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ASSISTANCE TO THE TEXTILE LABORATORIES AND DESIGN CENTRE*

DP/SYR/72/010

SYRIA

Technical report: Manual on textile design

Prepared for the Government of Syria by the
United Nations Industrial Development Organization
executing agency for the United Nations Development Programme

Based on the work of D.R. Hargreaves, expert in fabric design

United Nations Industrial Development Organization
Vienna

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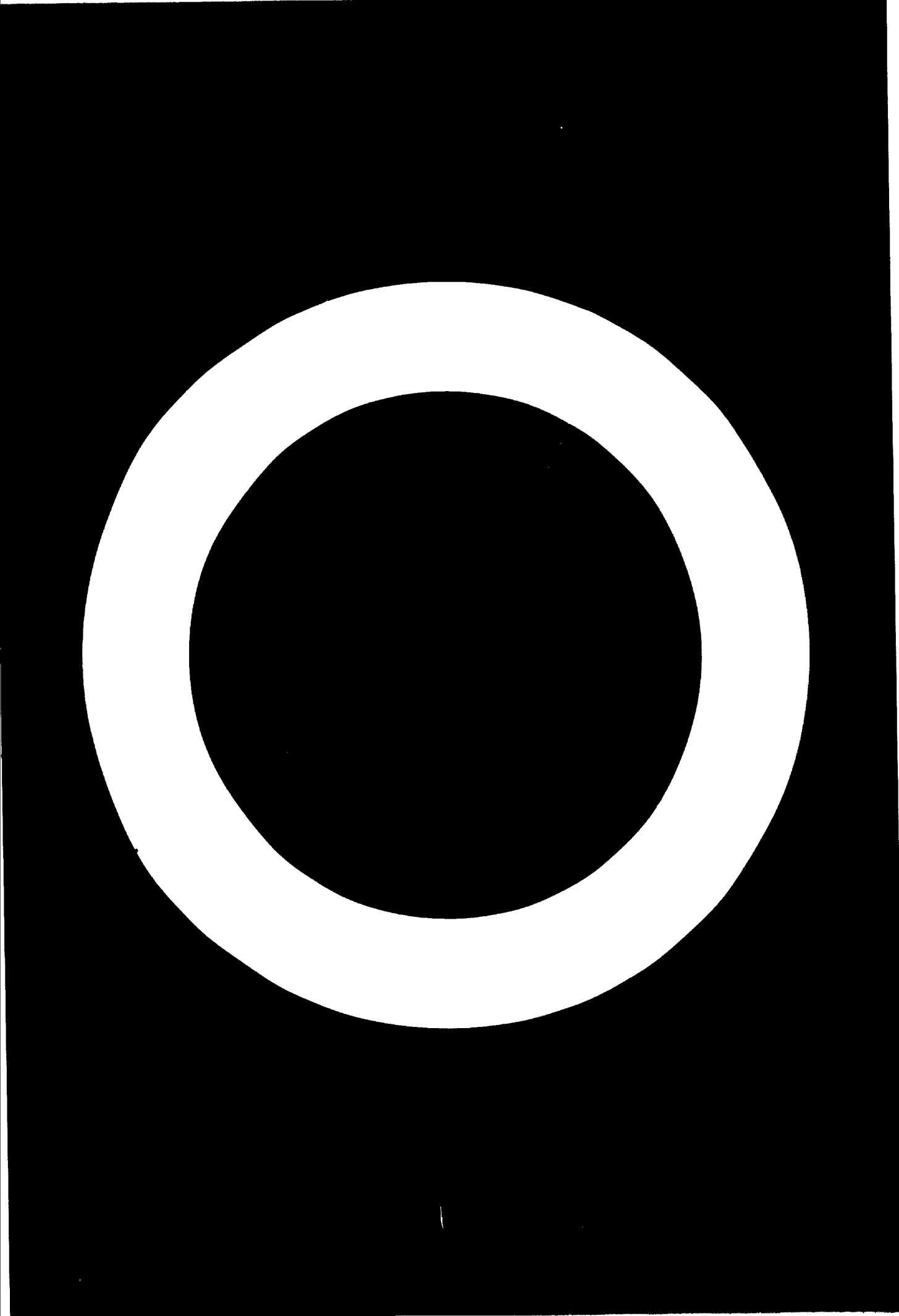

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SPECIAL NOTE:

All designs have been graphed using both colour and symbols in order to facilitate photocopying.

INTRODUCTION

The expert in fabric design took up his assignment on 27 January 1977 and completed it on 31 December 1977. His mission formed part of the project "Assistance to the Textile Laboratories and Design Centre" (DP/SYR/72/010).

Among the tasks accomplished, which are described in detail in a separate technical report[1/], was the training of the staff of the Design Centre. The expert decided, that a record of the technical and administrative information made available during the training courses should be provided. The idea of preparing a manual on textile design was discussed and approved at the tri-partite meeting in August 1977 and work on it commenced soon thereafter.

The manual has been prepared with special reference to the Syrian textile industry and should therefore be particularly valuable to the Design Centre. It incorporates much material not found in standard text-books on fabric design. It is intended to translate this manual into Arabic for the benefit of those staff members of the Design Centre who do not know English.

1/ DP/ID/SER.A/122.

CLOTH ANALYSIS

A cloth is analysed in order to find out exactly how it has been made with a view to reproducing it. This is an important aspect of textile designing and must be done accurately to obtain good results. The following are the particulars which are required from a cloth before it can be reproduced :

(1) The weave, or order of interlacing, together with the draft, peg plan and sleying plan.
(2) The number of ends and picks per inch or centimeter in the cloth from which may be calculated the ends and picks per inch or centimeter in the loom.
(3) The kind and quality of warp and weft yarns.
(4) The counts of warp and weft yarns from which may be calculated the counts in loom.
(5) The order of warping and wefting.
(6) The kind of finish required.
(7) The width and length, grey and finished.
(8) The weight of the fabric grey and finished.

Analysis for Weave

The first point to decide is which is the face side of the cloth. In many cloths this can only be told by experience. As a rule however the face is the smarter and brighter side. In a sateen this is especially so. In worsted suitings the face will have been sheared closer than the back and will have more press on it. In a heavily milled or fulled fabric, again the face will be smarter with the cover more compact and better if only lightly pressed. In the case of a twill fabric, the direction of the twill will be a guide. Usually in worsted and woollen fabrics the twill goes from left to right. Whilst in cotton twills the twill line is from right to left. If a large sample of the fabric is available it may bepossible to note a weavers knot. This would be on the face in a grey fabric and on the back in a finished fabric. If the selvedge is available on the sample a close examination for stenter pin holes will reveal which is the face as the pins stick through from the back to the front of the fabric.

Methods of Distinguishing Warp from Weft

(a) If one series of threads is two ply and the other is single it will be generally found that the two ply threads are the warp. This applies especially to such fabrics as twills, sateens, dress fabrics, coverts, venetians and velours.
(b) If one set of threads is found to have a higher number of turns per inch or centimeter than the other, it is usually found that the threads with the higher number of turns would be the warp. That is because the warp has to stand more tension and friction during weaving.
(c) Should one of the sets of threads be found to be a heavier count than the other, then generally the heavier yarn would be the weft. It is quite common to use a slightly heavier weft count in order to reduce the number of picks required in the fabric andthus increase production and lower the cost.
(d) If the sample to be analysed contains a piece of the selvedge this readily indicates which is warp.
(e) In certain cloths one can find lines or reed marks, especially if the sample is viewed in front of a strong light. These always prove the direction of the warp threads.
(f) A close examination of both sets of threads may reveal that one set of threads is much straighter than the other. The straighter threads can generally said to indicate warp, because both in weaving and finishing the weft is allowed to contract more than the warp.
(g) The order of colouring will quite often indicate which is warp. If there are a lot of colours, say six or eight running in one direction and only two or three in the other, then the warp will be the one with the most colours.

(h) In the case of checks it is usual for the length (Warp Direction) to be greater than the width, this also applies to colour and weave checks.
(i) In the case of striped fabrics more often than not, the stripe will be in the warp. However it must be born in mind that certain fabrics especially in ladies wear may have stripes running horizontally, this is a fashion trend which appears from time to time.
(j) If on counting the threads per inch or centimeter one set of threads is a higher number than the other, then that would be the warp. Most fabrics are woven with slightly less picks than ends, because again this improves production and lowers costs.

After a decision has been made as to the face of the cloth and the direction of the warp, the next step is the actual weave analysis. The method is as follows :

1). Pull out a number of threads from the left hand side of the sample to form a small fringe.
2) Seperate the next thread from the cloth into the fringe of picks by means of a sharp pointer (a burling needle set in a handle is very good as the minute ball on the point helps to prevent splitting the threads)
3) Mark down the interlacing of the thread on point paper, putting marks down where the end goes over the picks and leaving blanks where the end goes under the picks. Proceed in this way until a repeat of the weave is obtained. Care must be taken to mark down the threads on the point paper in the same order as they appear in the cloth.

Special Note In some cases it is easier to pull out picks than ends especially in acase where there are many more ends than picks. If picks are pulled out, then marks will be entered on the point paper where the picks go under the ends. In the case of heavilly milled fabrics or fabrics with different materials in warp and weft it may be found that it is easier to pick the weave out one way than the other. If difficulty is encountered pulling out warp threads then a switch is made to the opposite method. Experience is the best way of deciding wether to pull out the warp or the weft.

Extra Small Samples. Some times in the case of a very small sample it may be necessary to analyse the weave without destroying or disturbing the sample. This can only be done by following the weave under a piece glass and marking it down on point paper accordingly.

Counting Ends and Picks per inch or centimeter

This is of the greatest importance as innaccuracy in counting the threads per inch or centimeter will affect the whole cost of production and the effect in the reproduced cloth, probably with disastrous results. There are two methods of counting threads per inch or centimeter. In each method a piece glass is of great assistance.
(a) Counting the threads in one inch of fringe by means of a needle and glass. In the case of counting threads per centimeter a metric piece glass usually is 2.5 cm. and the count would be made in the fringe over 2.5 centimeters and then the result divided by 2.5.
(b) A direct count in the body of the cloth using the piece glass either over one inch or 2.5 centimeters.

If possible counting the number of repeats of weave or colouring plainin one inch or 2.5 centimeters is a good method. That is if the repeatis on 16 threads and there are 4 repeats and 6 threads in one inch or 2.5 centimeters then the number of threads per inch is $4 \times 16 + 6 = 70$. This divided by 2.5 = 28 threads per centimeter.

Preliminary Examination

Before obtaining full reproduction particulars, the cloth sample should be given a preliminary inspection for the following :-

(a) What type ofcloth is it ? check the handle and feel of the fabric.
Cotton, is thin, slightly hairy and warm to the touch.
Worsted, is smooth more full handle than cotton, slightly hairy and warm to the touch.
Woollen, thick, rough and course but warm to the touch.
Viscose & Acetate Rayon, smooth and cold to the touch.
Polyester. The hand and feel of a 100% Polyester fabric would dspend on the system of spinning. On the cotton system the fabric would a slighly fuller hand but much more resilience and not as soft to the touch. 100% Polyester fabrics spun on the worsted system are very rare even if they exist. They would not be able to compete with fabrics made from 100. Filament polyester. These are very easy to identify, they have a very smooth silk like hand, and the filament can be easilly identified by pulling a few threads from the fabric and examining them to see if they are continous. 100% Polyester fabrics made from yarns spun on the woollen system are in large scale production. They can be identified by a rough hand, full but slightly on the hard side.

(b) What would be the end use of the fabric ?. Would it be a suiting, dress fabric, shirting, coating or outerwear, blouse or lingerie, overcoating, sportswear, swimwear, blanket etc. As a very general guide the type of fabric end use will give a guide as to the fibre content. This is only a very generall indication as the work of the designer is to find new end uses and new applications for the raw materials available.
Some Examples are:-
Suiting would be 100% wool worsted spun or polyester/ worsted blend. Other admixtures such as wool nylon or wool rayon are however used as well as polyester/cotton and polyester/rayon.
Dress Fabric. Under this heading could come any or all of the natural and man made fibres in use today. Blends of Polyester with cotton are very popular as well as polyester with rayon. Acrylics are in wide use both in 100% and blended with wool.
Shirtings. Probably the biggest production in this field is in polyester/cotton, although there is still a big production of 100% cotton shirtings for the higher priced market.
Coating or Outewear. Here again lightweight coatings may be 100% Wool, a blend of Polester/Wool, Polester/Cotton, Wool/ Acrylic or 100% Polyester. The development of new showerproof finishes over recent years has made it possible to use almost any reasonably constructed fabric for rainwear.
Blouse or Lingerie. Nylon in 100% filament is very popular in the manufacture of these fabrics. However filament acetate is still used a lot and for blouses 100% cotton or Polyester/Cotton blends.
Overcoatings. Usually 100% wool or wool acrylic blends.
Sportswear. Generally 100% cotton, Polyester/ Cotton or Polyester/ Rayon.
Swimwear. The most popular fibre in use is probably stretch nylon although polyester/cotton blends are also used.
Blankets. May be manufactured from 100% woollen spun yarn or wool acrylic blends. Also 100% polyester spun on the woollen system. This blends gives the blanking very good laundering properties.

In the preliminary examination note should also be taken of the method of spinning.
Cotton Spun Yarns have a hard feel, they are not very elastic and

have few projecting fibres with reasonable parallelisation of the fibres.
Worsted spun yarns when untwisted slightly will not come apart. The fibres are parallel
Woollen spun yarn is very uneven and will seperate without much tension.
Man-made staple fibres may be all the same length and the crimp wil straighten out if stroked.
Crimped fibres indicate fine quality wool.
Wavy fibres indicate coarse wool.

(d) Decide if possible, what type of finish has been applied; clear cut, highly pressed, semi milled, heavilly milled, secured only, raised, raised and drawn, moss, velour, sanded etc.

SPECIAL NOTE. If a chemical and physical testing laboratory is available the sample should be sent for fibre analysis and a check made for any chemical finishes which may have been applied. These would include such finishes as stain repellent, shower proofing, crease resist in the case of 100% cotton fabrics, permanent press etc. Exact identification of all the fibres present can be made in in the laboratory if sufficient fabric is available for testing. However the weave analysis, a count of ends and picks and analysis for yarn counts and warping and wefting plan must be done before chemical analysis destroys too much of the pattern.

DETAILED ANALYSIS

In the reproduction of a fabric from a small pattern, many things have to be considered and calculated. The following procedure must take place before any calculations can commence.

(1) Cut a pattern to a known size, what ever is convenient to the size of sample available. It is usual to have several sizes of cutter available i.e. 1"x1" 2"x 2", 3"x 3" or 2.5cm. x 2.5cm, 5.0cm. x 5.0cm or 8.0cm. x 8.0cm.
(2) Weigh the pattern in grains or grammes.
(3) Analyse the pattern for weave, from which a draft and a peg plan can be made. At this stage be careful not to destroy the ends or picks which are removed in taking off the weave. It is good to have a board available covered with black velvet (white or grey is used for dark colours). Then the ends or pick can be laid out side by side as they are taken out of the sample. The velvet will hold the small threads and not let them get blown away or similiarly lost. The threads must be carefully separated as they are removed from the sample.
(4) Weigh in grains or grammes a convenient number of warp threads. 36 x 1" or 18 x 2" (1 yard) or 40 x 2.5cm. 20 x 5.0cm. (1 meter). It is much more convenient to work in an equal number of yards or meters as this directly relates to the yarn count.
(5) Using same procedure as (4) weigh an equal number of weft threads. If the sample is such that more threads are available of the warp than the weft or vice versa it should be remembered that the more threads are weighed, the more accurate will be the result.
(6) Measure the crimp ratio of each type of thread, that is stretch one loose thread to remove the crimp and measure its lenght against one in the fabric. Take four to six threads in this manner and get an average.
(7) Count ends and picks per inch or centimeter in the fabric.
(8) Test all the different threads encountered both in warp and weft, for twist, wether two ply and wether 'S' or 'Z' direction.
(9) Note down the warping and wefting orders if not a plain fabric.

Fabric Widths

Cloths are usually made to set standard widths depending on the type of fabric, the market concerned and the available machinery in the plant.

Worsted suitings may be 56"-58" or 60",145cm. to 150cm.

Woollen and Dress Fabrics, coatings etc are usually made 54"or 140cm. Cotton Goods vary :- 54" , 48" , 44" , 40" , or 140cm., 120cm 100cm. and 90cm.
Curtain Fabrics and soft furnishings are often 48"- 120cm. though better qualities such as worsted and mohair are 54"- 140cm. Upholstery fabrics such as moquettes, velvets, tapestries etc. are quoted 48"/50" (120cm/125cm) inside lists. Calculate on 50" or 120cm. Fur fabrics for mantlings, shoe linings etc. are 54" inside lists. Carpets are made 18", 22½",27", 2yds., 2½ yds., 3yds., 3½ yds, 4yds,4½yds.,- 45cm., 60cm., 70cm., 180cm., 220cm., 270cm., 320cm., 360cm., and 410cm.
After analysis the fabric of course will be manufactured at the particular width according to the customer to who it will be sold and the particular end use for which it is required.

Warp Length
When analysing suitings and overcoatings it is usual to assume a warp length from which to weave a piece of cloth. For thinner counts 80yds or 70 meters may be assumed and for thicker counts a basic length of 70yds or 65 meters. However mechanical handling allows longer warp lengths and it is convenient to calculate at 100yds. or 100 meters. For moquettes , tapestries and other goods in which several different warp lengths are made up into one fabric an assumed finished length is taken and the warp lengths calculated fromthis in proportion to the take up. Cotton cloths may be woven from 100yds warp per piece or 100 meters. Man made fibre fabrics are produced so that the finished length is approximately 100 yds, or 100 meters in which case the warp length is around 105 - 112 yds or meters and the grey length 103 - 107 yds or meters.
Actually again warp length depends on the set up in each plant. Some mills tend to maximise warp lengths in order to save handling costs. If a company manufactures fabric to stock the warp lengths are worked out to give the most efficient handling at the lowest cost factor. This of course is true in companies producing fabric only against orders but in this type of company the warp lengths tend to be shorter.

Percentage loss in finishing
The percentage loss in finishing has to be assessed. Experience over a large range of fabrics is best. It is essential in the modern mill to keep a careful record of all grey fabric particulars and all finished fabric particulars. These are grey length, grey width, grey weight (this is grey piece weight and grey weight per yard) and the count of ends and picks in loom state fabric. Finished fabric particulars recorded are the same. When analysing a sample loss in finishing can be assessed very closely if one refers to similar fabrics produced in the past and uses the grey and finished results obtained as a guide.
A general guide is :-
Yarn dyed high quality worsteds assume a loss of 5%.
" " medium " " " " " " 6-7%.
Piece dyed worsteds assume a loss of 8%.
Woolens are most difficult to assess because of the great variety of finishes use from clear finishes to a ver highly raised finish. Low quality woollens loose as much as 30%, while medium quality woollens from 15-20%, and for the high qualities, 8-15%.
A good general averageis to take 16.67 or 1/6th.
Cottons often gain weight after finishing due to added starches, crease resist resins, etc. If sufficient sample is available the chemical testing can remove any resins and calculate the percentage used.

Analysis Calculations

Having obtained all the information mentioned on the previous pages the following information must be calculated before the fabric can be reproduced.

(1) Weight per yard of finished cloth in ozs. or grammes.
(2) Counts of warp in loom.
(3) Counts of weft in loom.
(4) Ends per inch or cm. in loom.
(5) Total ends in warp.
(6) Reed width.
(7) Finished length.
(8) Picks per inch in loom.
(9) Weight of warp.
(10) Weight of weft.
(11) Check calculation.

The particulars calculated below in example 1. are from a pattern of cloth 3" x 3" from which the following details may be obtained.
(a) 3" x 3" weighs 29.3 grains.
(b) 36 threads each 3" long of warp weigh 2.61 grains (2 ply)
(c) 36 threads each 3" long of weft weigh 2.54 grains (single)
(d) Extension of warp 3" to 3.3"
(e) Extension of weft 3" to 3.4"
(f) 70 ends per inch finished.
(g) 68 picks per inch finished.
(h) Warp length 30yards.
(i) Estimated grey length 74 yds.
(j) Cloth width 58".
(k) Estimated loss in finishing 5%.

(1) WEIGHT PER YARD OF FINISHED CLOTH

This is usually taken as a linear (running) yard and not a square yard.

$$\frac{\text{Weight of 3"x 3" (or suitable size) in grains x fin. Width x 36 x 16}}{\text{Square inches of pattern(9 sq. in.) x 7000}}$$

e.g. $\frac{29.3 \times 58 \times 36 \times 16}{3 \times 3 \times 7000} = 15.54$ ozs./ yard.

It can be observed from the above calculation that for a 3"x 3" pattern 58" wide cloth, the only variable is the weight of the pattern. The remainder of the calculation can be reduced to a constant :-

i.e $\frac{58 \times 36 \times 16}{3 \times 3 \times 7000} = 0.53$ = K- constant or gauge point.

For a 2"x 2" pattern 56" wide K = 1.152.
" " 2"x 2" " 58" " K = 1.193.
" " 2"x 2" " 60" " K = 1.23.
" " 3"x 3" " 56" " K = 0.512.
" " 3"x 3" " 58" " K = 0.53.
" " 3"x 3" " 60" " K = 0.549.

Thus if a pattern measuring 3" x 3" weighs 22.7 grains the weight per yard, 56" wide would be 22.7 x 0.512 = 11.62 ozs/ yard.

(1a) Weight per meter of finished cloth

This again is taken as a linear (running) meter and not a square meter.

$$\frac{\text{Weight of 8cm. x 8cm (or suitable size) in grammes x Pin Width x 100}}{\text{Square centimeters of pattern (64 sqr cm.)}}$$

It should be noted that as the weighing of the original sample is done in grammes, there is no need for further conversion as in the English calculation of grains to ozs.

e.g. The weight of the sample 8cm. x 8cm = 2.09 grammes.

$$\frac{2.09 \times 150\text{cm.} \times 100\text{cm}}{64.} = 489.84 \text{ grammes per meter.}$$

Again it can be seen that for a 8cm x 8cm pattern 150cm wide cloth, the only variable is the weight of the pattern. The remainder of the calculation can be reduced to a constant :-

i.e. $\frac{150\text{cm} \times 100\text{cm.}}{64} = 234.38 = K$ - constant or gauge point.

For a	2.5cm x 2.5cm	pattern	140cm. wide	K = 2240.
"	" 2.5cm x 2.5cm	"	150cm. "	K = 2400.
"	" 5.0cm x 5.0cm	"	140cm. "	K = 560.
"	" 5.0cm x 5.0cm	"	150cm. "	K = 600.
"	" 8.0cm x 8.0cm	"	140cm. "	K = 218.75.
"	" 8.0cm x 8.0cm	"	150cm. "	K = 234.38.

Thus if a pattern measuring 8cm x 8cm weighs 1.63 grammes, the weight per meter at 140cm. wide would be 1.63 x 218.75 = 356.56 gms.

(2)Counts of Warp In Loom

In this calculation there are certain factors to be taken into consideration. The yarn taken from the pattern of finished cloth is in three aspects different from what it was in the loom :-

(a) It is crimped due to the interlacing of warp and weft and this is accentuated in finishing.
(b) There will be a loss in weight due to the processing of accumulated dirt being washed out.
(c) There will be a certain amount of fibre shrinkage in finishing. To obtain loom counts therefore these factors must be allowed for.

(a) can be measured by machine or by stretching the yarn straight on a ruler and measuring the extension.
(b) depends on the type of yarn and treatment of finish. This must be estimated.
(c) depends on the type of finish e.g. there will be much more fibre shrinkage in a milled or fulled coating than in a clear cut finished tropical suiting. Also much less fibre shrinkage wouldtake place when man-made fibres such as polyester are present.

(a) & (c) will make the loom counts lighter, (b) will make the loom counts heavier.

$$\frac{7000 \times \text{Yds. Weighed} \times \text{Stretched Length} \times (100 - \% \text{ loss})}{\text{Hank Length} \times \text{Weight in Grains} \times \text{Original length} \times 100.}$$

e.g. $\frac{7000 \times 3 \times 3.3 \times 95}{560 \times 2.61 \times 3 \times 100} = 15.01$ or 15's Worsted Count.

(3) Counts of Weft In Loom

This is obviously the same calculation as for warp substituting weft particulars for warp particulars.

e.g. $\frac{7000 \times 3 \times 3.4 \times 95}{560 \times 2.54 \times 3 \times 100}$ = 15.896 or 16's Worsted Count.

Working out counts on the metric system

Metric Worsted & Woollen 1's Metric 1 meter weighs 1 gramme.
2's Metric 2 meters weigh 1 gramme.

Warp Counts

$$\frac{\text{Meters Weighed} \times \text{Stretched Lgth.} \times (100\% - \text{Loss})}{\text{Wt. in Grammes} \times \text{Orig. Length} \times 100.}$$

e.g. $\frac{2.74 \times 8.38\text{cm.} \times 95}{.16965 \times 7.62 \times 100}$ = 16.87 Metric Worsted Count.

Weft Counts

As warp counts substituting weft particulars.

e.g. $\frac{2.74 \times 8.64 \times 95}{.1651 \times 7.62 \times 100}$ = 17.88 Metric Worsted Count.

(4)Ends per Inch in Loom

This is obtained from the finished ends per inch and will be in proportion to the weft shrinkage.

$$\text{Ends/1" In Loom} = \frac{\text{Ends/1" Finished} \times \text{Original Length}}{\text{Stretched Lenght of Weft.}}$$

e.g. Ends/1" in Loom = $\frac{70 \times 3}{3.4}$ = 61.76 i.e. 62 ends per inch.

Ends per centimeter in loom

As above obtained from the finished ends per centimeter and will be inproportion to the weft shrinkage.

e.g. Ends/1cm. in loom = $\frac{27.5 \times 7.62\text{cm.}}{8.64\text{cm.}}$ = 24.25 ends/cm.

If the width in loom is known(reed width) then the following formula can be used :

$$\text{Ends/1" In Loom} = \frac{\text{Ends/1" Finished} \times \text{Finished Width}}{\text{Loom Width}}$$

or :

$$\text{Ends/1cm. in loom} = \frac{\text{Ends/1cm. Finished} \times \text{Finished Width}}{\text{Loom width.}}$$

(5) Total Ends in Warp

This is equal to the ends/1" or centimeter finished, multiplied by the finished width of cloth in inches or centimeters.

e.g. 70 x 58" = 4060 ends. 27.5 x 150cm = 4125 (It is best to use an even number 4124)

(6) Reed Width

This is obtained from the finished width and is in direct proportion to the weft stretch :

$$\text{Reed Width} = \frac{\text{Finished Width} \times \text{Stretched Length (Weft)}}{\text{Original Length}}$$

e.g. R.W. = $\frac{58 \times 3.4}{3.0}$ = 65.7"

or metric $\frac{150\text{cm.} \times 8.64}{7.62}$ = 170cm. Reed Width.

(7) Finished Length

The theoretical method of determining this is to calculate warp contraction from warp length :

$$\text{Finished Length} = \frac{\text{Warp Length} \times \text{Original Length}}{\text{Stretched Length (Warp)}}$$

e.g. F.L. = $\frac{80 \times 3}{3.3}$ = 72.7 yards.

or metric F.L. = $\frac{100\text{m.} \times 7.62}{8.38}$ = 90.9 meters.

Note Warp Lengths vary from market to market, and from fabric type to fabric type. In the modern mill it is usual to use 100 yards or 100 meters forconvenience of calculation. Mechanical handling facilities for warps and grey and finished pieces enable much longer warps to be made and much heavier pieces to be handled by personnel. Also it should be remembered that a mill producing lightweight fabrics using fine yarn counts, can get more pieces on a beam than can a mill producing very heavy fabrics for such things as upholstery and industrial fabrics etc. Each category of production unit has its own system, but all are aimed at minimising the amount of handling, speeding up production and thus lowering costs.

(8) Picks Per Inch or Cm. In Loom

This will not vary exactly with the extension of the warp, which represents the shrinkage of the warp length to finished length. When the weft is woven into the warp, the warp threads must bend to interlace with it. It will depend on the difference between finished length and grey length which is an estimated figure depending on weave, counts of yarn, ends and picks per inch and types of material. Special Note. It is very essential in any weaving opperation to keep a very close check on grey and finished ends and picks, lengths and widths. Statistics are built up according to cloth types over a number of years of opperation and these can be then used in cloth analysis, with very accurate results. The statistics are also used in quality control, for instance if a particular quality suddenly starts to come up heavy or light, or wider than usual then an investigation must be made to discover the cause. This will be dealt with in the section on investigation of deffects in fabrics.

(8) Picks per inch or cm. in loom (Cont)

Grey Length is assumed to be 2/5ths of the difference between warp length and finished length.

e.g 80 yds. warp, finished 72.7yds. Grey length 75.6 yds.

100 m. warp, finished 90.9 m. Grey Length 94.5 meters.

$$\text{Picks/1" in loom} = \frac{\text{Picks/1" Finished} \times \text{Finished Length}}{\text{Estimated Grey Length.}}$$

e.g. Picks/1" in loom = $\frac{68 \times 72.7}{75.6}$ = 65.5 picks/1"

e.g. Metric - Picks/1cm in loom = $\frac{26.77 \times 90.9}{94.5}$ = 25.6 picks/1cm.

(9) Weight of warp

This is obtained by multiplying the total number of ends by the length of the warp, which gives total yardage or meters, and dividing this by the yards per pound or meters per gramme, thus the following formula can be used :

$$P = \frac{T \times R \times L}{C \times H}$$

$$\text{or } \frac{\text{Ends/1"} \times \text{Reed Width} \times \text{Warp Length}}{\text{Count} \times \text{Standard Hank No.}} = \text{Weight in Pounds.}$$

e.g. $\frac{62 \times 65.7 \times 80}{15 \times 560}$ = 38.8 lbs. N.B. Ends/1" x Reed Width is the same as Total Ends in warp.

$$\text{Metric. } \frac{\text{Ends/1cm} \times \text{Reed Width} \times \text{Warp Length}}{\text{Count (Meters/ Gm)} \times 1000} = \text{wt in Kilos.}$$

$$\frac{24.25 \times 170 \times 100}{17.88 \times 1000} = 24.4 \text{ Kilos.}$$

(10) Weight of Weft

This is obtained by multiplying the total number of picks in the grey cloth by the reed width in inches or cm. converting to yards or meters and dividing by the yards per pound or meters pergramme.

$$\text{Weight} = \frac{\text{Picks/1"} \times \text{Reed width} \times \text{Grey Length}}{\text{Counts} \times \text{Standard Hank Number.}}$$

e.g. $\frac{65.5 \times 65.7 \times 75.6}{16 \times 560}$ = 36.4 lbs.

$$\text{Metric. } \frac{\text{Picks/1cm} \times \text{Reed Width} \times \text{Grey Length}}{\text{Count (Meters/Gm.)} \times 1000} = \text{wt. in Kilos.}$$

e.g. $\frac{25.6 \times 170 \times 94.5}{17.88 \times 1000}$ = 23.0 Kilos.

(11) Check Calculation

The addition of the weights of warp and weft required, converted to ounces or grammes, and an allowance made for the percentage loss in finishing, divided by the finished length, will give the ounces per yard or grammes per meter of the fabric. This should compare favourably with the weight per yard already calculated, if the analysis has been correctly carried out.

$$\frac{(\text{Wt of Warp} + \text{Wt. of Weft}) \times 16 \times (100 - \% \text{ loss})}{\text{Finished Length} \times 100}$$

e.g. $\frac{(38.8 + 36.4) \times 16 \times 95}{72.7 \times 100} = 15.7$ ozs./yd.

This compares with 15.54 ozs obtained from the 3" x 3" Sample weighed so it is reasonably correct.

Metric Calculation Check

$$\frac{(24.4 + 23.0) \times 1000 \times 95}{90.9 \times 100} = 495.4 \text{ grammes per meter.}$$

This compares with 489.84 grammes obtained from the 3cm x 3 cm. sample weighed so it is reasonably correct.

Final Note. Quite often an analysis of a fabric sample can only be used as a guide. That is after full details of the construction have been calculated, the method of actually manufacturing the fabric may have to be adjusted to suit the machinery available in the plant. Also the counts of the yarn may have to be changed slightly to utilise yarn counts already in production. It is not always convenient either from a cost stand point or from the point of view of having to make changes in the production schedule, to make a special yarn count just for one particular sample.

Adjustments in fabric setting, changing of one yarn count for another in the same weave, and adjustments in ends against picks, i.e. increase in warp sett and decrease in picks or vice-versa will be dealt with in the section on fabric setting and calculations.

SYSTEMS OF WEAVE MAKING

Weaving transforms the yarn into fabric on a loom which interlaces two sets of threads at right angles. The warp runs down the length of the cloth and the weft or filling runs across the cloth at right angles to the warp, crossing the fabric from selvedge to selvedge.

The majority of weaves used in the textile industry are of relatively simple construction, being made of simple weave units which show the order of the floats or the interlacing of the threads. The weave units are changed relative in position to each other by simple uniform steps known as change or move numbers.

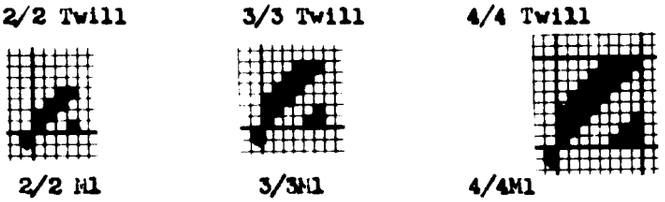
It is impossible to make a weave with an odd number of floats in a repeat or complete pattern, therefore all weaves have an even number of floats in the repeat, and the average float is determined by the threads in the weave unit divided by the number of floats.

Average Floats in Weaves Up To 12 Threads

No. of Floats	Threads in Weaves. 2	3	4	5	6	7	8	9	10	11	12
2	1	1½	2	2½	3	3½	4	4½	5	5½	6
4				1¼	1½	1¾	2	2¼	2½	2¾	3
6						$1\frac{1}{6}$	$1\frac{1}{3}$	$1\frac{1}{2}$	$1\frac{2}{3}$	$1\frac{5}{6}$	2
8								$1\frac{1}{8}$	1¼	$1\frac{3}{8}$	1½
10										$1\frac{1}{10}$	$1\frac{1}{5}$

A weave may be indicated in two ways :

(1) Graphically, that is marked in on point paper as shown in the following illustrations, where the base starting point for the weave is indicated in RED. SOLID



(2) Numerically , the numerical descriptions of the above weaves are given below the weaves. The figures above the line represent floats of warp, and the figures below the line represent floats of weft.

Usually in representing weaves graphically on point paper the marks on the point paper represent the warp lifted while the blanks on the point paper represent the weft lifted. It is customary to mark the bottom left hand corner in the design in some way, and a common way of doing this is to put a ● in the bottom left hand corner. This is to ensure that the design is never read wrong way up.

The MOVE NUMBER indicates the starting point of each thread or pick until the design is complete. A move of 1 will always produce regular twill designs, but there is no binding rule to a move of 1 as any move number can be used according to the weave that is being made.

The Following signs and positions are used inthe NUMERICAL description

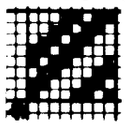
M which indicates M plus is a move from the bottom to the top of the design.

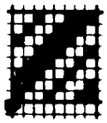
M- which indicates M minus is a move from the top to the bottom of the design.

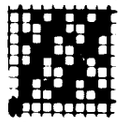
$\frac{}{}$ which indicates plus means a move from the left to the right of the design.

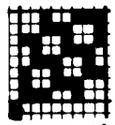
$\frac{}{}$- which indicates minus is a move from the right to the left of the design

<u>To Find The Repeat of A Weave</u>
When there is only one move number the design will repeat on the total number of ends and picks to which the numerical description totals up. See the following examples :

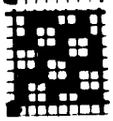
1) $\frac{2}{1}\ \frac{2}{3}$ M1 

2) $\frac{3}{2}\ \frac{1}{2}$ M1. 

3) $\frac{3}{2}\ \frac{2}{2}$ M2 

4) $\frac{3}{2}\ \frac{1}{2}$ M3 

5) $\frac{3}{2}$ M2 

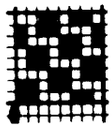
6) $\frac{3}{2}\ \frac{1}{2}$ M5 

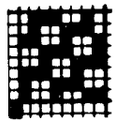
7) $\frac{4}{1}$ M1 

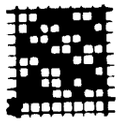
8) $\frac{4}{1}$ M2 

9) $\frac{4}{1}$ M4 

10) $\frac{2}{3}$ M1 

11) $\frac{2\ 2}{3\ 1}$ M3 

12) $\frac{3\ 1}{2\ 2}$ M-3 

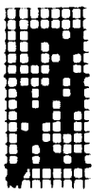
13) $\frac{3\ 1}{2\ 2}\frac{}{}$6 

14) $\frac{3\ 1}{2\ 2}\frac{}{}$-1 

When the size of repeat has been determined, mark it on the point paper and under no circumstances overstep this either with base dots or weave.

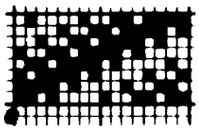
Compound Numerical Weave Descriptions
In a compound numerical weave description, there may be several numerical weave descriptions combined :

e.g. $\frac{3\ 3}{1\ 5}$ & $\frac{3\ 3}{4\ 2}$ & $\frac{3\ 3}{4\ 2}$ M2



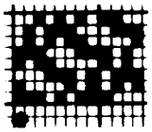
or there may be just one numerical weave description with several move numbers :-

e.g. $\frac{3\ 1}{1\ 3}$ M - 1 plus 2



or there may be a combination of the two, that is several numerical weaves descriptions and several move numbers.

e.g. $\frac{2\ 2}{1\ 3}$ & $\frac{1\ 3}{3\ 1}$ & $\frac{2}{2}$ M0 plus 3 - 1

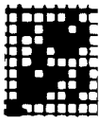


Method of Finding Repeat of Weave
In the compound description if the M is written straight up, the number of picks in the repeat of the design is known and the number of ends have to be found. When the M is written sideways the number of ends in the repeat are known and the number of picks has to be ascertained.

The following formulae are used for finding the size of the repeat in compound numerical weave descriptions :-

Least Common Multiple of orders of weaving x No of move numbers
Algebraic sum of Move Numbers.

e.g. $\frac{3\ 1}{3\ 1}$ & $\frac{2\ 2}{3\ 1}$ & $\frac{2\ 2}{2\ 2}$ M3 plus 2 minus 1



weave.

Picks = 8

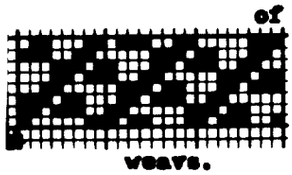
Threads = $\frac{8 \times 3}{4}$ = 6

Revised Formula for Finding Repeat of Weave, Where Number of Orders of Weaving Differs from Number of Move Numbers:

Least Common Multiple of Orders of Weaving x No of Move Nos. x No. of Orders of Wvg.
Algebraic sum of Move Numbers.

e.g $\frac{3\ 1}{3\ 1}$ & $\frac{2\ 2}{3\ 1}$ & $\frac{2\ 2}{2\ 2}$ M1

Repeat Picks = 8 Threads $\frac{8}{1} \times 1 \times 3$ = 24



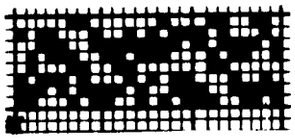
weave.

A further example where the Numbers of Orders of Weaving differs from the Number of Move Numbers :

e.g. $\frac{3\ 1}{3\ 1}$ & $\frac{2\ 2}{3\ 1}$ & $\frac{2\ 2}{2\ 2}$ M3 plus 2 minus 1 plue 0.

Picks = 8

Threads $\frac{8}{4}$ x 4 x 3 = 24



Weave.

<u>When Lowest Common Multiple of Weave Numbers and Algebraic Sum of Move Numbers have No Measure in Common, Omit the Sum of Move Numbers From the Equation</u>

e.g $\frac{3\ 1}{3\ 1}$ & $\frac{2\ 2}{3\ 1}$ & $\frac{2\ 2}{2\ 2}$ M3 plus 2 minus 1 plus 0 minus 1.

Picks = 8

Threads = $\frac{8}{(3)}$ x 5 x 3 = 120

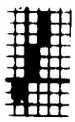
Omit

<u>EXAMPLES OF SOME COMMON WEAVES IN USE</u>

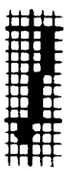
1) Plain, Calico or Tabby. This is the most common weave in use today. It really came into its own in the early 1950's with the wide availability of polyester. This helped to stabilise and strengthen plain weave fabrics and introduced such popular marketing features as wash & wear and easy care.

2) 2/2 Warp cord or rep.

3) 3/3 Warp cord or rep.



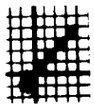
4) 4/4 Warp cord or rep.



5) Prunella Twill or 2/1 Twill, This is a widely encountered weave usually found in cheap quality fabrics. It gives a lightweight twill, but due to the uneven nature of the weave, that is 2 thirds of the warp appearing on the face to 1 third of weft, fabrics using this weave tend to be unstable and to crease easily. Also from a design point of view difficulties are encountered in balancing the strength of colour showing in the warp, with that in the weft. For instance in plaids or checks the warp over plaid is very strong and balancing the weft over plaid to show equal in strength of colour, is very difficult.

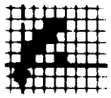
6) Prunella Twill Weft Backed 1/1. An interesting but costly weave to utilise. Has been very popular in the past in Gabardines. However it requires an excessive number of picks causing low production and hence the extra cost.

7) 2/2 Hopsack, Basket Weave, Matting or Celtic. 

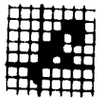
8) Crow Twill. 

9) Broken Crow, Crow's Foot or 4 End Satinette. 

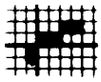
10) 2/2 Twill, Common Twill, Cassimere, Kersey or Shalloon. This is one of the most popular worsted suiting weaves, especially where all wool fabrics are concerned. Due to the equal amounts of warp and weft on the face and back of the fabric it gives a good stable fabric. Also the balance of colour in warp and weft in overplaids and checks is easilly maintained.



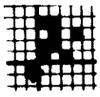
11) Devon or 2/2 Cut & Feathered every Two or 2 x 2 Herringbone.

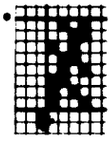


12) 2/2 Weft Cord or Rib.

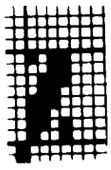


13) Reversble Rib or Cord.

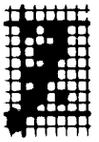


14) Whipcord. This weave is usually combined with and increased warp set to give a steep angled twill. 

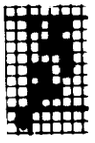
15) 2/2 Twill, weftbacked. Again thie is a very expensive weave to employ and is not encountered very often. Any weft backed fabric requires a considerable increase in the number of picks with the reultant loss of production and increased cost.



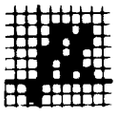
16) Crow Twill, Weft Backed 1/1 again an expensive weave to employ.



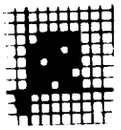
17) Broken Crow or Crow's Foot, weft Backed 1/1 - expensive weave. Weft Baked Fabrics will be dealt with specially later in the manual.



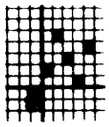
18) Venetian, 5 End Whipcord or Covert. The weave employed in covert coatings and sometimes for men's formal evening wear jackets.



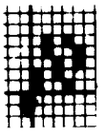
19) Doeskin or 5End Warp Satin. Another weave used in coatings with a covered finish and men's formal evening wear jackets.



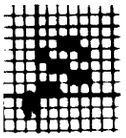
20) 5 End Weft Satin. This weave lends itself to very heavilly raised finishes as it presents weft floats to the napper or raising machine.



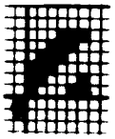
21) Imitation Prunelle Warp Backed 1/1. Warp back fabrics are not as expensive as weft backs, they give more weight and density to the fabric without slowing down production in the loom.



22) 5 End Weft Corkscrew. Corkscrew weaves are a type of imitation weft back or warp back and will be explained later.

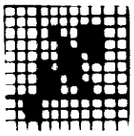


23) 3/3 Twill. A popular weave for overcoatings.

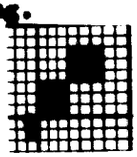


24) 3/3 Spot another popular weave used in woollen tweeds and coatings.

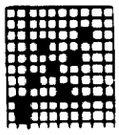
25) 3/3 Broken Twill.



26) 3/3 Hopsack or Matting.

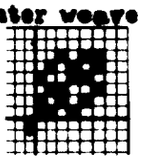


27) 6 End Satin or Sateen.

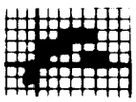


28) Damask

29) Damask- this is a tighter weave than no. 28.



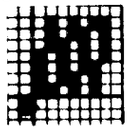
30) Prunelle or 2/1 Twill warp backed with 1/1 Twill Stitch.



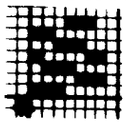
31) Prunelle or 2/1 Twill warp backed with 1/1 loose stitch.

32) 7 End Whipcord.

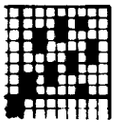
33) 7 End Warp Corkscrew.



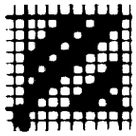
34) 7 End Weft Corkscrew.



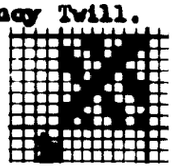
35) Pseudo orlimitation 2/2 Twill warp backed 1/1. This is a very popular weave for warp backed gabardines. However a warp backed gabardine is a very high quality and expensive fabric to make today. With the advent of very efficient water repellent treatments and showerproofing over recent years, expensive gabardine fabrics have lost a lot of their popularity.



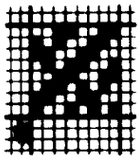
36) 8 End Twill, a very popular weave which with a light warp and dark weft gives a diagonal.



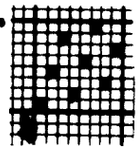
37) 8 End Fancy Twill.



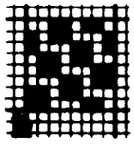
38) 8 End Fancy Twill consisting of one twill line with 2/2 H.B. alternating-H.B. is short for Herringbone.

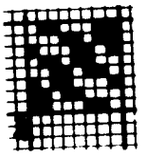


39) 8 End satin or sateen.

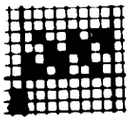


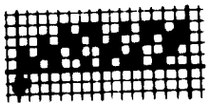
40) Twilled Hopsack, Mat, Celtic or Barathea. This is the most often used weave for men's formal evening wear or dinner jackets. It is also used very often in blazer fabrics.



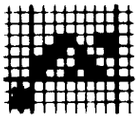
41) Mayo Twill or Campbell. 

42) Broken Twill or Twilled Spot. This weave gives a shallow diagonal like twill in appearance and can be reversed to give an Herringbone, see example 42A.

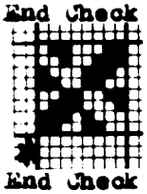


e.g. 42A. 

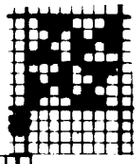
43) 2/2 Twill Feathered 4/4 or 4/4 Herringbone.

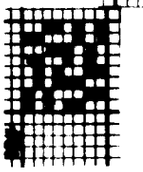


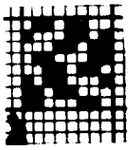
44) 2/2 Twill 4/4 Check or Diamond.

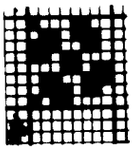
45) 8 End Check 

46) 8 End Check or Birdseye. This weave is the true Birdseye weave and coloured 1 dark- 2 light - 1 dark gives the birdseye effect used in men's suitings.

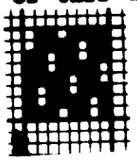


47) 8 End Cord Check. 

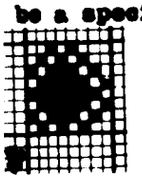
48) Mayo Spot Reversed. 

49) Granite Weave. 

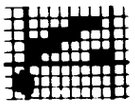
50) Buckskin, the main characteristic of this weave is that it gives a predominantly warp face.



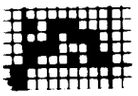
51) 8 End Honeycomb. There will be a special section on honeycomb weaves later in the manual.



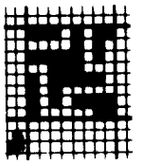
52) 2/2 Twill Warp Backed, 1/1 twill stitched or twill back.



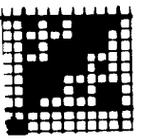
53) 8 End Double Plain Weave, or Satinette Warp Backed 1/1.



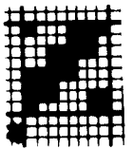
54) Double 2/2 Twill - Plain Stitched. This again is a very expensive cloth to make and reasons for and against this type of cloth will be explained in the section on Double Cloths.



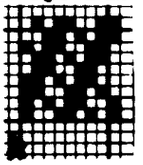
55) Double 2/2 Twill - warp twill stitch.



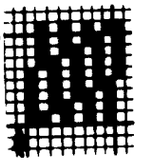
56) Double 2/2 Twill - warp and weft twill stitch.



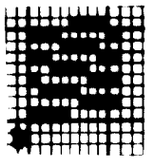
57) 9 End Whipcord - there will be a special section devoted to whipcord weaves in the manual.



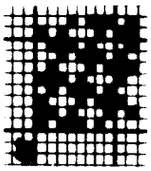
58) 9 End Warp Corkscrew.



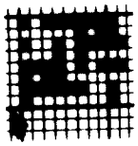
59) 9 End Weft Corkscrew.



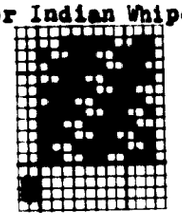
60) 10 End Sponge Weave.



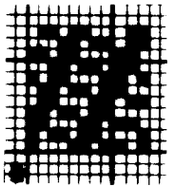
61) 2/2 Twill Double Cloth stitched with extra warp.



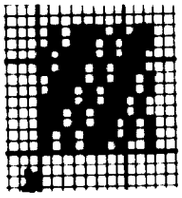
62) 11 End Whipcord or Indian Whipcord.



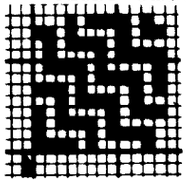
63) 11 End Whipcord. This weave will give a more prominent twill than either No. 62 or No. 64.



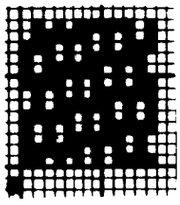
64) 11 End Whipcord.



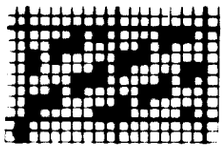
65) Pseudo or Imitation 2/2 Twill Double Cloth.



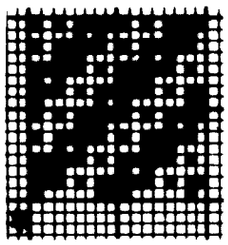
66) 13 Shaft Corkscrew.



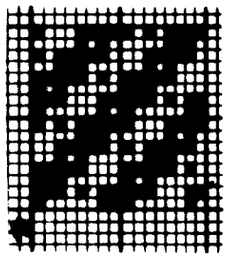
67) 2/2 Twill Warp Backed 1/1 Satin Stitch.



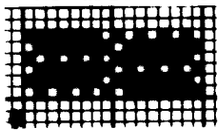
68) 2/2 Twill Double Cloth Warp Satin Stitch.



69) 2/2 Twill Double Cloth, Warp & Weft Satin Stitch.



70) Bedford Cord Weave. This weave will be explained in more detail later in the manual. Also how the size of the cords can be varied.



SPECIAL NOTE. The numerical system of weaving can be useful in the analysis of weaves. For example, quite often it will be found necessary to make an analysis of a weave, where a full repeat of that weave is not available in the sample to be analysed. Or it may be that the weave is on a very large repeat. By marking down the numerical weave description and the Move numbers as the analysis proceeds it will be quite often seen that there is a definate and systematic order in the weave. Once the numerical weave description and the move numbers are known, the repeat of the weave can be worked out completely, with out pulling further threads from the sample.

A Satin or Sateen structure is an interlacing of a given number of threads and picks, which produce a flat unbroken and untwilled surface. In all satin weaves one intersection only occurs on each thread and pick.

Method of Designing

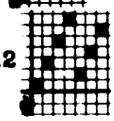
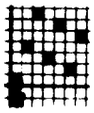
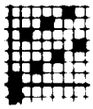
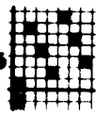
Mark of on point paper the number of threads and picks for the repeat, this must be an equal number of each. Fill in the bottom left hand square. From this square which is indicated in the examples by a solid red, count one, two, three, or four etc. squares up and one on. Fill in this square and continue counting in the same move order up and on until the repeat of the weave is completed.

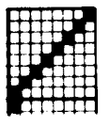
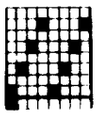
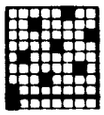
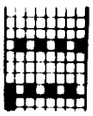
Examples of Satin Weaves or the Satin Base are as follows :

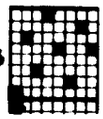
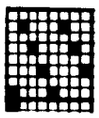
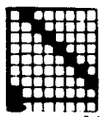
4 Shaft Irregular  the marks are on picks 1-2-4-3.

5 Shaft Regular M2  M3 

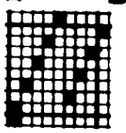
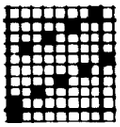
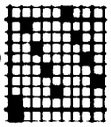
6 Shaft Irregular  the marks are on picks 1-5-3-6-2-4.

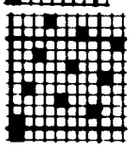
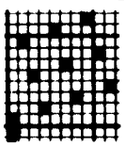
7 Shaft Regular M2  M3  M4  M5 

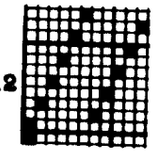
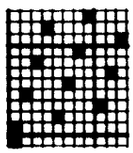
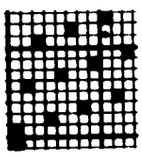
8 Shaft Regular M1  M2  M3  M4 

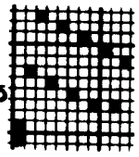
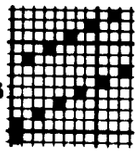
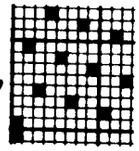
M5  M6  M7 

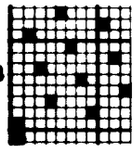
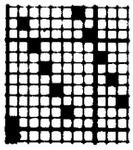
It will be noted that M1 & M7 give twills while M2 & M4 are not satins.

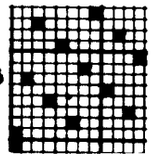
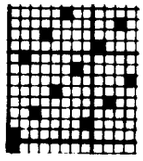
9 Shaft Regular M2  M4  M5  M7 

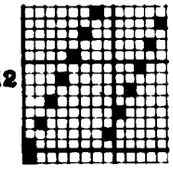
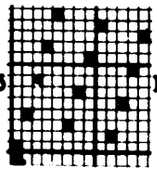
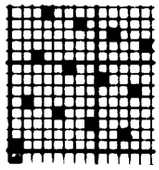
10 Shaft Regular M3  M7 

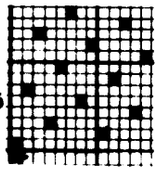
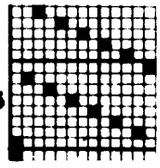
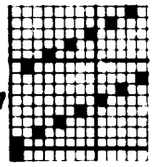
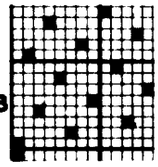
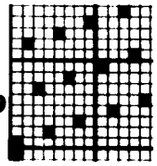
11 Shaft Regular M2  M3  M4 

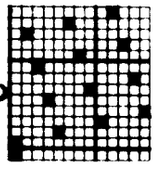
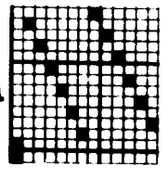
11 Shaft Regular (Cont) M5  M6  M7 

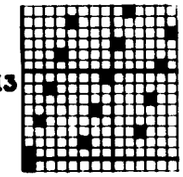
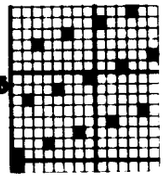
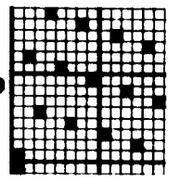
M8  M9 

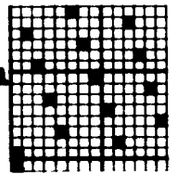
12 Shaft Regular. M5  M7 

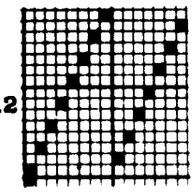
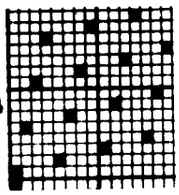
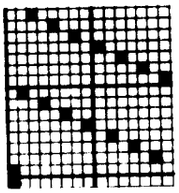
13 Shaft Regular. M2  M3  M4 

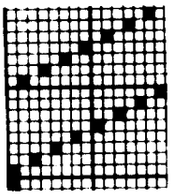
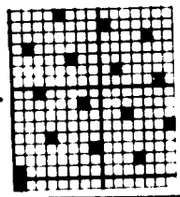
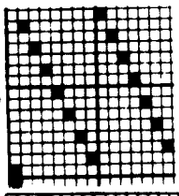
M5  M6  M7  M8  M9 

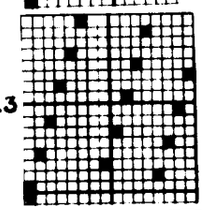
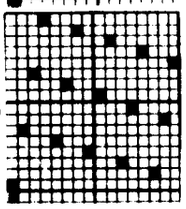
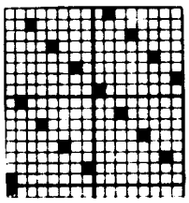
M10  M11 

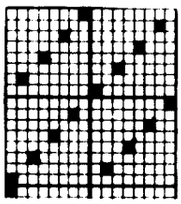
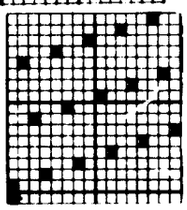
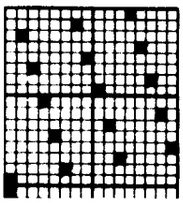
14 Shaft Regular. M3  M5  M9 

M11 

15 Shaft Regular. M2  M4  M7 

M8  M11  M13 

16Shaft Regular. M3  M5  M7 

M9  M11  M13 

NOTE. From examining closely the above weave examples, it will be seen that :

a) By counting one less than the repeat of the weave, reverse twill is obtained.

b) A sateen is only formed when the move number will not divide equally into the weave repeat, or when the move number has no measure in common with the weave repeat.

Note Especially the two irregular sateens which are not made by this method, namely :

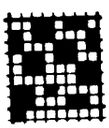
The Four End Sateen (1 - 2 - 4 - 3) and
The six end Sateen (1 - 5 - 3 - 6 - 2 - 4)

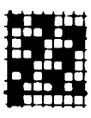
Sateen Derivatives

Sateen Derivatives are made by adding one or more lines of dots to the sateen base dots. Again there are two classes of sateen derivatives

1) Regular 2) Irregular.

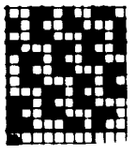
Regular This type of Sateen Derivative is constructed when dots are added to the satsen base dots in the same relative position. Examples are shown below :

8 Shaft M3 Sateen with dots added in same position on each base dot. 

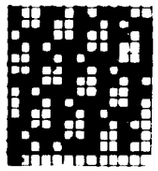
7 Shaft M2 Sateen with dots added in the same position on each base dot. 

Further examples of regular sateen derivatives :

11 Shaft M4 with dots added in the same position on each base dot.



13 Shaft M4 with dots added in the same position on each base dot.

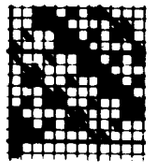


Irregular Sateen Derivatives

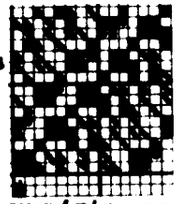
Note. To differentiate between the different motifs added to the different rows of base dots, crosses, oblique lines and dots are used in the examples

12 Shaft M7 with two different rows of dots added.

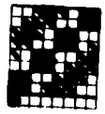
12 Shaft M5 with two different rows of dots added.



15 Shaft M11 with three different rows of dots added. Here there are three separate rows of base dots.



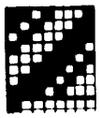
8 Shaft M5 with two different rows of dots added.



It will be noted on examining once more, the sateen base weaves given on the preceding pages, that the sateens running at high or low angles only have one row of base dots. The sateen base weaves running at 45 degrees invariable have two or more rows of base dots and these are the only ones that can be used for making irregular sateen derivatives.

CREPE WEAVES

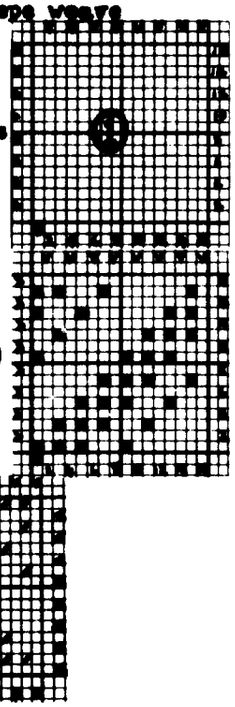
Method of Designing

To convert the 8 end weave $\frac{3\ 3}{1\ 1}$ M1  to a crepe weave proceed as follows :

Stage 1 Mark off twice the number of ends & picks as the weave occupies. Mark off the even threads and picks outside the area of the repeat, see diagram on right.

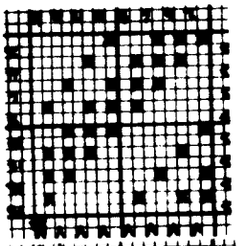
Stage 2 Mark in the 8 end weave on odd ends & picks , commencing in the bottom left hand corner.

Stage 3 Turn the point paper a quarter of a turn(90 degrees) and mark the weave in again on odd ends and picks, commencing in the bottom left hand corner.



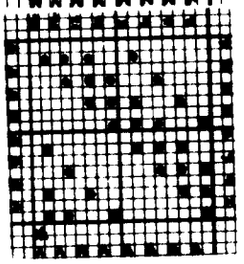
<u>Stage 4</u> Turn the point paper a quarter of a turn (90 Degrees) in the same direction as before. Marke the weave in again on odd ends & picks starting in the bottom left hand corner

④

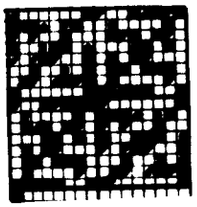


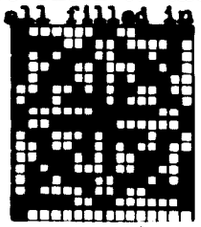
<u>Stage 5</u> Turn the point paper a quarter of a turn once more in the same direction as previously. Mark in the weave again on odd ends and picks starting in the bottom left hand corner.

⑤



<u>Note.</u> Solid suares are used for stage 1, oblique lines for stage 2, crosses for stage 3 and dots for stage 4. This clarifies each stage and the four stages combined in the finale weave are shown to the right and the complete weave all filled in below.

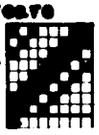


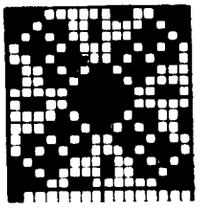


When building up these weave at any stage after stage 1, if a space already filled in is encountered, this indicates a previous mistake and the weave must be checked out again thoroughly. After practice it will be found to be easy to make these weaves without either marking the even ends & picks or using different symbols.

Modification of the Method

<u>First Modification.</u> Start with the second thread of the 8 end weave $\frac{3\ 3}{1\ 1}$ Ml instead of the first. The completed weave is shown to the right. Also starting with the third thread or any of the 8 different threads will each give a different modification of the crepe weave.



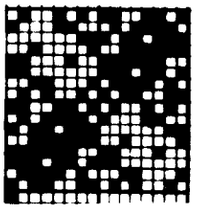


<u>Second Modification.</u> In the first position, (Stage 1)mark in the marks of the 8 end weave $\frac{3\ 3}{1\ 1}$ Ml

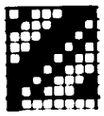
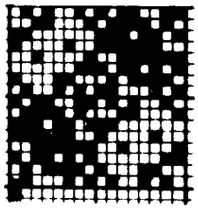
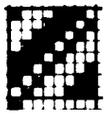
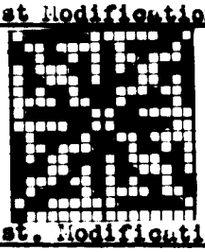
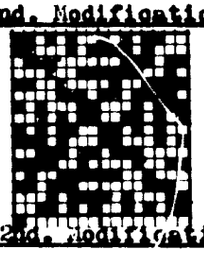
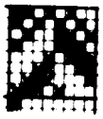
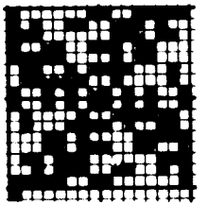
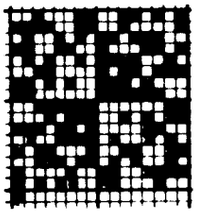
In the second position, (Stage 2)mark in the blanks of the 8 end weave.

In the third position (Stage 3) mark in the marks again of the 8 end weave.

In the fourth position (Stage 4) mark in the blanks of the 8 end weave.



Further examples of the modifications to the basic 8 end weave $\frac{3\ 3\ 1\ 1}{1\ 1}$ are given below.

Basic Weave	1st. Modification	2nd. Modification
		
Basic Weave	1st Modification	2nd. Modification
		
Basic Weave	1st. Modification	2nd. Modification
		

Crepe Yarn.

Apart from the weave method of developing crepes, their are several other ways to manufacture crepe fabrics:

Yarns. Creps yarns are especially hard twisted yarns in which the uneven twist is set by steaming. After finishing the yarn is allowed to relax somewhat and a crepe effect results in the cloth. Fabrics may be contsructed with all crepe yarns, ordinary warp and crepe filling or weft, and vice-versa or end and end warp, that is one thread of ordinary yarn and one thread of crepe yarn alternating. The filling may be all crepe yarn or pick and pick, - 1 pick ordinary yarn and 1 pick creps yarn. It is customary to make crepe yarn twist on twist if two ply, This accentuates the crepe effect. If two yarns are used in the construction of a crepe fabric the creps yarn is usually the opposite direction of twist to the normal yarn.

By using end and end and pick and pick of ordinary twist yarn and crepe twisted yarn in combination with plain weave, a creps fabric will result. Of course if the same combination of yarns is used in combination with a crepe weave, the crepe effect will be much more accentuated.

One of the disadvantages of constructing crepe fabrics using special crepe yarns, is the cost factor. As the yarns have an extra amount of twist in them, production in the spinning is slowed down and the yarns are very costly. Also if going into white fabrics for subsequent piece dyeing, they must be tinted with a fugitive tint in order to identify them from the ordinary twist yarns and to keep them seperate.

An economical way of producing crepe fabrics is by chemical means in the finishing process. A plain weave fabric can be printed

with caustic soda made into a paste. This causes shrinking in the parts touched by the paste and the untreated portions of the fabric cockle, creating an artificial crepe effect. One of the main disadvantages of this method, is that it is not very durable. After several launderings the crepe effect has a tendency to disappear especially if the fabric is pressed with too much pressure after washing.

Probably the most efficient way to make crepe fabrics, both from a cost point of view, and from the permanency of the effect created, is to use two different yarns with varying shrinkage factors. For instance a blend of 70% polyester with 30% cotton and a second blend with 70% cotton and 30% Polyester will have sufficient shrinkage difference to be used for making crepe effects in fabric. In recent years, the advent of high shrinkage polyester and normal polyester can be utilised in 100% polyester crepe fabrics. After heat setting, crepe fabrics containing polyester retain their crepe effect almost indeffinately. In fact it can be said that if the temperature of the fabric is never subsequently raised above the temperature at which it is heat set, then the crepe effect is permanent.

To further extend the application of crepe weaves and crepe yarns, they can be utilised in the production of seersucker fabrics. This type of fabric has areas of crepe and areas of ordinary flat surface. The areas may be in any shape, but the most popular are stripes and checks. Seersucker fabricks are woven with coloured yarns and also are very popular in plain white, for subsequent printing. This type of fabric has numerous applications such as shirtings, leisure wear, sportscoatings, ladies dresses, lingerie fabrics and also soft furnishings and upholstery.

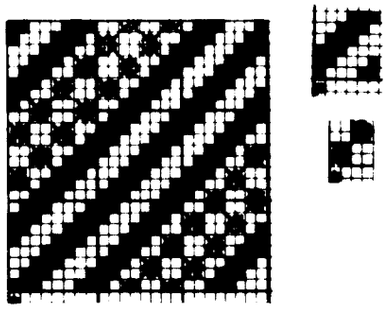
COMPOUND TWILLS

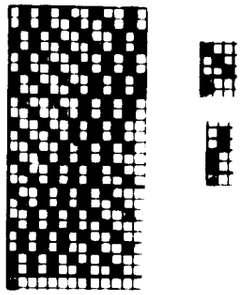
Compound twills are a development of ordinary twills and are composed of two or more weaves or weave effects, so arranged as to form a twill.

Points to be Noted

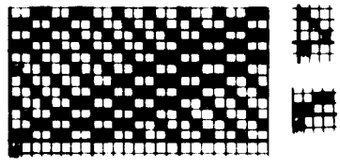
1) The resultant weave must repeat on a multiple of the repeats of all the weaves employed.
2) The weaves employed must join or cut well together unless they are to be used in a fabric which may be back coated. Any long floats in apparell designs are best stitched down to avoid subsequent wear problems.
3) Weaves employed should be basicaly of the same structure and approximately the same average float. For instance to use of loose weaves and tight weaves employed together can cause take up problems in the loom, Finishing problems such as puckering and instability and making up and wear problems if one of the weaves is much looser than the other. The materials employed in the construction of the fabric must always be taken into consideration however. The use of polyester in cloth can stabilise fabrics where two types of weave, tight and slack are employed, whereas if the same fabric was manufactured in a 100% natural fiber content, stability and puckering would be a big problem.

Design 1 is a compound twill on 24 x 24 and is composed as follows : 3 x 3 twill occupies 15 threads and the remainder is occupied by 2 x 2 hopsack. It will be noticed that 24 is a multiple of 6 and 4, i.e the two weaves employed.

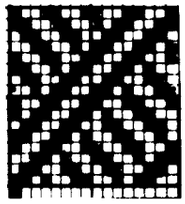




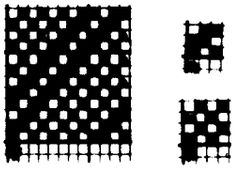
Design 2 Ie a compound twill built up from 1 x 2 twill M-1 and 2 x 2 Warp Rib. The Warp Rib is filled in in such a way as to form a steep angled twill.



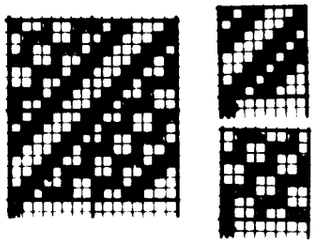
Design 3 Is a compound twill built up from 1 x 2 twill M-1 and 2 x 2 Weft Rib. The Weft Rib ie filled in in such a way as to form a shallow angled twill.



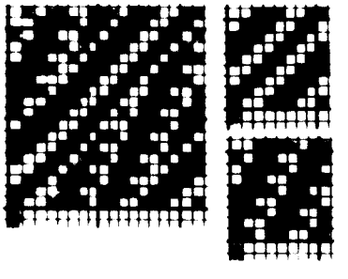
Design 4 Is a design built up from 2 x 2 straight twill and 2 x 2 reverse twill.



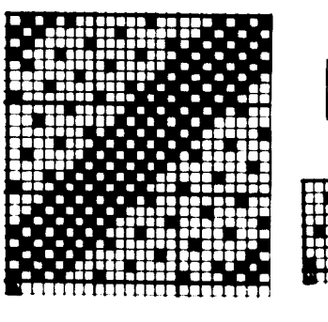
Design 5 Ie composed of 2 x 1 Twill M1 and plain weave. This would be a good weave to use in a fabric which had a polyester content. Heating setting in finishing would help to stabilise any tendency to puckering caused by the difference between the tight plain structure and the less tight twill.



Design 6 Is constructed from $\frac{2\ 2}{3\ 1}$ M1 twill and the reverse of the twilled hopsack or barrathea weave.



Design 7 Shows a compound twill made by combining twill weaves of different angles.
a weave $\frac{2\ 3}{2\ 1}$ M1 combines well with $\frac{5\ 1}{2\ 1}$ M2 resulting in an eighteen harness repeat.



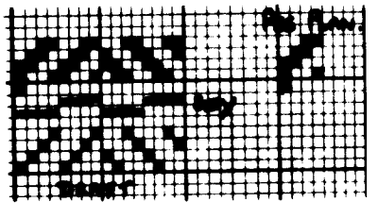
Design 8 Is constructed from plain weave and 8 end M3 sateen. This is an unusuall combination which would pucker to a very great extent. The average float of the 8 end sateen gives a very slack weave, whilst the plain weave is very tight. However it must be remebered that the puckering by the plain weave would give a deffinate rib effect which may be a desired effect provided that the effect was permanent and not subject to wear problems.

WEAVE STRIPES

Weave stripes can be constructed in a variety of ways e.g.:

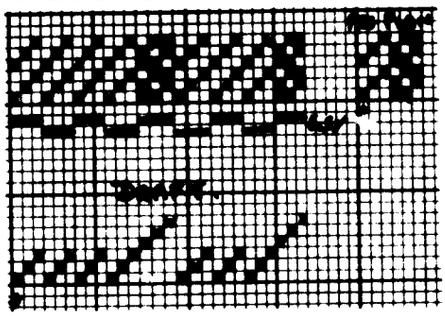
1) By re-arrangement of twill weaves, the most simple example of which is a herringbone. When designing weave herringbones from standard twills it is usualy found that making the herringbone cut cleanly where the twill reverses gives the neatest appearance.

2 x 2 Twill - 8 x 8 H.B. showing design, draft, peg-plan and sley.

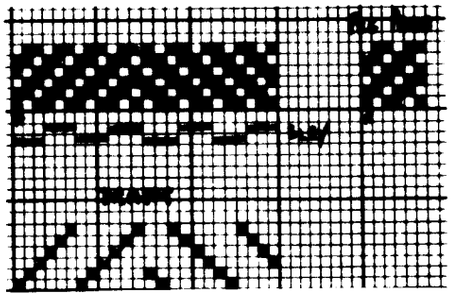


When a herringbone or weave stripe is made using a basic weave such as two and one twill. Or some other weave which as more warp or weft on one face than the other, there are two methods of reversing the twill, and these are illustrated below :

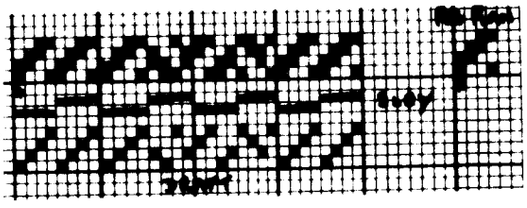
1 x 2 Twill Fancy Herringbone. Here the reverse of the weave 2 x 1 Twill is used for the reverse part of the H.B.



2 x 1 Twill, 12 x 12 H.B. In this example 2 x 1 twill is used throughout. The reverse part of the H.B. being simply in the form of a chevron. This is used when it is necessary for both the straight and reverse twill to show the same or to be both warp face. Note specially the draw on six harness and the way that the 1st end of the reverse is on the 2nd. harness to ensure a complete separation in weaving. If this end was drawn on the 5th. harness it would cause problems and it would tend to catch with the 11th. end of the straight part of the herringbone.



2 x 2 Twill Fancy Herringbone. It should be noted that in the 2 x 2 twill weave, if a jump of 1 is made in the draw and then the draw is continued in reverse a clean cut in the H.B will always result.

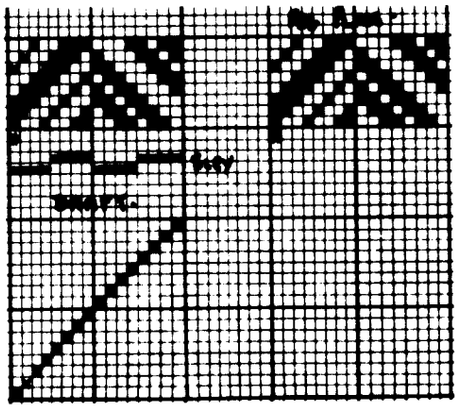


Further examples of re-arrangement of twill weaves

In this example $\frac{3\ 1}{2\ 2}$ M1 is shown arranged as a 8 x 8 Herringbone. It will be noted that the opposite of the weave is used for the reverse twill.

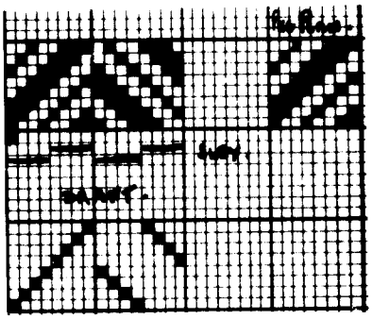
e.g. $\frac{2\ 2}{1\ 3}$ M-1

This results in a different look in the straight twill as against the reverse and a shadow effect is obtained. Also the resultant draft is on 16 harness which makes a rather difficult weaving job.



In the second example to the right an 8 x 8 Herringbone is created in $\frac{3\ 1}{2\ 2}$ M1 by simply reversing the weave that is using $\frac{3\ 1}{2\ 2}$ M-1

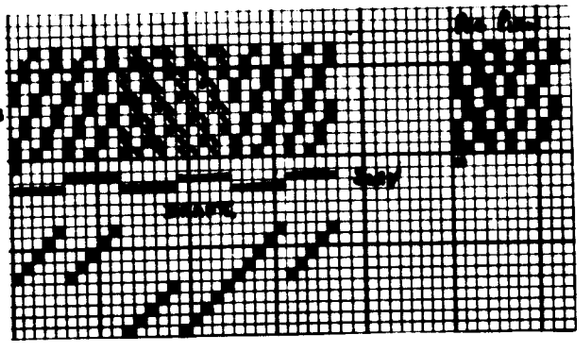
The way the cut is arranged at the point where the straight and reverse twill join, should be specially noted. This is the best way of cutting to avoid long weft floats . Also the draft has been reduced to 8 harness thus making weaving much easier.



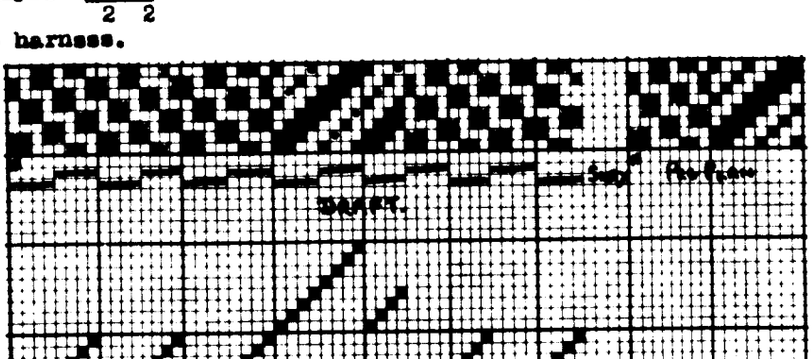
2) Stripes formed using a sateen base

This type of stripe is produced by starting with a sateen base or two or more sateen bases and adding dots as in the case when making sateen derivatives. Of ocurse all the sateen bases used must be on the same size of repeat, or a multiple of the same number of ends and picks.

The example shown on the right using a 10 end sateen M7 and a 5 end sateen M3. The resultant weave repeats on ten ends & picks It will be noted that the sateen derivatives used are a weft face Venetian with a warp face Venetian reverse stripe. In the draft the warp face weave is drawn on the front harness in order for it to weave better. It is always better to have harness with heavy lifts in the weave, to the front of the loom.



The second example of a weave stripe formed by using a sateen base is given below. The groung weave consists of a 8 end M3 Sateen with appropriate dots added to form a twilled hopsack or barrathea. The stripe section uses as a base a 8 end M5 Sateen and the dots are added in such a way as to form a simple $\frac{3\ 1}{2\ 2}$ M1 twill. The resultant design is drafted onto 16 harness.

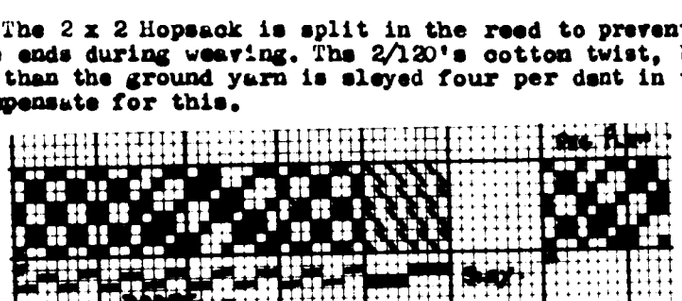


3) Stripes formed by various weaves in combination

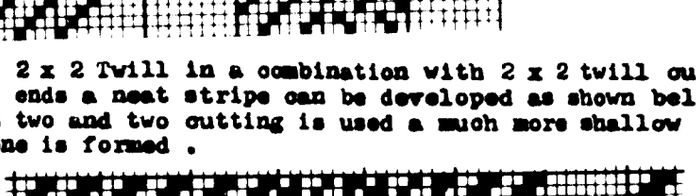
Using a combination of split hopsack (2 x 2 basket weave), a fancy stitched 3 x 3 hopsack and a 2 x 2 weft rib a fancy stripe can be designed as shown below. Construction details for a suiting fabric using this design are as follows :

Warping Plan.	Ends.	Weft.
2/30's English Worsted	32	1/15's English Worsted
2/120 Cotton Twist	8	
Total ends in patt.	40	

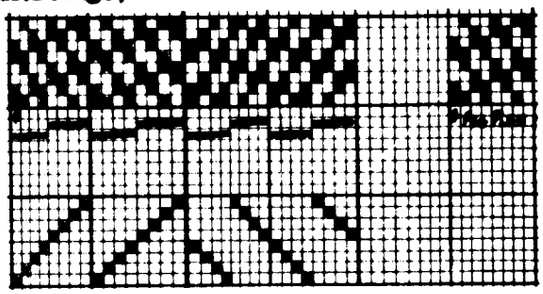
Note. The 2 x 2 Hopsack is split in the reed to prevent rolling of the ends during weaving. The 2/120's cotton twist, being much finer than the ground yarn is sleyed four per dent in the reed to compensate for this.



By using 2 x 2 Twill in a combination with 2 x 2 twill cutting every two ends a neat stripe can be developed as shown below. Where the two and two cutting is used a much more shallow herringbone is formed .



A further example of the use of 2 x 2 twill cutting every two ends is given below. This has been drawn onto 8 harness in order to facilitate drawing in. If drawing in is done manualy it is easier for the opperative to remember a straight draft. If an automatic drawing in machine is in use, the machine can handle straight or fancy drafts with equal facility. Using a fancy draw the number of harnesses could be reduced to four. (This question will be dealt with in more detail in the section on drafting.)

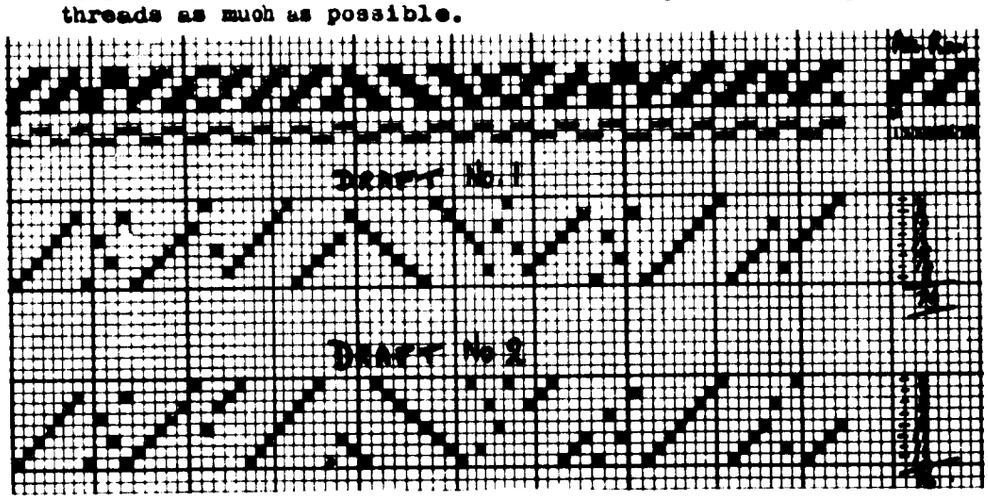


DRAFTING AND CALCULATIONS FOR HEALDS OR HEDDLES PER INCH/CM

Simple weaves on small repeats are usually on a straight draft, in which case the peg plan is exactly the same as the design. the Jacquard loom would obviate drafting but it is not usual to weave small repeat designs on this type of loom. They are however used quite often for sample making and this will be explained in greater detail in the section on range making.

The reduction of a design by drafting is possible whenever two or more ends are lifting or weaving exactly alike. Dobby looms have a limitation on the number of harness that can be used and therefore it is essential that the design be reduced by drafting to the lowest number of shafts possible. However other factors come into drafting such as weaving efficiency and wether drawing in of the ends through the harness is carried out manually or is done by an automatic drawing in machine.

Below is given an example of a design based on 2 x 2 twill, 2 x 2 hopsack and 2 x 2 reverse twill or herringbone. This example could be drafted on to four harness. This would mean however that the sections of the design weaving 2 x 2 hopsack would be drawn on the same harness side by side. When this is done, the two adjacent threads have a tendency to wrap around one another. Also they rub against each other very fiercly during weaving, causing frequent yarn breakage, loom stoppage, loss of production and a resultant lowering of quality. It is usual therefore in this case to make the draft on 8 harness and seperate the adjacent threads as much as possible.



It will be noticed from the example at the bottom of page 35, that two drafts are given, draft 1 and draft 2. This is because draft no.1 was the first one which was worked out. The procedure after completing the draft is to add up the number of dots (ends) on each harness. The totals are placed on the right hand side of the draft and then totaled up as shown. This serves three very important purposes :

1) The total of all the ends on each harness should equal the repeat of the design. If there is a difference then the draft must be re-checked for error. This is not 100% certain to spot an error. However a compensating mistake in the draft would be the only thing which would cover up this method of checking. The importance of checking every draft carefuly both by this addition method and also be having a further check by another designer cannot be stressed too much. This is the method employed by all leading mills to eliminate mistakes.
2) After adding up the number of dots (ends) on each harness the results must be examined carefully. If draft no. 1 on the preceding page is checked and compared with draft no. 2 it will be noticed that on the first harness on draft no.1 there are only 8 ends per repeat of the design. On draft number 2 by rearranging it slightly there are 12 ends on the first harness. Therefore draft number 2 with the heavier loaded harnesses towards the front of the loom is the best one. It should be noted that there is much more adjustment on the harnesses at the front of the loom than at the back, so it is a very big advantage to have the harnesses with the most ends at the front. Not every designer bothers to re-arrange a draft after it has been made the first time, however it is a must if weaving efficiency is to be improved.
3) The total number of ends drafted on to each harness in the repeat of the design is now used to calculate the total number of heddles required on each harness in order to weave the fabric. Wire sliding healds are mostly in use now, and the calculation for finding the number of heddles on each harness using draft number 2 on the previous page is as follows :

The formulae $\frac{\text{Dots on Harness} \times \text{ends per inch or cm}}{\text{Total dots in draft.}}$

The heddles per inch on each harness on draft no. 2 with a fabric with 60 ends per inch would be :

Harness no.1 $\frac{12 \times 60}{76} = 9.5$ or 18 over 2".

Harness no.2 $\frac{11 \times 60}{76} = 8.7$ or 87 over 10"

Harness no.3 as number 2.

Harness no.4 $\frac{9 \times 60}{76} = 7.1$ or 71 over 10"

Harness no.5 $\frac{7 \times 60}{76} = 5.5$ or 11 over 2"

Harness no.6 as number 4.

Harness no.7 $\frac{8 \times 60}{76} = 6.3$ or 63 over 10"

Harness no.8 as no.4 and no.6.

After having calculated the number of heddles per inch, and knowing the width of the fabric and of the harness, the number of heddles required on each harness can be calculated:

e.g if the harnesses were 72" wide then the number of heddles on each harness would be as follows:

Harness no.1 9.5 x 72 = 684.

Harness no.2 8.7 x 72 = 627. (626.4)

Harness no.3 as number 2.

Harness no.4 7.1 x 72 = 512. (511.2)

harness no.5 5.5 x 72 = 396.

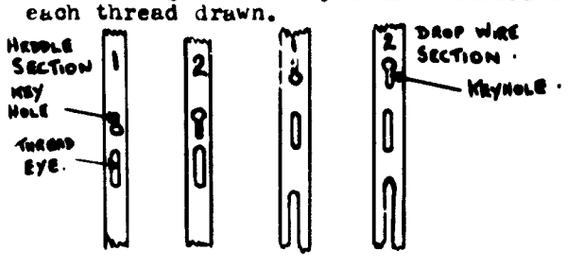
Harness no.6 as number 4

Harness no.7 6.3 x 72 = 454. (453.6)

Harness no.8 as no.4 and no.6.

It is very advantages to have the exact number of heddles on each harness as required. Extra heddles have a tendancy to move about in weaving and cause broken warp ends. A special type of heddle is available for emergency. Such as if a broken heddle occurs in the centre of a warp which is in the loom. This special type can be fitted in place immediately in the loom. A special machine has been available for a number of years which can be set to count and place any given number of heddles on a shaft.

An article on drafting would not be complete without mentioning the advantages of the drawing in machine. This opperates at a speed of between 2000 and 4000 ends per hour depending on the complexity of the warp being drawn. In the ultra modern mill it is the custom to draw every warp seperate. This eliminates loom down time caused by tying one warp to another in the loom. The drawing in machines, places drop wires on each end, draws the end through the appropriate heddle eye and sleys the end through the reed all in one action. The draft for the machine is prepared usually in the design studio and thoroughly checked. The machine usually opperates from a punched paper or plastic roll. After the control tape has been punched by the opperator this again is thoroughly checked for errors. The drawing in machines works from 4 end and end leases. That is to say, the four main colours in the design are each in a separate lease. Any colours other than four are in a extra lease at the front. After the control tape is placed on the machine and the opperation starts, there can be no error in any of the subsequent sequences. If the machine finds a mistake in one of the leases or in the arrangement of the drop wires, heddles etc. it will stop automatically in order to allow the opperator to correct the mistake. As the machine is working the warping order can be checked by the opperator and when a colour outside one of the four leases is required to be drawn, this is placed on the drawing in hook by hand.
As shown below heddles and drop wires are controlled by a key hole each hole being the reverse of the previous. These are presented to the drawing in hook by a screw thread which turns one half turn for each thread drawn.



In the example of the design given below which is a weave stripe consisting of 37 ends of twilled hopsack or barrathea and 11 ends of $\frac{3}{2}\ \frac{1}{2}$ M2 twill the calculation is done in centimeters.

Assuming the fabric to have 33 ends per centimeter the calculation for the heddles per centimetar on each harness would be as follows :

Harness no.1 $\frac{4 \times 33}{48}$ = 2.75 or 11 over 4 cm.

Harness nos. 2 & 3 same as no. 1

Harness no. 4 $\frac{5 \times 33}{48}$ = 3.44 or 34 over 10cm.

Harness nos. 5, 6, 7, & 8 same as no. 4

Harness no. 9 $\frac{3 \times 33}{48}$ = 2.06 or 2 over 4cm.

Harness nos. 10 & 11 same as no 9.

Harness no. 12 2 x 33 = 1.375 or 8 over 11cm.

If the harnesses were 180 cm. wide the the number of heddles required on each harness would be as follows:

Harness no.1 2.75 x 180 = 495.

Harness nos. 2 & 3 same as no.1

Harness no. 4 3.44 x 180 = 619.2 (620)

Harness nos. 5, 6, 7, & 8 same as no. 4

Harness no. 9 2.06 x 180 = 370.8 (371)

Harness nos. 10 & 11 same as no. 9

Harness no. 12 1.375 x 180 = 247.5 (248)

Drafting and the Maximum Number of Heddles per inch/cm. on any one Harness

When weaving fabrics with a high warp setting such as gabardines it is often found neccessary to draft the design on to twice or three times the number of harness which would normally be required if the cloth was an ordinary square sett. For example weaving a fine gabardine with 120 ends per inch in the reed and using 2 x 2 twill the calculations for heddles per inch on 4 harness, 8 harness and 12 harness can be compared:

If the 2 x 2 twill were to be drawn on 4 harness, heddles per inch would be $\frac{1 \times 120}{4}$ = 30 heddles per inch. This is far too many for one harness. So we can try the calculation using an 8 harness draft $\frac{1 \times 120}{8}$ = 15 heddles per inch.

Maximum Number of Heddles per inch/cm (cont:-)

15 heddles per inch is still very high so the calculation is repeated using a 12 harness draft $\frac{1 \times 120}{12}$ = 10 heddles per inch.

Ten heddles per inch would be a satisfactory number for this type of fabric. Apart from the fact of course that there is a limit to the number of heddles which can be crowded on to one single harness, if too many heddles per inch are used weaving problems arise. A maximum of 9 or 10 heddles per inch, that is approximately 3.5 per cm. is generally considered the maximum for suitings while cotton and silk fabrics can have more. If too many heddles per inch are used, it becomes very difficult in the loom to separate the ends in the warp and make a clean shed. The problems such as stitching occour, where the shuttle catches ends as it is travelling through the shed and either breaks them or causes wrong places in the design.

Although flat wire heddles are the most common in use today and the most efficient, it has been found at times when weaving speciality fancy yarns in the warp of a fabric such as chenilles, loop yarns, shag tails, boucles etc. that the eye in the heddle of the flat wire types is not big enough. In such case reverting to the older type of round wire heddle with a larger eye will improve weaving efficiency.

Sleying

The number of ends drawn through each dent in a reed usually divides an equal number of times into the repeat of the design. e.g. :-

Plain Weave repeat of two -- sleyed two per dent.
2 x 2 Twill repeat of four -- sleyed four per dent.
Venetian or five end whipcord repeat of five -- sleyed five per dent.
2 x 1 Twill repeat of three -- sleyed three per dent.

The reason for doing this is that if a 2 x 2 twill fabric was being woven on a repeat of 84 ends, sleyed four , the sleying plan would repeat 21 times i.e. 4 x 21 = 84 However if the design repeated on 82 ends, both the weave repeat and repeat of sleying plan would have to be run twice over i.e 164 ends or 41 repeats of weave and of the order of sleying. This method is sometimes used where extra striping ends are used and have to be crammed in the reed however there is always the danger that some ends will show up different in the second repeat of the weave as against the first due to there changed position in the reed in respect to the other ends. A good example of this might be where a striping or decoration thread may be in a dent with a dark thread on the first repeat of a sleying plan and on the second repeat it may be separated. This could cause that decoration thread to either appear weaker or stronger and the difference may not diesappear after finishing.

Plain weave although sleyed two per dent in most designs, can be sleyed three or four per dent. A fabric sleyed three or four per dent may show reed marks after finishing. On the other hand some of the very fancy decoration yarns used in plain weave suitings and sportswear are too coarse in a fabric sleyed two per dent and break down constantly in weaving with the resultant fall off in production and quality. The alterantive then is to change the sley to three per dent. It should be noted however that the work of the Sample and Design Department is to try out fabrics with the different alternatives, decide which method produces the best fabric in the particular design, and then the design can go forward through production smoothly.

COLOUR AND WEAVE EFFECTS

By using a combination of different colours of yarn in the warp and in the weft colour effects are obtained. This is a novel and attractive way of improving the appearance of a cloth. It is usuall to refer to the yarns used as dark, medium and light. The number and type of colours used in the warp is virtualy unlimited however the number of colours used inthe weft is limited in a box loom to seven, if there are four boxes on either side of the loom while a rapier or projectile loom can usually weave eight weft colours.

In any design each end and pick shows on the face in some part of the weave and it can be said that a colour and weave effect is a pattern in two or more colours, produced by the two in combination. It is frequently quite different in appearance to either the order of colourin or the weave because :-

1) The weave tends to break the continuity of the colours in the warp and weft.
2) The colours show on the face wether they are brought up in a warp float or a weft float.

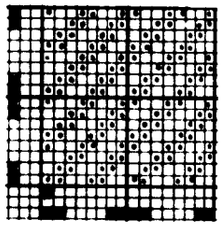
The weaves employed in conjunction with coloured ends tocreate colour and weave effects may be divided into three classes :-

a) Weaves which bring warp and weft equally or nearly equaly on the face and enable the colours to be applied in both warp and weft.
b) Warp face weaves, in which the weft is practically concealled so that is neccessary to apply the colours chiefly in the warp.
c) Weft face weaves in which the warp is concealed so that it is best to apply the colour chiefly in the weft.

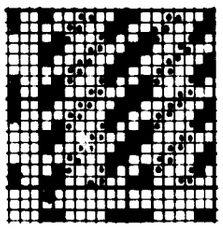
In styles such as hair lines it is neccessary to apply the colours both in warp and weft.

<u>Method of Constructing Colour & Weave Effects</u>

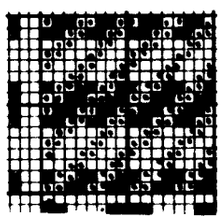
1) Mark the weave in with faint dots carrying the weave over 8 or 12 ends more than the least common multiple of the repeat of the weave. The warping plan is then marked underneath and the wefting plan at the side. In this example the warping and wefting plan would be refered to as 2 dark, 4 light, 2 dark. Red or solid is used for the warp colour and black crosses for the weft colour.



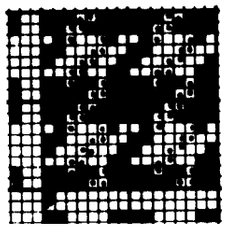
2) Bearing in mind that the dots on the design indicating the weave mean that the warp is lifted, mark on the weave the colour of each warp end, where it shows on the face. See example right :



3) Mark in the plan the colour of each pick where it shows on the face. As marks in the design indicate warp lifted, the blanks on the design show where the weft shows on the face.



The combination of No.2 and No.3 is shown to the right. The warping plan would be written as :



Red (Dark)	2,2	= 4
White(Light)	.4.	= 4
		8 Total Ends

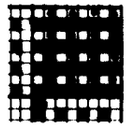
and the wefting plan is :

Cross(Dark)	2,2	= 4
White(Light)	.4.	= 4
		8 Total Picks.

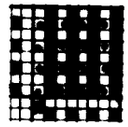
The resultant design is known as a houndstooth or 4x4 check.

NOTE. It should be noted that care should be taken with regard to the starting position of the design. As will be shown in the following plain weave designs eight different colour and weave effects can be obtained by either changing the starting point of the weave or the starting point of the colouring plan. Although the designs are grouped in four pairs of the same effect, when they are combined in a more complex design with another order of colouring such as 2 dark 2 light, or 2dark 3 light, mistakes can occour and fabric can be woven wrong if special care is not taken with the start of the design.

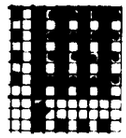
Plain Weave 1st pick of weave - mark one miss one.
colour plan Warp - 1 dark, 1 light.
Weft - 1 dark, 1 light.
This gives a horizontal hairline with the dark line on the first pick.



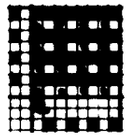
Plain Weave 1st pick of weave - mark one miss one.
colour plan Warp - 1 light, 1 dark
Weft - 1 dark, 1 light1
This gives a vertical hairline with the dark line on the second end.



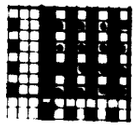
Plain Weave 1st pick of weave - mark one miss one.
colour plan Warp - 1 dark, 1 light.
Weft - 1 light, 1 dark.
This gives a vertical hairline with the dark line on the first end.



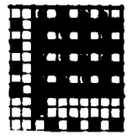
Plain Weave 1st pick of weave - mark one miss one.
colour plan Warp - 1 light, 1 dark.
Weft - 1 light, 1dark.
This gives a horizontal hairline with the dark line on the second pick.



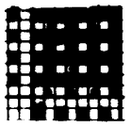
Plain Weave 1st pick of weave - miss one mark one.
colour plan Warp - 1 dark, 1 light.
Weft - 1 dark, 1 light.
This gives a vertical hairline with the dark line on the first end.



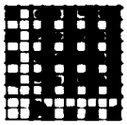
Plain Weave 1st pick of weave - miss one mark one.
colour plan Warp - 1 light, 1dark.
Weft - 1 dark, 1 light.
This gives a horizontal hairline with the dark line on the first pick.



Plain Weave 1st pick of weave - miss one mark one.
colour plan Warp - 1 dark, 1 light.
Weft - 1 light, 1 dark.
This gives a horizontal hairline with the dark line on the second pick.



Plain Weave 1st pick of weave - miss one mark one.
colour plan Warp - 1 light, 1 dark.
Weft - 1 light, 1 dark.
This gives a vertical hairline with the dark line on the second end.

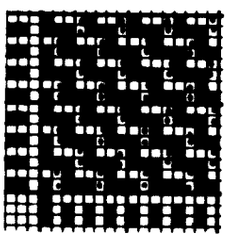


It should be noted that in most designs where plain weave is concerned or in fact any weave which creates a hairline that line is most often a vertical one. The importance of checking the start of the weave and the start of the colouring plan cannot be stressed enough. It is suprising how often where laxity in checking procedures are prevalent, the number of colour and weave designs which are started in the loom wrong and even woven wrong. Also in the case of soft contrast in the colours employed to create the effect, a close check must be made to see if the design is right.

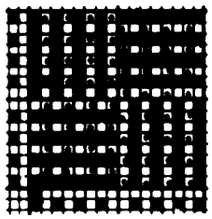
An exception to rules which point towards vertical hairlines is in the weaving of upholstery fabrics on dobby looms. Plaids such as Glen Checks and also simple hailines in plain weave as become very popular as upholstery fabrics. It is the usual method to weave the plaids or checks and the hairlines across the loom instead of in the warp direction as with apparel fabrics. The reason for this is that when the fabric is used in covering furniture it is turned round. The furniture trade quite often needs longer lengths of fabric for covering such things as long sofas and 54" or 60" wide finished cloth cannot be used without having a joining in the back of the sofa. Therefore the designs are "Railroaded" that is woven across the width. In use they are then turned round and appear quite normal.

Another trend which has developed recently in apparel is to cut garments across the cloth in order to save fabric. Garments have been marketed quite successfully with checks in the horizontal direction although they look rather odd to put it mildly. Now changes are being made in the layout of designs in order to cope with this method of cutting. In other words the designs are being woven across the loom and not in the warp direction. One thing can always be said about designing it is absolutely neccessary to adapt to new trends and developments. What was a strict rule yesterday may have changed completely tomorrow.

The sample design shown to the right is 2 x 2 twill with a warp colouring of 1 dark, 1 light and a weft colouring of 1 dark 1 light. This is a very popular standard design for suitings. It will be noted that the colour and weave effect runs from the top left of the design to the bottom right. This is the exact opposite direction to the twill. This type of design is very critical to manufacture. It must have very even fault free yarn as every irregularity shows up in the fabric. This design is often refered to as a pick & pick, a pin head or a sharkskin.

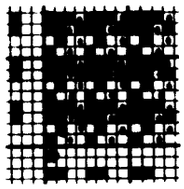


FURTHER DEVELOPMENTS IN COLOUR AND WEAVE EFFECTS



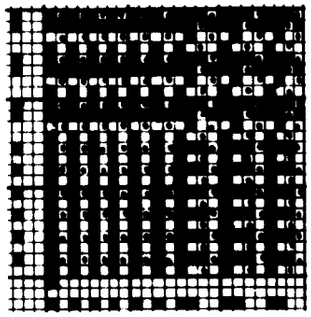
A further step, in the use of vertical an horizontal hairlines on plain weave is shown at the right. This design is known as a parquet effect. It will be noted that the plain weave starts - mark 1 - miss 1 on the first pick and is the same throughout the design. The change over from a vertical to a horizontal hairline is achieved by changing the order of warp colouring and the order of weft colouring half way through the design. That is the first 8 ends and picks are 1 dark - 1 light and the second 8 ends and picks are 1 light - 1 dark.

Four Pointed Star Effect or 2 x 2 Houndstooth



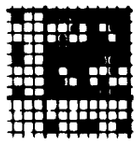
If a colouring plan of 2 dark - 2 light is used on plain weave a four pointed star effect results as shown by the example to the right. This is also sometimes refered to as a 2 x 2 Houndstooth

The Glen Check or Glen Plaid



An ever popular design in plain weave for all types of apparel is the Glen Check or Glen Plaid. A small section of this design is shown to the right. Basically this is a combination of the 1 dark - 1 light colouring plan and the 2 dark - 2 light colouring plan on plain weave with the first pick weaving - mark one, miss one. A Glen Check can be made in any size of repeat, however the most popular size is about 1" of the 1 dark - 1 light or ground area and 1" of the 2 dark- 2 light or over check area in the warp. In the weft the ground is made longer than the warp by about 25% and the over check is left about square or about 1% longer. On examination of the Glen Check colour and weave effect it will be seen to be made up of four distinct patter areas. A 1 x 1 Vertical Hairline which is always known as the ground, A 2 x 2 Houndstooth or Four Pointed Star, a vertical Saw Tooth effect and a horizontal Saw Tooth effect.

The Birdseye Effect



If the Birdseye weave given at No.46 on Page 20 is coloured - 1 dark - 2 light - 1 dark in both the warp and the weft, a spot effect as shown to the right is the result. It will be noticed in this effect that there is a light coloured cross and a light coloured square alternating in the warp and in the weft direction. During weaving and Finishing the dark ends roll to cover up the light coloured square and a small circular dot or birdseye results. This colour and weave effect is quite popular from time to time.

A Standard Design Procedure For the Development of Colour and Weave Effects

A good method often used in the development and search for new colour and weave effects is by the use of a Jacquard loom and a section warp with several different orders of colouring. The procedure is as follows. Utilising a Jacquard loom which as a straight tie and 388 hooks a warp is made and put into the loom. If the loom is 48" wide the warp could consist of 12 sections each 4" wide. Each section as a different colouring plan, the orders of colouring can be any which the designer thinks will produce good effects. The colours used are Black for Dark and White for light. When the warp has been entered in the loom and is ready for weaving the procedure is to weave four or five inches of as many different

colouring plans in the weft as possible. Then the weave is changed by means of the cards on the jacquard and all the weft colouring plans woven over again. Proceeding in this manner as many different weaves as possible are tried out in combination with the warping and wefting orders. Care should be taken that the weaves used are similar in construction however this is not critical as ends or picks will be adjusted if they are not sufficient, during later development.

After weaving is completed, the sample fabric is finished and then all the samples are cut up, each being numbered very carefully in order to identify, the warp section from which it is cut, the weft colouring plan and the weave used. This numbering must be done very accurately. For example with a 12 section warp, 20 different orders of wefting and 16 different weaves, 3840 different colour and weave effects will be obtained so it is very important that they do not become mixed after they have been cut into small swatches.

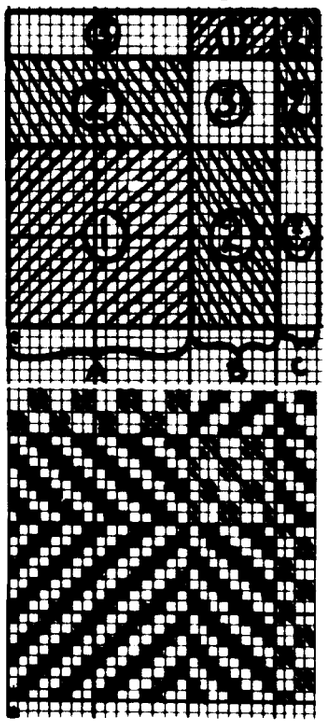
As it will be found that quite a number of the resultant pattern effects are very similar and some even almost identical, the next step is to group them by visual examination. After this a more close inspection is given and the ones which appear worthy of further attention and development are separated. It is a very good policy not to throw out any of the samples, but to mount them all in the order they were woven, in sample books. There is then no necessity to have to make them again. Also the books are always available as a source of reference and eventually a big library of colour and weave effects can be built up. The use of black and white yarns in warp and weft is to show up the resulting pattern in the best contrast.

After the best designs have been selected, they are then developed further in suitable colour schemes for the intended market and any adjustments in ends and picks per inch/cm. are made in order to come up with a nice fabric with the required amount of weight, firmness and drape. Calculations for warp and weft setting and for fabric weights will be dealt with later in the manual. This method of developing colour and weave effects is used quite frequently and some mills have very large numbers of samples to which they constantly refer and this collection has been built up over several years.

WEAVE COMBINATIONS FOR CHECKS

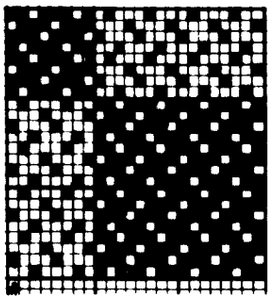
<u>Checks made from Stripes.</u> The method of doing this is shown to the right. Take a given stripe design indicated by the brackets 'A' 'B' and 'C'. Draw vertical lines at the joining of the various weaves and on these vertical lines mark off spaces similar to the various widths forming the stripe. These widths must not be less than the measurement of the warp stripes, but can be longer. On these marks draw horizontal lines the same length as the stripe design. This gives the skeleton of the check design which has to be built up from the various weaves used in the stripe. This is done by alternating them in the various segments. Where possible it is preferable to make the joinings out cleanly.

To the right is shown the completed check design which is built up from 2 x 2 twill, 2 x 2 reverse twill and 2 x 2 hopsack. It will be noted that all the joinings of the check cut cleanly.

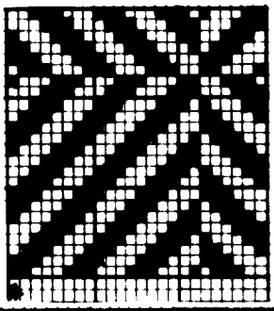


Check effects in single cloth can be made by :

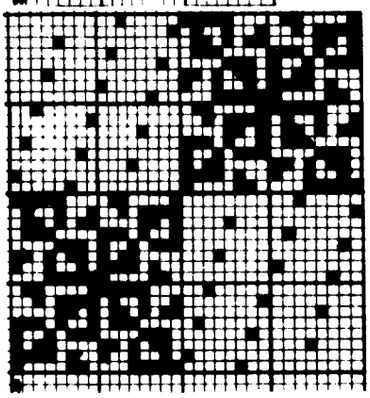
1) Colour of yarn only, the weave being the same throughout.
2) Weave only, the colour being the same throughout.
3) A combination of colour and weave, the effect being dependant on both.



The example to the right is of a simple check made by weave only. Using a combination of four end warp sateen and four end weft sateen, the check effect is produced by the contrast between areas of warp face and areas of weft face. If woven in a solid colour or monotone, the contrast between the weaves would be quite sufficient to make a neat check. If a combination of black warp and white weft was used an almost solid black would result in the warp sateen area, while the weft sateen area would be almost white or very light grey in appearance. If a worsted spun warp was used with a woollen spun weft, and the fabric raised after finishing, the weft being woollen could be worked into quite a long pile, whilst the worsted yarn with more twist and more resistance to raising would be less effected thus giving a nice contrast.

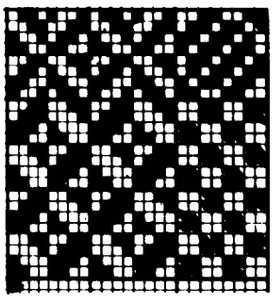


A check made from 3 x 3 twill and 3 x 3 reverse twill is illustrated on the right. This weave was very popular for use in coatings as it gives a little more weight than the tighter and more common 2 x 2 twill weave. The change in direction of the twill is quite sufficient to show up the check effect in a fabric which is all one colour or a piece dyed fabric. However a combination of light warp and dark weft looks very interesting in this type of design.



Surface in weave gives a novel combination for developing a check effect. The illustration to the right shows a combination of a 16 harness 13 sateen and a 16 harness crepe weave. The crepe weave being much tighter than the sateen weave would create a raised surface or blister effect.

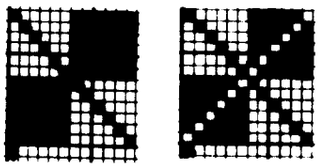
Any number of different weaves can be used in combination and an example of four weaves placed together to make a check is shown to the right. It should be noted however that the more weaves that are used in the combination, the more complicated in becomes to get a neat clean cut at the edge of each weave. Also the more weaves that are used the larger the repeat and not all of such complex designs are draftable so would require weaving on a jacquard loom.

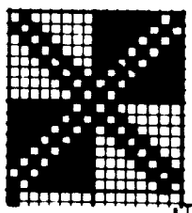


HOPSACKS AND BARLEYCORN WEAVES

Apart from the standard 2 x 2 nosack weave, hopsacks or barley-corn weaves may be may large e.g. 3 x 3, 4 x 4, 5 x 5, 6 x 6 etc. However as the size of the hopsack weave gets bigger the structure becomes slacker due to the increasing length of the warp and weft floats. When this occurs the structure can be tightened up by inserting stitches in suitable positions. These stitches may be formed by either sinking the warp under the weft, or lifting the weft over the warp, or a combination of both.

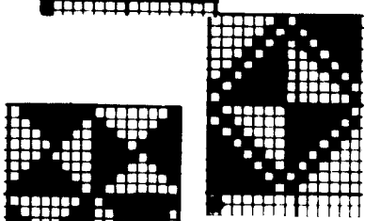
The first example shown to the right is a six and six hopsack. As this would weave very loosely two rows of stitches are inserted to tighten it. The first row, running from the bottom left of the design to the top right consist ofsinking the warp under the weft for one float. The other row of stitches running from the top left to the bottom right of the design are made by lifting the warp over the weft in single stitches. The completed design is shown below the original.





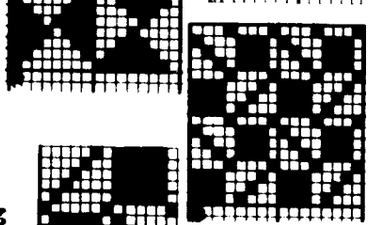
The second design to the right shows a eight and eight hopsack. Here two rows of stitdes are employed in stead of one to give more stability.

Design three, again to the right is on a repeat of 14 ends x 16 picks. This ensures a neat cut all round the design. In this case as well as inserting a single row of stitches part of the warp hopsack is transposed onto the weft hopsack.

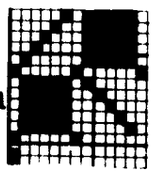


The fourth example shows an example of a fancy hopsack. The hopsack effect is built up on a diagonal so that the number of long floats is eliminated.

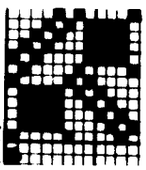
On the right a three and five hopsack is shown. This is stitched alternately to the left and then to the right. This is a well balnced structure.



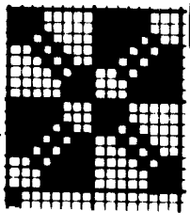
Five and six hopsack with stitches alternating to the left and then to the right is illustrated by the design on the right.



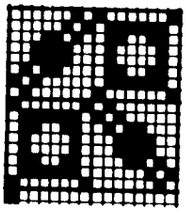
Six and Six hopsack can be stitched with double rows of alternating stitches, see example on the right. This of course will give a much firmer structure than the example of a six and six hopsack at the top of this page which only as single rows of stitches.



On the right there is an illustration of what was originaly an eight and eight hopsack. This is transformed by stitches and a small section of three and three hopsack to give a novel and different type of hopsack.

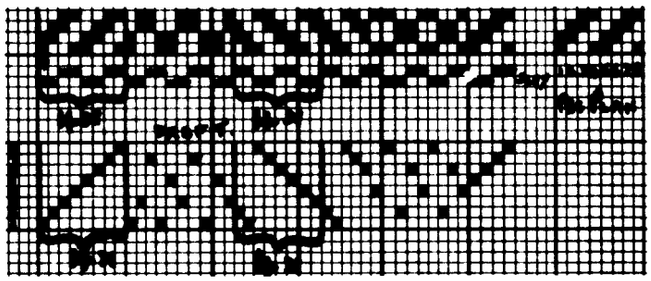


A further example to the right illustrates how a new weave can by created by moving sections of the warp hopsack into the weft and vice versa. Then the weave is stitched with a double row of stitches to ensure stability.



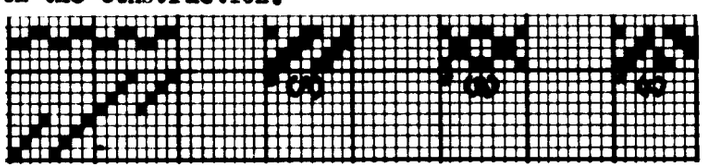
HOW TO MAKE A DESIGN FROM A DRAFT AND PEG PLAN

This is accomplished in the reverse manner from the drafting of a design which was explained earlier starting on page 35. If a Peg Plan is given together with a Draft and the Peg Plan works every harness , then some kind of design will be produced. To work out the design proceed as shown in the example below :



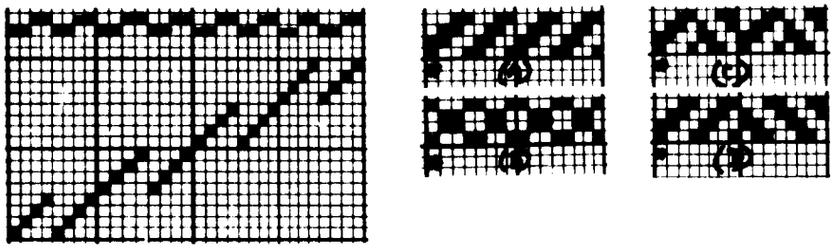
Number the VERTICAL rows of the peg plan and the HORIZONTAL rows of the draft with the corresponding number. However many rows there are in the peg plan, there must be the same number of harness or shafts in the draft, e.g. if there are 8 ends in the peg plan there must be 8 harness in the draft. The first vertical row in the peg plan and the first horizontal row in the draft are numbered alike, Number 1. The second vertical row in the peg plan and the second horizontal row in the draft are Number 2 and so on until all the ends in the peg plan and all the horizontal rows in the draft have been numbered to correspond. To make the design, where ever a mark appears on the first harness mark above it the corresponding lift shown in the peg plan. In this case it is mark 2 - miss 2. Then go to the second harness and repeat the process again marking in the lifts shown on the second vertical row of the peg plan above where a mark appears on the second harness, the lift this time is miss 1 - mark 2 - miss 1. Proceed in this manner until all the harnesses have been filled in and then the design is complete.

Below to the right is shown an example of a special draft which can be used to alter the weave and design in a loom by merely changing the peg plan. This is used quite often in sample manufacturing to enable several designs to be woven on the same warp and save production time. On a straight four harness draft, three warps would be required to weave the three designs, 2 x 2 twill, 2 x 2 Hopsack and 8 x 8 Herringbone. However the fabric structure, (Ends and Picks per inch/cm.) must be such as to accomodate the changes in the weave without producing an unsatisfactory cloth, either a loose fabric or one which is too tight and boardy. In the example shown the hopsack would be probably too loose if woven with the same construction as the twill however adding one pick in an average cloth would compensate. The 8 x 8 herringbone would in all probability weave and finish quite satisfactorily using the same construction as the twill. The clean cut every 8 ends however does tends to make the fabric weave tighter and the designer may decide to take out a pick from the construction.



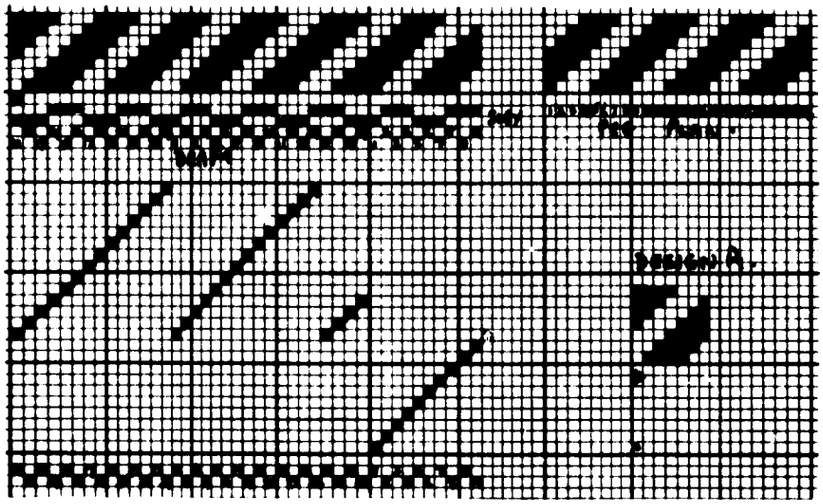
On examining this special draft it will be noticed that the onds are drawn through the harnesses 1 to 4 for the first eight ends and 5 to 8 for the second eight ends. Peg Plan A to the right of the draft would weave 2 x 2 Twill, Peg Plan B would weave 2 x 2 Hopsack and Peg Plan C 8 x 8 Herringbone. It should be noted that although 2 x 2 twill and 8 x 8 Herringbone would normaly be drawn 4 per dent in the reed, in this case they have to be drawn 2 per dent to prevent rolling or twisting of the ends when the 2 x 2 hosack is being woven.

A further example of using a special draft to weave more than one design is shown below. This is on 16 harness again with the ends being drawn in groups of eight. However if larger herringbones are required the groups of ends can be larger. For instance if the ends were drawn 1 to 4 for 16 ends instead of 8, 5 to 8 for 16 ends and so on. The draw would still weave 2 x 2 twill with peg plan A, 2 x 2 honeck with peg plan B, but with peg plan C it would weave 16 x 16 herringbone instead of 8 x 8 as it is now. With peg plan D it would weave 32 x 32 herringbone instead of 16 x 16 as it would with the draw as shown.



How to Find Whether a Given Design Can be Woven on a Given Draft

The first thing to check is that the draft is a multiple of a complete repeats of the design given. If the design does not divide into the number of ends in the draft, an equal number of times then it can ot be woven on that draft. In the example below the design A repeats on 7 ends. The draft is on 42 ends so as 7 divides into 42, 6 times it is alright so far. The design is now marked out for the full 42 ends above the draft. Number each shaft of the draft from 1 upwards, then number each end in the design according to the number of the shaft or harness on which it is drawn. Examine the design VERY CAREFULLY and if all ends bearing the same number weave in exactly the same manner then the design can be woven with the given draft. If all ends do not work alike, it may be that the starting point of the design is wrong. In order to find the correct starting point start with the second end of design A and mark out above the draft for the full repeat of 42 ends, number each end again according to the harness it is drawn on in the draft. Re-check to compare all ends on the same harness to see if they weave alike. If they do then it is alright and a peg plan can be made. If some of the ends on the same harness are different, then the draft is no good. After checking all starting points of the design, if no situation is encountered where all the ends drawn on each respective harness are the same, then the design cannot be woven on the draft.

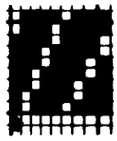


CONSTRUCTION OF WHIPCORDS

It should be noted that a whipcord weave is best produced on an odd number of harnesses. The move number of a whipcord weave is generally a move of two (M2). The main characteristic of this type of weave that it shows on the surface of the fabric as a series of diagonal ribs or twills of a prominent character, separated by more or less prominent lines or cuts. The twills or cords are formed by grouping the threads and bringing them on the surface in a series of warp floats to form a twill at an acute angle. The twill is accentuated in angle as well as prominence by increasing the warp setting, i.e. the number of ends per inch/cm. as against the number of picks. As the warp sett is increased the picks are decreased to compensate. The method of calculating this will be dealt in the section on Cloth Setting later in the manual.

Design 1 which repeats on 9 ends and picks is an example of a whipcord. The warp makes the twill by floating over seven and under two picks, and as the position of each float moves two warp way, an acute angled twill is formed.

Design 1.

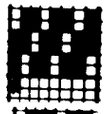


Design 2. $\frac{3}{2}$ M2 is known as a FIVE END VENETIAN or covert and is one of the more popular weaves used for whipcords.

Design 2.

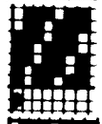
Design 3 shows a whipcord on six ends and picks this is $\frac{4}{2}$ M2

Design 3.



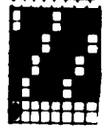
Design 4 on seven ends and picks is a popular type of whipcord. $\frac{7}{2}$ M2

Design 4.



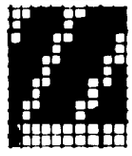
Design 5 on an even number of ends and picks 8 is $\frac{6}{2}$ M2

Design 5.



Design 6 $\frac{7}{3}$ M2 again on an even number of ends and picks would show an increased cut between the twills because the warp is under the weft for three picks in each repeat.

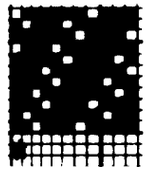
Design 6.



Note. Designs 3 and 5 have two picks in the same shed and this could result in rolling of the weft, an undesirable effect which causes weaving problems. Design 6 although on an even number of ends and picks eliminates this defect by allowing one pick to show on the face more than the other.

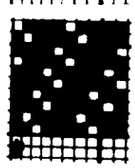
The cuts between the twills may be emphasised by inserting a short binding float between the long warp floats.

Design 7.



Design 7 on 11 ends and picks illustrates this this weave is $\frac{7\ 2}{1\ 1}$ M2 where the two float will appear to make the cut between the twills deeper.

Design 8.

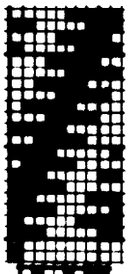


It should be noted that care should be taken to ensure that the short binding floats do not appear on the surface. The longer floats should be sufficient to roll together and over the binding floats covering them. Design 8 is a modification of design 6 on 10 ends and picks where a short two float has been introduced to accentuate the cut between the long twills.

Designs 9, 10, and 11, illustrate how some other weave can be developed between the whipcord twills.

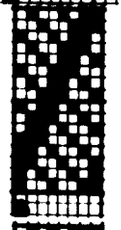
Design 9 has long floats of weft with two stitches of plain weave before and after each long warp float which forms the cord. These long floats of weft combined with the stitching will tend to make the separations between the cords wider.

Design 9.



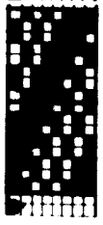
Design 10 has 1 x 2 reverse twill for 11 picks between each cord or twill. this again will create a wider separation between the cords.

Design 10.



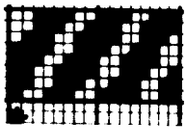
Design 11 shows a whipcord on an even number (8 x 16) ends and picks. Here the cords are separated by 2 x 2 weft rib. The single stitch of weft before each cord of seven warp floats will prevent rolling of the weft.

Design 11.



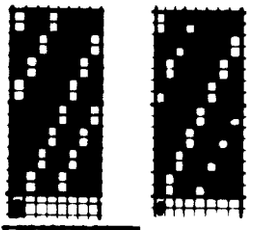
Design 12 illustrates how the angle of the whipcord twill can be varied. The weave $\frac{5}{3}$ M1 + 2 would give a slight wavy effect as M1 gives a 45 degree angle of twill while M2 gives the steep twill angle.

Design 12.



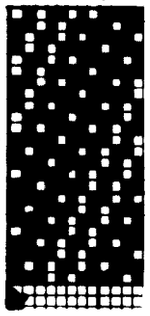
Design 13 has an eight float cord combined with a four float cord. This will give a thick cord and a fine cord. However as this is on an even number of ends and picks two picks in each shed result. To remedy this the four float can be changed to five, as shown in the design on the extreme right.

Design 13.



Design 14 although on an even number of ends and picks, 12 x 24 does not have two picks in the same shed and therefore would not cause problems in weaving.

Design 14.

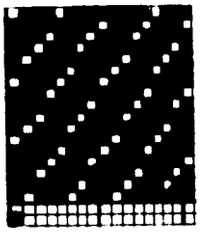


Design 15 is built to give a variation in the angle of the twill as is design 12. Here the weave is :

$$\frac{5\ 4\ 5}{1\ 1\ 1}\ \text{M1} + 2 + 1$$

Here the fabric would be almost totaly warp faced. Tho single stitches being covered by the rolling of the long warp floats.

Design 15.



CONSTRUCTION OF HONEYCOMBS

In this type of fabric, the structure of the weave causes the threads to form ridges and hollows which give a cell-like or honeycomb appearance to the cloth. Both warp and weft float loosely on both sides of the cloth. These weaves are suitable for towels, bed covers, quilts and blankets. They have also been used very successfuly in apparel and for upholstery. Apparel fabrics are woven quite loosely, the weave being used for effect only, then they are bonded to usually a nylon tricot. This stabilises the honeycomb sufficiently without adding toomuch extra weight. For upholstery the honeycomb effect gives depth and dimension to the cloth. The long floats of warp and filling or weft are bound down by giving the fabric a back coating of latex or acrylic foam or simply a plain back coating without foam.

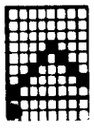
There are two classes of honeycombs :

Ordinary Honeycombs

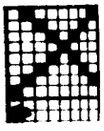
These form the cell structure or honeycomb on both sides of the fabric and most of them can be woven from a pointed or chevron type draft, thus reducing the amount of harnesses required in weaving.

The method of constructing the weave is as follows. Take one more than half the number of picks on which the design will repeat, e.g. with a design repeating on 8 picks that would be 5.

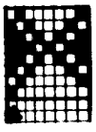
On this number of picks make a point as in Design 1. (1)



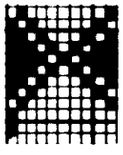
Then reverse the point as in Design 2. (2)



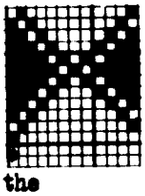
Now fill in one side of the diamond spaces with dots, leaving the other diamond empty, see Design 3. (3)



Design 4 is a larger honeycomb weave built exactly the same but on a repeat of ten. This will draft down to six harnesses. (4)

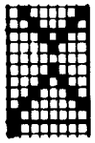


Design 5 on a 12 x 12 repeat requires 7 harnesses (5)

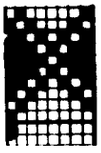


Note From the above examples it can be seen that either of the diamond spaces may be filled in and that one yarn floats on the face more than the other. For instance in Design 4 the weft floats are bigger 9 - 7 - 5 - 3 - 1 than the warp floats 7 - 5 - 3 - 1.

Design 6 shows the method of arranging the base so as to obtain equal floats of warp and weft. This is done by missing a pick before inserting the reverse of the pointed base marks. (6)

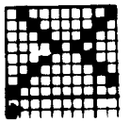


Design 7 shows the completed design with the warp floats 7 - 5 - 3 - 1 and the weft floats 7 - 5 - 3 - 1. (7)



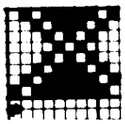
The design can be arranged to give equal floats of warp and weft also by making the design on two more ends than picks. this is shown in Design 8, the method of placing the base dots.

(8)



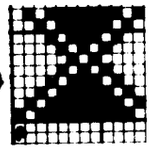
Design 9 shows the design complete with the diamonds filled in. It should be noted however that this method when compared with that detailed in Designs 6 & 7 will require an extra harness to produce the same length of float.

(9)



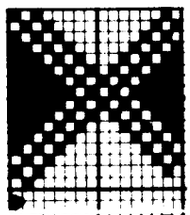
Design 10 is a larger version of design 9 and it should be noted that in this type of design the marks are inserted in the larger diamond spaces.

(10)



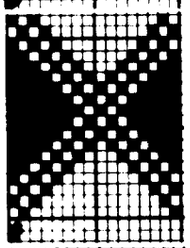
Large honecomb weaves are liable to be very loose in structure when constructed in the ordinary manner. However in order to make them firmer a double row of base marks may be inserted as shown in Design 11 which will draft onto nine harness but gives unequal floats of warp and weft.

(11)



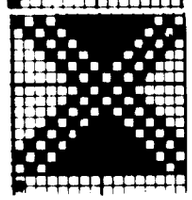
Design 12 shows the way to obtain equal warp and weft floats by extending the design by two picks giving a repeat of 16 ends by 18 picks. This however is still able to be drafted onto 9 harness.

(12)



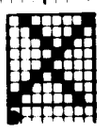
Design 13 provides equal floats in warp and weft, it requires 9 harness again but the weave is extended by two ends instead of picks the repeat being 18 ends by 16 picks.

(13)



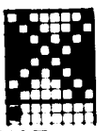
Design 14 Shows another base used for honeycomb weaves. This also ives an equal number of floats in warp and weft but due to the way the point of the base is off set it has to be a straight draft.

(14)



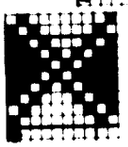
Design 15 illustrates the filling in of the warp floats on the base shown in Design 14.

(15)



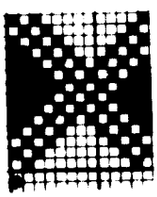
Design 16 is a larger honeycomb weave built using the off setting of the base dots to ensure equal warp and weft floats. This is a 10 harness straight draft.

(16)



Design 17 on a 13 harness straight draft shows how to off set a double row of base dots and ensure a firmer structure in a larger honeycomb of this type.

(17)



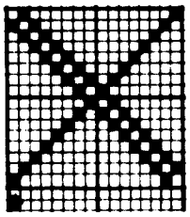
In Ordinary honeycombs such as Designs 1 through 17, the ridges in the fabric occur where the long floats of warp and weft are formed. The hollows in the structure are formed where the threads interlace more tightly in plain weave order. For example looking at Design 17 on Page 52, a ridge is formed by the first end and also by the first pick. The ridge merges into a hollow as it progresses towards the centre of the weave where five ends and picks interlace in plain weave order. In finishing puckering occurs an emphasises the ridges and hollows. Although the designs are constructed on a diamond base, the cell formations in the cloth are rectangular in shape.

Brighton Honeycombs

These weaves are quite different from Ordinary Honeycombes in construction and have to be woven on a straight draft. Also the number of threads in a repeat must be a multiple of four.

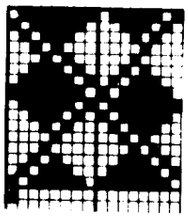
Design 18 shows the method of setting out a base for a Brighton Honeycomb. A diamond is first made by inserting a single row of base marks from left to right, and a double row from right to left.

(18)



Design 19 is the completed weave. To obtain this, marks are added to the double row of base marks to make small diamonds in the right hand corner of each diamond space. A similar diamond formed by weft floats being left in the upper and lower corners. The length of the float of the centre thread of each small diamond spot is 1 thread less than half the number of threads in the repeat. As this design is on a repeat of 16 ends and picks the longest float would be : 16 ÷ 2 = 8 - 1 = 7.

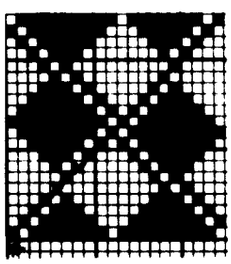
(19)



In the same way as ordinary honeycombs the long floats of warp and weft form vertical and horisontal ridges in the fabric when a Brighton honeycomb weave is used. However the difference is that Brighton Honeycombs have two large and two small cells in each repeat. The large cells or hollows are formed where the double line of base dots crosses the single line. The small hollows are formed in the centre of each diamond space. The Brighton structure is sometimes made with two thicknesses of yarn, arranged so that the thick yarn is inserted where the longest floats of warp and weft are. This serves to accentuate the ridge.

Design 20 is an example of a larger Brighton Honeycomb on 20 ends and picks. This of course is a 20 harness straight draft.

(20)



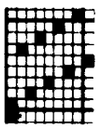
CONSTRUCTION OF CORKSCREW WEAVES

Corkscrew weaves are really twilled ribs and can either be used alone or in combination with other weaves. They can be made to produce either a warp or weft surface, and they are most regular when constructed on an odd number of threads.

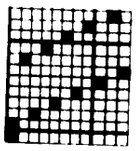
Ordinary warp corkscrews are contsructed on a sateen base and the move number M.is two plus counting weft way. The examples below show a seven end sateen, a nine end sateen and an eleven end sateen base.

7 Ends Sateen

9 End Sateen

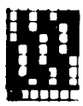


11 End Sateen

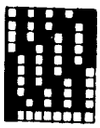


To make a corksorew weave on one of these bases, marks are added vertically on eaon sateen base dot until there are one more mark tnan there are blanks. For instance on the 7 end sateen there are four marks and three blanks on each end. The completed weaves are shown below.

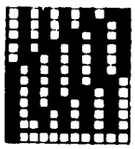
7 End Corksorew.



9 End Corksorew.



11 Ends Corksorew.



The diagrams below are of the first and second picks of the 11 end corkscrew. From an examination of these it will be seen that the face and back are nearly alike, the warp predominating on both sides of the cloth.

1st Pick of 11 End Corksorew.

2nd Pick of 11 End Corksorew.

From a study of the above examples it can be seen that the corkscrew twill ie formed by alternate ends on face and back enclosing the ends in the middle. The odd ends form the twill and the even ends form the similar twill on the back. The picks being enclosed by the ends. The crossing of the ends from face to back and vice versa forms the cuts.

Corkscrew twills may be made with warp threads enclosing or covering the picks or the weft picks enclosing or covering the warp threads and these are known as warp corksorews and weft corkscrews respectively. The long floats on face and back will roll together and form a warp or weft surface as the case may be. This results in firstly one set of threads only showing on the face and secondly, regular and equal cuts and twills.

The diagram shown at the right indicates the way the first and second thread of the 11 end corkscrew weave interlace. It shows clearly how the weft will be totaly hidden in the centre of the fabric between the two sets of ends.

If it is desired to make a firmer construction the weave may be stitched in plain weave order as shown below. The long warp floats will still roll together to form a continuous twill, covering up the stitches on the face. However the floats on the back of the fabric now weave plain.

11 End Warp Corkscrew with Plain Weave Stitching.

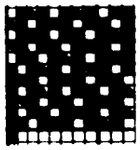
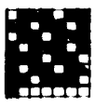


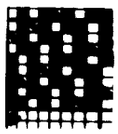
Diagram showing the interlacing of the 1st & 2nd. threads of the 11 end corkscrew with Plain Stitching.

The following weave samples show the seven and nine end corkscrew weaves with Plain Weave Stitching inserted.

7 end corkscrew with Plain Weave tight stitching.

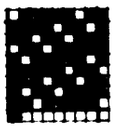


9 end corkscrew with plain weave tight stitching.

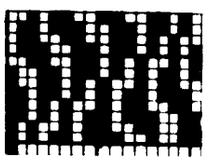


In place of plain weave, a stitch of a longer float may be used. These longer stitches as well as tightening up the fabric give it a bulkier and firmer handle.

9 end corkscrew with two float stitches in place of plain weave.



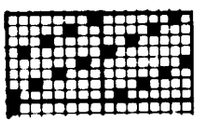
The weave illustrated to the right is a special corkscrew on 17 ends x 12 picks. An extra end has been inserted every three. This weaves three up and three down and gives a firm and bulky handle to the resulting fabric.



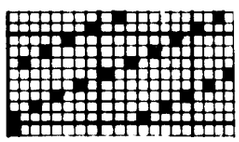
<u>Warp Corkscrews Which Repeat on An Even Number of Ends & Picks</u>

In constructing warp corkscrews which repeat on an even number of ends and picks the method of making the weave is modified. The examples below show the base marks for making the weaves on 8 picks and 10 picks respectively.

Base Dots for a Corkscrew Weave on 16 ends x 8 picks.

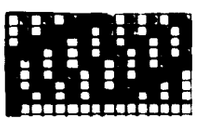


Base Dots for a corkscrew weave on 20 ends x 10 picks.

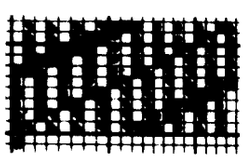


It should be noted from the above, that the repeat of the weave is on twice as many ends as picks. A line of base marks as indicated by the crosses is put on the odd vertical spaces, the move number being 2 plus, weft way. Then a second line of base marks shown as solid red squares is put on the even vertical spaces as centrally as possible. The designs are then completed by arranging each vertical space with two more marks than blanks as shown below.

Corkscrew weave on 16 ends x 8 picks.

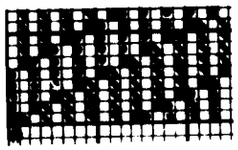


Corkscrew weave on 20 ends x 10 picks.



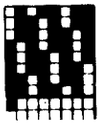
Corkscrew weaves repeating on an even number of ends and picks can also be made on the base illustrated at the bottom of Page 55 but having the number of marks equal to the number of blanks as indicated below:-

To the right is an example of a corkscrew weave on 20 ends x 10 picks. This has the number of marks equal to the number of blanks i.e. the warp floats over 5 and under 5.

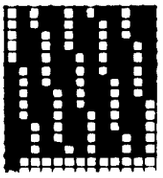


Many more weave can be made on the corkscrew principle for example the angle of the twill can be varied from the normal shallow angle to 45 degrees and steeper. Also the threads which appear on the face can be changed and combinations of warp and weft corscrews designed.

On a 8 end M5 sateen base a 45 degree twill angle is obtained, see weave on right.

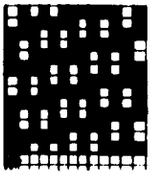


With a 13 end M8 sateen used as a base a very steep angled twill results as can be seen by the example on the right.

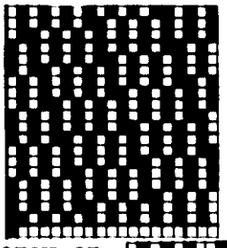


In the two corkscrew weaves illustrated below, an undulating type of twill is obtained due to the grouping of the base dots.

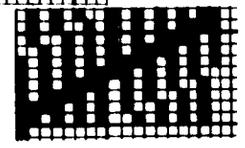
13 End Fancy Corkscrew Weave.



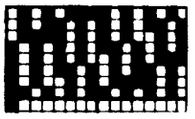
19 End Fancy Corkscrew Weave.



On the right is a further example of a corkscrew on a 18 end x 10 pick repeat. This gives two different sizes of twill, the larger being a warp float of 6 and the smaller a warp float of 5.

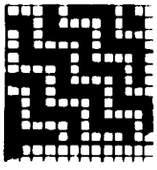


One twill can be made to run at the normal angle while the angle of the other twill can be varied. The weave to the right on 16 ends x 8 picks shows this.

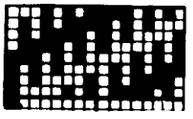


Below are illustratsd two further examples of variations in corkscrew weaves combining warp and weft twills. The closing up of the warp twills will shorten the weft twills to some extent but allowing the weft to float on the face emphasises the cut.

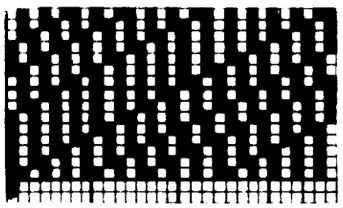
This weave to the right demonstrates the combination of warp and weft twills at a 45 degree angle.

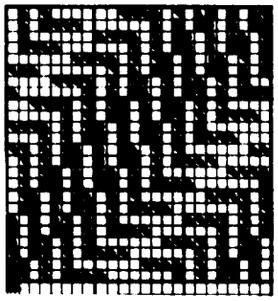


On a repeat of 16 ends and 8 picks the weave on the right has a series of warp floats of 4 separated by weft.



Further examples of fancy corkscrew weaves are illustrated below. To the left a weave is shown which combines four warp corkscrew twills. The illutration on the right shows a weave incorporating both warp and weft corkscrew twills.





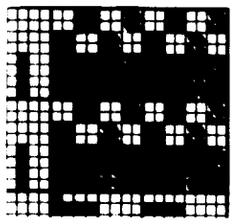
WEFT Corkscrew Twills are exactly the opposite to warp corkscrews and when made on a odd number of threads are constructed on a sateen base counting 4+2. Marks are then added to the base marks horizontally and as these marks equal warp, the number of marks on each horizontal space should be one less than the number of blanks. When the weft corkscrew repeats on and even number of threads the weave will have twice as many picks as ends.

METHODS OF PRODUCING VARIETY OF EFFECT IN THE SAME WEAVE AND COLOURING

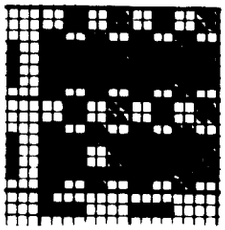
In colour and weave effects different patterns can be obtained in one order of colouring and one weave by changing their positions relative to one another. This is illustrated in the three examples below. The weave used is two x two hopsack on the same footing or starting point throughout. The change in effect is obtained by changing the order of the four and four colouring.

Weave

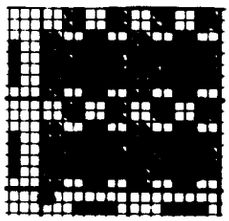
Effect 1.
Warp Colouring
4 Dark - 4 Light.
Weft Colouring
4 Dark - 4 Light.



Effect 2.
Warp Colouring.
4 Dark - 4 Light.
Weft Colouring
1 Light - 4 Dark - 3 Light.

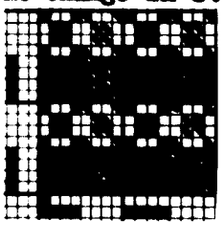


Effect 3.
Warp Colouring.
3 Light - 4 Dark - 1 Light.
Weft Colouring.
1 Light - 4 Dark - 3 Light.

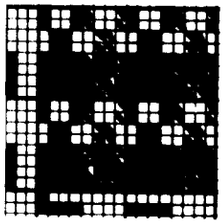


To change the colour and weave effect without changing the order of colouring, the footing or starting point of the weave must be changed. Below are three further designs obtained using the two x two hopsack weave, the order of colouring in each case is 4 dark - 4 light in warp and weft. The change in design is produced by the change in starting the weave. This is :

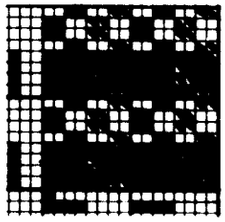
Effect 4. Weave 2 x 2 Hopsack. 1st end = mark 1 - miss 2 - mark 1.



Effect 5. Weave 2 x 2 Hopsack. 1st end = miss 2 - mark 2.



Effect 6. Weave 2 x 2 Hopsack. 1st end = miss 1 - mark 2 - miss 1.



Classification of Colour and Weave Effects

The order of colouring of colour and weave effects may be classified as follows :

1) Simple warping and wefting, the order of warping may be different from the order of wefting, they may both be the same, or the order of wefting may be different from the warp.

2) Compound warping and simple wefting.

3) Simple warping and compound wefting.

4) Compound warping and compound wefting, both may be the same or one different from the other.

The following table shows the type of design produced in each type of combination.

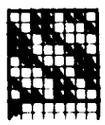
Order of Colouring.	Simple Weave.	Stripe Weave.	Check Weave.
Simple Warping & Simple Wefting.	Simple Patteren.	Stripe Pattern.	Check Pattern.
Compound Warping & Simple Wefting.	Stripe Pattern.	Stripe Pattern.	Check Pattern.
Simple Warping & Compound Wefting.	Crossover Pattern.	Check Pattern.	Check Pattern.
Compound Warping & Compound Wefting.	Check Pattern.	Check Pattern.	Check Pattern.

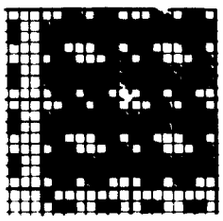
Hairlines

These consist of solid vertical or horizontal lines in 2 - 3 or more colours and the term "Hairline" is used to distinguish designs in which each line of colour is equal to the width of one thread. The most basic example of the single hairline and perhaps the most common is the 1 x 1 hairline on plain weave, examples of which are shown on Page 41. The finer the hailine the more critical is the problem of unevenness. In the plain weave hairline very evenly spun yarns are required to produce a satisfactory fabric. All yarns used in this type of design should be tested for evenness on the

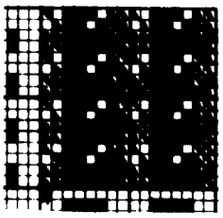
evenness tester and unsatisfactory and irregular yarns rejected. The contrast between the light and dark yarns emphasises any yarn faults black and white being most critical. As the contrast is reduced imperfections in yarn are less noticable.

To the right is an illustration of the Mayo or Campbell Twill with a warping plan of 1 light - 2 dark - 1 light. The filling or weft plan being the same. This gives a double line in the vertical drection.

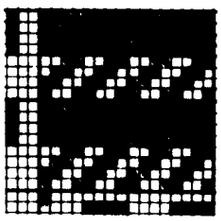




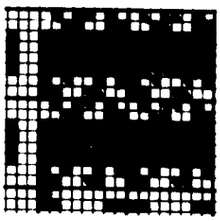
If a 3 x 1 Twill has a warping plan of 2 light - 4 dark - 2 light. With a weft colouring 2 dark - 2 light another vertical stripe is produced (see right)



The Shepherds Check. This is a very popular design in its plain form all though it can be combined in a multi - tude of forms with overchecks. Simply it is 2 x 2 twill with the first thread weaving 2 up - 2 down and both the warp and weft colouring plans are 4 light - 4 dark. (see right)

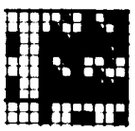


A variation on the shepherds check can be obtained by using 2 x 2 twill - 4 x 4 herringbone as shown to the right. It should be noted that the H.B. starts with 2 reverse then 4 straight twill followed by 2 reverse to complete the weave. The warp colouring is 2 dark - 4 light - 2 dark. While the weft is 2 light - 4 dark - 2 light. This changes the form of the check to a four pointed star effect.

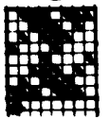


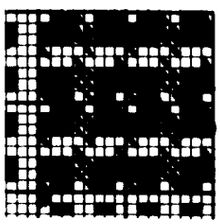
Birdseye and Spot Effects

The weave and colouring plan used to obtain a birdseye effect is illustrated on the right. This is a 8 harness crepe weave. The effect in the fabric is for the small square spot to dissapear completely whilst the cross shaped spot becomes perfectly round. This is caused by the way the three floats in the weave roll together.

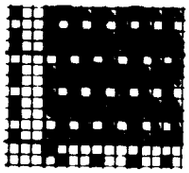


A larger spot effect produced by using a weave derived from 3 x 1 revers twill and 1 x 3 straight twill with a 1 light - 2 dark - 1 light colouring plan is shown. (see right).

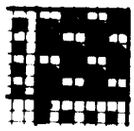




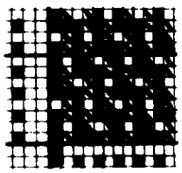
A novel spot effect using plain weave with a warping plan of 1 light - 1 dark - 1 light, and the opposite in the weft that is 1 dark - 1 light - 1 dark is illustrated to the right. This gives an interlaced effect



Step Patterns

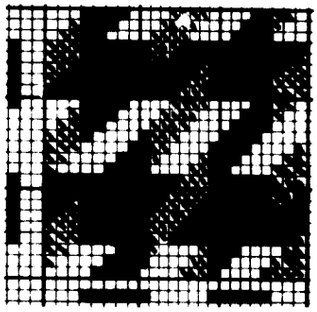


In these designs vertical and horizontal lines of colour form zigzag lines which run in a diagonal direction. The most popular fabric to use this effect is shown on the right. This is a simple two x two twill with a warp coloring 1 dark - 1 light, the weft being the same. Utilising a spun yarn for the dark and a silk or other filament yarn gives a very beautiful effect for a mens suiting fabric.



A larger step pattern results from changing the weave to 2 x 1 twill. This effect illustrated right also produces a rather steep cross twill. It should be noted that step effects resulting from twill weaves usualy run in the opposite direction to the twill.

All Over Effects

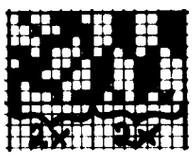


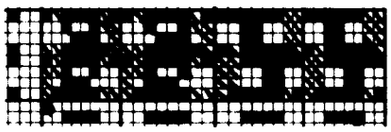
This type of colour and weave effect results from arranging the repeat of the colour plan and the repeat of the weave on such a number of ends and picks that wto or more repeats of each is required to produce one complete repeat of pattern. In the example to the right the weave is 4 x 4 twill, while the colouring plan is 3 light - 6 dark - 3 light. Therefore three repeats are required in the weave with two repeats of the colouring plan before the full effect can be seen.

To take an example from the table given on Page 58, a combination of a simple warping and wefting colour plan with a stripe weave should give a stripe pattern. As will be seen from the example below this is correct. The two different weaves forming the stripe weave are shown to the left with the resultant colour and weave stripe to the right.

Warp Colouring Plan.
2 Light - 4 Dark - 2 Light.

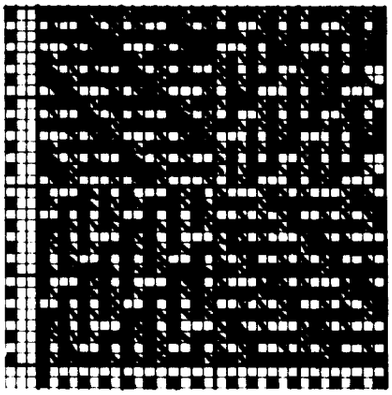
Weft Colouring Plan.
1 Light - 2 Dark - 1 Light.

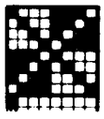




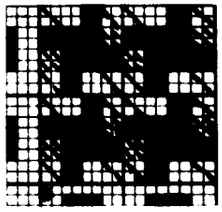
SPECIAL NOTE Extra care should be taken when checking the correct starting position for the weave and for the warp and weft coloring plans. As will be see from the first examples on Page 57 and Page 58 some of the effects can be very similar. When examining the first few inches at the start of weaving a sample or production pieces the lift of the first pick should be examined very thoroughly as quite often mistakes are encountered. Also it should always be remembered that the bottom left hand corner of the peg plan is marked in some way to ensure that it is not read the wrong way up.

With a simple order of warping and wefting i.e 1 dark - 1 light and a check weave, a check design will result as the example on the right shows. The check is also brought about by reversing the order of colouring that is changing it to 1 light - 1 dark where the check is required. The check weave a four and four stitched hopsack is also shown.





If the colouring on the above four and four stitched hopsack is changed to 2 light - 4 dark - 2 light a large four pointed star effect is obtained. This change is illustrated to the right.

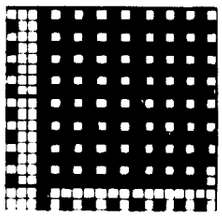


THE METHOD OF ANALYSING COLOUR & WEAVE EFFECTS

It may be neccessary to analyse and colour and weave effect from a piece of fabric, or the designer in searching for new and novel effects may draw some out on point paper, then analyse them in order to find the best way of weaving them. The method used for producing the weave is as follows :

1) Examine the colour and weave effect very closely and select the most likely warping and wefting colour plan. This is done by marking each end according to the colour which predominates on that end. Then each pick is marked according to the colour which predominates. In the example shown (Fig. 1) which is a step effect running at a 45 degree angle from right to left, it will be noticed that odd ends and picks are predominantly dark (Red) whilst the even number of ends and picks are mainly light (White).

Fig. 1

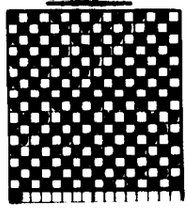


2) After having decided on the colouring plan, the next step is to mark with a circle any space in the design which is not the same colour as that marked under each end at the bottom of the design. Every end in the colour plan is treated in this manner. As crosses in the final design indicate warp lifted it will be seen that any space which is not the same colour as that marked underneath the end, indicates that the warp is not lifted at this point and remains down with the weft passing over it. The circles therefore represent the weft on the face of the design and are not required to be marked in the weave. <u>On no account</u> must they be included as part of the weave.

3) Mark with a cross any space on each pick which is not the same colour as that marked at the side of each pick. All picks must

be treated in thie manner. Wherever crosses are inserted in the weave in this manner it indicates that the weft is not lifted and the warp passes over it. These crosses showing warp lifted are an integral part and the basis of the weave. Fig. 2 shows the basic design from which the weave is built up, with all the circles and crosses inserted.

Fig. 2



4) The final step in the analysis is to take the basic weave shown at Fig. 3 and fill in the neccessary number of blank spaces in order to create a weave. Often several weaves can be made on the same base as will be seen but the one used should be the simplest and most stable for the structure of the fabric.

Fig. 3

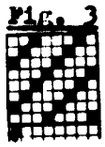


Fig. 4

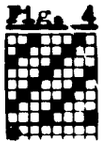


Fig. 4 shows the basic weave and this will make the step effect without further additions to it, using a warping and wefting plan of 1 dark - 1 light. However Figs. 5 & 6 show 2 x 2 twill and the step design can be woven on this as well, and the weave is better balanced than 1 x 3 twill. The adding of marks in other positions will make 2 x 2 hopsack weave (Fig.7) and 3 x 1 twill (Fig 8) The marks added are done in solid colour (Red) in order to clarify the method in which the weave is built up

Fig. 5
2 x 2 Twill

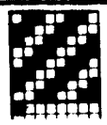


Fig. 6
2 x 2 Twill

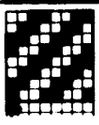


Fig. 7
2 x 2 Hopsack

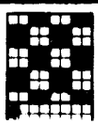
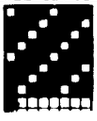


Fig. 8
3 x 1 Twill



The following are further examples of the analysis of colour & weave effects. On the left is shown the effect to be analysed with the circles (Weft lifted) and the crosses (Warp lifted) inserted. The centre design in each case shows the completed weave after analysis and the effect shown to the right is the warp and weft colouring inserted over the weave to proove that the analysis was done correctly.

Fig.9 shows a double hairline colour and weave effect which is obtained with a weave made up of 8 ends of 2 x 2 twill and 8 ends of 2 x 2 hopsack the warp and weft colouring plan being 2 dark - 2 light.

Colour & Weave Effect

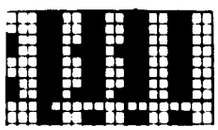
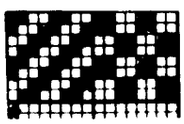


Fig. 9
Weave.



Proof

Fig.10 Illustrates a small spot effect obtained by using a warp colouring plan 2 light - 2 dark and weft plan 1 light - 1 dark on 2 x 2 twill.

Colour & weave Effect

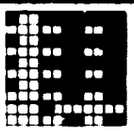
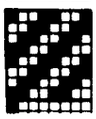


Fig. 10
Weave.



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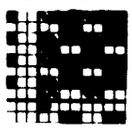


Further examples in analysis

Fig. 11 is an eight pointed star or sunburst effect and after analysis the weave is found to be a check on 12 ends and picks.

Colour & Weave Effect

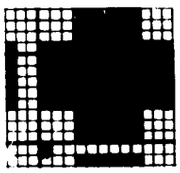
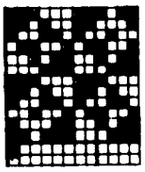


Fig. 11
Weave.



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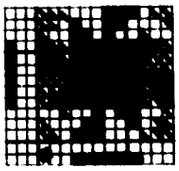


Fig. 12. Shows another basic colour and weave effect often encountered. This consists of a double line vertical hairline & a small four pointed star or 2 x 2 houndstooth. The weave is again as in Fig. 9, 8 ends of 2 x 2 twill and 8 ends of 2 x 2 hopsack.

Colour & Weave Effect

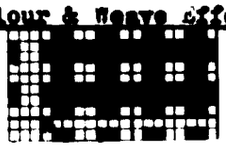


Fig 12
Weave

Proof

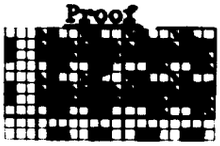


Fig. 13. a basket or entwined spot effect is obtained by using a variation of the basket or hopsack weave and colouring it 1 light - 2 dark - 1 light in warp and weft.

Colour & Weave Effect

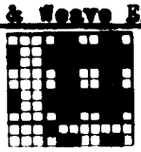
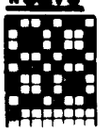


Fig. 13
Weave



Proof

Fig. 14 This colour and weave effect gives a large spot effect twilling at a steep angle. It will be noted that the weave repeats on 10 ends and picks. However as the colouring plan is 2 dark - 2 light in both warp and weft, the weave must be run over twice before the weave and colouring plans coincide.

Colour & Weave Effect

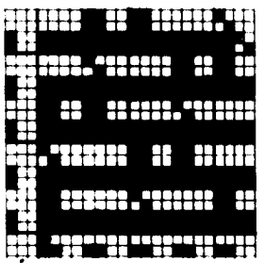
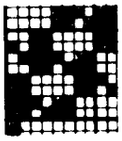


Fig. 14
Weave



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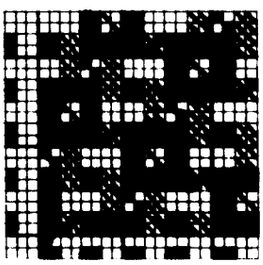


All the examples given have been coloured dark and light only to clarify the method of analysis. The actual way in which all colour and weave effects are coloured is entirely up to the ideas and capabilities of the individual designer. For example where it is neccessary to colour a design 2 dark - 2 light, the 2 dark could consist of 1 end of Navy and 1 end of Royal Blue. The 2 lights may be lend of light blue and one end of White this method of colouring is just one of many unlimited applications

TWIST IN YARNS

The twist and turns per inch which a yarn contains is a very important factor as it influences the results in all stages of manufacturing and in the finished fabric. The amount of twist or the number of turns per inch/cm. suitable for a given yarn depend on the following factors :

1) The nature of the yarn and its planned use.
2) The effect required in the fabric.
3) The count or size of the yarn.

An increase of twist gives an increase in both yarn strength and elongation. This however has its limits and beyond a certain point an increase of twist will result in a decrease of strength. A peculiar feature however is that a yarn does not commence to decrease in elongation at the same point at which the strength begins to decrease. The turns per inch/cm. which a yarn contains influence the handle and appearance of the fabric to a large extent especially in worsted and woollen cloths. Hard twist worsted yarns produce a cloth with a crisp handle in which the weave is clearly defined. Soft twisted yarns produce a softer, fuller handling cloth in which the weave is less defined.

In addition the turns per inch/cm. effect the shrinka e properties of the material. In hard twist yarns in which the fibres are bound down by twist, there is not the opportunity for fibre movement which there is in a cloth of the same quality but containing yarn of less twist. When designing a new fabric it is important to understand whttype of twist is required in the yarn and to arrive at this, the charactertistics required in the cloth, the type of finish required, and the proposed end use, must all be taken into consideration. For example if a napped or covered finish is to be applied to the fabric a low twist yarn will be required especially in the weft. It is of course much easier to weave low twist yarns in the weft than in the warp. Warp twist must be sufficient to allow the yarn used for the warp to undergo the stresses and strain of weaving. Too much twist in a yarn which is to be used in a fulled and napped finish cloth will cause the yarn to resist fulling and napping to such an extent that the proper finish will not be obtained. Many deffective cloths are produced by lack of attention to having the yarn for a fabric made with the correct number of turns.

Many types of cloth are entirely dependant on the type of twist to produce a particular effect. Crepe fabrics are a typical example. These may be made from a large variety of different materials such as all silk, all wool, silk warp - wool weft, nylon warp, cotton weft, acetate warp and weft, all cotton etc. In all cases however a special twist yarn is employed. For instance a crepe may be made with a nylon warp and a fine botany wool weft. The botany weft will be very hard twisted and will be woven one pick "S" or left hand twist and one pick of "Z" or right hand twist. The weft arrangement could also be 2 picks "S" - 2 picks "Z". During wet finishing the hard twist yarn is acted on by heat and moisture which causes it to shrink producing the crisp crepe appearance required. Crepe fabrics are often defective because of variations in twist in the yarn, which will effect the creping property. It is usual to tint the "Z" reverse twist yarns with a fugitive colour in order to keep them separate in the plant and make them readily identifiable during weaving.

Hard twist yarns are difficult to weave especiallywhen newly spun. The twist causes them to be very lively and to snarl easily. If insufficient tension is not applied in the shuttle or to the weft creel if the loom is a gripper type or rapier, snarls are woven into the cloth with disastrous results, as at this point there will be three picks in a shed. Damping of the yarns by steaming

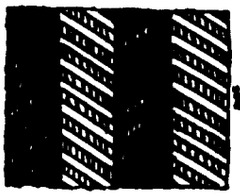
oan be used as a means to set the twist but this must be done very oarefully in a oontrolled conditioning oven in order to ensure that the yarn on the inside and the outside of the yarn package gets the same amount of moisture. Natural conditioning in order to set the twist is the most satisfactory, but here the time factory related to fabric delivery is involved. With hard twist yarns several weeks may elapse before the yarn is set in a suitable condition for weaving.

Yarn twist direction is illustrated below :

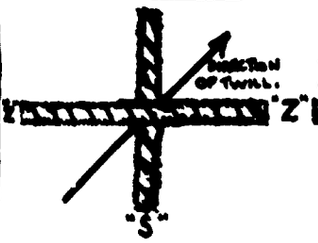
Direction or Angle of Surface Fibres.	 Clockwise.	 Anticlockwise.
Plan of Spindle Direction of Revolution.		
Worsted and woollen Yarns.	Right or Openband.	Left or Crossband.
worsted Yarns	Spinning.	Twisting.
Single Cotton Yarns.	Twist or twist way or Double weft.	Weft or weft Way.
Double or Folded Cotton Yarns.	Reverse.	Right.
Silk.	Left.	Right.
International Notation.	"Z"	"S"

<u>Twist Direction</u> can be used by the designer to emphasise an effect or subdue it. as illustrated below in a herringbone having a "S" twist warp and "Z" twist weft. The twill to the right shows up more distinctly than the twill to the left. This is because

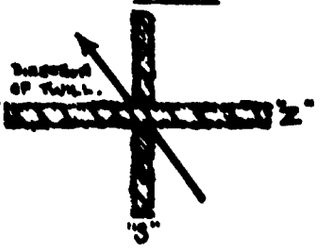
<u>Fig. 1</u>



<u>Fig. 2</u>



<u>Fig. 3</u>



the warp and weft are twisted in opposite directions.(See Fig. 2 & Fig. 3 on previous page).Upon being placed at right angles to each other as they will be in the cloth, they have a tendency to stand apart from each other. It should also be noticed that the slight ridges in the yarns caused by the insertion of twist run in the same direction that is from the bottom right hand corner of the cloth to the top left. Being twisted in opposite directions assist in giving a clean distinct appearance to the weave. If the structure is to be a twill a neat pronounced effect can be obtained by making the twill oppose the surface direction of the twist.

In Fig. 2 the direction of the twill opposes the surface direction of the twist. The light is reflected more strongly and the twill is more pronounced as illustrated in the dark section of the herringbone Fig. 1

In Fig 3. the direction of the twill runs in the same direction as the surface direction of the twist and therfore the twill is very subdued or softened

"S" and "Z" Twist Effects

Some very interesting shadow effects can be obtained in fabric using "S" twist and "Z" twist yarns in combination. These can be done in both yarn dye fabrics, that is using coloured yarns or in piece dye fabrics with all white yarns. The most simple of these designs is the Tricotine which is a plain weave vertical hairline utilising "S" and "Z" yarns to achieve a shadow hairline effect. Fig.4 shows the way a tricotine is made using all white yarn whilst Fig. 5 illustrates a tricotine using a colourin of 1 white- 1 black in warp and weft.

Fig.4

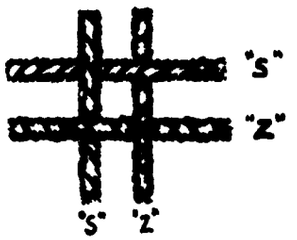
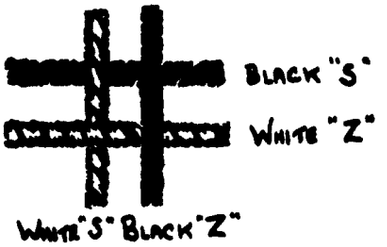


Fig.5

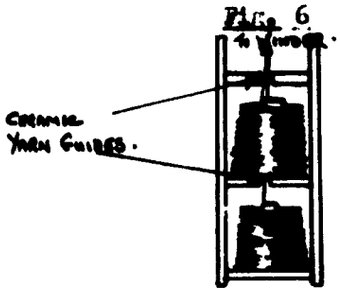


It should be noted that in plain weave hairline effects the "S" warp yarn weaves under the "Z" weft yarn. Where coloured yarns are involved the twist of each colour is the opposite in the filling(weft). That is as seen in Fig.5 the warping plan is 1 white "S"- 1 black "Z" but the weft colouring plan is 1 black "S"- 1 white "Z" this ensures the vertical hairline effect in both the colour and shadow caused by the difference in twist. Many different effects can be obtained using "S" and "Z" yarns the only limitation being that only half the number of colours can be used as against designs which are made with yarns of the same twist direction. For example if a four colour design was to be made in "S" and "Z" yarns 8 different yarns would be required 4 of the "S" twist and 4 of the "Z" twist. Also the "Z" twist yarns have to be tinted with a fugitive tint in order to keep them separate at all stages of manufacture. With white yarns tinting is fairly simple however coloured yarns present a slightly more difficult problem. One method used with coloured yarns is using coloured size. Charcoal grey could be sized using white size for the "S" yarn and bright pink for the "Z" yarn. Another method used by manufacturers who specialise in weaving "S" and "Z" twist fabrics is to have the "Z" twist yarns treated with a chemical which shows up flouresoent when seen under ultra violet light. Special lighting is then set up in areas where the yarn is to be handled.

Cone on Cone Twist Effects

By placing two cones one above the other, passing the thread of the lower cone through the centre of the upper and winding the two threads on to one package a special low twist yarn can be made. The resulting yarn usualy has an uneven twist which averages out at about 1½ turns per inch (2.5 cm.) This type of yarn is usually used solid in the weft and gives a very nice uneven type of small moire effect. Fig. 6 below shows the method of setting up the cones for winding. Yarns may be made in this manner using 2, 3 or even 4 threads wound together and high or low contrast colours may be used.

Fig. 6



A method of calculating the twist required in any yarn is to use the twist co-efficients given in the table below.

Twist Co-efficients for Various Yarns. Co-efficients expressed as 1/1000 of 1.

	Very Tight.	Tight.	Med.	Slack.	Very Slack
Worsted Yarns					
Sgl. Bty No. 70s.	- -	120	105	90	-
" " " for doubling	110	99	88	78	67
2 ply 70s Qual.	155	140	125	110	95
Sgl Bty 60s Qual.	110	100	90	80	70
" " " for dbling	102	92	81	71	60
2 ply 60s qual.	145	130	115	100	85
Sgl Xbd. 50/56s Qual.	-	100	85	70	-
Sgl Xbd for dblg.	95	85	70	64	53
2 ply 50/56s Qual.	135	120	105	90	75
Sgl Xbd 40/50s Qual.	-	90	75	60	-
Sgl Xbd for dblg.	88	78	67	57	46
2 ply 40/50s Qual.	125	110	95	80	65
Sgl 32/40s Qual.	-	80	65	50	-
Sgl Xbd for dblg.	81	71	60	49	39
2ply 32/40s Qual.	115	100	85	70	55
Woollen Yarns.					
Sgl Saxony Wln.	200	165	130	95	60
" " " for dblg.	138	110	95	74	68
2ply Saxony Wln.	195	165	135	105	75
Sgl Cheviot Wln.	185	150	115	80	45
" " for dblg.	127	106	85	64	42
2 ply Cheviot Wln.	180	150	120	90	60
Cotton Yarns.					
Single Cotton.	145	130	115	100	85
" " for dblg.	145	124	102	81	60
2 ply cotton.	205	175	145	115	85

The method of using this table is as an example to find the Turns Per Inch of a 2/48's 70s quality worsted yarn, first find the diameter of the yarn. The diameter of a yarn is the square root of the yards per lb. $= \sqrt{24 \times 560} = 116$. If a medium twist is required :

$$116 \times \frac{125}{1000} = 14\frac{1}{2} \text{ Turns per Inch}$$

The range of twist yarns available to the designer for use in fabrics is virtualy unlimited, to mention just a few :

Slub Yarns are deliberately made with thick uneven places. These yarns may be single or plied. In plied form they are usualy produced by using two ground yarns to which is fed intermittently a short-staple soft twisted slubbing. They are used as decoration in a fabric and one essential is for the slub to be randomly spaced in the yarn. If the slub is regularly paced it makes a pattern effect in the fabric which is not acceptable.

Bouclé Yarns These are usualy 3 ply. They consist of a single carrier thread on to which is twisted the loop thread. This loop thread is overfed in order to form the loops and then a final binder threads is twisted to stabilise the yarn.

Scaffold Yarns These consist usualy of a thread of worsted or cotton to which a filament yarn has been twisted. To save a twisting operation, the filament is usualy added on the spinning frame and allowed to wind on with the spun yarn.

Granderelle or Two Colour Twist Yarns. These are simply two different coloured yarns twisted together.

Three Ply Yarns. This type of yarn is very expensive but has the advantage of being able to create a special effect in fabric. For example two of the yarn could be Navy Blue while the third may be light blue. This creates a yarn which is two thirds dark and one third light. The resultant twist effect in the fabric is much softer.

Hook Twist Yarns. This is an economic way of producing a two colour twist effect in a single yarn. The method of manufacture is to run two different coloured rovings together and then spin. The finished yarn appears to be made from two different coloured threads twisted together.

Thick and Thin Yarns. These are different from the slubs yarns in that usualy the slub yarn has only thick places and the slubs are shorter than the thick places in a thick and thin yarn. Also the thick and thin places are longer 6" - 8" random in size and spacing.

Coloray Yarns. These are white yarns containing a mixed proportion of coloured rayon fibre, e.g. 3% red - 3% yellow - 3% Turquoise. They are used in piece dye fabrics and if for instance a fabric made with these yarns was dyed a medium grey it would contain a random fine scattering of red, yellow and turquoise.

Crepetail Yarns. These contain long loose tails spaced randomly and are used in the weft only. Usualy after weaving there is a tendency for part of the tail to stick out of the fabric. This is removed during shearing.

Trashy Yarns. These which are usually spun from 100% cotton or a blend of cotton with polyester have been very popular in recent years. They contain a lot of natural vegetable matter usually found in cotton fabrics where the yarn has not been cleaned properly. They are used mostly in all white fabrics for printing in one or two colour designs.

Pinpoint Nub Yarns. These contain very fine pinpoint nubs and may be in one, two or more colours. The nubs are usually fed in during blending and allowance has to be made for some loss during subsequent processing.

The number of fancy yarns available is only limited by the designer's imagination and it is usual to work closely with the spinner on the development of new effect yarns.

THE PLANNING, PREPARATION AND PRESENTATION OF SEASONAL FABRIC RANGES

The planning of fabric development work, scheduling of sample production and proper presentation of the new ranges when ready, must be done according to an organised schedule. Each textile market has its season or seasons when the cloth buyers are looking for the new fabrics which they will utilise in their new lines of garments and it is vital that the design studio has all new fabric samples swatched and ready for presentation at a time which coincides with the start of the buying season. If the new ranges are presented too early, very little interest will develop whilst a too late exhibition of new fabrics samples will result in disaster and a missed market.

There are perhaps six stages to the development and preparation of a new range of fabrics for any market. These could be listed as follows :

Market Investigation. This should be a continuing process of observation linked with good feedback from salesmen. After each selling trip a report should be received from the salesman concerned. This should detail customers ideas as regards the type of fabrics they are looking for in the future, what colours they feel will be popular and what type of designs they would like to feature. Often clips of fabrics which are creating interest are obtained by the salesmen and these are a valuable indication of market trends.

Getting and using good feedback from salesmen often creates quite a problem. Salesmen have a tendency to dislike the writing of reports, especially if they find that the people to whom the reports are directed, are not reading them. Regular meetings must be scheduled during the development period of a new range and salesmen should be present to give their comments and impressions. If at these meetings it becomes apparent that the designers are not taking note of sales reports, a very adverse effect can be expected. However if the importance of the information coming from sales is obvious then it can be expected to develop interest and the importance of the reports to the design studio will be realised.

Design ideas originate from a wide variety of sources one of which will be found to be the local market. It is also very neccessary for the designers to have the opportunity to occasionally accompany the salesman , meet buyers and consult with them regarding their needs. There is no doubt that the majority of successful styling innovations arise in response to the recognition of a user need of one sort or another. This is not to say that an original idea developed in the design studio should not be proceeded with. What it does mean is that when a new fabric is at the planning stage a monitoring of the market place should take place. This will discover if the need for it exists, theprecise nature of that need and the scale of demand.

The ideal situation to aim for is a continous interaction between the design studio and the intended market, with continous feedback from the various marketing and merchandising departments. Studies in Europe and North America have shown that it is those firms which have paid close attention to the marketplace which have survived the intense competition of the past decade . Failure on the other hand is associated with the "take it or leave it " approach to customers, or that the designer knows best. The leading and eminently successful designers produce what the customer wants, not what the designer prefers. Also, in this respect one should have no favourite colour but try to develop an equal appreciation of all colours.

As the market information is studied and analysed it must be considered with regard to the new range development and

evaluated against the limitations imposed by supply of raw materials, production machinery type and availability, and cost factors.

It will be generaly found in most markets that demand for styling and fabric desi,n can be divided into two main categories. Firstly there is the conservative element which is not influenced very quickly by fashion change and is very traditional minded. Then there is the acutely fashion conscious section of the garment industry which lives by a quick turnover of trend. Both must be taken into consideration when planning a new season ran e as they are both essential to a balanced production output and design programme.

To further complicate matters the designer has to try and anticipate fashion trends about a year ahead, so that those buying and planning in advance have access to patterns that will be in the shops about two seasons later. Rapidly changing life styles and technological advances in production techniques all contribute to the changing fashion scene. One of the big changes in the past decade is that certain properties in fabrics have become less important; durability, insulation and quality have been superceded by the concept of built in obsolescence. Cost has always been a very important factor but today it is certainly one of the more essential limiting features of fabric development. Profits based on reduced costs and efficient production should not be looked upon by the designer as hampering his work but should be regarded as representing a tremendous challenge to overcome with ingenuity and expertise the constraints imposed by the budget.

Defining fashion is no easy task. Basically it is a process of change which takes place in the way we live our livesand it occurs at all levels, from the buildings we live in, what and how we eat, how we are educated, what we read, the recreation we choose, the industries we develop, the way we travel, probably the most complete definition is Fashion is Lifestyle. It expresses changes in taste, changes in peoples wants and desires and changes which may come about suddenly or gradually. Certainly whichever way it happens it is part of an evolutionary process. It is part of society, a pattern reflective of its general economic, social, moral, political and philosophical condition. The word has probably become more synonymous with fabric, clothing and accessories because this is the area where changes can be most obviously expressed. So then what is the method employed to analyse and indicate a direction for a new line of fabrics. The first decision to be made is with regard to raw materials, and yarns.

Raw Materials & Yarns. Limitation may be set on the choice of raw materials either by the location of production units, certain raw materials being unobtainable in the country concerned or cost limitations may restrict the use of other types of fibre, yarn etc. Certainly every effort should be made to utilise fully raw materials freely available locally. All designers should be given the opportunity of exposure to the international fashion scene and in this connection there is no substitute for visits to international fabric exhibitions in order to evaluate trends and to keep abreast of the latest technolo ical developments in new materials and yarns. Technical magazines should always be available in the design studio giving current news on new fibre development, the availability and prices of the natural fibres and new trends in yarn and fabric design and manufacture.

A system often used in many design studios is to make each designer responsible for a number of customers and for any special designs or fabric types they may request. Working closely with the customers and sales each designer will by the begining

of each season have been able to form an idea of the types of fibre, yarns and fabrics he will be working on. The designer will then draw up a programme of proposed styling with samples of yarns and fabrics , an indication of any special fibre blends he suggests using and a selection of colours indicated for the coming season.

The Head Designer will then review very thoroughly each suggestion presented by the design team and evaluate these in light of his own ideas formed during recent visits tothe market place, visits to international fabric and design exhibitions, discussions and observation at shows presented by the major fibre producers and information provided by reports on fashion trends in technical magazines. He will then go over all the proposed development work with the Head of Sales and Merchandising. It will be obvious if the preparatory work has been done effectively and in close co-operation with clients and salesmen that quite a lot of planned styling will be utilising fibre blends of a similar type, yarn counts which are very close to one another and colours which probably only differ slightly in tone. Of course included will be one or two really outstandin and different ideas.

Preparations are now all complete for the first merchandise meeting to be held with the real object of planning the direction of fabric development work for the coming season. This meeting should be attended by the Head Designer, the Chief of Sales and Merchandising and all design and sales personnel. All people who will be present at the meeting should thoroughly brief themselves beforehand on the proposed agenda so that the meeting can proceed smoothly and without undue delay.

The essential feature of discussion apart from the forming of a work plan and schedule for sample production will be to decide on blends which will be used for the new fabrics, what yarn sizes will be required and to get a direction with regard to the trend in colour. Each designer in turn will present ideas for the new season so that they can be discussed, evaluated and duplication of work avoided. As mentioned above similarity in fabric character, yarn blend and size and also colour utilisation will most certainly be encountered. Therefore through discussion and mutual agreement the whole programme can be streamlined. As an example some suggested items which may be discussed are as follows :-

1) One of the designers after discussions with a client may be proposing to develop a line of polyester/cotton slacks in a blend of 65% polyester- 35% cotton. Another designer may have on the agenda an idea for a ladieswear fabric in a 70% polyester - 30% cotton. The yarn size for the 65/35 blend might be suggested as 1/16's cotton count while the yarn size for the 70/30 blend 1/12's c.c.

Obviously it is not neccessary to run both blends and both yarn sizes so what indications are there for modifications, and what changes should be made?. What are the advantages and disadvantages of the proposed changes?. Certainly 1/12's will be cheaper to spin than 1/16's but would the slightly coarser looking fabric woven be acceptable?. The two blends would finish with an almost identical hand so which one would be cheaper ? polyester is cheaper than cotton in some parts of the World at the present time, hence the trend towards 100% polyester fabrics. The 70/30 blend would perform slightly better in wear than the 65/35 blend but would the small decrease performance wise be acceptable.

The importance of discussions at this stage of planning for a new season can now be readily seen. A decision may be taken to run the 65/35 blend thus eliminating a blend. Then after considering the two yarn sizes it may be prudent to compromise if it was felt that 1/12's was too coarse for the finer fabric and spin 1/14's for both cloths.

Colour trends. The decorative aspect of a garment wether a solid colour or a fancy pattern has the initial impact on a prospective customer and not until closer examination does handle, quality and garment styling become apparent. It is therefore very important at the first seasonal merchandise meeting that colour trends are interpreted correctly. What are the sources from which an idea of colour direction can be gained. Firstly the big fibre producers in Europe and North America have presentations each spring, and Fall of new fabrics and ready made garments indicating there ideas on colour trend. Because of the impact these companies have on the major markets through television and magazine advertising it is wise to bear the colour forcasts made by them in mind. The way a lot of designers work is to make their own modifications of the indications they pick up durin their visits to various countries in search of new ideas.

2) Colour is a very important item for discussion during the first planning session and with all designers and sales staff present an excellent consensus of opinion is available and the outcome will be a very viable and harmonious range of colours with which to work. Again it will most certainly be found that several of the designers are thinking on the same line. Perhaps a burgundy is indicated as being a popular colour for the new range. However three different tones are suggested , this question can be resolved easily by the experience of the design team. Again a compromise may be necessary in which a new burgundy can be dyed containing a little of the characteristics of all three of the shades proposed.

3) A review of the previous season colours should be made at this point. These of course will be spring colours for the year before, if it is the spring range which is being planned. Sales information has to be available as to which have been best sellers and then decisions can be made as to what colours can be replaced and wether the ones retained are liable to continue to sell well. Colours which continue in the line and new ones which are introduced must be studied very carefully of course in order to ensure continued harmony and co-ordination.

Fabric design. The ideal situation for both designer and fabric manufacturer is where the pilot plant development and sampling unit is a minature version of the actual production department. This will help streamline the process from production on paper to the finished fabric. Also any problems encountered in sample production can be eliminated before the new range of designs is released for production. To be a really successful designer it is necessary to aquire a wide technological knowledge as well as an artistic ability. With the increased sophistication of machines, yarns and finishing techniques as well as computer aided design systems a thorough knowledge in all the spheres of production is essential. The designer has the connecting role between, raw material selection, spinning, weaving, dyeing and finishing and marketing. It is his responsibility to create designs which are compatible with the machinery which will be eventually called on to produce those designs in long production runs. It is also very important to always consider built in cost reduction factors where possible in new designs.

4) In the merchandise meeting it is proposed to make a Glen Check with a 1" ground and a 1" overplaid section. However checks of this type it is felt will be very popular for the coming season. Two more sizes are discussed 1⅛" x 1⅛" and 1¼" x 1¼". Will the middle size serve both prospective sales areas and if so will it be then an advantage to make a very small one, say ⅜" x ⅜" to compliment the mid size check. All these questions are put forward as examples of

subjects for discussion. What would be the result of having a 1" x 1" Glen Cneok and a 1½" x 1½" Glen cheok amongst the new designs? Obviously the size difference does not warrant the weavin, of both designs. However if the cheoks were made they would probably both sell. Then suppose orders were received for 600 pieces of the smaller oneok and 400 pieces for the one slightly larger. The two orders would have to be handled separately in both warping and weaving. If only one of the designs had been shown, then the 1000 pieces sold would be a much more economical production run and yield a bigger profit. This illustrates an essential part of the designer's responsibility and the way a good design team can reduce costs considerably.

5) As in the case when the new colours were selected for the upcoming season, a complete review of last season's desi ns must also be made. Quite often good designs will run for several seasons. Others which are begining to loose their popularity may have their market life extended by being re-coloured. Also desi ns which were styled specifically for a fall season may prove to be good sellers in Spring tones and vice-versa.
6) What type of design is going to prove to be the most popular in the coming season? Stripes were in big demand last season, will they continue? If so will they be the same width, narrower or wider? Will the contrast in colours be more pronounced or will it be softer and more muted? As the meeting progresses it will be suprising to see the similarity of ideas emerge, especialy if the market research has been done diligently in the begining.
7) Between seasonal development programmes designers will have been working on new experimental fabric constructions, the testing and evaluation of new fibre blends and yarns and also trying out new finishing procedures. Now this work should be presented for discussion with the idea of including any suitable items in the new line. Some of the developments may be exactly right while others may need further modification. Or it may be that there is uncertainty about a particular fabric in which case it may be neccessary to visit one or two customers with it and get a further reaction.
8) As the merchandise meeting progresses and the new line of fabrics begins to take shape it will most certainly be found that there is a surplus of projected designs over and above the actual number required for presentation. In deciding which styles should be left out it is neccessary to consider several points. Firstly the new range must be well balanced with plain fabrics, semi plain fabrics and fancies in equal proportions. Secondly when several different types of production machinery are available in the manufacturing plant designs must be chosen which will ensure balanced production runs. It is no good having some of the machinery over sold whilst the other is short of work. Finaly a very important consideration in deciding what to include and what to leave out, some types ofdesign because of ease of manufacture etc. are high profit items and therefore they have priority of selection.

The first meeting will now be almost complete. Decisions have been made regarding the choice of raw materials, colour trends and types of design to be worked on. Now a production schedule must be drawn up for sample manufacturing and a deadline set when all the new fabrics and styles will be ready for presentation.

Planning and Scheduling Sample Production

At this stage each salesman must present an estimate of the amount of sample fabric he will require in each of the new designs to be made. This must include material for making sets of sample swatches and also sample fabric lengths for the making of model garments. These estimates provide the basis for working out the amount of raw material, yarn and cloth required. Then a manufacturing schedule can be drawn up, priorities given and a deffinate timetable established for the production of the new line.

For example it will most probably be found that some yarns carried over from the previous season, will be in use in the new line. So designs using these yarns can be drafted out and warping commence right away. Designs requiring new yarns will come a little later in the schedule when they have been spun and evaluated. Some piece dye fabrics may contain designs which are to be used again. Grey fabric if available must be dyed up in the new colour range. If no grey fabric is available, manufacturing can proceed with this immediately.

The complete sampling schedule cannot of course be finalised at the first meeting of the season however as the person responsible for the planning must consult with the Spinning Manager and the Dyeing and Finishing Manager. This is in order to have their opinions regarding the timing of work to be carried out in their respective departments. Finaly after the first meeting, a series of weekly merchandise meetings must be planned up to the time that all the new fabrics are ready for presentation. These weekly discussions will review all designs as they are finished, decide on their suitability in the light of the market at which they are aimed and recommend any necessary changes.

It cannot be emphasised too strongly that the procedures outlined so far are the ones likely to succeed in providing the right information, the exchange of thought and the proper stimulation, so that the development of the new range of fabrics is at all times related to market requirements as closely as possible. It also keeps everybody concerned both in designing and sales fully informed on progress, problems encountered and efforts being made to overcome them. Additionaly any changes which may occour in the market may be reacted on immediately.

Presentation

As preparation of the new fabrics progresses plans mustbe made for the final presentation to prospective clients. The type and scale of the presentation of course will depend on the company or organisation involved. It should be pointed out however that it doesn't matter how fantastic a range of fabrics is, it will not sell unless it is shown to it's very best advantage. The way in which styles are shown is vital to the image which a company or organisation wishes to project in the market.

Some comments may be appropriate at this time on the selection of suitable designs after all the ranges have been woven or knitted in blanket form. As blankets or section ranges are cut into swatches they must be numbered very carefully. Detail on the method of numbering blankets will be given in the section on "Administration in the Design Studio". It is important that all swatches are cut so that they may be examined independent of their neighbour. After examination the best designs are selected and the less attractive ones rejected. These should be filed for future use. There is no real criterion for the decision as to which is a good design and which is bad. These ideas change with time, and are influenced by many factors. however the designer should work with the salesman during the selection. The salesmen is the market contact and should have a feel for what is liable to be a good selling design, whilst the designer should not only have his finger on the pulse of the market but also be able to give a guide as to which of the

selected styles has caused sample manufacturing problems, which may be magnified and further complicated in subsequent large scale production.

If any particular design has caused production snags and the salesman thinks that it may be a particular big seller, it must be put aside for further evaluation. Every attempt must then be made to solve the manufacturing problems involved. No style should ever be released for selling unless it can progress smoothly through all phases of manufacture without causing bottlenecks. Problem designs are the ones which can turn a profit situation in the manufacturing area quickly into a loss.

In selecting designs a lot of experience is involved. There are however one or two guidelines. When working on yarn dyed fancy styles, the object should be to arrive at 4 or 6 well balanced patterns in each design. Checks or stripes, shadows or any other feature of decoration should have the same strength in relation to the ground colour in each of the 4 or 6 selections made in one single style. Vertical direction designs are usually preferable to horizontal ones although there is always the exception to every rule. Fabrics with a light warp and dark weft are usually preferable to ones with dark warp and light weft. Any slight imperfections tending to show in the warp direction in the former. Slightly elongated checks are preferable to square ones and narrow stripes have always enjoyed a slight preference over very wide ones. However as we are dealing in fashion and fashion is change, this may be completely different tomorrow. So it amounts really to what has been said before many times, know your market and your production machinery and its limitations and use this information intelligently when selecting new designs.

Colour co-ordination should be a priority in the selection of the styles to be included in the new range, and this theme should be evident throughout. This will have a big impact on sales as when a new line is presented in this way a customer can buy fabrics for slacks, shirts, blouses, dresses, suits and sportscoats all from the same source in a colour co-ordinated package, then it is to his advantage to do so. All print designs for apparel should be done in colours which either match or harmonise with the solid shades used in dress and leisure wear fabrics. Printed sports shirts should be coloured to compliment the tones used for slacks, printed blouse fabrics should accent the colours used in fabrics which are intende for skirts etc. This co-ordinate theme lends itself to all types of fashion fabrics wether prints or solid colours wether it be apparel, upholstery or soft furnishin e. One of the more recent examples is for weavers and knitters of soft furnishings, working with the manufacturers of wallpaper and other wall coverings to produce matching designs in planned colour themes.

After selection of the new range is finalised presentation of the line must be worked out. The presentation may be of a modest nature or it may be in the form of a big exhibition or fashion show, depending on the circumstances. In the case of small organisations the emphasis must be placed on neatness and colour. All samples have to be prepared in swatches for showing. These samples may be small (9" x 12"→ or may take the form of a large feeler, the full width of the fabric often folded double, with the various colour ways shown in smaller swatches along one edge. Care must be taken in the choice of backing, binders and choice of printing style for any information, name of organisation, trade-marks which may be used in the presentation. This can add very much to the overall effect if treated in a neat and attractive manner. While carelessness in this direction can create a very poor impression. Size of swatches often depends on what a salesman can carry, wether selling is carried out from showrooms, how much travelling is involved etc. Often sample garments can be prepared as these will have a better impact, the customer being able to see immediately the effect the fabric will create in a garment. This

method of presentation is quite often resorted to when a brand new type of fabric, perhaps containing a new fibre, blend or yarn is to be marketed.

The larger companies and organisations often resort to either a special exhibition, inviting customers to a reception in their showrooms and a special presentation of their new season's line, or hiring space in one of the larger hotels to give a fashion show with representatives of the press, T.V and radio present as well as prospective customers and prominent members of the public. This type of show not only creates big interest amongst buyers and garment manufacturers but helps promote the new fashions to the general public as well due to the coverage given by the news media. One of the most famous of these is a well known "Breakfast Show" which is held in New York to present the lates fabrics of one of the leading American textile manufacturing companies. This is a top presentation with both a fashion and stage show written around a particular theme. Top T.V., Screen and Stage personalities are in attendance and all the guests are served breakfast, the show starting early in the morning and running for several hours.

Another more modest show seen in South America involved the services of only 3 models and three projection screens. The screens were white panels about 54"/137cm. wide set side by side about 98"/2½m. apart. A projector was in use which could screen 3 colour slides at the same time. In a darkened room a picture of draped fabric was shown on the left hand screen, a second slide showing a model wearing a garment made from the fabric was shown on the centre screen and a close up of the cloth showing details of the design was projected on to the right hand screen. After a few seconds in which buyers were able to study the fabric and design, a spotlight switched on centre stage and the model shown on the centre screen appeared live. This show was very effective and demonstrates what can be done to really promote a new range of fabrics without an expensive outlay. Even when advertising is limited by a restricted budget some very attractive and novel presentations can be planned with a little initiative and imagination.

To overcome the problem represented by a large cash outlay some companies combine their resources in introducing their new designs to the market. This is usualy done where the companies concerned do not have overlapping interests. For example a cotton manufacturer may join with a worsted manufacturer and a knitter in a special promotion project.

The seasonal cycle is now complete, the new range has after careful planning and preparation been presented and marketed successfuly, all details have been handed over to manufacturing for a smooth production run and the design studio must turn once again to the planning and preparation for a new season.

ADMINISTRATION IN THE DESIGN STUDIO

The subject of administration in the design studio is one which is sometimes neglected especially where stress on the importance of artistic ability is put. However the neccessity for an efficient, competent and methodicaly detailed administration system cannot be stressed too much. The keeping of accurate records and thorough checking and double checking of work is an absolute must if drastic and expensive mistakes are to be avoided.

There are many system used to control the work in the design studio and it would be impossible to cover all of them, however a general outline can be given of what is needed in order to ensure a smooth and rapid flow of work. Records have to

kept of every stage involved in the produotion of a new design or fabric. It is not only important that a design be graphed properly and the correct colours used but also every detail in the records, regarding raw materials, yarns, finishing prooedures etc. be absolutely correot. To illustrate the methods use to progress a design through the studio and ensure accurate reproduotion arterwards in the manufacturing area it is best to study each fabric development stage:

1) Raw Materials. An accurate record of all raw materials used, must be kept in the design studio. This usualy consists of a simple numbered file detailing the blend, what it consists of percentage wise and the fibres used, quality, type, fibre length and denier. All information must be available for future use. If a change occurs at any stage in the blending then the information must be recorded immediately. It is suprising how a simple mistake in recording a blend change can cause thousands of yards of fabric to be made wrong. A slight difference in fibre quality or the wrong denier being used will give the finished fabric a completely different character.

2) Yarns. Files have to be kept of all yarns used in fabric development. Usually coloured yarns and white yarns are filed separately. The yarn size (count), turns per inch/cm. wether the yarn is single, two ply etc. and the blend used to spin the yarn. Some systems employ a code which gives the yarn size as well as the yarn number. For example 228006 could be used to indicate that the yarn is 2/28's shade 006. Each season yarn sample cards must be prepared showing the colours and types of yarn which will be used in the new fabrics. It is essential that these cards are accurate and up to date. They must not contain samples of yarns used in previous season which are now obsolete or these old yarns will get used again by accident and cause problems. Some design studios use names instead of numbers to describe the yarn colours and this can be very useful in helping designers to memorise the different shades. It is helpful to arrange the yarn shade cards in groups acoording to the way they will probably be used in fabrics. For example greys, graded from dark through light will be together, blues the same, browns, greens etc. Also it is the custom to wash the yarns in hank form before wrapping them on sample cards in order that a true representation of the colour is obtained. Attention to small details such as this all help the smooth opperation in the design studio.

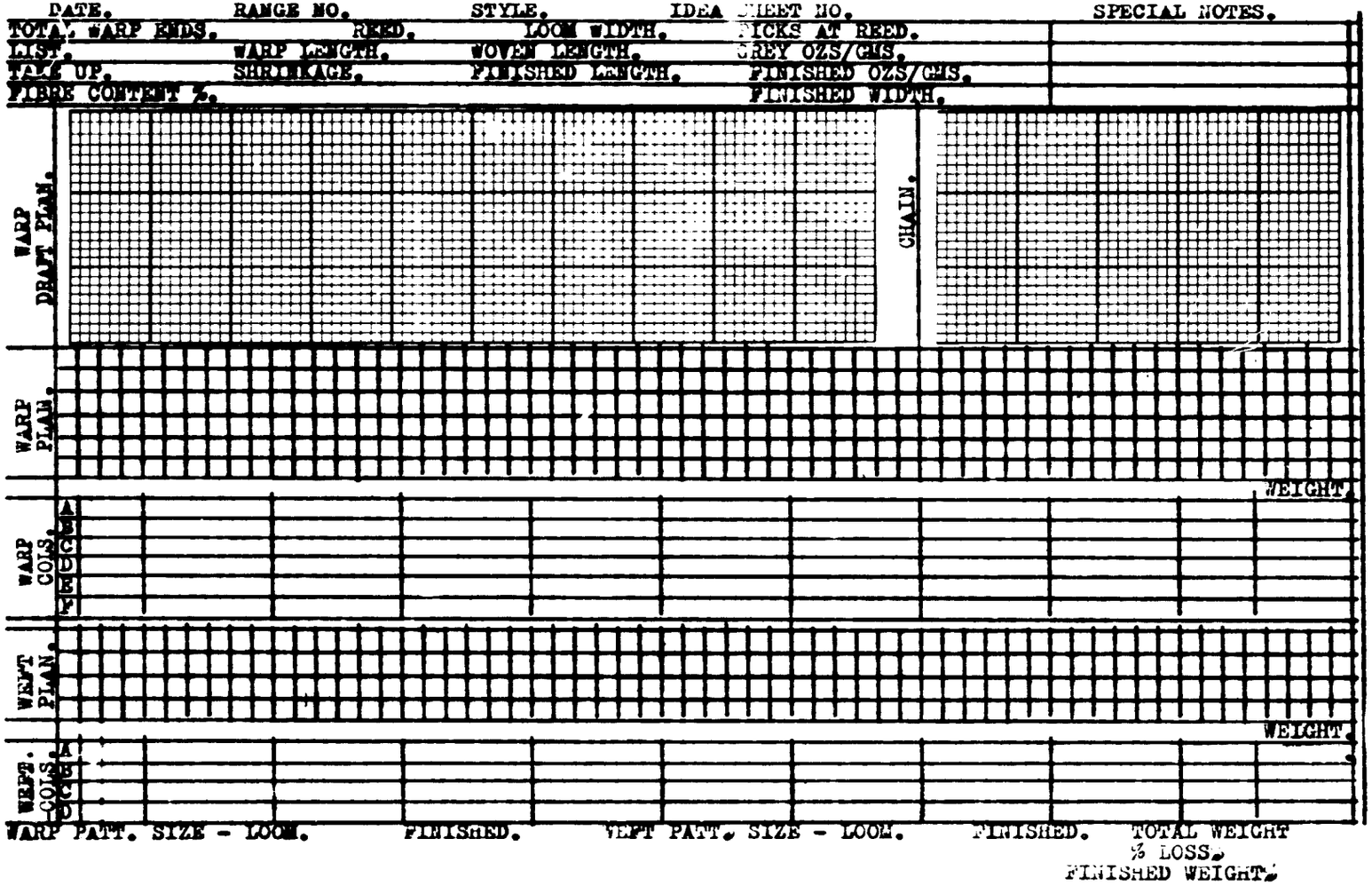
3) Development of New Designs and Fabrics

Every minute detail in the progress and development of a new design must be kept carefully in the records. For instance it is neocessary to know where a certain idea originated. May be it was requested specially by a certain customer as an exclusive style. If this information is not on record the finished fabric may be marketed as a general item causing a loss of goodwill even if not the loss of a large order. So a file recording idea sources, the salesman and customer concerned and the date it was presented to the design studio is kept. This is cross referenced to the range sheet.

Range sheets come in all sizes and types, however they must record all construction details for the fabric in question. A typical example of a range sheet is shown on Page 78 and this contains the following details :

a) Date quite often overlooked but essential. One important use is to serve as a reminder to the designers after several years as to the last time a certain style was in fashion.

b) Range Number This is simply a number to identify the new design. A lot of different systems are used. It is common however for the design office to have two numbering systems


DATE.
RANGE NO.
STYLE.
IDEA SHEET NO.
SPECIAL NOTES.
TOTAL WARP ENDS.
REED.
LOOM WIDTH.
PICKS AT REED.
LIST.
WARP LENGTH.
WOVEN LENGTH.
GREY OZS/GMS.
TAKE UP.
SHRINKAGE.
FINISHED LENGTH.
FINISHED OZS/GMS.
FIBRE CONTENT %.
FINISHED WIDTH.
WARP DRAFT PLAN.
CHAIN.
WARP PLAN.
WARP COLS.
WEIGHT.
WEFT PLAN.
WEFT COLS.
WEIGHT.
WARP PATT. SIZE - LOOM.
FINISHED.
WEFT PATT. SIZE - LOOM.
FINISHED.
TOTAL WEIGHT
% LOSS.
FINISHED WEIGHT.

for recording the progress of each new style. When a new range goes into production in the sample and design area it carries one number to identify it up to the time that it is finished and the different colourways have been selected. Then it is renumbered with a quality number for production and sales control. The reason that a new number is necessary is because as the new designs are finished and evaluated some ofthem will be rejected as unsatisfactory. Those thrown out leave gaps in the numbering sequence and new numbers are given running consecutively, this avoids confusion. Also a good system to employ is to number the styles in groups according to the fabric type and weight. As an example the following list gives a short extract from a typical system :-

Quality.	Weight.	Type of Fabric.
1000 - 1499	5/6 ozs. 155/185 gms.	) Piece Dye Fancy Weaves Shirting.
1500 - 1999	8/9 ozs. 250/280 gms.	) Piece Dye Fancy Weave Dress Fabric.
2000 - 2499	9/10 ozs. 280/310 gms.	) Yarn Dye Fancy Suiting & Slacks Fabric.
2500 - 2999	11/12 ozs. 340/370 gms.	) Piece Dye Fancy Weave Slacks Fabric.
3000 - 3499	13/14 ozs. 400/430 gms.	) Yarn Dye Fancy Suiting & Slacks Fabric.
4000 - 4499	15/16 ozs. 465/495 gms.	) Fancy Piece Dye Furnishing Fabric.

This list can be modified and extended to suit any size of production unit and the big advantage of this type of system is that the number of each fabric provides ready identification to the fabric type and weight, at all stages of production.

c) Style or Style Number. When a new design is being made, it is usual to make it in the form of a series of warp sections and then try out various wefts across it. This applies wether the new designs is to be made in coloured yarns or made in all white and piece dyed. In the piece dye style each warp section usually represents one design with variation being obtained by different drafts, a change of pattern chain, or a combination of both. The warp setting of all the designs which are combined together in this way must be suitable as to accomodate the interlacing of each different weave without producing a too tight or too slack fabric. Also in piece dye section ranges or blankets, it is customary to weave each design change and all the different wefts for the yardage required, and then repeat the process several times to correspond with the number of colours which will be dyed. In other words if it is planned to dye six different colours then all the different chains and wefts which make up the pattern range, will be woven six times over, always in the same order. While extra special care must be taken in the planning, layout and numbering of every style in every range, it should be stressed that piece dye styles are much more difficult to identify after dyeing and finishing and therefore should be treated with extra care.

The number of warp sections in each style range is planned according to the size of finished sample required. If for instance 10 sample setts were required of 9" wide x 6" long and the fabric being woven finished at 54"width, 6 warp section would be made. To make 10 sample setsabout 65"/70" of each weft would have to be woven. This would allow for loom take up and waste.

Of course the number of warp sections and the number of wefts woven in each sample can be varied. The size of the warp sections will vary according to the width of the loom and wether a large swatch is required, or wether a very small 2"/3" sample would be sufficient to see what the new

design looked like. The number of wefts used will depend on the number of colour crossings required and the number of pattern chains which will require to be tried out.

The numbering of warp sections and wefts woven is very important and mus be done accurately and systematically. The different section in any new sample will be numbered during weaving according to the way the designer has laid them out on the pattern sheet. It is only neccessary to number each warp section at the begining and each weft section at one side but the marking must be in indelible marking fluid in order that the numbers are not washed our in finishing or covered up in dyeing. A simple but effective numbering method is illustrated below :-

Warp Sections

Weft Section	1	2	3	4	5	6	7	8	9	10
10	1/10	2/10	3/10	4/10	5/10	6/10	7/10	8/10	9/10	10/10
9	1/9	2/9	3/9	4/9	5/9	6/9	7/9	8/9	9/9	10/9
8	1/8	2/8	3/8	4/8	5/8	6/8	7/8	8/8	9/8	10/8
7	1/7	2/7	3/7	4/7	5/7	6/7	7/7	8/7	3/7	10/7
6	1/6	2/6	3/6	4/6	5/6	6/6	7/6	8/6	9/6	10/6
5	1/5	2/5	3/5	4/5	5/5	6/5	7/5	8/5	9/5	10/5
4	1/4	2/4	3/4	4/4	5/4	6/4	7/4	8/4	9/4	10/4
3	1/3	2/3	3/3	4/3	5/3	6/3	7/3	8/3	9/3	10/3
2	1/2	2/2	3/2	4/2	5/2	6/2	7/2	8/2	9/2	10/2
1	1/1	2/1	3/1	4/1	5/1	6/1	7/1	8/1	9/1	10/1

In a blanket or pattern range where wefts are woven to match the warp it is usual for number 1 weft to go with number 1 warp, two with two and so forth. When this is the case the sections numbered 1/1, 2/2, 3/3 etc. are known as the true sections and usual turn out to be the better balanced section fo selection purposes.

It should be stresses that the simplicity of the numbering system should not detract from its importance in the efficient running of the design studio. In the above example with 10 warps and 10 wefts, one hundred different small samples would be woven. When these have been cut up and are ready for selection it can be imagined what a mix up there would be if mistakes had been made in the numbering. This work is often treated by designers as insignificant however if a sample is numbered wrongly and gets out to the market it can result and has done many times, in hundreds of pieces of fabric being woven wrong.

d) Idea Sheet No. The idea sheet is a file of the origin of a design idea. It is neccessary to keep track of samples sent in by salesmen and customers. For example if a customer as a special idea in mind and sends a clip of fabric in it is essential that the design resulting from that clip is reserved for that particular customer.

e) Special Notes. This space on the rang sheet is reserved for any special process or finishing procedure or anything out of the ordinary which must be taken particular note of.

f) Total Warp Ends. This is found by multplying the ends per inch or ends per cm. by the reed width and includes the ends which are used in the list or selvedge.

g) Reed. Several different reed numbering systems are in use in the various countries throughout the World. The most common is where the reed number indicates the number of dents or spaces in one inch or one cm. The reed number shown on the range sheet must be followed by the number of ends required in each dent. For example 16 x 2 Reed in the dents per inch system would indicate a reed with 16 dents per inch and 2 ends in each dent. This would give 16 x 2 = 32 ends per inch. Then if the reed or loom width was 64" the total warp ends would be 32 x 64 = 2048. Likewise if the reed was 6½ x 2 in the metric sytem this would give 6½ x 2 = 13 ends per cm. With a reed width of 160 cm. the total warp ends would be 13 x 160 = 2080.

h) Loom Width. This is the width in reed and is decided by the designer according to how wide he wants the fabric to be after it is finished. Careful records are kept of every fabric which is made. These show the grey or greige particulars, after the fabric comes out of the loom. That is the grey width, grey length and the grey weight per yard/meter. After finishing the same particulars are recorded, finished width, finished length and finished weight. When the fabric goes into production the same details are noted of every piece manufactured. Averages are worked out for each batch of pieces going through the manufacturing unit and any deviation from the average is reported to quality control, for investigation. The designer relys on experience and the past performance of similar fabrics in order to decide on the loom width. If the new design is completely unfamiliar then the interlacing of the weave must be studied, the materials used in the construction of the new fabric, taken into consideration and then a loom width decided on. As the first sample produced, will be experimental, the width in loom is then adjusted afterwards if neccessary before bulk production starts. In production any variation in width, length and weight at either grey or finished stage indicate that problems are being encountered at some stage of manufacturing. Quality control will conduct an immediate investigation in order to locate the problem and correct the situation.

i) Picks at Reed. This indicates the picks per inch/cm. required in the loom. When the loom has been set up and a few inches woven a count is made to make sure the loom has been adjusted properly and is putting the correct number of picks into the fabric. The count should be made as close to the reed as possible, as the cloth relaxes as it moves away from the beat up point and will gain at least 1 pick and sometimes more.

j) List. The list or selvedge which serves many purposes is basicaly to enable to fabric to be handled easily during finishing although some fabrics are made without selvedge. The weave for the selvedge may be the same as the ground weave of the cloth or it may be different. A lot of experience is required in designing good selvedges, especially in such fabrics as gabardines which have a tendency to curl over or roll at the edges if the selvedge is not exactly right. There is also the Name Selvedge which requires special designing. This consists of writing along the edge of the fabric formed by an extra warp usualy of filament or mercerised cotton. The words usually indicate a company trade mark or the contents of the fabric, or both. The number of ends used to make the list, are deducted from the reed width before working out the balance of the design. For example if a ½" selvedge was required on each side of the fabric with 32 ends per inch, the selvedge would consist of 16 ends each side. It is customary and a safe idea to indicate when showing the total warp ends wether they include the list or not. In the example given at (g) above the Total Ends 2048 would be written as 2048 including list. If no list was required on the fabric it would then be shown just 2048.

k) Warp Length. The length of the warp varies according to the type of fabric being produced in plants where a large variety of cloths are manufatured. In designing and sample production it is calculated according to the number of wefts whoi will be woven. If 60 different wefts were to be put into the sample with 18" woven of each, $\frac{18 \times 60}{36}$ = 30 yards. However to this amount must be added take up in weaving which varies according to the weave and count of the weft. Then an allowance must be made for waste and the fact that a warp cannot be woven right out. There will be 1½ to 2 yards left at the completion of weaving stretching from the fell of the cloth to where the warp is fastened to the warp beam. Take up as mentioned before is based on experience and the observation of what happened when previous fabrics of a similar type were woven. For a plain weave in medium size counts, 5% is a good figure to use. This would increase with finer counts and more interlacings per inch/cm. So 30 yards weaving plus 5% would give 31½ yards and then a further 2 yards added for waste would be 33½ yards. As most small warping machines for samples opperate on a minimum of 5 yards multiples a 35 yard warp would be made in this instance. However it is always better to have a little extra on sample warps so that if changes are necessary in the loom or extra trials are required there is sufficient warp length for these to be woven.

In a production unit the question of warp length is a different matter. For greatest efficiency the longer the warp the less loom changes are required and greater the savings in cost. Different plants have different piece lengths, but for the production of lightweight fabrics and certain medium weights up to about 14/15 ozs. - 390/425 gms. 100 yds./meters is a very convenient length to work on . The warp length is then a multiple of the number of pieces required, 10 pieces = 1000yds/meters warp length. To keep costs as low as possible beams are used with the largest flanges possible in order to get as many pieces on one beam as possible. However one factor must be born in mind, pieces have to be shortened has the fabric weight goes up e.g a 100 yard piece at 14/15 ozs would weigh about 90 lbs. The same piece in a 35 ozs. upholstery fabric would weigh approximately 218 lbs. As the fabric as to be handled manualy during examination and mending the heavier weight fabrics are usualy divided into 50 yd./ meter pieces. This information can only be given as a general guide, because even now mechanical handling systems are being introduce which allow more pieces to be woven together and not separated until they reach the finished warehouse.

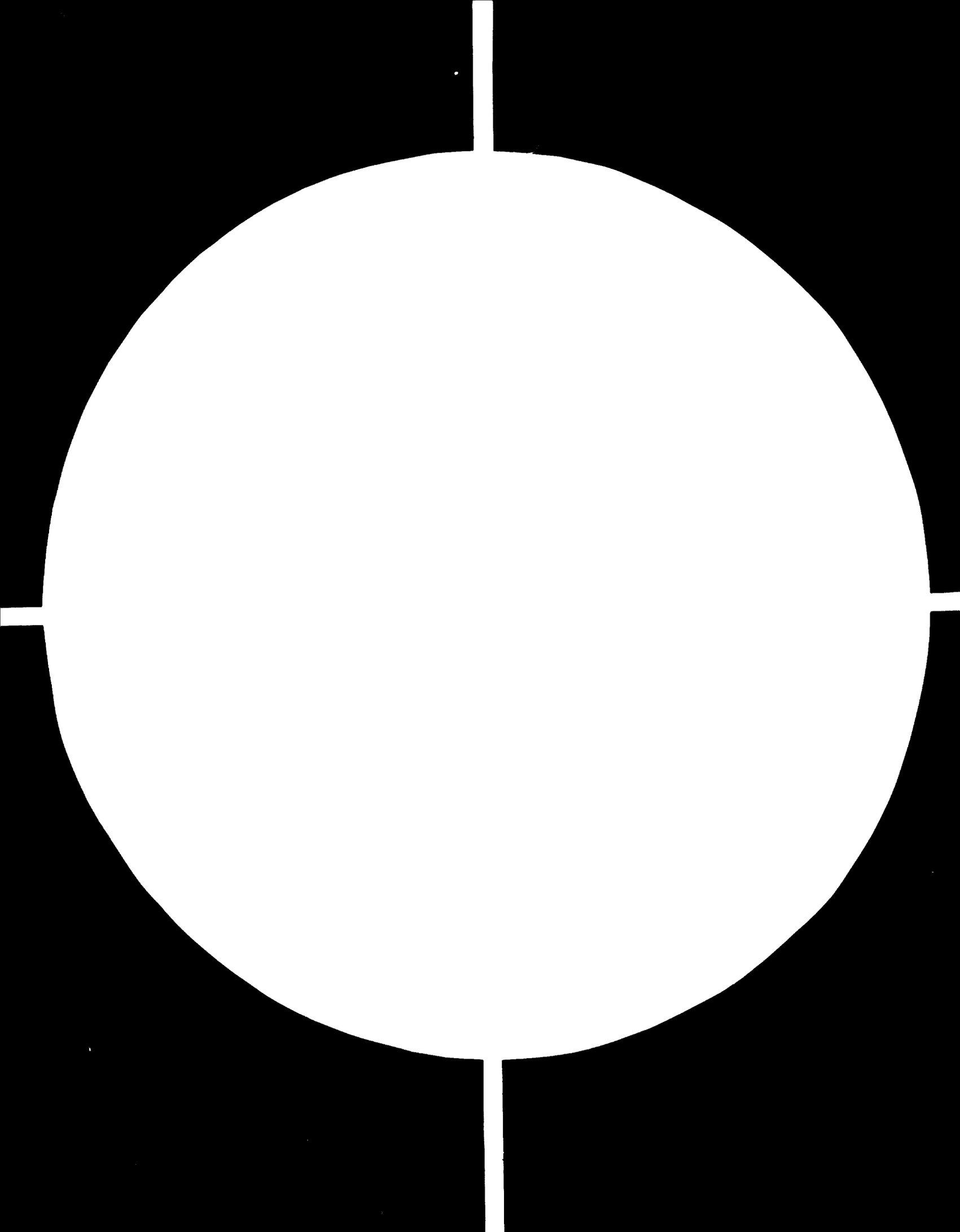
l) Woven Length. This is directly related to the picks per inch/cm. and the weave. The more picks and interlacings there are, the greater will be the take up and the shorter the length of fabric woven. Again experience is the deciding factor in a completely new fabric. However after a sample has been woven, careful measurements are taken and the percentage take up calculated. Then this gives an accurate guide for production. However as with the width, woven length should be watched carefuly and any discrepancies investigated.

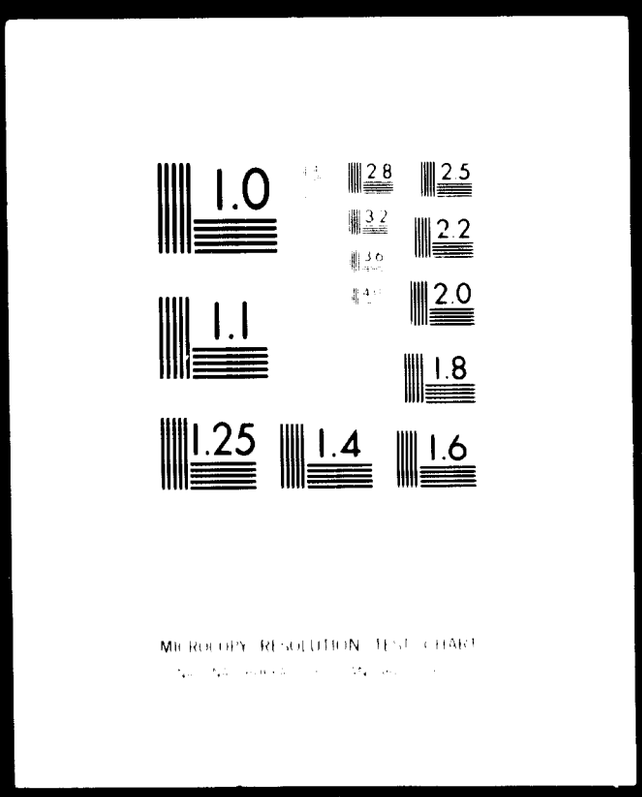
m) Grey Ozs./Gms. To calculate the Grey Weight per Yard/Meter, the total of the weights of warp and weft required to weave the cloth, is divided by the woven length.

n) Take Up. expressed as a percentage this is the amount that the warp shortens as the threads bend to interlace with the weft. For example if a 100 yds./meters warp was in a loom and the take up was 7% it would only be possible to weave a piece with a grey length of 93 yds/meters. Figures for take up are carefully recorded and any variance must be immediately checked. It could indicate a problem , either wrong number of picks, wrong size of yarn used in weft, or even a piece dressed short in length.

C-700

78.12.13





o) Shrinkage. During finishing the fabric will shrink and the amount of shrinkage is dependent on many factors. Raw materials, type of weave, and finishing procedure all can either increase or decrease the amount of shrinkage. The figure is expressed as a percentage and is obtained in the first place by careful observation and measurement as a new design progresses through the various stages of manufacture. Past experience will give a guide as to what amount of shrinkage will occur. The difference between the grey length and finished length is the amount of shrinkage. After this has been established there should not be a big variation in future production. Again, if substantial differences are observed quality control must make an immediate investigation to establish what changes in processing or raw materials have caused the differences.

p) Finished Length. To arrive at this figure the percentage of shrinkage is deducted from the woven or grey length, e.g. a 93-yard/meter grey length with a 5 percent loss in finishing would give an 88.4-yard/meter finished length.

q) Finished ounces/grams. In calculating the finished weight of the fabric the total of the warp and the weft weights are taken and a percentage deducted for loss during finishing. Again, percentage loss during the finishing process varies with the type of fabric and must be arrived at by a careful recording of how each type of cloth performs. After the percentage loss has been deducted the weight of the finished fabric is divided by the finished length to arrive at the finished weight.

r) Fiber content %. The percentage of fiber in each blend used to spin the yarns for a new fabric must be recorded. Then a calculation is made based on the grey weight of the fabric so that the exact amount of each fibre component can be expressed and quoted. In most markets throughout the world these figures have to be made available to customers because due to labeling regulations the fiber content must be shown on all garments. A typical calculation is given:

	Weight
A fabric is made with	
WARP 2/36s 55% Polyester/45% Wool	32.8 lbs
2/60s Mercerised Cotton	2.1 lbs
	34.9 lbs
WEFT 2/30s Slub 50% Polyester/	
40% Wool/10% Silk	16.3 lbs
2/30s 55% Polyester/45% Wool	16.8 lbs
	33.1 lbs
Total overall weight	68.0 lbs

The following calculations are done to determine the % weight in each yarn:

WOOL			POLYESTER		
$32.8 \times \frac{45}{100}$	=	14.76 lbs	$32.8 \times \frac{55}{100}$	=	18.04 lbs
$16.3 \times \frac{40}{100}$	=	6.52 lbs	$16.3 \times \frac{50}{100}$	=	8.15 lbs
$16.8 \times \frac{45}{100}$	=	7.56 lbs	$16.8 \times \frac{55}{100}$	=	9.24 lbs
Total wt. of wool		28.84 lbs	Total wt.of Pol.		35.43 lbs

As the cotton yarn is 100% the weight of cotton is 2.1 lbs.

Weight of silk	$16.3 \times \frac{10}{100}$	=	1.63 lbs
Percentage of wool	$\frac{28.84}{68.00} \times 100$	=	42.41%
Percentage of Poly.	$\frac{35.43}{68.00} \times 100$	=	52.10%
Percentage of Cotton	$\frac{2.10}{68.00} \times 100$	=	3.09%
Percentage of Silk	$\frac{1.63}{68.00} \times 100$	=	2.40%
			100.00%

If the calculations have been done correctly, the percentages should add up to 100

In some markets fiber percentages under 5% arenot required to be shown, but as each country has different rules and regulations it is up to the designer to clarify this matter for himself.

e) Finished Width. All fabrics are made to finish to certain standard widths according to the markets and end use. For example, ladies wear fabrics are usually finished 54"/56" wide, 140 cm. Worsted suitings are 58"/60" wide, 150 cm. Therefore, when calculating the specifications for a new design the fabric is given such sufficient width in the loom to finish at the correct width for the market in question. The designer, by experience, should know what loom width to use for most common fabrics. When something entirely new is being prepared for sampling the width in loom and finished must be noted very carefully. After the sample has been finished adjustments can then be made in order that production pieces will be correct should the sample have come up too narrow or too wide. It should be noted that if a fabric finishes too narrow problems are caused when the maker-up is cutting out garments. Fabrics which finish too wide cause wastage and loss of profit.

t) Warp Draft Plan and Chain. This area on the range sheet is for marking the draft with the full design and the sley plan, with the appropriate chain which will weave the required design.

u) Warp Colors and Warp Plan. In the column marked Warp Colors on the range sheet the counts and color of each yarn are listed and given a code letter A,B,C,D,E,F. Due to lack of space the example range sheet given had to be compressed somewhat and it is recommended that eight spaces A-H be used, together with eight spaces to correspond in the warp plan. After the colors have been listed the warp plan is laid out using the coded letters. This saves time in having to write the colors out twice and also saves space. The eight columns in the space under the warp colors allow for eight different colorways to be used and theweight of each color is on the extreme right.

v) Weft Colors and Weft Plan. As with the warp colors it is recommended that eight spaces A-H be also allowed for weft. The weft colors and plan work in exactly the same way as the warp with the weight of each color on the right.

w) Warp and Weft Pattern Size, Loom - Finished. The warp pattern size is calculated in the loom by dividing the warp repeat by

the ends per inch/cm. The finished size of the warp pattern is then worked out by dividing the loom size by the reed width and multiplying by the finished width, see example below :

A new design is made with a repeat of 64 ends in the warp, it is 68"/173cm. in the reed and finished 56"/140cm. wide, and there are 36 ends per inch, 14 ends per cm. in the loom.

Warp Patt Size Loom = $\frac{64}{36}$ = 1.78" $\frac{64}{14}$ = 4.57 cm.

Warp Patt Size Fin. = 1.78 x $\frac{56}{68}$ = 1.47" 4.57 x $\frac{140}{173}$ = 3.7 cm.

The weft pattern size is calculated in the loom by dividing the weft repeat by the number of picks. The finished weft pattern size is then obtained by dividing the answer by the grey length and multiplying by the finished length, e.g. :

If the above design had a weft pattern repeat of 72 picks, was woven with 34 picks per inch, 13 picks per cm, the grey length from 100yds/meters was 96 yds/mtrs. and the finished length was 92 yds/mtrs. then the calculations would be:

Weft Patt Size Loom = $\frac{72}{34}$ = 2.12" $\frac{72}{13}$ = 5.5cm.

Weft Patt Size Fin. = 2.12 x $\frac{92}{96}$ = 2.03" 5.5 x $\frac{92}{96}$ = 5.3 cm.

The purpose of calculating the pattern sizes is to check on the correctness of the design. If all details such as shrinkage are correct and the pattern size does not correspond with the calculated size then a mistake has been made during manufacturing at some stage. Then the whole process must be checked back stage by stage until the reason for the variation in size is found. Typical reasons for a variation in warp pattern size are :
Wrong reed used. Reeds are quite often dirty at the end where the number is marked, and sometimes the number is wrongly read.
Too many picks will hold out the warp causing it to finish wider.
Incorrect Finishing Procedure. The cloth may have been scoured too long causing excessive shrinkage and making the finished pattern size slightly smaller. On the other hand the fabric may have been set too wide during stentering making the pattern slightly larger.
Differences in the size of the weft pattern may be caused by :
Too many picks causing the pattern to be smaller.
Too few picks causing the pattern to be too big.
Excessive shrinkage or too little shrinkage during scouring.
Too much overfeed or too little overfeed during stentering.

x) <u>Total Weight, % Loss, and Finished Weight.</u> After the weights of each of the yarns have been totaled a deduction is made for the percentage loss during finishing and the finished weight is arrived at. As in all the cases mentioned previously the percentage loss in finishing is again a matter of careful weighing and recording. By experience the designer will know what to expect, for example a cotton fabric with a scour only finish will loose far less weight, than a worsted fabric. A botany worsted would loose about 6% in finishing whilst a woollen fabric wit h a napped finish can loose 12/14%. 100% cotton fabrics with a resin crease resist finish have a tendency to gain weight slightly due to the resin added.

An example of a completed range sheet for a polyester cotton leisurewear fabric 9/10 ozs - 296 gms is given on page 86.

DATE. 6.12.77 RANGE NO. 2001 STYLE. 10 IDEA SHEET NO. 1 SPECIAL NOTES. 1

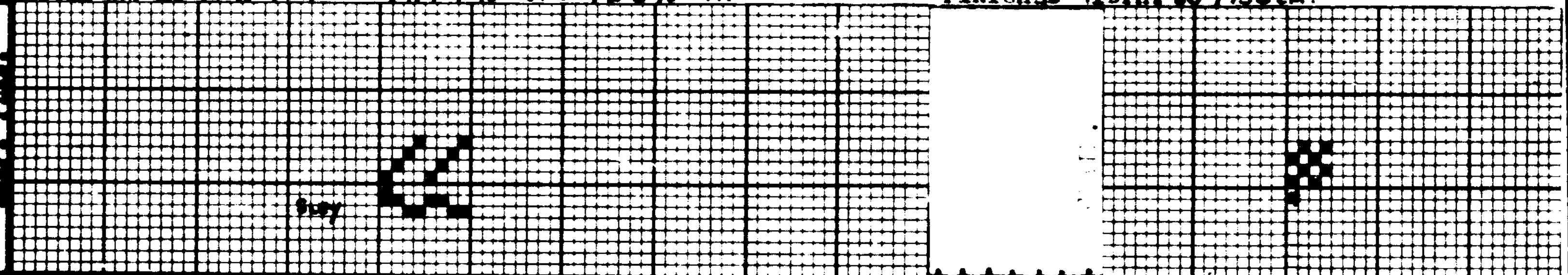
TOTAL WARP ENDS. 4152 REED 31/2 (24.6/2cm) LOOM WIDTH. 67" / 170cm PICKS AT REED 48/1" 19/1cm. To Be Piece Dyed

LIST. None. WARP LENGTH. 100 yds/m WOVEN LENGTH. 96 yds/m. GREY OZS/GMS. 9.95/282 gms. in 6 Shades.

TAKE UP. 4%. SHRINKAGE. 3%. FINISHED LENGTH. 93.12 yds/m. FINISHED OZS/GMS. 9.96/282 Gms.

FIBRE CONTENT %. 50% Polyester | 47.7% Cotton | 2.3% Silk. FINISHED WIDTH. 60"/150cm.

WARP DRAFT PLAN.



WARP PLAN

A =	5	6	2	1	6	6	=	40		=	2328
B =	6		2	2		6	=	30	57 Repts + 48 Ends	=	1728
C =		1			1		=	2		=	116
			6m		2m			32			4152 Total Ends.

WARP

		WEIGHT. 100 yds	Kilos.
A = 16	1c.c. 50% Polyester | 50% Cotton. 17 Turns Per Inch "S" Twist.	13.17	7.78
B = 16	1c.c. 50% Polyester | 50% Cotton. 17 Turns Per Inch "Z" Twist. (Tinted Pink)	12.86	5.83
C = 16	2 cc 50% Polyester | 50% Cotton. Single Yarn 10 T.P.I "Z" Two Ply. 14 T.P.I. Z.	1.73	.78
D:		31.76	14.4
E:			

WEFT PLAN

A =	1		1				=	30	
B =		1	1	1	1		=	32	
C =		1			1		=	2	
	16m		16m					64	Total Picks.

WEFT

		WEIGHT.
A = 14	1cc 50% Polyester / 50% Cotton. 15 Turns Per Inch "Z" Twist.	12.82 - 5.81
B = 14	1cc 50% Polyester | 40% Cotton | 10% Silk Nubs. 15 Turns Per Inch "S" Twist.	13.67 - 6.2
C = 16	2cc 50% Polyester | 50% Cotton Single Yarn 10.T.P.I "Z" Two Ply 14 T.P.I "Z"	1.50 - .68
D:		27.99 - 12.69

WARP PATT. SIZE - LOOM. 1.16" FINISHED. 1.04" WEFT PATT. SIZE - LOOM. 1.33" FINISHED. 1.30" TOTAL WEIGHT 59.75

2.95cm. 2.64cm. 3.30cm 3.28cm % LOSS. 3% 1.79

FINISHED WEIGHT. 57.96

Clerical Work & Sample Scheduling

There is a lot of clerical work to be done in a design studio which can be carried out by people other than the experienced designers, thus releasing them for the more complicated work. Generaly this work is done by the assistants or untrained personnel who may be studying, part time at a textile school or who may have just graduated from textile college but are lacking practical experience. It will of course depend on the size of the organisation and the design studio, but it is a very good sytsem to have one untrained or semi-trained assistant working with two designers. The duties of the assistants should be planned to cover some of the following duties :

Sample Progress. After a production schedule has been worked out for each season a record of the progress must be kept as each of the new designs is prepared for manufacturing. The most efficient way of doing this is to have one of the assistants responsible for this work. As the range sheets are prepared by the designers they are given to the progress clerk so that the manufacturing schedule can be arranged. Each section range may require 40 or 50 different yarns so it will be the responsibility of the progress clerk to ensure that all the yarns are available before warping commences. A common error is for the warper to commence dressing a section range and then when the 4th or 5th section is arrived at one of the required yarns is not available, and a substitute has to be used. However if a careful record is kept of yarn stock in the sample area and new yarns are progressed through the spinning yarn shortage will be avoided. Also another important aspect of the planning work, is to schedule ranges to be warped at the same time when several ranges are using the same yarn count and colour. There is nothing more wasteful and time consuming as getting 40 lots of yarn out of yarn storage, dressing two warps and the returning the yarn into store, only to find that there are three more warps to dress using the same 40 shades next day. Also mistakes and bad planning of this sort will throw the all sample production schedule out and cause new designs to be late for showing to customers.

When samples have been warped they must be planned so that in drawing in, any new designs which can be tied to one another will be. Also in weaving scheduling should be done in such a way that the samples follow one another with as few changes to loom settings as possible. All this will help the smooth flow of work, reduce costs, and also create a good working atmosphere.

It should be remembered that when the new sample ranges are ready for finishing, sufficient length of fabric will be needed in order that the finishing machinery will run satisfactorily. If warping and weaving has been planned correctly, designs requiring the same type of finish will arrive in the finishing area together. These can be joined together and finished at the same time thus giving longer lengths of fabric and making handling much easier.

The progress clerk will keep each designer informed with regard to manufacturing of the new samples which have been worked out by that designer. When weaving commences the designer should receive a full width cutting of the first 6"/7" of each sample. This will be checked for the correctness of the design, colour etc. The new design should also be checked thoroughly in the loom. It should be stressed that although the new fabrics are experimental, accuracy is absolutely essential. Far too often a small error is missed in a new sample. This gets right through to the sales several hundred pieces are ordered and then the mistake is noticed. The question now is should the mistake be corrected or the pieces woven as the original sample. Usually this is a very difficult question to decide. The customer may like the

new design with the mistake in it even though it is technically wrong. As a result if the design is corrected and the pieces are woven, the difference may be noted and the pieces returned. So quite often it is necessary for the designer to visit the client concerned to explain the situation and arrive at a satisfactory solution. The obvious answer is to check the designs thoroughly in the first place and avoid this situation arising.

Finally the various clerical duties shared by the assistant designers should be rotated every six months in order to give each trainee experience in the different administration procedures and also allow a period of time working with each of the different designers.

THE CONSTRUCTION OF BACK CLOTHS

Where it is necessary to increase the weight of a fabric to a great extent without altering the face appearance and texture this can be done by changing the weave from an ordinary weave to a weave with a backing. The increase in weight is effected by introducing an additional sett of threads either as extra warp or as extra weft,and attaching them to the single fabric structure in such a way that they do not show or disturbe the face of the fabric in any way. The extra material when used as warp means that there are two sets of warp threads one forming the face of the fabric and the other forming the backing. If the added weight is introduced as weft then there are two sets of weft, one forming the ground of the face weave and the other adding the extra weight to the back. Warp backed fabrics are more popular then weft backs, because of the extra picks needed to make a weft back which of course results in an increase in cost and a loss of production. Although when making a weft back a cheaper yarn may be used for the backing merely to add weight, and sometimes woollen yarns are used. In warp back structures, cheap yarns cannot be used as the yarn must be strong enough to stand up to the stresses applied in weaving. Sometimes the backing threads or picks may be used for ornamentation as well as increasing the weight.

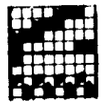
These types of fabrics are generally used in making suitings, ladies coatings and ladies dress cloths although they can be utilised in any manner at the designers discretion. Recently they have found a new popularity in upholstery fabrics. The proportion of face threads to back may be 1 face - 1 back or if cost is a big factor this may be reduced by using a 2 face - 1 back ratio. These structures can be used in any materials or combination of materials, and although not widely used, the making of the design should bethoroughly understood as they lead up to the method of designing the weave structure for double cloths.

In making the design for a back cloth, the procedure is as follows :

<u>2 x 2 Twill Warp Back</u> Fig 1 shows the 2 x 2 twill weave. Mark this out on alternate ends, the first end representing a face end and the second end representing a back end, this is shown in Fig. 2 by the black crosses. The back threads are then stitched to the face of the fabric as shown by the red solid squares. It should be noted that the stitches are inserted in such a manner between the warp floats, so that the floats of two roll over the single stitches and cover them completely.

<u>Fig 1</u>

<u>Fig 2</u>



In making a 2 x 2 twill warp back care should be taken to see that each back end is stitched at least once on the face in one repeat.

In making a weft back cloth the design is marked off on alternate picks and this lengthens it weft-way (see fig.3). Then, theback picks nos. 2,4,6 and 8 are marked in as warp. These are shown by the oblique lines in fig.3. The idea of this is to give a better idea of where the weft floats should be stitched. The weft stitches are introduced where they will be best covered by the weft floats on either side of them. The red circles in fig. 3 show the stitches and represent the position where the mark will be removed allowing the weft to come to the face of the fabric. Fig.4 shows the completed weave for the 2 x 2 twill weft-back fabric.

Fig. 3

Fig. 4

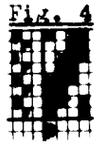


Fig. 5 shows a 2 x 2 twill warp-back where the stitching is carried out on alternate ends. Thus the weave repeats on 16 ends instead of 8. The advantage of this type of structure is that it lessens the number of stitches that may appear on the face. The weft-back weave with stitches on alternate picks is shown at Fig. 6, while Fig. 7 shows the completed weave for the weft-back with stitches on alternate picks.

Fig. 5

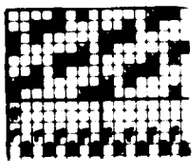


Fig. 6

Fig. 7

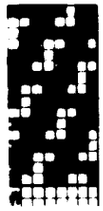


Fig. 8 shows the Mayo or Campbell twill and the method of making a warp-back from this weave is shown at Fig. 9. The construction of the design for the weft-back Mayo twill is shown at Fig. 10 and the completed weave at Fig. 11.

Fig. 8

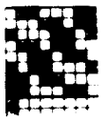


Fig. 9

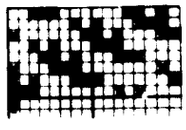


Fig. 10

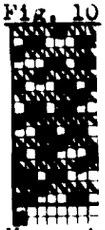


Fig. 11

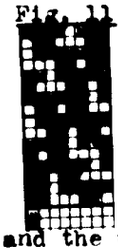


Fig. 12 shows the twilled Hopsack weave and the warp-back design for this is shown at Fig. 13, while the weft-back weave under construction and completed are shown at Figs. 14 and 15 respectively.

Fig. 12

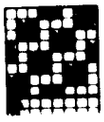


Fig. 13

Fig. 14

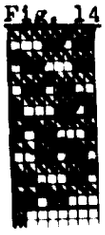
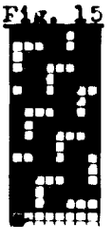


Fig. 15



A fancy steep-angled broken twill is shown at Fig. 16. This weave repeats on five ends and ten picks. The weave for changing this into a warp-back structure on 10 ends and 10 picks is shown at Fig. 17. The construction of the weft-back weave is illustrated by Fig. 18, while Fig. 19 shows the completed weft-back weave.

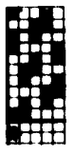
Fig. 16. 

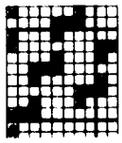
Fig. 17 

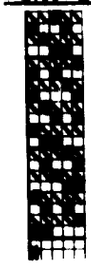
Fig. 18 

Fig. 19 

2 x 2 twill cut and feathered every 2 ends can be made into a back cloth. The weave is shown at Fig. 20. Fig. 21 is the design for a one face one back construction with extra warp. Fig.22 indicates where stitching would be for the weft back and Fig. 23 is the completed weft back design.

Fig. 20 

Fig. 21 

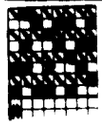
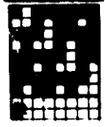
Fig. 22 

Fig. 23 

A very popular weave for men's outerwear is a 3 x 3 twill warp back structure.The 3 x 3 twill weave is shown at Fig. 24 below. The method of constructing the warp back design with the stitches inserted is demonstrated in Fig. 25. The insertion of stitches for the weft back design and the completed design are shown in Fig. 26 and Fig. 27.

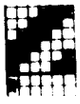
Fig. 24 

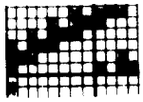
Fig. 25 

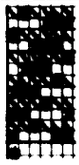
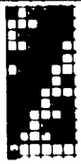
Fig. 26 

Fig. 27 

The 3 x 2 Hopsack weave (Fig. 28) could be used for a ladies coating. As the repeat of this weave is on 15 ends x 5 picks, the warp back design extends to 30 ends. This is shown in Fig. 29 whilst Fig. 30 shows the method of inserting stitches for a weft back construction, Fig. 31 illustrating the completed weave.

Fig. 28 

Fig. 29 

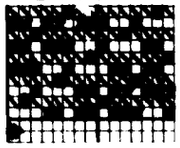
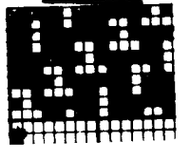
Fig. 30 

Fig. 31 

Another fancy stitched Hopsack is illustrated by the design Fig. 32, the conversion to a warp back is shown at Fig.33. Fig. 34 shows the stitch insertion and Fig. 35 the completed weft back weave.

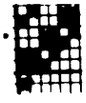
Fig. 32 

Fig. 33 

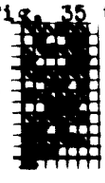
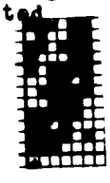
Fig. 34 

Fig. 35 

In the construction of woollen coatings variations of the Hopsack weave are often used. This type of weave has also found application in upholstery fabrics woven on dobby looms. The 6 x 4 twilled Hopsack shown at Fig. 36 is converted into a one face one back warp back fabric by utilising the weave shown at Fig. 37. Fig. 38 demonstrates the method of converting this weave into a weft back structure, and Fig. 39 is the completed weft back weave.

Fig. 36

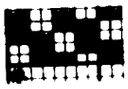


Fig. 37

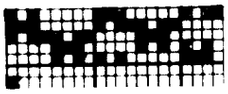


Fig. 38

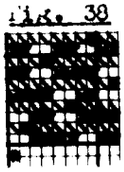
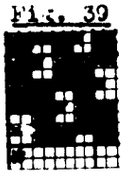


Fig. 39



Back Cloths Backed With Yarns of Different Diameter to the Face Threads:

Both warp and weft backed fabrics can also be constructed on the two face one back principal. The advantage of using this type of design is a thicker thread can be used on the back. The fact that there is only one thread or pick on the back for two on the face compensates for the added thickness of the backing yarns used. Advantages of two face one back structures are:-

a) The thicker backing yarn costs much less than the fine yarns used on the face.
b) The backing yarn can be of lower quality or even of different material for the purpose of cheapness. For example, fine botany worsted yarns may be used for the face of the cloth with coarser woollen spun yarns on the back.
c) In weft backed fabrics, the number of backing picks, one in two, is only half that of the face. Compared with a one face one back weft back structure weaving costs are considerably reduced.
d) In warp backed fabrics there is a corresponding reduction in the number of ends in the warp so that the cost of drawing-in and sleying is less. Also, the reduction of the number of ends in the warp helps in the weaving of the fabric.

When constructing two face one back fabrics the count of the backing yarn should not be any thicker than half the count of the face yarn, e.g. a 2/40s worsted used for the face, then the backing yarn should not be thicker than 2/20s or 1/10s. Finer yarns can be used, but as they are more expensive and they do not give the same amount of cover on the back as the thicker yarns this is not a good practice. If finer yarns are to be used then they should not be more than two or three counts finer, i.e. in the above where 2/20s is given as the ideal count for the backing yarn, 2/24s would be the finest and to go to counts finer than this would create an unsuitable fabric.

Weaving Particulars Used in Making Weft Backed Fabrics

Some typical constructions for fabrics using woollen yarns for the backing weft are given below. A woollen yarn used on the back improves the handle of the fabric, making it softer and fuller.

1) 2 x 2 twill weft back, one face one back.
2/40s worsted warp and face weft. 4½ run or 27 skeins YSW woollen yarn for backing weft. Sett 68 ends per inch, 38 picks per inch. 66 inch wide in reed. Fabric weight 17 ounces per yard, 56" x 36".

2) 2 x 2 twill, one face one back, sateen stitched.
2/40s worsted warp and face weft. 4¼ run or 30 skeins YSW woollen yarn for backing weft. Sett 60 ends per inch, 108 picks per inch. 70" wide in reed. Fabric weight 19 ounces per yard, 56" x 36".

3) 2 x 2 twill, one face one back, sateen stitched.
2/30s worsted warp and face weft. 3¼ run or 20 skeins YSW woollen yarn for backing weft. Sett 52 ends per inch, 92 picks per inch. 72 inch wide in reed. Finished weight 24 ounces per yard, 56" x 36".

4) 3 x 3 twill, weft back - two face, one back.
2/32s worsted warp and face weft. 3½ run or 20 skeins YSW woollen yarn for backing weft. Sett 68 ends per inch, 96 picks per inch. 68 inch wide in reed. Finished weight 19 ounces per yard, 56" x 36".

Weaving Particulars Used in Making Warp Backed Fabrics

1) 2 x 2 twill, one face one back, sateen stitched.
2/48s worsted face and back warp and weft. Sett 132 ends per inch, 64 picks per inch. 66" wide in reed. Finished weight 17/18 ounces per yard, 56" x 36".

2) 2 x 2 twill, warp back, two face one back.
2/48s worsted face warp, 2/26s worsted back warp, 2/48s worsted weft. Sett 96 ends per inch, 66 picks per inch. 68 inches wide in reed. Finished weight 18/19 ounces per yard 56" x 36".

NOTE: The yards per pound on the YSW Yorkshire Skeins Woollen system is 256 yards - one skein.
On the American run system one run is 1600 yards per pound.

Method of Constructing Designs for 2 Face 1 Back, Warp and Weft Back Fabrics
An example of fancy weave constructed from 2 x 2 twill with cutting ends between the floats is shown at Fig. 40. To change this into a two face one back warp backed design, proceed as shown in Fig. 41. Always start by making the first end of the design face, the second end back and then two face one back for the full repeat, which will end with one face. The same method is used when constructing the design for a weft-back structure with the ratio of 2 picks face, 1 pick back. i.e. First pick face, second pick back, then two face one back, ending with the last pick on the face. The stitches to hold the backing ends into the face structure are inserted in exactly the same manner as when making a one face one back design. These are shown in solid red inserted between the warp floats (see Fig. 41), so that the warp floats will roll and cover them. Figs. 42 and 43 show the two face one back weft-backed design, Fig. 42 shows the method of inserting the stitches and Fig. 43 the completed two face one back weft-backed structure.

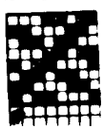
Fig. 40 

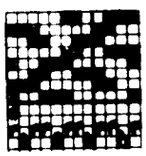
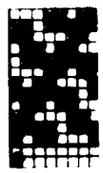
Fig. 41 

Fig. 42 

Fig. 43 

To convert the Mayo or Campbell twill shown at Fig. 44 to a 2 face - 1 back, back cloth design proceed as shown in Fig. 45. which is the warp back cloth structure. Figs.46 and 47 are the weft back, 2 face- 1 back design.

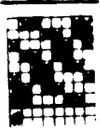
Fig. 44 

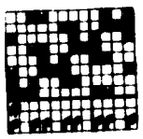
Fig. 45 

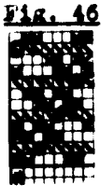
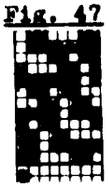
Fig. 46 

Fig. 47 

Four x four stitched hopsack is a good coating weave suitable for adding backing either in the warp or in the weft. The basic weave is indicated in Fig. 48 and the warp back design (2F - 1B) in Fig. 49. Fig 50 is the weft back with the stitches indicated by the red circles and Fig. 51 shows the completed weft back weave.

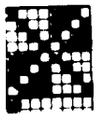
Fig. 48 

Fig. 49 

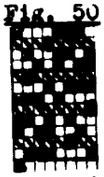
Fig. 50 

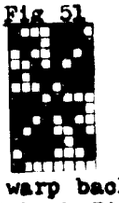
Fig 51 

Fig.52 is the Birdseye weave and conversion to a warp back (2f - 1b) is shown at Fig. 53. The stitches for a weft back Birdseye with a ratio of 2 picks on the face and 1 pick on the back are shown in Fig. 54 and the completed weave in Fig. 55.

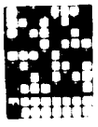
Fig. 52 

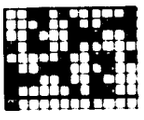
Fig. 53 

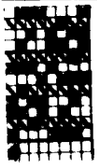
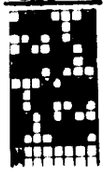
Fig. 54 

Fig. 55 

A Mayo twill reversed every four ends, is shown at Fig.56 and the way this is converted to a two face- one back, warp back and then a weft back is illustrated in Figs. 57, 58 and 59.

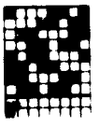
Fig.56 

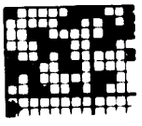
Fig. 57 

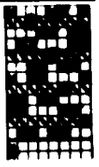
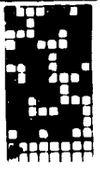
Fig. 58 

Fig. 59 

2 x 1 or Prunelle weave shown in Fig.60 makes a good version of a back cloth and in the 2F-1B warp structure the stitches are hidden very effectively as can be seen in Fig.61. The weft stitches also cover well and Fig. 62 shows the position of these stitches while Fig.63 demonstrates how the completed weave looks.

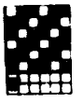
Fig.60 

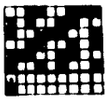
Fig. 61 

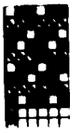
Fig.62 

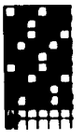
Fig.63 

Fig.64 shows a hook weave on a repeat of 10 x 10. This makes a barrathea but different from the normal twilled hopsack weave. To convert it to a 2 face - 1 back warp backed design it is opened up and stitches inserted as indicated by the solid red squares in Fig.65. For a weft back (2F - 1B) the design is opened up weft way and stitches inserted as shown by the red circles in Fig.66, the complete weft back weave is indicated at Fig.67.

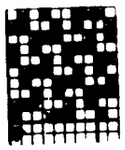
Fig.64 

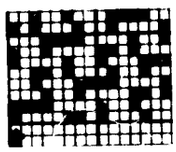
Fig.65 

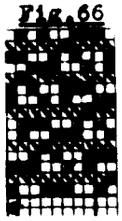
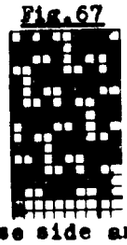
Fig.66 

Fig.67 

The twilled hopsack weave can be used on the reverse side and this is shown in Fig.68. Fig.69 is the 2F - 1B warp back weave for this while Fig.70 shows the construction for a 2F - 1B weft back, the complete weave of which is shown at Fig.71.

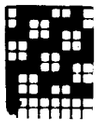
Fig.68 

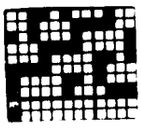
Fig.69 

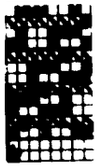
Fig.70 

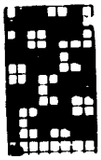
Fig.71 

Fig.72 shows the twilled hopsack or barrathea weave, face up. This converted to a 2F - 1B warp back is shown at Fig. 73 and Figs.74 and 75 illustrate the stitch position for the weft back and the completed weave.

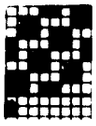
Fig.72 

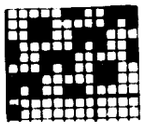
Fig.73 

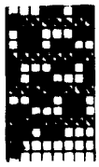
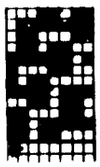
Fig.74 

Fig.75 

Defects in Back Cloths Due to Faulty Stitching

Fig. 76 shows the design for a 2 x 2 twill warp back with a 1 Face - 1 back proportion of backing ends. With the twill method of stitching the back to the face, there is always the danger of a double twill effect showing on the face. This is because only alternate twills are stitched and one line of twill having to cover the stitches may be raised slightly more than the other. To overcome this defect a sateen order of stitching is employed and this is illustrated in Fig.77 where it will be seen that every pick is stitched and the stitches are evenly distributed between the two twill lines.

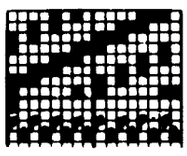
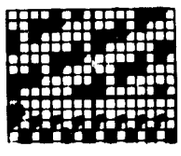
Fig.76 

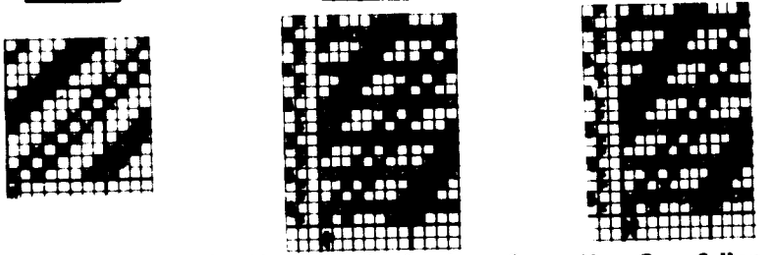
Fig.77 

In a 2 x 1 Twill or Prunella the problems encountered are somewhat different. Fig.78 shows the 1F - 1B warp back version of the 2 x 1 twill with the stitches in twill order. This would of course tend to give a double twill effect such as that which occurs in the fabric produced by the weave shown at Fig.76 P.94. However if the sateen order of stitching shown at Fig.79 is used, only alternate picks are stitched and this tends to produce a raggy cloth. Also the stitches tend to form themselves into twill lines from right to left thus giving a cross twill effect. This is shown in Fig.80. Fig.81 illustrates another method of stitching a 2 x 1 twill but this again results in a rather unevenly balanced structure and can cause shrinkage problems during finishing. So in the case of 2 x 1 twill the stitching shown in Fig.78 is the one most prefered.

Fig.78 Fig.79 Fig.80 Fig.81

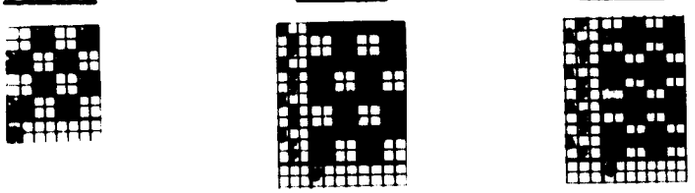
In Fig.82 a fancy twill care must be taken in selecting the places for stitches when converting it into a 2F - 1B Weft back design. In Fig.83 only alternate warp ends are stitched and for the best possible effect in a weft back, every end must be stitched. Fig.84 shows the design changed so that every end is stitched.

Fig.82 Fig.83 Fig.84



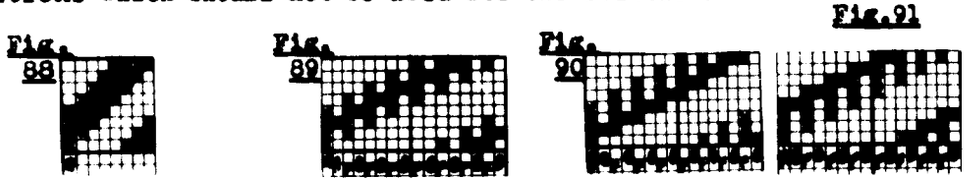
When making a 2F - 1B Weft back design from the 2 x 2 Hopsack shown at Fig.85, if the design is started 2 picks face - 1 pick back the stitches are only covered on one side by a weft float. In this way they may show through onto the face. Fig.86 shows this quite clearly. If however the design is started 1 pick face - 1 pick back - 2 picks face etc, then the stitches are covered on each side by weft floats, see Fig.87.

Fig.85 Fig.86 Fig.87



A 4 x 4 Twill shown in Fig.88 should be stitched so that the stitches fall as near aspossible between the adjoining twills. This covers the stitches best and is shown in Fig.89. Fig.90 and 91 illustrate positions which should not be used for the stitches.

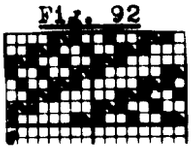
Fig. 88 Fig. 89 Fig. 90 Fig.91



The Use of Backing Yarn as Decoration:
In any back cloth the backing yarn may be brought to the surface in the form of decoration, it may be made to show very softly or in large spots, or motifs. This adds novelty to the fabric as well as extra weight.

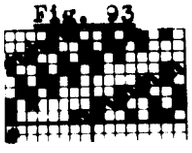
Fig. 92 is a 2 x 2 twill fabric with a 1 face 1 back construction. On one line of twill single stitches are introduced in the normal manner between the floats of warp, so that they will be covered. On alternate lines of twill these stitches are over the weft floats completely in the open. This will give a fine single twill line and if the backing yarn is a different colour from the face yarn a 2-colour twill will result.

Fig. 92



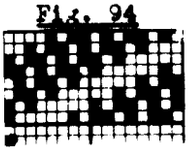
The 2 x 2 twill, 1 face 1 back, can be further modified as shown in Fig. 93 below. Here, the single warp floats in Fig. 92 have been changed to two floats, making a larger alternate twill.

Fig. 93



If the decoration floats are further extended to three, as illustrated in Fig. 94, it then becomes unnecessary to stitch the backing yarn further. Here, the 2 x 2 twill is the fine twill line and the backing yarn forms an alternate heavier twill line.

Fig. 94



In employing the backing yarn as decoration it need not necessarily be used always in a twill line. Fig. 95 again on a 2 x 2 twill ground, 1 face 1 back, shows the backing yarn brought up in the form of a Hopsack spot effect.

Fig. 95

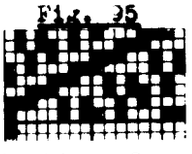
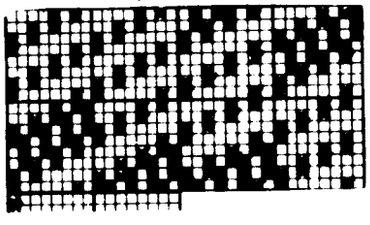


Fig. 96 is a further illustration of a spot effect on a 2 x 2 twill ground weave. Here the backing yarn is brought on to the surface in groups of 5, 2 floats. In this example, however, the backing ends have to be stitched on the face in the usual manner to prevent long floats on the back.

Fig. 96



An alternative method of using the backing yarn for decoration is to interchange the face and back yarns in certain areas of the cloth. The way in which this is done is shown in Fig. 97. The ground weave used is a 2 x 2 twill, 4 and 4 cut check. In the bottom left-hand corner of the design the backing yarn is on the surface forming the reverse twill. Stitches are inserted where they will cover up best. For the next 8 picks the sequence is reversed, the backing yarn reverting to the back of the cloth while the straight twill is formed by the face yarn. On the opposite side of the check, or diamond, (the right-hand side) the opposite occurs, that is, in the bottom right-hand corner the face twill (straight twill) is formed by the face ends and in the following 8 picks an interchange occurs, the reverse twill being formed by the back ends. If this design was coloured one black - one white in the warp, white reverse twill would show in the bottom left and top right-hand corners, while black straight twill would appear in the top left and bottom right-hand corners.

Fig. 97

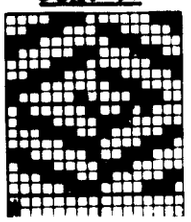
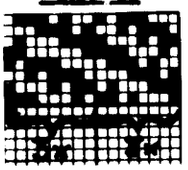


Fig. 98 illustrates another cut check design formed by 3 x 1 twill, using the interchange method. Here thetwill is all reversed, the interchange being shown by black crosses in the bottom left and top right of the design, with red (solid) in the top left and bottom right of the design.

Fig. 98



Another spot effect is illustrated in the design shown at Fig. 100. The ground weave 2 x 2 twill with ten ends, cut and feathered every two, is shown in Fig. 99. The stitching of the backing warp is inserted between the twills to obtain maximum cover. Then, the backing warp is brought up in a series of three floats to form a motif.

Fig. 99

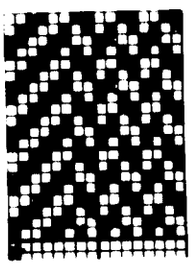


Fig. 100

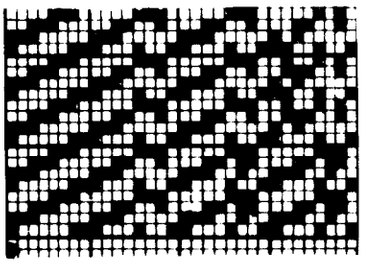


Fig. 101 illustrates a method of designing a 2-colour twilled Hopsack or Barathea. The reverse of the normal Barathea weave is used and the back is brought up on to the face in a series of Hopsack twills or small spots. Fig. 102 illustrates the effect as it would appear in the cloth.

Fig. 101

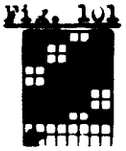
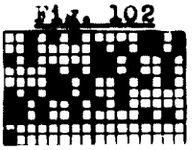
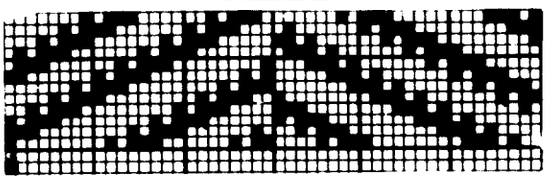


Fig. 102



An interchange effect on 3 x 3 twill - 12 x 12 herringbone is shown at Fig. 103. Three different coloured twills would result in this design if grey was used for the face warp, white used for the back warp and black used for the weft. The warp twills would be grey and white interspersed with black weft twills.

Fig. 103



Using the weave $\frac{3\ 1}{2\ 2}$ M3 a novelty twill design can be made by bringing the backing warp up between the face twills as shown in Fig. 104. In this design it is not necessary to stitch the back warp owing to the shortness of the floats on the back.

Fig. 104

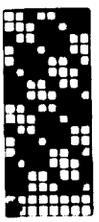
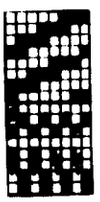


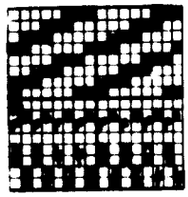
Fig. 105 illustrates a novelty spot effect on the 2 x 2 twill back cloth weave. The face warp is 2 dark 2 light and the back warp is 2 light 2 mid. In the weave alternate twills are interchanged, stitches being inserted between the floats where they will cover. If this fabric is woven with a solid dark weft the design will show up as alternating light and mid spots.

Fig. 105



A further modification of the spot effect illustrated at Fig. 105, page 98, is obtained by reversing the light and the mid on the second 8 ends of the design. This is shown in Fig. 106.

Fig. 106



PSEUDO OR IMITATION BACK CLOTHS

Imitation back cloths have the advantage of not requiring as many ends or picks per inch/cm. They are less costly to manufacture, can be constructed in lighter weights but still give the impression of a real back cloth fabric.

To construct the weave for an imitation back cloth the size of the repeat must be decided upon. There are two methods of obtaining this, where the ratio of ends or picks is 1 face 1 back. In the first method the number of threads and picks in a repeat of the face weave to be imitated is multiplied by two and then one taken away.

Example: 2 x 2 twill - 1 face - 1 back = 4 x 2 = 8 repeat
Therefore, 8 - 1 = 7 threads and picks in repeat of imitation fabric.

In the second method, instead of deducting 1 from the repeat of the base weave, after multiplying it by 2, an addition of 1 is made.

Example: 2 x 2 twill - 1 face - 1 back = 4 x 2 = 8 repeat
Therefore, 8 plus 1 = 9 threads and picks in the repeat of the imitation fabric.

In designing two face one back warp back structures, the calculation isas follows: threads and picks in base weave x 3 minus 1 squals threads and picks in imitation back cloth weave.

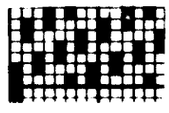
Example: 2 x 2 twill - 2 face - 1 back = 4 x 3 = 12 repeat
Therefore, 12 - 1 = 11 threads and picks in the imitation back cloth weave.

For a 3 face 1 back structure the calculation is: threads and picks in base weave times 4 - 1 = threads and picks in imitation design.

Example: 2 x 2 twill - 3 face - 1 back = 4 x 4 = 16 repeat.
Therefore, 16 - 1 = 15 threads and picks in the repeat of the weave for the imitation back cloth.

Fig.107 demonstrates the way an imitation warp backed fabric is constructed for a 2 x 2 twill fabric. The repeat of the weave is on 7 ends and picks. Starting in the bottom left-hand corner the line of twill is run-in across the design on alternate ends. When the repeat is reached it throws the second line of twill on to the opposite end to the first, that is, it interchanges. In this particular design, because of the shortness of the back floats, stitching is not required.

Fig.107



If it is required to make a lighter fabric on the weave illustrated in Fig. 107, page 99, stitches can be inserted between the twills and they will cover up in exactly the same way as with a proper warp back fabric. This is illustrated in Fig. 108. The alternate twills are shown in black crosses and black solid squares in order to clarify the design. The stitches tighten up the fabric considerably enabling the setting to be reduced, thus resulting in a lighter weight.

Fig. 107

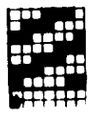
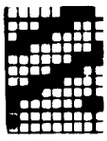


Fig. 108 is an example of the second method of constructing an imitation warp backed fabric, where 1 is added to the repeat resulting in a repeat of 9 ends and 9 picks. This results in a more open structure, which requires an increased setting and a heavier cloth, being formed. Stitches are necessary in order to give a firm fabric and reduce the length of the floats on the back.

Fig. 108



In constructing a design for a 2 x 2 twill, 2 face 1 back, fabric the repeat would be on 11 ends and picks. Fig. 109 is the weave and the method of constructing this is to start in the bottom left-hand corner and run the twill across the design. The twills are grouped in twos with a miss in between each. When the edge of the weave repeat is reached, this is continued and the base dots for each group of two are emphasised in red (solid). It should be noted that the two face - one back structure results in a tighter construction with reduced weight.

Fig. 109

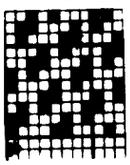
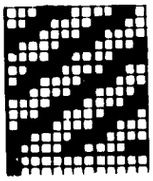


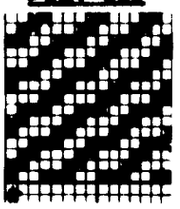
Fig.110 illustrates the weave for a 2 x 2 twill, 2 face 1 back, construction using the larger repeat, 13 ends x 13 picks. The method of inserting stitches between the twills in the position which gives the best possible cover is shown by the red (solid) squares.

Fig. 110



A design for a 3 face 1 back imitation double cloth is shown in Fig. 111. This is on the larger repeats of 15 ends. The design is stitched between the twills so that the single floats will be completely hidden. This design for 2 x 2 twill is quite rare in use.

Fig. 111



Prunelle or 2 x 1 twill can be changed into an imitation double cloth. The design on the smaller construction repeats on five endsand picks, and as there are only 3 floats on the back of the fabric, it is not necessary to stitch the weave. Fig. 112a illustrates the Prunelle weave and Fig. 112b is the design for a 2 x 1 twill, 1 face, 1 back imitation warp back.

Fig. 112a

Fig. 112b

Construction of the design for imitation Weft Backed Fabrics

To make a design for an imitation weft backed fabric the procedure is as follows: The example given is 2 face, 1 back, 2 x 1 weft twill. The repeat will be on 5 ends and picks and the weave is dotted in, in pencil, on alternate picks. As in the construction of a warp back, due to the repeat of the weave being on an odd number of ends and picks, the second line of floats is thrown on to the odd numbered picks. After the weave has been marked in in pencil the blanks are marked in as warp with black crosses. Fig. 113 illustrates the completed weave.

Fig. 113

A further example of a design for a 2 x 2 twill, 2 face, 1 back, imitation weft backed fabric is shown at Fig. 114. It should be noted that, if stitches are required, these are inserted between the weft floats. As with all weft backs, it is customary to insert all the crosses after the pencilled outline has been put in. Then appropriate crosses for stitching are removed. Finally, the pencilled construction marks are rubbed out. In the diagrams the pencil marks have been left in to make the method clearer.

Fig. 114.

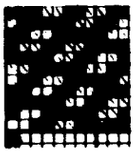
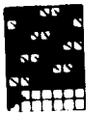


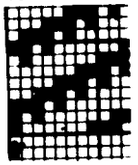
Fig. 115 represents a 2 x 2 twill, 1 face, 1 back, imitation weft backed weave.

Fig. 115



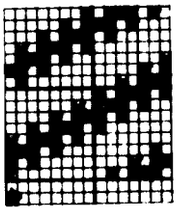
Further examples follow of various warp and weft backed designs. Fig. 116 is a 3 x 3 twill imitation warp backed design. The proportion of ends is 1 face, 1 back and the weave is stitched on every twill line in order to tighten it up.

Fig. 116



In the design illustrated at Fig. 117 a 4 x 4 twill, 1 face, 1 back warp backed structure, with stitches on each twill line, is shown. The weave repeats on 15 ends and picks.

Fig. 117



Figs. 118a and 118b are examples of a 2 x 1 twill, 2 face 1 back imitation warp backed design. Fig. 118a on the left shows the unstitched weave. Fig. 118b to the right is stitched between each pair of warp floats and provides a much tighter construction.

Fig. 118a

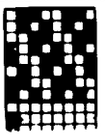
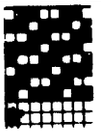
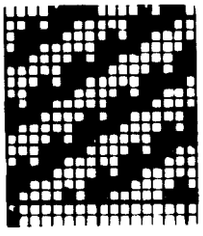


Fig. 118b



A 3 x 3 twill imitation warp back using 2 ends on the face to 1 on the back is demonstrated in Fig. 119 repeating on 17 ends and picks. Due to the long floats on the back stitches must be inserted in the positions indicated by the red solid squares.

Fig. 119



The design repeating on 23 ends and picks illustrated at Fig. 120 is a 4 x 4 twill, 2 face 1 back imitation warp back, and again this has to be stitched between the twills, in order to eliminate long floats on the back of the fabric.

Fig. 120

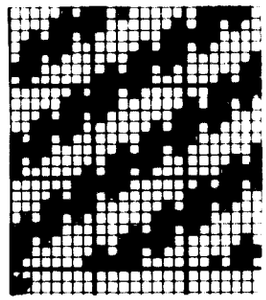


Fig. 121a illustrates a 2 x 2 twill, 1 face 1 back, imitation warp backed fabric. If this design had a warping arrangement of 1 black (indicated by red solid), and 1 white (shown as blank in the design), a pick and pick, or sharkskin effect would be obtained. This effect is shown at Fig. 121b.

Fig. 121a

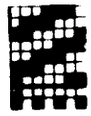
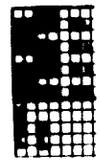


Fig. 121b



The design for a 3 x 3 twill, 1 face 1 back, imitation weft backed, stitched on every twill, is shown at Fig. 122.

Fig. 122

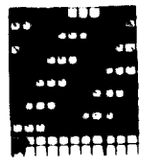


Fig. 123 is a 4 x 4 twill, 1 face 1 back, imitation weft back, and again this is stitched on every twill. Special attention should be paid to the position of all stitches, espseially in the weft backed designs, where they are indicated by a sinker, (red oirole).

Fig. 123

A 2 face 1 back imitation weft backed weave for the 2 x 1 twill (weft twill) is shown at Fig. 124. This is on a repeat of 8 ends and picks.

Fig. 124

Imitation weft backed designs for 3 x 3 twill and 4 x 4 twill with a proportion of picks 2 face to 1 back are illustrated in Figs. 125a and 125b. Stitches are needed to shorten the weft floats on the back of the fabric in both designs.

Fig. 125a

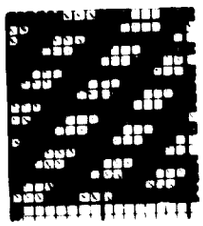
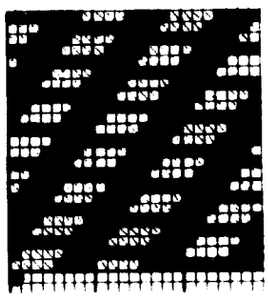


Fig. 125b



CREATING FIGURED OR MOTIF DESIGNS BY MEANS OF EXTRA WARP

Not only can the extra warp in a back cloth fabric be used to add extra weight, it can also be used to create large decorative effects. These are different from the smaller novelty effects discussed on Pages 96, 97 and 98. This style of fabric is used in large areas and quite often right across the warp of the fabric. As a result, it requires the use of a Jacquard loom, which of course has a much larger figuring capacity than the Dobby looms on which the smaller novelty styles can be woven. It is advantageous when designing extra warp figured designs to arrange the ground weave so that it can be woven on harness shafts mounted either in front of or behind the Jacquard. When this is done the full repeat of the Jacquard harness can be used for weaving the figured effect. If both ground and fancy ends are drawn through the Jacquard harness it will be readily seen that in the case of a 1 face 1 back design (the face being the ground weave) the capacity of the Jacquard for figuring will be cut in half. When only the decoration or fancy threads are drawn through the Jacquard the cards are cut in the normal way from the figured design and it is not necessary for the design to be opened out to include the ground weave. The ground weave is generally a tight construction and the example shown at Fig. 126 uses plain weave as the base weave. Due to the difference in take-up during weaving, this type of fabric has to be woven on two beams. Quite often tappets are used to control the movement of the shafts weaving the ground of the fabric. Fig. 127 shows the figured effect and the way this is opened out in weaving can be seen in Fig. 126. Here, the proportion of ends is 1 fancy and 1 ground.

Fig. 126

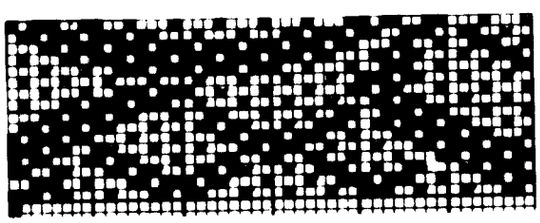


Fig. 127

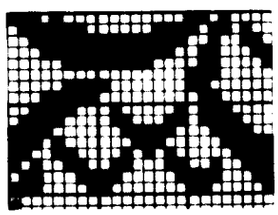
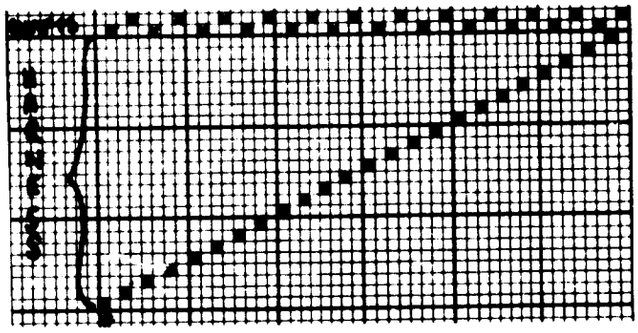


Fig. 128 illustrates how the design shown at Fig. 126 on Page 104 is drawn in the loom. The first, third, fifth, and so on, ends being the fancy yarn used for the creation of the figured esign, are drawn through the Jacquard harness. The second, fourth, sixth, and etc. are drawn through two shafts worked by tappets at the back of the Jacquard harness. These weave the plain weave ground.

Fig. 128



CREATING FIGURED OR MOTIF DESIGNS BY MEANS OF EXTRA WEFT

To design this type of fabric the ground weave to be used is run-out over the full repeat, which will be used for the design. Ground weaves are generally of a simple interlacing, such as straight twills, herringbones, small crepe weaves, cut checks, etc. The figure or motif is superimposed on to the ground weave where desired. Fig. 129a illustrates a design using a ground weave of 2 x 2 twill, on a repeat of 24 ends and picks, with a diamond spot effect or motif superimposed.

The extra yarn used in the weft to create the fancy effect is usually finer in count than the ground yarn and can be introduced in the usual method, i.e. 1 face, 1 back, or 2 face, 1 back, the back yarn being the one used for decoration. The extra material may be introduced intermittently into the fabric or continuously, or it may be a combination of both. Two extra yarns may also be used to create a 2-colour effect and this is illustrated at Fig. 130a on Page 106. Where the decoration yarn is introduced intermittently in a fabric, it has to be stitched to the back to prevent long floats when it is not on the surface creating the design.

Fig. 129a

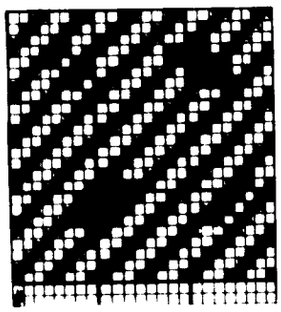
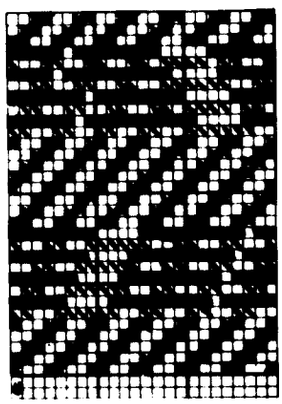


Fig. 129b



The method of stitching the decoration is indicated by the single solid red squares in the Fig. 129a on Page 105. It should be stressed that this stitching must be well balanced, if too many stitches are inserted the decoration yarn will become too tight and create a cockled or puckered appearance on the face of the fabric. This would be accentuated during subsequent finishing procedures, especially if the ground yarn and the decoration yarn have different shrinkage factors.

Fig. 129b on the previous page (105) shows the design opened out for card cutting, with each pick for the ground and figure marked in. It should be noted that the ground pick immediately preceding each decoration pick is changed, allowing all the warp ends to lift, in the area where the decoration will float on the surface on the next pick. This has the effect of accentuating the decorative motif.

Card Cutting Instructions Where One Extra Weft is Used

Where the ground structure only is concerned, the Jacquard cards are cut in the normal manner, i.e. cut marks. On the pick where the extra material is shown each pick is cut twice. The instructions being as follows:

1) For ground pick - cut marks and figure.
2) For figure pick - cut all but figure and figure stitches.

If Fig. 129b on Page 105 is examined, it will be found that the design opened up corresponds exactly with these instructions.

Fig. 130a illustrates a section of a fancy motif typical of a fancy vesting cloth woven with extra weft. The ground weave is 2 x 2 Hopsack and the figured effect, a fancy spot, is formed by two extra decoration wefts depicted in the design as a solid red square and a green dot.

Fig. 130a

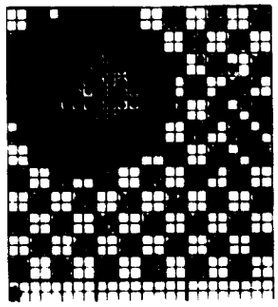
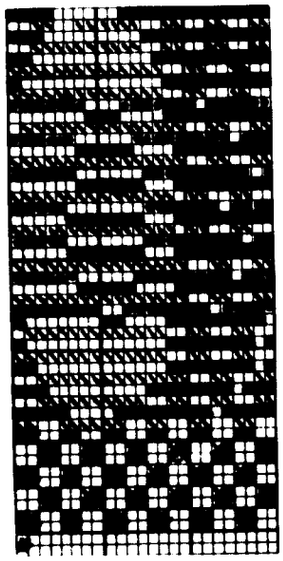


Fig. 130b



Card cutting instructions for designs where two extra decoration wefts are involved, are as follows:

1) For ground, cut marks and figures.
2) For figure one pick (solid red) cut all but figure one and figure one stitches.
3) For figure two pick (green dot) cut all but figure two and figure two stitches.

Figure 130b shows the extended card cutting plan for the 2-colour motif illustrated at Fig. 130a.

CLOTH SETTING

The setting or ends and picks per inch/cm. in a fabric depend on various factors:-
a) The diameter or thickness (counts) of the yarn.
b) The frequency of interlacing of weave structure.
c) The quality of the material used in the fabric.
d) The type of finishing routine through which the fabric will be put.
e) The purpose or end use for which the cloth will be used.
f) The amount of twist in the yarn.

An unstressed thread is approximately a cylinder, decreasing in density from the axis of the thread to the surface. In making fabric it is subject to considerable bending and deformation. Yet it is found that within reasonable limits, the number of threads per inch/cm. (sett) is inversely proportional to the square root of the number of fibres in the cross section.

There are various methods used to calculate the ends and picks in any weave:-
Ashenhurst's Diameter Intersection Theory. When the counts of the warp and the weft are the same, it is assumed that an intersection takes up as much space as a thread. To calculate the diameters per inch or the number of threads which could be laid side by side in one inch, the following formulae are used:

Worsted Yarns. Diams. per inch $= \sqrt{\text{yards per lb.}} - 10\%$

$= .9 \times \sqrt{\text{yards per lb.}} = 21.3 \times \sqrt{\text{counts}}$

Cotton and Spun Silk Yarns Diams. per inch $= \sqrt{\text{yards per lb.}} - 10\%$

$= .9 \times \sqrt{\text{yards per lb.}} = 26.1 \times \sqrt{\text{counts}}$

When the diameters per inch have been calculated, allowance must be made in the setting formula for the particular weave or the intersections involved. This is calculated as follows:-

Let D = diameters per inch of the yarn
W = threads in one repeat of the weave
I = intersections in one repeat of the weave
T = threads per inch

Then threads per inch - T equals $\frac{D \times W}{(W+I)}$

Example: To calculate the setting for 1/20s Cotton in a plain weave fabric, first find the diameters per inch.

$26.1 \times 20 = 117$

$T = \frac{117 \times 2}{(2+2)} = 58.5$ ends and picks per inch.

In the table below the factors "W" and "(W+I)" are given along with the average float of the weaves.

Weave	W	(W-I)	Average Float
Plain	2	4	1
2/1 twill	3	5	1.5
2/2 "	4	6	2
2/3 "	5	7	2.5
3/3 "	6	8	3
3/4 "	7	9	3.5
4/4 "	8	10	4

In the following table, Diameters per Inch are given for a wide range of Worsted and Cotton yarn sizes:

Worsted.			Cotton.		
Counts.	Diams. per Inch.	Sett in Plain Wv.	Counts.	Diams. per Inch.	Sett in Plain Wv.
1	21.3	10.65	1	26.1	13.05
2	30.12	15.06	2	36.9	18.45
3	36.89	18.45	3	45.55	22.78
4	42.6	21.3	4	52.8	26.1
5	47.6	23.81	5	58.36	29.18
6	52.17	26.09	6	63.93	31.97
7	56.35	28.18	7	69.05	34.53
8	60.25	30.12	8	73.82	36.91
9	63.9	31.95	9	78.3	39.15
10	67.36	33.68	10	82.54	41.27
11	70.64	35.32	11	86.56	43.28
12	73.79	36.89	12	90.41	45.21
13	76.8	38.4	13	94.1	47.05
14	79.70	39.85	14	97.66	48.83
15	82.49	41.25	15	101.08	50.54
16	85.2	42.6	16	104.4	52.2
17	87.82	43.91	17	107.61	53.81
18	90.37	45.18	18	110.73	55.37
19	92.84	46.42	19	113.77	56.88
20	95.26	47.63	20	116.72	58.36
22	99.91	49.95	22	122.42	61.21
24	104.35	52.17	24	127.86	63.93
26	108.61	54.30	26	133.08	66.54
28	112.71	56.35	28	138.11	69.05
30	116.66	58.33	30	142.96	71.48
32	120.49	60.25	32	147.64	73.82
34	124.2	62.1	34	152.19	76.09
36	127.8	63.9	36	156.6	78.3
38	131.3	65.65	38	160.89	80.45
40	134.71	67.36	40	165.07	82.54
42	138.03	69.02	42	169.15	84.57
44	141.29	70.64	44	173.13	86.56
46	144.46	72.23	46	177.02	88.51
48	147.57	73.79	48	180.83	90.41
50	150.61	75.31	50	184.55	92.28
52	153.6	76.8	52	188.21	94.1
54	156.52	78.26	54	191.8	95.9
56	159.39	79.69	56	195.31	97.66
58	162.22	81.11	58	198.77	99.39
60	164.99	82.49	60	202.17	101.08
70	178.21	89.10	70	218.37	109.18
80	190.51	95.26	80	233.45	116.72
90	202.07	101.03	90	247.61	123.80
100	213.00	106.5	100	261.00	130.5
			110	273.74	136.87
			120	285.91	142.96
			130	297.59	148.79
			140	308.82	154.41
			150	319.66	159.83
			160	330.14	165.07

This table gives the ends per inch in plain weave for just one of the setting theories. In the following pages other methods of calculating the ends and picks per inch will be detailed. These can then be compared and the differences in each system, and the advantages, and disadvantages, with alternatives discussed.

It should be noted that all the systems for calculating the sett of a fabric give the Maximum Sett. The designer must decide, depending on the type of fabric, finish, and end use, how much below maximum the practical setting will be. In some cases, for example, fabrics for tents, waterproof awnings etc., the maximum sett is used. It is impossible, however, to list every type of textile fabric with the appropriate setting. Experience goes a long way in arriving at a decision regarding this matter, however given the same weave and yarn size the sett can vary from market to market depending on the circumstances which affect the costing of the fabric. In some instances it may be necessary to take out one end and one pick per inch, or even two picks per inch, in order to reduce the cost.

Law's Maximum Setting Theory: According to Law, the diameters per inch of yarn can be calculated by the following data:

Worsted — Diameter - $D = \sqrt{500 \times \text{count}}$
Cotton — " $D = \sqrt{800 \times \text{count}}$

From the diameters per inch of the yarn, calculated as above, and the average float of the weave, the setting can be determined.

To calculate the average float simply divide the number of ends in the repeat by the number of intersections, e.g.

2 x 2 twill - ends per repeat = 4, intersections = 2, $\frac{4}{2} = 2$

In very fancy weaves the average float on one end or one pick may be different from the next. In order to arrive at the figure used the average floats of all the different ends and picks must be added together and then divided by the number of different ends and picks.

To determine the sett for a given weave, according to Law's theory,

Let T = threads per inch. D = diameters per inch of yarn.
F = average float

Then $T = \frac{D \times F}{(F + 1)}$ plus various percentages.

For the more common weaves the settings can be obtained as follow:

Plain Weave = $T = \frac{D \times F}{(F + 1)}$

Twill Weaves = $T = \frac{D \times F}{(F + 1)}$ plus 5% for each float exceeding 2.

For Hopsacks, Mayos, and Twilled Hopsacks = $T = \frac{D \times F}{(F - 1)}$ plus 4.5% for a 2-float, but plus 9.5% for each float exceeding 2.

Sateen Weaves = $T = \frac{D \times F}{(F + 1)}$ plus 5.5% for each float.

Weave values - W can be worked out and substituted for the part of the formula $\frac{F}{(F+1)}$. The table below gives a list of weave values or setting ratios. (see Page 110).

Average Float	Plain	Twill	Hopsack or Mat	Sateen
1	0.5			
1.5		.6		
2		.66	.7	.74 4-end satin
2.5		.73		.82 5-end "
3		.79	.82	.87 6-end "
3.5		.84		.93 7-end "
4		.88	.95	.98 8-end "
4.5		.92		1.02 9-end "
5		.95	1.06	1.06 10-end "
5.5		.99		1.10 11-end "
6		1.02	1.17	1.14 12-end "

The formula for finding the diameters per inch can be reduced to the following:

Worsted $22 \times \sqrt{C}$ where C equals the count.
Cotton $28 \times \sqrt{C}$

To compute the setting under Law's system we can calculate the setting for 1/20s cotton, which in the table under Ashenhurst's theory would give 58 ends and picks per inch.

By Law, $28 \times 20 \times .5 = 62.6$ ends and picks per inch, i.e. 4 ends and picks more.

Brierley's Maximum Setting Theory: The basis of this theory is that square settings vary according to the following formula:

Threads per inch - $T = \sqrt{K\ C} \times F^m$.

Where T = threads per inch
K = constant varying according to the kind of yarn and system of numbering.
C = Average counts of yarn.
m = constant varying according to type of weave.

For worsted yarns K = 134
For cotton yarns K = 200
m for twill weaves = 0.39
" sateen " = 0.42
" Plain and hopsack weaves = 0.45

The following table gives F^m values for twill, sateen and hopsack weaves:

Average Float	Weaves		
	Twill	Sateen	Plain and Hopsack
1			1
1.5	1.17		
2	1.3	1.34	1.37
2.5	1.43	1.47	
3	1.54	1.59	1.64
3.5	1.63	1.69	
4.0	1.72	1.79	1.87
4.5	1.8	1.88	
5	1.87	1.96	2.06
5.5	1.94	2.04	
6	2	2.12	2.25

It should be noted that the weave values given at the bottom of page 110 are arrived at by raising the average float to the power of $\frac{m}{2}$. for example

Four end sateen has an average float of 2
m for sateens is 0.42.

$$2^{0.42} = 1.34$$

Comparing the setting of a plain weave fabric using 1/20s cotton calculated using Brierley's theory against the sett arrived at by Ashenhurst - 58.5 and Law - 62.6

$T = \sqrt{200 \times 20} \times 1 = 63.25$ ends and picks per inch

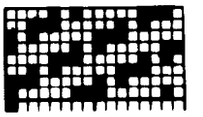
SETTING CALCULATIONS FOR BACKCLOTHS

In Fig. 1 a design for 2 x 2 twill backed in the proportion of 1 end face 1 end back and stitched every twill. This makes the stitching 1 float in 4. Suppose the setting for the fabric in the single 2 x 2 twill structure is 72 ends and picks, to find the sett for the backcloth, divide 72 by 4 (the ratio of stitching). This equals 18. Take 18 from 72, equals 54. Then add the 54 to the 72, which gives 126 ends maximum setting for this particular 2 x 2 twill warp back. i.e. 62 ends face and 62 ends back.

Fig. 1

As a further example Fig. 2, a 2 x 2 twill warp back stitched on alternate twills means that the stitching is 1 in 8. With 72 ends and picks as the setting for the single cloth the calculation to find the setting for the back cloth is as follows:

Fig. 2



$\frac{72}{8} = 9.$ $\quad 72 - 9 = 63.$ $\quad 72 + 63 = 135.$

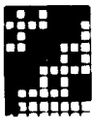
This will be adjusted to either 64 ends face and back or 66 ends face and back.

In a backed cloth where the proportion is 2 ends on the face to one on the back the above would read 64 ends face and 32 ends back. In other words the number of ends on the back is reduced by half in the same proportion as the number of ends on face to the number of ends on the back in the design.

THE SETTING OF DOUBLE CLOTHS

Fig. 3 shows a 2 x 2 twill double cloth on 8 ends and picks and it is stitched by lifting backing ends over face picks. When every warp end is stitched in this manner there is a reduction of 20% from the single cloth sett.

Fig. 3



2 x 2 twill 2/40s max. sett =

$\sqrt{22 \times 20} \times .66 = 64.9$

As fabrics, especially suitings, are not made at maximum sett we could reduce this by five per cent: = 62. To find the double cloth sett a further reduction of 20% is required = 50 x 2 which gives 100 ends and picks in the 2x2 double cloth.

In a 3 x 3 double cloth using the twill and a proportion of 1 end face,1 end back (see Fig. 4) the single fabric setting minus 5% would be 74 ends and picks. To calculate the double cloth setting it would be:

74 - 20% = 59 x 2 = 118 ends and picks for the double cloth.

Fig. 4

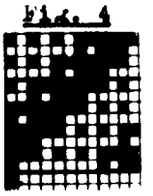
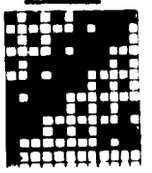


Fig. 5 is the 3 x 3 twill double cloth stitched both ways, that is, by lifting back ends over face picks and by sinking face ends under back picks. To find the setting for this type of double cloth take the single sett, 74 as above, and:

74 - 25% = 55.5 x 2 = 111 ends and picks for the double cloth.

Fig.5



Double Cloths Stitched by Interchange Weft Way

When a weave interchanges every two ends a 25% reduction is allowed from the single cloth sett, e.g.:

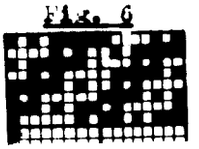
A 2/40s worsted fabric with 50 ends and picks per inch in a plain weave would require, in a double plain:

50 - 25% = 37.5 x 2 = 75 ends and picks per inch in the double plain.

Fig. 6 is a design for a 2 x 2 twill double cloth interchanged every 4 face ends. The setting for the fabric can be found from the following formula:

Interchange face ends	:	2	::	Percentage reduction for 2	:	Percentage reduction required

Fig. 6



If the design illustrated in Fig. 6 had 68 ends in the single cloth setting, then the calculation for the double cloth setting would be:

4:2::25:x Therefore, 4x = 50 x = 12.5%

The double cloth setting 68 - 12.5% = 59.5 (60) x 2 = 120 ends and picks.

Double Cloths Stitched by Interchange Warp and Weft Way

Where a double cloth is stitched by interchanging in both the warp and weft direction,the percentage reduction in sett is 6% greater than where the interchange takes place in one direction only. e.g.

Where 25% is used for the reduction in the above example, the interchange being every 2 ends weft-way, if the interchange was every 2 ends and picks the reduction would be 31%.

Note: The same calculation is used for arriving at the percentage reduction but the difference is

Interchanged ends & picks	:	2	::	31	:	x

SIMILARLY BUILT CLOTHS

In fabrics made using the same weave, the setting varies as the square root of the counts, where yarns of similar type and quality are used. For example, if a fabric is constructed with 62 ends and picks of 2/36s worsted, using 2 x 2 twill, a series of similarly built cloths can be calculated using the following formula:

$$\left(\begin{array}{c}\text{Setting}\\ \text{of}\\ \text{given}\\ \text{cloth}\end{array}\right)^2 \times \left(\begin{array}{c}\text{Counts}\\ \text{of}\\ \text{required}\\ \text{cloth}\end{array}\right) = \left(\begin{array}{c}\text{Setting}\\ \text{of}\\ \text{required}\\ \text{cloth}\end{array}\right)^2 \times \left(\begin{array}{c}\text{Counts}\\ \text{of}\\ \text{given}\\ \text{cloth}\end{array}\right)$$

If, in the above-mentioned cloth, the designer wanted to change the count to 2/24s, the calculation would be:

$$62^2 \times 12 = X^2 \times 18 \quad \text{OR} \quad X = \frac{62^2 \times 12}{18} = 50.6 \text{ ends and picks (50)}$$

The formula can also be used to find the counts if, for example, it was necessary to weave the fabric with 72 ends and picks per inch. In this case the calculation would be:

$$62^2 \times X = 70^2 \times 18 \quad \text{OR} \quad X = \frac{70^2 \times 18}{62^2} = 22.9 \text{ (2/46s)}$$

To obtain the same balance of structure in similarly built cloths when the weights are altered, the setting and counts must also be changed. To calculate these changes the following formulae are used:

1) $$\left(\begin{array}{c}\text{Setting}\\ \text{of}\\ \text{given}\\ \text{cloth}\end{array}\right) \times \left(\begin{array}{c}\text{Weight}\\ \text{of}\\ \text{given}\\ \text{cloth}\end{array}\right) = \left(\begin{array}{c}\text{Setting}\\ \text{of}\\ \text{required}\\ \text{cloth}\end{array}\right) \times \left(\begin{array}{c}\text{Weight}\\ \text{of}\\ \text{required}\\ \text{cloth}\end{array}\right)$$

2) $$\left(\begin{array}{c}\text{Counts}\\ \text{given}\\ \text{cloth}\end{array}\right) \times \left(\begin{array}{c}\text{Weight}\\ \text{given}\\ \text{cloth}\end{array}\right)^2 = \left(\begin{array}{c}\text{Counts}\\ \text{required}\\ \text{cloth}\end{array}\right) \times \left(\begin{array}{c}\text{Weight}\\ \text{required}\\ \text{cloth}\end{array}\right)^2$$

Reverting to the above fabric 2 x 2 twill with 62 ends and picks of 2/36s worsted, and supposing this weighed 13.9 ounces, then to make a similarly constructed fabric at 18 ounces per yard the calculation would be:

$$62 \times 13.9 = X \times 18 \quad X = \frac{62 \times 13.9}{18} = 47.8 \quad \text{(48 ends and picks)}$$

Having found the setting of the new cloth, it is now necessary to calculate the counts. This isdone using formula 2, e.g:

$$18 \times 13.9^2 = X \times 18^2 \quad X = \frac{18 \times 13.9 \times 13.9}{18 \times 18} = 10.7 \quad (2/22s)$$

A third formula is available in connection with changing setting, counts, weights and weaves of cloths. To obtain similarly built cloths the particulars should be altered according to the following formulae:

3) $$\left(\begin{array}{c}\text{Setting}\\ \text{of given}\\ \text{cloth}\end{array}\right) \times \left(\begin{array}{c}\text{Weight of}\\ \text{given}\\ \text{cloth}\end{array}\right) \times \left(\begin{array}{c}\text{Setting}\\ \text{ratio}\\ \text{of}\\ \text{requ'd}\\ \text{cloth}\end{array}\right)^2 = \left(\begin{array}{c}\text{Setting}\\ \text{of}\\ \text{requ'd}\\ \text{cloth}\end{array}\right) \times \left(\begin{array}{c}\text{Weight}\\ \text{requ'd}\\ \text{cloth}\end{array}\right) \text{of} \left(\begin{array}{c}\text{Setting}\\ \text{ratio}\\ \text{of}\\ \text{given}\\ \text{cloth}\end{array}\right)^2$$

A fourth formula is used in connection with formula 3 given on Page 113, and by combining the two, weight, weave, and counts can be changed to produce a cloth of similar firmness to any sample.

$$4.\ \left(\begin{matrix}\text{Counts}\\ \text{of}\\ \text{given}\\ \text{cloth}\end{matrix}\right) \times \left(\begin{matrix}\text{Weight}\\ \text{of}\\ \text{given}\\ \text{cloth}\end{matrix}\right)^2 \times \left(\begin{matrix}\text{Setting}\\ \text{ratio}\\ \text{of}\\ \text{requ'd}\\ \text{cloth}\end{matrix}\right)^2 = \left(\begin{matrix}\text{Counts}\\ \text{of}\\ \text{requ'd}\\ \text{cloth}\end{matrix}\right) \times \left(\begin{matrix}\text{Weight}\\ \text{of}\\ \text{requ'd}\\ \text{cloth}\end{matrix}\right)^2 \times \left(\begin{matrix}\text{Setting}\\ \text{ratio}\\ \text{of}\\ \text{given}\\ \text{cloth}\end{matrix}\right)^2$$

Taking the example on Page 113, namely, a 13.9 ounce 2 x 2 twill fabric constructed with 62 ends and picks of 2/36s worsted, what would be the setting and counts required to make a 17 ounce cloth in 3 x 3 twill with a similar firmness?

<u>To find the sett:</u> <u>NOTE:</u> In formulae 3 and 4 in place of the setting ratio, when calculating using Ashenhurst's Theory, use:-

$$\frac{W}{w} - I$$

Brierley's Theory, use the F^m values given on the bottom of page 110.

Law's Theory, use the weave values given at the top of page 110.

$62 \times 13.9 \times 7^2 = X \times 17 \times 6^2$ $\qquad X = \frac{62 \times 13.9 \times 7 \times 7}{17 \times 6 \times 6} = 69$ ends and picks

To calculate the yarn size, formula 4 is used:-

$18 \times 13.9^2 \times 7^2 = X \times 17^2 \times 6^2$ $\qquad X = \frac{18 \times 13.9 \times 13.9 \times 7 \times 7}{17 \times 17 \times 6 \times 6}$

$X = 16.3$ (2/32s)

<u>To Find a Suitable Weave:</u>

A cloth is woven with 60 ends and picks perinch of 2/24s worsted., and it is necessary to find a suitable weave.

Using Law's Theory, $T = D \times W$, therefore

$60 = 22 \times 6 \times W$

$60 = 22 \times 12 \times W$

Therefore - $W = \frac{60}{22 \times 3.46}$ $\qquad W = .79$

Referring to the table of weave values on the top of Page 110, it will be seen that a 3 x 3 twill has a weave value of .79, therefore a satisfactory weave for this fabric will be 3 x 3 twill.

It should also be noted that any fancy weave where the weave value worked out at .79 or the $\frac{\text{average float}}{\text{average float} + 1} = .79$ would be suitable to use in the above fabric.

SETTING OF GABARDINES

To construct a gabardine it is necessary to increase the number of ends per inch/cm. in order to create a steep angle of twill. When the ends per inch/cm. have been increased from the square sett, it is then necessary to calculate the decrease in picks.

To find the picks when the number of ends have been increased, the formula is:

A x 1.8 Where A = the increase in ends

Example: If a 2 x 2 twill fabric is made with 2/28s cotton and the twill angle is 45 degrees, to make this fabric into a gabardine the number of ends per inch could be increased from the square setting of 66 to 120. Then the calculation to find the picks is as follows:

New Sett 120 - Old Sett 66 = 54

54 x 1.8 = 7.34 x 1.8 = 13.21, say 13

Therefore, the picks per inch of the new cloth would be 66 - 13 = 53

In certain fabrics where an increase in picks and a decrease in ends is required the formula:

A x 3.6 Where A = the increase in picks

It should be noted that when making gabardines the maximum setting for the warp should <u>never</u> exceed twice the square sett. If this setting is exceeded it becomes very difficult to obtain a clean shed in weaving and also there is a tendency for warp slippage in the finished fabric.

SETTING AND AVERAGE COUNT

When calculating the sett of a fabric in which several different sizes of yarn are involved, it is necessary to find the average count. If finer yarns than the ground yarn are used as decoration this will reduce the weight of the fabric so that the setting must be increased slightly to maintain the finished weight. If decoration yarns thicker than the ground are used, this will increase the weight and some construction must be taken out of the fabric if the proper handle and finish is to be obtained.

Taking the following warping plan as an example:

Warping Plan					
	1/18s worsted	14	5	=	19
	2/80s cotton		2	=	2
	1/10s slub		1	=	1
					22

To find the average count divide the total number of each ends by the count, e.g.

19 - 18 = 1.056
2 - 60 = .033 (60 = cotton count converted to worsted)

1 - 10 = .01

22 - 1.099 = 20.02 Average Count

Therefore, the setting for the new fabric would have to be recalculated on 1/20s instead of 1/18s worsted count. If the weave was 2 x 2 twill the new fabric would need approximately 2 more ends and picks to keep the same weight.

BLENDS IN THE TEXTILE INDUSTRY

The rise and dominance of blends of fabrics in which natural and man-made fibres are intimately combined has brought about revolutionary changes in every branch of the textile industry. In research and development, in machinery and plant construction, in yarn production and in weaving, in chemistry for dyeing and finishing, in all dyeing and printing procedures, in designing and in the whole complex of marketing activities, the impact of blends has been so strong that its cumulative effect has forced a re-evaluation of all traditional attitudes and practices.

There are four basic methods for blending,
1) Hand feeding from behind the hopper line. This method involves a good deal of guesswork.
2) Sliver blending, which combines slivers of different fibres by doubling and drafting.
3) Manual blending. The different components are weighed by hand, spread out in layers and fed into the hoppers from the cross sections.
4) Automatic blending. Essentially the same approach as No.3 except that all procedures are automatically controlled.

Some of the most successful fabrics marketed have achieved their success, not because of design or pattern, or even texture, but rather because of hand plus performance developed through the combination of different fibre components to form a blend. The mixing of the fibres may be to improve hand and wearability, or to give a decorative effect, or some blends achieve both features at the same time.

One of the most interesting effects achieved in blending is a heather-toned Shetland Tweed, simply by piece-dyeing the cloth which is woven white, in one dye bath. There are many approaches to this technique. Fabrics utilizing blends of Polyester, Wool and Mohair, Polyester, Wool and Linen, Polyester, Wool and Cotton and even just Polyester and Wool, can be dyed in three colours to give heather mixture effects. In the case of making a 3 colour piece dyed effect in only polyester and wool it is necessary to employ a blend of two types of polyester, co-polymer and homo-polymer with wool. The blend could be 25% homo-polymer, 30% co-polymer and 45% wool. It is customary for the designer to work closely with spinning when developing new blends of this type. Then pad dyeing trials can be done even before the new blend has been spun into yarn, inorder to evaluate the dyeing possibilities.

The concept of using more than one fiber in the same blend is not new. While the modern science of fibre blending represents a highly refined technology, the simple idea of mixing two fibers in weaving goes back to antiquity. Mixture fabrics incorporating a linen or cotton warp with a silk weft were produced as early as 150 B.C. At the begining of the Middle Ages fabrics were being made which combined a hard twisted linen thread with finer linen or silk threads for a double warp and design motifs were produced in the weft by means of a fine silk.

Production of wool/linen union twills flourished in Europe during the 15th and 16th centuries as did linsey-woolsey cloths of course inferior wool woven on a flax warp as inexpensive decorative fabrics. It is interesting for a Designer to visit some of the museums either locally or whilst traveling. Quite often a novel fabric idea can develop from some such visit.

<u>How Man-Made Fibres are Used</u>
NYLON. is used for strenght, abrasion resistance and as an aid in weaving and knitting. In texturised form it finds application in shirts, swimwear, carpets, woven and knitted dress fabrics and lingerie fabrics. In most man made fibers, there are different types of cross section in the fibre itself. These can be very

POLYESTER - is used for overall wash and wear performance, for resistance to wrinkling, and for press retention. It adds strength and abrasion resistance to blends and lends itself to cross-dye effects, more detail of which will be given later.

ACRYLIC - is used to create bulk without weight and for versatility in surface texture. It, too, provides dimensional stability and has a hand similar to wool. It is used extensively in knitted outerwear.

ACETATE RAYON - is used for its silk-like hand in dress fabrics. It also adds lustre and can be used in some interesting cross-dye effects.

VISCOSE RAYON - is the man-made fibre most similar to cotton and is used extensively in blends with polyester for shirtings and leisure wear.

Producing Fancy Polyester/Worsted Fabrics by piece-dyeing:

By developing special blends of polyester and wool a wide range of fabrics can be built up with the following characteristics:

a) extensive colouration.
b) a wide range of fabric weight and degrees of fineness.
c) adequate light fastness over a wide range of colours.
d) adeceptable differential wear.
e) resistance to pilling and cockling.
f) reproducibility of shades from dye lot to dye lot.
g) fabrics indistinguishable from slubbing-dyed fabrics, can be piece-dyed with economy.

An example of some blends which can be used to make yarns for piece-dyed polyester/worsted fabrics are as follows.

55% polyester (Co-polymer) 45% wool
55% polyester (Homo-polymer) 45% wool
80% polyester (Co-polymer) 20% chrome-dyed black wool
80% polyester (Co-polymer) 20% white undyed wool
20% polyester (Homo-polymer) 80% white wool
27½% polyester(Co-polymer) 27½% polyester(Homo-polymer) 45% white wool

These blends can be spun using 3-denier polyester fibre as fine as 2/70s on the worsted system. Twist yarns can be made combining the different blends and when these are dyed they give the effect of a two-colour twist yarn.

The co-polymer will dye with modified cationic dyestuffs in addition to the dispersed dyestuffs traditionally applied to polyesters. The homo-polymer is dyeable only with disperse dyes and contains a fluorescent brightening agent.

Obviously, a very important need when processing these types of blends through spinning and weaving is that there should be some means of readily identifying each blend at every stage of the manufacture. The methods used for identification involve the use of fugitive tints, a different colour being used for each blend. In the finishing process these tints are scoured out of the fabric before dyeing.

To explain the method of obtaining novelty dyed effects, it is first easier to understand if one considers a simple case of taking the two types of polyester, co-polymer and homo-polymer, each in 100% form. If a disperse dye is applied this will dye both types of polyester to approximately the same colour. For example, if a blue disperse dye is used both polyesters will be dyed blue. The

Producing Fancy Polyester/Worsted Fabrics by Piece-Dyeing: contd.

co-polymer is also capable of being dyed with basic dyestuffs and these can be built on top of the disperse colour already applied. In this case the blue could be turned to, say a darker blue or a grey or a green. The shade resulting on the co-polymer is governed by the depth of the shade and colour of the disperse dye and the colour and depth of the basic dye.

The wool component can be dyed to any of a wide range of colours, giving the possibility of a three-colour combination. If colour-sealed black is used in the blends then this allows a fourth colour (black) component to be utilised. Normally, premetalised dyes or fast acid dyestuffs will be used for the wool component to ensure that the high all-round colour fastness requirements demanded by the menswear suiting trade are met. Careful selection of basic dyestuffs reduces cross-staining onto the wool to negligible proportions.

It is obvious that imagination and ingenuity are even more necessary in designing piece-dyed fancies than in the production of fabrics from dyed yarns. In designing pattern ranges, it is usual to combine several different designs side by side and then weave yardage for dyeing. If several different pattern chains are involved, these are generally woven one after the other until sufficient fabric is available for the first dyeing, and then the whole process repeated several times, depending on the number of different cross-dye colours which will eventually be needed.

It should be noted that, when combining the different blends of polyester and wool it should be aimed at having the final percentages of each fibre approximately the same. For example, an 80% polyester/20% wool yarn combined with a 20% polyester/80% wool yarn may have a 55% polyester/45% wool weft. The over all percentage would then be around 50% of each fibre.

The Use of High Shrinkage Polyester

High shrinkage polyester staple fibre can be used in blends with wool and this gives a loftier type of fabric with improved bulk and aesthetics after finishing.

This type of high shrinkage polyester is supplied in the form of a converted top with a nominal staple length (variable cut) of 3½ inches(89 mm). It is customary when using this type of polyester to blend it with approximately 50% of the normal 3-denier low-shrinkage fibre.

In constructing fabrics using high-shrinkage polyester allowance for the extra shrinkage during finishing must be made. Either a reduction must be made in ends and picks or a finer yarn must be used, otherwise the fabric is liable to come up too firm and boardy. Typical constructions for suitings and trousering fabrics using a yarn made of 25% high-shrinkage polyester, 50% normal polyester and 25% wool (70s quality) are as follows:

Weave	Yarn Count (worsted)	(Nm)	Loom sett (Thrds/ in)	(Thds/ cm)	Reed Width (in to finish 58in)	(cm to finish 150cm)	Finished Weight (approximately) oz/58 inch	(g/m²) yd
Plain	2/36	40/2	42x40	16.5x15.7	66	168	9.0	190
2/1 twill	2/44	49/2	56x56	22. x22.	67	170	10.0	212
2/2 twill	2/32	36/2	54x52	21.3x20.5	67	170	13.5	285
2/2 hopsack	2/30	34/2	54x54	21.3x21.3	67	170	14.5	305

Polyester fibre is offered in a wide range of deniers, such as 1.5, 2.25, 3.0, 4.5, 6.0, and 8.0. Various staple lengths are also available, such as 1.25, 1.5, 2.0, and 3.0 inches. The heavier deniers are used in blends where crispness and a springy yarn is required, a typical fabric which would require at least 4½ denier fibre in the yarn, would be a tweed. The crispness required in this type of fabric cannot be obtained with the finer denier fibres.

Polyester cotton yarns, which are usually made of a blend of 65% polyester and 35% cotton, use the 1.5 denier fibre, especially where it is required to spin the yarn up to such fine counts as single fifties (1/50s) cotton. With 3.0 denier fibre the spinning limits on the cotton system is 1/38s.

A polyester/cotton blend gives greater durability and consistent freshness to most all the classic constructions. The lightweight batistes, voiles, and chambrays, are not only easier to launder but last longer. The gingham, madras and Oxford constructions gain a measure of strength that is appreciated at every level. The seersucker, chord and poplin constructions are sharply up-graded in performance. The polyester fibre is springy and resilient. It has a memory and will return to its original position - wet or dry - regardless of how it has been twisted or crushed. As a result, it holds its shape even in damp, muggy weather, so that fabrics made with polyester tend to be stable. They resist wrinkling, wilting and drooping.

Another reason for its stability is that it is virtually insensitive to moisture. Water does not penetrate its surface and, therefore, does not affect its shape or size. It is also thermo-plastic. This means that once it has been set to a pre-determined shape by the application of heat, it stays that way. This makes possible permanent pleating and creasing. It is a lightweight and very durable fibre, which resists abrasion, is not damaged by sunlight, weather, milldew or moths. It also has low flammability.

CONSTRUCTION OF DOUBLE CLOTHS

There are many reasons why double cloths are produced and these could be listed as profusely as thedesigner's imagination. To list a few:

1) To produce fabrics with more weight but retaining a fine, smart face appearance.
2) To produce decorative effects impossible to obtain by any other means.
3) To weave self-lined fabrics, or reversibles.
4) When a fabric is designed with a loose, open construction such as some furnishing fabrics, a backing may be added in a very fine but strong yarn, to bind down long floats and stabilise the whole structure.
5) To produce specialty fabrics with different characteristics on the face and back. Very good example of this in recent years was a diaper fabric produced with a very soft cotton lining and a polyester outer shell. The type of weave used in the polyester fabric allowed moisture to penetrate in one direction only - outwards, thus keeping the interior dry.
6) To produce crepon or blister effects by weaving a double fabric in such a way as to create more shrinkage on the back than on the face, and creating blisters or crimps.
7) As an extension of number 6 designs have been woven where the back fabric, being constructed and woven much tighter, has caused the face fabric to form permanent pleats.

In making the design for a double cloth, the following procedure is adopted:

Suppose the plan to be made is a 2 x 2 twill for both the face and the back cloth and the ratio of ends and picks is 1 end face 1 end back, and 1 pick face 1 pick back, then the following applies:

1) When a pick is to be inserted in the face cloth, all back ends must be dropped.

2) When a pick is to be inserted into the back cloth, all face ends must be raised clear of the shuttle.

NOTE: In the first instance this ignores methods of stitching.

2 x 2 twill repeats on 4 ends and 4 picks, therefore, the plan for the double cloth will repeat on 8 ends and picks. Having found the repeat of the weave in use, the ends are now marked alternately. F = face and B = back. Fig. 1 shows the construction step by step. The procedure in making the weave is:

a) Lift all face ends over all back picks. The solid black square in Fig. 1 indicates where this has been done.

b) Drop all back ends under all face picks. The red circle, or sinker, is used in the design to indicate this.

c) Mark in the face weave in the normal manner on the face ends and picks. A black x in the design represents the face weave.

d) Mark in the back weave on the back ends and picks only. A red v is used as this symbol in the design.

e) Drop some face ends on to the back to stitch the face to the back. This is indicated in the design by a white dot where the centre has been removed from one of the solid black squares. Stitches (sinkers) are put where they would cover up and not show on the back, i.e. where there are suitable floats alongside them to cover them up.

f) Lift some back ends onto the face to stitch the back cloth to the face. The symbol - in red indicates where this has been done in the design and it will be noted that these stitches are placed in between the warp floats so that they also will be covered.

Fig. 1 shows the full construction step by step with the appropriate symbols, while Fig. 2 shows the completed weave from which the fabric would be woven with all the construction marks, sinkers, etc., removed.

Fig. 1

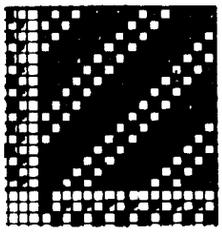


Fig. 2

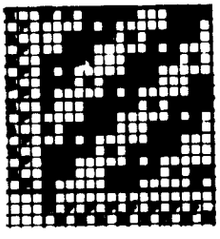


Fig. 3 illustrates the step by step construction of a design for a double cloth where the face weave is 3 x 1 twill and the back weave 2 x 2 twill. The proportion of face to back ends and picks is 1 face 1 back.

Fig. 3

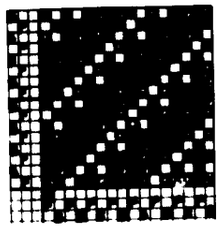
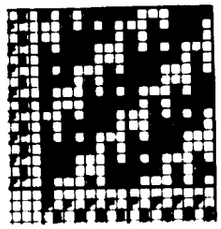


Fig. 4 is the completed weave from which this fabric would be woven, with all the construction symbols removed.

Fig. 4



Stitching by Interchange

When designs are being constructed where the stitching would be very difficult to conceal, the two cloths can be stitched together by an interchange of ends and picks. This is also sometimes used as a means of decorating the cloth.

Fig. 5 shows a design for a double plain fabric where the stitching is carried out by weft interchange. On examination of the weave it will be noticed that, for the first 8 ends of the design, the first pick is a face pick, whilst on the second 8 ends of thedesign, the first pick becomes a back pick. This interchange stitches the two fabrics together without the necessity of using single stitches, which of course would not be covered in a plain weave fabric. The step by step construction of the design is illustrated in Fig. 5 and the point of interchange is indicated. Fig. 6 shows the completed design as it would be woven.

Fig. 5

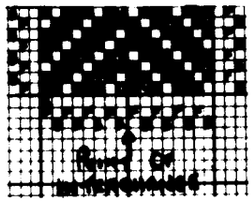
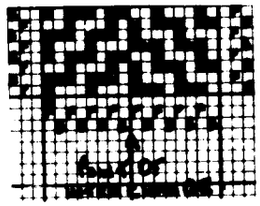


Fig. 6



The step design shown at Fig. 6 is typical double plain. The face ends always weave 3 up, 1 down, and the face picks are where the three floats of weft show on the surface. When one becomes familiar with the double plain design, it is no longer necessary to fill in all the construction details, or mark the face and back ends and picks.

Stitching by interchange can also be carriedout in the warp direction and Fig. 7 shows thed esign for this. For the first 8 picks the first end of thedesign is a face end, and then on the second 8 picks the first end of the design becomes a back end. The point of interchange is indicated, and Fig. 8 shows the completed weave.

Fig. 7

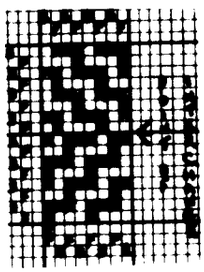
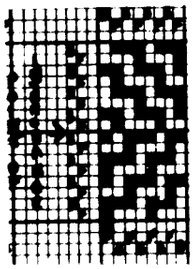


Fig. 8



The two methods of stitching by interchange, namely, stitching by weft interchange shown at Figs. 5 and 6 on Page 121, and stitching by warp interchange, shown at Figs. 7 and 8 above, can be combined. Fig. 9 shows this combination in which both the ends and picks are interchanged every 8. All the construction details are included and both points of interchange are indicated. Fig. 10 shows the complete design as it would be woven.

Fig. 9

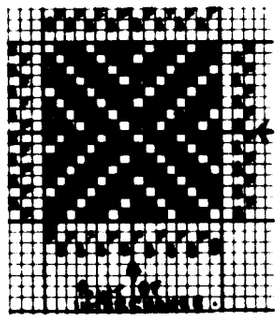
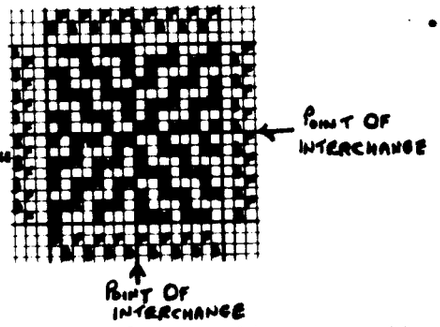


Fig. 10



When interchange is to be used as a method of decoration, as well as stitching the fabrics together, some quite novel effects can be obtained. Fig. 11 shows a small spot effect and the design at Fig. 12 shows how this spot effect could be obtained in a double plain fabric. The fabric is made 1 end face of a dark colour, and 1 end back of a light colour. The picking arrangement is the same, the first pick being on the face and light in colour, and the second pick being a back pick and dark in colour. Before starting to construct the design, the shape of the spot is drawn out to twice itsnormal size. This, then, becomes the area of interchange and when the fabric is woven the face would have a dark dot on a light ground, while the back of the fabric would be the reverse, i.e. a light spot on a dark ground. Fig. 13 is the completed weave with all construction details removed.

Fig. 11

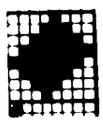


Fig. 12

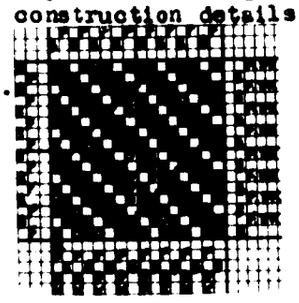
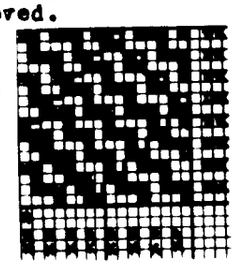


Fig. 13



Another decorative effect using the interchange double plain weave is shown at Fig. 14. The design illustrated at Fig. 15 is marked in corresponding colours, the black crosses form the dark area of the design, and the red solid squares forming the red area.

Fig. 14.

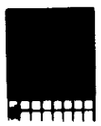
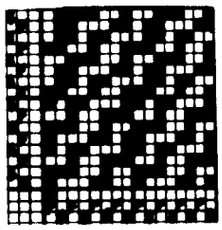


Fig. 15



Double Cloths Having Face and Back of Different Setts

Suppose it is required to make a fabric with the construction of 2 face ends to 1 back end, and 2 face picks and 1 back pick. The face could be made from 2/40s worsted with a weave of 2 x 2 twill, and this would mean that half the weight of the fabric would be on the face. The back could be constructed in a 2/20s worsted weaving plain and this would result in half theweight of of the fabric being on the back. Fig. 16 shows the construction for this design, while Fig. 17 is the completed design.

Fig. 16

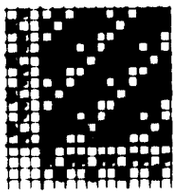


Fig. 17

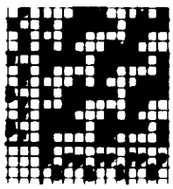


Fig. 18 shows a Mayo or Campbell twill and Fig. 19 illustrates the method of building up a 2 face 1 back fabric, having a face weave Mayo twill and the back weave plain. Fig. 20 shows the completed design.

Fig. 18

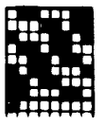


Fig. 19

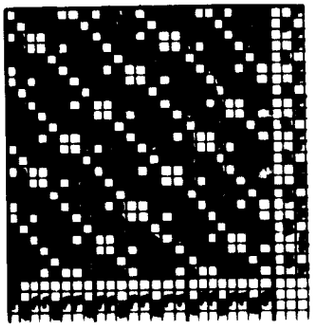
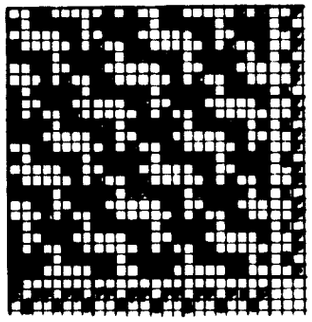


Fig. 20



The method of making a design for a 2 face 1 back double cloth with the face weave 2 x 2 twill and the back weave plain is shown in Fig. 21, while the completed weave with all the construction marks omitted is shown to the right, Fig. 22.

Fig. 21

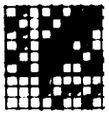


Fig. 22

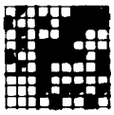


Fig. 23 shows the design for a 2 face 1 back double cloth with the face weave 2 x 2 hopsack and the back weave plain. Fig. 24 shows the completed weave from which the peg plan would be made. It should be noted that in both these designs, Fig. 21 and Fig. 23, sinkers are not employed for stitching because, as the back weave is plain, the stitches would show. The two fabrics are fastened together by lifting back ends over face picks where the stitch would be covered by the two floats of the face weave.

Fig. 23

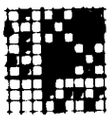


Fig. 24

An experiment is detailed to produce a design for a fabric where the face sett is 4 times the back sett, the face weave to be 4 x 4 twill and the back weave plain.

The construction for the face will be 4 x 4 twill, using 2/40s worsted (95 dians per inch). The face sett will be 76 ends per inch.

In utilising plain weave for the back, and as the proportion of face ends to back is 4 to 1, 1¼ run American woollen yarn would be a suitable backing yarn and this would require 19 ends and picks per inch. Fig. 25 shows the step by step construction of the design and Fig. 26 is the completed design. Again, as the backing weave is plain, stitching is done by lifting back ends over face picks in order to avoid stitches showing on the back.

Fig. 25

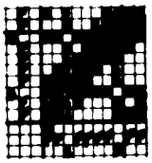
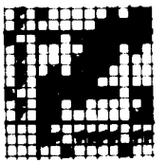


Fig. 26



The type of fabric using the 4 face, 1 back construction would give a fine faced heavy coating. The back being made of a woollen yarn would be raised to give a drawn pile effect. This type of construction is sometimes used also in travel rugs.

When the back of the fabric is to be raised very heavily, stitches could be used on the back as the raising would cover them. This type of design with a twill face usually has a tweed or mixture yarn, light warp dark weft, for the face, and quite often the plain weave back of the fabric is a fancy plaid design.

HUNG BACK CHECKS OR SELF-LINED FABRICS

This type of fabric is a single cloth in structure but has over-checks or decoration threads stitched on to the back. The decoration threads may be in either cotton, silk or worsted and are run from an extra beam in order to adjust the differential take-up encountered. These cloths are rather unique in structure, they are part single cloth, part warp back, part weft back, and part double cloth.

Where the fancy warp yarn runs on the back of the fabric, t e structure is the same as a warp back fabric.

Where the weft overplaid runs across the back of the fabric, the structure is that of a weft back.

Finally, where both decoration threads interlace on the back of the fabric, a double cloth is formed.

The big advantage of this type of fabric is that lightweight coatings, especially gaberdines, can be made up without lining, thus making them cooler to wear in a hot climate and also reducing the cost of making up. The decoration threads are stitched to the back of the fabric in such a manner that they do not show on the face. Usually, this type of fabric is woven back up in order that the decorations can be watched and to make sure that they are weaving properly. Also, in the case of whipcords and $\frac{3}{2}$ M 2 gaberdines and coverts, weaving is easier as the harnesses are lowered for three picks and only lifted for two. The extra warp threads are crammed in weaving and are completely extra in the reed. The decoration picks are also crammed, the take-up mechanism being stopped when the extra picks are inserted.

Fig. 1 shows thedesign for a 2 x 2 twill warp back with a single end and single pick overplaid. The overplaid is shown in solid red. The method of designing is to run out the ground weave over the full area of the repeat, but missing the end and pick (or ends and picks) where the decoration will be. It should be remembered that as the design is back up, the twill must be put in in the reverse direction so that,when the fabric is turned over,it will be correct. After the ground weave has been put in, the weave for the decoration threads and picks is inserted. In Fig. 1 the decoration warp thread is weaving 3 up 1 down, and the decoration pick also runs over three and under one. Where the warp decoration and the weft decoration cross, it is customary to have the warp predominating.

Fig. 1

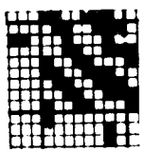


Fig. 2 on page 126 shows the step by step construction for a hung back or self-lined fabric, the ground weave of which is $\frac{3}{2}$ M 2 Venetian.

Suitable construction for this type of fabric would be a 2/32s Botany twist warp with 96 ends per inch. The weft would be a 2/32s Botany mixture with 52 picks per inch. The decoration yarn is 2/40s Mercerised Cotton and the fabric would be set 62 inches in reed to finish 57 inches.

In Fig. 2 the symbols used in the construction are as follows:

"Gr" This refers to the ground yarn
"Ch" In solid red is the first colour of the overplaid, the fabric having a 2-colour overplaid.
"Ch" Followed by green dots is the second colour of the overplaid.
"Black Cross" shows the ground weave.
"Red Cross" indicates the stitches for the fancy weft overplaid.
"Oblique Line" shows the weft interlacing where the warp and weft overplaids are crossing.

Special attention should be paid to the way in which the ground is opened up, in order to allow for the insertion of the decoration, and the solid ground area is shown in the top right-hand corner of the design, the weave of course being reversed in order to allow the fabric to be woven back up. Fig. 3 to the right shows the completed weave with all construction details removed.

Fig. 2

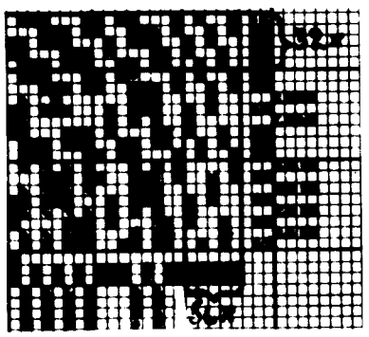


Fig. 3

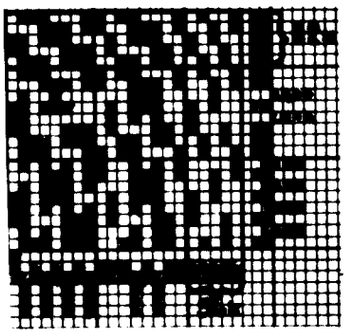
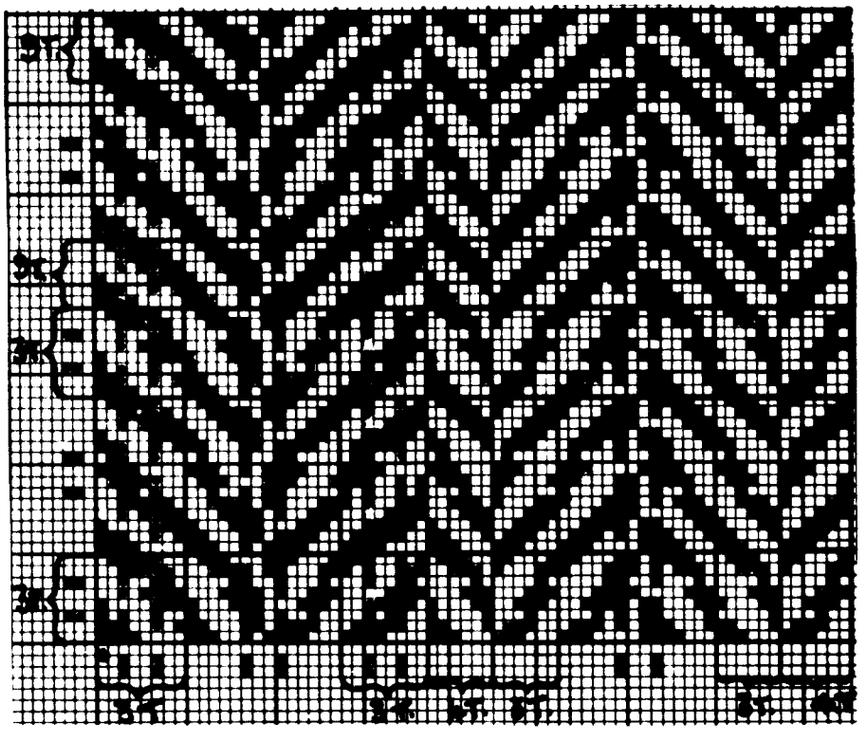


Fig. 4 shows the full design for a 3 x 3 twill, 24x24 herringbone, with a 2-colour fancy overplaid on the back.

Fig. 4



INDENT TWILLS OR IMITATION DOUBLE CLOTHS

The designs consist of a spiral type of weave structure arranged to show twills on each side of the fabric in imitation of double cloths. They are really a type of interchanged double cloth in which the interchange is arranged in such a manner as to form a fine twill effect. They are built up in a similar manner to Pseudos or imitation Backed fabrics.

Fig 1. is the design for an indent twill or imitation 2 x 2 twill double cloth. The weave repeats on 7 ends and 14 picks. Using the symbol 'black X' to represent the face weave, 'black V' to show the back weave and 'black dots' to represent the stitches creating the interchange the design is constructed as follows:-

a) Using the symbol 'black X' run in the 2 x 2 twill face design on odd ends and picks. This is done in a similar manner to when a back cloth is being designed. As the face twills are alternate and the design has a repeat of 7 warp ends, the first twill line is on the ends 1 - 3 - 5 - 7 whilst the second line of twills is on ends 2 - 4 & 6.
b) Using the mark 'black V' run in the 2 x 2 twill design for the back of the fabric. As the first end of the design is the face, in the bottom left-hand corner, the design for the back of the cloth will run 2 - 4 & 6 on the first half of the design, and 1 - 3 - 5 & 7 on the second half of the design.
c) Three lifter marks are now added (represented by solid black squares) one between the two crosses, one below the bottom cross, and one above the top cross. These lifters create the face ends of the fabric.
d) To complete the weave a further series of lifters are added in the position shown by the black dots. This creates the point of interchange.

It should be noted in Fig. 1 that although the warp ends interchange, the even numbered picks are always the back picks. Therefore, a cheaper quality yarn could be used with this weave for the even picks, which create the back of the cloth, without detracting from the face appearance.

Fig. 1

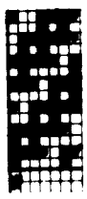
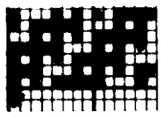


Fig. 2 shows the design for a 2 x 2 twill imitation double cloth on a repeat of 14 ends by 7 picks. Here, it is the weft which interchanges, while in the warp all the odd-numbered ends in the design stay on the face of the fabric.

Fig. 2



Weaves where interchange takes place in both the warp and weft are generally regarded as the most satisfactory type for imitation double cloth designs. Fig. 3 shows a 2 x 2 twill imitation double cloth repeating on 16 ends and picks where interchange in both the warp and weft direction occurs.

Fig. 3

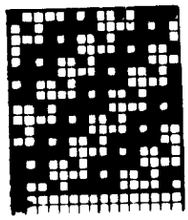
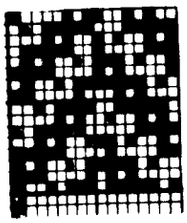


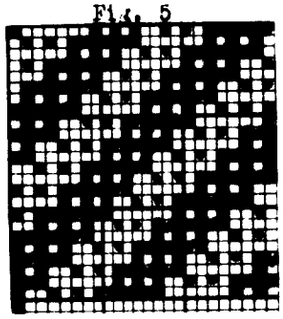
Fig. 4 is an imitation double cloth using 2 x 2 twill, 4 x 4 herringbone, as the weave for both the face and the back of the cloth. Again, in this design, interchange takes place in both warp and weft.

Fig. 4



In constructing larger twill imitation double cloth designs, more lifters are required for the face ends, to create the twill. Fig. 5 shows the imitation double cloth design for 5 x 3 twill on both the face and back. Four lifters are required on the face ends and two further stitches represented by the black dot to create a definite point of interchange.

Fig. 5



The construction of indent twills is confined almost entirely to imitating the smaller twills, such as 2 x 1, 2 x 2 and 3 x 3, and the 1 face, 1 back arrangement is usually adopted. The frequent interchanging of the individual threads requires that these structures be set looser than ordinary double cloths. A maximum setting would be no more than a 60% increase on the corresponding single cloth weave. However, an increment of no more than 50% is far more common.

METHODS OF CREATING CUTS IN DOUBLE CLOTHS

Quite often, when designing double cloths, it is necessary as part of the design to create a definite line, or cut, in the fabric either warp way, which would take the form of a stripe effect, weft way, or in both directions to form a plaid. Fig. 1 shows a method of creating a cut in the warp direction. The fabric is a 2 x 2 twill double cloth, 1 face, 1 back in warp and weft. Two distinct lines have been created in the design by making two of the back ends weave plain weave. This would give a double line effect in the warp direction.

Fig. 1

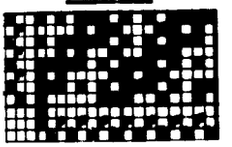
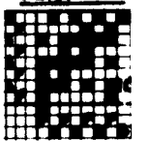


Fig. 2 shows the same method used to create a weft cut, i.e. a back pick is made to weave plain weave.

Fig. 2



In the design shown at Fig. 3, which is a 2 x 2 twill back cloth, 1 face, 1 back, arranged in the form of a cut check, the cut is emphasised by making the appropriate back ends and picks weave plain.

Fig. 3

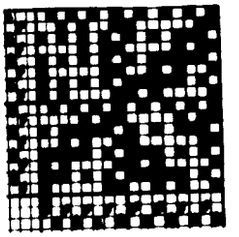
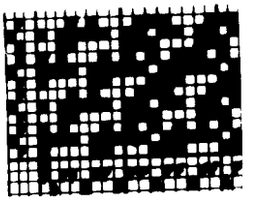


Fig. 4 shows a 2 face, 1 back double cloth structure, the face weave being 2 x 2 twill, whilst the back weave is plain. Here, a warp-line cut is created in two places in the design, by lifting the back end over all the face picks.

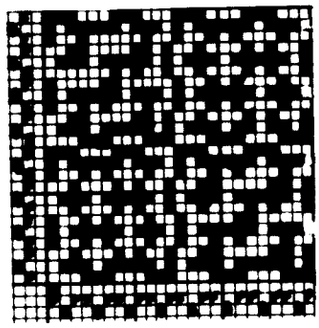
Fig. 4



Sometimes the cut maybe created by the variation in the weave only, at other times a decoration thread maybe made to run along the line of the cut to emphasize the effect. Another popular method is to employ a cord end or pick, that is, a thicker yarn tightly twisted to emphasise and create a rib of a pronounced character. The cord yarn may simply be the ground yarn doubled, i.e. if the ground yarn was 2/40s, then the cord would be 2/2/40s.

Fig. 5 is a 2 face, 1 back double cloth where the face weave is 2 x 2 hopsack and the back weave is plain. Here, a cut is created in both the warp and weft direction to make a novel kind of check effect. Two ends and two picks in the repeat are made to weave 3 x 3 cutting with each other, these are face ends and picks. The design is further elaborated to create twill (2x2) in the bottom right and top left-hand corners, andthis cuts with the hopsack weave.

Fig. 5



MULTI-FOLD FABRICS

It is possible to construct three-fold and four-fold fabrics, using the same principle as that used for making double cloth designs. Fig. 6 shows a diagramatic representation of a design where solid areas of fabric, light, medium and dark, are alternated in the form of a check. Fig. 7 shows a treble cloth using plain weave for each of the three layers of the fabric. The warping and wefting arrangement is L = light, M = medium, D = dark. If the design is examined carefully it will be found that the fabric, when woven, will correspond to the diagramatic representation, Fig. 6, i.e. the bottom left-hand square will be light, the middle square dark, and the bottom right-hand square medium etc.

Fig. 6

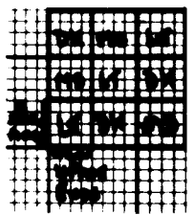
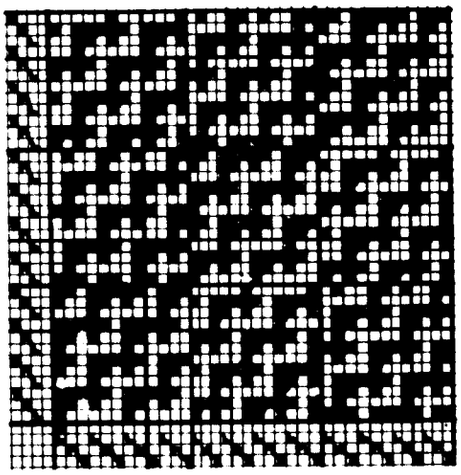


Fig. 7



THE PRODUCTION OF COLOUR AND WEAVE EFFECTS IN DOUBLE CLOTH FABRICS

Colour and weave effects can be produced in double cloths in a very similar manner to the way they are produced in single fabrics. Fig. 1 shows a double plain, 1 face 1 back. If the face ends and picks are all black and the back ends and picks all white, the effect will be of a reversible cloth with a black face and a white back. This is shown at Fig. 1a.

Fig. 1

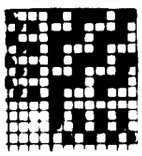


Fig. 1a

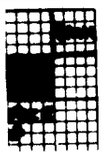


Fig. 2 shows what would happen if the proportion of face to back ends and picks is changed to 2 face, 2 back, and the warping and wefting colouring plan is 1 white, 1 black. Fig. 2a shows the design which results, a vertical hairline and the back of the fabric will also show a vertical hairline. However, where the hairline is dark on the face, it will be light on the back.

Fig. 2

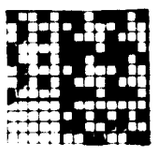


Fig. 2a

Fig. 3 is another double plain design with an interchange, the proportion of face to back ends being 1 back - 2 face - 1 back - 1 face - 2 back - 1 face. The weft being in the same order. If this design is woven using a warping and wefting colouring plan of 1 white, 1 black, the four pointed star effect shown at Fig. 3a will result. The face of the fabric will have a white star and the back of the fabric a black one.

Fig. 3

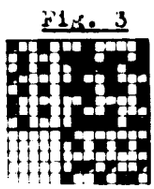


Fig. 3a

If a 2 face, 2 back, double plain design is made with the wefting arrangement 1 face, 1 back, and it is coloured 1 white, 1 black, in warp and weft, a little spot effect is obtained. The design for this and the resultant colour and weave effect are shown at Fig. 4 and Fig. 4a respectively.

Fig. 4

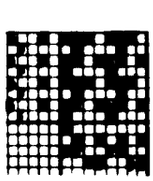


Fig. 4a

REVERSIBLE RUGS OR SHAWL FABRICS

This type of fabric, which is very popular for use in making travelling rugs and reversible coatings such as Hunting or Lumber Jackets, can be made with a cotton or spun polyester warp and a woollen spun weft. A single warp isemployed and either two, three or four different colours of weft.

An examination of the weaves employed will show that these structures are weft twills or weft sateen effects with a weft back, also stitched in twill or sateen order. This makes the fabric completely reversible and a weft faced weave is employed on both the front and back surfaces of the fabric. The finishing routine, which includes heavy napping, to raise a dense pile, in combination with the type of weave, ensures that the fine warp is completely hidden in the centre of the fabric. White warps are used usually and a complete range of colourways can be woven on one design simply by changing the weft colours.

The design isproduced by the interchange of face and back weft. Stripes, both vertical and horizontal, plaids, and ombre or shadow stripes and plaids, are very popular styles for this kind of fabric. These types of designs can be woven on dobby looms as usually the interchange is either vertical or horizontal, or both, and does not involve the use of a large number of shafts. Complicated figure effects do, however, require a jacquard harness.

Two suitable fabrics are given, as follows:

1) Warp 2/16s c.c.(14s metric) 100% cotton.
   Weft 1.6 run (5.4s metric) woollen yarn. A blend of wool and acrylic can be used in place of all wool.
   Warp sett 40 ends per inch (15.75 ends per cm.)
   Weft sett 60 picks per inch(23.5 per cm.)
   The fabric would require a hopsack lift, and would be sett 71 inches wide (180 cm.) in reed to finish 60 inches (152 cm.)

2) A fabric utilising a three-colour effect is -
   Warp 1/10s c.c. (17s metric) spun in 100% polyester.
   Weft 2 run (7s metric) woollen yarn. Again a blend of wool and acrylic could be used, and a good percentage would be 50/50.
   Warp sett 40 ends per inch (15.75 ends per cm.)
   Weft sett 90 picks per inch(35 per centimeter)

Fig. 1 shows the weft cross-section of a typical two-colour effect in a rug or shawl design. The black circles represent the warp threads, the red solid thread representing one pick of weft and the green (not solid) representing the second pick of weft.

Fig. 1

To construct the weave for a reversible fabric of this type proceed as follows:

1) Fig. 2 shows a twill base. First, insert the twill order warp lifts. one the pick which is required on the face. Fig. 3 shows the step-by-step construction and these warp lifts are indicated by solid squares.

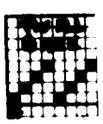
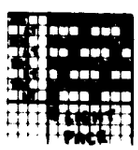
Fig. 2 

Fig. 3 

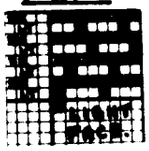
2) Insert the warp sinkers in twill order on the pick which is required on the back. These are indicated as black circles or sinkers in Fig. 3, page 132.

3) Lift all the remainder of the warp on the back pick, this is indicated by inserting black crosses.

The broken crow, or 4-end sateen, may be used in place of the twill base. In this case, the sateen warp lifts are inserted first, then the weft sinkers are inserted in the reverse order. Fig. 4 shows the sateen base for the broken crow, while Fig. 5 shows the construction of the weave.

Fig. 4

Fig. 5



In the examplesshown at Figs. 3 and 5 the wefting plan is 1 light, 1 dark, and this would result in a light face to the fabric, with dark on the reverse side. Figs. 6 and 7 show the changes required to produce a dark face in the same fabrics.

Fig. 6

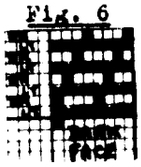
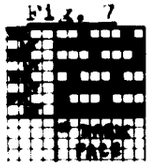


Fig. 7



Designs for a fabric woven in three colours are shown below. A twill base is used for the construction of the design and Fig.8 shows the weave to give a red face and a green back with the yellow pick in the centre. Where three colours of weft are used the pick, which will stay in the centre to be covered, is made to weave 2 up, 2 down. Fig. 9 showsthe weave, which will give a green face and a yellow back with the red pick weaving in the centre, whilst Fig. 10 gives a yellow face, red back and green hidden in the centre.

Fig. 8

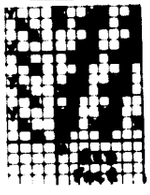


Fig. 9

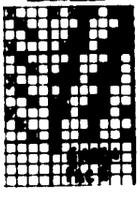
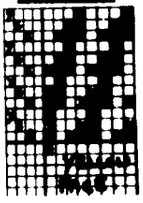


Fig. 10



The next step in the construction of this type of fabric is to proceed to figured styles and, asmentioned previously,, due to the enlarged repeat of the design, a jacquard harness is required.

The finishing procedure for this type of fabric involves fulling followed by napping, both the face and the back. Depending on the materials involved, several passes over the napper may be required before sufficient pile is obtained. It is a characteristic of some napping machines that after one side has been napped and the fabric is turned over, when the second pass is made some of the pile from the face is drawn through on to the back. Therefore, the technical face on which the better pile will be required should be passed through the napping machine last.

Fig. 11 represents a novelty figured effect for a reversible fabric. The procedure for designing this type of fabric is as follows:

1) Firstly, the figure is drawn out on point paper and filled in with a light tint, in order that other marks may be superimposed. This is the red area in Fig. 11.

2) The broken crow sateen (represented by an oblique line) is then inserted over the entire repeat of the design.

3) The reverse of the broken crow, represented by crosses in Fig. 11, is also inserted over the entire design area.

The design is now ready for card cutting, and card cutting instructions are as follows:- Cut each pick twice.

a) Cut all oblique lines and blanks.
b) Cut all oblique lines and red areas.

Note: All squares marked with a cross are left uncut.

The cards are laced alternately, 1a - 1b.

Fig. 12 shows the design opened up and indicates the first 8 picks as they would be woven when the cards have been cut according to the above instructions.

Fig. 11

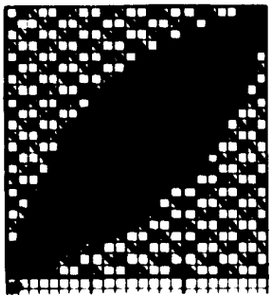
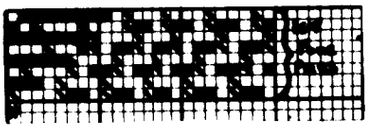


Fig. 12

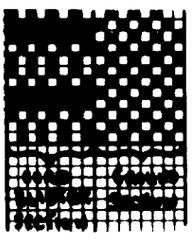


CRIMPS, BLISTERS, SEERSUCKERS AND CREPONS

These types of fabrics are usually produced for dress goods and sports and leisure wear. They are also met with in soft furnishings and upholstery. The effect is generally one in which the surface of the cloth shows blisters or distortions, and it is possible to produce this type of fabric in a variety of ways:-

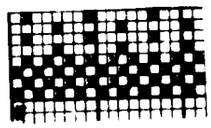
1) By a combination of suitable weaves, i.e. a slack weave combined with a tight weave. Fig. 13 shows this type of design where the ground weave consists of 8 ends weaving plain. The blisters or cord section is formed by using a Bedford Cord type weave. After finishing, the crimps in the cord blister section will be emphasised.

Fig. 13



2) By unequal tension of the warp threads in conjunction with a suitable design. This method usually required two beams in weaving. The slack ends produce the raised portion in the effect. Fig. 14 shows a design of this type with a section of plain weave for 4 picks running across the cloth. On every third end the plain weave is carried right through the design warp-way. These ends are woven from a separate roller and are held back to cause them to weave tight, thus creating a blister effect.

Fig. 14



3) By a suitable combination of materials, for example high shrinkage polyester, combined with the normal polyester. Or, an 80/ polyester/ 20/ cotton blend used with a 20/ polyester/80/ cotton blend. Differential shrinkage causes the blister effect. As an example, if a warp were made in the above using 8 ends of the80/ polyester/20/ cotton and 8 ends of 80/ cotton/20/ polyester, and woven in plain weave, during finishing the 80/ cotton blend would shrink much more, causing a seersucker stripe effect.

4) By dropping picks from the body of the cloth and floating them on the back andusing tightly twisted yarns for weft to obtain contraction. Fig. 15 is a design showing this.

Fig. 15

5) Crimped or seersucker fabrics can be also made by a combination of numbers 1, 2, and 3. That is, a tight and slack weave with the tight part of the weave emphasised by applying more tension to the warp, and then the use of two types of yarn with differential shrinkage in the tight and slack areas.

6) Blisters can also be created by chemical means:

a) Caustic soda is made into a thick paste using suitable coagulating agents. This can then be printed in a design form onto an ordinary plain weave cotton fabric. The caustic soda paste causes shrinkage in the parts that it touches and the untouched fabric cockles, or forms blisters.

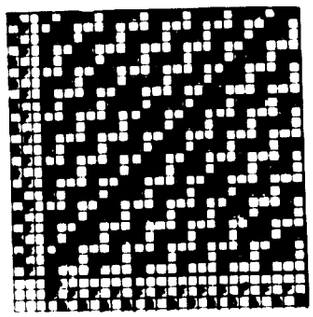
b) All wool crepons, after scouring, are printed to a pattern with sulphuric acid, ten to twenty degrees twaddle, thickened with gum. After drying, the fabrics are passed through a weak solution of bleaching powder for two minutes. Fabrics are then scoured well and fulled with soap until the crimp is sufficiently pronounced.

Figured Blister Fabrics

Fig. 16 shows thedesign for a blister fabric using double plain. The effect would give a diamond-shape blister and the method of obtaining the blister is to use a high shrinkage material on the back of the fabric and a low shrinkage material for the face.

The method of designing is as follows:- the double plain weave is made to cover the complete area of the design. No stitching is employed during this phase and interchange is not used either. Stitches are then inserted by lifting the back on to the face, in the form of a figured effect. The solid black squares in Fig. 16 show these stitches, and the fabric is only stitched at this point. In finishing the back will shrink much more than the face, creating the blister effect.

Fig. 16



To produce this type of fabric it is usual to use a shaft and harness mounting. The face weave will draft onto two shafts which are usually mounted in front of the jacquard harness and operated by tappets. Fig. 17 shows the draft for the design illustrated at Fig. 16, whilst Fig. 18 shows the design with all the face ends taken out. This is the design from which the cards are cut. When cutting the cards the following procedure is adopted:

1) Cut the black mark on the first pick.
2) Cut another card - all odd hooks.
3) Cut the third pick of the design, black marks only.
4) Cut another card - all even hooks.

If Fig. 18 is studied closely, it will be easily understood how these card-cutting instructions are arrived at.

Fig. 17

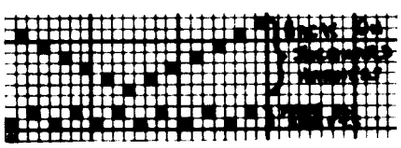
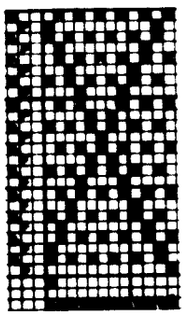


Fig. 18



CORDUROY FABRICS

The corduroy is classed as an extra weft pile fabric. In this type of structure, the pile picks are bound in at intervals in a straight line. The same weft is used for the basic cloth as for the pile cloth . When the fabric leaves the loom the weft floats lie across the face of the fabric forming tunnels, then they are cut to create a pile. The cuts are made right up the centre of the space between the binding points. After cutting the tufts of fibres project from the foundation of the fabric in the form of cords or ribs running length way usually up the fabric, that is in the warp direction. By modification of the weave they can appear to run across the fabric, this is done by creating ribs across where the fabric is stitched across the full width in such a way as no pile is formed at that point after cutting. This will be shown in one of the designs illustrating the different types of corduroy.

The finer class of cord designs, pinwales etc. which are used for dress fabrics and leisurewear are usualy made in fine yarns with plain backs. The corduroys used for mens clothing are heavier in most cases and to get the extra weight into the fabric a twill ground weave is usualy introduced. In the heavier fabrics fewer pile picks are necessary in relation to each ground pick because a thicker count of weft is used. It is usual to make the proportion - two pile picks to one ground pick.

In the simplest corduroy designs the pile picks are bound into the fabric in plain weave order on two consecutive ends. Fig.1 shows this and in the example the pile picks are bound in after every four ends. Also the plain weave has been reversed in alternate cords so that the complete design extends over the width of two cords. If this design was woven with a construction which gave 60 ends per inch finished and the repeat of the weave is on twelve, then the number of cords or wales per inch would be

$$\frac{60}{12} \times 2 = 10$$

If the fabric had 24 ends per cm. the the wales per centimeter would be

$$\frac{24}{2} \times 2 = 12$$

The arrow underneath Fig.1 indicates the point at which the weft floats would be cut to form the pile.

Fig. 1

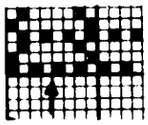
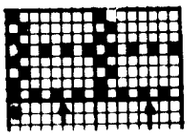


Fig.2 shows a design in which the plain weave binding is not reversedand the width of the wale in this case has been increased by two more ends. The result is practicaly the same which ever method of binding is adopted. In the design at Fig.2 all the pile floats are equal. However as the floats are cut in the middle of the space between the pile binding points (see black arrows) in both designs one side of each tuft is longer than the other. The number of wales perinch and per cm. with 60 ends per inch fin. and 24 ends per cm. fin in Fig 2 is as follows :

$\frac{60}{16} \times 2 = 7.5$ $\frac{24}{16} \times 2 = 3$

Fig. 2



A suitable construction for the weave given at Fig. 2 on Page 137 is as follows:-

Warp - 2/60s combed cotton, 72 ends per inch in reed (28.5 per cm.)
87 ends finished (34½ per cm.)
Weft - 50s c.c., total picks per inch in loom 368 (145 per cm.)

The difference in lengths of the weft floats which create the pile causes the whales, or ribs, to have a rounded formation as the longer side of the tufts forms the centre and the short side the outer part of the cord. This effect is illustrated by the diagram of a section across the warp of the design, Fig. 2, page 137. This cross-section diagram shown below, Fig. 3, illustrates one of the cords uncut, andone of the cords cut. The point at which cutting takes place is again indicated by the black arrow.

Fig. 3

Designs may be constructed to pfoduce various widths of cord, and the cords may be equal in width or varying, some wide and some narrow. Fig. 4 shows a design in which the whales have been made wider and here the stitching is reversed in the second three pile picks. With 60 ends per inch finished and 24 ends per centimetre finished, the number of whales per inch/cm. would be as follows:

$\frac{60}{10}$ = 6/1 inch $\frac{24}{10}$ = 2.4/cm. Fig. 4

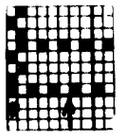
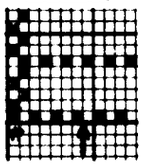


Fig. 5 illustrates a design with four consecutive pile picks between each ground pick. Again, plain weave is the binder.. This design gives a still wider whale, and with 60 ends per inh finish and 24 ends per cm. finished, the number of wales per unit area would be:

$\frac{60}{12}$ = 5/1 inch $\frac{24}{12}$ = 2/1 cm. Fig. 5



Where an increase in weight is required in a corduroy fabric the backing can be changed from plain weave to either 2 x 1 or 2 x 2 twill. Fig. 6 shows an example of a corduroy design using the 2 x 1 twill as the ground It is arranged with 2 pile picks to each ground pick and produces quite a heavy structure. However, as the cords produced by this design are only 3 ends wide and both sides of the tuft are of equal length, the ribs are

(see p.139 for Fig.6)

... not rounded and a poor and bare struoture results.

Fig. 6

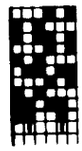
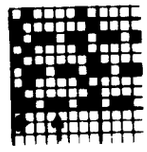


Fig. 7 illustrates a design similar to Fig. 1, in which the stitching is reversed in the ground weave. Again the repeat of the design extends over the width of two cords and, instead of plain weave, the ground weave is based on 2 x 1 twill.

Fig. 7



A corduroy design with a 2 x 2 twill back is shown at Fig. 8. This, again, has the stitching reversed so that the repeat takes up the width of two cords. This type of weave with two pile picks to every 2 x 2 ground pick is used for heavier structures.

Fig. 8

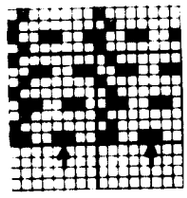
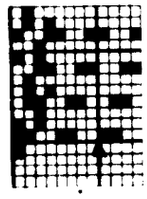


Fig. 9, which isanother weave used for a special heavy and wide cord is arranged so thatalternate pile picks are interwoven more frequently, with the object of producing greater variety in the length of the tufts, andthis causes the rounded formation of the tufted pile in the wales to be much more pronounced.

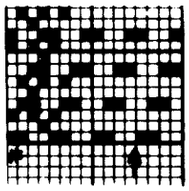
Fig. 9



All the designs given can be readily rearranged to produce cords of different widths in the same fabric construction. These result in varied and more interesting textures. Sometimes alternate cords are left uncut so that a stripe of tufted cord alternates with a stripes of float construction. Thistype of design with its modification is very useful in fabrics which are intended for heavy wear, as the tufts are anchored more securely.

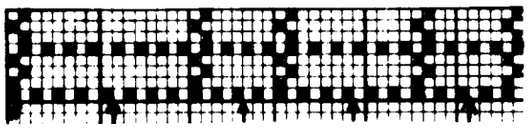
Another design for a heavily constructed fabric, using 2 x 2 twill ground weave, is shown at Fig. 10. Here once again the interweaving of alternate ground picks is done in such a manner as to make the rounded effect in the pile more noticeable.

Fig. 10



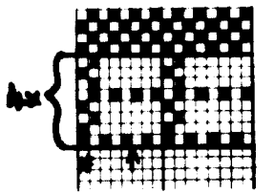
Another variation besides the method of leaving alternate cords uncut, and producing a tufted cord and an untufted one, is to produce cords of different widths. These can be varied according to the effect required. For example, a simple arrangement would be 1 wide cord alternating with 1 narrow cord. Another arrangement would be 1 wide, 1 narrow, 1 medium, 1 narrow. Fig.11 shows an example of this type of design.

Fig. 11



As mentioned previously, at the beginning of this article, the cords can be made to appear to run in the weft direction. This is done by having an area of cord created in the normal manner followed by an area where all the floats are bound down. When cutting occurs no pile is created in this area and, therefore, a rib is created running widthwise across the cloth. Fig. 12 illustrates the design which will create this effect.

Fig. 12



Sometimes the creating of weft lines is combined with the warp direction of the wales in order to create little staggered check effects. This is illustrated at Fig. 13. Or, cuts weftway may be combined with areas which are unbroken, this is seen at Fig. 14.

Fig. 13

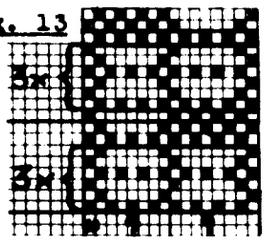
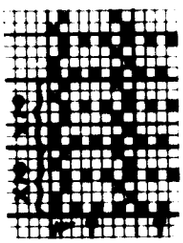


Fig. 14



Cutting of Corduroys

The cutting machine consists of a series of guides or cutting races and circular knives, one to each guide. Due to the distance between the cutting races the fabric can be cut in a single pass. All the cords are cut at the same time by the circular knives. There is one knife to each cord placed on a revolving shaft. Each knife rotates within a slot formed by the guide. When cutting starts, the pointed end of each guide is inserted under the pile floats in the centre of each cord. The cloth is fed forward towards the knives by means of tention rollers, but at the point of contact with the cutting edge it is drawn in a downward direction over the edge of a traverse bar. The floating pile picks are brought by the guides into the path of the revolving knives and are cut while the cloth is passing downwards. It is then either wound onto a beam or fliped, (folded).

After finishing, some very attractive fabrics have been produced on corduroy by overprinting. As an example, a corduroy fabric can be piece-dyed in a gold shade and then overprinted in maroon. The printing "tops" or colours the pile in the maroon shade, leaving the base of the fabric between the wales gold. This gives a very attractive two-colour "shot" effect. Other fabrics have been printed with check designs, and even houndstooth effects. This is mentioned as another method of improving the versatility and market appeal of this type of fabric.

The quality of corduroy can be varied considerably by the changes in the density of the weft. Once the width of the cord has been determined the end setting has to remain unchanged, but the scope for changes in the weft yarn counts and setting is sufficiently extensive to p rmit the construction of widely different qualities of cloth within each structure. The examples which follow represent good quality all-cotton fabrics in each of the selected weaves.

Weave at Fig. 4, page 138

Warp - 2/120s c.c. 72 ends/1 inch (28/1cm)
Weft - 50s c.c. 34 picks/1 inch (140/1cm)
This construction would give a weft contraction of 19%.

Weave at Fig. 7, page 139

Warp - 2/40s c.c. 30 ends/1 inch (12/1cm)
Weft - 20s c.c. 426 picks per inch(168/1cm)
The weft contraction here would be 20%.

Weave at Fig. 9, page 139

Warp - 2/30s c.c. 34 ends/1 inch (13/1cm)
Weft - 18s c.c. 436 picks/1 inch (172/1cm)
This construction would give a weft contraction of 25%.

Corduroy fabrics have a wide range of end uses and in recent years the lighter weight constructions have tended to gain favour because of the cost factor involved. Pin wales have become very popular, this is a very fine wale and the narrowest. Apart from use in apparel, these fabrics have become very popular in upholstery and all kinds of accessories, such as luggage, handbags etc. In the latter cases the corduroy fabric is bonded to plastic. Also, in many cases where the fabric would encounter considerable contact with dust and dirt, stain-resist and soil-release finishes are applied. Also, for outerwear, shower-proof finishes have been successfully used.

CRAMMED STRIPES

Cramming, or the increase in the number of ends in the reed, in certain areas of the fabric, can be done for a number of reasons. In a twill fabric such as that shown at Fig. 1, if the ground ends were sleyed 3 per dent and then increased to 4 and 6 per dent the density of the cloth in the crammed area would increase and the angle of the twill would be much steeper. In plain weave fabrics variations in the ends per dent can be used to create light and dark areas in an otherwise plain fabric. This is known as a shadow effect. Fig. 2 shows one such design.

Fig. 1

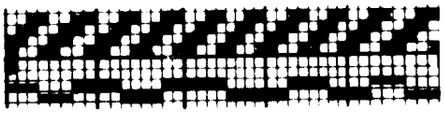
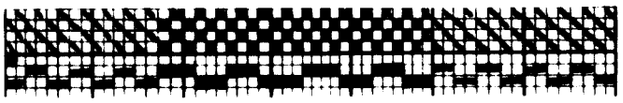


Fig. 2



Increasing the number of ends in the reed in different areas is used quite a lot in the manufacture of suitings, costume cloths, dress fabrics and leisure wear. Sometimes cramming has to be done to compensate for fine yarns used on an otherwise medium or thick count ground. When different weaves are combined, for example, a tight weave such as plain with a slack weave such ass sateen, the area of the sateen weave would have more ends per dent in the reed to compensate for the difference in the average float of the two weaves.

The simplest example of a crammed stripe is shown at Fig. 3. This illustrates a pin-stripe introduced into a common twill ground. The ground, which is 2 x 2 twill, and would be made using a medium or fine count yarn would be sleyed 4 per dent. Where the pin-stripe occours, 2 ends of fine mercerised cotton or silk are used. These are included in the same dent with 3 of the normal ground threads, making a total of 5 in that particular dent. There are two alternate methods of sleying these fine ends, Fig. 3 shows the ends immediately adjacent to one of the dividing teeth in the sley. Quite often this causes the cotton ends to break frequently during weaving as they are subject to much abrasion. Fig. 4 shows an alternative method where by moving the start of the design over, the two decoration threads, while still included with 3 ground threads, have ground threads on either side of them protecting them from abrasion. This is the best method of arranging the sleying in this type of design.

Fig. 3

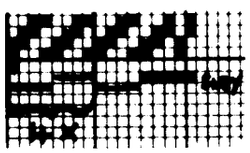
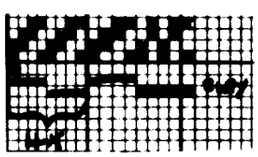


Fig. 4

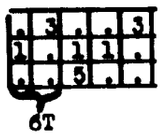


It should be noted that the method of sleying is usually indicated by lines covering the number of ends in each dent. Where extra ends are included thicker lines or double lines are used to emphasis the difference.

Fig. 5 is an example of a woollen suiting, the ground being 2 x 2 twill, 4 x 4 herringbone, and there are 28 ends of ground with a fancy stripe created by 5 ends of a finer mercerised cotton.

The warping plan is as follows:

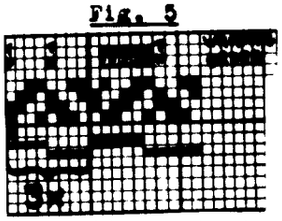
2ply run (American) Grey/White twist
2ply run (American) Solid Grey
2/20 cc Merc.Cotton - White



= 21
= 8
= 5
34

Construction: 34 ends per inch in the ground
68 inch wide in reed, to finish 58 inches

Fig. 5



Slaying Plan:
4 per dent 6 times
6 per dent 1 time
4 per dent 1 time

An alternative method of writing the slaying plan would be

$$\frac{4\ 6\ 4}{6\ 1\ 1}$$

The calculations for the ends of each colour in the warp would be as follows:

Total ends in fabric 68" x 34 = 2312
Ends in one repeat of pattern = 34 - 2 extra = 32
Therefore, repeats of pattern = $\frac{2312}{32}$ = 72 patts.plus 8 ends.

The fabric must be laid out in such a manner that the design is balanced from selvedge to selvedge. In other words, if possible the start of the design on the left-hand side of thef abric, and the finish of the design on the right-hand side, are the same. This is done in order to facilitate the cutting out of garments and the matching up of the patterns which go to make up the garments.

In the above design there are 29 ends in the ground and 8 ends are left over from an exact number of repeats of pattern. To arrive at a satisfactory balance the ground ends are divided into two, $\frac{29}{2}$ = 14 ends one side and 15 the other. To this must be added half the number of the ends over, in other words 4 endsmust be added to each side. It is not important to have one end difference between the left-hand side of the selvedge and the right, as this is not noticeable. Therefore, if the design is started on the 28th end it will be balanced.

The total ends in the fabric would be calculated as follows:

2ply run Grey/White	21 x 72 = 1512	plus 6 =	1518
2ply run Solid Grey	8 x 72 = 576	plus 2 =	578
2/20s cc M.C.	5 x 72 = 360	no extra =	360
			2456 Total ends.

In each pattern 2 of the 2/20s MC are extra, therefore, there are 2 x 172 = 144. 2456 - 144 = 2312 (total ends without extras)

A further example of a woollen tweed is given at Fig. 6 where the ground is sleyed 3 per dent and the decoration yarn 7 per dent. i.e., 12 of the decoration threads are extra in each repeat of the design.

The warping plan for Fig. 6 is as follows:

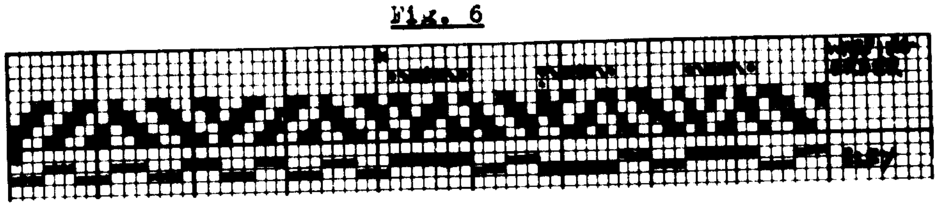
5 run (American) Grey/White twist	33				6				6				6	=	51
2/40 X 2/20 MCT Black/White	1			1	1			1	1			1		=	6
2/40 X 2/40 MCT Black/Lt.Grey	1	1			1	1			1	1				=	6
2/40 X 2/40 MCT Red/White	1	1			1	1			1	1				=	6
2/20 MC White	1				1				1					=	3
															72

13 ends per cm.; 175 cm. wide, in reed; to finish 148 cm./150 cm.

Weft 3½ run (American) Black 16½ picks per cm. <u>Finish</u> - milled.

F1

Fig. 6



The calculation for the ends of each colour in the warp is as follows:

Total ends in warp = 13 x 175 = 2275 (it is customary to use an even number for the total number of ends, as this simplifies calculations, so in this case we shall use 2276).

Ends per repeat of design = 72 - 12 extra = 60

Therefore, number of repeats of pattern = $\frac{2276}{60}$ = 37 patterns plus 56 ends over.

To balance the pattern, if it is started on the 22nd end, as indicated by the arrow in Fig. 6 it will be found that the design starts with 12 ground ends before the stripe and ends with 13 ground ends after the stripe.

The calculation for the number of ends of each colour, is as follows:

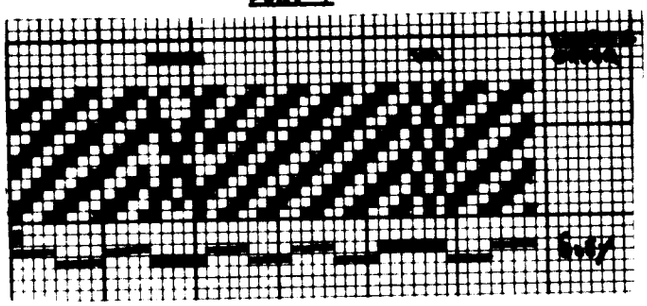
5 run Grey/White twist	51 x 37 =	1887	plus 35 extra =	1922
2/40x2/20 MCT Black/White	6 x 37 =	222	plus 6 extra =	228
2/40x2/40 MCT Black/Lt.Grey	6 x 37 =	222	plus 6 extra =	228
2/40x2/40 MCT Red/White	6 x 37 =	222	plus 6 extra =	228
2/20 MC White	3 x 37 =	111	plus 3 extra =	114
				2720
			-	456
				2264

Extras 12 x 37 = 444 plus 12 = 456

<u>NOTE</u>: The final total of 2264 is 12 ends short of the original 2276 because of the extra ends in the area taking up the 56 ends over for balancing purposes.

A worsted suiting fabric woven in 2x2 twill with a fancy geometric stripe and a plain cotton stripe weaving 2x2 rib is shown at Fig. 7.

Fig. 7



The warping plan for thedesign shown at Fig. 7 above is:

2/32s worsted - Dk./Lt.Blue twist	. 12	. 19	. 8	=	39
2/40s MCT Black/White	2	2	.	.	.	=	4
2/40s Worsted - Maroon	1	.	.	.	.	=	1
2/80s MC Grey	.	.	1	1	.	=	2
2/80s MC Blue	.	.	1	.	.	=	1
							47

Cloth construction: 56 ends per inch, 66½ inches in reed, To finish 58 inches.

Weft - 2/30s Navy, 54 picks per inch

Calculation for ends of each colour in warp:

Total ends = 56 x 66½ = 3724. Ends in pattern = 47 - 3 extra = 44

Pattern repeats $\frac{3724}{44}$ = 84 patterns plus 28 ends

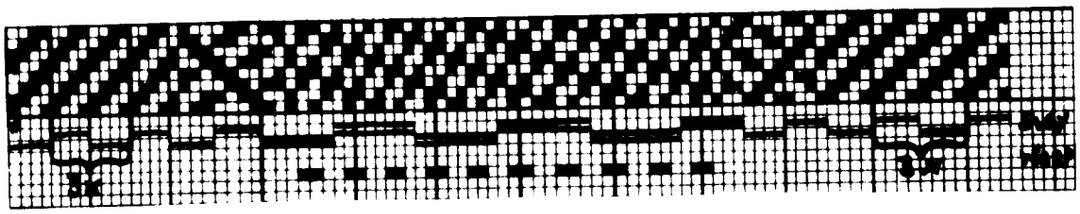
If the pattern is started exactly as in thedesign, it will have 12 ends in front of the geometric stripe and end with 11 ends after it, which is a good balance.

2/32s worsted - Dk./Lt.Blue twist	= 39 x 84 =	3276 plus 23 =	3299
2/40s MCT Black/White	= 4 x 84 =	336 plus 4 =	340
2/40s Worsted - Maroon	= 1 x 84 =	84 plus 1 =	85
2/80s MC Grey	= 2 x 84 =	168 plus	168
2/80s MC Blue	= 1 x 84 =	84	84
			3976
			- 253
Extras 3 x 84 = 252 plus 1 = 253			3723

NOTE: Again, because one of the extra ends is included in the additional ends used for balancing the pattern, the final total is 1 end short. This end can be added if necessary and in this particular case it is advantageous because the addition of another end ensures that the warp will finish with a full 4 ends per dent. Whenever extra ends are included in the balance it has to be decided whether additional ground ends should be added to the total to compensate. Obviously in a very large pattern if a very large number of ground ends were found to be missing, they would have to be added.

Fig. 8 shows a design made from 2 x 2 twill, a broken twill and an area of straight twill broken up with mercerised cotton or silk decoration threads in pairs. Special note should be made of the way in which the decoration threads are crammed completely extra, however the two dents on either side of the fancy stripe have only 6 ends per dent whilst the other dents in the stripe have 8 ends each. This method is quite often used to ensure an even balance when the design is sleyed. The difference between the 8 ends per dent area and the 6 ends per dent will not be noticeable after thedesign has been finished.

Fig. 8



It should be remembered that,as has been mentioned previously, most designs containing crammed mercerised cotton, silk, or other decoration threads, usually require weaving from 2 beams. Apart from the fact that the decoration threads are finer, and therefore more susceptible to breakage, the fact that they are crammed and often cutting with each other in the weave, also tightens them up. They are, therefore, dressed on a separate beam or roller, and woven in slightly slacker than the ground yarn.

A fancy pin-stripe design with a twill and broken twill ground is illustrated at Fig. 9. This illustrates the tightest weave for this type of pin-stripe decoration. The mercerised cotton ends used out with themselves and with the ground weave on both sides. This design is quite a difficult weaving proposition if special attention is not paid to the amount of extra allowed as the decoration threads are woven into the ground. Occasionally, the weaving of such a fabric is quite successful, and then because the decoration threads are on the tight side, they crack or burst during finishing.

Fig. 9

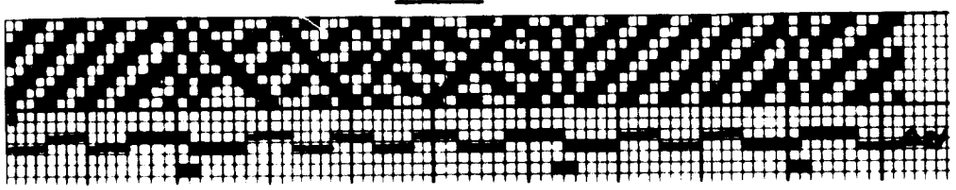
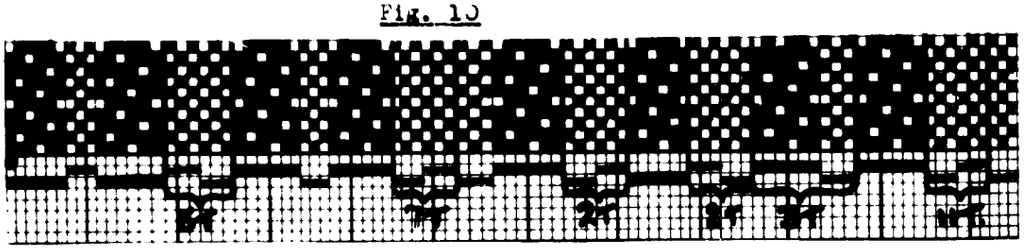


Fig. 10 shows an example of a fancy shirting fabric, the ground weave being plain and sleyed 3 per dent. The striping is a 5-end sateen crammed 6 per dent exactly twice the number of ends of the ground weave.

Fig. 10



A figured design to give a fancy stripe on a plain weave ground is shown in Fig. 11. The plain weave is sleyed 2s and the area of the weave which forms the figure is sleyed 6 per dent. This shortens the floats in the figured area to give a firm structure. The effect obtained in the stripe would be a wavy or twisted look but the angle would be steeper than that shown in the design, due to the cramming of the ends.

Fig. 11

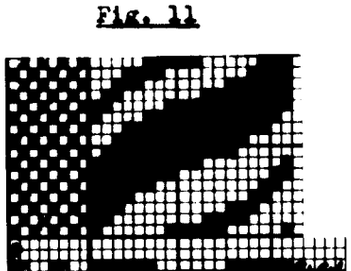
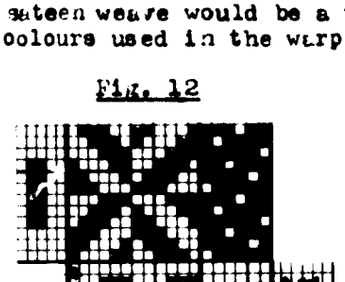


Fig. 12 shows a combination of a 6-end sateen weave combined with a 3 x 3 twill, 6 x 6 cut check. This type of design is suitable for a fancy coating. A suggested colouring is:

Warp: 3 light - 6 dark - 3 light
Weft: 3 light - 6 dark - 3 light

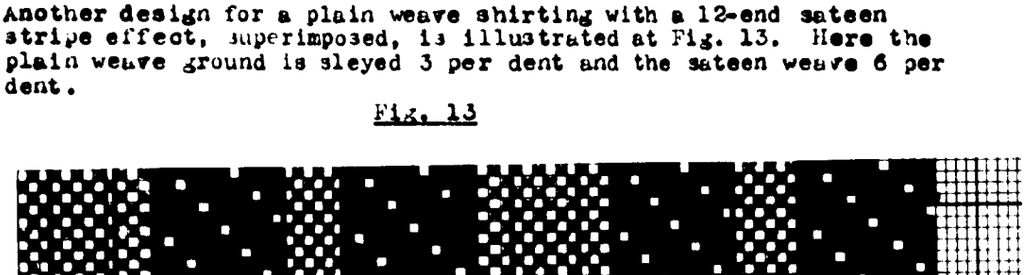
The 6 ends for the sateen weave would be a twist yarn combining the light and dark colours used in the warp and weft.

Fig. 12



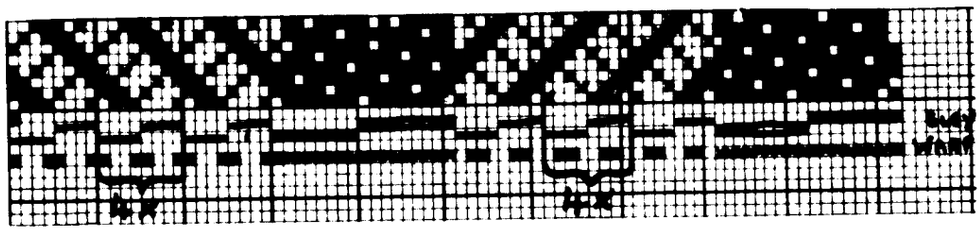
Another design for a plain weave shirting with a 12-end sateen stripe effect, superimposed, is illustrated at Fig. 13. Here the plain weave ground is sleyed 3 per dent and the sateen weave 6 per dent.

Fig. 13



In the design shown at Fig. 14 a dress fabric combining a 3x3 fancy twill and a 6-end sateen is shown. The ground area is to be coloured 2 light, 2 dark, in both warp and weft. The sateen stripe will be coloured with a twist yarn matching the light and dark areas of the ground.

Fig. 14



CRAMMED CHECK DESIGNS

This type of design is a combination of a crammed stripe with an overcheck introduced which is also crammed by adding extra picks in that area. This is done by allowing the take-up motion on the loom to pause while the required number of extra picks are put into the fabric. Most modern looms have a cramming motion fitted. If, however, a loom is being used which does not have this mechanism, a connection can be made from the pushing catch of the take-up motion to one of the spare jacks in the dobby. Then, when cramming is required, a lift is indicated in the pattern chain for the number of picks during which the cramming will take place. This causes the dobby jack to lift the pushing catch of the take-up motion, and thus stop the warp being taken up.

Fig. 15 shows a crammed check design with 3 x 3 twill ground weave. The warp part of the check is formed by 6 ends of the 6-end sateen, (warp sateen). The weft check, or overplaid, is 6 picks of the 6-end weft sateen. The ground warp is sleyed 3 per dent, and the sateen 6 per dent. The weft would be crammed accordingly for 6 picks. E.g. If the fabric was being woven with 40 picks per inch, in the ground area, the overcheck would be crammed to give 80 picks per inch.

Fig. 15

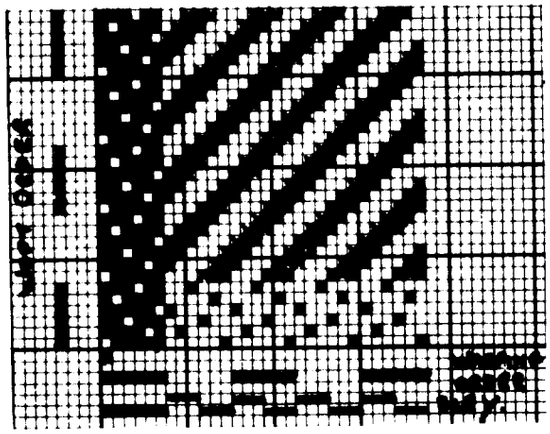
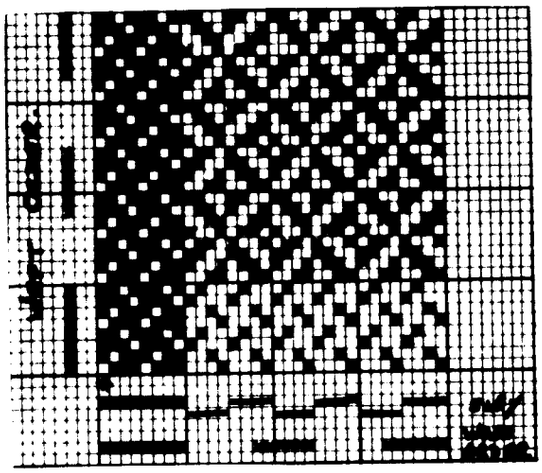


Fig. 16 is another example of a crammed check design using the broken crow, or 4-end warp sateen, in the warp overcheck, and the 4-end weft sateen as the overcheck in the weft. The ground is a 2 x 2 twill, 4 x 4 cut check. It would be noted in this particular design that in the sateen area fine yarn would be used. The setting ratio between 2 x 2 twill and a 4-end sateen is not so very different, so that if in this particular design the same yarn counts were used throughout, the sateen area would weave much tighter than the ground, and an unsatisfactory fabric would result. A suggested warping and wefting plan for this fabric would be:

Warping Plan -
150 denier nylon 8 ends
2/48s worsted 24 ends

Wefting Plan - exactly as warp.

Fig. 16



SOME RAPID DESIGN CALCULATIONS

One of the more important calculations used in textile designing is that to determine the weight per unit area of the fabric. For economic reasons the weight of yarn used in a cloth is limited. In England and North America fabric weights are usually expressed in ounces per square yard, or in ounces per running yard. The term "running yard" referring to a piece of fabric 1 yard long and the full finished width of the fabric, (this may be 54", 56", 58" or 60"). The following calculations will deal with the square measurements. In Europe, grams per square meter is used, but the growing use of S.I.Metric Units requires thedesigner to be familiar with both systems.

With the marketing of a wide range of electronic calculators, some very reasonably priced, very rapid calculations have been facilitated. As a result, simple equations for relating yarn count and cloth count to fabric weight have become more useful than tables of yarn yields etc. The following calculations, or equations, are very useful and can be easily carried out with a pocket calculator.

Weight in ounces/square yard: Given a number of warp or filling threads per inch (or total warp and filling yarns if both are the same) the warp or filling (weft) weight or total fabric weight can be calculated according to the equations given on the following page 150.

In the following equations:

"C" is the fabric count in warp threads or weft picks per inch.

"W" is the fabric weight in ounces per square yard.

For Denier - $W = \frac{C \times Denier}{7751}$

For Cotton Count - $W = \frac{C \times 0.6857}{Cotton\ Count}$

For Worsted Count - $W = \frac{C \times 1.0288}{Worsted\ Count}$

For Woollen Count - $W = \frac{C \times 0.3600}{Woollen\ Run}$

For International Metric Count - $W = \frac{C \times 1.1611}{Metric\ Count}$

For Tex - $W = \frac{C \times Tex}{861.2}$

For Decitex - $W = \frac{C \times Decitex}{8612}$

When the above equations are used warp ends and weft picks may be calculated separately if they are made up of different yarns. The weights thus obtained are added together to obtain the total fabric weight. For fabrics made from identical yarns add the total ends and picks and make one simple calculation. Where fabrics consisting of alternate ends and picks are concerned the calculations for the different groups of yarns can be made separately, using the equations and the total weight obtained by addition.

The equations given assume that the yarn lays flat in the fabric. Generally, for loom finished fabrics this is true of the weft yarn but the warp yarn assumes a crimped attitude as it curves under and over the filling or weft yarn during weaving. The warp take-up, therefore, makes it necessary for the calculated warp weights to be increased by 5 to 10%. Obviously, shrinkages resulting from various dyeing, wet finishing, and drying operations must also be taken into account. The equations, all involving two variables and a constant, are particularly convenient for repetitive calculations on the type of calculator which has memory function.

S. I. Metric Units: For converting from ounces per square yard (English units) to grams per square metre (Metric units) use the following equations:

Grams per square metre equals 33.91 x ounces per square yard

Ounces per square yard equals grams per square metre or 33.91

Ounces per square yard equals 0.02949 x grams per square metre

Milligrams per square cm. equals 3.391 x ounces per square yard

Weight in Metric Units: For the calculation of fabric weights "W" directly into grams per square metre from a given number "C" of warp threads or filling picks per inch, the following equations on Page 151 may be used.

For Denier - $W = \frac{C \times \text{Denier}}{228.6}$

For Cotton Count - $W = \frac{C \times 23.25}{\text{Cotton Count}}$

For Worsted Count - $W = \frac{C \times 34.88}{\text{Worsted Count}}$

For Woollen Count - $W = \frac{C \times 12.21}{\text{Woollen Run}}$

For International Metric Count - $W = \frac{C \times 39.37}{\text{Metric Count}}$

For Tex - $W = \frac{C \times \text{Tex}}{25.40}$

For Decitex - $W = \frac{C \times \text{Decitex}}{254}$

In the above group the "W" represents the fabric weight in grams per square metre, and "C" is the cloth count in ends or picks per inch.

In England and North America the cloth construction, of "C", is expressed usually in ends and picks per inch. In the parts of the world where the metric system is in use ends and picks are quoted per centimetre. When dealing with these specifications simply convert ends and picks per centimetre to ends and picks per inch by multiplying by 2.54.

Where both the fabric count and yarn count are in the metric system, the following equations give the fabric weights:

For Tex - $W = \frac{C \times \text{Tex}}{10}$

For Decitex - $W = \frac{C \times \text{Decitex}}{100}$

For International Metric Count - $W = \frac{C \times 100}{\text{Metric Count}}$

For Denier - $W = \frac{C \times \text{Denier}}{90}$

In this group of equations "C" is the warp or filling thread count per centimetre, and "W" is the fabric weight in grams per square metre.

As a final note, there are a number of pocket electronic calculators available of the memory type, which have direct built-in conversion factors from English measurement (weight, length, temperature, etc.) to Metric. This type of calculator is very useful indeed to the textile designer.

CONCLUSION

In concluding this manual on Textile Design and Woven Fabric Development, it would not be out of place to once again stress the role of the Designer.

Success or failure in the fashion business depends entirely on the designer's technological knowledge, the ability to forecast fashion trends, and the versitility to use raw materials and the production machinery available to the greatest advantage.

Throughout the preceding pages the basic rules have been given. All the top deck designers today started with the basic rules. However, it is essential to keep abreast of changing technologies in order to remain competitive. It also requires great flexibility of machinery and skill and tenacity, combined with originality, in the search for new raw materials to develop a most sophisticated and adventurous design and fabric development operation.

The designer must be very profit conscious and at the present time with the rise in raw material and labour costs generally, must plan all development work, balancing style, innovation and visual attractiveness with cost reducing factors.

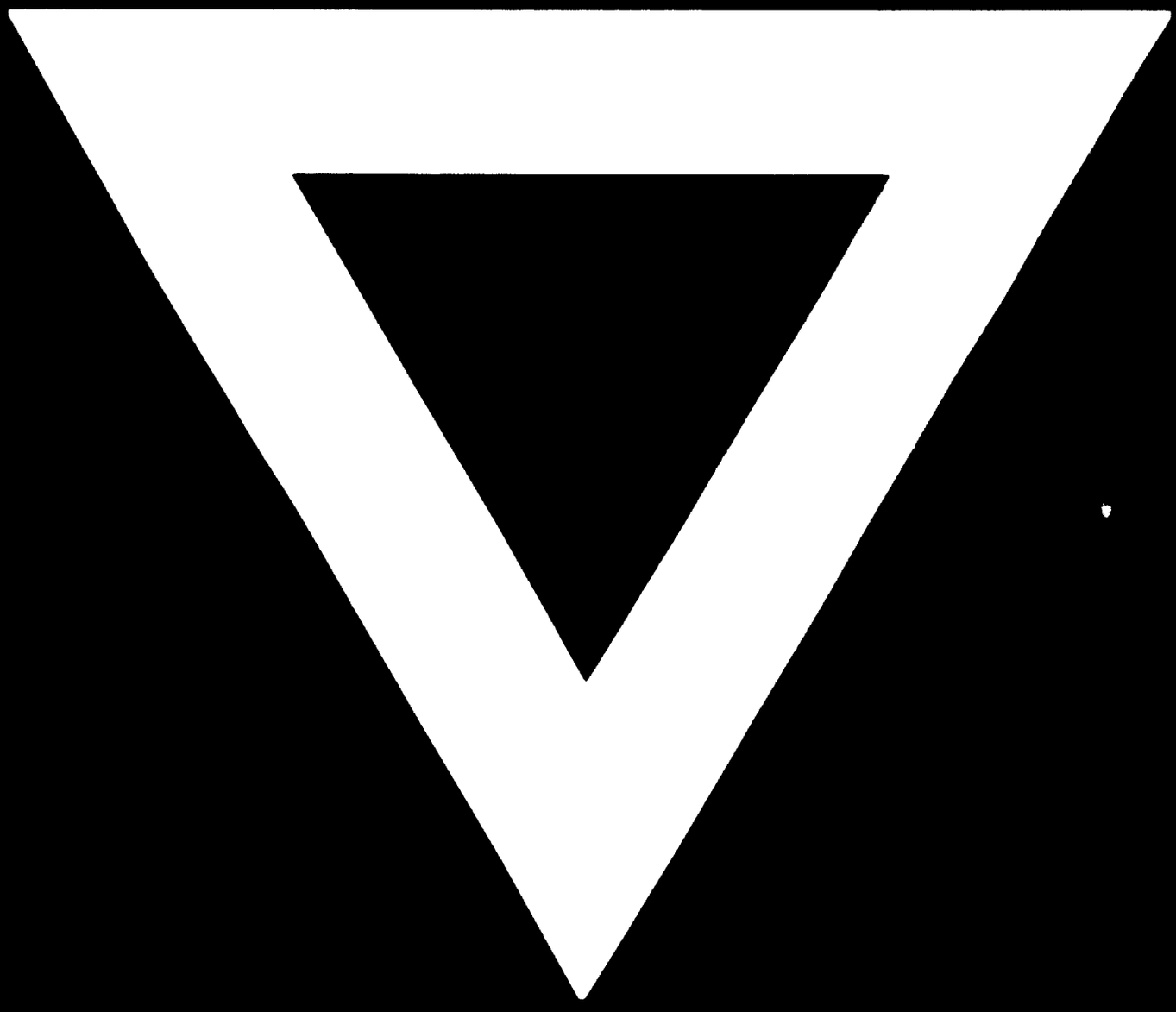
All new fabrics have to be presented in a form in which they are comprehensible to production, and they must also present the right concept to marketing.

New production methods have to be evaluated and it is essential that the designer keeps up-to-date on all new machinery developments in order to assess the impact they will make on the fashion scene. At the present time, open-end spinning, centrifugal spinning, bi-component fibres, and blended filament yarns are making their effect felt on the market. It has long been said that, where man-made fibres are concerned, the extrusion of continuous filament tow followed by cutting or breaking the filaments into short lengths, and then spinning them back together again, was rather a ridiculous procedure. More recently, a bi-component polyester consisting of filaments of both high-tenacity and low-tenacity polyester have been introduced. During texturising, stretching of the filaments causes the low tenacity ones to break. This produces a texturised yarn with both continuous and broken fibres and the handle of a yarn spun by one of the more conventional spinning processes.

In the weaving field, multi-shed looms are already running trials. In this type of loom several weft-carriers or projectiles travel through different sheds, which open in a wave-like formation. This loom, however, is still restricted as regards the type of weave (only simple weaves being possible) and the weft colour pattern. Co-axial weaving is another newcomer to the fabric development field. Here, two warps are employed, each interlacing the weft at different angles. This results in the ability to weave stable fabrics with very few picks.

The textile industry is in a state of continuous change and a very important part of the designer's work is to know, to understand, and to be a part of that change; to see the potential of a new and coming idea, and to adopt, develop, improve and expand it. Then, when that new idea has been exploited to its maximum potential, to anticipate its death with a bigger, better, and more successful innovation.

C-700



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