

Faults in Crêpe Fabrics Containing Rayon

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The investigation of the causes of faults in fabrics is one of the least enjoyable parts of the work of the scientist. It is frequently made unnecessarily difficult. Each department naturally strives to have against it the fewest possible number of the black marks awarded for responsibility for defects. It is not surprising, therefore, that one section will try to shift the blame on to another if possible, even if, in so doing, some departure from the truth is necessary. Apart from such avoidable difficulty, however, the subject is rendered inherently difficult by the fact that many faults due to particular processes do not appear until subsequent processes have been carried out. The effects of the later processes often preclude the application of straightforward and strictly determinate tests as to the cause of the trouble. In a large proportion of the cases examined indirect evidence alone is attainable, and the only possible strong argument in favor of the correctness of the findings is the reproduction of the fault. Unfortunately this is not always possible, and sometimes it is not permitted because it is urged that to reproduce the fault is to throw away good money after bad. The subject forms part of the large question in science of the value of negative evidence which is, in many cases, at least equal to that of positive results.

Weft Faults

The commonest faults in crêpe fabrics are generally more intimately associated with the weft than with the warp. So-called "barriness" may arise in a number of ways. The weave in a crêpe fabric is plain, two picks of weft with left-hand twist being followed by two picks with right-hand twist, and so on. Now the plain weave is particularly prone to show up irregularities in the yarns, weaving faults or finishing faults. Rayon yarns are characterized by their very high regularity. Apart, therefore, from the very rare fault due to the mixing of yarns of different deniers, weft bars in rayon crêpes are not due to irregularities in denier in the yarns prior to twisting. The twisting of rayon yarns in the manufacture of crêpe weft is beset with many difficulties. The variations in denier found after twisting are very much greater than those in the original yarn, since it is physically impossible to have all the spindles running at the same speed. As the twist varies the contraction also varies, and the denier differences thus brought about account for many of the

weft bars observed. It is frequently stated that weft bars in rayon crêpes may be due to differences in lustre, but this is not so. The high twist inserted in rayon crêpe weft confers on the yarn such an irregular broken surface that it appears no more lustrous than cotton. In fact, yarns which show too great differences in lustre to permit of their being used in the same warp, may safely be used for crêpe weft for the differences will be no longer visible.

In crêpes consisting entirely of rayon, which are frequently flat, a difference in denier between the weft with left-hand twist and that with right-hand twist shot in next to it, will show up as tram lines. If the cloth had a more pronounced figure such differences would not reveal themselves. This evidence of practically undistorted weft is very objectionable. In extreme cases the cloth may appear more like a poplin than a true crêpe. When there is an appreciable difference in twist in the yarns on two successive pirns, the place in the cloth at which the shuttle was replenished becomes clearly visible. The effect is totally different from that due to a temporary stoppage of the loom, as there is no detectable variation in the numbers of picks per inch on the two sides of the line of demarcation.

There is very little doubt that the weft in all-rayon crêpes is frequently over-twisted. To its natural plasticity is then added a very low tenacity, and it is not surprising that its power of distorting the warp is so low. It has been shown that an addition of 20 turns per inch to weft with about 40 turns per inch is accompanied by an insignificant difference in figure. The denier previous to twisting was 150, and the two wefts were shot into precisely similar warps. To avoid the possible introduction of further variables the two cloths were scoured and finished together.

When instead of rayon weft, silk or yarn composed of other natural fiber is used, weft bars are generally due to variations in denier. Natural products do not possess the high uniformity of rayon. Since, however, the fabrics containing wefts consisting of the older natural fibers have much more "figure," many of the irregularities do not appear. Strong transmitted light will reveal irregularities in the weft which are not seen by reflected light. The parts of the fabrics containing the thicker portions of the yarns may, owing to the greater distorting power of the heavier yarns, have a more pronounced figure, but such differences are far less objectionable than the

* Silk Journal and Rayon World.

corresponding ones in flat all-rayon crêpes. It is an interesting fact that the weft bars, due to differences in figure, are more obvious when dyed certain shades than in others. A completely satisfactory explanation of this does not appear to have been put forward.

The weft faults so far considered are to a certain extent inevitable and unavoidable. There are some, however, which can be avoided if due care is taken. If the weft is too lively and springy the weaver may be troubled with "lashing-in." The frequent stoppages of the loom in consequence are then liable to result in faint bars showing the setting on places. By proper adjustment in the shuttle, or by temporarily "setting" the weft by steaming or humidifying, this fault may generally be avoided. Fig. 1 illustrates this fault. Box marking is another fault coming into much the same category. The weft yarn may be trapped between the shoulder of the shuttle and the shuttle box, and is subjected locally to very high pressures. With rayon yarns, owing to the great plasticity of the material, the flattened portions do not recover their original form. In the cloth they reflect the light much more strongly than the parts of the weft which have not been flattened, and so show up with a high metallic lustre. The fault is easily investigated and traced from the position of the box marks in the cloth, the width of the cloth and the dimensions of the loom. Box marking is usually confined to fabrics with rayon weft yarns.

Warp Faults

Flat all-rayon crêpe fabrics are subject to a fault which does not occur in cloths which acquire a good figure. The fabric on being viewed in certain directions, appears to have been sprinkled with water in very fine drops. Various names have been given to the effect in different districts. It has been found that the trouble arises because small bunches of ends are slack as compared with the body of the warp. The weaver can do nothing to prevent this defect which is due to the process of warping. It has been suggested that it is in some way connected with electrification, though the reason is somewhat obscure. In order to minimize the trouble extra tension is often put on the warp during weaving. This is highly detrimental to the figure on the cloth, and it contributes materially to the flatness and lean handle which characterize so many all-rayon crêpes.

Warps consisting of acetate rayon are sometimes found to be very streaky. The fault has become more prevalent since fine filament yarns have come into use, the object of their employment being the increased covering power they afford. The streakiness may

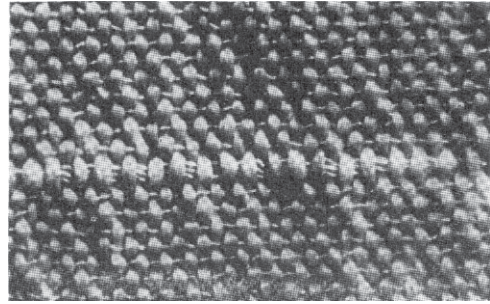


Fig. 1.

sometimes be due to such causes as differences in tension between the ends, mixing of yarns of different deniers or numbers of filaments, or intrinsic differences in lustre. But it is usually due to irregular lubrication of the yarn, lubrication being more difficult in the case of fine filament yarns than in the coarse or medium filament varieties. The oils spread out into very thin films on the filaments, in which state they become oxidized. Ordinary scouring does not effect a complete removal of the oxidized oil, and the residues prevent proper and uniform penetration of the dyestuffs. The streaks arise because only the outer layers of the yarn on the bobbins are exposed to the influence of oxidation. If the oil could be applied uniformly and were allowed to oxidize, its presence, though still objectionable, would not cause so much trouble. If the yarn is suspected of being likely to give rise to streaky warps and a very thorough removal of oil before dyeing is not practicable, it is best to give the fabric an ivory finish. The streaks are not visible until the fabric is dyed.

Scouring Faults

The tenderness of the various varieties of rayon, and the ease with which they are permanently deformed when in the wet state, have been duly impressed upon the dyers and finishers of rayon fabrics. Judging by the large number of faults which have been traced to imperfect scouring, it would appear that too much stress has been laid on these facts. It is impossible, in the twisting of rayon crêpe weft, to guarantee the weft absolutely free from occasional spots of the oil used for the purpose of lubricating spindles, etc. The oil is almost invariably accompanied by pulverized metal, difficult, it is admitted, to remove. It has been proved many times that hand scouring in a bowl will remove the oil marks, and the fabric will dye perfectly uniformly. But with the commercial scour complete removal of the oil is very rare indeed. Large amounts of fabric have had to be re-dyed in black or other dark shade because the light shades showed all the oil marks.

Crêpe fabrics containing silk weft are a source of considerable trouble in scouring. The removal of the sericin from the silk is not a simple matter, even when there is no tender rayon present to introduce complications. Viscose warps, although as weak when wet as acetate rayon warps, interfere less than the latter. It is, in fact, difficult to effect a thorough removal of the sericin without saponifying to some extent the acetate rayon. The sericin is not uniformly distributed on the silk yarns, and imperfect scouring results in complete removal from some parts only. On dyeing, the imperfectly scoured cloths take the dyestuffs in an uneven manner. Some of the effects produced are very remarkable as they show definite periodicities in the distribution of the residual silk gum. Peculiar lozenge shaped patterns are thus sometimes produced. This is the worst type of fault to investigate, because the nature of the gum has been altered in the dyeing process and the ordinary tests no longer apply to it. Similar effects have been observed with all-rayon fabrics, in which the rayon weft yarns have been sized in order to try to increase their distorting power. The patterns can be reproduced by marking weft yarn whilst on the bobbin or pirn.

As noted above, unevenly distributed oil which has become oxidized will remain in fabrics of this class after the ordinary commercial scour, though it can be removed on scouring by hand. It may sometimes be seen in a fabric which has been given an ivory finish, or dyed a light tint to give rise to very marked differential wetting. The patterns which appear on attempting to wet out the cloth are similar to those observed as due to residual silk gum. This differential wetting may also occur on fabrics containing fine filament rayon warps on which irregularly distributed oil has oxidized.

Before leaving the subject of scouring faults another fault, though not due to scouring, may be noted. The tendency of finished rayon fabrics to creasing is well known, but it does not seem to be as widely realized that the avoidance of creases is just as important in the stages of manufacture prior to scouring as in the finished cloths. Fabric ready for scouring and dyeing is often carelessly treated, and plaited pieces at the bottom of a large pile are subject to high pressure and develop very sharp creases. The dyeing properties of the rayon in the immediate neighborhood of the creases undergo change. Fig. 2 shows the effect after dyeing of a sharp crease in the fabric before scouring. A plain cloth has been chosen for this illustration as it brings out the effect in a more striking way. Apart from this alteration of the dyeing properties the creases cannot be satisfactorily removed.

Creases tempt the finisher to apply excessive tensions to cloth in the processes such as tentering. These high tensions result in permanent extensions, and the fabric has in consequence a very poor handle. Creases frequently cause fabric to be degraded.

Finishing Faults

Reference has already been made to the weakness of rayon in the wet state. Finishers apparently do not yet fully understand that most varieties of rayon in the dry state are not only weaker than the naturally occurring textile materials, but that their elastic limits are very definitely lower. Stresses which will not harm fabrics composed of the natural fibers will cause permanent deformation in cloths containing rayon. Many faults in crêpe fabrics consisting either wholly or partially of rayon are due to ignorance of this fact.

If in such processes as tentering or calendering too much tension is applied to rayon cloths, they are found to be permanently stretched. By no known treatment can they be persuaded to return to their original dimensions, though some partial recovery may take place on wetting and allowing to dry without tension. In this respect they differ most markedly from wool or silk fabrics, which can be manipulated in a remarkable manner. The natural tendencies of silk and wool to recover from strain can readily be assisted by means of moisture. In the manufacture of crêpe fabrics consisting entirely of rayon, there is constant danger of over-tensioning from the warping process onwards. As already noted, it results in poor handle and lean appearance with a minimum of figure. The fabrics lack the springiness or resilience so characteristic of a silk crêpe, and their tendency towards creasing is intensified. The fault of rain-spotting is due to over-tensioning. When water is applied locally to a strained fabric, it will stimulate whatever power of recovery from strain the material may possess. The places on which the spots fall will thus have a slightly better figure than the rest of the fabric, and the spot marks remain visible. This was proved by showing that a spotting fabric no longer showed the marks of water drops after wetting-out and drying without tension.

The intrinsic properties of the rayons are naturally conducive to the phenomenon of slipping observed in some rayon fabrics. It is clear that if the warp and weft of a fabric show plenty of corrugation on fraying the edges, the tendency to slip will be small. Excessive tensioning straightens the yarns in the cloth and removes the corrugations. It, therefore, enhances the liability of the fabric to slip. Little can be done to remedy this fault, which may be easily avoided if due

care is taken in manufacture. Very closely associated with slipping is the fault of blistering or bubbling which appears in parts of garments, such as sleeves, which are subjected to considerable stresses in wear. It is never observed, of course, in a crêpe fabric possessing reasonably good figure and resilience. Mechanically, it is fairly readily accounted for on considering the differences between the properties of the cloth in the warp and weft directions.

Garments made from crêpe fabrics consisting of rayon in association with the natural textiles are sometimes found to shrink progressively in ordinary wear. Of course, wetting increases the shrinkage enormously. Fabrics made from silk or wool are usually "set" by various processes. Most woven fabrics made of wool, for example, are crabbed and wrapper blown and are distributed in the fully shrunk condition. Setting processes are somewhat drastic, and their application to cloths containing rayon is not generally possible, for fear of spoiling the latter. Finishers of composite fabrics have to compromise and employ methods which will not harm the rayon. The natural fibers in these fabrics are thus only partially set, and exposure to

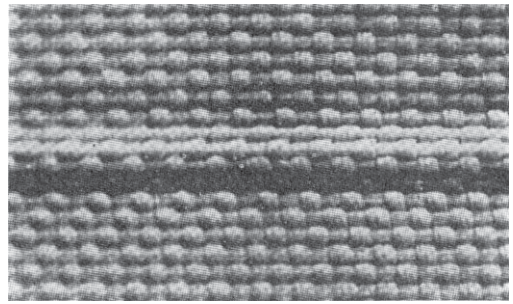


Fig. 2.

the moisture in the atmosphere causes further crêping or shrinkage. A fabric consisting of a rayon warp and silk crêpe weft may be tented to the stipulated width, but it would be unwise to guarantee that it would not shrink.

From this review of some of the faults which may be found in crêpe fabrics containing rayon, it is seen that the majority can be avoided if proper care is taken in manufacture. The use in conjunction of materials with widely differing properties imposes restrictions on the treatment of the resulting fabrics, so that certain possible defects can only be minimized.

