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THE MANUFACTURE OF TURKISH TOWELING FABRICS.

Contents: Introduction. *Plain Terry Pile.* Forming Loops on One Side of the Fabric. Loops on Both Sides of the Fabric. *Loom Motions.* Swinging Reed. Movable Journal-boxes. Movable Front and Back Rails. Another Reed Motion. Fancy Effects. *Jacquard Terry Pile Fabrics.* Using One System of Pile Warp. Using a Two Section Tie-up. Using a Regular One-section Tie-up. Using Front Harnesses. Designing and Card Stamping. Cutting Cards for a Two-section Tie-up. Cutting Cards for One-section Tie-up. Cutting Cards for One-section Tie-up Having Front-harness Attached. Showing Full Terry Pile on Both Sides of the Fabric. Cutting Cards for a Three-section Tie-up. For Two-section Tie-ups. For One-section Tie-up. For One-section and Front Harnesses. Novelty in Turkish Towels or Mats.

This article will be explained by means of thirty-six illustrations.

These fabrics, besides their extensive use as towelings, also find use as bath robes, dressing gowns, toiletings, counterpanes, mats, etc. They are what we technically call *terry* pile fabrics in which certain warp-threads form loops on the face, or what is most often the case, on face and back of the fabric. These loops are produced without the aid of wires on specially constructed looms, known as *terry looms.* Only one system of filling is required, but two systems of warp-threads are an absolute necessity in the weaving of these fabrics, one system being known as the ground or body warp, the other as the pile warp. The ground warp produces with the filling the body, *i. e.,* foundation of the fabric, and from which the characteristic loops, as formed by the pile warp, project. Each system of warp-threads is placed on a separate beam, since a different let-off for the two systems of warp is required.

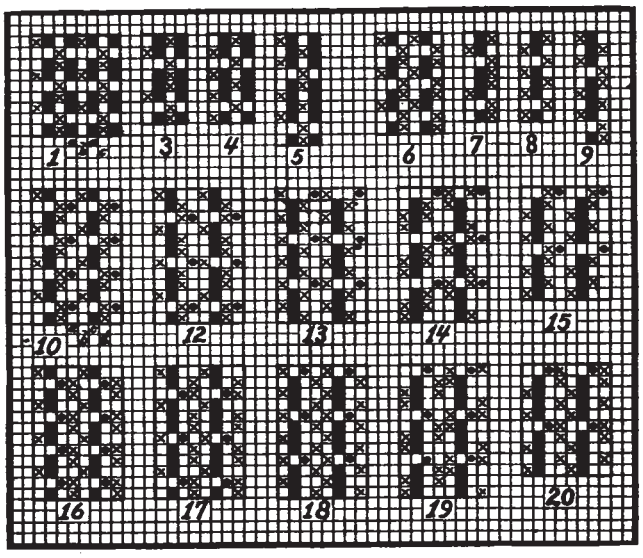
The difference of this class of pile fabrics from that of true warp fabrics is that the loop is not produced by a wire but by the special construction of the loom which is equipped with a special motion which enables the loops to be formed on the face or back, or face and back of the cloth. All fabrics used for turkish towels, dressing gowns, etc., are mostly made of cotton yarns, a few may call for linen yarns; in connection with cheap mantle cloth the pile is developed in woolen or worsted yarns.

Different makes of looms are met with in the manufacture of these fabrics, but in every case the object is to have two (or more) picks of filling left a short distance (say about ½ inch) from the fell of the cloth, and then to beat up these picks in unison with the next following pick. The ground warp on this beating up procedure is held taut, whereas the easing motion lets off the pile warp, the threads of which thus slide with picks beaten up by the reed to the fell of the cloth. Each pile thread thus driven home forms itself into a loop either on the face or the back of the fabric structure as regulated by its weave, risers in the latter throwing the loop on the face of the fabric and vice versa, sinkers in the weave throw their loops onto the back of the fabric structure.

These terry pile fabrics can be divided into *plain, fancy* and *Jacquard* structures; the latter two are obtained either by the weave, by the color pattern in the warp, or by both.

Plain Terry Pile.

These comprise the bulk of the turkish towels and bath robes made. Although loops on both sides of the fabric are the most often met with arrangement, we will first deal with loops produced only on one side of the fabric, *i. e.,* on its face.



FORMING LOOPS ON ONE SIDE OF THE FABRIC.

Weaves Figs. 1, 3 to 9 and Diagram Fig. 2, are given to illustrate the subject.

Weave Fig. 1 is the common, one-sided, 4 by 3 terry pile weave and Fig. 2 a diagram of a section of the fabric showing the interlacing of the pile and ground warp as well as that of the filling, also the formation of the loop. In weave, *full* type indicates pile warp up, *cross* type showing the interlacing of the ground warp.

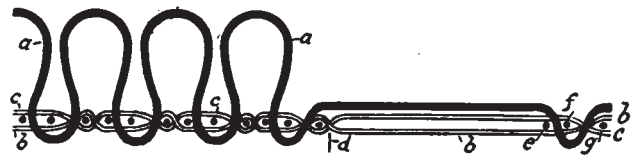


Fig. 2

To clearly illustrate the formation of the fabric, the following letters of reference in weave and fabric section are used correspondingly, viz.: *a*—pile warp, *b* and *c*—ground warp.

In fabric section, *d* indicates fell of cloth, *d* to *e* the distance of inserting the round of three picks, *e, f* and *g,* away from the fell of the cloth. These three picks are then in unison driven up to the fell of the cloth and when the loose pile warp, sliding on the taut ground warp-threads, forms the characteristic loops of the pile warp on the face of the fabric, which in this instance floats over two picks and is bound by one.

Weaves Figs. 3 and 4 both have four picks to the round, the first one interlacing the ground warp by $\frac{1}{3}$ and $\frac{3}{1}$ whereas the latter one interlaces the

ground warp with the plain weave. The float of the pile warp in both weaves is three picks.

Weave Fig. 5 has five picks to the round, the pile warp in this instance floating over four picks, the ground warp interlacing $\frac{1}{2}\frac{1}{1}$ and $\frac{2}{1}\frac{1}{1}$ respectively.

These single-face pile structures can also be made, arranged with one pile warp-thread to two ground warp-threads. Weaves Figs. 6, 7, 8 and 9 illustrate the subject, referring to the alteration of weaves Figs. 1, 3, 4 and 5 respectively, changing the repeat of the weave from four warp-threads to that of only three; no change in weave filling ways has been made.

Loops on Both Sides of the Fabric.

Weave Fig. 10 and diagram of its fabric section Fig. 11 are given to illustrate the formation of loops on face and back of the fabric structure.

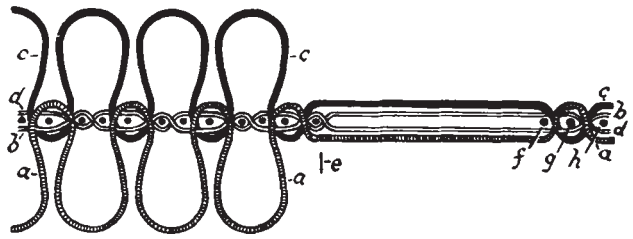


Fig. 11

Two kinds of pile warp are used. One is shown by *dot* type in weave and indicated by letter of reference *a* in weave and diagram, and which forms the loops on the back of the fabric; the other kind of the pile warp is shown in the weave by *full* type and indicated by letter of reference *c* in weave and diagram, and which forms the loops on the face structure of the fabric. Letters of reference *b* and *d* in weave and diagram indicate the two ground warp-threads in one repeat of the weave, and which by interlacing with the filling produce the ground or body structure of the fabric, being shown by means of *cross* type in the weave plan, and in outlines in the fabric section. The formation of the two loops in the loom is shown at the right hand of the diagram Fig. 11, *e* indicating fell of cloth, *e* to *f* distance of inserting the round of three picks, *f*, *g* and *h*, about ½ inch away from the fell of the cloth. Beating up the reed after said three picks have been inserted, will in turn push pile warp-thread *a* downwards (shown shaded), forming a loop on the back of the fabric structure, and pile warp-thread *c* (shown in *full* type), forming a loop on the face of the cloth.

This three-pick, two-faced terry structure is the one most frequently used, however, sometimes four or five picks are inserted in producing each horizontal row of loops; this is done without derivating from the principle of fabric structure thus far explained. Weaves Figs. 12 to 15 are given to illustrate the subject. Character of type used for indicating the various threads is the same as the one used in connection with Fig. 10.

Weave Fig. 12 has four picks to the loop, using a three-pick weave $\frac{}{2}\frac{}{1}$ and $\frac{2}{}\frac{1}{}$ for the interlacing of the ground warp, for which reason this weave will call for 12 picks in its repeat.

Weave Fig. 13 has the same formation of a loop as used in the previously given example, using the plain weave for the interlacing of the ground warp. Repeat of Weave 4 by 4.

Weave Fig. 14 has again the same formation of a loop as Weave Fig. 12, using in this instance the $\frac{2}{2}\frac{2}{2}$ 4-harness even-sided twill for the interlacing of the ground warp. Repeat of Weave 8 by 4.

Weave Fig. 15 shows five picks used for each loop, using the arrangement of $\frac{1}{1}\frac{1}{2}$ and $\frac{1}{1}\frac{1}{2}$ for the interlacing of the ground warp. Repeat of Weave 4 by 5.

The arrangement of the warp
1 end ground
1 " pile, face
1 " ground
1 " pile, back, as used in connection with Weaves Figs. 10, 12, 13, 14 and 15, in some instances is rearranged thus:
1 end ground
1 " pile, face
1 " pile, back
1 " ground, as is shown in Weaves Figs. 16 to 20, being the five weaves formerly explained, correspondingly rearranged, *viz:*

Weave Fig.	10	see	Weave Fig.	16
" "	12	"	" "	17
" "	13	"	" "	18
" "	14	"	" "	19
" "	15	"	" "	20

In drawing in the warp in the reed, usually two threads are placed in each dent; with the arrangement of 1 ground 1 pile, one of each series (see Figs. 10, 12, 13, 14 and 15) of threads is placed in one dent, whereas with the 2 ground 2 pile arrangement two ends of the same series are placed together in one dent. Both arrangements produce practically the same results, but the 2 and 2 structure has the advantage that by reeding as described, the threads in each dent of the reed work opposite to each other, and at the same time the pile and ground threads which on some picks work alike, are thus separated by the wires of the reed, so that it is easier for the loom fixer to obtain a clear shed.

Fabric Textures.

A standard texture for a good Turkish toweling is:
Pile warp: 2/20's cotton
Ground warp: 2/18's cotton
Filling: single 16s cotton.
Warp texture: 50 ends per inch
Filling: 58 picks per inch.
Take-up of pile warp: 5 yards dressed=1 yard woven fabric.
Take-up of ground warp: 2 per cent.
Shrinkage in width: 12 per cent.

Lower grades of fabrics may be made thus:
Pile warp: 2/16's cotton
Ground warp: 2/14's cotton
Filling texture: 36 picks or more per inch.
Take-up of pile warp: 3 yards dressed=1 yard woven fabric.
Take-up of ground warp: 2 per cent.
Shrinkage of width: 12 per cent.

From textures quoted it will be seen that (as a rule) the ground warp is heavier in its count than the pile warp. For a fabric requiring a soft handle don't put any more twist in your yarn than will produce a satisfactory fabric as to its strength and wear. The length of the pile loop formed influences the feel

(handle) of the fabric, a long pile handling softer as compared to a shorter pile. The length of the pile loop depends upon the distance the picks forming one loop (one repeat) are left away from the fell of the cloth previously to beating up, and which, considered on an average is about one-half inch, giving us a loop of about one-quarter inch high.

Loom Motions.

Different motions for producing the difference in beating up the filling in this class of terry pile weaving are in use.

In one method, in which a fast reed is employed, the going part is moved forward for a shorter distance after the two, three or four "loose" picks; while in another fast reed type, movable front and back rails are provided, which enable the edge of the cloth to be traversed, when required, in advance of the stroke of the reed for the necessary distance. In the system which meets with the greatest favor, however, a loose reed is used which is caused to move backwardly at the bottom, the upper edge of the reed acting as the fulcrum.

SWINGING REED.

Fig. 21 shows the use of a movable, *i. e.,* swinging reed used. The operation is thus: When cam *a* does not raise lever *b,* frame *c* remains lowered as does also the arms *d,* and when the lay swings towards the breast beam the outer ends of arms *d* come in contact with the inner ends of screws *e* whereby the arms *d* will be pushed in the inverse direction of the movement of the lay—that is, in the direction of arrow *f,* thereby swinging backward the reed *g* and preventing it from driving the last pick home, in other words preventing the reed *g* from driving the last pick against the fell of the cloth; but if the cam *a* raises the lever *b,* the frame *c* will be moved upward and the arms *d* will be raised so that their shoulders engage with the face of the lay, and the free ends of the arms *d* will be raised to such an extent that they will pass over the beveled ends of the screws *e* and the bar *h,* or lower part of the reed, will not be pressed in the direction of the arrow *f,* thus permitting the reed to drive the last

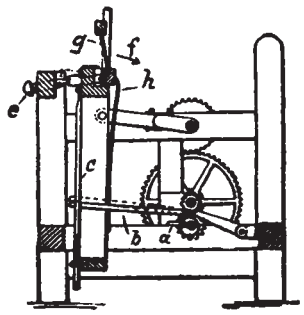


Fig. 21

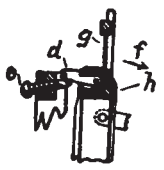


Fig 22

pick (as well as those previously inserted) home, *i. e.,* to the fell of the cloth, as represented in diagram Fig. 22, which shows a detail of Fig. 21. The loom can be so constructed as to drive the third, fourth, fifth or sixth pick home, as may be desired. The length of the loops is adjusted by means of the screws *e,* for the farther the screws project from the breast beam the greater will be the distance that the bar *h* is swung back, and thus the greater will be the distance between the fell of the cloth and the first pick of the new loop formation.

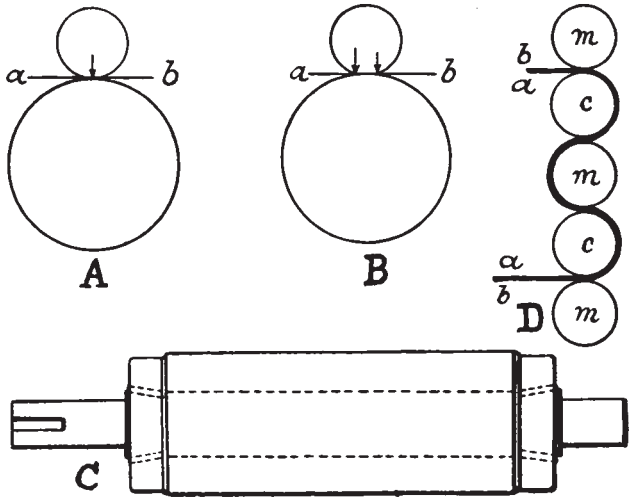
(To be continued.)

THE FINISHING OF COTTON GOODS.

Calendering.

The process of calendering, in a general sense, consists in subjecting the cloth, when suitably prepared and dried, to pressure between rollers (also called bowls) of various descriptions. The effects produced depend upon the nature and sequence of the nips, and the quality and preparatory treatment of the cloth. The chief effects aimed at in calendering include (as regards appearance) the following:

Glazing and brightening.
Flattening.
Closing.
Giving a thready or clothy appearance.
Embossing and allied effects.



Effects relating to the feel of the cloth include:

Smoothness.
Threadiness.
Hardness and firmness.
Elasticity.
Mellowness or softness.

The relations between these effects and their causes are considered in detail subsequently. We must first, however, refer to some general considerations and apparatus.

The essential features controlling the effects produced at any nip are:

(*a*) Degrees of pressure existing between the rollers, and, to a certain degree, their temperature.

(*b*) The surface properties of the rollers as regards smoothness and elasticity.

(c) The physical properties of the fabric under treatment, and its ingredients.

(*a*) represents the sum of the weights of the rollers lying above the nip, together with the pressure due to the compounded weight levers.

The nature of the pressure is slightly elastic in virtue of any such quality in the rollers, and in so far as the weights are at liberty to move vertically.

When "dead set" is applied, by locking the levers and tightening the thrust blocks, the remaining elasticity due to the nature of the rollers is almost neutralized, and in any case it is extremely small. This device is chiefly adopted in small and embossing calenders.

(*b*) The rollers being cylindrical, the contact between them and the cloth at the nip is that between straight lines or very narrow areas extending across the face of the cloth. The width of this area is in