SAWTRI BULLETIN

SOUTH AFRICAN
WOOL TEXTILE RESEARCH INSTITUTE
OF THE CSIR
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Editor: M. A. Strydom, M.Sc.

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PUBLICATIONS COMMITTEE

EDITORIAL

In these days of dwindling natural resources, energy conservation has become a key-word in the long-term planning of nearly every sector of our industrialised economy. South Africa is perhaps more fortunate than many other industrialised nations in this respect; where other nations rely heavily on oil, we have abundant supplies of coal and with an expanding petrochemical industry and SASOL's oil-from-coal technology, our energy future appears to be fractionally less than critical. But this situation should not lull us into a false sense of security. Coal is just another commodity with a finite supply and should be conserved as a source of energy just the same as any other of our natural resources.

In the textile industry, energy conservation starts in the wet processing sector where steam is generated to heat dyebaths, stenters and other finishing equipment. Recent surveys have shown that in certain cases the large quantities of steam drawn by this sector is actually wasted (see page 12 of this issue of the Bulletin). A SAWTRI/NPI survey currently under way has shown that there is also tremendous scope in South Africa for conserving energy by simply maintaining steam lines properly. Obviously, further savings are still possible with new technologies such as low temperature dyeing and finishing available today, but at this stage, it appears that the local industry can already effect substantial savings by merely sharpening up their mill maintenance procedures.

To date, SAWTRI has not spent much time or effort on matters relating specifically to energy conservation. However, our research policy is flexible enough to allow excursions into such a "non-textile" field and it is felt that the collective know-how and experience of our technical and our research staff should be tapped if this can, in any way, make a contribution to our national economy.

INSTITUTE NEWS

Director Visits the Industry

After taking up his new appointment as Director of SAWTRI, Dr Derek Turpie has been making extensive visits to the textile industry in the Western and Eastern Cape, Transvaal and Natal.

One of the initial tasks which the Director set himself was to acquaint himself at first hand with where industry feels SAWTRI should place its research emphasis with regard to the spending of its *National* funds. He did this by paying courtesy visits to industrialists in the textile field all over South Africa and asking them to indicate their suggested distribution of effort in 12 different categories. His survey covered 34 textile manufacturers representing some R450 million worth of value added, this representing a major portion of the industry. Included here were firms from the weaving industry, the knitting industry, the spinning industry, the scourers and carbonisers, the topmakers, the short staple and the long staple manufacturers, the cotton manufacturers, the wool manufacturers and those involved with synthetics and blends.

The average of 35 separate opinions (that of the 34 manufacturers above plus that of one large and important retailer) is given in the table below. Also given is the biased opinion, this being the opinion of the 34 manufacturers

SAWTRI's Spinning Department recently had this Guma/GAR yarn brushing machine installed. This machine gives a raised or brushed effect on spun yarns

after weighting with an estimated figure for the value added in each case (in nearly all cases this was supplied by management confidentially).

	Average opinion	Biased opinion
1. Treatment of effluent from raw fibre scouring and from dyehouse and finishing	8,3	7,8
2. Raw fibre scouring	1,0	0,8
3. Worsted (long staple) carding, combing and topmaking	3,4	2,8
4. Worsted (long staple) spinning, including Ring, Repco, Dref, etc., wool, mohair and blends with synthetics, core-yarns etc.	5,1	3,4
5. Cotton (short staple) processing up to and including spinning, includes Ring, Open-end, Dref. etc., cotton, blends with synthetics, etc.	6,7	7,3
6. Phormium tenax (bast fibre) processing from decortication to spinning	3,9	2,4
7. Textile physics and physical testing (all fibres)	12,1	12,5
8a. Chemistry, dyeing, finishing and chemical testing of wool, mohair and blends of these with synthetics*	7,6	12,1
8b. Chemistry, dyeing, finishing and chemical testing of cotton and cotton blends with other fibres*	12,1	11,1
9. Knitting and fabric development of knitwear (all fibres)	8,2	10,4
10. Weaving and fabric development of woven goods**, (all fibres)	14,7	12,7
11. Clothing technology	7,9	10,3
12. Machine development and innovation***	9,0	6,4
	100,0	100,0

* A few manufacturers suggested some effort should be placed on energy conservation in these areas.

** One manufacturer suggested some of this effort should be placed on non-wovens.

*** Most manufacturers suggested innovation rather than development.

Dr Turpie is most grateful for the ready cooperation shown by industry in enabling him to complete his survey. The information will undoubtedly play an important role in helping him to formulate SAWTRI's future research programme.

Some important points which have emerged from the survey are that from *industry's* viewpoint work on effluent treatment and clothing technology should be intensified, machine development and innovation reduced somewhat, and also that there is relatively little interest in research involving the early stages of mechanical processing of the various fibres. Presumably research in the latter areas would best be sponsored by the various Boards, etc.

Dr Turpie went on to visit the S.A. Wool Board, the Mohair Board, the Cotton Board and the Department of Industries and obtained indications from these bodies with regard to the research emphasis which they would like to see in the context of their own *research contracts* with SAWTRI. Indications from other important contractors have still to be obtained. This information will obviously be treated as confidential.

Dr Turpie recently left for Australia and New Zealand to consult with other research organisations affiliated to the IWS and who are currently working on wool scouring effluent disposal programmes.

Joint SAWTRI/Gubb & Inggs Project Launched

As stated in the Editorial, conservation of natural resources is in the long-term interest of our whole national economy. One of South Africa's resources which is relatively scarce and needs urgent attention is *water*. SAWTRI, together with organisations such as the Department of Water Affairs, the Water Research Commission, Universities and the National Institute for Water Research has long recognised this fact and for many years has been studying problems associated with wool scouring effluent disposal. Under the auspices of the Water Research Commission, SAWTRI and the Uitenhage-based wool washing concern of Messrs Gubb & Inggs have recently signed an agreement to conduct a series of industrial trials involving some of SAWTRI's laboratory and pilot-scale research results in this field. For this purpose, a

Dr L. Hunter, Assistant Director (right) talking to Messrs A. C. B. Maiden and W. Ives from Australia

sludge dewatering unit and a decanter centrifuge have been installed at the Uitenhage plant and work will commence in the near future.

Visitors

The following visitors were received at SAWTRI for technical discussions:
Messrs *Paterson* and *J. Lerminez* of Gatooma Textile Mills;
Mr O. Otero of Buenos Aires, Argentine;
Prof. F. J. Piccioli, Chairman of the Uruguyan Wool Board;
The late *Mr A. C. B. Maiden* (Mr Maiden was chairman of the Australian Wool Corporation);
Mr W. Ives of the Australian Wool Industry Conference;
Dr M. Christen of Messrs Ciba Geigy, Switzerland;
Mr H. Grimm of Messrs Hansawerke, Bremen, West Germany;
Mr Derek Bird of WIRA;
Mr A. E. Thomas, Managing Director of G. H. Mitchell & Sons, Adelaide, Australia.

Mr Derek Bird of WIRA (left), discussing some cotton testing procedures with Mr Donald Spencer

Staff Matters

A reorganisation of SAWTRI's staff structure has recently been announced:

Mr F. A. Barkhuysen and *Mr G. van der Walt* have been appointed Departmental Heads of Dyeing and Finishing, respectively, while *Mr E. Weideman* becomes Head of Textile Chemistry. *Mr T. E. Mozes* will head the Department of Wool Scouring and Wool Scouring Effluent Treatment. *Mr S. Smuts* has been appointed Head of Textile Physics, while *Mr A. Braun* will be responsible for the Testing Section of the Department of Industrial Enquiries. *Mr M. A. Strydom* takes over the Department of Long Staple processing and the processing of Phormium tenax will, in future, function as part of the Group for Cotton Processing. *Mr M. P. Cawood* has been appointed Head of Clothing Technology while *Mr P. de Wet Olivier* returns to SAWTRI as Head of Publications and Information.

At the moment attempts are being made to bring the staff complement to full strength by the beginning of 1980. Vacancies for chemists and physicists exist, as well as for qualified textile staff in the processing departments.

PUBLICATIONS

Technical Reports

No. 448 : Robinson, G. A., Cawood, M. P. and Dobson, D. A., Some Physical Properties of Different Blended Yarns and Knitted Fabrics Comprising 60/40 Wool/Polyester (August, 1979).

No. 449 : Hunter, L. and Turpie, D. W. F., A Comparison of a Conventional Spinning Lubricant for Wool with One Which Obviates the Waxing of Hosiery Yarns (September, 1979).

No. 450 : Hunter, L., The Hairiness of Undyed Ring- and Rotor-Spun Cotton and Cotton Blend Yarns (September, 1979).

Other Publications

Robinson, G. A., Cawood, M. P. and Dobson, D. A., Cockling of All-Wool Plain Single Jersey Knitted on Different Machines, *Text. Ind. Southern Africa* **2** (4), 2 (1979).

Veldsman, D. P., Energy Conservation in the Dyeing and Finishing Industries, *Dyers Dyegest* **8** (3), 7 (1979).

Hunter, L., Dimensional Constants of Knitted Fabrics and Their Uses, *Text. Ind. Southern Africa,* **2** (6), 18 (1979).

Hunter, L., Production and Properties of Staple Fibre Yarns made by Recently Developed Techniques, *Text. Progress,* **10** (1/2), (1979).

Hunter, L., Textiles, Some Technical Information and Data IV: Sewability, Sewing Needles, Threads and Seams (Oct., 1979).

TEXTILE ABSTRACTS

Kömer, W., Blankenstein, G. Dorsch, P. and Reinehr, U., **Dunova, an Absorbent Synthetic Fibre for High Wear Comfort.** *Chemiefasern/Textilindustrie 29/81* (6), E 62 (June, 1979).

This article describes ®Dunova, the new absorbent synthetic fibre of the Bayer Group. This fibre has a unique porous core-sheath structure which allows moisture to be absorbed rapidly through a 1-2 μm thick sheath into a capillary system within the fibre. This is claimed to give Dunova certain unique qualities such as high absorbancy and a high dampness perceptability limit, rapid moisture transport and a low specific mass. Laboratory trials are quoted as having shown that the fibre can retain up to 40% moisture without swelling and thereby adversely affecting the air permeability of the fabric. In addition it is claimed that the fibre feels warm and dry very quickly after heavy perspiration.

These claims indicate that Dunova would be an ideal synthetic fibre for garments worn next to the skin, in particular for leisure- and sportswear. It can be used quite satisfactorily on its own or in blends with wool or cotton.

(MAS)

Barella, A., Vigo, J. P. and Castro, L., **Une Contribution A L'Etude Des Facteurs Influant Sur La Formation Des Neps Dans Le Coton,** *Bull. Scient. ITF,* **8** (29), 9 (Feb., 1979).

The authors determined the nep forming potential of some 592 cottons over a period of five years and related this to various fibre properties. It was concluded that the main fibre parameters affecting nep formation are micronaire, tenacity (3,2 mm gauge) and percentage of "lint" as determined on a comb machine. (LH)

Fuchs, E. and Dorn, J. **Waste Heat Recovery from Effluent in the Textile Industry,** *Textil Praxis,* **34,** 545 (1979).

In general the energy consumption of a textile finishing mill is the following: 20% for drying and heat-setting treatments and 80% for scouring, bleaching and dyeing processes. The recovery of heat from the waste water can result in significant energy savings. For example, one dyehouse used about 90 m^3 water for hot bleaching, dyeing and rinsing per 8 hour shift. The drain-off water temperature was 80°C. A heat recovery plant was installed which utilised this waste water to heat fresh water up from 15°C to 67°C. About 4,6 x 10^6 kcal was saved per 8 hour shift. This is equivalent to about R30 000 per year, for a mill working on a single shift system.

The authors then described various types of heat exchangers which can be used, such as the plate-type, tubular or spiral heat exchanger. These exchangers are normally constructed in stainless chrome-nickel or chrome-nickel-molybdenum steels. (NJJvR)

THE HAIRINESS OF TWO-PLY WOOL/ACRYLIC AND WOOL/POLYESTER YARNS

by L. HUNTER

ABSTRACT

The effect of blending wool in different proportions with two acrylic fibre lots differing in linear density and with two different polyester types on the hairiness of R42 tex/2 yarns has been studied using a Shirley Yarn Hairiness Meter. Of all the yarns tested the all-wool samples were the least hairy, yarn hairiness generally increasing with increasing percentages of synthetic fibre. Of the blends tested, those containing normal polyester were the least hairy, followed by those containing the special low pilling polyester and the 3,3 dtex acrylic. Blends containing the 4,9 dtex acrylic were the most hairy.

INTRODUCTION

Although a great deal of work has been carried out on yarn hairiness[1–6] very little appears to have been done on the effect of blending wool with different synthetic fibres. It was therefore the aim of this study to investigate the effect of blending wool in different proportions with two different acrylic lots and with two different polyester types.

EXPERIMENTAL

A 20,1 μm, 72 mm mean fibre length wool was blended[7] in various proportions with 3,3 dtex and 4,9 dtex (85 mm) regular acrylic and spun into R42 tex S400/2 Z650 yarns on a double apron drafting (ring) system. Processing was on the Continental system. The wool was also blended in various proportions[8] with two different polyester types namely a "normal" (Trevira type 220) and a "special low pilling" type (Trevira type 330). Both types were 75 mm variable cut and had a linear density of 3,6 dtex. The wool/polyester blends were processed into yarn in exactly the same way as the wool/acrylic blends. After rewinding onto cones, the hairiness of the yarns was measured on a Shirley Yarn Hairiness meter at the standard distance of 3 mm . The tests were carried out at standard atmospheric conditions (20°C and 65% RH).

RESULTS AND DISCUSSIONS

Yarn hairiness has been plotted against percentage wool in Fig. 1 and it is evident that the yarn hairiness drops significantly with an increase in wool content. The yarns containing the 4,9 dtex acrylic was generally the most hairy followed by those containing the 3,3 dtex acrylic. The difference in yarn

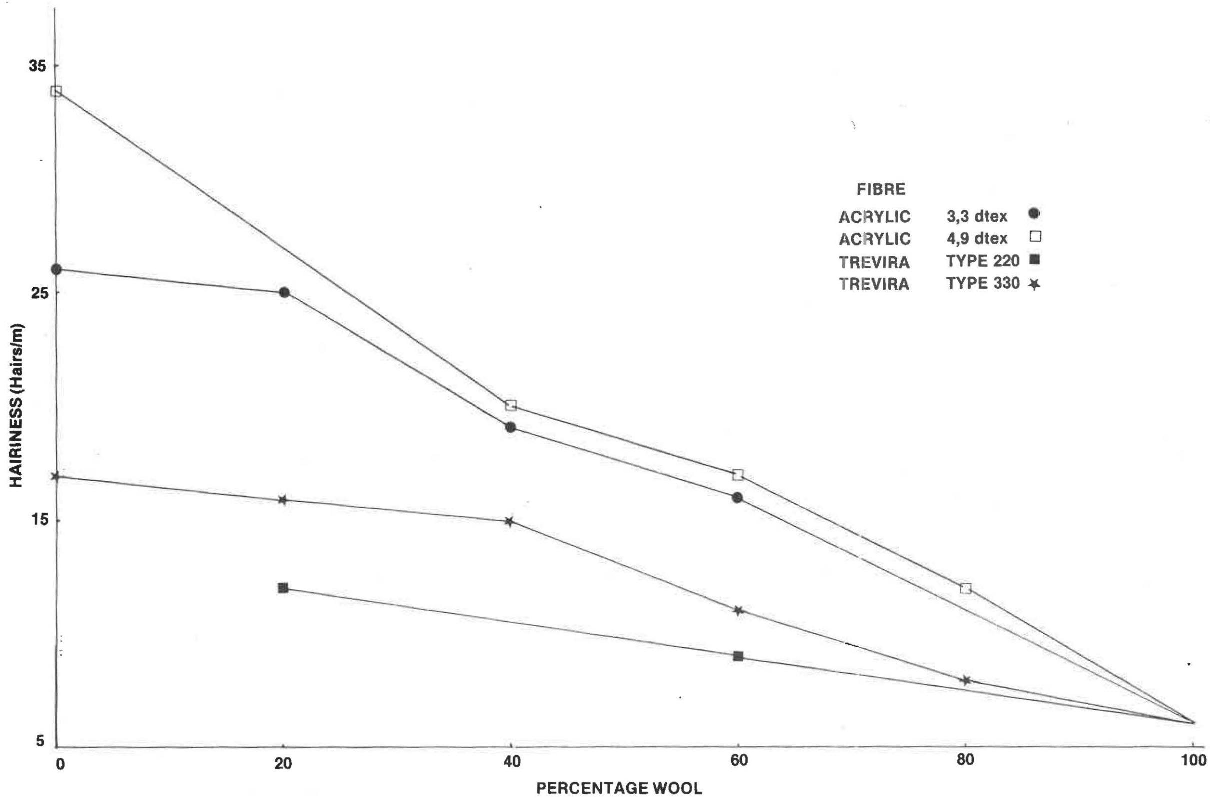

FIGURE 1

The Effect of Blend Level on the Hairiness of Wool/Acrylic and Wool/Polester Ring Yarns Spun on the Worsted System (R42 tex/2 yarns tested off cones)

hairiness was probably due to the difference in fibre linear density since coarser fibres generally tend to produce hairier yarns.

The normal polyester produced yarns which were not as hairy as those containing the special low pilling polyester. The all-wool yarn was the least hairy of all, which agrees with recent findings on other wool/polyester blends[9].

ACKNOWLEDGEMENTS

The author is indebted to Mrs M. Hill and Miss A. Coetsee for carrying out the hairiness tests. Permission by the S.A. Wool Board to publish these results is also gratefully acknowledged.

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ENERGY SAVING THROUGH THE MAINTENANCE OF STEAM LINES

by N. J. J. VAN RENSBURG and G. VAN DER WALT

Due to the oil crisis and inflation the cost of energy is increasing at alarming rates. When the amount of energy required to produce a fabric from the raw fibre is considered, it is found that the dyeing and finishing operations consume from 38% to 81% of the total amount of energy[1]. Furthermore, it is known that the energy costs of a dyehouse amounts to 12—15% of the total dyehouse costs[2]. Any saving in energy will lead to a reduction in the production cost and it is obvious that attempts to save energy in a mill should first of all be directed towards the dyehouse. Steam is one of the main sources of energy in the dyehouse and the saving of steam should therefore be an important objective in energy conservation programmes.

Steam can be saved in many different ways in the dyehouse. In this brief review some cases will be quoted to show how savings can be made through the proper maintenance of steam pipes, valves, etc.

It is generally accepted that steam and hot water pipes should be lagged to reduce heat losses. The question often arises as to what the magnitude of heat loss is in the case of bare steam pipes. Haile and Somers[3] published some results, from which the following graph (Figure 1) has been derived. The results are based on an ambient temperature of 24°C. Steam pipes with a nominal diameter greater than 100 mm were insulated with a 50 mm thick layer of glass fibre, whereas pipes smaller than 100 mm were insulated with a 40 mm thick layer of glass fibre. Figure 1 shows that a substantial amount of energy can be saved by the insulation of steam lines. For example, in the case of a 100 mm pipe and a steam pressure of 689,5 kPa (100 lbf/in^2) steam, about 3,5 MJ/hour/metre can be saved with a 50 mm fibre glass insulation, or alternately, this amount of energy will be lost through uninsulated pipes. This amount of energy which is lost may seem small, but when it is taken over a year and converted into money it can be a substantial amount. For example, Guthrie[4] reported that the following energy prices were ruling in Durban in March, 1977 for large users:

Coal	106 cents/MJ
Fuel oil	314 cents/MJ
Electricity	1021 cents/MJ.

This means that in the case of coal fired boilers the amount of money lost per metre of uninsulated pipes (100 mm dia.) could amount to approximately R30 000 per annum. In the case of oil fired boilers the loss would be substantially higher.

It may also be worthwhile to inspect the thickness of the insulation on high pressure steam lines. It has been reported[5], for example, that by increas-

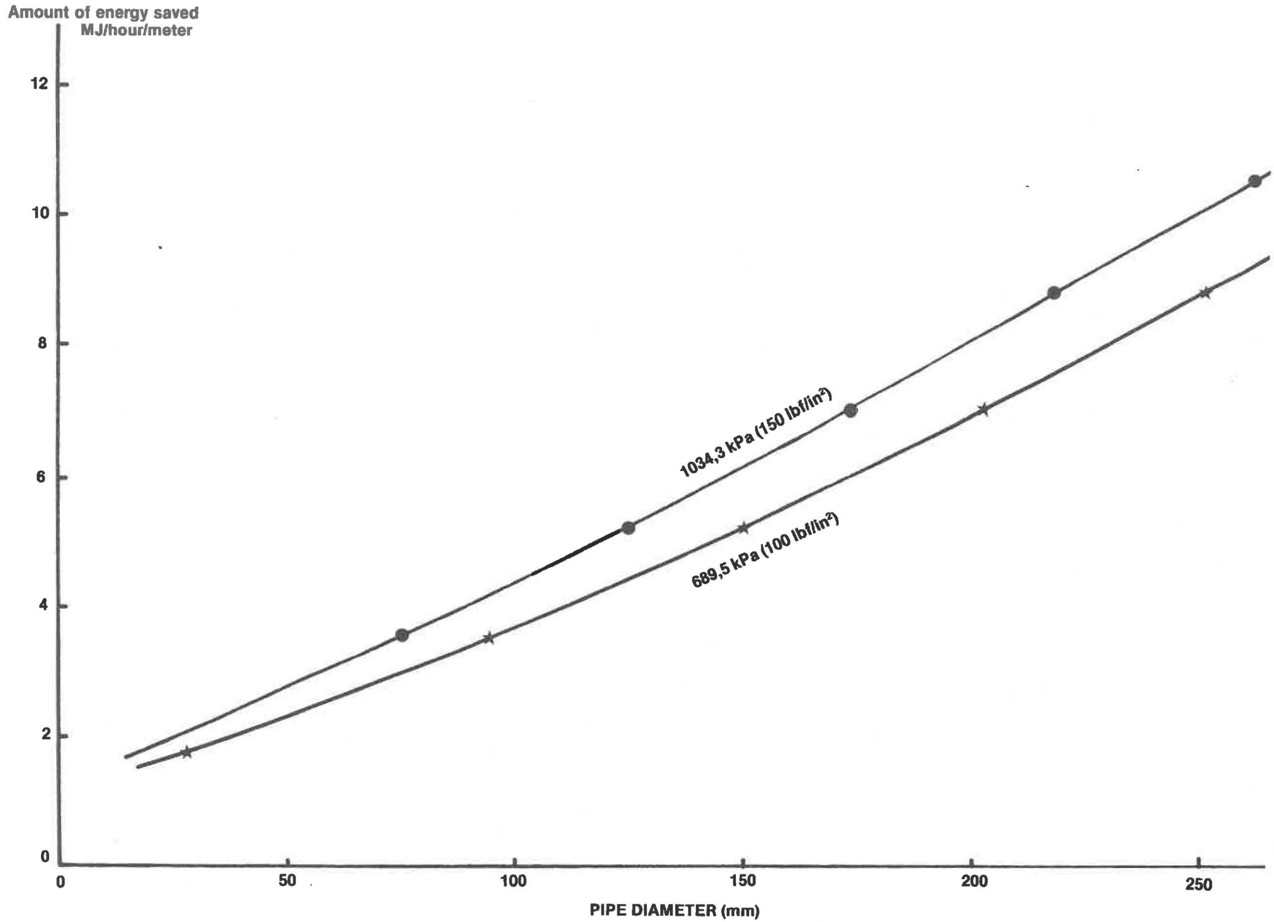

FIGURE 1

Potential energy savings by insulating bare steam pipes

ing the insulation thickness from 25 to 50 mm, about 27 barrels of oil can be saved annually per 100 metres of 77,5 mm pipe carrying 80 kg (175 lb) steam. Furthermore, studies by Du Pont engineers showed that the insulation of steam line flanges, which are normally left bare, can lead to considerable savings in fuel oil.

The maintenance of steam traps should be carried out on a regular basis. Wagner[5] surveyed six mills and reported that the percentage of steam traps showing a malfunction varied from 12% to as high as 43%. Calculations showed that this wasted energy cost the mills almost $10 million per year. Wagner also showed that when a closed trap failed and was bypassed, about 1 million kg steam was wasted per month in the case of a 12,5 mm (½ inch) trap with a 3 mm (⅛ inch) orifice and 2068,5 kPa (300 lbf/in^2) steam. In the case of 275,8 kPa (40 lbf/in^2) steam, the loss was 200 000 kg . Similarly, when an open trap failed large amounts of steam were wasted (about 15% of the amounts wasted when the closed trap failed).

The leakage of steam through holes in the steam lines should be thoroughly checked. It is advisable that even the smallest leak should be repaired immediately. Doshi and Dhamdhere[6] recently published some values to show the extent of steam loss which will be encountered through various diameter holes in different steam lines:

Steam Pressure (kPa)	Diameter of hole (mm)	Steam loss (kg/hr)
413,7	0,8	1,5
	1,6	6,0
	3,2	23,5
	6,4	94,5
585,1	0,8	2,0
	1,6	8,0
	3,2	31,5
	6,4	126,0

The Shirley Institute recently carried out an investigation of 74 textile mills and found that 34% of the mills could improve the insulation of the condensate in the boiler house while 51% could improve the insulation of steam pipes in the factory[7]. It was stated that the most frequent barriers to energy conservation programmes were:

(a) Unaware of problem 45%
(b) More important problems 24%
(c) Lack of capital 15%

To conclude, therefore, energy (and thus money) can be saved by the regular and efficient maintenance of steam supply lines. Attention should be paid to the proper insulation of steam pipes and flanges, where possible. Furthermore, leakages in valves and joints should be eliminated and temperature controls and pressure gauges should be checked constantly.

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PROCESSING VERY TRASHY COTTON INTO CARDED AND COMBED ROTOR-SPUN YARN

by J. D. SPENCER and H. TAYLOR

ABSTRACT

A batch of very trashy cotton (11% trash) was processed on a tandem card and given two drawframe passages. The drawframe sliver was split into halves, one half being spun on a Schubert & Salzer RU11 rotorspinner without further processing, whilst the other half was combed and given further processing before spinning into yarns of different linear densities. The resultant yarns showed very little difference of any practical consequence.

INTRODUCTION

It has been shown in earlier work[1,2] that trashy and BSG (Below Standard Grade) can be processed successfully following a tandem card/rotor spinning route. It was, therefore, decided to investigate the alternate routes of carded and combed rotor yarn production for very trashy cotton. The aim was to establish whether combing offered any advantages when processing such trashy material. Earlier work by Artz[3] *et al* indicated that for standard cotton with normal levels of trash combing offered little, if any, advantages over the carded route when rotor spinning was to be employed and it was considered to be of some interest to see if the same applies to very trashy stock.

EXPERIMENTAL

Fibre Tests

Samples of Acala 1517/70 Doly A2 lint were drawn from a bale, conditioned and tested under standard atmospheric conditions (20°C and 65% RH). These results are recorded in Table I.

The 2,5% span length and 50% span length values were measured on a Fibrograph (Model 330). Uniformity ratio, being the ratio of the 50% span length to the 2,5% span length, expressed as a percentage was then calculated. The lint samples were opened and cleaned on a Shirley Analyser. The percentage of trash was determined and the cleaned lint used for micronaire, fineness and maturity ratio testing on the IIC Shirley Fineness/Maturity tester.

Fibre bundle strength was determined at both 3,2 mm gauge and zero gauge using a Stelometer.

Mechanical Processing

The lint was processed into lap in the blowroom using three cleaning points, i.e. a porcupine cleaner, a two bladed beater and a Kirschner beater.

TABLE I

FIBRE CHARACTERISTICS

2,5% Span length (mm)	26,7
50% Span length (mm)	11,2
Uniformity Ratio (%)	42
Maturity Ratio	0,80
Fineness (mtex)	132
Micronaire	3,38
Zero gauge Tenacity (cN/tex)	36,0
Pressley (1 000 p s i)	74
3,2 Gauge Tenacity (cN/tex)	23,00
Extension (%)	5,6
Trash (%):	
Visible	9,0
Invisible	2,0
Total	11,0

The laps were carded on a Crosrol tandem card fitted with an LTAL autoleveller, at the rate of 25 kg/hr . Carding was followed by two drawframe passages. The drawframe sliver was then split into two lots. Whilst one lot was spun directly on a RU11 rotor spinning frame, the other lot was combed on a Platt Century comb, running at 200 nips/min . 15% of noil was removed during this operation. The combed sliver was then given two passages on a Zinser drawframe, followed by spinning on a RU11 rotor spinner. Both lots were spun with a 55 mm rotor, running at 35 000 rev/min and with a pinned opening roller running at 6 000 rev/min, a twist factor of 48 (tex) was used for al linear densities. Processing details are recorded in Table II.

At each operation the percentage trash and the 2,5% and 50% span length were recorded. (See Table III and IV respectively.)

The same range of yarn linear densities was spun from the slivers processed via each route. The respective yarn properties of each lot are recorded in Table V.

RESULTS AND DISCUSSION

Whilst the yarns from both sources spun well, on balance the combed yarn had the slightly higher tenacity although its evenness (Irregularity CV %)

was not as good. This difference in evenness is also evident in both the Classimat results and the thick and thin places recorded. Table III indicates that combing does not materially reduce the amount of trash in the yarn. Whilst initially it appears as if the combed sliver has a greater span length at both 2,5% and 50%, subsequent operations rather indicate that the major effect of combing was to increase the 50% span length and consequently the uniformity ratio although this is not reflected in the yarn evenness results.

The above findings are in general agreement with those of Artzt[3] on a cotton with a lower level of trash.

TABLE II

PROCESSING DETAILS

Blowroom	
Waste	7,0
Tandem Card	
Linear Density (ktex)	4,1
Irregularity (CV %)	6,0
Waste %	5,8
Drawframe 1st Passage	
Linear Density (ktex)	4,2
Irregularity (CV %)	5,1
Drawframe 2nd Passage	
Linear Density (ktex)	2,7
Irregularity (CV %)	5,4
Comber	
Linear Density (ktex)	4,6
Irregularity (CV %)	6,8
Waste (%)	15,0
Drawframe 1st Passage after combing	
Linear Density (ktex)	4,1
Irregularity (CV %)	5,8
Drawframe 2nd Passage after combing	
Linear Density (ktex)	2,6
Irregularity (CV %)	4,3

TABLE III

PERCENTAGE TRASH AT EACH OPERATION (SHIRLEY ANALYSER)

	VISIBLE	INVISIBLE	TOTAL
Cotton lint	9,0	2,0	11,0
Lap	4,3	2,0	6,3
Tandem Card Sliver	0,4	1,6	2,0
Drawframe Sliver 1st Passage	0,3	0,9	1,2
Drawframe Sliver 2nd Passage	0,3	1,1	1,4
Combed Sliver	0,1	0,8	0,9
Drawframe Sliver 1st Passage after combing	0,2	0,7	0,9
Drawframe Sliver 2nd Passage after combing	0,3	1,1	1,4
Comb — Noil	0,80	3,6	4,4

TABLE IV

FIBRE LENGTH CHARACTERISTICS AT EACH OPERATION

	2,5% Span Length (mm)	50% Span Length (mm)	Uniformity Ratio (%)
Raw Material (Lint)	26,7	11,2	42
Lap	26,9	11,3	42
Card Sliver	26,5	11,3	43
Drawframe Sliver 1st Passage	26,7	12,00	45
Drawframe Sliver 2nd Passage	26,9	13,1	49
Comber Sliver	27,4	14,1	51
Drawframe Sliver 1st Passage comber sliver	26,4	13,5	51
Drawframe Sliver 2nd Passage comber sliver	26,7	14,2	53
Noil or Comber Waste	18,0	6,7	37

TABLE V
YARN PROPERTIES

PROPERTY	CARDED ROUTE						COMBED ROUTE					
Linear Density Nominal (tex)	20	25	30	35	40	50	20	25	30	35	40	50
Actual	20,2	24,8	30,3	34,2	40,2	49,8	19,6	24,4	29,4	34,4	39,2	47,1
CV %	0,9	1,5	1,4	1,6	1,4	1,3	4,1	1,3	0,2	2,1	1,7	2,0
Twist (turns/m)	1070	957	874	806	757	677	1070	957	874	806	757	677
Breaking Strength (cN)	189	227	281	313	402	503	202	246	306	370	440	534
CV (%)	9,7	8,3	8,1	8,3	7,5	7,1	11,0	10,0	9,0	10,0	8,0	8,0
Tenacity (cN/tex)	9,4	9,1	9,3	9,2	10,0	10,1	10,3	10,1	10,4	10,8	11,2	11,3
Extension (%)	8,1	8,6	8,2	8,6	9,2	9,5	8,0	8,3	8,8	8,6	9,3	9,4
Irregularity CV (%)	17,4	15,7	15,3	15,1	14,9	14,9	18,6	17,9	17,4	16,5	16,2	16,0
Thin places per 1 000 m	53	9	4	3	6	3	173	57	56	31	18	13
Thick places per 1 000 m	26	12	9	6	6	13	55	60	24	29	18	7
Neps per 1 000 m	560	233	171	114	85	78	447	329	260	116	87	75
C S P	1531	1402	1618	1627	1625	1688	1404	1565	1568	1636	1574	1729
Classimat Faults per 10 000 m												
Objectionable Faults (B4 + C3 + D2)	2	9	17	17	13	16	50	32	11	20	16	9
Total no. of faults (A1 + B1 + C1 + D1)	380	65	202	101	70	90	569	459	327	232	210	175

SUMMARY AND CONCLUSIONS

The properties of rotor yarns produced from the same lot of trashy cotton via the combed and tandem carded routes, respectively, were evaluated. Whilst the breaking strength and tenacity of the combed yarns were slightly superior, the irregularity CV%, thick and thin places of the combed yarns were slightly inferior. Taking all the properties of both ranges of yarns into account very little practical difference was recorded. Combing therefore does not appear to improve rotor yarn quality to any significant extent. The extra cost involved due to the production of comber waste, in addition to the cost of the extra processing, therefore appears to be unwarranted.

ACKNOWLEDGEMENTS

The authors are indebted to the staff of the Cotton Processing Department who processed the yarn and to the staff of the Textile Physics Division for testing the yarn.

THE USE OF PROPRIETARY NAMES

The fact that instruments and equipment with proprietary names have been mentioned does not in any way imply that SAWTRI recommends them or that there are no other instruments and equipment as good or even better.

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KNITTING WITHOUT FABRIC TAKE-DOWN TENSION ON CIRCULAR DOUBLE JERSEY MACHINES PART I — THE USE OF A MECHANICAL SYSTEM

*by L. HUNTER, D. A. DOBSON and L. A. KERLEY**

ABSTRACT

A mechanical device was attached to the dial just behind the feeders on a circular double jersey machine which enabled knitting to be carried out without any other take-down tension being applied. When knitting a cotton interlock structure, the system allowed greige and calendered fabrics to be produced with virtually zero potential length shrinkage but with a fair amount of width shrinkage. With normal take-down tensions, the reverse generally occurred. Clearly, in practice, the take-down tension transforms potential width shrinkage into length shrinkage by stretching the fabric in length during knitting. Winch or jet dyeing of the fabric imposed considerable length distortion to the fabric and nullified any differences due to take-down tension. Possible advantages of such a zero take-down system are discussed.

INTRODUCTION

On circular double jersey machines, fabric take-down tension is generally required to assist in proper knock-over of the old loops when the new loops are being formed. Proper fabric control, removal from the knitting zone and winding up are other functions associated with the fabric take-down system.

For knitted outerwear, shrinkage in either length or width of less than 5% is generally desirable[1]. It is a well-known fact, however, that take-down tension, particularly if it is excessive, causes a great deal of fabric distortion. This distortion constitutes mainly length stretch, which subsequently manifests itself as laundering shrinkage when the fabric loops move towards their undistorted shape[2—8] (minimum energy). Consequently, it is not unusual to encounter length shrinkage of 20% or more when double jersey structures are washed immediately after knitting. Black[7] showed that even with low take-down tension and a narrow stretcher-board (spreader board) considerable fabric distortion can still occur on the knitting machine.

Obviously, superimposed onto the distortion at the knitting machine, is that due to dyeing and finishing. This will be subsequently reflected in the laundering shrinkage of the fabric, particularly if the fabric is not compacted or allowed to relaxed prior to making-up[4], or is not stabilised[9,10]. Stabilisation can be achieved by heat setting fabrics containing thermoplastic fibres, and to

*Valley Textiles (Pty) Limited

a limited extent by resin treating cotton and other natural fibre fabrics, provided these fabrics are not too far removed from the fully-relaxed state[4,5]. If dyed yarn is knitted, finishing is greatly simplified, it often involving calendering only and distortions imposed at this stage are greatly reduced. Nevertheless, for knitted fabrics containing natural fibres, dimensional stability to washing remains a problem, with length shrinkage being the main problem[12] because of length distortions during knitting and finishing.

In addition to the above factors, excessive take-down tension can also cause a deterioration in the knitting performance, by increasing the strain on the yarn, leading to yarn breakage and fabric holes and can increase needle breakage and wear on various machine parts in general[3,13]. The importance of take-down tension has led to the development of instruments[3,14,15]which allow it to be measured and controlled.

It is clear from the above discussion that a reduction in, or even the elimination of, take-down tension holds great benefits, particularly in terms of the reduction of fabric distortion during knitting and hence in fabric laundering shrinkage. In fact, many types of knitting machines can knit with little or no take-down tension, e.g. V-bed machines utilising the Presser-Foot arrangement (of Courtaulds)[16—18] and fully-fashioned and circular single jersey machines utilising sinkers.

This report deals very briefly with trials carried out at SAWTRI on a double jersey machine in an attempt to eliminate fabric take-down tension, attention being focussed on a mechanical device similar in principle to the Presser-Foot. The main objective of the initial trials, reported here, was to establish whether the elimination of take-down tension had any merit insofar as a reduction in fabric distortion and consequently laundering shrinkage was concerned. Other possible advantages accrueing from the system will be investigated later.

EXPERIMENTAL

In all tests, a 25 tex cotton yarn was knitted into an interlock structure on an 18 gauge Mellor Bromley 8 RD machine equipped with trip-tape positive feed.

Other knitting details were as follows:

Dial height	:	1,4 mm
MTF	:	12
Yarn Input Tension	:	2,5 cN
SCSL	:	1,67 cm
Delayed Timing	:	8—9 needles
Machine Speed	:	16,3 rev/min

To assist with the knock-over when no take-down tension was being applied, a system was devised (see diagram) which was attached to the dial just

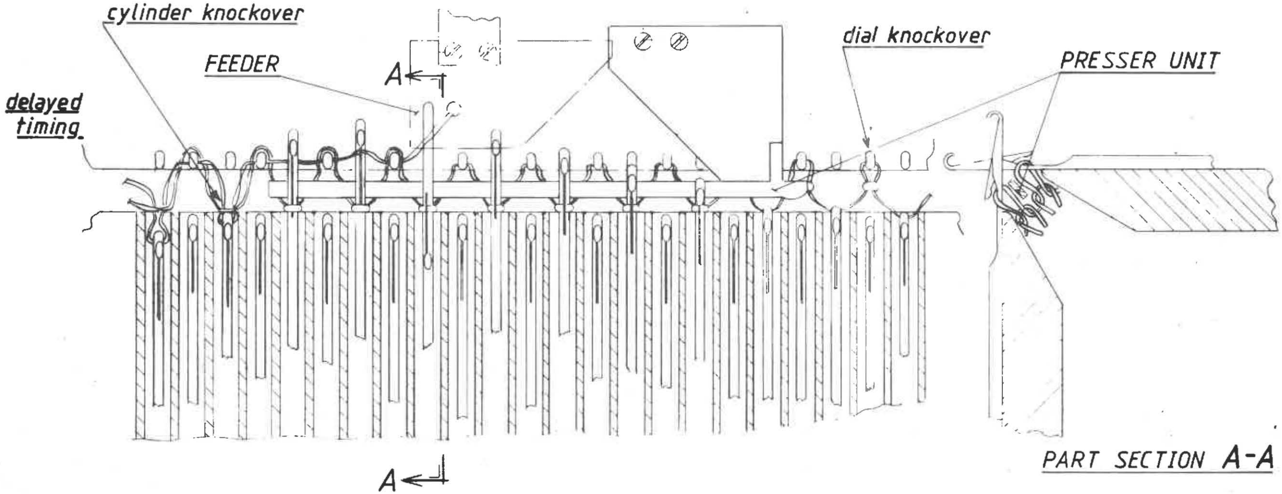

DIAGRAM SHOWING POSITION OF PRESSER UNIT behind each feeder. The unit resembles the well-known Presser-Foot used on V-bed machines. In the present trial, only four feeders were employed to assess the feasibility of the system. While the fabric was being knitted with this system in operation, the fabric by-passed the take-down rollers and collected in a cage beneath the take-down rollers, no stretcher board being used either. Without changing any settings on the machine, the unit was removed and some fabric was knitted with the normal take-down in action. The dimensional properties of the resulting fabric were determined immediately after knitting. A piece of each fabric was calendered under commercial conditions to simulate the finishing of cotton interlock fabrics knitted from dyed yarn. In addition, some fabric was winch and jet dyed. The aim was to establish how much distortion occurs during the above processes and how this is reflected in the subsequent fabric shrinkage during laundering. The effects of other finishes, e.g. scouring and bleaching, on the fabric dimensional properties is to be studied later.

Samples of the various fabrics were subjected to five wash/tumble-dry cylces (AATCC TM 135-IIIB) and their shrinkage measured (see Table I).

RESULTS AND DISCUSSION

The device illustrated in the diagram was developed after various others were found to be unsuitable. During the trials it was found that the device worked well with textured polyester and cotton but it did not function well when knitting wool. Provided the system was adjusted properly, no undue difficulty was experienced when knitting the 25 tex cotton yarns at normal machine speeds. The resulting fabric had a far better appearance and was more compact than fabric knitted with normal take-down tension.

The dimensional properties of the fabrics are given in Table I. What is striking is the fact that removal of take-down tension reduces length shrinkage of the greige fabric to virtually zero but increases width shrinkage significantly. What clearly happens in practice is that the take-down tension, by stretching the fabric in length, removes width shrinkage but imparts length shrinkage. In this respect, therefore, zero take-down tension merely changes the problem from length to width shrinkage. Nevertheless, it is possible that width relaxation (i.e. stability) may be achieved more easily than length relaxation (stability) during normal finishing procedures, and width shrinkage is generally more acceptable to length shrinkage, more so in the case of underwear than outerwear[4]. A certain amount of width shrinkage can be tolerated in underwear due to the inherent width stretch of the fabric, it tending to give a snug fit[1]. From this point of view, therefore, the zero take-down system may be preferable, even ignoring the other advantages which may accrue. Clearly, as the fabric tightness is reduced so the width shrinkage should be reduced, since the loops will be formed on the machine in a shape more closely resem-

TABLE I

DIMENSIONAL PROPERTIES OF COTTON INTERLOCK FABRICS KNITTED EITHER WITH OR WITHOUT TAKE-DOWN

Fabric No	Treatment	Fabric Mass (g/m²)	Wales/cm	Courses/cm	K_1	K_2	K_3	Shrinkage (%)		
								Length	Width	Area
Zero take-down Tension (Fabric not finished)	Dry-relaxed	250	8,87	13,53	167	22,55	7,39	—	—	—
	Washed*	304	10,70	13,67	203	22,78	8,92	1,7	16,9	18,6
Normal take-down tension (Fabric not finished)	Dry-relaxed	216	10,83	9,57	144	15,95	9,03	—	—	—
	Washed*	312	11,57	12,93	208	21,55	9,64	23,8	5,0	28,8
Zero take-down tension (Fabric calendered)	Dry-relaxed	229	8,83	12,43	153	20,72	7,36	—	—	—
	Washed*	295	10,43	13,57	197	22,62	8,69	6,6	14,7	21,3
Normal take-down tension (Fabric calendered)	Dry-relaxed	235	11,00	10,30	157	17,17	9,17	—	—	—
	Washed*	270	11,43	11,33	180	18,88	9,53	23,4	3,3	26,7
Zero take-down tension (Winch dyed)	Dry-relaxed	243	12,27	9,47	162	15,79	10,23	—	—	—
	Washed*	275	11,03	11,97	183	19,95	9,19	21,3	– 10,4	10,9
Normal take-down tension (Winch dyed)	Dry-relaxed	254	13,03	9,33	169	15,55	10,86	—	—	—
	Washed*	290	11,93	11,67	193	19,45	9,94	20,6	– 7,8	12,8
Zero take-down tension (Jet dyed)	Dry-relaxed	230	11,03	9,97	153	16,62	9,19	—	—	—
	Washed*	282	10,83	12,50	188	20,84	9,03	20,8	– 3,7	17,1
Normal take-down tension (Jet Dyed)	Dry-relaxed	254	12,17	10,00	169	16,67	10,14	—	—	—
	Washed*	302	11,57	12,50	201	20,84	9,64	18,6	– 4,7	13,9

*AATCC TM 135—IIIB

bling the fully-relaxed shape. In fact, according to the fully-relaxed dimensions of an interlock fabric[19,20], it appears that at an MTF of approximately 8 (for a 25 tex yarn) the relaxed open width of the material should equal the circumference of the knitting machine, resulting in little if any width shrinkage off the machine. Clearly, however, such a fabric would be far too slack to be commercially acceptable.

The results of tests on the winch and jet dyed fabrics (see Table I) show that considerable stretching occurs during these two processes and that differences due to take-down tension are nullified thereby. It also appears that subjecting these fabrics to five wash and tumble-dry cycles did not achieve the fully-relaxed state of the undyed fabric. Distortions imposed during dyeing are therefore very difficult to remove and little is to be gained from reducing distortion on the knitting machine if excessive length distortion occurs during finishing.

SUMMARY AND CONCLUSIONS

Trials have been carried out in which a device, similar to the well-known Presser Foot, was attached, just behind the feeder, to the dial of the knitting machine on a circular double jersey machine and which allowed the normal take-down tension to be dispensed with. The main objective of the trials reported here was to establish whether the elimination of take-down tension held any merit insofar a reduction in fabric length distortion, and therefore subsequent length shrinkage, was concerned since length shrinkage during laundering is one of the most serious problems associated with knitted cotton fabrics.

Cotton yarn (25 tex) was knitted into an interlock structure on four knitting feeders of an 18 gauge double jersey machine at commercial speeds. In one case, normal take-down was applied while in the other, take-down tension was eliminated by using a mechanical unit attached behind the feeders and which assisted knock-over. Washing tests were carried out on fabric straight off the knitting machine, as well as on dyed and calendered fabric and it transpired that a length shrinkage of more than 20% and a width shrinkage of about 4% with normal take-down tension were transformed into a length shrinkage of about 4% and a width shrinkage of some 16% when the zero take-down system was utilized for both *unfinished* and *calendered* fabrics. Clearly, under normal knitting conditions, take-down tension allows potential width shrinkage to be virtually eliminated but in so doing considerable length distortion is imparted which leads to large length shrinkage during washing. During both the winch and jet dyeing processes studied, however, considerable length stretch was found to be imposed on the fabric, and differences in take-down tension were nullified. The dyed fabrics displayed considerable length shrinkage during washing with no apparent advantage being gained from knitting with zero take-down. From the point of view of dimensional stability therefore, the elimination of take-down tension could have merits provided excessive length distortions are avoided during dyeing and finishing. Other advantages which may accrue from a zero take-down tension system are reduced needle and yarn breakage during knitting and reduced wear on various machine parts. More work is, however, required to refine the system.

ACKNOWLEDGEMENTS

The author are indebted to Mr B. C. Fisher for valuable technical assistance, the Department of Textile Physics for the shrinkage tests, Valley Textiles for finishing the fabrics and Mr D. J. M. Currie for preparing the diagram.

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KNITTING WITHOUT FABRIC TAKE-DOWN TENSION ON CIRCULAR DOUBLE JERSEY MACHINES PART II: THE USE OF A COMPRESSED AIR SYSTEM

by D. A. DOBSON, B. C. FISHER and L. HUNTER

ABSTRACT

By directing jets of compressed air onto the fabric at a point just after dial knockover on a circular double jersey machine, the normal fabric take-down tension can be eliminated. Cotton interlock fabric exhibited reduced length shrinkage but more width shrinkage during laundering than the identical fabric knitted with normal take-down. The appearance of the greige fabric knitted with the compressed air system was superior to that of the other fabric. The system may offer other advantages such as improved knitting performance, and lower needle breakage and wear in general.

INTRODUCTION

In Part I of this series[1], the merits of knitting without take-down tension on circular double jersey machines were discussed and a mechanical system, similar to the Presser-Foot of Courtaulds, was described. This system allowed cotton interlock fabric to be knitted which exhibited very little length shrinkage but more width shrinkage during laundering. As an alternative to the mechanical system, another system has been developed, which utilizes jets of compressed air. Some preliminary results are reported for this system.

EXPERIMENTAL AND DISCUSSION

Knitting details were the same as for Part I[1], delayed timing being used. Details of the compressed air system are shown schematically in the diagram. The system essentially involves directing a single jet of air onto the fabric at a point just after the dial knock-over. The air, therefore, effectively assists with the knock-over of the dial loops thus obviating the need for the normal take-down tension. The use of synchronised timing would probably necessitate a modification to the system. No undue difficulty was experienced with cotton when knitting an interlock structure, and less fly was observed on the machine than when knitting with normal take-down tension. Difficulty was experienced, however, when attempts were made to knit wool, it being surmised that the elastic properties of the wool could be responsible for this. Laundering shrinkage was determined on the greige fabric in the same way as in Part I[1] and the results are given in Table I.

According to the results given in Table I, it appears that the dimensional properties of the two fabrics knitted with zero take-down tension were very

TABLE I

DIMENSIONAL PROPERTIES OF GREIGE COTTON INTERLOCK FABRICS KNITTED EITHER WITH OR WITHOUT TAKE-DOWN

Fabric	Treatment	Fabric mass (g/m^2)	Wales/cm	Courses/cm	K_1	K_2	K_3	SHRINKAGE (%)		
								Length	Width	Area
Zero Take-down Tension (Mechanical System)	Dry-relaxed	257	9,1	13,5	171	22,5	7,6	—	—	—
	Washed*	318	10,8	14,1	212	23,5	9,0	1,7	15,5	17,2
Zero Take-down Tension (Air jet system)	Dry-relaxed	264	9,1	13,9	176	23,1	7,6	—	—	—
	Washed*	327	11,1	14,2	218	23,6	9,3	2,2	15,8	18,0
Normal Take-down Tension	Dry-relaxed	236	11,0	10,3	157	17,2	9,2	—	—	—
	Washed*	270	11,4	11,3	180	18,9	9,5	23,4	3,3	26,7

*AATCC TM 135-IIIB

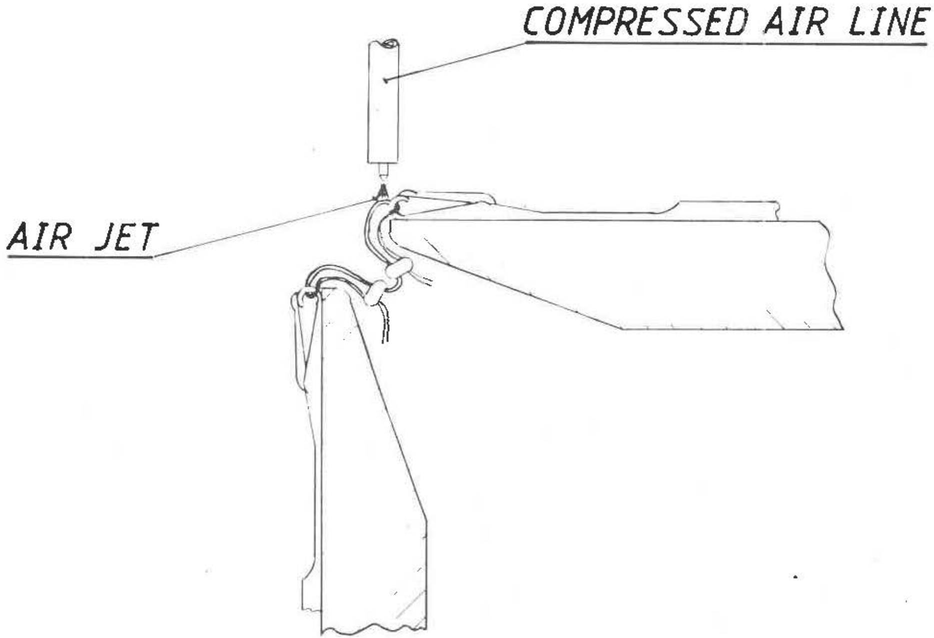

DIAGRAM SHOWING POSITION OF AIR JET

similar, whereas they differed noticeably from the fabric knitted with take-down tension. The conclusions arrived at in Part I concerning the mechanical system therefore also applies to the compressed air system. The greige cotton fabric knitted with the compressed air unit had a far more compact appearance than that knitted with the normal take-down.

GENERAL CONCLUSIONS

It can be concluded that knitting with zero take-down tension, with the aid of either a mechanical or compressed air system at the knitting feeders, allows greige cotton fabrics to be produced with a better (more compact) appearance and which exhibit much lower length shrinkage but higher width shrinkage than similar fabrics knitted with normal take-down tension. In practice, such a shrinkage pattern may be preferable and other advantages may also accrue from the zero take-down tension systems, e.g. fewer yarn and needle breakages during knitting and less wear on the knitting elements in general. However, it has been found that either winch or jet dyeing imposes considerable length stretch on the fabrics and eliminates any differences due to the take-down tension during knitting. It is clear, therefore, that from the point of view of dimensional stability of cotton fabrics, finishing the fabric under high length tensions can neutralize any improvements in the fabric stability achieved by knitting without take-down tension. Zero take-down tension on the knitting machine will only offer advantages if the fabric is not subsequently stretched when it is being finished, for instance when knitting dyed yarn.

Further studies will be undertaken on the two systems.

ACKNOWLEDGEMENTS

The authors are indebted to Mr D. J. M. Currie of the Department of Machine Development and Innovation for preparing the diagram and to the staff of the Departments of Dyeing, Finishing and Textile Physics for technical assistance. The authors are also indebted to Messrs Valley Textiles (Pty) Ltd., for dyeing and finishing the fabrics.

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A NOTE ON THE SPINNING OF COTTON ON A MODIFIED REPCO MARK I SPINNER USING THE WRAPPED CORE-SPUN TECHNIQUE

by D. W. F. TURPIE, J. CIZEK and D. J. M. CURRIE

ABSTRACT

Experiments are described in which cotton rovings have been successfully spun on a modified Repco Mk I spinning machine at 220 m/min. using the wrapped core-spun technique developed at SAWTRI. The regularity of the yarns was not as good as that of equivalent ring yarns, but this is not regarded as constituting a serious disadvantage for certain applications. Spinning of cotton on the modified machine would therefore appear to be commercially viable.

INTRODUCTION

During 1976 SAWTRI developed a technique for spinning mohair yarn on the Repco with the aid of two strands of synthetic filaments[1]. The yarn was named Repco wrapped core-spun (RWCS) yarn since one of the synthetic strands generally positioned itself in the core of the yarn whereas the other wrapped itself around the outside of the yarn. The technique has since been used extensively in the production of a variety of staple yarns from a variety of materials, one of the main advantages being that it both extends the range of materials that can be spun on the machine and enables the production of ultrafine yarns at extremely high spinning efficiencies. Not only does it enable relatively coarse qualities of mohair to be spun into fairly fine linear densities[1], but some yarns have been made on an experimental basis from such short blends as wool/cotton[2]. Further advantages are that very low uptwist factors can be used.

While absolute values for the irregularity parameters are high by normal standards, as for example on mohair RWCS yarns[3], those for cotton-rich wool/cotton blends were found to be exceptionally high[2] and precluded their use for practical purposes. It was suggested, however, that even with wool-rich blends of wool/cotton some re-design of the drafting system may be worth-while considering in view of the acknowledged high productive capacity of the Repco machine[2]. Following upon these developments it seemed that the next logical step would be to ascertain if some relatively simple modifications to the machine could be carried out to enable the spinning of very short fibres, such as cotton itself, using the RWCS technique. Work has been reported on the spinning of Sea Island cotton at Leeds University on a Repco-type machine, but it was also mentioned that valid comparisons with known standards were difficult[4].

MODIFICATIONS

Diagrams illustrating the drafting and self-twist assembly before and after modifications are given in Fig. 1 and 2 respectively. Both are drawn to the same scale and illustrate that a significant reduction in nip distances leading to potentially improved control of the short fibres was achieved. A smooth top roller and cut-away shroud guide, designed on similar lines to that used for doubling the linear production[5], have been incorporated. An adjustable tensioning roller was fitted in preference to the tensioning spring since it allowed the ratch between the apron and front rollers to be reduced from 22 to 20 mm .

EXPERIMENTAL

Two experiments were carried out. In the first, locally produced *combed* cotton rovings of 500 tex having 63 turns/m were spun into 21 tex RWCS yarns using two 17 dtex nylon multifilament yarns as core and binder. These were uptwisted with 856 turns/m. As control, the same rovings were spun on a

TABLE I

PHYSICAL PROPERTIES OF COTTON YARNS PRODUCED ON THE REPCO AND THE RING FRAME

	Combed Cotton Yarns		Carded Cotton Yarn
	RWCS	Ring	RWCS
Nominal linear density (tex)	21	21	21
Actual linear density	22	21	20
Breaking strength (cN)	353	395	312
Tenacity (cN/tex)	16	19	15
Extension (%)	12	7	12
Irregularity CV (%)	18	13	24
Thin places per 1000 m	135	0	639
Thick places per 1000 m	310	4	1 174
Neps per 1000 m	179	25	1 212
Yarn delivery speed (m/min)	220	13	220
End breaks during trial run	Nil	Nil	Nil

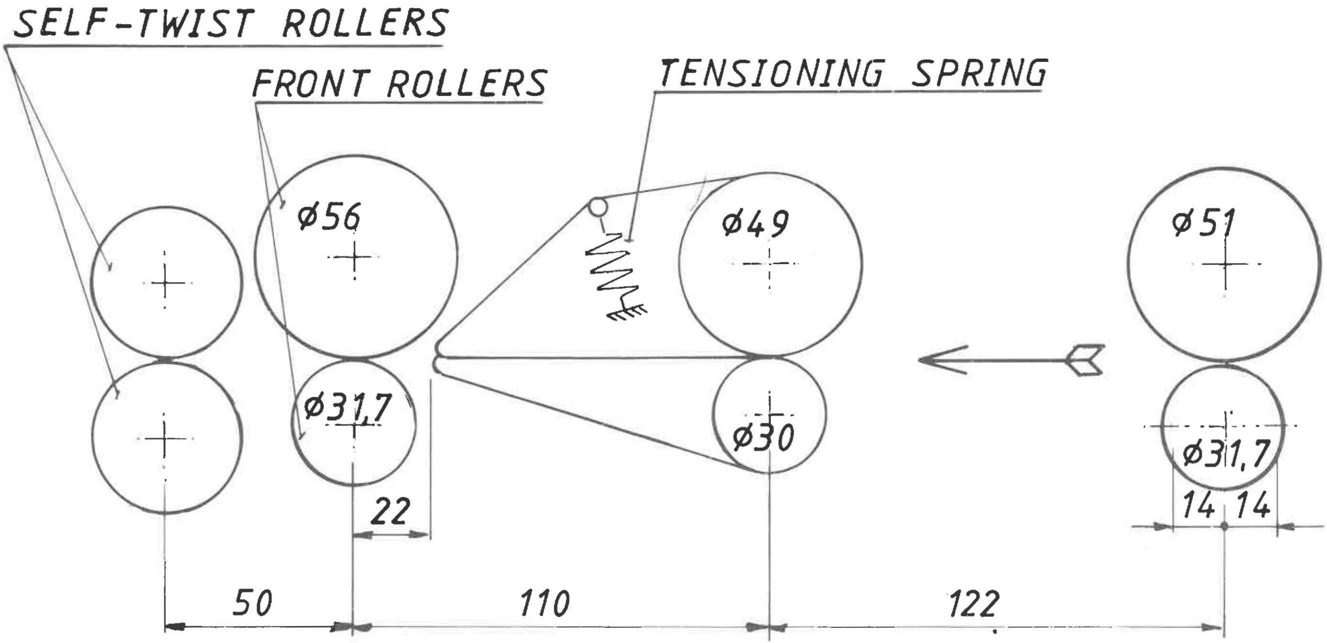

Fig 1 DRAFTING & SELF-TWIST ASSEMBLY ZONE
PRIOR TO MODIFICATION

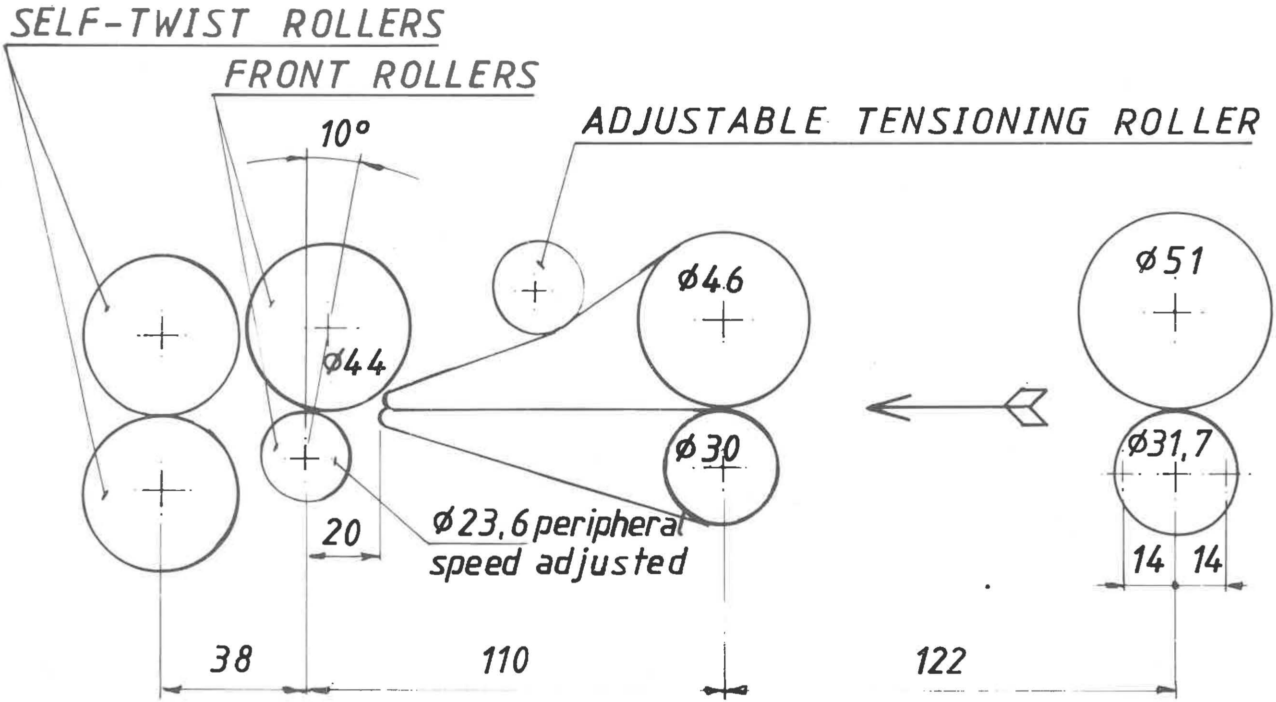

Fig 2 DRAFTING & SELF TWIST ASSEMBLY ZONE
AFTER MODIFICATION

cotton ring frame to the same level of twist. In the second experiment, *carded* cotton rovings of 433 tex made from Acala 1517/70 and having 51 turns/m were spun into 21 tex RWCS yarns, again using two 17 dtex nylon multifilaments and uptwisting with 856 turns/m . All yarns were steamed and then tested for the usual physical properties.

RESULTS AND DISCUSSION

The physical properties of the yarns produced in the two different experiments are given in Table 1.

The results shown in Table I indicate that the RWCS yarn was not as regular as the equivalent ring yarn. From previous experience it was expected that this would be the case and the results are not regarded as constituting a serious disadvantage for certain applications. The extension of the RWCS yarn was far higher than that of the ring yarn but the breaking strength of the RWCS yarn was somewhat inferior. (Polyester may have been a more popular choice than nylon, but no multifilament polyester yarns were available in the required linear density.) The factor of overriding importance, however, is the yarn delivery speed. The RWCS yarn was delivered 17 times as fast as the ring yarn. On the other hand, however, the RWCS yarns had to be uptwisted.

It seems that the spinning of cotton on a modified Repco may be a commercial possibility. Further in-depth studies will be carried out at SAWTRI in the near future, involving both the spinning of various cotton yarns on the modified machine, and the construction of various fabrics.

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A NOTE ON THE USE OF SOFTENED PHORMIUM FIBRE AS WEFT IN CURTAINING

by G. A. ROBINSON, E. WEIDEMAN and J. D. SPENCER

ABSTRACT

The use of a phormium rich yarn (produced from softened phormium, blended with polypropylene staple and with a polyester core) as weft in curtaining fabric is described. Details of the softening process, preparation of the spinning of the yarn on a Dref II OE spinning machine and weaving details are given. Tests carried out on the fabric indicate that strong, durable curtains can be produced using a high percentage of phormium.

INTRODUCTION

Phormium fibre is coarse and can normally only be spun into coarse linear density yarns such as 800 tex for twill cloth type bag manufacture. In order to improve the range of end uses for phormium fibre, work was initiated at SAWTRI to soften the fibre and to blend the softened fibre with a synthetic carrier fibre[1, 2].

Initial attempts to spin yarns below 250 tex from a gilled roving (70/30 phormium/acrylic) were disappointing and the yarns were very weak (tenacity of 4 to 5 cN/tex) and very uneven which limited their use[1]. The reason for this was probably a combination of factors, from the quality of fibre itself on the one hand to the type of preparation and spinning used on the other. However, with further experience gained in the production of good quality softened fibre and the recent acquisition at SAWTRI of a Dref II OE spinning machine, spinning blends of phormium and synthetic fibres has become a viable proposition. The spinning of core-spun yarns on the Dref is a relatively straight forward process and this was also considered to have merit for spinning phormium into yarns of increased tenacity. The character and colouring of these "new" yarns make the weaving of new "textured" fabrics possible and in this report the production of a curtaining fabric comprising 53% phormium, 22% polypropylene and 25% polyester in the weft is described.

EXPERIMENTAL

Chemical and mechanical softening

Decorticated phormium fibre in loose carded form (in 40 kg lots) was treated with 0,4% (m/v) sodium hydroxide at a 40:1 liquor-to-goods ratio. The temperature of the solution was kept at about 95°C for one hour. After about 45 min the sodium hydroxide had exhausted onto the fibre to give a final pick-up of 6,5% (omf). The fibres were washed and rinsed three times at room temperature on an experimental washing machine[3] fitted with a polyester porous belt. The squeeze rollers were rubber coated (shore hardness 75) and the fibres were squeezed at a pressure of 11,32 N/cm . The fibres were then lubricated by dipping them into a solution containing ®Bevaloid 4027 (5% m/v), squeezed, opened by a fleece breaker and finally dried at 80°C in a Fleissner dryer.

Carding

The opened fibre was carded once on a Turner and Atherton sample carding machine, then blended by hand with 30% polypropylene staple fibre (11 dtex, 15 cm) and then carded twice more on the same machine to ensure as even a blend as possible. Final delivery was in sliver form. The polypropylene fibre in the blend was introduced as a carrier only and to create higher fibre cohesion and hold the sliver together in subsequent processing.

Gilling and Drawing

The card slivers were gilled three times on an NSC intersecting preparer gill box with auto-leveller, type GNP, using a draft of 4,5 at each passage. They were then drawn to a linear density of 10 ktex during a fourth passage.

Spinning

The 10 ktex slivers were spun on a Dref II open end spinning machine with three multifilament (167 dtex f30) flat polyester core yarns fed into the perforated roller to give a core-spun yarn of R200 tex. The yarns were spun at a delivery speed of 120 m/min and the final composition of the yarn was 53% phormium, 22% polypropylene and 25% polyester.

Weaving

It was decided that the character and colouring of the above yarn was ideal as a weft yarn for curtaining. A warp was subsequently made with 1 173 ends of R35 tex/2 polyester/cotton (50/50) yarn to a reed width of 173 cm and dented in the reed 1 end/dent. The warp was woven in a 6-colour Dornier Rapier Weft Insertion loom into plain weave, using weft mixing of the phormium-rich "effect" yarn at 13 picks/cm .

Finishing

The fabric was Dolly scoured with 5% soda ash (o.m.f.) and 0,5 g/*l* non-ionic detergent, dried on a stenter, steamed and brushed, cropped and decatised.

RESULTS AND DISCUSSION

The phormium-rich yarn and the fabric were tested for certain physical properties and the results are shown in Tables I and II, respectively.

TABLE I

PHYSICAL PROPERTIES OF A PHORMIUM-RICH WEFT YARN

Yarn Linear Density (tex)	Irregularity (CV %)	Blend (%)	Yarn Breaking Strength (cN)	Yarn Breaking Extension (%)	Tenacity (cN/tex)
200	29,6	53% phormium 22% polypropylene 25% polyester	2 330	22,4	11,7

The yarn was strong and sufficiently soft and pliable to be woven in a rapier loom at 220 picks/min. By using a fine cotton/polyester warp the mass of the fabric was kept to within commercial standards (around 220 g/m²).

TABLE II

PHYSICAL PROPERTIES OF A PHORMIUM-RICH CURTAINING FABRIC

Fabric Mass (g/m²)	220
Fabric Thickness (mm)	1,28
Drape (%)	65,2
Martindale Abrasion:	
Mass loss after 10 000 cycles (%)	3,2
Fabric Strength (N) Warp	227
Weft	1 549
Fabric Extension (%) Warp	10,9
Weft	33,5
Area Shrinkage (%): (IWS TM 9)	1,3
(IWS TM 185) (3 hour wash)	1,1

Considering a weft "effect" thread was used in the construction causing the fabric to be considerably stiffer in the weft direction than the warp direction, the fabric still exhibited reasonably good draping characteristics.

The fabric strength, abrasion resistance and shrinkage after washing were very good. The high extension at break of the fabric in the weft direction is characteristic of a fabric made from core-spun yarn. A sample is shown in the appendix.

CONCLUSION

Softened phormium fibre was blended with a synthetic carrier to help processing and then spun on a Dref II spinning machine with the addition of a flat filament core yarn to increase the yarn tenacity. The phormium-rich yarn performed well during weaving on a high speed weaving machine.

The irregularity of the yarn and its character and colouring make it possible to produce curtaining with a new textured look and the physical properties measured indicate that the fabric is suitable for medium-weight curtaining.

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THE USE OF PROPRIETARY NAMES

® denotes registered trade marks. ® Bevaloid 4027 is the trade mark of Messrs Bevaloid (S.A.). The fact that products with proprietary names have been used in this report does not in any way imply that SAWTRI recommends them or that there are not substitutes which may be of equal value or even better.

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APPENDIX
SAMPLE OF FABRIC USING A PHORMIUM-TENAX BLEND WEFT YARN