Weiner R49-23

AMERICAN
DYESTUFF REPORTER

LUME 38 APRIL 4, 1949 NUMBER 7

UARTERMASTER CORPS ACCELERATED TEST METHOD

For Evaluating Shrink-Resistant Wool s Developed for 10½-Oz. Wool Shirting*

LOUIS I. WEINER

Textile Finishing Research Laboratory at the Philadelphia Quartermaster Depot

Foreword

In a previous report (Textile Series Report No. 46) the research and development work of the Quartermaster Corps on the shrink-resistant treatment of Army wool items has been discussed in some detail. As was pointed out in that report, our research in this field is continuing with the aim of further application of shrink-resistant treatments to Army wool items.

The experience gained in the application of a shrink-resistant treatment to socks has indicated that in undertaking treatment of other items it is necessary to make a comprehensive and thorough study of conditions of testing, in order that a satisfactory test method might be developed for evaluating between different types of treatment for ultimate acceptance of goods after they reach the Quartermaster Corps.

While it is recognized that the development of a test method is implicit in the entire problem of shrink resistance as applied to civilian as well as to military uses of wool, there are limiting conditions with respect to the latter which necessitate certain approaches to test methods which are, in a sense, peculiar to military needs. Accordingly, test methods such as have been under consideration for civilian shrink-resistant wool production have not offered a satisfactory solution to our military requirements.

Two of the most important limiting factors on the test methods which we have sought to obtain apply to the need for an accelerated test on the one hand and also one which will correlate with severe field treatment on the other. With these two controlling elements dominant in our consideration, our office has developed in the Textile Finishing Research Laboratory, located at the Philadelphia Quartermaster Depot, a test method which after careful and thorough evaluation has been presented to industry as a basis for submission of experimental fabrics for an improved wool shirting. The principal requirement of this improved fabric is that it shall be resistant to shrinkage under the conditions outlined in this test.

In view of the widespread interest in this problem of testing and its anticipated use in procurement at such time as a military requirement may arise, it has been felt desirable to present a clear picture of the background data on this test method. It is believed that this report will be of interest to the wool textile industry both for its explanation of the basis for the tentative specification for shrink resistance which is under discussion with the industry at this time, and also for its possible assistance in connection with some of the broader problems of shrink-resistant treatments on wool materials as a whole.

It is desired to invite attention to the fact that the work reported upon, which has been carried on over a number of years, has involved the study of every shrink-resistant process for wool known to this office upon which samples have been made available by the producers or developers of the process.

Accordingly there has actually been a great deal of collaboration in this project from many people in industry in the course of this study. Many individuals both in the chemical manufacturing industry and the wool industry have assisted along the way and have contributed very generously of their time in working with us on this study of test methods for wool shrink resistance. Particular reference should be made to the assistance furnished to us by the Textile Foundation and later by the Harris Research Laboratories, under our research contracts with these organizations sponsored by the National Research Council which have been concerned with various fundamental studies on wool and its treatment for shrink resistance.

The work being reported upon herein was performed under the direction of Mr. Louis I. Weiner of the Textile Finishing Research Laboratory, assisted by Mr. John Zimmerman, Mr. Francis Spagna, and Mr. John O'Boyle. In the preparation of this report, Mr. Norman Roberts, Historian of the Laboratory, has assisted.

S. J. KENNEDY,
Research Director for
Textiles, Clothing and Footwear.
September, 1948

SECTION I

Summary

As an outgrowth of research studies on shrinkage-resistant treatments for 10½ oz. all-wool Army shirting, conducted at the Quartermaster Research and Development Laboratories, an accelerated test method has been devised which permits the prediction of the amount of shrinkage in laundering of this fabric. This test has been adopted tentatively after careful study and consideration of the quantitative effects of the many variables which are inherent in testing shrinkage in wool fabrics.

In the test, wool specimens and standard ballast to make a 6-pound load are agitated in 4 inches of water buffered to a pH between 5 and 7 at a temperature of 140°F.

*Textile Series, Report No. 53 Office of the Quartermaster General, Military Planning Division, Research and Development Branch. Released for public information by The Office of Technical Services, U. S. Department of Commerce.

for a period of one hour in a 24-inch Norwood washer. After this the specimens are centrifugally extracted, dried in a tumbler, sprayed and pressed.

A short summary of the characteristics of the test with special reference to its applicability, reproducibility, correlation and recommended performance levels is given below:

1. The test method has been shown to be applicable to practically all of the types of shrink-resistant treatments now commercially available.
2. The test is reproducible within very narrow tolerance limits. Although four specimens per test are recommended it has been found that two specimens per test are adequate for some treated fabrics.
3. A very good correlation has been found to exist between the accelerated test and successive Army mobile launderings for the four different classes of treatments studied. The recommended test has been found to be the equivalent of 20 mobile launderings.
4. Based on consideration of the effect of dimensional changes on the utility of shirts made from treated shirting, performance levels have been set for the warp at not more than 5 per cent relaxation and 4 per cent felting shrinkage and for the filling at not more than 4 per cent relaxation and 3 per cent felting shrinkage on commercially procured fabrics.
5. Analysis of the performance of commercially treated shirting fabric reveals that it will be necessary to have several of the manufacturers advance their processing technology to meet the levels cited.

Other tentative requirements for shrink-resistant wool fabrics include a requirement for ageing, that the hand of the fabric shall not be unduly stiffened by exposure for 100 hours in the Atlas Single-Arc Fade-Ometer. Work is currently under way to establish this requirement based upon a standard testing instrument. There is also a requirement on alkali solubility which is the same as that previously developed for the testing of wool socks, and which is discussed in detail in Textile Series Report No. 46, "Treatment of Army Socks for Shrink Resistance by the Quartermaster Corps."

SECTION II

New Accelerated Shrinkage Test for 10½ Oz. All Wool Shirting

Probably the most widely accepted accelerated test method for evaluating the shrinkage of textile items containing wool is that developed during the war by the Quartermaster Corps for cushion-sole socks. This test procedure is now used in practically all military agencies in this country and in Canada and has been adopted as a tentative standard by the National Association of Hosiery Manufacturers in this country.

In seeking a method for testing the shrinkage resistance of all-wool shirting, consideration was first given to this accelerated test. In studying the procedure, however, several shortcomings became apparent which made it evident that certain modifications would be necessary before it could be applied to shirting. Careful examination revealed that major improvements could be made on the basis of existing knowledge of the effect of laundering variables on shrinkage.

The procedure finally adopted after analysis of the more important shrinkage test conditions discussed later in this report may be summarized as follows:

The test is performed in a 24-inch diameter Norwood washer. The wool specimens and standard ballast are agitated in four inches of water buffered to a pH between 5 and 7 at a temperature of 140°F. for a period of one hour. The specimens are then centrifugally extracted, dried in a tumbler, sprayed and pressed. (See appendix for detailed statement of test method.)

Our office has found it to be a desirable practice, in order to establish proper controls, to obtain separate computations for relaxation and felting shrinkages. The test, therefore, requires that a determination of relaxation shrinkage be made before subjecting the fabric to the above test for felting shrinkage. The suggested relaxation procedure consists of soaking the specimens without agitation in soft water at 80°F. for a period of two hours, after which they are centrifugally extracted, dried in a tumbler, sprayed and pressed. Although the results of the one-hour accelerated test, when used alone will include both relaxation and felting shrinkages as a single value, this figure will be slightly lower than the sum of the two types of shrinkage when measured separately because of the additional tumbler drying involved in the latter method.

SECTION III

Principal Factors in the Determination of This Test Procedure

A. REPRODUCIBILITY OF TEST— In order to evaluate the reproducibility of the new method a series of separate tests were carried out and the validity of the data obtained was analyzed statistically. It was found, as illustrated in Figure 1,

Fig. I

AVERAGE % SHRINKAGE OF 10½ oz. SHIRTING AFTER LAUNDERING BY THE ACCELERATED TEST

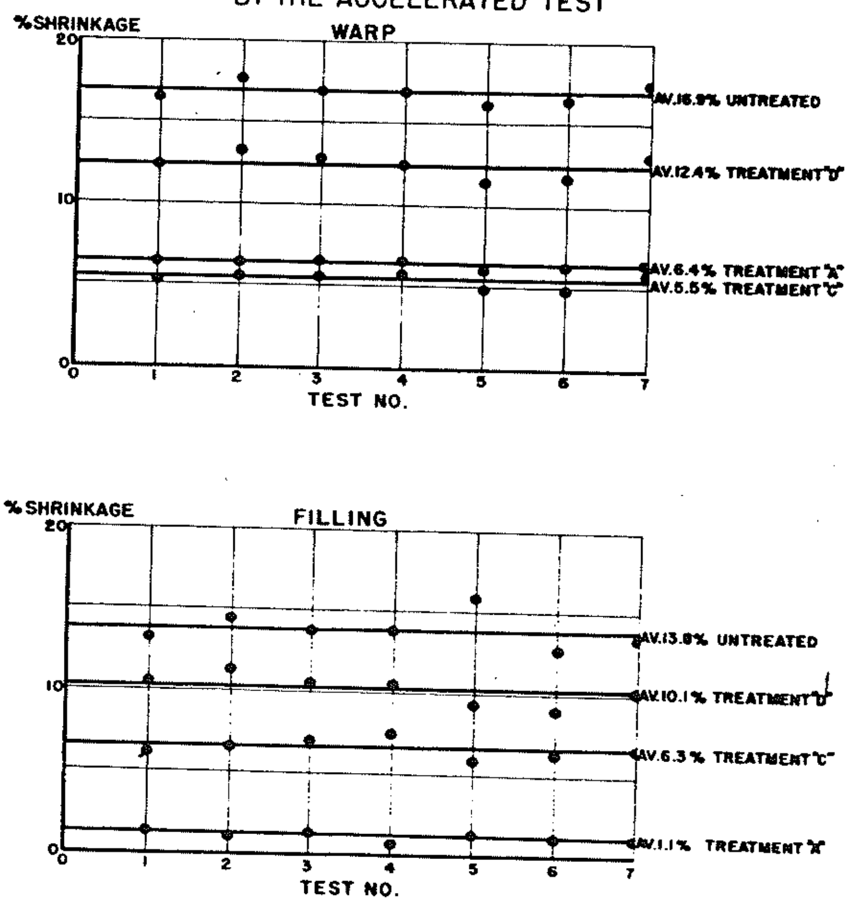
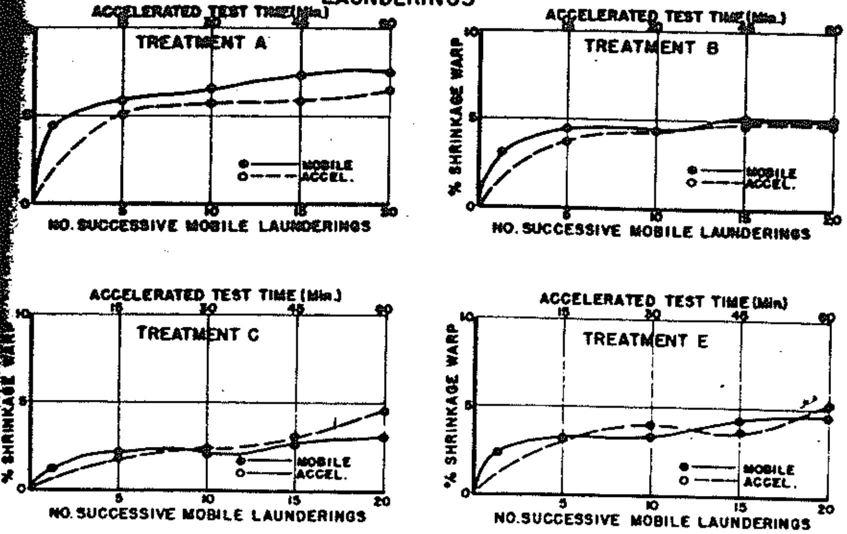


Fig. 2

CORRELATION OF THE ACCELERATED TEST WITH SUCCESSIVE MOBILE LAUNDERINGS



...t the replicate averages fell within an ...usually narrow range.

The good reproducibility of the test ...ults permits the attainment of significant ...rage results with the testing of only ...ee or four specimens per lot. It is in...esting to note in Figure 1 that in spite ... the slight differences in shrinkage of ...e of the treatments, in no case does a ...gle average value of one treatment over...lap the grand average of another. Likewise it is noteworthy that although the test places the warp shrinkage of treatments A and C quite close numerically it reveals wide differences between their filling shrinkages. This correlates well with the observed behavior of these fabrics in usage. The special precautions and somewhat unorthodox procedures recommended for this test are fully justified by the good reproducibility of results obtained.

B. CORRELATION OF THE NEW TEST WITH SUCCESSIVE FIELD LAUNDERINGS—Establishment of an absolute correlation between a single accelerated test and successive field launderings is a difficult task. Previous work has shown that even when such a correlation is established for one type of finish it will not necessarily apply to another. However, in the particular test which is now recommended more than the usual success has been achieved in obtaining such a correlation, and data obtained show that for as many as four different types of commercial treatments a significant and usable correlation exists.

The data charted in Figure 2 show that for the various treated fabrics the 60-minute accelerated test within reasonable tolerance is almost the exact equivalent of 20 launderings. It is definitely felt on the basis of these data that a fabric which will successfully stand the rigors of the one-hour accelerated test should exhibit adequate stability when laundered in the field and should withstand a minimum of 20 successive launderings before failing.

C. ESTABLISHMENT OF PERFORMANCE LEVELS FOR RELAXATION AND FELTING SHRINKAGE—In an effort to establish realistic rather than arbitrary performance levels for a proposed specification for shrink-resistant shirting, a series of service tests was performed on shirts treated by various commercial processes. This investigation indicates that it was consistent with the present state of technological development in this field to expect that treated shirts should withstand 20 Army launderings before shrinking out of fit. Since the accelerated test produces shrinkage equivalent to this number of launderings, it was considered reasonable to establish as the specification performance level for this test the maximum shrinkage which can occur before a shirt loses its utility.

It has been found, after a study of a large series of shirts made from 10½-oz. shirting, that the garments continue to be wearable until shrinkage of the collar (the first area in which serviceability is affected by excessive shrinkage) reaches 6 per cent. This value, although seemingly high, is correct for this weight fabric in the neckline styling used in Army shirts. It should not be assumed, however, that this value will apply to other types of shirting fabric.

Since the collar is cut in the warp, it is reasonable to expect that the shirts will be wearable up to 20 Army launderings if the warp fabric shrinkage does not exceed 6 per cent in the accelerated test. It is possible to liberalize this requirement further, since as much as 3 per cent relaxation shrinkage is removed during the sponging operation to which all wool cloth purchased by the Army is subjected. Thus an over-all warp shrinkage of 9 per cent has been set as the performance level for 10½-oz. shirting.

For the purpose of quality control it is desirable to indicate how much of this 9 per cent shrinkage should be felting and how much should be relaxation. A figure of 5 per cent has been established as the maximum allowable warp relaxation shrinkage. Three per cent represents that subsequently removed by sponging; the remaining 2 per cent is permitted to compensate for the effect of the tumbler drying which is part of the relaxation shrinkage test. (See Figure 7.) Thus the 9 per cent overall shrinkage is divided into 5 per cent relaxation and 4 per cent felting.*

Since practical experience has shown that shrinkage in the filling direction is always somewhat less than in the warp, filling shrinkage allowances of 4 per cent relaxation and 3 per cent felting have been established.

D. LEVELS OF PERFORMANCE FOR SEVERAL CURRENT SHRINK-RESISTANT PROCESSES—Specimens of shirting treated by a number of commercial shrink-resistant processes were subjected to the accelerated test to determine how realistic the performance levels were in terms of the present state of technological development in this field. The relaxation and felting shrinkages in both the warp and filling directions are shown in Table I. It will be noted that of the seven treatments evaluated in this experiment, only three met the performance requirements with respect to felting shrinkage. However, many of those manufacturers whose products did not secure adequate shrinkage control have expressed confidence that they can reduce the felting shrinkages to a point below the 4 per cent maximum by further improvements in the application of their treatments.

* Relaxation and felting shrinkage are not exactly additive unless they are computed on the same base.

TABLE I

Performance of 10½ Oz. Shirting Treated by Commercial Shrink Resisant Finishes

Treatment	Warp Shrinkage % Relaxation	Warp Shrinkage % Felting	
A	2.8	2.8	
E	2.9	3.5	
B	3.1	3.6	
C	0.5	5.7	Spec. 4%
G	—	8.9	
F	—	9.4	
D	2.1	12.1	
U	4.4	13.0	
Treatment	**Filling Shrinkage % Relaxation**	**Filling Shrinkage % Felting**	
A	1.7	0.3	
B	0.7	0.5	
E	3.2	1.1	
C	3.1	4.5	Spec. 3%
G	—	5.1	
F	—	5.3	
D	3.2	8.4	
U	3.2	9.1	

SECTION IV

Variables in Testing Which Affect the Rate of Shrinkage of Wool

A. DETERGENT—There is a fairly prevalent erroneous belief that felting shrinkage will not take place in the absence of soaps or detergents. That this is not the case is known to those familiar with textile processing who realize that under certain specific conditions (for example, when the wool is fulled in an acid medium) more rapid felting takes place than when soap is used.

Actually, in most conventional washing operations the effect of soap or detergent on the felting rate will depend more on the amount and stiffness of the suds than upon intrinsic differences between the detergents themselves (which appear to play a more minor role). For example, it has been found that in the horizontal types of washers which reciprocate about a horizontal axis—such as the Smith-Drum, the Norwood, practically all commercial washwheels and also home washers such as the Launderall and Bendix — increasing the amount of soap in the washers invariably decreases the amount of felting that takes place. This phenomenon is believed to be the result of the cushioning action of the suds that form above the surface of the wash liquor. When more suds are formed, part of the energy exerted by the fabric or garments dropping to the surface of the liquid during agitation is absorbed by this cushioning by the suds with the result that less felting occurs. Data reported by Carter and Grieves*(1)* for a horizontal-axis type of wash wheel show how an increase in soap concentration up to a certain value causes a decrease in felting. These data are plotted in Figure 3.

The condition indicated by this curve is undesirable from the standpoint of developing a good accelerated test, since high soap concentrations will tend to destroy the accelerated nature of the test and low soap concentrations will cause considerable variation in results due to unforeseen reduction in the strength of the soap and its suds. This latter factor has been one of the causes of variation in the accelerated test for cushion-sole socks which specifies a *running suds,* meaning by implication a low suds system. Accordingly the shrinkages obtained by this test fall along the steep portion of the curve in Figure 3 and thus are subject to significant variation as a result of changes in soap concentrations. Specification of a fixed quantity of soap for each wash load will not help this situation since the presence of titratable acid or alkali or saponifiable oils in the fabric will alter the amount of suds produced and accordingly cause variations in shrinkage.

In view of the fact that in a horizontal

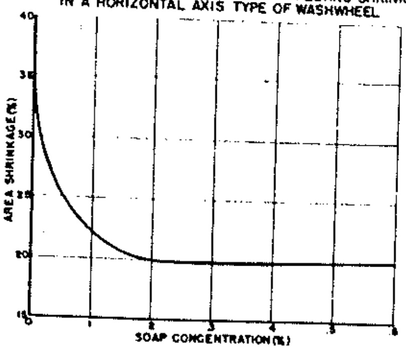


Fig.3
INFLUENCE OF SOAP CONCENTRATION ON FELTING SHRINKAGE IN A HORIZONTAL AXIS TYPE OF WASHWHEEL

type washer, the presence of soap affects the amount of felting obtained by introducing variations in shrinkage results, it has been concluded that the most effective accelerated shrinkage test for a shirting fabric would be one from which soaps or detergents were eliminated.

When wool shirting samples are laundered in water without any soap being present, shrinkage results of the magnitude shown in Table II are obtained, as contrasted with shrinkages on the same fabrics in the presence of a soap solution.

The above data and those of Carter and Grieves previously referred to appear to show quite clearly that a truly accelerated test which will be reproducible must be carried out in the absence of soap or detergents. It was shown in Section III of this report that an accelerated test performed without detergents can correlate well with successive normal launderings in which a detergent is used.

Two further factors must be taken into consideration when comparison is made between the effect of soap upon shrinkage and that of a synthetic detergent. The first of these is that it is necessary to have definite information as to the sudsing power of a detergent if any conclusion is to be drawn as to its specific effect upon shrinkage. This is clearly evident from the above discussion where it is shown that the amount of felting which occurs in the horizontal type of wash wheel depends more upon the amount and nature of the suds produced than upon inherent differences between the cleansing agents themselves.

In contrast to this situation in a horizontal type washer, it should be noted

TABLE II

Fabric	Warp Shrinkage % Water	Soap Solution*
Untreated	16.9	14.2
Treatment D	12.4	11.1
Treatment E	5.8	3.2

* A running suds was used in this test. If more soap were used even less shrinkage could be expected to occur.

that in the more common type of home washer, in which agitation occurs by rotation back and forth about a vertical axis, a different mechanism operates with respect to the action of soap. Since in this type of washer the load is completely submerged beneath the surface of the wash liquor, the degree of mechanical agitation is not affected by the quantity of suds present. In fact, in this type of washer it is more often found that the presence of soap or a detergent actually facilitates the felting process because of a lubricating action which they provide.

Thus, before a general statement can be made regarding the relative properties of soap and synthetic detergent in inhibiting or accelerating felting, careful specification of the type of washing machine used is needed. In addition, definite information is required as to the lathering and lubricating properties of the particular materials to be used.

B. HYDROGEN ION CONCENTRATION—It is well known that hydrogen ion concentration or pH is one of the important factors determining the rate at which felting occurs. Because of the rather wide range of pH's accepted on deliveries of 10½-oz. shirting, it is obvious that this factor could constitute a significant source of variation in the test procedure. Where no detergent is present, the rate of felting is highest in the low pH (acid) regions, and lowest in the high pH (alkaline) regions. The rate of change of the curve is most rapid in the alkaline and acid regions and slowest in the neutral region. A typical curve relating felting and pH is shown in Figure 4.

Examination of this curve shows that it might be advantageous from the standpoint of accelerating the test to operate at low pH's. However, since the specimens can be handled more easily in neutral solutions and since greater reproducibility is obtainable in the neutral portions of the curve by reason of the slower rate of change in this region, it has been found advisable to specify that the test be conducted in a pH range of from 5 to 7. This range can be easily maintained by the use of standard buffer solutions.

C. TEMPERATURE—Conflicting data have been reported in the literature regarding the effect of temperature on felting. Data reported by Speakman, Stott and Chang*(3)* suggest that temperature variation in milling causes little if any change in shrinkage between 100° and 130°F. However, more recent data on untreated wool reported by Carter and Grieves*(1)* covering temperatures from 70° to 150°F. and on treated wool, as reported by the Quartermaster Textile Finishing Research Laboratory from 100° to 140°F. show that increasing the temperature sig-

Fig. 4
EFFECT OF pH ON FELTING SHRINKAGE[2]

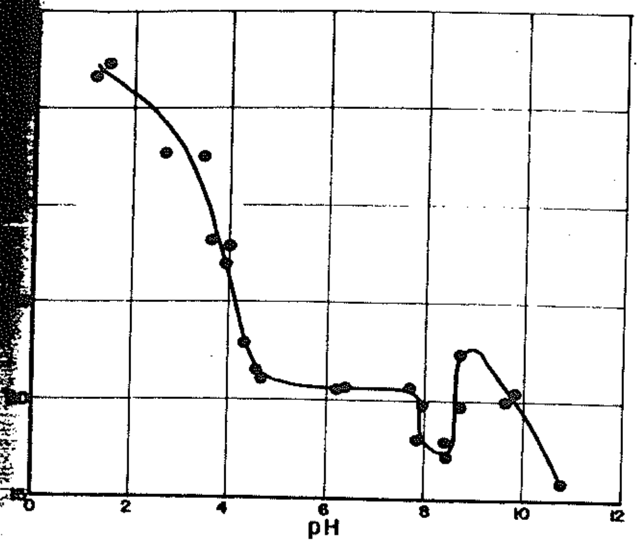
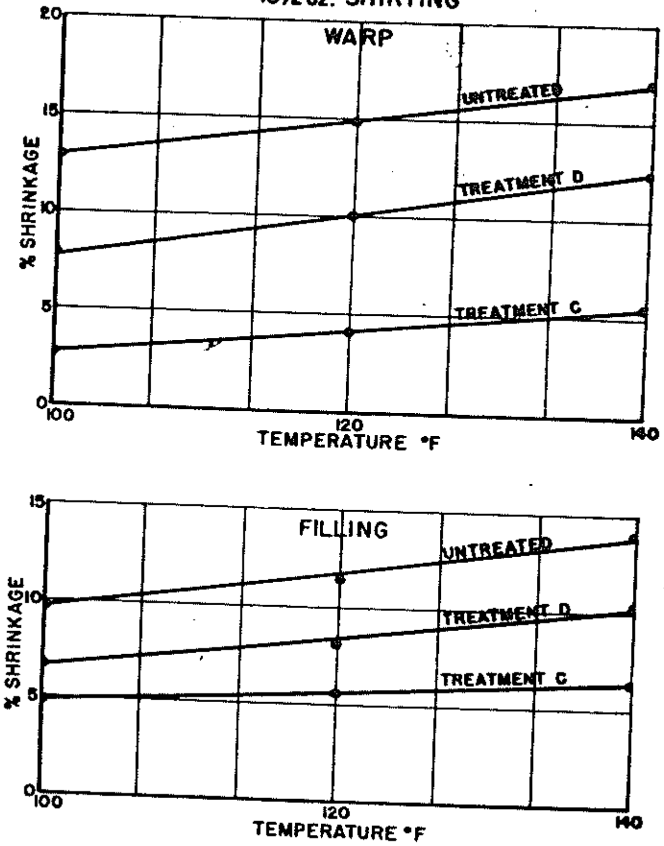


Fig. 5
EFFECT OF TEMPERATURE ON SHRINKAGE OF 10½ oz. SHIRTING



nificantly increases felting where the material is agitated in a horizontal wash wheel. Data for both warp and filling shrinkage are shown graphically in Figure 5.

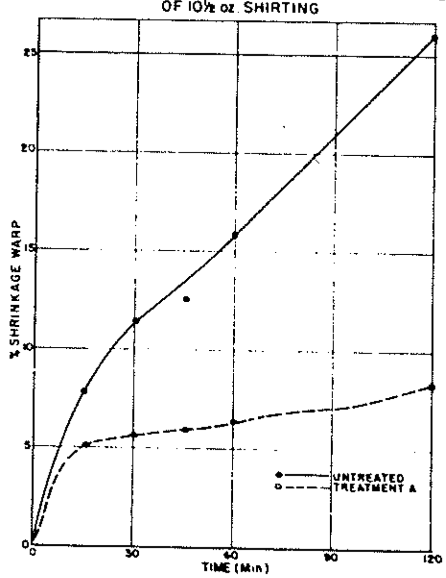
This chart shows a definite increase in shrinkage at temperatures up to 140°F. This, plus the fact that under field laundering conditions proper control of temperature is not always possible, led to the establishment of a 140°F. temperature for the accelerated shrinkage test on socks, which was adopted during the war. Since that test came into use, continuing studies as well as routine acceptance tests have shown no evidence that the wool was being damaged at that temperature. On the other hand we have found excellent correlation between our accelerated test at 140°F. and successive mobile launderings at 100°F. as is pointed out above.

D. NATURE OF LOAD—Variation in shrinkage has been claimed to result from indiscriminate use of various types of ballast. If a ballast composed of untreated wool is used its character changes with frequent use due to felting. If soap residues are allowed to remain in the ballast they may produce undesirable sudsing in subsequent tests. The size of individual specimens comprising the ballast also affects the end results. It has been found that wool will felt more rapidly when laundered with a wool ballast than with a cotton ballast of corresponding weight.

In our newly developed accelerated shrinkage test it has accordingly been determnied that the ballast should consist of shrink-resistant treated wool swatches of the same size as the test specimens. It is necessary to inspect the ballast carefully to make sure that it has not previously been contaminated with soap or synthetic detergent. At the expiration of fixed intervals the ballast should be re-examined and replaced if evidence of felting is found.

E. TIME OF AGITATION—It is in the interest of economy in laboratory operations to keep accelerated tests as short as possible. In Figure 6 is shown the relationship between warp shrinkage and time of agitation. On the basis of this chart it was determined that one hour is the minimum time which can be used safely in accelerated tests to show major differences in shrinkage. In addition, it was found that a better and mor consistent correlation between this test and successive mobile launderings could be obtained in one hour than in the longer test periods.

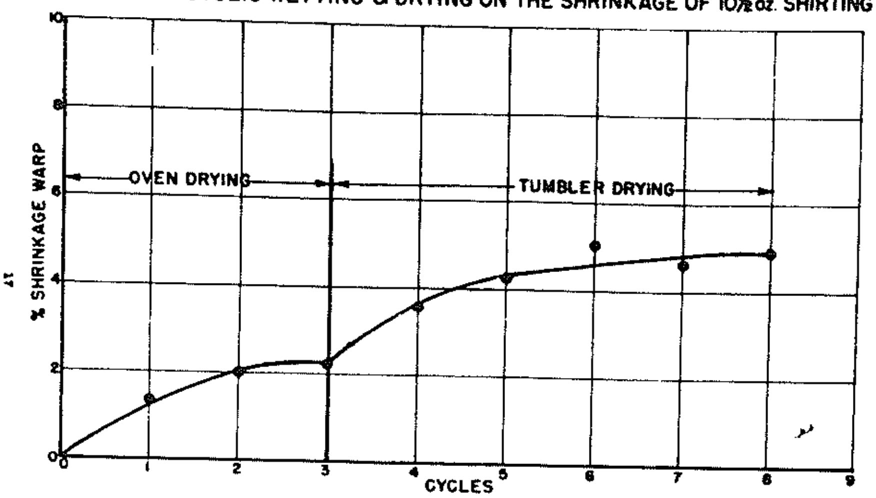
Fig. 6
EFFECT OF TIME OF AGITATION ON THE SHRINKAGE OF 10½ oz. SHIRTING



F. METHOD OF DRYING—Another serious cause of variation in testing the shrinkage of fabrics is introduced in the drying operation. Practically all current Government and commercial test methods require that woven fabrics be dried in an oven followed by spraying and pressing. For material purchased by the Armed Services such a provision is inconsistent with the actual method of drying generally used in field laundry practice. Under field conditions garments made from 10½-oz. shirting will be dried in a tumbler, since this will normally be the only equipment available. On the other hand, in post laundries it may be expected that when standard methods are set up for handling washable wool shirts, drying will be accomplished in a tumbler followed by pressing on a tailor's press.

Laboratory analysis of this problem has revealed that considerably more shrinkage occurs as a result of tumbler drying than oven drying, and accordingly it is felt more realistic to include a provision for

Fig.7
EFFECT OF CYCLIC WETTING & DRYING ON THE SHRINKAGE OF 10½oz. SHIRTING



the former procedure in the test method. In one series of tests it was found that successive cycles of wetting and oven drying (carried out so as to avoid felting) did not eliminate all of the mechanical or relaxation shrinkage of the shirting. This latter effect is achieved only where tumbler drying is resorted to as shown in Figure 7. Other tests on both wool and cotton fabrics have revealed that more uniform shrinkage is obtained by using tumbler drying since less manual handling of the specimens is involved.

SECTION V

Other Tentative Specification Requirements

In addition to the major aspect of our tentative specification on a shrink-resistant treated fabric, which has been discussed above, two other important specification requirements, alkali solubility and ageing, are contemplated.

It is recognized that the alkali solubility test provides a satisfactory means for determining the chemical effect of certain types of shrinkage-resistant treatments upon a fabric. Its reliability has been amply demonstrated as a control test in the chlorination of wool under procurements of socks by the Army during the war.

In the tentative specification requirement a 6 per cent increase in alkali solubility is permitted for this treated fabric, whereas only 3 per cent was allowed in the case of the cushion sole socks. This relaxation in requirements is made pending the introduction of greater improvements in commercial techniques in treating fabrics of this type.

The necessity for an ageing test will be clearly evident when one considers the frequent requirement for long-term storage of military items under adverse temperature conditions. While none of the current treatments recommended by the industry appear, when properly applied, to result in a decrease in fabric strength under long-term storage, there is a tendency for some treatments to exhibit harshness or for the fabrics to stiffen appreciably upon long-term ageing.

The test currently contemplated is now simply a visual and tactile inspection of the material after 100 hours' exposure in the Atlas Single Arc Fade-Ometer. There is now under development a test method requirement for the stiffening of fabric on ageing based upon a standard testing instrument.

APPENDIX 1

A detailed outline of the new accelerated shrinkage test is given below. Before performing this test the sample shall be relaxed in accordance with the procedure previously described. Where the relaxation procedure is used the felting shrinkage shall be based on the dimensions of the relaxed specimens.

TEST SPECIMENS—Four 24 x 24-inch specimens marked in the warp and filling directions in accordance with the procedure outlined in Federal Specification CCC-T-191a, Section XIV, Paragraph 1a shall be used.

MACHINE — The washing machine shall be a standard rotary reversing type (described in Federal Specification CCC-T-191a, Section III, Paragraph 5f), having a cylinder which measures 24 inches in diameter by 24 inches in length. Other sizes of laundry machines may be used provided they are calibrated to give the same results as the standard washer at the laboratory of the procuring agency.

PROCEDURE—Water at 140°F., and of not over 50 p.p.m. hardness, shall be entered into the machine until it reaches a level of four inches above the bottom of the inside cylinder. The water shall be buffered to a pH between 5.0 and 7.0 using a suitable buffering agent. The specimens to be tested and clean ballast (composed of detergent-free treated wool flannel cut to 24 x 24 inches) to make a six-pound load are placed into the water and the machine is put into operation and agitation allowed to proceed for a period of one hour.

The temperature of the water in the washer shall be maintained at 140°F. during the entire cycle. At the end of this period the specimens shall be centrifugally extracted for five minutes at a speed of 1575r.p.m. and dried in a tumbler-drier at a stack temperature of 130°F. for 30 minutes. The tumbler drier shall consist of a cylinder having an inside diameter of 36 inches and a length of 24 inches and shall rotate at a speed of 35 r.p.m. Other sizes of tumbler driers may be used provided they are calibrated to give the same results as the standard drier at the laboratory of the procuring agency. After drying the specimens shall be sprayed, pressed and conditioned before measurement for not less than four hours at a standard atmosphere as described in Federal Specification CCC-T-191a, Section II

MEASUREMENT OF SHRINKAGE—After reaching equilibrium in the standard atmosphere the specimens shall be measured and the shrinkage computed in accordance with the procedure outlined in Federal Specification CCC-T-191a, Section XIV, Paragraph 1h. Measurements shall be taken to the nearest 0.1 of an inch and shrinkage or elongation shall be reported to the nearest 0.1 of a per cent. Elongation shall be reported prefixed with a (—) minus sign.

APPENDIX 2

A statement of the test methods and tentative specification requirements for alkali solubility and ageing, as abstracted from the proposed specification for "Cloth, Wool, Flannel, All Wool, 10½ Ozs., O.D., Shrink-Resistant Treated," are given below:

ALKALI SOLUBITY—*Scope*—This test shall be used for determining the total alkali solubility and the change in alkali solubility of the wool top, yarn or fabric, whichever has been subjected to the chemical treatment. The test shall be conducted according to the procedure described below:

Test Specimens—For this determination, four treated and four untreated samples shall be used from the same production lot. From each sample, a specimen weighing 1 gram (± 0.1 gram) shall be cut for test purposes.

Procedure—The alkali solubility rocedure outlined in the Supplement eral Specification CCC-T-191a, Section VII, Paragraph 3a(3) shall then be ved, wherever applicable.

uirement—If a chemical method of cing shrink resistance is used (e.g. ination), the alkali solubility of the rial after treatment shall not be increased more than 6 per cent (absolute) over the untreated material.

AGEING—A specimen of the finished cloth approximately 2 inches wide and 4 inches long shall be exposed in an Atlas Single Arc Fade-Ometer for a period of 100 hours with the face of the fabric exposed to the source of radiation. At the end of this time, the specimen shall be removed and conditioned in a standard atmosphere for a period of 4 hours.

Requirement—When submitted to this test, the fabric shall not harshen or stiffen excessively.

References

1. E. Carter and W. Grieve, Wool Industries Research Association, Special Publication No. 6, October 1944.
2. Speakman and Menkhart, Journal of Society of Dyers and Colourists, January 1948.
3. J. Speakman, E. Stott, H. Chang, Journal of the Textile Institute, July 1933.

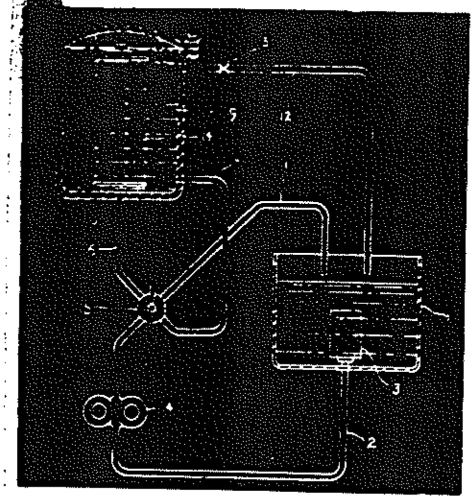
• PATENT DIGEST •

PAUL WENGRAF

eing Apparatus r Package Dyeing C, 6

. Pat. 597,733 (British Celanese, Olpin-Wesson, February 2, 1948)

t is well known that the dyeing meth- of dispersed, water insoluble acetate estuffs which are successfully used in eing acetate rayon fabrics on the winch on the jig, give bad results in package



Brit. Pat. 597,733

Dyeing Apparatus for Package Dyeing

dyeing. It has frequently been observed that the packed material, for instance bobbins, act as filtering media. Thus the outside layers absorb the dispersed dyestuff pigments while the inner layers are less colored or not colored at all. Reversing of the direction in which the dyebath penetrates the textile body does not help very much. Large amounts of dispersing agents can improve the results but in dyeing mixtures of dyestuffs it can be observed that the ratio of absorption does not correspond to the initial proportion of the single dyestuffs contained in this mixture; in other words some of the dyestuffs were absorbed at a higher speed than the others. The present patent solved the problem in a very simple way: a candle filter (3) is placed in the dyebath reservoir (1) on top of the pipe (2) which leads to the dyeing apparatus; by turning the valve (5) in different ways the dye liquor can be either pressed through the bobbin (14) in one or the other direction or brought back to reservoir (1) by pipe (11). The filter, being the main feature in this invention, is characterized by the size of the pores, preventing a passage of particles having a dimension in excess of 0.0005 mm.

Pigment Printing—Combined With Reductive Discharge D, 2, 02

Brit. Pat. 598,260 (S. A. Francolor, February 13, 1948)

Pigment printing pastes consisting of oil-in-water emulsions or of water-in-oil emulsions are generally known for their good effect in application printing on white fabrics but they do not sufficiently cover a predyed ground to substitute discharge effects. It has been tried to incorporate one of the usual discharging agents, for instance sodium formaldehyde sulfoxylate or other dyestuff destroying product (also some of the oxidizing group) into the aqueous phase; but it was not possible up to now to concentrate a sufficient amount of these products in the printing paste to obtain satisfactory results; moreover, these agents are composed of electrolytes, breaking in time the emulsions. Therefore the pastes lacked stability. It has been observed that even considerable amounts of discharging agents can be introduced into emulsions of pigment printing pastes by adding the reducing substance in form of a protective colloid solution for instance a thickened hydrosulfite, formaldehyde sulfoxylate and the like. The protective colloid may be one of the usual thickeners such as gum, starch, alginate, polyvinyl alcohol and so on. The emulsions are produced, according to British Pat. 570,742 of the same company, on the base of glycerophthalic resins, modified with a fatty oil (soy bean oil), ground with a red pigment ("Lutetia Scarlet NRF") which is pasted with white spirit. On the other hand sodium formaldehyde sulfoxylate is dissolved in a gum tragacanth mucilage and homogenized with the first mentioned resin emulsion by stirring. The paste is printed on a fabric dyed a dark blue with a dischargeable polyazodyestuff; bright red effects on marine ground are obtained after aging. Analogous examples are given for pastes containing Monastral green and titanium white.

Reference is made to U. S. Pat. 2,017,120 (Celanese): zinc salts of vat dyestuffs are used as insoluble pigments and combined with an alkaline zinc formaldehyde sulfoxylate discharge paste. But this patent has only a slight analogy with the present invention because pigment printing with this kind of emulsion was not yet known at the time of the issue of the Celanese patent (1935).

Sizing—Starch Mixed with Etherifying or Esterifying Agents A, 4, 01

U. S. Pat. 2,451,686 (W. A. Scholtens Chem. Fabrieken, Moeller-Lolkema, October 19, 1948)

A dry composition, readily dispersible in water to a transparent paste, can be prepared by mixing cold soluble starch and an esterifying or etherifying agent and pouring the dry mixture into slightly alkaline solutions. Upon contacting this mixture with water the cold swelling starch, which is very reactive, undergoes immediately etherification and a viscous paste results which can readily be used for sizing and thickening purposes. Apparently the use of starch ethers or esters has some advantage in comparison with simple cold swelling non-etherized starch.