TEXTILE RESEARCH

Publication of Textile Research Institute, Inc., and The Textile Foundation

IN THIS ISSUE

VOLUME XIII . **NOVEMBER, 1943** . NUMBER 13

TEXTILE RESEARCH

VOL. XIII NOVEMBER, 1943 NO. 13

Published monthly by Textile Research Institute, Inc., and The Textile Foundation. Publication Office: Prince and Lemon Sts., Lancaster, Pa. Editorial and General Offices: Room 2701, 10 East 40th St., New York 16, N. Y. Director of Information: Douglas G. Woolf. Editor: Julian Jacobs. Publication Committee: Douglas G. Woolf, chairman; M. Earl Heard; Stanley B. Hunt; Dr. Louis A. Olney; Robert W. Philip; E. R. Schwarz, F.T.I. Subscription (available only to those not eligible for membership in Textile Research Institute, Inc.) $5 a year; foreign $5.50.

Entered as second-class matter, October 29, 1932, at the Post Office at Lancaster, Pa., under the Act of August 24, 1912.

VOL. XIII **TEXTILE RESEARCH** NO. 13

Outstanding Features in

This Month's Issue

Change in Textile Research Volume Dating

In order that future volumes of Textile Research may correspond with the calendar year, it has been decided to continue Volume XIII through the balance of this year which makes the present issue Number 13. Volume XIV will therefore commence with the issue of January, 1944.

Stress-Strain-Time-Temperature and Humidity Behavior of Textiles

Delayed elasticity is a phenomenon which is observed in most polymers, as well as in other materials and fibers. A study of this phenomenon has been conducted at the Massachusetts Institute of Technology on the creep and creep recovery behavior of rayon, nylon, and silk filaments. (See page 2.)

Industrial Cotton Fabrics

Progress in the development of fabrics for industrial purposes is described. (See page 12.)

Healthy Research Competition

Douglas G. Woolf clarifies the relationship of research organizations within the textile industry and emphasizes the need of coordination. (See page 16.)

Warmth of Blanket Materials

Results of tests of comparative warmth of blankets of various constructions and of two fineness grades of wool are given. (See page 21.)

Practical Application of Recent Physical Research is Outlined in this Article on the Fundamentals of

The Stress—Strain—Time—Temperature and Humidity Behavior of Textile Fibers*

By Edward R. Schwarz, F.T.I.†

In the development of test methods for textiles, the early work was concerned largely with the discovery of the factors entering into test procedures which affected the results of the tests. Thus the effects of moisture regain on the strength and stretch of fibers, yarns and fabrics was investigated and is still being studied. As in all mechanical testing equipment, friction, inertia, and momentum had to be considered. It also became apparent that time was an important factor. Rate of load application, rate of deformation and rate of moisture regain studies led to the development of constant rate of stretch application and constant rate of load application testing machines of various types, as well as standardized conditioning methods for ensuring known or constant moisture regains.

The charts resulting from many of these tests took the form of hysteresis loops and it became evident that there was a *time lag* involved which merited further research. Because it was suspected that this time lag was intimately connected with the ultimate structure of the materials under test, a research program was set up at the Massachusetts Institute of Technology under the sponsorship of the Textile Foundation and under the author's direction. The program concerned itself in large part with

* Review of "Elastic and Creep Properties of Filamentous Materials and Other High Polymers"—Leaderman, *The Textile Foundation, Natl. Bur. Standards, Washington, D. C. Also 10 East 40th St., New York 16, N. Y. 278 pp. Price, $2.00.*

† Professor of Textile Technology, Massachusetts Institute of Technology.

the optical and mechanical study of fiber, yarn and fabric structure. Other work, along similar lines, was conducted elsewhere under the same auspices, but was correlated closely with the work at M. I. T. Notable in this connection were the researches undertaken by Sisson on X-ray diffraction studies of fiber structure; by Morey on fluorescence and polarized light microscopy of fibers; and by Steinberger on the deformation of fibers in tension and in torsion.

In addition to work by Osborne on the microscopical analysis of fiber structure (later followed by work by Hock at the National Bureau of Standards), work was undertaken by Hotte, Sieminski, Broadfoot, Killian, Bellinson and Fox at M. I. T. The initial portions of the researches are summarized in somewhat popularized form by the writer under the title: "Textile Fibers in the Light of Modern Science."[1]

The work by Leaderman reported by him in the book[2] just published by the Textile Foundation formed the latest portion of the program and was carried out in the M. I. T. textile division research laboratories over the past several years. In addition to its importance from a technological point of view, it is of considerable value since it shows how simple physical tests may be related directly to the fundamental chemistry and physics of fiber structure. As one example, it makes possible the computation of energies of activation which hold the groups of long-chain molecules of both natural and man-made fibers together.

To the textile manufacturer whose interests lie in the spinning, weaving and finishing of textiles there is also much of interest. The book outlines the behavior of silk, viscose and acetate rayons, and nylon and indicates that other fibers, such as hair and wool, have similar characteristics.

Principles of Creep

In general, suppose that a fiber fastened securely at one end is loaded at the other with a weight less than its breaking strength. Several things happen. First, there

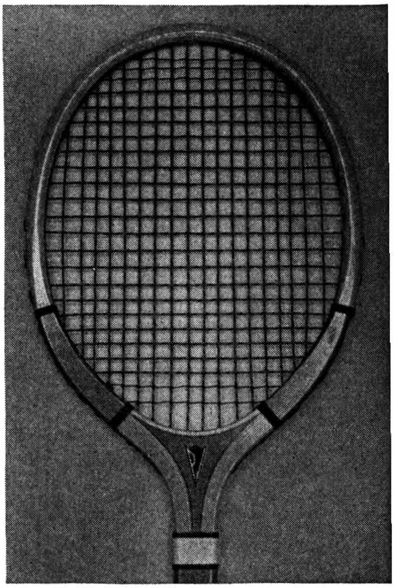
[1] TEXTILE RESEARCH, Vol. VII, Nos. 7, 8 (1937).
[2] See footnote (*) on opposite page.

is an instantaneous extension—an elastic stretch. Then there is a slower extension which decreases as time goes on, eventually becoming extremely slow. If the load is now removed, three things can occur. First, there is an instantaneous and complete recovery of stretch equal to the initial instantaneous extension. This is followed by further recovery which takes place at a slower and slower rate. Under certain conditions—which are frequently met—the slow recovery is not complete, even after an extremely long time and the specimen is "set" at a length greater than the original. The remaining extension, which is nonrecoverable unless the conditions of the test are changed (as in temperature or moisture) is known as secondary creep. It will be seen that in such an instance as this the slow extension under load is made up of two components, primary creep, which is recoverable, and secondary creep, which is not.

The presence of secondary creep complicates the work covered in this book. Fortunately it can be eliminated in most instances by stretching the fiber under a load somewhat greater than that which is to be used in the test. Sometimes several applications and releases of this load are required, but the result is to produce a "mechanically conditioned" specimen. In this sample the secondary creep is absent and the elastic stretch and primary creep can be studied conveniently.

In the absence of secondary creep—that is, after the mechanical conditioning of the fiber—tests show interesting results when the loading is cyclic. Suppose a load, less than that used for conditioning, is applied for say five minutes, then removed for five minutes, re-applied and again removed similarly. The fiber deformation will take place as though the initial load had been left on indefinitely and that, instead of removing the load eventually for a short time, an equal and opposite load had been allowed to act from the instant of removal of the initial load, indefinitely. The second load takes effect at the instant of its application and the specimen behaves as if it had continued indefinitely in conjunction with the initial load and the equal and opposite load already effectively applied at earlier times but whose joint action continues. Since the results of such a system are obtained by superposing the actions of a series of positive and negative loads, the term ''superposition'' principle is used.

It should be apparent that, according to this principle, the deformation behavior of the fiber is governed at any instant by the superposed actions of all of the previous loads up to that instant. The fiber gives every evidence of recalling its past history and of modifying its present behavior in the light of it. This is often called the ''memory effect,'' and its mathematical formulation the ''recollection function.'' As in most cases, the phenomena must be kept as simple as possible in order that even complex mathematics can be used. In service, as in nature, things are not so simple. Loads are not usually applied in constant magnitude for equal periods before and after their removal. Nor are they simple tensions. In most instances, fibers are deformed under complex combinations of tension, torsion, bending and compression. But they are still obeying definite laws of deformation under load, and for even the beginning of a complete understanding of what is happening and what can be done about it, the nature of these laws must be determined.



(Photo by Ewing Galloway, N. Y.)

Fig. 1. A mechanically conditioned string allows efficient use of elastic properties, as in a tennis racquet.

This book is written in an attempt to state and to clarify the simple laws of creep and creep recovery for various types of fibers. Such statements and clarification are necessary before intelligent analysis of the service or manufacturing behavior of fibers, yarns or fabrics can be made. Without them the investigator would resemble the man who was told to find something that had been lost. In the absence of a knowledge of what the particular specimen looks like, he can never be certain that he has found it. He does not know what he is looking for. This book, then, seeks to make the reader aware of the fact that creep and creep recovery exist, that they exist in several different forms and that they obey certain laws and can be recognized by certain characteristics.

The explanation of what happens when these laws are applied is discussed in terms of mathematical formulas for those who wish a rigorous treatment; in terms of mechanical or electrical models for those who wish to reason by analogy; and finally in terms of the molecular structure of the fiber itself for those familiar with the results of chemical, X-ray and optical research on fiber structure. Cross comparisons further use these three forms of explanation to clarify the picture and indicate that the modern "fringe" and "kinetic" theories of cell and fiber structure can afford a reasonable explanation of what is found to occur experimentally. The mechanical models are made up of combinations of springs (elastic elements) and dash-pots (viscous elements) in series and in parallel. The springs correspond to continuous chains of molecules, while the dash-pots are associated with the secondary bonds between molecular chains and the rate at which they break up.

Practical Applications

Most textiles are subjected in service to repeated application and removal of loads, in themselves insufficient to cause breakage. The extension and contraction properties make the difference between lack of durability and satisfactory service. The idea that a suit of clothes will last longer if it is allowed to rest between wearings is not a figment of the imagination.

Textile finishers are familiar with the results achieved by calendering, decating, crabbing, tentering, mercerizing and sanforizing. Yarn spinners and fabric weavers have long recognized the advantages gained by "setting" the twist in yarns. All of these operations utilize the plastic and elastic properties of fibers. This research adds qualitative and quantitative information to the fundamental background on which many manufacturing and finishing techniques are based. For the handling of rayon and nylon, for example, such knowledge is of immediate importance. The nature of the deformations produced is shown by curves which can be shifted back and forth along the time scale on which they are plotted by changes in temperature. Humidity also changes the deformation-time curves. Viscose rayon in water (or in a 100% relative humidity atmosphere) behaves much as does nylon under large loads at standard conditions of humidity and temperature. In general these changes are in the direction of deformation rather than time. Mechanically conditioned nylon under large loads was found to be "stiffer" on removal of load than at the time of original load application. Mohair fibers in water (or in 100% relative humidity atmosphere) manifest a different behavior. They act somewhat as does rubber under small elongations. While the usual load-deformation loops under cyclic loading give little information as to fundamental patterns of behavior, the creep tests demonstrate these patterns definitely and show how seriously the shape and slope of these ordinary loops are affected by time. The constant rate of load application employed does not provide relaxation times sufficient in magnitude, or proper in placement, to provide really meaningful diagrams. On the other hand, with proper understanding and control of conditions, it is possible to plot with ease the long-time creep behavior of a fiber, from data obtained from a relatively short and simple cyclic loading test. Since temperature, humidity and vibrations are very difficult to control adequately over long test periods, this technique is a powerful tool for the laboratory research worker. Abundant evidence of the agreement between such tests and the long duration tests is given in

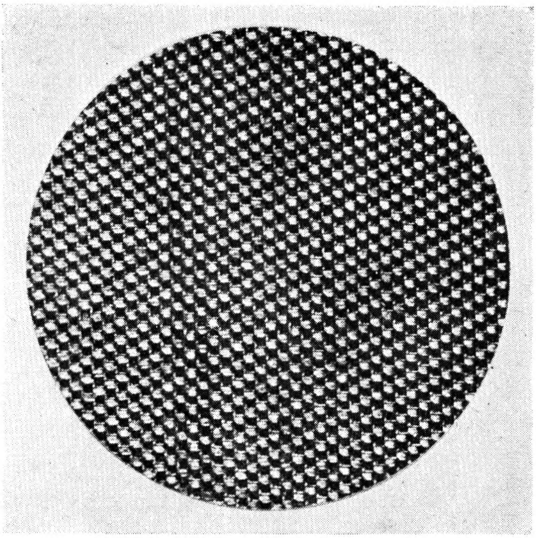


Fig. 2. Note vertical streaks. The ability of a yarn to recover after stretching is important in connection with the prevention of streaks in fabric.

the book.

For use in clothing which need to hold a crease, as in trousers, or to be crease-free, as in other garments, the properties of fibers as to creep and creep recovery are obviously of interest. In such diversified usages as tire cords, filters, blankets, fire hose, hosiery, or power transmission belting, which stretch under loads less than the breaking strength—under loads repeatedly applied and removed—creep and creep recovery are important.

The first part of the book deals with early work, dating back more than 100 years, on silk, rubber and glass in which the phenomena of creep and creep recovery were studied. Terms are defined and the nature of the superposition principle is outlined. The balance of Part I is concerned with mechanical and electrical models, the nature of primary creep, together with calculations of activation energies, and with the theories of structure of high polymers in general and fibers in particular as they are related to creep phenomena.

The details of the experimental work, including apparatus design, construction and operation and the control of variable factors such as temperature, humidity, time, mechanical vibration, inertia, etc., are given in Part II. There follows a detailed discussion of the data obtained for silk, acetate and viscose rayons and nylon fibers under a variety of carefully planned experiments. The book concludes with a summary of the creep patterns and mechanism of deformation of fibers and high polymers in general.

The entire volume is concerned with a presentation of basic information on the stress-strain-time-temperature-humidity behavior of fibers, which is of fundamental importance to the research worker and, in application, is important to the textile manufacturer and finisher as well as to the ultimate consumer. Use and extension of its techniques is recommended. It will merit careful study and thoughtful interpretation by every textile technologist. It is a substantial portion of the skeleton upon which the flesh and vital organs can be assembled to form a beautiful and impressive figure typifying textile technology itself.

RESEARCH ACTIVITIES

Morning and afternoon technical sessions will be held in connection with the annual meeting of Textile Research Institute, Inc., Thursday, November 18, at Hotel Roosevelt, New York. The morning session at 10:00 A.M. will be under the chairmanship of Giles E. Hopkins and will be devoted to the Institute's activities in applied research. The afternoon conference under the direction of Dr. Milton Harris will be a symposium of functional properties of clothing fabrics, dealing with the work which has been done as a result of war-time necessity but which will have its results in our postwar economy. At the luncheon Dr. Hugh S. Taylor of Princeton University, will be the guest speaker. A brief membership meeting for the election of officers and the presentation of the president's report will precede the luncheon. Both the membership meeting and the luncheon will be presided over by Fessenden S. Blanchard, president of the Institute.

The meeting of the New York Section of the American Association of Textile Chemists and Colorists originally scheduled for December 10 will be held December 3, 1943. All meetings this season will be held at the Downtown Athletic Club, New York.

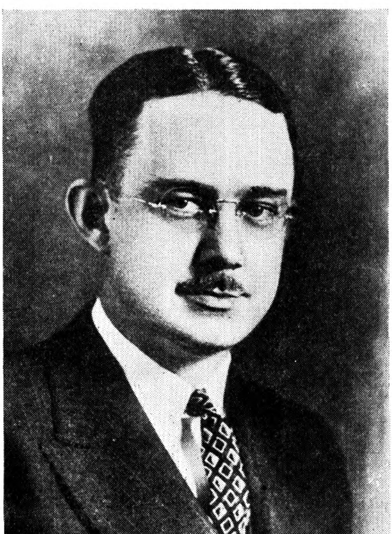
A national center for the physics profession is to be established in New York City, according to an announcement by the American Institute of Physics. A building has been purchased and a campaign is now being conducted to finance the project.

A new plastic called "Judelite" has been developed by research workers at the University of Calcutta, according to an announcement from India.

George H. Dunlap has joined the staff of the Textile School at North Carolina State College as a textile consultant and research supervisor. Mr. Dunlap will serve as a connecting link between the Textile School and the mills of the State, aiding the manufacturers in their technical problems and also keeping the staff of the Textile School abreast of the latest developments in the industry. He will also supervise a number of research projects, one of which will be the cotton carding project of the Textile Research Institute, Inc., referred to on page 11 of this issue.

Dr. Van L. Bohnson has retired as director of acetate research for du Pont. He is succeeded by Dr. Fenton H. Swezey, formerly assistant director.

Robert W. Philip, of Atlanta, has resigned as editor of "Cotton" and vice-president of the W. R. C. Smith Publishing Company, to become president and executive director of Callaway Institute, Inc., of LaGrange, Ga. He will assume his new duties on or before January 1. Mr. Philip succeeds, as president of the Institute, Fuller E. Callaway, Jr., and, as executive director, Perrin N. Collier, who has resigned to devote his full time to the position of vice-president and general manager of the newly-formed USEO division of Callaway Mills. Callaway Institute, Inc., is a self-contained institution, devoted to research, science, and education, whose facilities and services are available, under contract, to any mill or other element in the textile industry or to any other type of business it is qualified to serve. It was chartered early this year as a separate institution, acquiring as a nucleus the staff and equipment of the research department of Callaway Mills.


Robert W. Philip.

**Textile Research Institute, Inc.
Undertakes Critical Study of**

Cotton Carding

COTTON CARDING, recognized as one of the principal bottlenecks in the manufacture of cotton fabrics for military purposes, will be the subject of an intensive research study at the Textile School of the North Carolina State College, under the direction of the Textile Research Institute, Inc., of New York City. This project, which has been assigned to the Textile School by the Institute, will be financed by funds allocated by the Production Research and Development Branch of the War Production Board, Washington, D. C. This allocation is a recognition of the importance of cotton carding in the production of military and essential industrial fabrics, and also of the vital part being played by the Textile Research Institute, Inc. in the war effort.

G. H. Dunlap, who recently concluded a preliminary study of the problem of increasing card production, under a grant by the Textile Foundation, will supervise this new and broader research which will be more thorough and far-reaching than any project of this type heretofore conducted. Special attention is to be given to the quality element of the cottons used, and to the physical changes of the fibers themselves under a wide range of carding conditions. The work will also involve analyses of the various types of waste removed, and the spinning and testing of many hundreds of cotton yarns.

Dean M. E. Campbell will have general direction of the work for both the school and the Textile Research Institute. Dean Campbell, who was recently made a member of the Institute's technical research committee, has been designated as chairman of the special committee on carding research.

Research Plays Important Role in the Development of

Industrial Cotton Fabrics*

By B. L. WHITTIER**

DELAY IN EMBARKING ON A LARGE SCALE RESEARCH PROGRAM has brought out much criticism of the cotton industry. I have been in sympathy with this criticism and am delighted with the growing interest in research that is evident in the cotton and cotton textile industry.

It must be admitted that many of the developments of importance to the textile industry have been the direct result of research in other industries. Furthermore, some of the present impetus to research on the part of those directly concerned with the manufacture of textiles has been due to the imminence of losing markets to competing products.

Gradual but important progress in cotton manufacturing, however, has been going on for over 100 years and in the field of industrial fabrics a great deal of development has been brought about within the last 25 or 30 years.

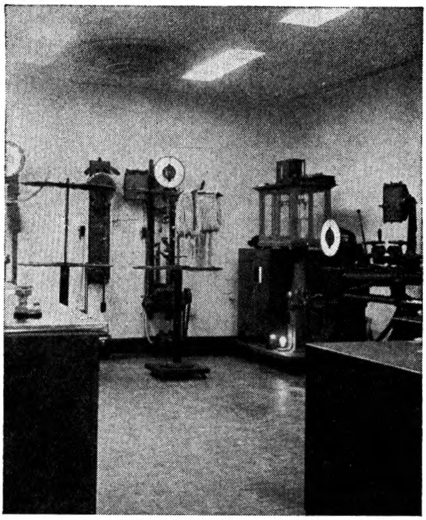
Cotton fabrics made and used for industrial purposes have none of the glamor of dress goods, tapestries, and decorative fabrics, which appeal to the eye or hand. Processors and users (rubberizers, impregnators, etc.) of industrial cotton fabrics, however, are just as particular about certain physical characteristics of the materials they use as the buyers of dress goods are particular about the design, color, and, in many cases, the weaving quality.

Until 1912, little thought was given to exactness of manufacture of industrial fabrics, the production of which was rather small. With the coming of pneumatic tires, a need arose for some specifications for the fabric and a

* From an address by Mr. Whittier in Denver, Colo., before the Gates Technical Club.

** Mt. Vernon-Woodbury Mills.

Fig. 1. Corner of testing laboratory at Baltimore plant, Mt. Vernon-Woodbury Mills, Inc.



group of rubber technicians approached the cotton manufacturers. Through the medium of the A.S.T.M., then in its infancy, a set of tolerances was set up for the 17¼ oz. 36 inch 23 × 23, 23/11 ply fabric then universally used.

Even at the end of the last war, however, cotton mills sold most materials to meet a specified width and weight, which were about the only requirements that any mill would guarantee to meet. Furthermore, the width and weight were only approximate. The reaction to a request that the materials should have a specified minimum tensile strength was that it would be impossible to determine the strength because it would vary with different atmospheric conditions. They felt there was no way to control this and besides, it was said that cotton was too variable a raw material to maintain control of strength within a roll of goods or from one roll to another.

Persistence on the part of the rubber manufacturers finally convinced the cotton mills that it was possible to keep some control of breaking strength by choosing the right kind of cotton and by careful attention during the process of manufacture. In the early twenties, we actually were selling some fabrics for mechanical goods that were guaranteed to meet, within tolerances, a specified count, a minimum breaking strength, a specified gauge or thickness, and crimp. Then someone asked us to furnish a fabric with same weight, count and general texture but with a different gauge. I well remember a man whose ability I admired and whose character I respected, throwing up his hands in horror and saying, "What in Heaven's name do they expect? If it weighs so much and counts so much per inch, it just naturally will have a certain thickness. What's more they have no right to butt into our business about which they know nothing."

Of course, the fact was that some of the large rubber companies had hired young, technically trained men with textile experience who knew that certain changes could be made to the finished product. In their positions outside the textile industry, they could commit the heresy of suggesting that different twists in yarn, rearrangement of size and ply of yarns, changes of weaving tension, etc., could and would effect the desired results.

Fortunately, the industrial goods manufacturers accepted this challenge. Gradually methods of tests were set up, instruments for measuring characteristics and performance were developed and perfected, laboratories were built, equipped with atmospheric control, and technicians were trained to operate the laboratories. Mill operators and technical men visited processing plants and discovered that certain characteristics in the fabrics were really needed to make satisfactory finished products.

Once this equipment was available and the right state of mind existed the necessary practical research and technical development followed. Studies were made to determine the best cotton for industrial fabrics and mills began to select cottons having specific properties. Processing throughout the manufacturing was improved, resulting in greater uniformity and strength of yarn and cloth. The introduction of long draft spinning helped to accomplish this.

Probably the main developments, however, came in weaving. It is generally believed that weaving heavy cotton fabrics is a simple matter. When it is considered, however, that the material used for industrial purposes is not subject to any finishing process to calender it or smooth it out, that continuous lengths up to 500 yards without defects must be finished, that thickness must in some cases be controlled within a tolerance of 1/1000 of an inch, that weight per square yard, variations in width, lengths of rolls, elongation, uniformity and character of

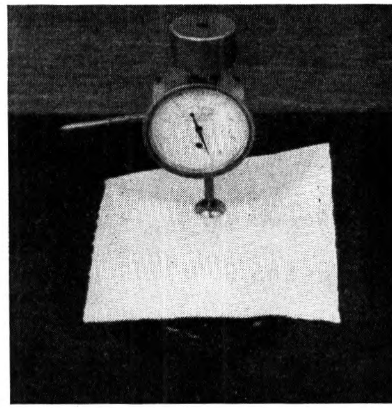


Fig. 2. Measuring thickness of a heavy fabric in thickness tester.

selvages must all meet rigid requirements, the importance and difficulties of weaving can be understood. Even though there has been no significant change in loom design, changes have been made which have helped to produce specification fabrics, and in many cases cotton manufacturers have improved their looms through the use of devices designed and built in their own shops.

The net result is that we are now meeting specifications and requirements for quality and uniformity that formerly were considered absolutely impossible.

Needless to say there is room for further progress in the development of industrial fabrics and the problems calling for research are many and varied. For example, the requirements for strength or resistance to tear have necessitated, in many cases, a highly undesirable bulky construction, so that an increase of strength per unit weight and unit cost would be of great importance.

Improved resistance to heat, cold, rot, abrasion, and flexing is desirable and an improvement in water-repellent and flame-resistant treatments is needed. Research in these directions would help to maintain or to strengthen the position of cotton fabrics in the industrial field.

Close cooperation between the manufacturers of industrial goods and the users of their products is imperative. Qualified technicians representing the cotton manufacturers should be in constant touch with their customers, studying their needs and employing research upon their problems to develop the improved and new products demanded by ever-changing industrial conditions.

The opportunity for research is unlimited and I believe the cotton industry is destined to play a leading role in coming developments.

Textile Research Needs Coordination While Also Maintaining

Healthy Research Competition

By DOUGLAS G. WOOLF

"As a scientist it seems to me that it is vitally important that we keep a number of competing groups busy in the field of both pure and applied science in order that we may develop to the maximum the potentialities of our industrial age. These groups must be large enough and powerful enough to have available the resources of modern techniques for research and development, but they should be diverse enough and numerous enough so that there is real technological and scientific competition."

The above is from no less an authority than President James B. Conant, of Harvard University, in a letter to *Life*.

There is a special message for the textile industry in those words. The emergence of several new research groups in this industry has aroused a certain amount of confusion and doubt in the minds of many textile manufacturers.

The confusion is understandable. The doubt must be resolved.

There is only one endpoint which all textile research organizations have as their goal: a sounder basis of textile manufacture, whereby the public, the employees, and the invested capital profits.

Research Organizations

To dispel the confusion, it is pertinent to identify the various units in the textile research field.

There are the three educational-research tie-ups in the South: in North Carolina, South Carolina, and Georgia. Their primary purpose is an elevation of textile school education to a status where ample funds and adequate personnel are available. As one who has fought for advancement of textile education over more than a quarter of a century, I hail that development as one of the most encouraging steps in textile progress.

There are the specialized research organizations, representing specific branches of the textile industry, such as the newly-organized Institute of Textile Technology, the Research Department of the Cotton-Textile Institute, and the research activities of the National Cotton Council—all engaged in the promotion of cotton manufacture; the long-established research program of the American Association of Textile Chemists and Colorists; and similar organizations. There, too, the need is a real one—and is being met effectively.

There are also the strictly technical organizations, such as Committee D-13 of the American Society for Testing Materials, the American Association of Textile Technologists, the Industrial Fiber Society, and similar groups, indispensable to textile advancement.

There are, finally, the over-all organizations such as the Textile Foundation and the Textile Research Institute.

Coordination of Textile Research

As Dr. Conant stated, there is room for, and need of, "real technological and scientific competition." We have such competition in the textile field today.

However, there is also a crying demand for coordination of textile research, and for elimination of duplication of effort.

That is where an organization like the Textile Research Institute comes in. In addition to conducting its fundamental, applied, and economic research programs, it hopes that it may serve as a coordinating agency, as a clearing house for textile research, to assist other groups in the avoidance of unnecessary duplication, and thus to help point up textile research toward its main objective, as stated previously in this article.

Toward that end, the Textile Research Institute has invited other research groups to a conference on Nov. 17, the day before the Institute's annual meeting. Out of that conference, it is hoped to develop a research program which will hook up sound competition to concerted action toward our common end.

How One Research Laboratory Solved an Equipment Problem by Designing

A Modern Conditioning Cabinet

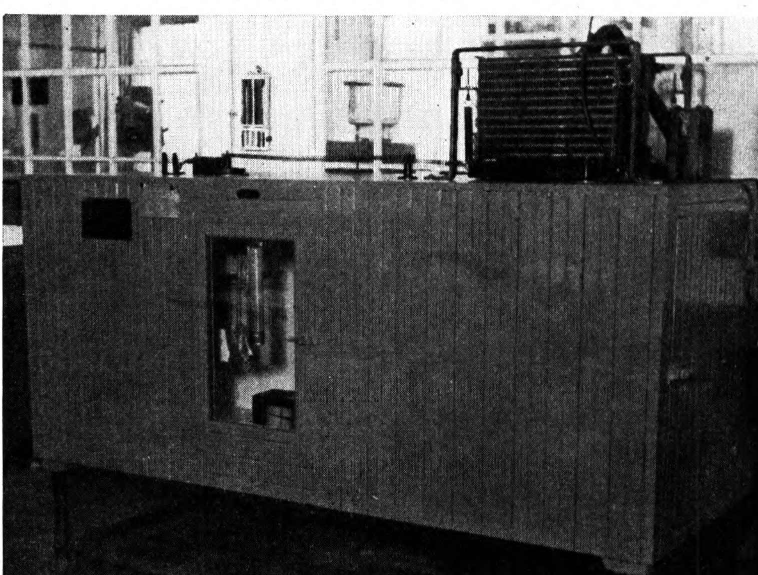
By RAYMOND MACE*

STUDIES OF MOISTURE AND TEMPERATURE RELATIONSHIPS and their effects upon the stress-strain characteristics of textile fibers, yarns, and fabrics are assuming increased importance in the field of textile research. For such studies and for routine testing it is imperative that there be maintained an accurate control of temperature and humidity at any given level.

In the belief that other organizations similarly handicapped in securing conditioning equipment due to wartime scarcity of materials will be interested in the way

* Chief technologist, Manville Jenckes Corporation, Manville, R. I.

Fig. 1. Modern conditioning cabinet constructed by Manville Jenckes Corporation, used for controlling temperature and humidity in connection with moisture regain tests.



one company solved its problem, a description is given of the construction of a practical conditioning oven.

The Manville Jenckes Corporation needed an auxilliary oven to use for research for the reason that their regular equipment is in constant use for routine testing. The oven described was built from existing equipment such as is likely to be available in most textile laboratories: namely, a conditioning cabinet originally used to condition tire cord fabric, a refrigerator unit that was once a part of a drinking fountain, plus a few parts. The original cabinet was perfectly all right for conditioning samples at a wide range of relative humidities, but was not equipped with a unit to control temperature. With the addition of this refrigerator unit to the conditioning cabinet a fairly wide range of temperature and humidity is possible.

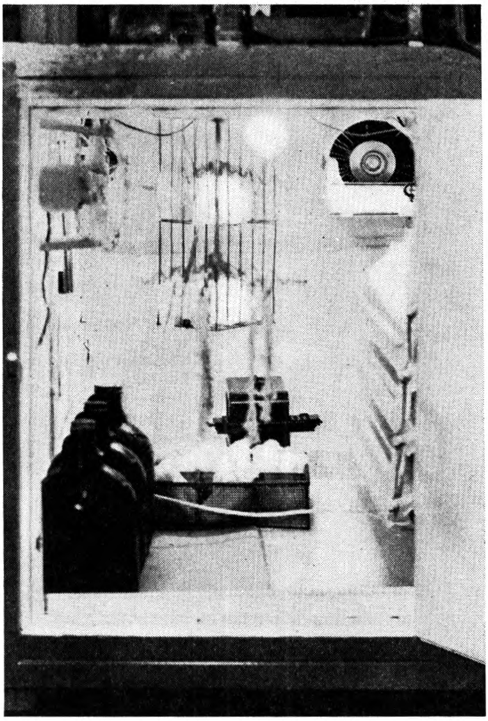


Fig. 2. View through door at right hand end of conditioning cabinet.

The coils from the refrigerator unit are housed in a separate compartment that has a louvre front (shown at right in Fig. 2) located in the right hand end of the cabinet. This is operated by the thermostat system which opens when the refrigerator unit is functioning and closes when the unit stops. This is quite important as may readily be seen, because if there were no means of closing the cooling unit the coils would defrost and there would be an increase in relative humidity. The louvre

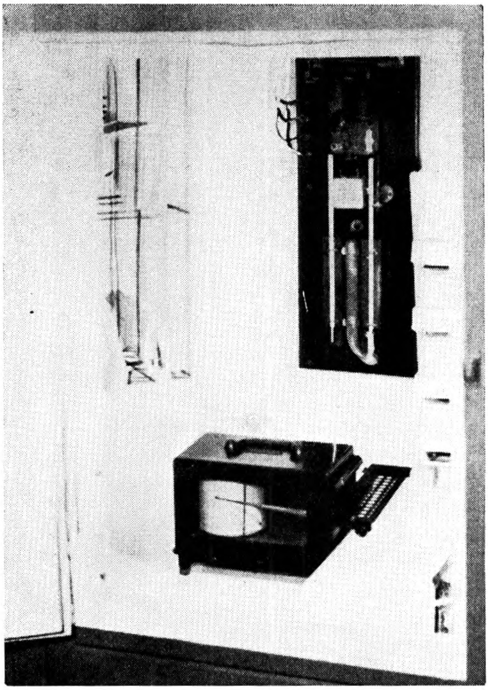


Fig. 3. View through center door of conditioning cabinet.

and unit enclosing the cooling coils are not too expensive and can be made up by a tinsmith for approximately twenty dollars.

The humidification unit and cabinet (illustrated in Fig. 1) which measures 84"x36"x36", was originally made by the Roseville Engineering and Machine Works of Newark, New Jersey. The humidification unit is quite simple and consists of a pan to hold water (upper right, Fig. 2) in which a blade fan revolves to pick up particles of water that in turn are blown out from this blade fan by an electric fan operated by the humidification control board. This board is operated by two dry cells through a relay control (as illustrated in Fig. 3). The medium of control is operated by sensitized hair which can be obtained from Julian P. Friez & Sons, Baltimore, Maryland.

There is also a small electric fan located on one of the inside walls of the conditioning unit whose function is to keep the air in the cabinet in complete circulation. The cabinet is also equipped with revolving sample racks for the same purpose.

This conditioning oven has been in constant service since it was placed in operation and has proved entirely dependable. Among the research projects now being carried on at Manville Jenckes are studies of moisture regain at other temperatures, and humidities at other values than the present standards.

Studies of Thermal Transmission Disclose Additional Data in Regard to

Warmth of Blanket Materials*

AMONG THE INHERENT FACTORS which decide the degree of thermal insulation or warmth of a blanket are: fiber properties; yarn construction; fabric construction; and treatment given the fabric after construction.

An investigation was conducted at the laboratory of the R. H. Macy & Co., Inc., Bureau of Standards with the following objectives: (1) to study the effect of fabric construction and of after-treatment on warmth; (2) to compare relative air permeability with relative warmth; and (3) to study the effect of humidity on warmth.

Fabrics used in this investigation were supplied by the Lebanon Woolen Mills, Inc., of Lebanon, Tennessee, and consisted of lock, twill, crepe and plain weaves. Two fineness grades of local wool were used, namely, 50–54s and 56–58s.

Thermal insulation or warmth tests were reported in watts /° F. (temperature difference) and also as percent thermal insulation based on the following formula: $100 = (W/°F \times 100)/w/°$ F., wherein "W" refers to the watts /°F. temperature difference with the specimen under test and "w" refers to the watts /°F. temperature difference with the base calorimeter. Table I gives results of comparative tests of thermal insulation on fabrics constructed of 50–54s wool. Table II shows the effect of change in wind velocity and thermal insulation.

From the data furnished by the tests the following

* From an address by Ephraim Freedman, director of Macy's Bureau of Standards. This paper was delivered before the September meeting of the American Association of Textile Technologists and was titled: "Factors Influencing Thermal Transmission of Blanket Materials." A limited number of copies are available and may be obtained by writing Carl C. Mattman, c/o A. M. Tenney Associates, 10 East 40th St., New York 16, N. Y.

TABLE I. % thermal insulation of lock, twill, crepe and plain weaves, 50–54s local wool (off 6th napper)

Fabric	20 picks		24 picks		28 picks	
	Watts per °F.	% T. I.	Watts per °F.	% T. I.	Watts per °F.	% T. I.
Lock	0.313	61.3	0.301	62.8	0.295	63.5
Twill	0.265	67.3	0.263	67.5	0.248	69.4
Crepe	0.277	65.7	0.260	67.9	0.259	68.0
Plain	0.400	50.6	0.392	51.6	0.381	52.9

conclusions may be drawn:

1. The finer the wool, the greater the thermal insulation.
2. The higher the count, the greater the thermal insulation.
3. The plain weave does not provide as much warmth as do the lock, twill, and crepe weaves.
4. Thermal insulation is increased, in general, by successive nappings. Of course, there is a limit to the number of nappings that can be made without reducing, if not destroying the value of the blanket.
5. In slowly moving air, increased thermal insulation is accompanied by increased air permeability.
6. The warmth of a blanket decreases as the wind velocity increases.
7. As the humidity increases the warmth of a blanket decreases.

TABLE II. Effect of change in wind velocity and in relative humidity on thermal insulation of 56–58s local wool

Wind velocity	Twill Weave	Twill Weave	Twill Weave	Crepe Weave	Lock Weave	Plain Weave
	24 picks Off loom	24 picks Off 6th napper	20 picks	20 picks	20 picks	20 picks
4 miles per hour						
Watts/°F.	0.420	0.259	0.269	0.264	0.302	0.364
Relative humidity in duct	69%	69%	69%	69%	69%	69%
Watts/°F.	0.465	0.288	0.290	0.292	0.315	0.393
Relative humidity in duct	84%	89%	83%	83%	83%	83%
11.4 miles per hour						
Watts/°F.	0.643	0.404	0.430	0.430	0.454	0.557
Relative humidity in duct	73%	73%	78%	78%	68%	68%
18.2 miles per hour						
Watts/°F.	0.795	0.631	0.737	0.627	0.626	0.696
Relative humidity in duct	53%	42%	48%	54%	50%	56%

RESEARCH AIDS

Registered Trade Names

A list of the trade names registered in the United States Patent Office for cotton textiles with special finishes, and for the compounds used to impart special finishes has been issued. This 97 page circular was prepared by Ruby K. Worner, associate textile technologist and Walter M. Scott, chief of the Cotton Chemical Finishing Division, Southern Regional Research Laboratory. In addition to the trade name, registration number, date, and owner, there are included: the description taken from the trade-mark certificate; information by the owner or agent; and information from other sources.

The list is designated as Bureau of Agricultural Chemistry and Engineering Miscellaneous Circular ACR–192 "Registered Trade Names Applicable to the Finishing of Cotton Textiles." Copies are obtainable upon request to Southern Regional Research Laboratory, 2100 Robert E. Lee Boulevard, New Orleans 19, Louisiana.

Allocations and Priorities Guide

The nineteenth revised edition of the Allocations and Priorities Guide is now available. This 719 page book describes the priorities system, how it operates and its application, priorities regulations, and the controlled material plan.

An index of War Production Board forms is given and a complete summary of all P, U, M, E, L, and T orders has been brought up to date. Price of the Guide is $3.00, and may be obtained from Coordinators Corporation, 11 South LaSalle Street, Chicago; or at 90 Pine St., New York, N. Y.

Chemical Formulary*

Volume VI, of the Chemical Formulary brings up to date the well known series with the latest tested formulae, processes and methods for use in the preparation of marketable products. Included in the contents are chapters on adhesives, emulsions, resins, plastics, and waxes, and textile processes. A chapter on substitutes for scarce materials has been added. Volume VI is entirely new with no duplication of previous volumes.

* THE CHEMICAL FORMULARY. H. Bennett, editor-in-chief. *Chemical Publishing Co., Inc., 26 Court St., Brooklyn, N. Y., 635 pp. Price, $6.00.*

Synthetic Adhesives*

Of vital importance in the wood and metal trades, synthetic adhesives are also making progress in the textile field for such applications as the laminating of cloth and in certain finishes. The author describes the composition and main properties of synthetic cements and glues, and outlines methods for their application. The book is intended as a main reference work which will tell the works manager or foreman which adhesive will best serve specific requirements. It is not, however, an exhaustive catalogue of industrial adhesives.

* SYNTHETIC ADHESIVES. Paul I. Smith. *Chemical Publishing Co., Inc., 24 Court St., Brooklyn, N. Y. 125 pp. Price, $3.00.*

Glue and Gelatine*

Natural protein glues are, in spite of the advances made by protein cements, still of the greatest value as adhesives and the demand for them far exceeds the supply. This book is simply written and furnishes information with which every user of these products should familiarize himself. The source and methods of manufacture of the common types are described. Their properties and qualities are outlined as well as reference to miscellaneous uses. This new book will be of use to mills using gelatine in the throwing and sizing of warps and in finishing textile piece goods.

* GLUE AND GELATINE. Paul I. Smith. *Chemical Publishing Co., Inc., 24 Court St., Brooklyn, N. Y. 145 pp. Price, $3.75.*

ABSTRACTS

Members of Textile Research Institute, Inc., desiring complete copies of articles abstracted may obtain photostat copies at cost by addressing the Institute's office, 10 East 40 St., New York 16, N. Y. The price of a photostat negative is seldom more than 50 cents per page of original text.

Translations of articles appearing in foreign language publications and abstracted in Textile Research, *will be furnished at cost when the original publication is obtainable.*

ANALYSIS: TESTING LABORATORY METHODS

Moth Damage

New method for quantitative determination of moth damage to textile fibers. W. J. Hamburger and K. R. Fox. *American Dyestuff Reporter* 32, 357–360 and 373–374 (Aug. 16, 1943).

A method is described which may be used to determine the efficiency of mothproofing compounds on textile fibers. Moth damage is evaluated by measuring the reduction in mean staple length of a sample of fiber after inoculation with carpet beetle larvae. Staple arrays are prepared from shearling fiber both before and after inoculation and by a suitable tracing and planimetering method, the per cent reduction in staple length is calculated. Correlation between the amount of mothproofing medium present as shown by chemical analysis and the reduction in staple length is indicated by a series of curves. Very good agreement between repeat tests was noted. Test procedure is suggested for selecting sample of fiber, preparing arrays, selecting larvae, inoculating sample, and evaluating fiber damage.

Dry Cleaning

Report of A.A.T.C.C. committee on fastness to dry cleaning. C. A. Seibert, chairman. *Am. Dyestuff Reptr.*, 32, 362–65 (Aug. 16, 1943).

A tentative test for fastness to dry cleaning has been developed by a research subcommittee of the A.A.T.C.C. Small pieces of wool, cotton, silk, viscose rayon and acetate rayon (or preferably a piece of special stain record cloth) are attached to a sample of the material to be tested. This specimen is placed in a jar containing fifty times its weight of the following composition: 987 parts solvent (either Stoddard Solvent, carbon tetrachloride or tetrachlorethylene; carbon tetrachloride to be used for arbitration tests), 5 parts dry cleaning soap, 4 parts water and 4 parts tertiary butyl alcohol. The jar is placed in a Launder-Ometer or similar machine and run for 25 minutes at 80° F. It is then rinsed and pressed dry according to an outlined procedure, depending upon the equipmentment available and the type of fabric under test. A wet cleaning test method is also described, which is, briefly, a 15 minute wetting of the sample with a .1% soap solution at 100° F., followed by rinsing. Specimens which will withstand both wet and dry tests without appreciable color change or staining of the attached white fabrics are assigned a Class 3 rating; those which do not change color but stain attached white fabric are Class 2; and those which will not pass Class 3 requirements in the wet test but do so in the dry test are Class 1. Specially dyed viscose rayon fabric may be used as controls in this test.

Accelerated Ageing

Report of A.A.T.C.C. committee on accelerated ageing tests for sulfur-dyed materials. T. R. Smith, chairman. *Am. Dyestuff Reptr.* **32**, 380–384 (Aug. 30, 1943).

The loss in strength of five different commercial sulfur dyeings when treated by six proposed ageing methods is shown. A proposal is made for a standard procedure for conducting accelerated ageing tests on sulfur dyed material in an electric oven, in which a six hour ageing at 135° C. and a fixed relationship between quantity of test material and capacity of the oven of 25 grams per cu. ft., is suggested practice. A novel recommendation is the addition of 20 c.c. of water for each cu. ft. of oven capacity at regular intervals to introduce humidity as a factor in the test. Another proposal concerns a tentative procedure for conducting accelerated ageing tests on sulfur-dyed fabrics by means of an autoclave. The construction and operation of a suitable autoclave is described. Results of autoclave ageing experiments indicate that steam at 115° C. accelerates degradation roughly equivalent to hot air at 135° C. Data are given which show the effect of five years storage on eight commercially dyed sulfur shades as indicated by both breaking strength tests and cuprammonium fluidities. As expected, the black dyed goods showed the greatest degradation.

Determination of Starch

A rapid colorimetric method for the quantitative determination of starch in textile fabrics. R. L. McEwen. *Am. Dyestuff Reptr.* **32**, 371–73 (Aug. 16, 1943).

A colorimetric method previously used for the determination of starch in vegetables, was found to be applicable to the rapid determination of small amounts of starch in textile fabrics. The sample of fabric or yarn is disintegrated mechanically and the starch solubilized by treatment with 42% perchloric acid for 30 minutes at room temperature. An aliquot is taken and the perchloric acid neutralized. The solution is made acid with acetic, and potassium iodide and potassium iodate added, following which a colorimetric reading is obtained with a photoelectric colorimeter fitted with a red filter to minimize the error due to dextrins. The iodine color is discharged with thiosulfate and the reading made again to allow correction for the presence of fibers in the test solution. The starch content is then determined by reference to standard graphs of starch content vs. colorimeter reading, previously made using known amounts of starch of the same type as that present in the fabric tested. All types of starch do not give the same concentration of iodine color when the same weights of starch are present.

Mildew Resistance

Soil suspension method for testing mildew resistance of treated fabrics. M. S. Furry and M. Zametkin. *Am. Dyestuff Reptr.* **32**, 395–98 (Sept. 13, 1943).

According to the authors the soil suspension test represents a simple, rapid and dependable method for evaluating the efficiency of mildew proofing treatments on fabrics intended for out-of-door use. The procedure consists of (1) leaching the fabric for 24 hours in running water, (2) saturating in a water suspension of a specially composted soil, (3) placing in a bottle upon a wick of glass cloth which has been wet with culture medium, (4) incubating ten days for cotton or fourteen days for jute and (5) washing, conditioning and determining breaking strength. The results are compared with an untreated control carried through the same process, and with the original strength of the treated fabric. Some of the microorganisms causing rotting of fabric were isolated and identified and, by inoculating fabric with the isolated species, an indication of the destructive effect of each was obtained. A table is presented showing the effectiveness of nine finishing treatments as evaluated by the soil suspension method.

CHEMICAL AND PHYSICAL RESEARCH

Molecular Weights of High Polymers

Molecular weights of high polymers. M. L. Huggins. *Ind. and Eng. Chem.* 35, 980–86 (Sept. 1943).

The use of a number of equations giving the relation between osmotic pressure or viscosity of solutions of synthetic polymers and molecular weight is discussed. The usual equations for small molecules give large errors. The equations for rod-like chains, kinked chains, and large spherical molecules are given. Both the number average and the viscosity average molecular weight should be determined to give the best characterization of the polymer.

The Drying of Rayon

The drying of rayon. H. P. Simons, J. H. Koffolt, and J. R. Withrow. *Trans. Am. Inst. Chem. Engrs.* (1943) 133–55.

Part I. The drying of rayon skeins. This paper summarizes experimental data on the effect of various drying operating conditions as temperature, humidity, and air velocity (1) upon the chemical engineering aspects of the drying of 150 denier, 40 filament viscose rayon yarn, in skein form, and made by the "Spool Process" and (2) on certain properties of the yarn.

The results of the work indicated: (1) That the rate of drying of this rayon yarn, previously centrifuged, and under the conditions investigated conformed to the usual drying equation

$$\frac{-dW}{d\theta} = 1.24G^{1.47}(\Delta H)W$$

where

$dW/d\theta$ = rate of drying, lbs. of water evaporated per hour per lb. of bone dry stock
G = mass velocity, lbs. per minute per sq. ft. cross sectional area
$\Delta H = H_s - H_a$ = saturation humidity corresponding to wet bulb temperature of air-humidity of main stream of air, lbs. water per lb. bone dry air
W = free moisture content of stock, lbs. water per lb. of bone dry stock

This equation represented only the falling rate period of the normal commercial rayon drying conditions. No constant rate period was observed in the drying of the skeins which had been previously centrifuged. (2) Drying conditions in the ranges investigated, namely, from room temperature to 200° F., percentage humidity from 2 to 40 percent, and air velocity from 20 to 60 lbs. of air per minute per sq. ft. of cross sectional area, caused no observable degradation as shown by the determination of wet tensile strength, elongation, copper number, and cuprammonium disperse viscosity.

Part II. The Drying of Rayon

The work on this phase of the rayon drying problem presents data on the drying of 150 denier, 40 filament rayon cakes made by the "Viscose Pot Process." This investigation was carried out in the experimental dryer described in Part I. The objectives and background were somewhat similar to the work on skeins but was extended to include investigations of the moisture gradient at a given plane during drying. The electrical resistance of the rayon cakes was found to vary with the moisture content of the cakes, and an instrument for measuring this resistance calibrated to moisture percent was developed and used. The details of this apparatus are described and typical charts of this preliminary investigation of moisture gradient in rayon cakes during drying are presented. The equation

$$\frac{-dW}{d\theta} = 0.88(\Delta H)G^{0.5}W$$

was found to represent the rate of drying of the cakes.

Here again drying air temperature, humidity, and air velocity in the ranges investigated had no noticeable effect on the copper number and cuprammonium disperse viscosity.

Drying of Textiles

The drying of textiles. A. C. Walker. *Textile Research* **13**, 15–35 (March 1943).

A report is given of some of the results of a textile drying research project conducted by Textile Research Institute, Inc., the objectives of this project, some of the results of which have previously been published, were: determination of amounts of moisture retained by important textile fibers when brought to equilibrium at a series of temperatures in the range between 37.8 and 150° C.; effect of heat and humidity on physical properties of textiles; effects of finishing and scouring agents on moisture relations of textiles; and a study of package drying. Curves are shown representing the data secured. Relationship is shown between vapor pressure and the reciprocal of the absolute temperature (1/T) in degrees C. The experimental points fit straight lines or two intersecting straight lines of very nearly the same slope up to temperatures as high as 150° C. (1/T = 0.00236). Sufficiently accurate linear functions may be derived from four charts shown for most industrial purposes. The hysteresis effects in humidity-moisture and humidity-electrical resistance relations for cotton were studied. It was observed that even if cotton is brought to the same atmospheric test condition from the same direction to avoid the well known hysteresis effect, different samples may still have different moisture content, and therefore, different properties such as for example the electrical insulating quality. It was noted that such differences are dependent on the previous history of the material, particularly the manner in which it is dried. These differences may amount to as much as 1 per cent in moisture content. Differences were also found in some cases where the previous history might be assumed to be the same. It was noted that a difference of but 0.1 per cent moisture content may cause a difference in electrical resistance of as much as 25 per cent. The studies of heat and humidity relationships of different textiles disclosed that high humidity at any temperature is more harmful than low humidity, this being particularly true for purified cotton and cuprammonium rayon. Carpet wool shows the degrading effect of humidity somewhat more than clothing wool, as does mercerized cotton and acetate rayon. Finishing and scouring agents tend in certain cases to decrease the moisture content. A limited study of drying of packaged cotton has disclosed that yarn may be dried in a fraction of one hour under suitable, commercially practicable conditions, and that such drying may be carried out under conditions where the material may be brought to a predetermined moisture content without over-drying. The theory of moisture distribution in textile fibers is discussed and the effect of the removal of moisture in drying upon the molecular structure, and therefore, physical properties of fibers. Too thorough or uneven drying may impair the valuable properties of flexibility, softness and strength.

DYEING: BLEACHING: FINISHING

Vat Dyeing Spun Rayon Blends

Vat dyeing spun rayon and blends of cotton, wool and acetate. Spun rayon-wool fabrics—Part IX of a series on wartime dyeing. A. Fitzgerald, Textile Bulletin **64,** 18–21, 52 (Aug. 15, 1943).

Practical methods for desizing, scouring and bleaching spun-rayon-wool blends are described. It is recommended that a relatively high percentage of desizing agent having both proteolytic and amylolytic properties be employed. A fatty alcohol type detergent plus ammonia is suggested for the boil-off and the peroxide bleaching method must necessarily be used, the temperature of both processes best not allowed to exceed 160° F. Drying on a 90-ft. enclosed frame gives the most satisfactory results and care should be taken that the cloth is both dry and cold before padding with the vat pigment.

Dyeing Redwood Fibers

The dyeing of redwood fibers. H. Luttringhaus. *Rayon Textile Monthly* 24, 115–16 (Sept. 1943).

A short report of tests conducted to determine the affinity of the fiber for acid and chrome colors. It is shown that certain dyes will yield colors fast to A.A.T.C.C. wash test No. 1 if properly applied. It is shown not to be feasible to dye either acid or chrome colors in the same bath with wool.

Fire Resistant Finish

Fire resistant duck. J. R. Redmond. *Am. Dyestuff Reptr.,* 32, 375–78 (Aug. 30, 1943).

The need for and the purpose of Tentative Specification J.Q.D. No. 242 (Fire, Water and Weather Resistant Duck) is discussed. Chlorinated paraffin is a mandatory component of the finish in this specification and considerable research has been carried out based upon this product. In order to measure the stability of a particular chlorinated paraffin the amount of HCl evolved upon heating for four hours at 175° C. is determined. Commercial chlorinated paraffins were found by this test to range from .79% HCl evolved for stabilized types to 1.75% for unstabilized types. A study was made of the effect of certain added materials on the amounts of HCl evolved in this test and a number found to accelerate the decomposition greatly. Iron oxide, zinc oxide, zinc carbonate and zinc borate were among this class, while such substances as basic magnesium carbonate, aluminum stearate, dicyandiamide and lecithin were found to retard the dechlorination. It is pointed out that the temperature of 175° C. is far above any temperature encountered in practice and in searching for a more representative test one has been devised which consists of shredding a certain amount of the finished fire-resistant duck into the tube containing the chlorinated paraffin to be tested and measuring the HCl evolved after four hours at 110° C. In this way some indication of the stability of a given paraffin and, as well, the catalytic action of the finish used, has been obtained. The progress of deterioration of an unstable finish on exposure to the elements can easily be traced by periodic tensile strength determinations and this has usually been found to be readily correlated to acid formation in the cloth as noted by pH determinations.

FIBERS: YARNS: FABRICS: MECHANICAL PROCESSES

Synthetic Fibers

Synthetic fibers for the post-war world will be tailor-made to fit specific requirements. Douglas G. Woolf and Winn W. Chase. *Textile World* **93**, 105–07 (Sept. 1943).

There are now three fronts in the Battle of the Synthetics. The potential implications of the third front—completely synthetic fabrics vs. fabrics made by old-school methods—are staggering to the imagination. This much is certain, there will be nothing accidental about the synthetics of the future. They will be tailor-made to meet specific requirements. This article appraises the effect of developments in synthetics since World War I—developments which are now evolving with such rapidity that there now looms on the horizon the possibility of a complete revolution in textile processes and products.

Properties of synthetic fibers—charts to aid textile men in choice of synthetics for specific applications. *Textile World* **93**, 108–20 (Sept., 1943).

Charts are presented which show for the common synthetics: their microscopic appearance; their more important physical properties; the effect upon them of such influences as heat, age, sunlight, various chemical agents; dyes, and resistance to organisms; their uses; and the manufacturers together with trade names of their products. The arrangement of these charts presents the data in a manner which should make them particularly useful to all who are interested in textiles.

Mildew Resistance

Resistance of various textile fibers to mildew. N. E. Borlaug. *Rayon Textile Monthly* **24**, 60–61 (Aug. 1943). *Ibid.* **24**, 93–94 (Sept. 1943).

A study conducted by the Pest Control Research Section of Grasselli Chemicals Dept., E. I. du Pont de Nemours & Co. Evaluations were made by (1) soil burial tests; laboratory culture tests; and storage of cellulose acetate at 80° F. and 80% R.H. The viscose rayon, cellophane, cotton, and completely saponified acetate fabrics were entirely destroyed in the soil burial tests. All the cellulose acetate and nylon samples were relatively bright and clear after being removed from the soil and rinsed, also relatively little loss of tensile strength was observed. The results of laboratory culture and storage tests further demonstrated that cellulose acetate rayon and nylon possess a high degree of resistance to attack by fungi and bacteria. Light weight cotton fabrics and viscose rayon nettings are difficult to protect with fungicide treatments. Heavy weight cotton fabrics i.e. 8 oz. duck and heavier, can be satisfactorily protected. Detailed description is given of test methods used.

Leather Fiber Fabric

The preparation of leather-fiber fabric. A. Miekeley. *Collegium* **1941**, 257–67; *Chem. Zentr.* **1942**, **I**, 302–3 (through *Chem. Abstr.* 1943, **37**, 2610[2]).

The results of fundamental investigations on the prepn. of fabric from leather fibers were as follows: (1)

Influence of properties of the leather fibers. Cr-tanned fibers gave much better results than vegetable-tanned fibers as regards strength, wear-resistance and softness of the material, because the Cr-tanned fibers are naturally softer and felt is better than vegetable fibers. However, the Cr-tanned fibers must not dry before use, for then they lose much of their felting ability and softness. Vegetable-tanned fibers must be well washed before use and detanned with soda soln. If the fat content of the leather-waste is too high it interferes with the adhesion of fibers and binding agent and lowers the strength of the material. The fibers must not be too short. (2) *Influences of binding medium.* Exptl. results show clearly that the various cementing agents affect the properties of the fabric in different ways. Emulsions with a polyvinyl-acetate base gave products with higher tensile strength than those with acrylic acid ester polymerization products. Therefore fabric prepd. with the latter emulsion is more flexible than one prepd. with vinyl acetate emulsion. The results show that synthetic binders, with the exception of MVW emulsion, do not equal latex in wet wear-resistance. In addn. the wet-wear resistance is closely related to H_2O absorption. In general, the greater the H_2O absorption, the poorer will be the wet wear-resistance of the fabric. The same is true of swelling in H_2O. It is clearly shown that as the amt. of binder is decreased the quality degenerates. This holds for all binders investigated. Vinyl acetate emulsions have an advantage over other binders investigated in that they have unusually great emulsifying power. Waxes, fats, plasticizers of all kinds, even tar, can be emulsified and incorporated into the fiber mass with no addnl. treatment. To be sure, the binding power of the emulsion is influenced in many cases. (3) *Influence of additives such as plasticizers or water-repellents.* Leather fibers and binders alone usually do not produce a usable product. Depending on the binder and fiber, fats, plasticizers, water repellents, etc., must be added to improve one or more of the properties of the material. Correct choice of material and detn. of proper dosage are extremely difficult because the added materials themselves may have influence on the properties in a pos. or neg. direction. Addn. of fats, e.g., improves H_2O-resistance and therefore wet wear-resistance, but lowers the strength. Many waxes and plasticizers also behave in the same way. (4) *Fabrication.* Molding, pressing and drying have great influence on the properties of the finished product. The best results are obtained when the sheet of material is sucked or pressed almost free of water. By pressing or milling while warm many properties such as H_2O or wear-resistance are often greatly improved. At the same time the flexibility is often unfavorably influenced.

MISCELLANEOUS

New Trends in Nylon

Nylon—a new material for industry. Anon. *Modern Industry* **6**, 38–41 (July 15, 1943).

Many uses are described for Nylon as a fiber and as a plastic. The physical qualities are tabulated comparing molded nylon with molded cellulose acetate and molded vinylidene chloride. Excellent illustrations accompany the text showing present successful applications together with some postwar products.

Fiber Trend in Full-Fashioned Hosiery

Hosiery's complex wartime problem. John Black. *Domestic Commerce* 31, 17 and 28 (Oct. 1943).

The transition during the years

1939 to 1943 inclusive, from the use of approximately 100 percent silk to an estimated 0.5 percent silk is described and illustrated graphically. In 1941 nylon had captured 17.6 percent of the field with silk holding 80 percent. For 1943 it is estimated that rayon will furnish 92 percent of the hosiery, and cotton 7 percent.

Handling Rayon Cut Staple

New developments in handling of rayon cut staple. John W. Reinhardt. *Rayon Textile Monthly* **24,** 88–90 (Sept., 1943).

A description is given of the operation of the Proctor impact dryer for cut rayon staple.

Light Reflecting Floors

Light from floors speeds war production. Bull. of the Universal Atlas Cement Co., 135 East 42 St, New York. 24 p. (1943)

A new type of light-reflecting floor installed in war plants is described. Built of concrete made of white portland cement instead of gray, the floors become reflectors instead of absorbers of light. Lighting on underside work surfaces is increased by 61 percent and illumination on vertical work surfaces by 20 percent. Savings in cost of lighting are given. A section is included on recommended surface treatment of existing floors.

Manufacturing of Rayon Hosiery

Throwing rayon yarns for the hosiery trade. E. J. Schellenberg, Jr. *Textile Age* **7,** 37–44 (Aug., 1943).

The development within the past year of new methods and increased care and control of operations have resulted in an improved product by the throwster. Methods are outlined for reeling, application of sizing material or oil to the yarn, winding or redrawing, twisting, steaming, and coning.

Radiant Heat

Radiant heat drying lamps for drying, baking and heating processes. *Westinghouse Bulletin* issued by the Westinghouse Lamp Division, Bloomfield, N. J.

A twelve-page illustrated bulletin describing the application of lamps for radiant heat and giving examples of typical installations.

The Mather Lecture

Textile research and development. Sir Robert H. Pickard. *Am. Dyestuff Reptr.* **32,** 399–404 (Sept. 13, 1943). (Reprinted from *J. of Tex. Inst.*)

Delivering the "Mather" lecture at the annual meeting of the Textile Institute (British), Sir Robert Pickard defined research as it applies to the textile industry, stating that research shades off into "development," a word very freely used at the present time. This in turn sometimes shades off into investigations which are sometimes misnamed research and merely aim at "trouble shooting" or trouble avoiding. He also emphasized the need for education in textile technology and stated that the majority of educational institutions are tied to one fiber, teaching the technology—as distinct from the science—of one fiber only. A plea is made for more generalized education. Examples are given of some of the ways in which textile research can aid the textile industries. A central research establishment for textile industries generally is essential. The development of association research in Great Britain and the way in which it functions is described. Postwar developments are touched upon and mention is made of the trend in England toward mass production of textiles.

Textile Research Institute, Inc.

10 East 40th Street
New York 16, N. Y.
Telephone: Lexington 2-2196

Washington Office

Industrial Building
National Bureau of Standards
Telephone: Woodley 5088

AIMS OF TEXTILE RESEARCH INSTITUTE, INC.

To promote, cultivate, facilitate, and conduct textile research

AIMS OF THE TEXTILE FOUNDATION

To engage in economic and scientific research for the benefit of the textile industries and their allied branches, including raw materials

LANCASTER PRESS, INC., LANCASTER, PA.