. At the then following beating up of the weft thread, the additional supply of weft thread is equally distributed over the whole width of the fabric. If the apparatus is arranged and operated for forming the loops of the weft thread consecutively from the left side towards the right side, i. e., in the direction of the movement of the shuttle, additional tension may be applied to the thread.

Figs. 13 and 14 illustrate another method of supplying additional weft thread just at the end of the pick. A buffer member 7 is provided within the shuttle receiving box 2 which is pushed to the right by the incoming shuttle 1 and abuts against the one arm lever 35 turning it in a clockwise direction around its fulcrum 36. The end of lever 35 is connected by a connecting element 37 with the end of lever 38 which rotates about pivot 39 mounted to a sliding piece 41. This piece has a bore through which weft thread 4 travels freely. Lever 38 has a clamping nose 40 which presses the weft thread 4 against slide member 41 whenever lever 38 is turned clockwise. The connecting member 34 moves to the right upon clockwise operation of lever 35 by the incoming shuttle and not only turns lever 38 clockwise, thereby engaging the weft thread, but also pulls slide member 41 to the right and thereby pushes additional weft thread to the right, i. e., into the shed. By adjustment of the length of levers 35 and 38, the amount of additional

thread supplied can be definitely controlled. The starting position of lever 35 is determined by the position of the adjustment screw 75 against which lever 35 abuts while the shuttle is on the way. Slide member 41 and levers 35 and 38 may be pulled backwards into starting position by a mechanism indicated by the string 24, the roller 25 and the weight 15.

While I believe the above described embodiments of my invention to be preferred embodiments, I wish it to be understood that I do not desire to be limited to the exact details of method, design and construction shown and described, for obvious modifications will occur to a person skilled in the art.

I claim:

1. In looms for weaving, an apparatus for withdrawing a predetermined length of weft thread from the shed after completion of the weft insertion comprising a stationary part adapted to slidably carry the weft thread and having an opening and a movable member, said movable member having an eye through which the weft thread runs during the weft insertion into the shed, said eye extending into said opening while the weft thread is inserted into the shed, means for operating said movable member and adapted to remove said eye from said opening for a predetermined distance and to thereby pull the weft thread through said opening whereby the weft thread forms a loop the extent of which is in proportion to the length of the thread withdrawn from the shed substantially as described.

2. In looms for weaving, an apparatus for supplying a predetermined length of weft thread to the shed after completion of the weft insertion comprising a stationary part adapted to slidably carry the weft thread and having an opening and a movable member, said movable member having an eye through which the weft thread runs during the weft insertion into the shed, said eye being remote from said opening while the weft thread is being inserted into the shed, a means for operating said movable member and adapted to move said eye into said opening and to thereby permit the weft thread, which formed a loop the size of which is in proportion to the distance of said eye from said opening, to move into the shed, whereby an additional amount of weft thread is available which is in proportion to the size of the formerly formed loop, substantially as described.

3. In a loom for weaving, an apparatus for feeding into and withdrawing a predetermined amount of weft thread from the shed comprising a reciprocable thread holder having a thread channel therein, movable jaws carried by said thread holder for gripping the thread protruding from said holder, jaw operating means associated with said holder and actuable to close said jaws upon the thread and to open said jaws, and reciprocable means actuating said jaw operating means whereby, due to the difference of the reciprocating motion of said thread holder and said reciprocable means, the distance and direction is determined by which the thread is carried by the holder when the jaws are closed.

4. In looms for weaving, an apparatus for withdrawing a predetermined length of weft thread from the shed after completion of the weft insertion comprising a stationary part adapted to slidably carry the weft thread and having an opening and a movable member, said movable member having an eye through which

the weft thread runs during the weft insertion into the shed, said eye extending into said opening while the weft thread is inserted into the shed, a mechanism comprising spring means for
5 operating said movable member and adapted to yieldingly remove said eye from said opening and to thereby yieldingly stretch and pull the weft thread through said opening, whereby the weft thread forms a loop the extent of which is in
10 proportion to the length of the thread withdrawn from the shed, substantially as described.

5. In looms for weaving, an apparatus for supplying a predetermined length of weft thread to the shed after completion of the weft insertion
15 comprising a stationary part adapted to slidably carry the weft thread and having an opening and a movable member, said movable member having an eye through which the weft thread runs during the weft insertion into the shed,
20 means for yieldingly holding said eye in a position which is remote from said opening and for yieldingly stretching the weft thread while the weft thread is being inserted into the shed, a mechanism for operating said movable member
25 and adapted to move said eye into said opening against the action of said means and to thereby permit the weft thread, which formed a loop the size of which is in proportion to the distance of said eye from said opening, to move into the
30 shed, whereby an additional amount of weft thread is available which is in proportion to the size of the formerly formed loop, substantially as described.

6. In looms for weaving, an apparatus for controlling the length of the weft thread inserted

into the shed comprising a stationary member adapted to slidably carry the weft thread and having an opening, a movable member having an eye through which the weft thread runs during the pick, and means for removing said eye
5 from said opening, whereby the weft thread is pulled into a loop and withheld from entering the shed and for moving said eye into said opening, whereby weft thread withheld from the shed is permitted to enter the shed. 10

7. In looms for weaving, an apparatus for controlling the length of the weft thread inserted into the shed comprising a stationary member adapted to slidably carry the weft thread and having an opening, a movable member having
15 an eye through which the weft thread runs during the pick, and means for removing said eye from said opening, whereby the weft thread is pulled into a loop and withheld from entering the shed and for moving said eye into said opening, whereby weft thread withheld from the
20 shed is permitted to enter the shed, said means comprising yielding means adapted to yieldingly stretch the weft thread.

8. In a loom for weaving, an apparatus for
25 feeding a predetermined amount of weft thread into the shed and for withdrawing it from the shed comprising a reciprocable member adapted to slidably carry the weft thread, movable jaws mounted to said member, jaw operating means
30 movably connected with said member and adapted to close said jaws upon the thread and to open said jaws, and actuating means for actuating said jaw operating means.

RUDOLF ROSSMANN. 35