BEHAVIOUR OF POLYAMIDE STRETCH YARNS IN WARP KNITTING PROCESS

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1. Introduction

Fabrics knitted from stretch yarns are known to show very good functional performance. Freedom of movement, high dimensional stability and hygroscopicity as compared to those of the fabrics produced from simple synthetic yarns, render stretch yarns particularly advantageous for the production of lightweight warp knitted underwear.

Since the high elastic elongation of stretch yarns permit goods to be produced in less size series, garment fabrication technology can be simplified to a certain extent. At the same time—because of the high elongation and elasticity of stretch yarns—upon the effects of tension and heat applied during their processing, higher deformations take place in such yarns and fabrics than in traditional yarns. Even slight deviations in knitting technology may cause—by enhancing these effects—excessive variations in the properties of products (mainly in dimension) and thus difficulties in the garment fabrication process.

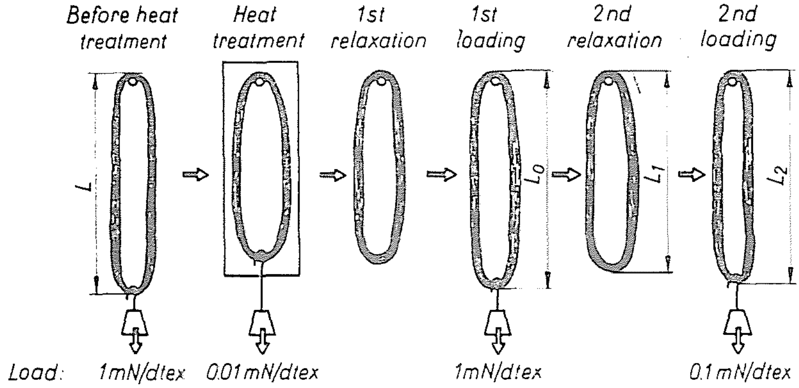
In view of the above, extensive experiments have been made to determine the relations between yarn and fabric properties. At first, a method had to be developed for the investigation of yarns of high elongation, taking also the conditions of the processing technology into consideration.

2. Testing work

2.1 Yarn testing

Both the processing of synthetic textured yarns of high elastic elongation and their behaviour in fabrics are decisively influence—in addition to the original properties of the raw material—by the conditions of their texturing. As to the finished goods, among the resulting yarn characteristics (volume, resistance to bending, frictional properties, elongation, etc.) it is the elasticity

* Habselyem Knitted Mill



Crimp: $Cr = \frac{L_0 - L_1}{L_0} 100$ [%] Characteristic crimp: $Ch = \frac{L_0 - L_2}{L_0} 100$ [%]

Shrinkage: $S = \frac{L_0 - L}{L} 100$ [%]

Fig. 1. Conditions and characteristics of testing yarn hanks

which is of basic importance. The differences shown in the elastic elongation values of stretch yarns, as compared to those of the non-textured yarns, require considerable changes in the processing technology.

In view of the above it is clear that among the methods used for testing textured yarns those determining the elasticity of the yarns are of the highest importance.

The methods for determining the elastic properties of yarns can be divided in twQ main groups.

— intermittent and
— continuous

procedures.

Intermittent test methods can be applied both for individual yarns or for yarn hanks. In these tests yarn length or hank length is to be measured under different loads. Measurements can be made,after or without pretreatment. (The pretreatment of yarns or hanks consists of cold or warm water or hot-air treatment or of a combination of these.)

However, as the individual yarn test method was found to give rather scattering results it was considered as not realiable enough. Thus, hank tests were made on the sample yarns by treating the initial hanks in hot air, after which they were allowed to relax, then loading and unloading followed, and at last they were allowed again to relax. The test conditions are given in *Fig. 1.*

For evaluating the results the characteristics: Cr (crimp), Ch (characteristic crimp) and S (shrinkage) have been determined on the basis of the hank length L measured prior to the heat treatment, and after the first and second

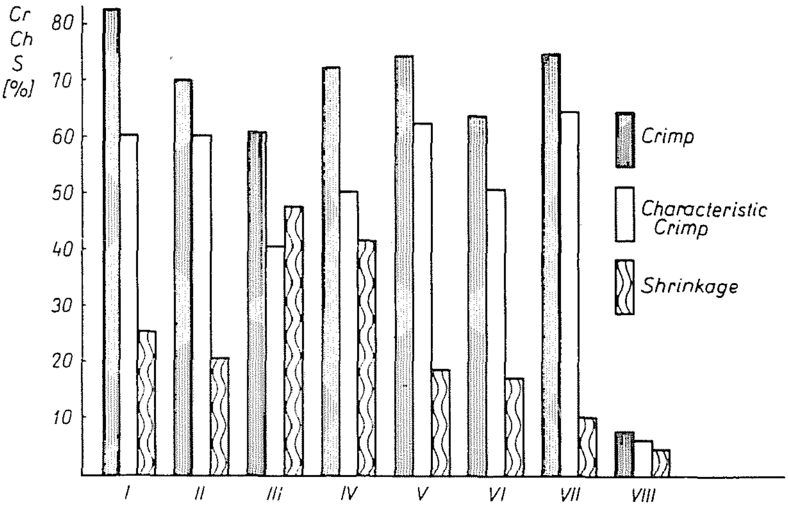


Fig. 2. Results of hank tests

loadings (L_0 and L_2) respectively, furthermore after storing in between the two loadings (L_1).

The test yarns (Table 1) to be processed later into the test fabrics, were of different counts and materials.

Table 1

Main characteristics of the test yarns

Notation	Count	Material	Remark
I.	22 dtex f7 × 2	PA 6.6	HE (yarn producer A)
II.	22 dtex f7 × 2	PA 6.6	HE (yarn producer B)
III.	44 dtex f12 × 2	PA 6.6	HE
IV.	44 dtex f13 × 2	PA 6	HE
V.	78 dtex f17	PA 6.6	HE
VI.	78 dtex f17 × 2	PA 6.6	HE
VII.	110 dtex f34	PA 6.6	HE
VIII.	167 dtex	PES	set

The measured values in *Fig. 2* illustrate that the shrinkage trends of the different types of yarns—which influence their behaviour during finishing—are rather different and so are the elastic properties of the yarns after heat treatment.

In *continuous testing*, yarn elasticity is measured on a running yarn by the force required to extend a unit yarn length. On the test device type Rotschild

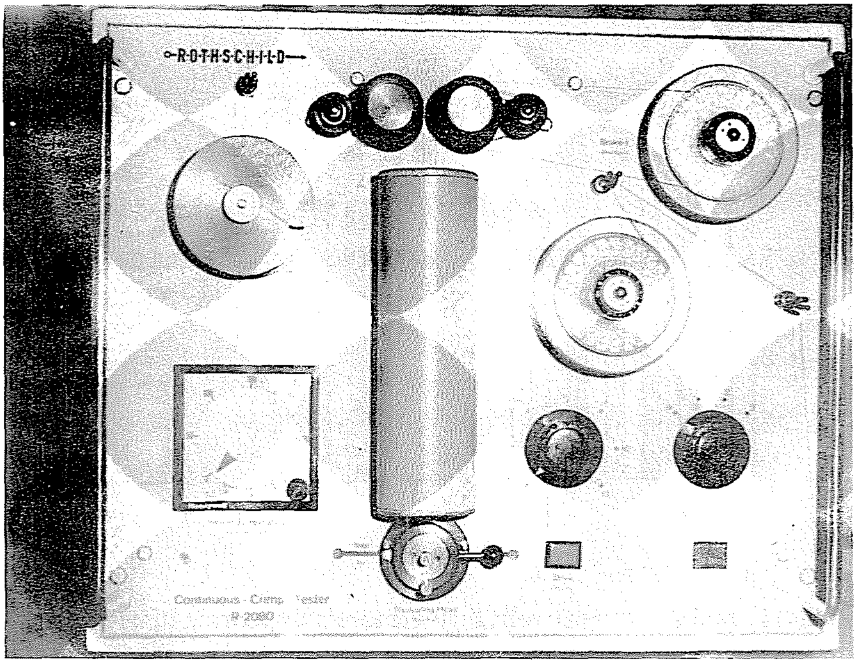


Fig. 3. Device for continuously measuring the yarn elasticity

R 2080, used in our experiment *(Fig. 3)*, yarn tension (pre-loading), yarn feed and heat effect are controllable thus the parameters of normal processing can be adequately approached. *Fig 4* shows the path of the test yarn and the setting characteristics chosen for our experiments.

On the yarn section tested (within individual bobbins) no change in the contraction force was observed at temperature 293 K (about 20 °C). The same test repeated at 448 K (about 175 °C), gave more uneven contraction force values varying over a wider range even within individual bobbins *(Fig. 5)*.

It was found furthermore that while in the absence of heat treatment the effect of changing the yarn feed was of no importance, in the case of applying heat treatment, contraction force increased considerably with reduced yarn feed *(Fig. 6)*. In view of the analogous behaviour of all the yarns tested, the joint effects of heat and yarn feed can be considered as general. (*Fig. 7* contains the test results for four types of test yarns.)

From the comparison of the measuring data obtained (Figs 2 and 7) it follows that *in the intermittent and continuous test methods used by us the different yarns are graded on the same way*, thus, both methods are suitable for comparative measurements. The advantages of the continuous test method are to give quick results and the adjustability of test conditions.

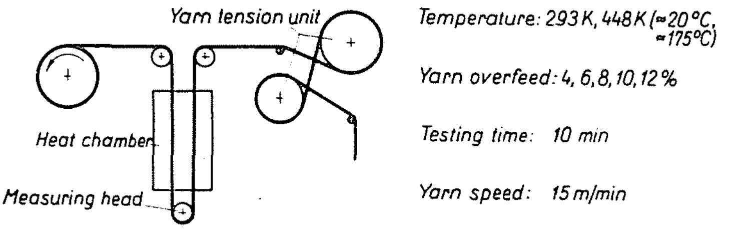


Fig. 4. Path of the tested yarn

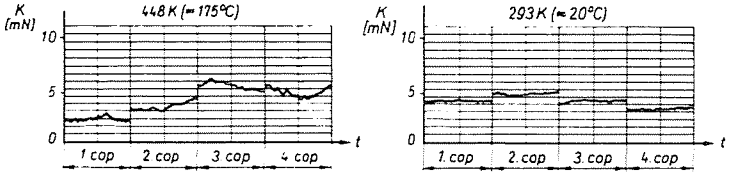


Fig. 5. Values of the contraction force in continuous measurement vs. temperature for yarn type I. (Yarn overfeed: 12%)

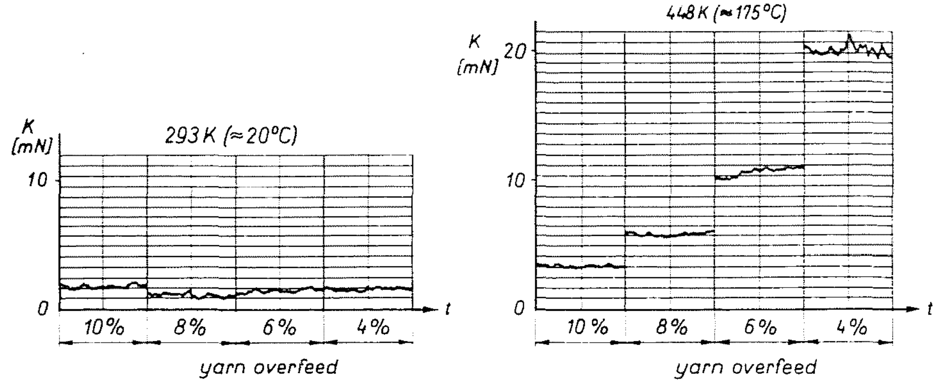


Fig. 6. Values of the contraction force in continuous measurement vs. yarn overfeed for yarn type I.

2.2 *Fabric testing*

For determining the elastic properties of the test fabrics, various procedures have been applied.

*Method KERMI**: It is based on the measurement of the deformation due to loading and the degree of recovery which follows unloading (1). The indices of elongation—elasticity are given in *Fig. 8*. Course- or walewise measurements

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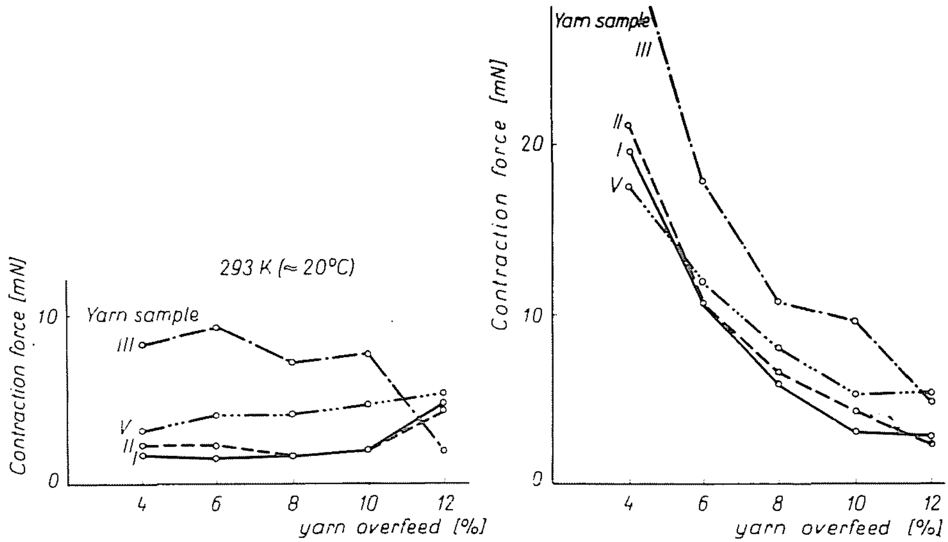

Fig. 7. Effect of yarn overfeed and treating temperature on the contraction force of the yarn

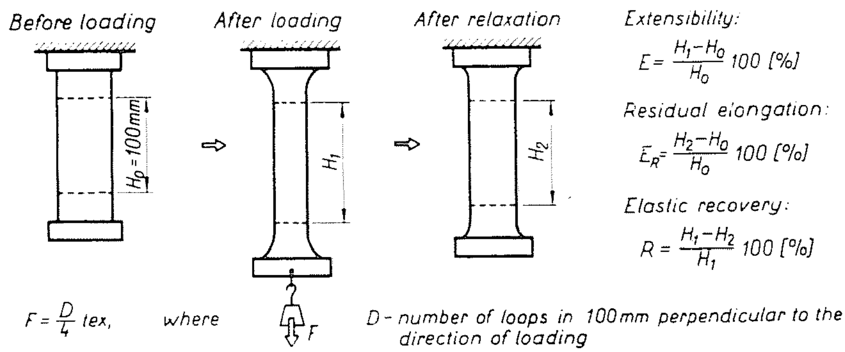

Fig. 8. Conditions and characteristics of the yarn tested according to KERMI's method

may be carried out at several—determined—instants of the loading or unloading. The loading force F differs for each resultant yarn count, fabric type, density and test direction (2).

The method of identical extension is based on the measurement of the force to extend the fabric in one direction to a determined extent. The test principle follows the practical experience that similar wearing comfort of products made of different types of fabrics can be achieved if the force necessary to extend the fabric in the required measure little varies. (Accordingly, greater difference between sizes in wearing and unloaded values can be allowed for in fabrics of higher than of lesser elongation.)

Table 2

Test fabrics

Sample	Number of guide bars	Type of yarn		Threading of the ground guide bars
		in the ground	for patterning	
A	4	dtex 22 f7 × 2	PES set, dtex 167 (22%)	Bars 1 and 4: 1/1
B	1	dtex 78 PA 6.6	—	Fully threaded
C	2	dtex 44 f12 × 2 PA 6.6	—	Bars 1 and 2: 1/1
D	4	dtex 44 f12 × 2 PA 6.6	dtex 44 f12 × 2	Bars 1 and 4: 1/1
E	10	dtex 110 PA 6.6 (88%)	textured acetate dtex 220 (12%)	Bars 1 and 4: 1/1
F	4	dtex 22 f7 × 2 PA 6.6 (72%)	dtex 78 × 2 PA 6.6 (28%)	Bars 1 and 4: 1/1
G	6	dtex 22 f7 × 2 PA 6.6 (74%)	dtex 78 × 2 PA 6.6 (26%)	Bars 5 and 6: 1/1

The advantage of this test method is its quickness, while its drawback is that only the extensibility of the fabric is measured, its recovery not.

— *In the method of identical loading* the characteristics formed from the different elongation components of uniformly loaded fabrics are used for comparing the elastic properties.

— Any of the applied fabric tests can be completed with *washing test* indicating the specific dimension changes of the fabric after five washings.The conclusions to be drawn refer in the first place to the wearing performance of the fabrics. Thus, it is advisable to use finished goods for washing tests.

Seven types of fabrics knitted from the test yarns have been tested (Table 2). The guide bars forming the ground produce the fabric structure shown in *Fig. 9*. Both the one-bar fabric B and the other open work structures offer greaber possibility for the deformation of the fabric.

Owing to the small proportion and spotlike arrangement of the pattern does not influence basically the properties of the fabrics tested, only slightly modifies them.

On the basis of the fabric test methods described, the conclusion can be drawn that *fabrics made of stretch yarns are highly sensitive to the conditions of the deformation process*. Accordingly, when using different test methods (e.g. applying constant or continuously increasing loading force, resulting in differential creeping phenomena) the fabrics are not ranked in the same order.

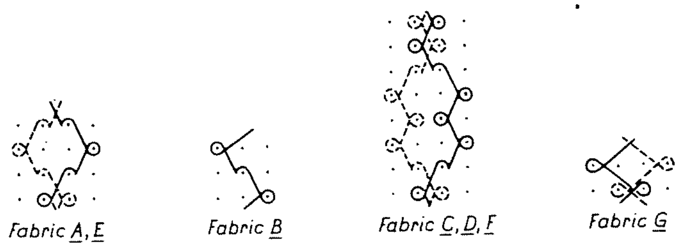

Fig. 9. Lapping movement of the base guide bars in knitting the test fabrics

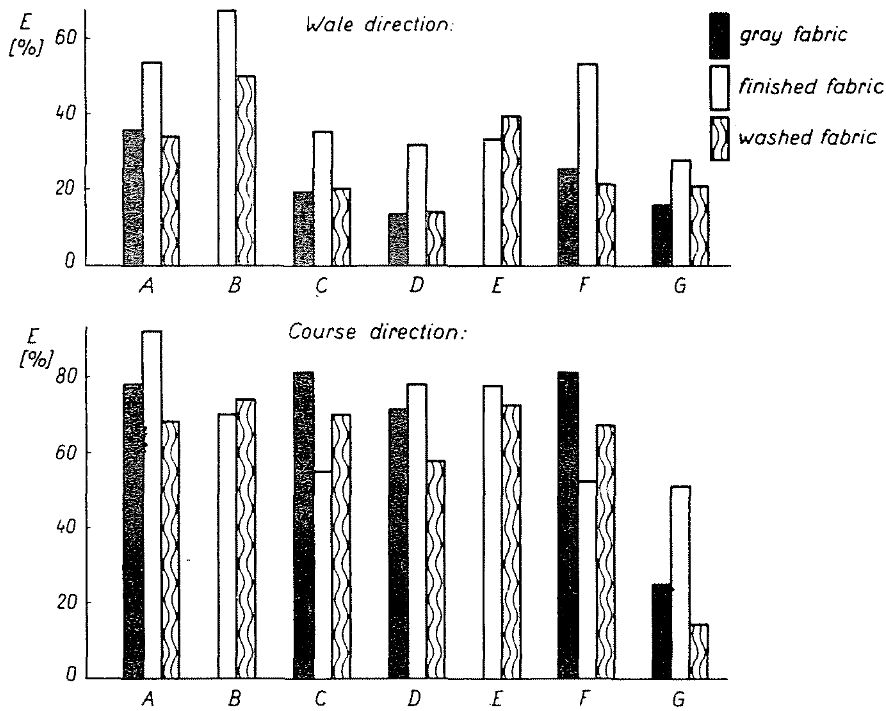

Fig. 10. Extensibility values of the test fabrics

Confronting the test results and the practical experience, the *method KERMI proves to be the most suitable for testing the elastic properties of fabrics.*

This method can be applied suitably in two ways:

— for exact quality control with 3 minutes' loading and after unloading, allowing a relaxation period of 24 hours,

— for quick data supply during processing, taking readings after 3 minutes' loading and allowing 3 minutes' (eventually 1 hour) relaxation.

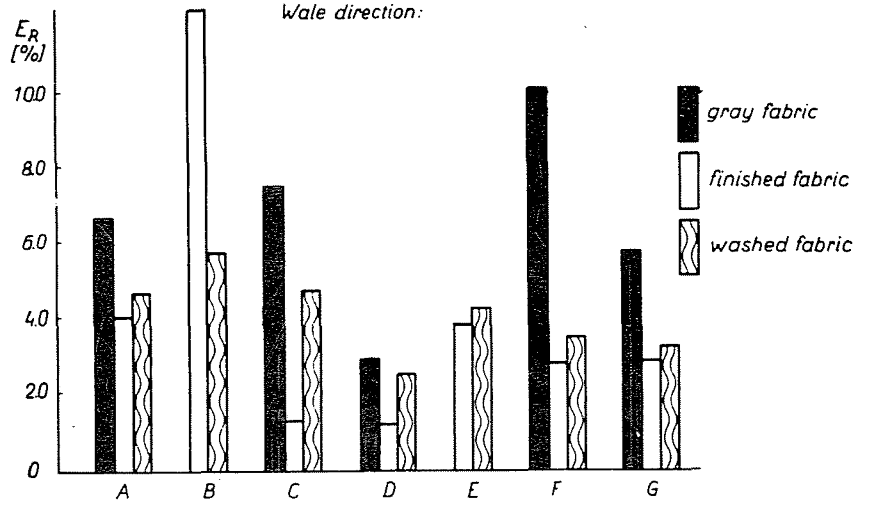

Fig. 11. Residual elongation values of the test fabrics

Differences in fabrics can best be observed on the basis of extensibility. *Fig. 10* illustrates the extensibility values of gray, finished and washed fabric samples for 3 minutes' loading.

There is a relationship between the characteristics representing a tendency to elongation: the values of extensibility E and of residual elongation E_R rank the fabrics in a nearly similar order, i.e. the ratios of residual to total elongation of the fabrics are almost equal. This tendency was primarily found in walewise direction *(Fig. 11)*, while in coursewise direction the tendency appeared to be less unambiguous.

By analyzing the *relation between the elasticities of yarn and fabric*, experimental results prove a connection to exist between yarn and fabric properties.

Excluding the one-bar fully threaded fabric B deviating in every respect from the others, the highest extensibility in coursewise direction is observed in the two fabrics A and B which consist in more than 70% of the yarn type I, showing the highest crimp Cr, the highest characteristic crimp Ch and the lowest contraction force C. The reduced extensibility of the third fabric G of similar composition can be explained by its more uniform and denser ground structure.

The fabrics C and D knitted from yarn III with the lowest crimp characteristics and the highest contraction force show—among the samples—the lowest extensibility in wale direction and the lowest residual elongation after finishing. This is related with the high shrinkage value—the highest obtained so far—in the hank test.

The examples described clearly show the seviceability of the selected yarn and fabric test methods, furthermore, *a relationship to exist between yarn and fabric elasticity*. On the basis of the relationships obtained, *a direct relation can be stated to exist between fabric extensibility and the crimp characteristics shown by the hank test, and an inverse relation between the contraction force indicated by the continuous yarn test, and the fabric extensibility.*

The *relation between fabric ground structure and fabric extensibility* can be determined by comparing the fabrics A, F and G made of the same ground yarn and with the same threading but using different lapping movements.

It is seen that among the 2-needle underlap tricot (G), the 2 courses one-needle underlap atlas (F), and the combination of atlas and one-needle underlap tricot (A)—all produced by opposite lapping—the extensibility values are the lowest for those made with 2-needle underlapping. This can be explained by the fact that 2-needle underlapping results in an increase of yarn density (there are twice as many sinkerloops in the same cross section) thus in higher friction between the yarns, hampering the structual rearrangement of the fabric. On the other hand, the sinkerloops include a lesser angle with the course direction, as a consequence also the deformation in course direction is smaller.

The other two fabrics (A and F) exhibit somewhat similar behaviour under loading in wale direction. The reason for this is that both are produced with a ground structure formed by one-needle underlapping. For the exceptional high extensibility of the fabric A in course direction, the far apart, stripe-like arrangement of the pattern yarn is responsible.

Indications found with respect to the *relation between patterning and fabric extensibility* can be confirmed by comparing the fabrics C and D produced under otherwise similar conditions.

The extensibility and elastic recovery of the finished fabrics are higher for those of a ground structure without patterning (fabric C). The stiffening and densening effect of the pattern yarn reduce unambiguously the elongation tendency and the capacity for recovery (fabric D).

The effect modifying the elasticity of the fabrics is considerably influenced by the arrangement of the pattern yarns within the fabric. In their presence the extensibility of the fabric decreases. Using only a limited amount of pattern yarn this effect on the total elongation or on other elastic properties of the fabric becomes negligible. With evenly distributed pattern yarns there will be no such areas in the fabric where only the ground structure exists, and this more even yarn distribution itself contributes to the fabric resistance.

3. Practical Application of the Results

On the basis of the experiments described practical methods have been developed, suitable for achieving

- — full exploitation of yarn elasticity in finished fabrics,
- — quick and reliable checking of machine settings in mill practice under conditions of mass production,

as well as optimum technological conditions have been determined.

3.1 Warping

In warping, identical tension of the yarns is of paramount importance. However, in mill practice it is not easy at all to fulfil this requirement. In principle

- — only yarns textured under fully identical conditions are to be warped on to the beam,
- — all bobbins should be of the same size,
- — bobbins should be not too far spaced apart, and
- — the number of friction places, the yarns are passing, be the same.

Actually, the above requirements can be fulfilled only to a certain extent, thus some difference in the tension of the ends cannot be excluded. According to our experience, *differences in tension of 20—30 mN per yarn (about 2—3 p) do not cause deviations appearing in the finished fabric*, thus such variations are permissible. On modern creels, with correctly set yarn tension units, differences in the distance between front and back bobbins, in bobbin dimensions, and in the number of friction places, do not cause differences exceeding the above value provided yarn brakes are adequately adjusted. Great care should be taken *to warp yarns only from the same lot on to the beam and that all bobbins should contain only yarns textured under the same conditions.* These requirements can be satisfied only be the yarn suppliers, thus they have to be informed in advance that the given textured yarn will be processed on warp knitting machine into piece dyed fabric. Namely, in that case yarn producers pay the utmost attention to select bobbins of the same lot. Since this practice has led to the desired result, it appears to be worth of the excess cost.

The condition of using *approximately identical bobbin sizes* at the beginning can be easily fulfilled, difficulties may arise, however, in processing yarn rests. According to our experience no fully even fabric appearance can be achieved with the use of yarn rests, thus they are to be applied either for pattern yarn or for producing seconds. The same is valid for yarn rests of different lots.

Test measurements have been made on a polyamide 6.6 yarn, dtex 22 f7 × 2, using a Liba warping machine for section beams of 21″ × 14″, suitable for warping simultaneously 288 ends on to the section beams. On the creel—closer to the warping machine—1/3 part of the bobbins contained yarn rests (small diameter), while the remaining 2/3 part of the bobbins on the farther side of the creel were full ones. The same tension (20 mN, i.e. a disc weight of about 2 p) was applied for all the bobbins. We have measured the yarn tension and its variation by means of an electronic instrument. The measured values were in

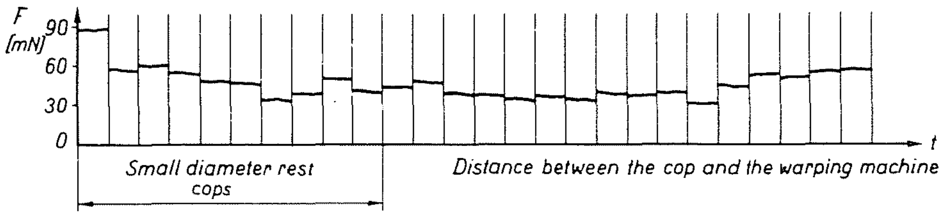

Fig. 12. Yarn tension in warping vs. the cop to warping machine distance

the range of 30 to 90 mN (about 3 to 9 p). This 60 mN (about 6 p) variation, however, may even increase in the course of further processing, causing differences in yarn shrinkage and dye take-up, which impair the uniformity of the fabric appearance. Between bobbins of small and large diameter, marked differences in yarn tension could be observed, which were compensated due to the fact that the smaller bobbins were nearer to the warping machine, thus their yarn reached the beam sections by contacting less yarn guides, thus underwent less friction. In special cases, however, a slight resetting of the yarn tension posts (to change the angle of warp on the yarn tension unit) still proved to be necessary *(Fig. 12)*.

To measure the tension on all the ends is practically impossible. Satisfactory results can, however, be obtained in checking the correct braking of the yarns by measuring the tension with the aid of a hand device on 3—4 ends at even intervals along the width of the beam during the warping of every section beam. If new bobbins are put on to the creel it is advisable to measure yarn tension on at least 15 to 20 ends at the usual warping speed prior to warping.

3.2. Warp knitting

In order to investigate the conditions of uniform fabric formation the tension arising in the individual guide bars along the full width of the fabric has been analyzed. Practical reasons, imposed to measure the tension near the beams, thus the values obtained were lower than those found in the actual loop formation process. But also these values were suitable for pointing out uniformity or unevenness.

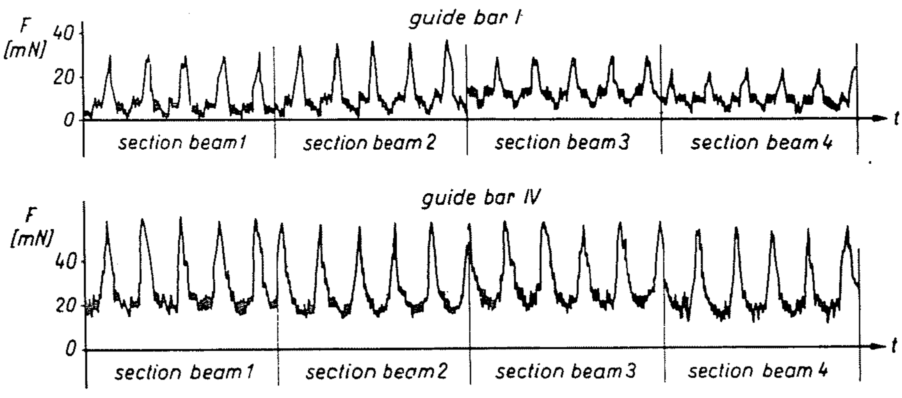

Fig. 13. Variations in yarn force in the individual section beams in the base guide bars (Fabric F)

Three types of fabrics have been tested, their characteristic data are given in Table 3. The diagrams obtained for fabric F are plotted in *Fig. 13.* A mean difference of 10 mN (about p 1) was found in the tension of the section beams forming a complete warp beam. Naturally, during loop formation, variations in tension occur. In general, variations ranged from 10 to 30 mN (about 1 to 3 p) in the place of measuring, depending on the type of loop structure. In the actual place of loop formation this value is multiplied.

Table 3

Characteristics of the tested fabrics

Fabric	F	G	H
Ground yarn		dtex 22 f7 × 2 PA 6.6	
Pattern yarn		dtex 78 × 2 PA 6.6	
Ground structure	one-needle underlap, two-courses atlas (4 courses) one-needle underlap half-tricot (4 courses), lapping in opposite direction	two-needle underlap half-tricot, lapping in opposite direction	one-needle underlap two-courses atlas, lapping in opposite direction
Loop length measured on the machine, (mm)	Ground: Guide bar I = 2.23 Guide bar IV = 2.45	Guide bar V = 3.75 Guide bar VI = 3.73	Guide bar I = 2.10 Guide bar II = 2.08
Run-in: length of fabric made of 30 cm yarn length, (cm)	Guide bar I = 4.73 Guide bar IV = 5.15	Guide bar I = 4.87 Guide bar IV = 4.90	Guide bar I = 4.80 Guide bar II = 4.71

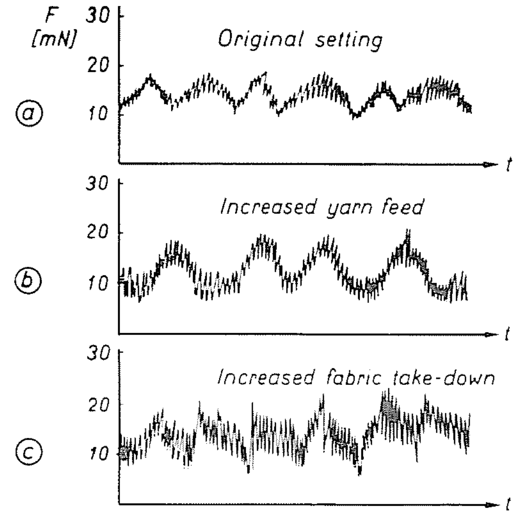

Fig. 14. Effect of changing the factors of machine setting on yarn tension

The extent of tension variations influenced by slight modifications of *yarn let-off or fabric draw-off was also investigated.* The diagrams in *Fig. 14* show the changes in tension on one of the beams for fabric H in the cases of the original setting (a), of increased yarn let-off (b), and of increased fabric draw-off (c). According to our experiments, variation in yarn tension cannot be moderated by such changes in setting, nor can tension peaks be eliminated by applying looser or tighter yarn let-off. Thus, *it is no use to change original machine setting in order to reduce yarn tension variations.*

From the testing of warp knitted gray fabrics the general conclusion can be drawn that deviations due to the scatter of yarn properties and unevenness in warping cannot be eliminated by changing the machine setting. If there are differences in the tension ranges of the section beams, so in addition to fabric unevenness resulting from different yarn tensions, loose or tight bands are formed in the fabric. Dimensional changes in coursewise direction of 5 pattern repeats along the width of the fabric, thus deviations by $\pm 3\%$ around the mean values were observed in our experiments. According to our experience this may be responsible for causing unevenness, corrugations and variations in fabric width.

In order to reduce variations in yarn tension, the values measured in the regions of scatter of the individual section beams have to be adjusted so as to comply with the identical mean values. This can be done by occasional checking of the warping tension and by selecting section beams similar in this respect, furthermore by turning-off slightly those section beams along their axes, which show tension deviating from the mean value of yarn tensions measured on the section beams on the warp knitting machine. For this purpose yarn tension is to be measured on 3 yarns of the individual section beams with the use of a hand measuring device.

When knitting the same type of fabrics on several machines, yarn tension values should be kept equal as close as possible on all the machines. One has to endeavour to achieve the highest accuracy possible in mill practice, since the measurement is not carried out where the actual loop formation takes place, but in a region where stresses are considerable lower, thus the values obtained may extremely increase in critical places. Similarly, care has to be taken to ensure uniform draw-off.

3.3 Finishing

In the finishing processes (washing, bleaching, dyeing and drying) considerable stresses are acting on the gray fabric influencing the properties of yarns and fabrics to a high extent.

It is the task of finishing by making use of the inherent elastic elongation of the yarn to develop the elastic properties and extensibility of the fabric and impart adequate dimensional stability to it. According to our experience the following order of the finishing processes is suitable for treating stretch warp knits:

tubing,
wet treatment (i.e. washing and dyeing or a bleaching),
hydro extracting,
opening the tube,
drying,
rolling-up.

3.3.1 Tubing

Forming a tube of the open fabric is necessary, because otherwise the wide warp knitted fabric may easily crease during the subsequent wet treatment (a risk especially when treated in winch-machine, while in using jet or overflow dyeing machines the danger is less imminent).

Chain stitch type 501 applying viscose rayon proved to be fairly suitable for seaming the tube as being easy to undo prior to drying, and since the braking strength of wet viscose is considerably lower than in dry state. In our practice Viscose rayon dtex 110 is applied for this purpose.

3.3.2 Wet treatment

Fig. 15 shows the temperature-time diagram for a characteristic washing-dyeing technology.

The aim of the 20 minutes' treatment at 313 K (40 °C) temperature introducing the process is to relax the fabric during which it shrinks both in

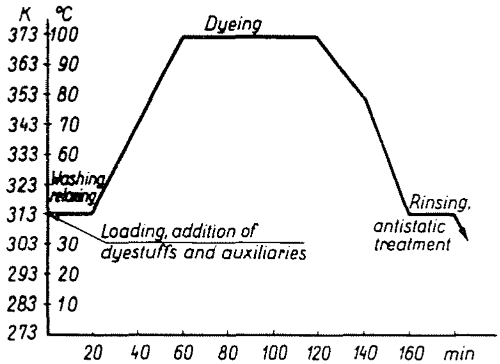

Fig. 15. Temperature-time diagram for finishing

length and in width. This is a consequence of the fact that in warp knitting loops are formed under tension, thus the yarn contained in them cannot shrink fully or nearly fully in dry state. In hot water this relaxation is completed and simultaneously filament get also thorougly soaked.

After this 20 minutes' treatment heating follows at a rate of 1.5 K/min, and the dyeing process—depending on colour and dyes—lasts 45 to 60 min at about 373 K (100 °C) temperature. The dye-bath is cooled from 373 K to 353 K (from 100° to 80 °C) at a rate of 1 K/min, then further to 313 K (40 °C) at 2 K/min. Also rinsing and antistatic softening treatment are carried out at this temperature.

In dyeing, acid or disperse dyes are used, depending on the colour and shade depth desired. For dark shades the colour fastness of acid dyes is superior, but are likely to point out yarn stripiness in the case of eventual differences in texturing conditions. Thus, when applying acid dyes, special care has to be taken no to tolerate differences in the texturing parameters of the processed yarns.

According to our experience overflow dyeing machines are most suitable for treating stretch fabrics, as their mild action does not cause extension or creases in the fabric.

3.3.3 Hydro extraction

Fabrics taken out from the dyeing machine are hydro extracted for a short time (about 1/2 min). A longer treatment can lead to irremovable creases in the fabric.

3.3.4 Opening the fabric tube

After hydro extraction the fabric tube is opened and the unfolded fabric is laid out. Under modern mill conditions this process is carried out by a special machine.

3.3.5 Drying

Drying is a fairly delicate process in the finishing of stretch fabrics.

The process is carried out on a pin tenter at a temperature below that of the heat-setting. In a three-chamber machine polyamide 6.6 is treated at the following temperatures:

Chamber I	453 K	(180 °C)
Chamber II	448 K	(175 °C)
Chamber III	448 K	(175 °C)

The fabric passes the three chambers at a speed of 15 m/min, i.e. it remains in the heating chambers for 36 s.

Drying temperature should be kept under any circumstances below that used in the texturing process, otherwise the previous treatment will be rendered ineffective.

The fabric has to be carried on to the pin tenter of the drying machine with an overfeed of about 30%, permutting the fabric to contract and avoiding its excessive loading which can lead to loose its bulk. The same is valid for setting the fabric width.

It has to be noted that in drying about 55 to 70% of the fabric width, measured on the warp knitting machine, is to be set, depending on the fabric structure and the elastic elongation required. The width of the fabric after taken from the dyeing machine, prior to drying, is about half of the width of that on the warp knitting machine.

3.3.6 Rolling-up

The fabric removed from the drying machine is laid out at first, then after storing for 1 or 2 hours, it is rolled-up. During rolling-up it has to be extended to a certain extent, otherwise the roll would not be tight enough. This results in a loss in width of about 3%.

3.4 *Properties of the finished fabric*

There are many types of stretch fabrics both as to their yarn composition and fabric structure. From this it follows that also the elastic properties of the different fabrics are different. A few general conclusions, however, can be drawn from our investigations.

(1) The coursewise extensibility and the residual elongation of the fabrics tested are about one and a half-times that in wale direction. This indicates a higher crosswise sensitivity to tension.

(2) Residual elongation decreases considerably with increasing relaxation period, thus the measurable elastic properties are greatly influenced by the time of relaxation. In order to reduce variations in fabric dimensions it appears to be expedient to apply a relaxation period of 24 hours in between the technological processes.

(3) The finishing processes reduce the values of extensibility in both main directions, rendering the fabric "more rigid". The decrease in the tendency to extension is, in general, higher in wale direction, attributable to the fact that under processing the fabric is almost always more stressed in length direction.

(4) Stretch fabrics show rather different dimensional changes after five washings. In general, fabrics shrink in both directions, and their two-directional (area) shrinkage may be as high as 10%. Some of our test fabrics exhibited higher shrinkage in course direction, while others in wale direction.

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Summary

The relationship between the characteristics of synthetic textured yarns of high elastic elongation and those of the warp knitted fabrics has been studied. The experimental results permit to chose test methods (convenient even in the manufacturing process) both for stretch yarn and fabric investigations. The trends can be used for designing the optimal conditions and parameters of the warping, knitting and finishing technology to achieve less variations in the dimensional properties of the products and less difficulties in the garment fabrication process.

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