July 13, 1926. 1,592,625

J. L. DAVIDSON

LOOM

Filed Jan. 14, 1922 3 Sheets-Sheet 1

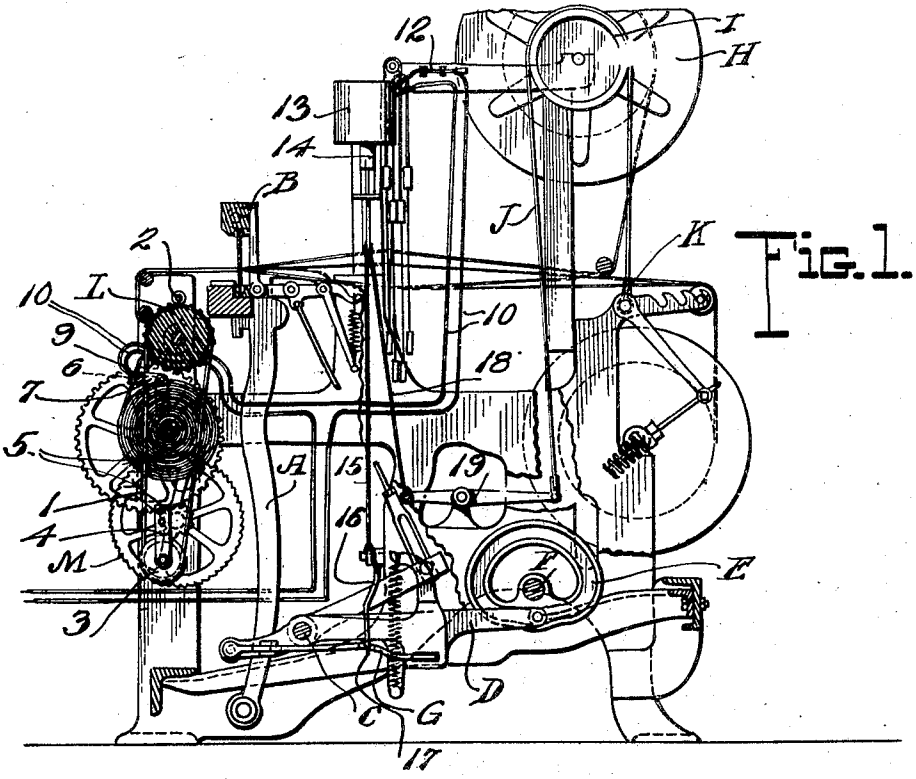


Fig. 1.

Fig. 2.

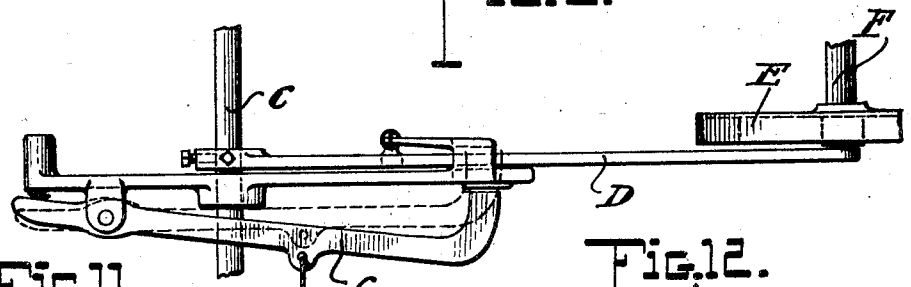


Fig. 11.

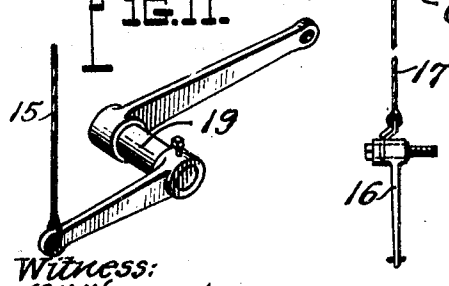
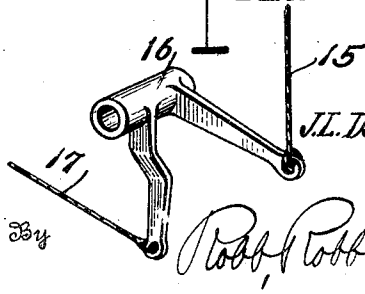


Fig. 12.



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LOOM

Filed Jan. 14, 1922 3 Sheets-Sheet 2

Fig. 3.

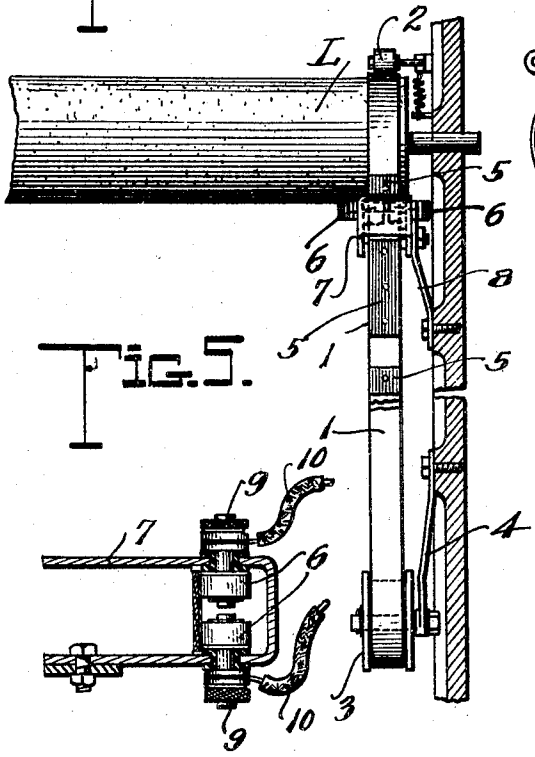


Fig. 4.

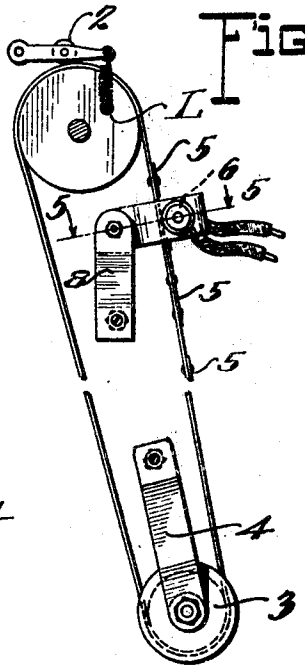


Fig. 5.

Fig. 6.

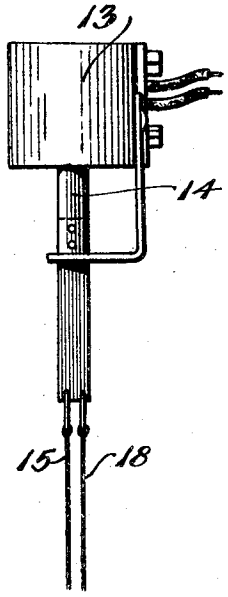
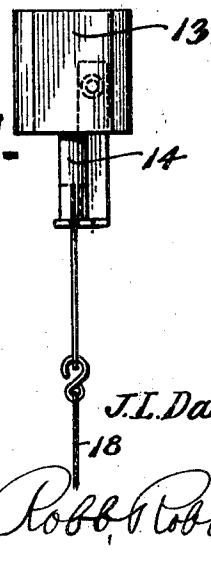


Fig. 7.



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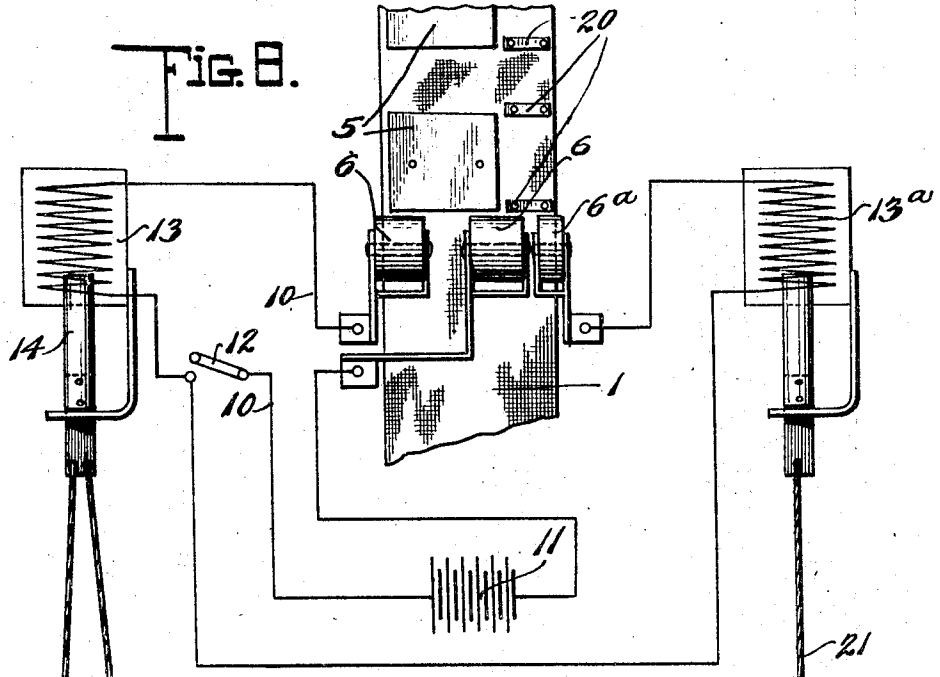
July 13, 1926. 1,592,625

J. L. DAVIDSON

LOOM

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Fig. 8.



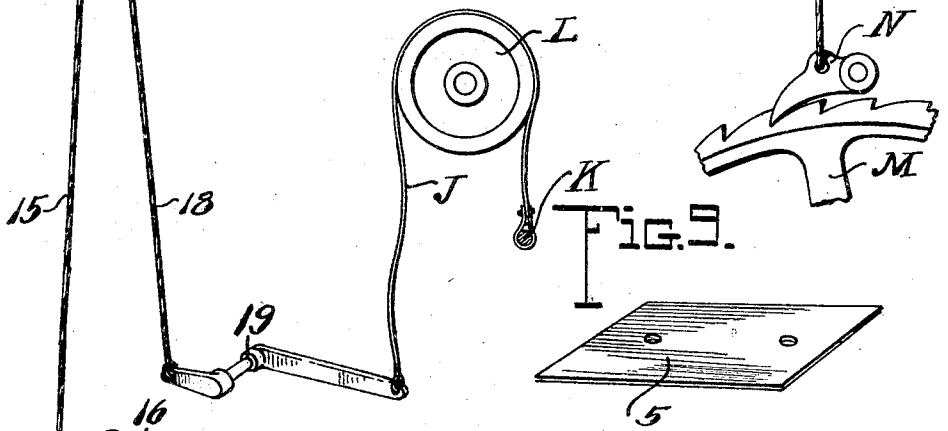


Fig. 9.

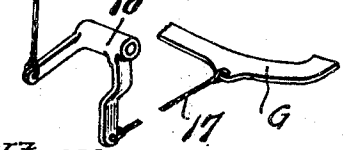




Fig. 10.

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Patented July 13, 1926. 1,592,625

UNITED STATES PATENT OFFICE.

JOHN L. DAVIDSON, OF CHARLOTTE, NORTH CAROLINA, ASSIGNOR OF ONE-HALF TO ROBB, ROBB & HILL, A COPARTNERSHIP COMPOSED OF JOHN F. ROBB, HARRY C. ROBB, AND HUGH S. HILL, OF CLEVELAND, OHIO, AND WASHINGTON, D. C.

LOOM.

Application filed January 14, 1922. Serial No. 529,167.

The present invention relates to improvements in looms, and more particularly has to do with a novel control means through the instrumentality of which the character of the weave may be changed so as to produce what are generally known as fancy fabrics, where the main body of the material is of one weave and the borders of another.

The control means of this invention is especially adapted for use in the manufacture of terry pile woven towels, huck-a-backs and other dobby woven towels, of handkerchiefs, table cloths, scarfs, napkins, blankets, ginghams and the like, involving a change of weave at the border.

It will be understood by those skilled in the art of manufacture of textiles that fancy fabrics are generally woven into patterns of varying designs merely by the change of the type of weave. The extent and arrangement of these different weaves is produced by the throwing into operation at the proper time the mechanisms for the respective weaving, the changes being effected by pattern chains, the make-up of which is necessarily dependent upon the structure of the yarns or filling threads, that is, the size of the same, the actuating instrumentalities of the chains being set on the basis of the number of picks per inch. As there is a direct ratio between the number of picks and the movement of the pattern chains, there is always a difficult factor of reckoning outside of multiples, in addition to the variation of lengths of fabric units due to inability to exactly calculate on the basis of size of yarn, but only rendered apparent in the long run, whereby it has been heretofore impracticable to produce articles such as towels or napkins, etc., of an exact unit length. This necessitates in actual practice that the units of the fabric when woven be cut by hand.

It is an object of this invention to produce a control of the changes of weaves quite independent of the structure of the yarn and in direct ratio to the linear measure of the particular weave desired, so that each article is of the same exact length, rendering it possible, therefore, to cut the units of the woven fabric by machine, a great labor-saving factor of itself.

To best understand the advantages of these improvements, it may be well to refer to the difficulties or disadvantages of the present pattern mechanisms. In the well-known types of terry looms of today, for example, utilized for the manufacture of such articles as Turkish towels, the change of weave is produced by what is termed a pattern chain which is moved step by step through a complication of mechanism, and determining by its make-up the weaving of the terry and plain portions of a fabric to the desired extent and sequence. These chains require the best part of the loom fixer's time and attention, and for many reasons they are the cause of loss of thousands of dollars worth of material annually. The chains are not only subject to breakage but they are run heavily oiled, resulting in gumming up after a few hours work to such an extent as to become deficient, and the loom fixer in working upon the chains usually manages to transfer much of the soil to the fabric which necessarily becomes a loss.

Aside from this, however, these chains require much skill and labor in preparation, especially where the pattern is involved or the fabric unit is of some length, frequently involving several hours in fabrication to produce the proper design, not overlooking the painstaking arithmetical calculations based upon the number of threads per inch in determining the proper setting of pattern changing instrumentalities. Even with the best of skill and experience it is difficult to make the proper allowance for variation in the filling threads or the compactness of the weaving as hereinbefore premised, so that the repeat weave during the continuous weaving operation does not correspond to the specifications as regards length of the plain and terry weaving and in consequence the length of the article. This in itself necessitates the rebuilding of the chains a number of times.

It has therefore been my prime object to simplify the process of manufacture by an elimination of these and other difficulties,

by providing a pattern control of such positiveness of action that in an actual test a variation of a fiftieth of an inch in a long run of hundreds of towels did not occur. My invention is therefore designed primarily as a positive control for lengths and sequence of varieties of weaves.

In its application I am able to entirely dispense with the conventional pattern chain, and with it the greater part of the labor and time consumed in the construction thereof, to say nothing of the initial heavy expense of the chain head construction, making it entirely feasible for the loom fixer to take over into his care more than a third more looms, conservatively speaking.

In the carrying out of my invention, the primary feature of the device takes the form of a carrier or endless circuit closer, the surface of which embodies nonconductive and conductive material so arranged that through the instrumentality of an electromagnet operatively connected with the terry motion in the terry loom adaptation, the weave of the fabric is changeable instantly and precisely in accord with the design determined by the relative spacing between the conductive or circuit-closing sections of the carrier member which, furthermore, is positively driven synchronously with the movement of the fabric to thereby insure reproduction of exactness of lengths of the varieties of weaves. It will therefore be seen that I have devised an electro-mechanical innovation in pattern control mechanisms, of such a simple character as to make it possible within a few minutes to modify the pattern by the application of circuit-closing sections which are detachably mounted upon the carrier, the length and spaced arrangement of which determine the extent and sequence of the plain and terry weaves.

Though I wish it to be understood that the adaptation herein of my invention is merely illustrative of the possibilities and is therefore not to be taken as delimiting the field of its utility, the principles of my invention may be most easily understood by its application to the terry loom for weaving of double pile fabrics such as Turkish towels in which it is customary to produce a pattern by the change from terry weave to plain weave at the ends of the towels in sequence any number of times, forming stripes of plain and terry fabric. It is the extent and arrangement of these sections of weave which the present invention is designed to automatically control.

It is, of course, quite well known that the terry weave and plain weave in toweling is governed mainly by the extent of the beat-up movement of the beat-up reed; that is to say, during plain weave, the reed has imparted to it full forward movement after each pick, whereas in terry weave the reed is given only a partial forward movement for several picks and then a full movement, resulting in the formation of the loops due to the fact that here is but slight tension on the terry warp at the full beat-up of the reed, while the ground warp remains under full tension. Therefore, to control the type of weave, it is but necessary to regulate the beat-up to give full forward movement after each pick during plain weave, and partial forward movement in sequential steps followed by a full forward beat in terry weave. In these improvements, applied to the terry loom, the pattern control embodies certain operative connections with the terry motion operating to produce the changes in the terry and plain weaves. This explanation is given to impart a setting to the characteristics of my improvements and will enable those skilled in the art to which it appertains to appreciate the specific application set forth herein.

Other cooperations and applications of its principles will be hereinafter referred to, though it may be said primarily that the important feature of my device resides in the provision of an electric control of the simplest character, eliminating the most complicated mechanical structures which have heretofore been employed for producing the same results but in a less efficient manner and of an inferior character.

These and such other objects as may hereinafter appear are attained by the novel construction, combination and arrangement of parts to be hereinafter specifically described and claimed.

Reference will now be had to the accompanying drawings forming a part of this specification, wherein:

Figure 1 is a vertical sectional view of a terry loom, illustrating the general mechanism thereof and the application of my invention thereto.

Figure 2 is a detail plan view of the coupling means for the terry motion showing a portion of the actuating connection of my invention therewith.

Figure 3 is an enlarged fragmentary sectional view showing the sand roll and the contact carrier or pattern control member forming the primary feature of this invention.

Figure 4 is a view in elevation of this carrier and the circuit closing contacts therefor.

Figure 5 is a sectional view through the contact roller mounting on the line 5—5 of Figure 4.

Figure 6 is a side elevation of the actuating electro-magnet used in this invention.

Figure 7 is a view of this electro magnet at right angles to that of Figure 6.

Figure 8 is a diagrammatic view of this invention and the operative connections with certain mechanisms of the loom.

Figure 9 is a detail view of one of the contact plates for the carrier.

Figure 10 is a modified form of contact plate.

Figure 11 is a detail view of the bell crank controlling the brake member for the terry warp beam.

Figure 12 is a detail view of the bell crank controlling the terry motion coupling member.

Throughout the following detailed description and on the several figures of the drawing, similar parts are referred to by like reference characters.

General mechanism of the terry loom.

Referring to the drawings, a sufficient portion of the mechanism of a conventional terry loom is depicted in Figure 1 to illustrate the application of my invention, and the operation of this mechanism is so well known to those skilled in the art to which the invention relates as to need no particular description thereof. It will suffice to mention that A designates the lay, and B the reed operated from the beat-up motion in the customary manner. Upon the rock or beat-up motion shaft C is loosely mounted the cam lever D carrying at its opposite extremity a roller engaging in the groove of the cam E mounted upon the back shaft F. The rock shaft C, during plain weave, is rocked by the cam E back and forth at every revolution of this cam, which is so shaped that the said shaft is rocked for every full beat-up stroke of the reed, at every third forward beat of the lay, but, of course, the shape of the cam may readily be varied, as well known, to modify this ratio.

In order to do plain weaving it is only necessary that the cam lever D be uncoupled so that at its forward end it turns loosely on the shaft C, whereupon the shaft is maintained in such position as to permit the reed to make its full stroke on the lay at every forward beat.

The operation of coupling and uncoupling of the cam lever to the shaft C is produced automatically by the actuation of the terry or coupling lever G under the control of my special means which takes the place of the corresponding control in the usual loom through the pattern chains.

Further referring generally to the terry loom mechanism, we note at H the terry warp beam having at one end the friction or brake drum I over which the friction strap J passes, one end of said strap being fixed to the end of the whip roll rod as indicated at K. The connection of the other end will be referred to hereinafter. The woven fabric passes as usual around the sand or take-up roll L which is positively driven through a train of gearing, this take-up mechanism including the ratchet wheel M with which the take up pawl N is associated (see Figure 8 of the drawings).

The pattern control.

Passing now to the special subject matter of this invention, and referring more particularly to Figures 3 to 8 of the drawings, I employ as the main control feature a carrier member or belt 1, which in the present adaptation is mounted upon one end of the sand roll, as shown best in Figure 3, so as to move synchronously with this roll and therefore in harmony with the movement of the fabric. I desire it to be understood, however, that the control member need not be arranged to cooperate with this roll essentially, for it is within the purview of my invention to dispose it elsewhere according to convenience. In fact, in some loom mechanisms, it would be impracticable to so arrange it with respect to the sand roll, in which event it may be disposed at the most convenient position and positively driven so to move in direct ratio to the movement of the fabric.

While I have shown a plain, endless belt, it is further to be understood that this may be constructed to engage a sprocket member if deemed essential, that there may be no relative movement between the belt and the sand roll, this being merely a mechanical variation within the skill of any workman in the art. The length of the belt is subject to modification to accord with the length of the unitary elements of the woven fabric or its ratio of travel with respect to the movement of the cloth. In the form depicted the carrier frictionally engages the roll L and is held firmly in contact therewith by a spring actuated friction roller 2 mounted upon the frame of the loom. Preferably an adjustable idling pulley or roll 3 suspended from the frame by the supporting bracket 4 is utilized to prevent the carrier from flapping during travel.

The carrier of leather, fabric or other material, has mounted upon its surface at proper intervals determined by the pattern to be woven, a series of metallic contact plates 5, the arrangement of the present example being composed of three such plates, two relatively short, and one intermediate relatively long, the latter controlling the weave at the end of the towel or other unit to be woven. Thus the surface of the carrier embodies conductive and nonconductive material, the former constituting circuit closing means. At this point it may be well to explain that these thin plates are purposefully made detachable so as to enable their positions to be changed as desired to effect changes in the pattern, and while in one form they may be riveted securely in place, a very excellent and satisfactory modification of the plates is shown in Fig. 10 where-

in the metal 5′ is provided with sharpened, bendable tabs 5″ designed to be pressed through the material of the carrier and detachably held in position thereon.

At a convenient point, a pair of spaced contact rollers 6, 6 are mounted in a U-shaped guide member 7 and insulated therefrom and out of electrical connection with each other, as best seen in Figure 4, the guide member engaging about the belt and serving to guide the same and being mounted upon an adjustable bracket 8 in turn secured to the frame of the loom. The shafts of the rollers 6 constitute binding posts 9 to which are led the electric conductors or wires 10 in circuit with any suitable source of current at hand, a general indication of which is designated in Figure 8 by the reference character 11. In this circuit, in addition to the switch 12, is arranged the electromagnet 13, supported at an elevated position upon the frame of the loom, and embodying the core member 14 which is designed to move vertically upwardly upon the closing of the circuit as the rollers 6, 6 pass upon any one of the contact plates 5 of the carrier. The actuating core is connected by the member 15 to one arm of a bell crank 16 mounted upon the lower part of the loom, the other arm of which bell crank is connected by the member 17 to the coupling or terry lock lever G, hereinbefore mentioned, so that during the travel of the rollers 6, 6 over the particular contact plate 5, this lever is held out of interlocking relation, and hence plain weave is produced. Immediately the rollers 6, 6 pass from the plate the circuit is broken, the solenoid core drops back, and the lever G again couples up the terry motion to continue the terry weave.

It will be obvious, therefore, that by the arrangement of the plates 5 on the carrier, the changes in the weave are automatically produced according to the arbitrary spacing of the said plates, and the lengths thereof naturally regulate the extent of the particular weaves, so that a direct and effective control of both sequence and lengths of the various weaves is simply procured, to modify which requires only the variation in the spacing arrangement of the plates and their lengths.

By virtue of the use of the electric control these changes are instantaneous and therefore far superior to the operation of change of weave through the instrumentality of cams, such as embodied in known constructions of pattern chains where the riding to the peaks of the cams involves such a space of time relative to the picks as to be very noticeable in the result of the weave. It is needless to enlarge upon the advantages of this electric control in view of the preliminary explanation hereinbefore given.

Brake control.

The control, however, is of greater utility than that just described. In addition to the operative connection with the terry motion, I employ this same solenoid as a control for the braking operation of the terry warp beam H. To this end the core 14 is connected by the member 18 with one arm of a second bell crank 19 arranged at the base of the loom frame, the other arm of which bell crank has attached thereto the end of the braking strap J passing over the friction drum I hereinbefore mentioned. During terry weave, the tension is off, that is, the strap J is comparatively loose, but immediately the change to plain weave is produced, as above described, the solenoid shifts the bell crank 19 and draws the strap J taut, exerting the desired braking action during this type of weave to insure compactness thereof.

Take-up control.

The foregoing control as to the pattern and breaking operation does not exhaust the application of my invention to loom mechanisms, as will be apparent from further consideration of the diagrammatic showing in Figure 8. As well known to artisans skilled in weaving, it becomes desirable at times to insure compactness of the weaving that the positive forward movement of the take-up be released in order that the fabric may let back, in changing from the terry to plain weaving, as well as during the latter. This is readily accomplished in my system of control by the provision of a series of contact plates on the carrier 1 adjacent to the pattern control contacts. Referring again to Figure 8, these special contact plates are designated 20 and they are arranged in proper relation to the plates 5, one of the rollers 6 for which is disposed preferably to overlap the second series of plates. A second contract roller 6^a in circuit with a second electromagnet 13^a completes the control circuit for operating the take-up pawl N, which is connected by the member 21 with the core of the solenoid 13^a. The control of this take-up mechanism as just explained is optional, but the adaptation is an important desideratum in this art.

Conclusion.

It will be seen from the foregoing that in the weaving of a Turkish towel of a length of 48 inches over all, for example, having a border at each end of the towel 2½ inch plain weave, ½ inch pile, ¾ inch plain, ¾ inch pile, 1 inch plain, and then 37 inch pile in the main body, it would be necessary simply to attach metal strips to the carrier belt, one to aggregate 5 inches for the two joining ends, then a space of ½ inch, then a metal plate ¾ inch, a space

¾ inch, and then a 1 inch metal plate. This will positively hold the weaving operations to the exact lengths, regardless of the thread structure itself, and obviously any failure on the part of the take-up pawl to function, due to any drag against it or other cause, would not affect the result, since the sand roll positively determines the length of the piece of fabric to be woven as well as the change of weave.

In the case of hucks or other dobby woven towels, handkerchiefs, etc., it is immaterial whether the dobby has two cylinders or a double line of pattern pegs, for the control is designed to operate in the same way. That is to say, an operative connection from the solenoid would be run to the switch or the trip that is employed for effecting the change of weave.

The possibilities of this invention are probably best illustrated in connection with the manufacture of huck towels. The simplest or the cheapest loom for this purpose is one containing a single action dobby, this type of mechanism being possibly the most easily handled loom manufactured. Those skilled in the art realize that to change the weave at the borders in fabrics of this character a very large amount of box chain rigging is necessary to control the weave that is produced by the dobby chain design. That is to say, it is required that a multiplier dobby be employed which with all the rigging costs about three times as much at the very least as the common dobby. I find it entirely feasible to adapt my invention to a common single action dobby, and this simple mechanism will do just as good work as any multiplying dobby costing, as above stated, a great deal more.

There has always been a desire on the part of towel manufacturers to put out a towel on which the border design would be printed in colors, but owing to the fact that it has heretofore been impracticable to make in the weaving of towels an article of a definite length throughout the woven piece, the mechanical printing of such border design was found impracticable. However, with my system of control in use, the manufacturer is able to produce a fabric in which the unitary towel lengths are of exact dimensions, and it now becomes possible to resort to the mechanical printing of the border designs.

It is needless for the purposes of this application to further enlarge upon the advantages of my system of control. It will, of course, be apparent that changes may readily be made in the details of construction of my apparatus without departing from the spirit of the invention and within the scope of the claims hereto annexed.

Having thus described my invention, what I claim as new and desire to secure by Letters Patent is:

1. In loom apparatus, the combination with mechanisms for producing varieties of weaves to form patterns, of electrically operative means to effect change from one weave to another in a desired order, said means including a continuously traveling member movable synchronously with the travel of the fabric and having its surface formed of conductive and nonconductive material.

2. In loom apparatus having mechanism for producing variation in the weaving to form patterns, the combination with a take-up roll and pawl therefor, of a traveling pattern control cooperative with the take-up roll to move synchronously with the fabric, and having means for effecting changes in the weaving and separate means for release of the take-up roll to permit the fabric to let back.

3. A terry loom having a continuously running cam, a cam lever acted upon by said cam, and a coupling member on said cam lever normally in coupling position, in combination with electric pattern control means for moving the coupling member to instantaneously uncouple the cam lever when plain weaving is to be done.

4. A terry loom having a continuously running cam, a cam lever acted upon by said cam, and a coupling member on said cam lever normally in coupling position, in combination with an electric pattern control embodying a series of contact members arranged in position to close an electric circuit during the movement thereof at predetermined times, and means in said circuit operatively connected with the coupling member to instantaneously uncouple the same under the control of said circuit-closing means when plain weaving is to be done.

5. An electric control device for looms, comprising a carrier member adapted to be driven by the loom mechanism, and having its surface divided into electro-conductive sections and nonconductive sections arranged in the order of the different weaves of the pattern to be produced.

6. An electric control device for looms, comprising an endless carrier adapted to be positively driven by the loom mechanism and having upon its surface a series of sections of conductive material arranged in spaced relation to accord with a particular type of weave to be produced in the fabric, the length dimensions of said sections corresponding with the length dimensions of the said particular type of weave of the fabric.

7. An electric pattern control device for looms, comprising an endless carrier adapted to be driven in synchronism with the movement of the fabric, and having upon its sur-

face a series of metallic contacts detachably connected thereto in spaced relation to accord with the arrangement and sequence of certain sections of weave to be produced in the woven fabric.

8. In a terry loom, the combination with the terry motion and a coupling member therefor, a terry beam and braking means therefor, of a pattern control device including an electrical circuit closer adapted to travel in synchronism with the fabric, and an actuating magnet operatively connected with the coupling member and the braking means for the terry warp beam, said magnet being actuated incident to closing of the circuit therefor whereby to produce plain weave and simultaneously operative to effect braking operation during such plain weave.

9. In loom apparatus, the combination with mechanism for producing varieties of weaves, of electrically operative means to effect change from one weave to another in a desired order, said means including a continuously travelling member movable synchronously with the travel of the fabric and provided with circuit making and breaking instrumentalities.

10. An electric control device for looms, comprising an endless member adapted to be driven by the loom mechanism and having its surface divided into weave-change producing sections arranged in a desired order, certain of said sections being adapted to close an electric circuit and maintain it closed for a predetermined length of woven fabric.

11. In loom apparatus for producing variation in the weaving to form patterns, the combination with the take up roll, of a pattern control device cooperative with said roll to move synchronously with the fabric and having its surface divided into weave-change producing sections, the linear dimensions of which correspond to the linear dimensions of the pattern elements to be woven.

In testimony whereof I affix my signature.

JOHN L. DAVIDSON.