Feb. 17, 1948. H. H. FONDA 2,436,067

TENSION REGULATOR AND EQUALIZER FOR PILE FABRIC LOOMS

Filed July 26, 1945. 3 Sheets-Sheet 1

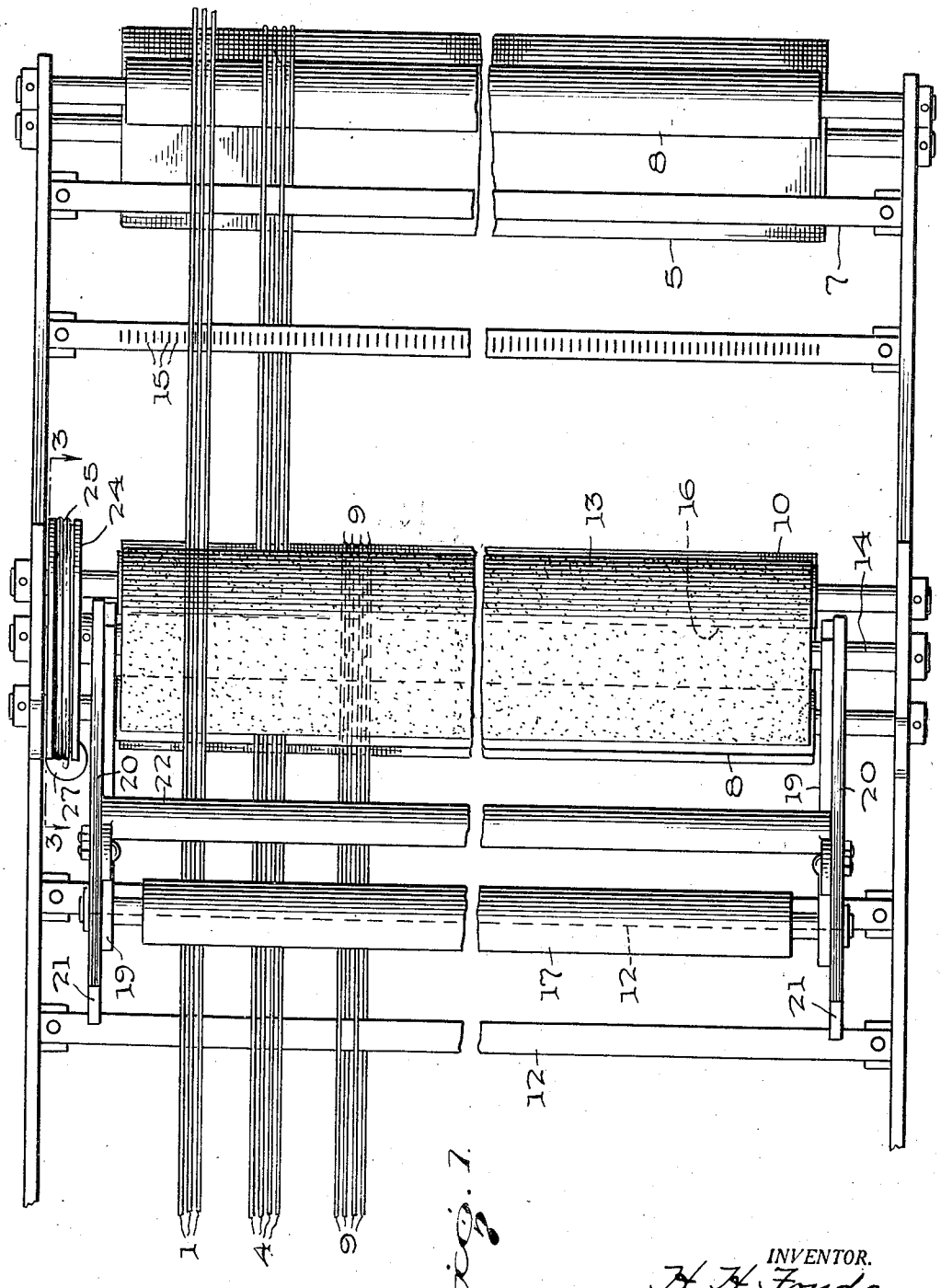


Fig. 1.

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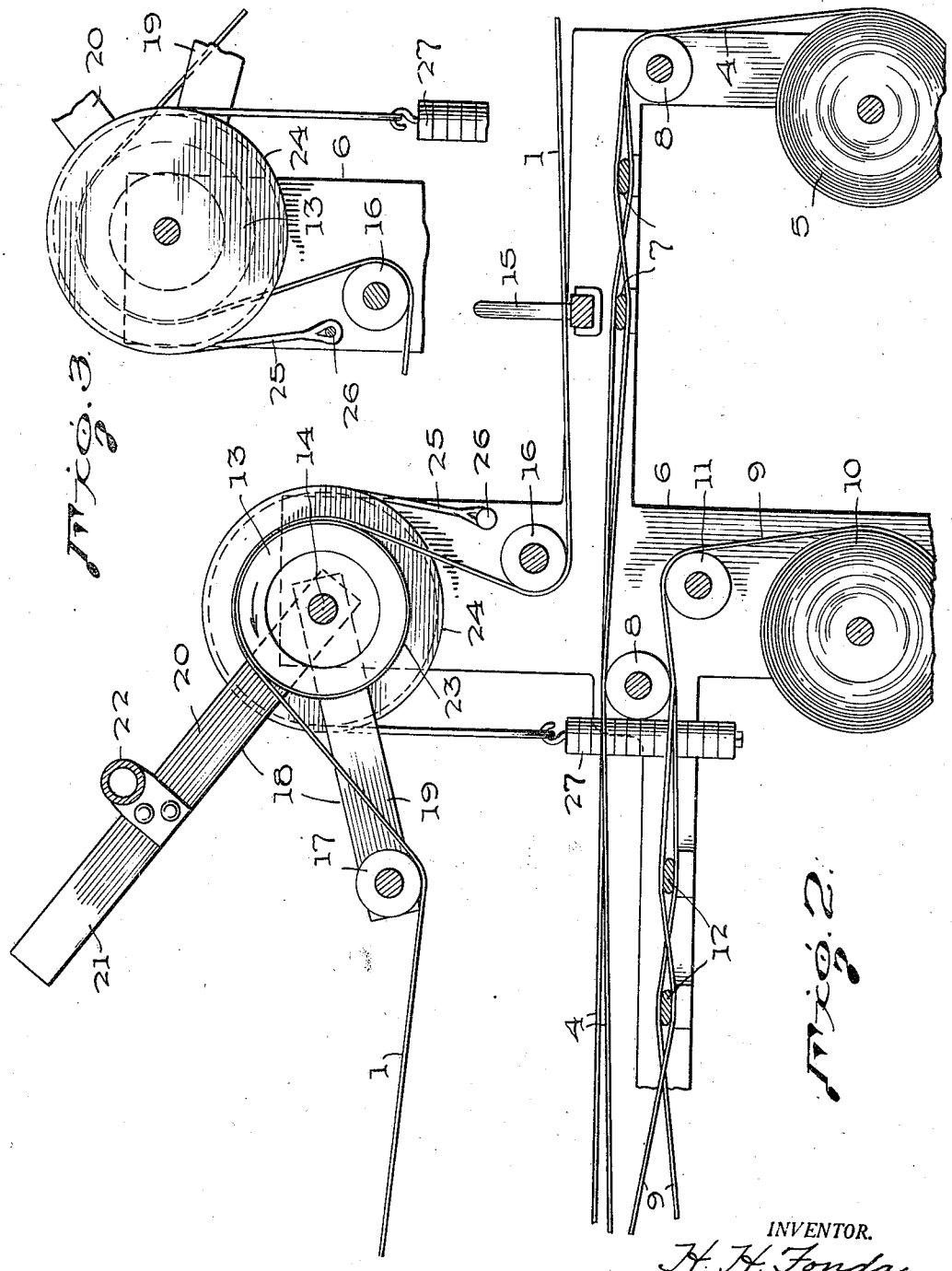


Fig. 3.

Fig. 2.

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TENSION REGULATOR AND EQUALIZER FOR PILE FABRIC LOOMS

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Fig. 4.

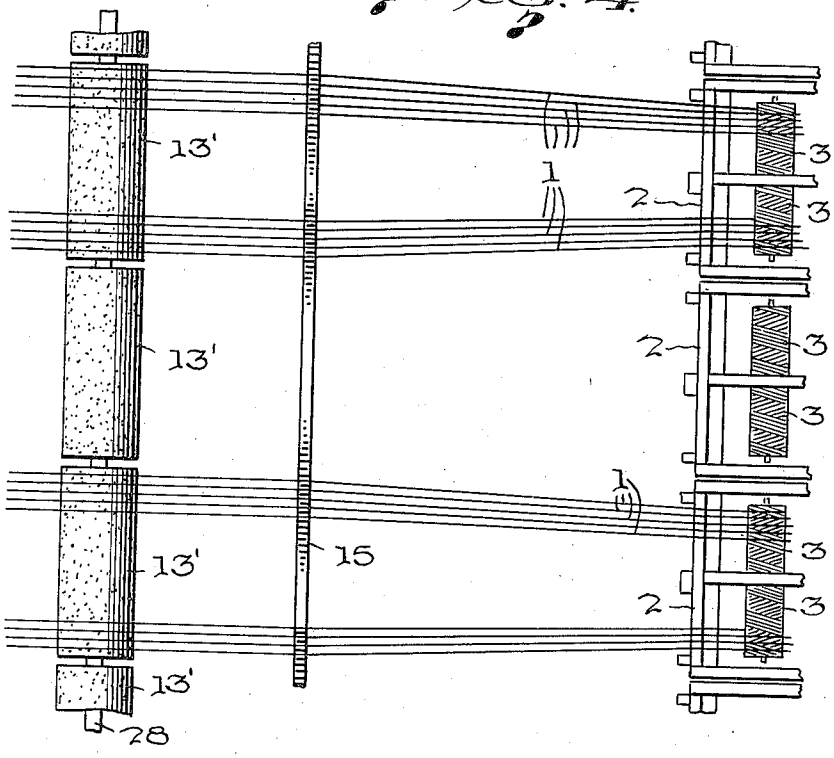


Fig. 5.

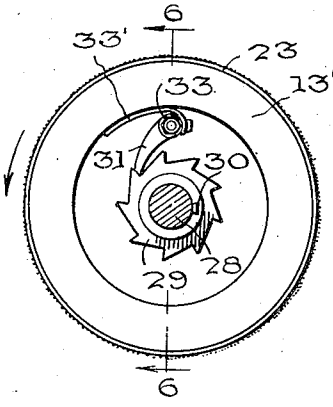
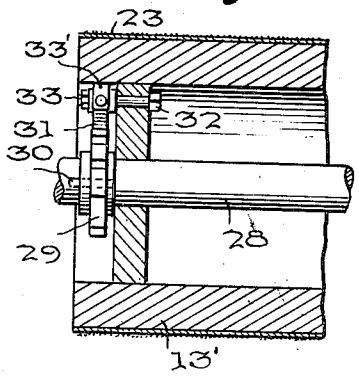


Fig. 6.



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2,436,067

UNITED STATES PATENT OFFICE

2,436,067

TENSION REGULATOR AND EQUALIZER FOR PILE FABRIC LOOMS

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Application July 26, 1945, Serial No. 607,227

13 Claims. (Cl. 139—104)

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This invention relates to looms, and more especially, to pile fabric looms of the type referred to and disclosed in my joint application with Gustav E. Schulz, Serial No. 607,154, filed of even date herewith, now Patent No. 2,414,064.

The invention herein particularly concerns a means for regulating and equalizing the tension in the warp strands or yarns, such as the surface or pile yarns, although it is to be understood that the invention may also be applied to any other warps or group of yarns where it is desired to regulate and equalize the tension therein.

In the normal operation of a pile fabric loom, the warps and surface yarns are in a state of almost constant motion due to the action of the heddles or harness in forming the successive sheds. The heddle action, together with the take-up of the fabric as it is woven, draws the warps and surface yarns from their beams and/or creels located at the rear end of the loom. Thus, unless some means for regulating the tension of the yarns is provided, each strand would be independent of the others and the tension would vary according to the individual yarn arrangement and let-off from the various beams or yarn packages, owing to the fact that in winding the yarns on the beam or on creel spools or plugs, certain of the yarns will be inadvertently placed under greater strain than others. This results in unequal pay-off of the yarns as the weaving operation is performed by the loom, with consequent non-uniformity of the fabric, which is particularly noticeable in the case of pile or surface yarns by the showing of definite lines or streaks lengthwise of the fabric.

The primary object of the present invention is to provide a tension regulator and equalizer which permits the use of a simple creel with a plain type of tension on each yarn or strand, and which forces each spool or yarn package to give up an equal amount of yarn during the successive weaving operations, in spite of any irregular tensions in the creel ends of the yarns, thereby delivering the yarns to the loom at exactly the same rate so that in the formation of each pile loop on the pile wires, the tension on each loop will be uniformly the same and will produce an even surface on the fabric.

In carrying out the aforementioned object, the invention contemplates the provision of a tension regulator and equalizer assembly particularly applicable to pile or surface yarns, and which includes a friction roll over which the yarns are passed in substantial frictional contact therewith, together with a whip roll which is so mounted as to be free to oscillate about the axis of the friction roll to apply a beating or pressure action upon the yarns and thereby equalize any unequal tension on the yarns, preliminary to and without interference with the normal heddle action of the loom, and without producing undue slack or excessive tension in the yarns during the heddle action.

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A further object of the invention is to provide a tension regulator and equalizer of the character indicated in the foregoing, wherein the friction roll is divided into sections, with the sections mounted on and fixed to a common shaft for normally simultaneous rotation, but having provision for individually releasing the respective roll sections at will so that when released, the roll section is free to turn on the shaft without disturbing any other section, thereby permitting a group of yarns to be pulled through the loom one section at a time.

Other and further objects and advantages of the invention will be hereinafter described and the novel features thereof defined in the appended claims.

In the drawings:

Figure 1 is a top plan view of the rear portion of a loom having my invention applied thereto;

Figure 2 is a longitudinal sectional view taken through the portion of the loom shown in Figure 1;

Figure 3 is a detail sectional view taken on the line 3—3 of Figure 1, and showing the brake means for the friction roll;

Figure 4 is a fragmentary top plan view of a modified form of the invention in which the friction roll is divided into a plurality of sections, and also showing a typical arrangement of creels from which the pile yarns are drawn into the loom;

Figure 5 is a view in end elevation of one of the friction roll sections of Figure 4, and particularly showing the manner in which the friction roll sections are releasably connected to a common shaft by a ratchet and pawl device; and

Figure 6 is a sectional view taken on the line 6—6 of Figure 5.

Like reference characters designate corresponding parts in the several figures of the drawings which show only the rear portion of a conventional pile fabric loom of well known make, the construction and operation of which will be readily understood by those skilled in the art. It is to be understood, however, that my inven-

tion is not limited to use with looms of this precise construction, since it may be applied with equal facility to other types of looms and to any set of yarns or warps running lengthwise of the fabric, where it is desired to keep the yarns under uniform tension.

According to the construction depicted in the drawings by way of illustration, 1 represents the surface or pile yarns leading from a beam or creels at the rear end of the loom. When creels are employed, as shown at 2 in Figure 4, they may be either of the stationary type or preferably a portable type as more fully disclosed in a separate application of Leslie E. Bryant, Serial No. 607,179, filed July 26, 1945. For the purposes of the present invention, it is sufficient to say that the pile yarns or strands 1 are led off from individual spools or yarn packages designated 3 in Figure 4, the number of which will vary according to the number of pile strands required for the particular fabric being woven.

The stuffer warps are designated 4 and are led forwardly through the loom from a beam 5 rotatably mounted at the rear end of the loom frame 6, these stuffer warps preferably passing about the lease rods 7 and over one or more guide rolls 8 extending transversely across the loom.

The binder warps designated 9 are similarly supplied from a beam 10 also mounted near the rear end of the loom frame, these warps passing over one or more guide rolls 11 and about the lease rods 12, as clearly shown in Figure 2.

Thus the pile yarns 1, the stuffer and binder warps 4 and 9 extend longitudinally through the loom and through the various heddles (not shown) which are in the normal operation of the loom almost constantly in motion in an upward and downward direction to form the successive sheds in the successive stages of the weaving operation, as will be fully understood by those skilled in the art. Owing to this heddle action, the tension in these yarns is intermittently reduced and increased in more or less rapid succession, with the result that the let-off of the yarns is rather jerky. In addition to the variation in tension produced by the heddle action, there is a still further and common variation of tension in the individual yarns or strands which is caused by the initial winding of the yarns upon a beam or onto creel spools or yarn packages. This initial winding of the yarns onto the beam or into the yarn packages inadvertently produces greater strain on some yarns than on others, so that when the yarns are payed-off as the weaving operation is performed by the loom, there would normally be an almost infinite variation of the tension in the yarn strands from point to point across the loom. This unequal tension in the individual yarn strands is particularly disadvantageous and objectionable in the case of pile or surface yarns, because the resulting fabric will be non-uniform and will oftentimes show definite lines or streaks lengthwise on the surface of the fabric.

I have found that these difficulties and objections may be completely eliminated and the performance and operation of the loom otherwise materially improved by the employment of a tension regulator and equalizer which will now be described.

My new tension regulator and equalizer includes a roll or drum designated 13 which is mounted on a shaft 14 suitably journaled in the loom frame 6 near the rear end thereof, said shaft and roll extending transversely across the loom from side to side. In applying my tension regulator and equalizer to the pile or surface yarns, the yarns 1 are led over this roll 13, first preferably passing through an open-top comb or reed 15 mounted transversely across the loom and provided with equally spaced splits or spaces through which the individual yarns are respectively extended to spread and hold the yarns in transversely spaced relation to each other and to prevent the yarns from running off the ends of the roll. Between the comb 15 and the roll 13, there is preferably provided an idler roll 16 which is mounted transversely across the loom and is freely rotatable on its own axis. This idler roll is disposed somewhat below the roll 13 and more or less underlies the same in order to cause the yarns 1 to make substantial contact with the surface of the roll 13.

At the opposite side of the roll 13 and suitably spaced therefrom is a second idler roll 17 which is free to turn about its own axis and normally rests upon the upper sides of the yarns 1. The idler roll 17 is mounted in a frame 18 which includes two arms respectively designated 19 and 20 at each end of the frame. The arms 19 and 20 are disposed in intersecting relation to each other and are rigidly connected at their intersecting ends, at which latter point the arms are loosely journaled on the shaft 14 at the opposite ends of the roll 13, so that the frame, together with the idler roll 17 which may be termed a whip-roll, is free to oscillate about the axis of the roll 13. Each of the arms 20 at the opposite ends of the frame 18 is preferably extended, as at 21, to form handles by means of which the frame may be rocked to and from a position engaging or disengaging the roll 17 with or from the yarns. A bar 22 extended transversely across the frame 18 and connected at its opposite ends to the respective arms 20, is provided to strengthen the frame and add weight thereto. This weight may be varied in any suitable manner by increasing the weight of the bar 22, or by suspending weights therefrom, it being important to maintain sufficient pressure of the roll 17 against the yarns 1 to establish and maintain contact of the yarns with the roll 13, as well as create sufficient tension in the yarns 1 to produce a smooth and uniform loom and weaving operation, with the correct amount of tension imparted to the pile loops as they are formed on the pile wires (not shown) during the weaving operation.

As will be seen from reference to Figure 2 of the drawings, the location of the respective rolls 16 and 17 is such as to cause the yarns 1 to contact the surface of the roll 13 over approximately one-half of the periphery of the latter, and in order to produce a firm or positive grip between the roll 13 and the yarns 1, the surface of the roll is preferably covered with some anti-slipping or friction material, such as sandpaper or emery paper 23. Through the use of such friction material and by making the roll 13 of adequate diameter, there will be no relative slippage between the yarns 1 and the roll when the yarns are placed under tension and the tension in the individual yarns is uniform.

At one or both ends of the roll 13, which may be termed the friction roll, a suitable drag or braking action is preferably applied to the roll. By way of example, the drag or brake may have the form of a drum 24 fixed to the end of the shaft 14 to which the roll 13 is also fixed. A flexible band, strap, rope, or the like, designated 25, of suitable material is extended about the drum 24 with one of its ends anchored to the loom

frame, as at 26, and its other end supporting a weight 27. By varying the number of turns of the flexible member 25 about the drum 24, and/or by varying the number or size of the weight 27, the drag or braking action on the friction roll 13 may be adjusted to the desired amount.

In the operation of the loom, as the weaving action progresses, the pile or surface yarns 1 are drawn from their source of supply through the comb or spreader, from which they are directed beneath the idler roll 16, then over the friction roll 13, and finally under the whip roll 17 before passing to the heddles. Due to the braking action or drag upon the friction roll 13, the yarns 1 may be fed into the loom from simple creels and with only a very little or plain type of tension on the end of each yarn. Owing to the gripping action or frictional engagement of the friction roll 13 with the yarns 1, each creel spool or yarn package is forced to give up an equal amount of yarn in spite of possible irregular tensions in the creel ends of each strand. As it receives an equal amount of each yarn, the friction roll 13 delivers to the weaving side thereof at exactly the same rate, and, therefore, the tension on each pile loop as it forms over the pile wires in the loom is unformly the same, resulting in an even surface on the fabric. For this reason, the tension regulator and equalizer which constitutes my invention, causes the fabric to be constructed more evenly, and much less of the surface has to be sheared off in order to acquire a smooth finish, thereby reducing waste, increasing quality, and lessening finishing cost.

The friction roll 13 rotates about its own axis at intervals and in amounts regulated by the draw of yarn when the loom is in operation. The greater interval of rotation is produced by the take-up of yarn as the fabric is woven, and therefore in regular beats, and the lesser interval of rotation occurs at a different time and is largely produced by the heddle action and by the oscillating movement of and pressure produced on the yarns by the whip roll 17. Through the weight of this whip roll and its frame, a beating or pressure action is produced on the yarns 1 and automatically equalizes any unevenness in tension in the individual yarns, yet the combination of tension and weight are so adjusted as to result in proper weaving operation without causing excessive tension or undue slack in the yarns.

While the friction roll 13 may have a continuous length extending from side to side of the loom, this roll may be divided into a plurality of separate roll sections designated 13', as illustrated in Figure 4 of the drawings. The number and length of each roll section may be varied according to the width of the particular loom to which the same are applied, and also according to the number of yarns 1 which may be conveniently provided from a single creel 2 or beam. Where several creels are to be employed, they are arranged side by side, as shown in Figure 4, and the yarns 1 from each separate creel pass over a separate friction roll section 13'. The friction roll sections are mounted upon a common shaft 28, and at one or both ends of each roll section, there is provided a toothed ratchet member 29, each ratchet member being suitably secured to the shaft 28, as by a key 30. Carried by each roll section 13' and cooperating with the respective ratchet members 28 is a pawl or dog 31 which is normally engaged with one of the teeth of its corresponding ratchet member 29, so that all of the roll sections will rotate simultaneously with

each other pursuant to rotation of any individual roll section. The dogs or pawls 31 are each pivotally attached to their respective rolls by a bolt 32 and nut 33, or an equivalent fastening means. By means of a flat spring 33' or an equivalent device, the pawl is normally held in engagement with the ratchet member 29, and the roll section 13' will remain secured to the shaft 28, but by releasing the spring and swinging the pawl out of engagement with respect to the ratchet member, the roll section may be disconnected from the shaft 28 so that it is free to rotate independently of any other roll section. When the pawl is so disengaged, the yarns 1 passing over the roll section may be pulled through the loom without disturbing any of the other roll sections and their yarns, this being particularly advantageous when changing yarns or replacing creels, or when ripping out the fabric as is sometimes necessary. As best shown in Figures 5 and 6, it will be seen that the ratchet members 29 and pawls 31 are preferably recessed in the ends of the respective roll sections, and it will be understood that any one or more of the roll sections may be disengaged at will from the shaft 28 so that the yarns may be freely pulled through the loom one section at a time, following which the disengaged roll section or sections may be reengaged with the shaft 28 for simultaneous rotation as required during the normal operation of the loom.

The equalizing of the yarn tension as previously described is one feature of the invention in the supplying of the yarns uniformly to the loom, while the regulation of the tension itself in the respective yarns is a second feature performed by the invention to prevent excessive tension and excessive pull on the pile wires. Thus the invention in its tension regulating and tension equalizing functions eliminates an inherent objection and defect which is prevalent in both cross-wire looms and conventional stationary wire looms and provides the ideal operation which results in uniform tension and uniformity of surface of the fabric.

While the specific details have been herein shown and described, the invention is not confined thereto as changes and alterations may be made without departing from the spirit thereof as defined by the appended claims.

I claim:

1. In a loom having provision for receiving and directing a plurality of yarns from a source of yarn supply, longitudinally therethrough from back to front of the loom, means for regulating and equalizing the tension in the individual yarns, said means including a roll disposed transversely of the loom and having a friction surface over which the yarns are passed in frictional contact therewith, and a second roll spaced from the first roll in the direction of advancement of the yarns and disposed in parallel relation thereto; said second roll being bodily movable about the axis of the first roll to produce a beating action on the yarns responsive to operation of the loom and normally bearing upon the upper side of the yarns with a predetermined and unrestrained pressure.

2. In a loom through which yarns are adapted to be longitudinally drawn from a source of yarn supply, an idler roll extending transversely across the loom and rotatable about a stationary axis, a friction roll arranged in spaced parallel relation to said idler roll and also rotatable about a stationary axis, said friction roll being located at a higher elevation than the idler roll, and a whip-roll arranged in spaced parallel relation to said

idler and friction rolls and having means for supporting the same so that the position of its axis is free to shift about the axis of the friction roll, while permitting the whip-roll to rotate about its own axis, said rolls defining a path for the yarns extending beneath the idler roll, then over the friction roll, and finally beneath the whip-roll, so that the whip-roll will produce a beating action on the yarns responsive to operation of the loom.

3. In a loom through which yarns are adapted to be longitudinally drawn from a source of yarn supply, an idler roll extending transversely across the loom and rotatable about a stationary axis, a friction roll arranged in spaced parallel relation to said idler roll and also rotatable about a stationary axis, said friction roll being located at a higher elevation than the idler roll, and a whip-roll arranged in spaced parallel relation to said idler and friction rolls and having means for supporting the same so that the position of its axis is free to shift about the axis of the friction roll, while permitting the whip-roll to rotate about its own axis, said rolls defining a path for the yarns extending beneath the idler roll, then over the friction roll, and finally beneath the whip-roll, so that the whip-roll will produce a beating action on the yarns responsive to operation of the loom, in combination with a spreader disposed at the rear of said rolls and through which the yarns are adapted to be passed in uniform transversely spaced relation.

4. In a loom through which yarns are adapted to be longitudinally drawn from a source of yarn supply, an idler roll extending transversely across the loom and rotatable about a stationary axis, a friction roll arranged in spaced parallel relation to said idler roll and also rotatable about a stationary axis, said friction roll being located at a higher elevation than the idler roll, and a whip-roll arranged in spaced parallel relation to said idler and friction rolls and having means for supporting the same so that the position of its axis is free to shift about the axis of the friction roll, while permitting the whip-roll to rotate about its own axis, said rolls defining a path for the yarns extending beneath the idler roll, then over the friction roll, and finally beneath the whip-roll, so that the whip-roll will produce a beating action on the yarns responsive to operation of the loom, in combination with a spreader disposed at the rear of said rolls and through which the yarns are adapted to be passed in uniform transversely spaced relation, said spreader having the form of an open-top comb.

5. In a loom through which yarns are adapted to be longitudinally drawn from a source of yarn supply, an idler roll extending transversely across the loom and rotatable about a stationary axis, a friction roll arranged in spaced parallel relation to said idler roll and also rotatable about a stationary axis, said friction roll being located at a higher elevation than the idler roll, and a whip-roll arranged in spaced parallel relation to said idler and friction rolls and having means for supporting the same so that the position of its axis is free to shift about the axis of the friction roll, while permitting the whip-roll to rotate about its own axis, said rolls defining a path for the yarns extending beneath the idler roll, then over the friction roll, and finally beneath the whip-roll, so that the whip-roll will produce a beating action on the yarns responsive to operation of the loom, in combination with brake means for imparting a drag to the friction roll.

6. In a loom through which yarns are adapted to be longitudinally drawn from a source of yarn supply, an idler roll extending transversely across the loom and rotatable about a stationary axis, a friction roll arranged in spaced parallel relation to said idler roll and also rotatable about a stationary axis, said friction roll being located at a higher elevation than the idler roll, and a whip-roll arranged in spaced parallel relation to said idler and friction rolls and having means for supporting the same so that the position of its axis is free to shift about the axis of the friction roll, while permitting the whip-roll to rotate about its own axis, said rolls defining a path for the yarns extending beneath the idler roll, then over the friction roll, and finally beneath the whip-roll, so that the whip-roll will produce a beating action on the yarns responsive to operation of the loom, in combination with brake means for imparting a drag to the friction roll, said brake means including a brake drum fixed to the friction roll and having an external braking surface on the periphery thereof, and a flexible friction member extending about the braking surface of said drum, with one end of said flexible friction member fixed to the loom at one side of said drum, and the opposite end of said flexible member being freely suspended at the opposite side of said drum and supporting a weight.

7. A loom as defined in claim 2, wherein the whip-roll is carried by a frame of substantial weight, with the frame arranged for rocking movement about the axis of the friction roll.

8. A loom as defined in claim 2, wherein said friction roll is divided into a plurality of separate roll sections mounted on a common shaft, with the sections arranged on said shaft in spaced relation to each other end-to-end, and including means for releasably securing each roll section to the common shaft aforesaid so that when so secured, the roll sections will rotate simultaneously, and when released, each roll section is free to rotate independently of the other roll sections, thereby permitting the yarns to be pulled through the loom section by section.

9. A loom as defined in claim 2, wherein said friction roll is divided into a plurality of separate roll sections mounted on a common shaft, with the sections arranged on said shaft in spaced relation to each other end-to-end, and including means for releasably securing each roll section to the common shaft aforesaid, said last-named means comprising a pawl carried by each roll section and a ratchet member for each pawl fixed to the shaft.

10. A yarn tension regulator and equalizer assembly for looms, comprising an idler roll, a friction roll, and a whip-roll, said idler and whip-rolls being disposed in parallel relation to each other and to the friction roll and at opposite sides of the axis of the friction roll, and the whip-roll being freely shiftable about the axis of the friction roll and adapted to rest upon the yarns as the yarns pass beneath the idler roll, then over the friction roll, and finally beneath the whip-roll so that the whip-roll will produce a beating action on the yarns responsive to operation of the loom.

11. A yarn tension regulator and equalizer assembly for looms, comprising an idler roll, a friction roll, and a whip-roll, said idler and whip-rolls being disposed in parallel relation to each other and to the friction roll and at opposite sides of the axis of the friction roll, and the whip-roll being freely shiftable about the axis of the

friction roll and adapted to rest upon the yarns as the yarns pass beneath the idler roll, then over the friction roll, and finally beneath the whip-roll, so that the whip-roll will produce a beating action on the yarns responsive to operation of the loom, with the yarns maintained in firm frictional contact with the friction roll over substantially one-half of the periphery of the latter.

12. Apparatus as defined in claim 10, wherein the whip roll is rotatably mounted in a frame for rotation about its own axis, with the frame supported on the axis of the friction roll and freely shiftable about said latter axis.

13. Apparatus as defined in claim 10, in combination with means for imparting a braking action to the friction roll.

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