WU4/H/516

Rec: 139318

SAWTRI TECHNICAL REPORT

NO 230

Some Novel Methods for Producing Mohair Blankets

by

G. A. Robinson, L. Layton and R. Ellis

SOUTH AFRICAN WOOL AND TEXTILE RESEARCH INSTITUTE OF THE CSIR

P. O. BOX 1124
PORT ELIZABETH
REPUBLIC OF SOUTH AFRICA

ISBN 0 7988 0418 1

SOME NOVEL METHODS FOR PRODUCING MOHAIR BLANKETS

by G. A. ROBINSON, L. LAYTON and R. ELLIS

ABSTRACT

Three novel methods of producing mohair blankets are described and compared with the conventional method of weaving. These three types of blankets can be produced on conventional equipment utilising needle punching, warp knitting and weaving machines, respectively. In the case of needle punching some patterning effects are obtained using special scrims. In warp knitting, new designs and cellular effects are readily obtained and in weaving the mohair is kept to one surface only so as to produce a "non-slip" blanket. Fibre retention in these blankets, measured in terms of the single fibre withdrawal force, and the results obtained on the blankets produced by conventional and unconventional means, are discussed.

KEY WORDS

Needle punching — warp knitting — Co-we-nit — carbine needles — weaving — mohair pile fibre — mohair blanket — loop yarn — fibre withdrawal force — fibre retention.

INTRODUCTION

Mohair blankets form one of the traditional end commodities produced from the lustrous *mohair* fibre. Mohair blankets are characterised by their low mass, soft and silky handle, excellent insulation properties and luxurious appearance. They are relatively expensive, however, and the recent increases in raw material prices are jeopardising the future market[1]. In fact, there has been a recent decline in the production of mohair blankets, partly caused by price increases of the raw material. Nevertheless, mohair blankets reign supreme in a class of their own as high quality blankets.

The traditional method of manufacturing mohair blankets is by weaving loop yarns on rather slow running weaving machines (10—15 m per hour), a procedure which in itself is very uneconomical and therefore an alternative method of production would be an attractive proposition. It would not only be desirable from a cost advantage point of view but could also be instrumental in stimulating new designs and structures with possible improvements in physical properties. SAWTRI investigated the possibility of producing such blankets by three different methods, namely needle punching, warp knitting and weaving, each method being completely or partly different from the conventional method.

Before an attempt is made to develop a new type of mohair blanket the merits of the traditionally manufactured article should first be appraised. A new type of mohair blanket should be –

(a) as good as, or better than the traditional blanket in appearance;
(b) similar in mechanical properties, warmth, insulation, handle, etc.; and
(c) cheaper, easier or quicker to produce or have some or other advantages in design, non-slip effects etc.

APPRAISAL OF THE CONVENTIONAL WOVEN MOHAIR BLANKET

The traditional blanket is manufactured by weaving a fancy mohair loop yarn in both the warp and weft directions with a low number of ends and picks per centimetre. The loop yarn is made by two doubling processes, the first of which is known as the *folding* effect, and the second as the "running back" or *locking* effect. Two single or ply ends of about 44 tex worsted yarn are folded with a mohair yarn of about 220 tex, the mohair thread being overfed to produce loops in the yarn. This is illustrated by Fig. 1. The loops formed in this manner are unstable and therefore this loop yarn is subjected to a second doubling process known as "running back".

Fig. 2 shows the second stage in the manufacture of loop yarns; the folded loop yarn is run back with another end of single 44 tex yarn and the loops of

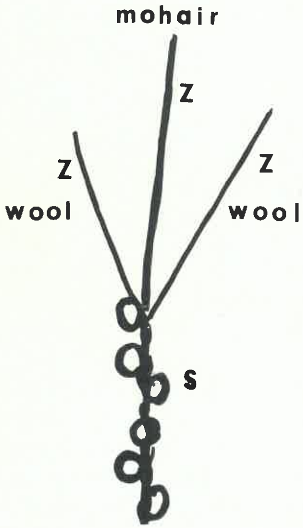


FIGURE 1

First Process – Folding Effect

FIGURE 2

Second Process – "Running back" – Binding the Mohair loops to give a stable yarn

mohair are locked into position by this binder thread. The resultant fancy loop yarn has a linear density of about R450 tex with evenly spaced loops.

There are variations of this process, the most common being that ply yarns are used in the locking process.

These loop yarns are often wound into hanks, dyed and brushed and then used for weaving into rugs and shawls. They may also be woven directly into blankets after dyeing, and the woven fabric raised to give a pile effect. This type of woven blanket may be plain weave and constructed with only about four ends and picks per centimetre.

When the blanket fabrics are raised the rollers of the raising machine pluck the mohair loops, breaking them and drawing the fibres parallel to give a raised pile. The base of the fibres remain locked in the yarns in the fabric. The resultant fabric has a long pile of soft, silky fibres with the characteristic lustre of mohair, and the resultant mass per unit area of the blanket is in the region of 350 g/m^2.

In this report it will be shown that plain and fancy mohair yarns can be used in other ways to produce blankets.

Needle punching:

Needle punching is an old established process which has received considerable attention in recent years especially since the introduction of non-woven blankets and carpeting. Previously this process had only been used for compacting wadding for insulation purposes and for needling jute in the production of a backing fabric or underfelt for floor coverings. Recently these needle punching machines have become more precise and sophisticated, enabling the use of finer fibres such as synthetics and rayons. The end commodities have improved, with the major part of production being for industrial and domestic purposes. It has been estimated that 90% of all blankets manufactured in the U.S.A. are manufactured by the needle punched process(2). In the United Kingdom the corresponding figure is about 30%, whilst in South Africa, the production of blankets by this method is almost non-existent.

Needle punching is one of the categories of textiles commonly grouped under the heading of non-wovens(3, 4, 5, 6). However, these fabrics nearly always incorporate some base fabric or scrim which is usually woven to give added strength.

The needle punching process is considered to have a great future although at the present time the process is very limited as far as design is concerned. Only printed designs, embossed or mottled effects, achieved by blending, are possible.

Warp Knitting:

By using a worsted yarn for the pillar stitch and a mohair loop yarn laid in as a weft a very stable fabric can be made by the warp knitting process. When using the conventional Co-we-nit RM 4FD machine equipped with latch needles it was found in earlier investigations that the loops of the inlay yarn were occasionally caught by the needle hooks and were incorporated into the pillar stitches. The mohair fibres in such loops could no longer be brushed out to give the desired surface effect (see Fig. 3). It was therefore considered that the use of *latch needles* when laying in mohair loop yarns was not commercially feasible.

It was also found that occasionally the yarn loops in passing through the guide eyes were stripped back to form an entanglement above the guide eye resulting in a fault in the fabric. This was especially the case when a construction was selected in which the mohair loop yarn was threaded in on bar 2 (weft) where the guide eyes are rather small.

Weaving:

In the weaving of the conventional mohair blanket there are certain factors which in themselves create uneconomical and undesirable conditions. For example, the use of leno crossing threads and loop yarns as warp, results in low production

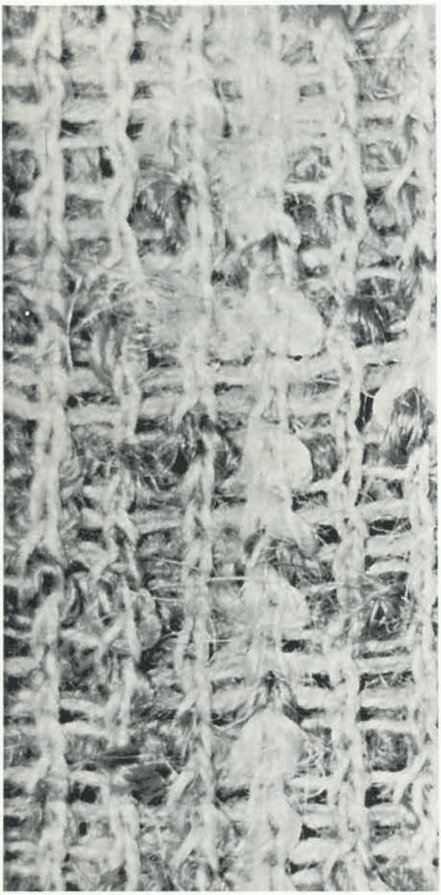


FIGURE 3
Mohair loops incorporated in the Pillar Stitch

rates because the machines used can only be run at relatively slow speeds. Furthermore, the mohair blanket is inclined to slip off the bed. It was therefore decided to design a blanket which cannot only be produced on conventional machines at high speeds but which also incorporates a non-slip surface.

One of the greatest problems encountered in producing mohair pile fabrics is the shedding of the fibres both during raising and subsequent use. In this report the force necessary to withdraw single fibres from the blanket has been used as a measure of the fibre shedding propensity of the blankets.

Previous work carried out on the tuft withdrawal of bundles of fibres (different than tuft withdrawal from carpets), showed that it was inevitable that some fibres in the tuft were held in the clamp by both their ends, and therefore the measurement of these forces included some fibre breakage. Smirnov, Bershev and Sukarev[7] described an apparatus for determining the "strength of attachment" of a pile and later Bershev and Smirnov[8] designed a new clamp for use on the RM-3 Tensile Testing machine which enabled them to measure the "strength of attachment" of electrostatically attached pile fibres, which in some cases were less than 2 mm in length. Such a machine was not available at SAWTRI and, therefore, the Instron Tensile tester was used to measure the "single fibre withdrawal force" which can be considered as a measure of the fibre retention in a fabric.

EXPERIMENTAL AND DISCUSSION OF RESULTS

A. Needle punched:

In this report details of a method of producing a mohair blanket by needle punching and involving the use of a base fabric or scrim are given. The design of the scrim imparts the colour or pattern to the fabric. The scrim was produced on the Co-we-nit RM 4FD machine using coarse mohair yarns with a relatively low twist but strong enough to allow the barbed needles to pass through the yarns without puncturing or damaging the scrim structure. This mohair scrim is expensive compared with scrims in normal use but in this instance it was of prime importance as it enabled patterning effects to be achieved. It was found that a scrim with a mass per unit area of 200–250 g/m^2 maintained its strength after needling, provided that the depth of penetration and needling were kept within reasonable limits. The scrim must be sufficiently dominant to impart the necessary colour and design to the blanket when used with either natural or dyed mohair fibre, or both.

Scrim or base Fabric:

The scrim or base fabric was produced on a 1,9 m (75") Karl Mayer Co-we-nit RM 4FD machine using two guide bars only. The yarns used were 125 tex ($^1/7$s worsted count) 100% mohair. The yarns were dyed to various shades to demonstrate patterning effects and the construction used produced cellular or open effects. Fig. 4 shows the construction of a base fabric using a 9 gg set-up (9 needles per

5,08 cm). Many other designs are possible and some have been described in previous studies[9].

The scrim comprised 4 courses per centimetre and the take-up ratios (yarn to fabric) were –

bar 1 (pillar stitch) – 4,0:1
bar 2 (laid-in) – 5,5:1

The scrim fabrics were steam-decatised before being presented for lap formation subsequent to needling.

Fibre web or batt:

The fibre used was BSH mohair, having a mean fibre length of 84,8 mm and a mean fibre diameter of 42 μm. During carding the mohair was sprayed with Eutectal (Manufacture de Produits Chimiques). The mohair web or batt was produced by carding and cross lapping and the mass per unit area of the batt of fibres was about 100 g/m^2 on each side of the scrim.

Needle punching:

A 0,38 m (15″) Garnett Bywater laboratory model needle punching machine using needles 1625/3/M/HP with standard point, plated finish, was used.

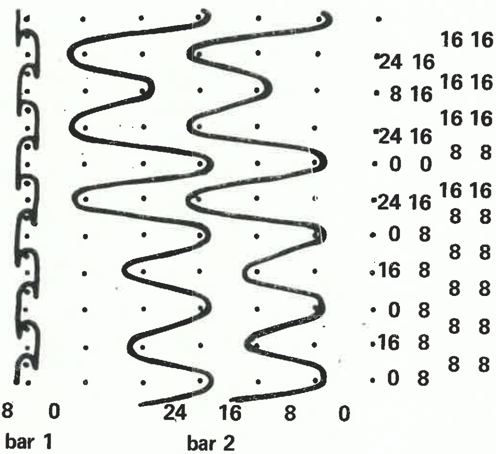


FIGURE 4
Design for Scrim Fabric

The machine speed (N) was 250 punches per minute.

The needle board density (D) = 10,24 needles per cm (26 needles per inch) of board 15,24 cm deep (6″ deep).

The feed (F) = 0,8 cm per cycle

$$\text{Therefore, needling M} = \frac{D}{F}$$

$$= \frac{26/2{,}54}{0{,}8} = 12{,}8 \text{ needle punches/cm}^2$$

$$\text{and production (FN) (metres)} = \frac{0{,}8 \times 250}{100} \times 60$$

= 120 metres per hour for a single passage through the machine.

Normally for needle punched blankets three passages through the needle punching machine are used, viz. first passage: scrim plus face batt; second passage: turn over and needle second batt; third passage: turn over and give final needling. At each passage the needle penetration was kept constant at 1,59 cm ($\frac{5}{8}$ in.). In the case where the amount of mohair was low (100 g/m^2) it was, however, decided to have a further three passages resulting in three needlings each side alternately.

To prevent fibre loss during finishing it was decided to treat the material with a resin before raising. This treatment was carried out by total immersion in a 10% solution of resin.

The solution consisted of –

75,5 g of water

22,0 g of acrylic resin Rhoplex HAB (Triton Chemicals, 45,5% active matter)

0,5 g of wetting agent Triton X – 100 (Triton Chemicals, 10% active matter)

and 2,0 g of Catalyst A (Triton Chemicals, 25% active matter).

The fabric was padded to 100% expression, dried at 60°C and cured at 130°C for 3 minutes.

The fabrics were then raised to impart a long luxurious mohair pile to the blanket.

B. Warp Knitting:

In the warp knitting of mohair loop yarns it was decided to use a 12/12 gg Co-we-nit machine, (6 needles per 2,54 cm and 6 guides per 2,54 cm). Normally a Raschel machine would have been used, but this was not available. With such coarse gauges special grooved guides can be used with larger eyes so that the yarn lies protected in the groove of the guide eye, but these can be used on bars 3 and 4 only. It is possible to use bar 3 for laying-in the mohair loop yarn as a weft and it was found that improved running performances were obtained by this method.

A needle recently adopted for the Co-we-nit machine (Karl Mayer), is the *carbine needle* (Karabiner needle) which is often used in conjunction with tubes especially in the case of coarse and effect yarns. The effect yarns are drawn in through the tubes to prevent the needles picking up the long protruding fibres and the one-piece carbine needle is much sturdier than the latch needle and less prone to breakage (see Fig. 5).

In view of the unique shape of the carbine needle, stitch formation can only be achieved by lapping in one direction as shown by the arrow (Fig. 5). As the angle at which the yarn should approach the needle (so as to enter the hook or beard) is critical, the tubes of the 3rd guide bar must be set so low that the mohair loop yarn does not impede the movement of the pillar yarn at the point of overlap.

When using carbine needles in the production of Co-we-nit fabrics special movements of bar 2 (weft bar) are necessary to ensure that the weft thread allows the pillar thread (bar 1) to knit. Fig. 6(a) shows a normal Co-we-nit bar 2 movement which could be used to form air cells in a blanket structure and Fig. 6(b) shows the more intricate movement necessary when using carbine needles. (Note that the extra movement after bar 1 has overlapped the needle for the stitch, is only made on the left shog when the yarn in bar 2 passes around the needle as shown.

The actual movements of bar 2 (Fig. 6(b)), appear to be quite intricate. It can be seen that when the guide bar 2 shogs to the right, there is the same movement

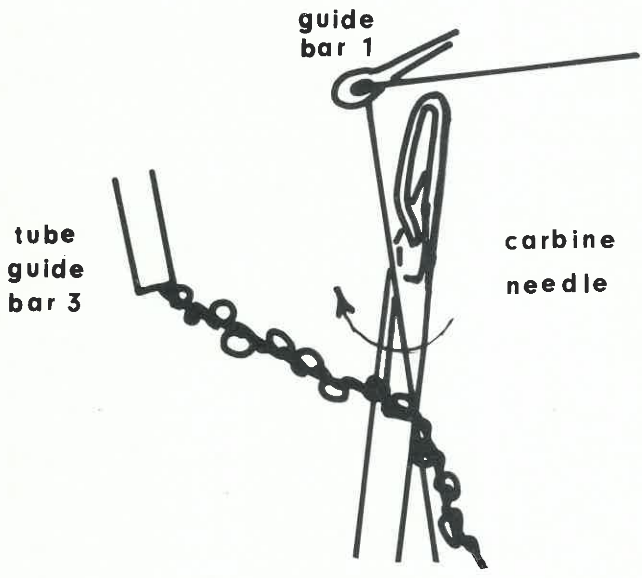


FIGURE 5

The Carbine Needle showing the correct angle of the thread to ensure entrance into the beard

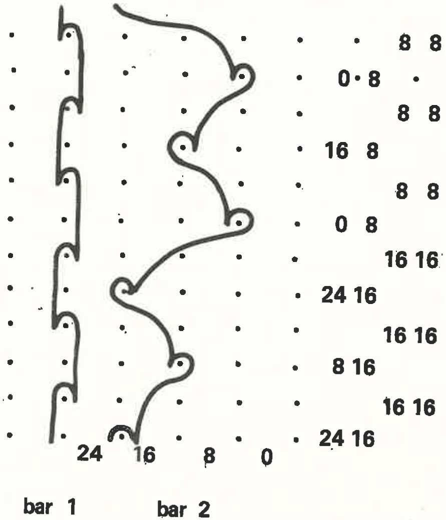


FIGURE 6(a)

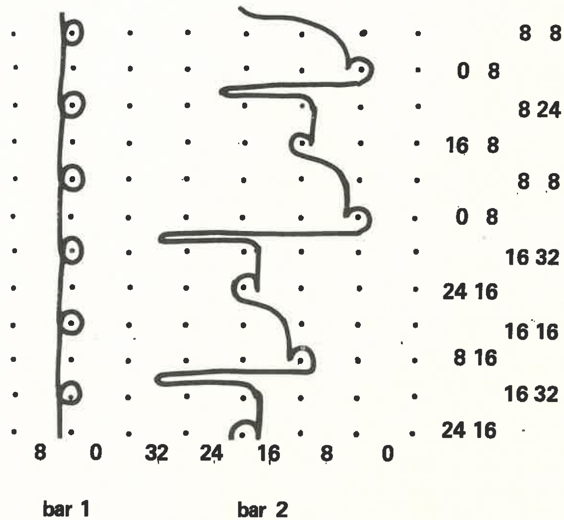


FIGURE 6(b)

Comparison of guide bar movements of bar 2 when used in conjunction with:
(a) Latch Needles and
(b) Carbine Needles

as in the normal Co-we-nit bar 2 movement because the thread passes around the "safe" side of the needle and cannot thread into the hook. On the overlap movement to the left, however, the thread overlaps the open side of the needle and, therefore, as the needles fall the thread from bar 2 must be taken away from the needle to ensure that it does not engage and enter the needle hook and at the same time clear the way for the thread from bar 1 to enter the needle hook.

The conversion to carbine needles necessitates 8 new cams, a new trick plate, new needle segments and optional tube segments for bars 3 and 4. The fall plate is no longer necessary when using this type of needle.

The advantages of using carbine needles for this type of manufacture are –

- fewer needle breakages;
- sturdier needle;
- no latch or open end for fibres to catch on;
- no fall plate;
- higher speeds;
- lower fault rate, and

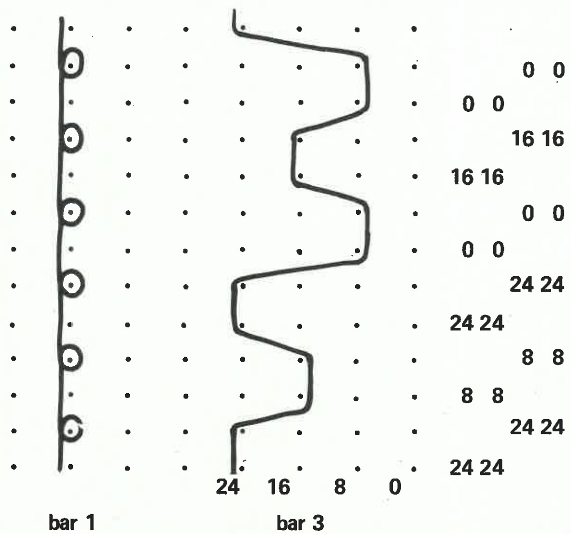


FIGURE 7

Simplified movement of bar 3 when used for weft inlay

they are especially suitable for coarse effect yarns.

The disadvantages are –

slightly more complicated designing, and

a more critical setting of bar 1.

If only two bars are used, viz. bars 1 and 3 (the latter fitted with tubes for use with coarse yarns), the pattern chain is simplified as shown in Fig. 7.

All three pattern chains, viz. –

Fig. 6(a) – latch needles;

Fig. 6(b) – carbine needles;

and Fig. 7 – carbine needles

produce the same structure. The latter method proved to have the best knittability rate.

A second construction is shown (see Fig. 8) which allows the mohair loop yarn to lay-in in a zig-zag or atlas order thereby effecting greater stability in the fabric.

The yarns used were:

Bar 1 : R45 tex/2 polyester/cotton 50/50 (intimate blend staple fibre)

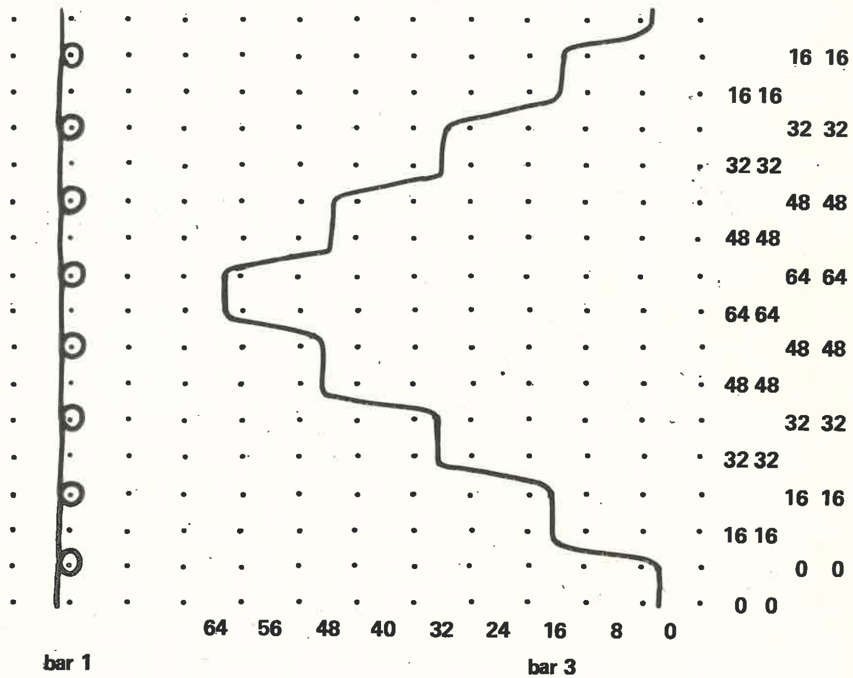


FIGURE 8

Structure for blanket using an Atlas type movement on bar 3

Bar 3 : R450 tex Mohair loop yarn.

The fabric mass per unit area was 360–370 g/m^2 with 5 courses per cm. At a machine speed of 170 courses per minute the production rate was 20 m/h. Finishing consisted of raising the blanket fabric on a Pilkington Raising machine, once on each side.

C. Weaving

A R26 tex/2 warp yarn was produced from a 50/50-polyester/cotton blend. The warp beam had 3696 ends drawn in over 167,6 cm. The weft yarns used were R26 tex/2 50/50-polyester/cotton and R420 tex mohair loop yarn in the ratio 4:1 with a total of 25,2 picks per cm.

The weave plan is shown in Fig. 9. The fabric was woven on a Saurer 100 WT loom, with double lift open shed dobby, 4 x 4 box "pick at will", 190 cm reed space, at a speed of 145 picks per minute giving a production rate of about 8–10 m per hour. The design was on eight heald shafts straight draft plus two heald shafts for selvedges.

The fabric produced had a plain polyester/ cotton back with all the mohair loops on the face. Finishing consisted of raising the fabric on a Pilkington Raising machine, on the loop side only, resulting in a secure and even pile.

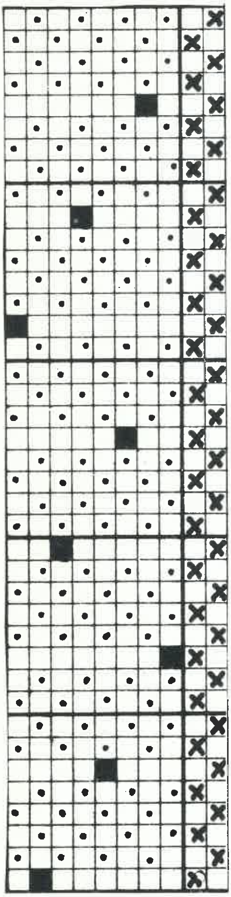


FIGURE 9

Weave plan for non-slip woven mohair blanket

being so secure in the fabric that they broke under test.

In the case of the warp knitted blankets, the lightweight blanket No. 4 had a low fibre withdrawal force and this was the only sample that had properties inferior to those of a conventional woven mohair blanket, but was considered to be quite acceptable. It can be seen that the higher density blankets (higher courses per cm) showed a corresponding increase in mass and thickness as expected, and also corresponding increases in fibre retention.

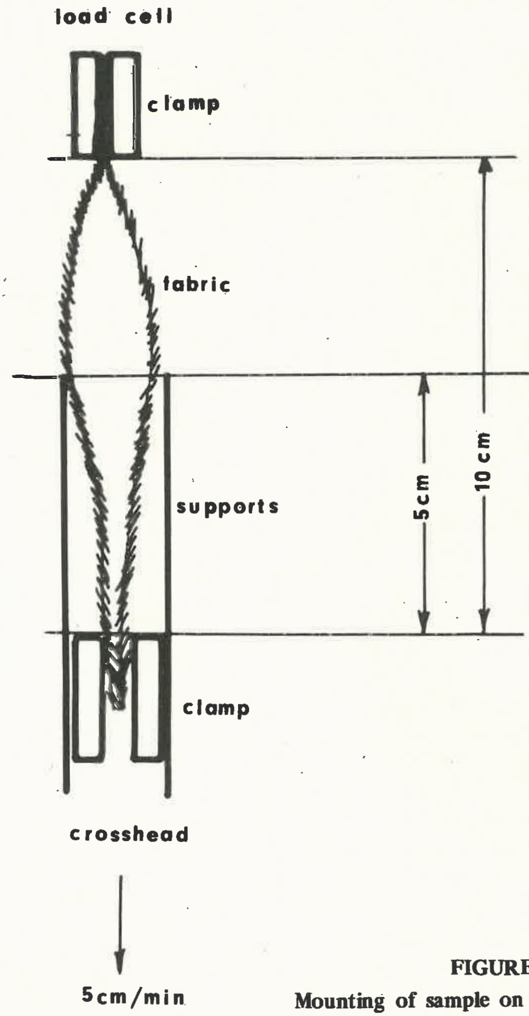


FIGURE 10
Mounting of sample on the Instron Tester

It can also be seen that with all the fabrics some fibre breakage occurred during the fibre withdrawal force measurement, i.e. the fibres were held so tightly in the fabric that they broke. A high percentage of fibre breakage during withdrawal indicated good fibre retention in the fabric.

CONCLUSIONS

The three new types of blankets as described in this report compare favourably with the traditional blanket. In each case the blankets can be produced at competitive rates compared with conventional mohair blankets and in the case of the needle punched blankets there is the advantage of the pile fibre having a different colour to that of the scrim, thereby producing a patterning effect. The woven mohair blanket has the advantage of combining the non-slip property of a cotton sheet on one side and the warmth of a conventional blanket as well, with the additional advantage that the mohair blanket does not slip off the bed.

The measurement of single fibre withdrawal force gave an indication of fibre retention in the fabric and it was shown that the fibre retention of the three novel types of blankets described was as good as or better than that of the conventional mohair blanket. Blankets with a high fibre breakage had very good fibre retention.

ACKNOWLEDGEMENTS

The authors wish to thank Messrs. S. Smuts, D. Alcock, S. J. Harri and F. T. Bruiners for technical assistance.

THE USE OF PROPRIETARY NAMES

The fact that chemicals with proprietary names have been mentioned in this report does not in any way imply that SAWTRI recommends them or that there are not substitutes which may be of equal or better value.

REFERENCES

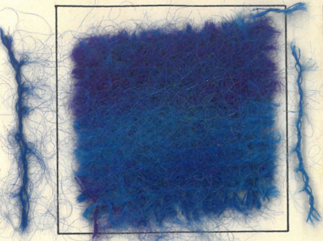
1. Uys, D. S., S.A. Mohair Board – private communication (1974).
2. Rhodes, D., Lantor Ltd., – private communication (1970).
3. Buresh, F. M., Nonwoven Fabrics. Reinhold Publishing Corp., New York (1962).
4. Krcma, R., Nonwoven Textiles, The Textile Trade Press, Manchester (1967).
5. Lennox-Kerr, P., Nonwovens. The Textile Trade Press, Manchester (1971).
6. Krcma, R., Manual of Nonwovens, The Textile Trade Press, Manchester (1971).
7. Smirnov, G. P., Bershev, E. N. and Sukharev, M. I., Apparatus for Determining the Strength of Attachment of a Pile, Tekstil'naya Promyshlennost' 31, No. 6, pp.55–56 (1971). In Russian.
8. Bershev, E. N. and Smirnov, G. P., New Design of Upper Clamp for the RM-3 Tensile Testing Machine, Tekstil'naya Promyshlennost' 31, No. 6, pp.56–57 (1971). In Russian.
9. Robinson, G. A. and Layton, L., Standard Co-we-nit Design Techniques, *S.A. Textiles* (April, 1970).

Published by
The South African Wool and Textile Research Institute,
P.O. Box 1124, Port Elizabeth, South Africa,
and printed in the Republic of South Africa
by Nasionale Koerante Beperk, P.O. Box 525, Port Elizabeth.

ISBN 0 7988 0418 1

APPENDIX I

1.

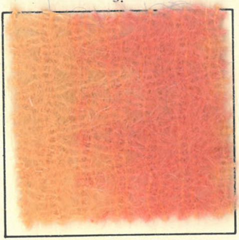


Sample of a conventionally woven mohair blanket

2.

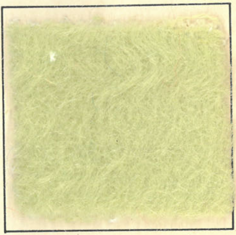
Sample of a Needle-punched mohair blanket, using a Co-we-nit scrim for patterning

3.



Sample of a Warp-knitted mohair blanket

4.



Sample of a Woven mohair blanket with cotton/polyester 50/50 sheet backing, giving non-slip properties