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In This Month's Issue

Paper-Saving Changes

As a further step in cooperation with the Government program to meet the paper shortage, we are making certain typographical changes in TEXTILE RESEARCH, *effective with this issue. We have gone from a single-column to a double-column measure, reduced the type size, and utilized more of the margin space. Previously we had reduced the weight of the paper used. All these steps, while helping to conserve paper, do not in the least impair the editorial service of* TEXTILE RESEARCH. *On the contrary, we have increased the total amount of text.*

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As previously noted, Volume XIV commences with this issue.

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An Unpredictable Year

Douglas G. Woolf, viewing the future for the textile industry, discusses the trends now emerging which will affect both the immediate and the long-view post-war period. (See page 2.)

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Cotton Textiles for Plastic Laminates

A recent survey of the requirements of the laminators of plastics shows that research is needed if cotton textiles are to improve or even hold their present dominant position as the reinforcing element in plastic laminates. (See page 11.)

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The Evening Action of the Cotton Card

A method is described whereby it is possible to determine the evening which can be expected from the card in averaging out the irregularities present in the picker lap. The results of such tests are given. (See page 20.)

Research is the Only Sure Prediction for an

Unpredictable Year

By DOUGLAS G. WOOLF

This is an attempt to look into the future—into 1944 and beyond—from the standpoint of textile research. Since the trend of every major phase of textile activity depends very largely upon research, this is a summary of the textile outlook as a whole.

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The term research used to bring automatically to the mind of the average textile manufacturer the picture of a man with a test-tube, or a microscope. It stood for something academic and rather stuffy—an abstraction—with no, or only the most remote, bearing on his own job of work.

Today the real scope of the term is coming into recognition, and with it a realization of the practical application of research to the business of making textiles and making money.

That is why a new interest in research is sweeping the industry. That is why hard-headed business men are putting cash on the barrel-head to finance research.

Research is the one sure prediction in an otherwise unpredictable year. Its growth in 1944, and beyond, is absolutely assured.

It will take many forms: fundamental research, applied technical research, economic research, new product research, research in industrial relations, and the development of new and improved statistical guides as tools for economic research, and of new and improved test-methods and specifications as tools for technical research.

Consequently the outlook in textile research is the outlook in the textile industry as a whole.

A Kaleidoscopic Future

It is almost impossible to grasp the complexities of the textile picture for 1944 and the years ahead. It appears to be a maze of conflicting trends and impulses. Consequently it would be helpful to try to arrange these in groups.

There is, first, the time angle. Every statement about the textile future must be clearly dated, so as to indicate whether it refers to the remaining period of the war, with its continuing pressure for war production, but also with its constant emergence of cutbacks, reconversion, and essential civilian requirements; to the immediate post-war period, with its problems of renegotiation, disposal of surplus property, re-employment of returning service men, etc.; or to the broad post-war period which will follow this initial adjustment.

Next, there is the geographical angle. There will be a vital international phase, including the re-clothing of devastated peoples and the re-equipping of their textile industries; and the competition from newly industrialized countries, together with the opportunity for broader markets in those nations. Then there is the domestic phase, with its competition among sections of the country, among industries, and among branches of the textile industry itself.

True, each of these phases has its impact upon all the others. Trends now emerging will affect both the immediate and long-range post-war period. What happens in Timbuctoo will have its repercussions in Oshkosh, Wisconsin, and vice versa. But it is necessary to keep clearly in mind these conflicting time and geographical angles, as each of them requires a new yardstick for evaluating it, and an individual approach to its solution.

Research in the War Effort

There is a tendency in some quarters to regard the chapter of textile research in the war effort as closed. That is an erroneous conclusion as are all the other easy assumptions about the end of the war. Even if the European phase of the war should be concluded in 1944—and there is absolutely no assurance on that—the Pacific war will still have to be won. More than that, it is the hope of most of us that we will not slide off again into the happy illusion that we can disarm and be safe. Consequently, it would seem that a continuing program for the improvement of military textiles is in order.

It was this thought which Rear Admiral W. T. Carter, assistant chief of the Bureau of Supplies and Accounts, undoubtedly had in mind when he said in a recent address: "The Navy often is asked whether there still is research and development work to be done. . . . We can answer this by stating definitely that while we have come a long way in improving our textiles and clothing we still have a long way to go." He said testing techniques are still in their infancy, and stated as an example that the ordinary tests for water-repellency, although suitable for mill control, are of little value in predicting the behavior of a new fabric or garment under conditions of wear.

One fact to be remembered in this connection—second only to the service rendered to the fighting forces—is that war research will play a most important part in determining the type of textiles available to citizens after the war. This was dramatically demonstrated in the report entitled "The Functional Properties of Clothing Fabrics," just issued by the Textile Research Institute, Inc. which provides a thrilling glimpse into the significance of war-time research to the *public interest post-war*.*

The Immediate Post-War Period

The problems of the textile industry in the immediate post-war period are on us. There have been cutbacks and, of course, there will be more. There has been reconversion to essential civilian fabrics and there will be more.

A ten-point armistice plan was recently presented to the textile industry by Frank Walton, former director of the Clothing and Leather Division of

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* Copies of this report have been sent to members. They may be purchased by non-members at 50¢ each by writing to the Textile Research Institute, Inc., 10 E. 40th St., New York 16, N. Y.

the War Production Board. This plan, and all other plans for meeting the emergencies which will arise constantly from now on throughout the immediate post-war period, require the most careful study by the industry, primarily through its associations, in order that the minimum of disturbance and hardship to both employers and employees will result. The important point here is that no time should be lost in arriving at the basis for constructive plans.

This problem is regarded by many as purely a political one. True, there are major political phases involving such questions as Government methods for disposing of surpluses; Government attitude toward renegotiation; post-war financial reserves; continuing of price and wage controls, etc. This political phase does not fall within the scope of this article. However, it should be emphasized that Government alone is not going to control these policies. Industry will have an important part to play. The extent to which it can influence the solution constructively depends upon the extent to which industrialists approach it with an open mind, which is the basis for real research.

There is also the need for group and individual research, starting immediately, on such problems as the development of new products, the utilization of new technical developments now in the making, the delineation of the types of organization best suited to the specific needs of particular branches of the industry and particular companies within these branches. In the study, whether by associations or by companies, technical and economic research will have to be applied and, above all, will have to be coordinated. That was what was meant at the start of the article when emphasis was placed upon the breadth of the scope of textile research.

New Technical Developments

It is impossible to over-emphasize the significance of those technical developments in textiles which were in the making prior to the war, and of those which have grown out of the research on military textiles referred to previously. In some directions, the war held up the furtherance of certain of those developments; in other directions it increased the tempo. Many of them will not get into general utilization during the immediate post-war period. There will be pressing problems of reconversion and of re-employment, coupled with those arising out of world rehabilitation. The day after the Armistice, there will not appear on the streets men and women clothed in futuristic garments. However, the duration of this interim period may be shorter than is generally realized. Here again, the accelerated tempo of textile research will play an important part. Certainly it is not safe for any branch of the industry or for any individual to count on an unlimited breathing spell. Immediate knowledge of the potentialities of new technical development is absolutely essential.

Textile Raw Materials of the Future

It is possible here merely to indicate a few of the major trends. Probably the most important is in the direction of what has been called "The Battle of the Fibers." In the thoughts of many of us, the term "battle" in this connection has become obsolete. It implies adherence to the status quo,

Courtesy
M. I. T. Textile Division

Fig. 1. Illustrates possibilities in the field of high speed photography for post-war research. Edgerton High Speed photograph of yarn balloon (top view) rotating 9000 revolutions per minute, shows the effects of wind resistance on the balloon and the centrifugal force on the fibers in the balloon. Note passage of yarn down and to right from the pigtail guide, then back in a curve to the ring traveller, and thence to the left onto the bobbin. Free fiber ends trail up to right from the yarn of the balloon. (Just one example of post-war possibilities.)

an attempt to fight for supremacy of fibers previously used by individual branches of the industry and by individual companies. The opposite attitude, that of complete open-mindedness, was succinctly expressed by Robert R. West, in his summary report on the excellent session held on this subject at the annual meeting of The Cotton-Textile Institute. "The emphasis at this session," said Mr. West, "was on the suitability of these fibers to be used in conjunction with other fibers rather than as displacements, and it was repeatedly emphasized by the speakers that in considering the construction of products, end-products for the industry, the emphasis should be put on the utility value of various fibers to achieve a given result rather than on a predilection for any one given fiber."

A similar thought was expressed by Dr. Claudius T. Murchison, President of The Cotton-Textile Institute, in his annual address at that same meeting. "In the long run," he said, "science working within the form of the economic law will determine the victor in the battle of the fibers, if there is to be a victor. On the other hand, it may create a situation in which the fibers will cooperate in a common program of textile production. It is conceivable that the idea of competition will give way to the idea of coordination and that all working together may produce a result from which all will be the gainers. In any event, the day is rapidly approaching when we must all be objective and realistic in view of inter-world circumstances."

The fact that these two statements were made at a meeting of cotton manufacturers, and were applauded by those present, is in itself a sufficient commentary on the new phase which has been reached in the utilization of textile raw materials.

Emergence of New Finishes

Possibly second in importance to technical development in raw materials is the emphasis which has been placed on research in the direction of new finishes. This was already well under way before the war; it has been greatly accelerated by war-time research to meet the needs for durability under unprecedented conditions in the arctic and in the jungle, in the air and under the sea. New visions of fabrics possessing unheard of durability and versatility have been aroused. It was recently said by Mr. E. N. Edgerton of Pacific Mills, that the public is beginning to hear increasingly of war-time developments in the treatment of textiles—developments which make fabrics not only dye-fast but water-repellent, shrink-proof, crease-resistant, indestructible, mildew-proof and fireproof. Only, he added, the expectation of a great number of persons is that after the war fabrics and apparel will, or should, contain all of the new treatments. Whether they will is still uncertain, he pointed out, but post-war textiles in general will be vastly improved.

To this statement can be added the observation that probably never will fabrics possessing all the properties of resistance be produced for all uses. In many cases one or more of these properties would be unnecessary. However, here again, the safest way is to maintain a completely open mind as to the trend of textile finishes after the war. Particularly is it desirable to avoid the feeling that the utilization of any particular type of finish can be postponed until there is a public demand for it. The way in which many of our newer and more prosperous industries have developed—often at the expense of older and less progressive industries—has been through the anticipation of public use value, and the creation of products best fitted to serve it. This technical progress has been supported by promotional activities which made the public aware of the availability of such new products.

If any one textile company thinks it can wait until there is a public demand for something new, its executives may wake up some morning and find that one or more of its competitors has gotten in first and preempted the field. If the textile industry as a whole adopts this laissez-faire attitude then it will undoubtedly wake up some morning to find that other industries have invaded its erstwhile bailiwick.

That again is where textile research and its application come into the picture.

New Equipment Development

Probably the third major zone of post-war changes will be in the field of textile equipment, and auxiliary equipment sold by general industrial companies to textile mills.

Major changes in existing textile equipment may well be delayed beyond the period of active utilization of new fibers and new finishes. There will be the immediate problem of reconversion of many textile machine shops from war-time to a peace-time basis. There will also be the demand for textile machinery to re-equip damaged textile plants throughout the world, and to fill the domestic void created by inability to secure replacements during the war. The all-time record productive activity in the industry during the last three years has inflicted a tremendous toll upon equipment in place. However, here too there can be no complacence about the future. It has often been pointed out that much of the standard textile equipment does not represent mechanical perfection, to indulge in under-statement. Trends toward by-passing the spinning frames and the loom were already in existence in isolated cases before the war. It would be a fallacy to imagine that such attempts will be abandoned in the post-war period.

This can be a threat to existing textile machinery manufacturers and existing textile mills, or it can be an opportunity. The choice between threat and opportunity lies through research.

In auxiliary equipment there are also major developments in prospect. Just to mention one, there is the whole new field of electronics. Speaking before the American Society of Mechanical Engineers at its annual meeting, Stephen T. Herr, of the Brown Instrument Company, predicted that "electronic instruments will increase post-war production, finishes and quality to a degree never before realized, with their importance in industry comparable to their value in war devices, now mostly secret, of which radar is the best-known."

The Economic Outlook

Less predictable than the era of technological change, as to its trends, but certainly not less inevitable, is the era of economic change which faces the textile industry. Here again there are both the immediate and long-range prospects. Factors entering into the immediate picture extend from now through the initial post-war readjustment, including rehabilitation, meeting pent-up civilian demands, the ever-present possibility of clothes rationing, re-clothing returned service men and women, the re-location of men in their jobs with minimum disturbance to those who have taken their places during the war, the problem of the disposal of surplus textiles, etc. etc.

In the long-range view there are the factors previously mentioned: our position in world textile trade, and the competition among specific industries themselves not only for the textile markets but for an increasing share of the consumer's dollar. In addition there will be the problems involved in new productive efficiency reached during the war, in multi-shift policies, in the replacement of man-power by labor-saving devices, in the financial problems growing out of the large public debt, possible inflation, and the need for corporate reserves to meet modernization demands.

In fact, it seems almost certain that the economic problem will be greater than the technical problem after the war. Emphasis during the last few years has been on technological improvements and on reaching new levels of production effort. Major emphasis after the war may have to be placed upon the intelligent utilization of these new facilities, benign in themselves but potentially malignant in their abuse. The whole problem of gearing our distribution machinery to take care of our expanded production will be with us again.

It does no good to point to unlimited production and unlimited world demand unless the two can be synchronized. Synchronization lies through the utilization of both technical and economic research, and through the relation of one to the other, to meet currently the problems as they arise and to plan for the future.

As a movie fan might express it to the reader of this article: this is where you came in.

RESEARCH ACTIVITIES

The new plans for the Textile School at North Carolina State were outlined by Malcolm E. Campbell, dean of the Textile School, N. C. State College, in an address before the annual convention of the Southern Textile Association, held at Charlotte, N. C., December 11, 1943. Dean Campbell stated: "If the textile schools of the country are to meet their responsibility in furnishing young men and women with adequate training for the field of research, it is not too soon to plan for special college courses in this kind of work. Among the subjects that should be included are physics; chemistry; mathematics; at least a short course in textile manufacturing; dyeing and finishing; microscopy; fiber, yarn and fabric testing; methods of statistical analysis; report writing; and if possible, a reading knowledge of at least two foreign languages. Thus, there is ample material for at least two years of specialized undergraduate work and, where it can be offered, from one to three years of graduate work in preparing a student for textile research."

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A new central laboratory is being constructed at Atlas Point, near Reynolds, Pa. by the Atlas Powder Company. The new laboratory will be devoted to broad industrial research, some of it related to the textile field.

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A special library for reference listing of seized enemy patents was opened Jan. 1 at the Office of Alien Property Custodian, 17 Court Street, Boston. Among the nearly 50,000 patents are some 2,000 in the field of textiles. The patents are particularly strong in dyes, plastics, and electrical goods and represent a wealth of recent foreign research.

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Lieut. William F. Macia, U. S. N. R., of the Brooklyn Naval Clothing Depot, now on leave from the A. M. Tenney Associates, has been elected president of the American Association of Textile Technologists.

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Improvements to cotton looms to give them increased stability and weight, making them vibrate less, and giving increased production are being marketed by the Mountain City Foundry & Machine Co. of Greenville, S. C. It is stated that seven mills have adopted these improvements.

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New light fastness standards which represent a distinct improvement over previous standards have been developed by the Committee on Fastness to Light of Dyed Textiles, of the American Association of Textile Chemists and Colorists, under chairmanship of W. D. Appel. These standards represent a new idea in that only two dyes are used to produce the range of 10, 20, 40, 80 and 160 hours fastness to the Fade-Ometer. One of these is a fugitive dye and the other an extremely fast dye. In developing the standards each dye was applied to wool slubbing separately and then the two were blended mechanically. By this means any desired degree of fastness can be obtained merely by using the proper proportions of each of the dyed materials. The new standards were adopted as tentative by the Research Committee of the A.A.T.C.C. at their recent meeting in New York, to replace the present standards. Authorization was granted to go ahead and prepare a substantial quantity of the new standards for distribution to the trade.

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Research in connection with water-repellent finishes, upon the effect of fabric and garment construction on the degree of water-repellency that can be obtained in "breathable" type garments, is reported as being conducted by manufacturers of well-known water-repellents in cooperation with a group of converters.

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Properties and textile applications of Calgon were described at a recent meeting of the Philadelphia Section, American Association of Textile Chemists and Colorists. Some of the important uses are: (1) in scouring operations to prevent the precipitation of lime soap, also to dissolve it when previously formed on textile materials; (2) to prevent the precipitation of dyes, oils and sizes by the calcium salts in water; and (3) as a water treatment in textile mills having a very soft water to prevent the pick up of iron from pipe lines.

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The influence of fabric structures on the properties of laminated plastics, the relationships of un-spun cotton fiber in laminates, also the relationships of pre-treatment of fabrics to the electrical properties of a laminate are included in the research program planned by the Research Division of the National Cotton Council.

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Improvement in cotton fiber strains and an attempt to find the correlation between methods of fertilizing and the resultant characteristics of cotton lint, are purposes of experiments in the growing of cotton being conducted by the Goodyear Tire and Rubber Company, according to a recent announcement. Cotton plants are grown in a series of gravel-and-water-filled tanks where all elements of nutrition are under direct control and comparison of results can be obtained. Practical translation of laboratory findings into actual growing practice is being had through cooperation of growers scattered across the entire cotton belt. A history of these cottons is being kept from the time the seed is planted until the cotton is destroyed in a tire test.

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A limited amount of each of seven basic types of glass fiber is being made available for experimental purposes by the Owens-Corning Fiberglas Corporation, Toledo, Ohio. Information regarding the properties, uses and methods of application of the glass fibers will be provided.

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In order to reduce the noises in the small chambers on submarines, 1⅛ inch batts of Fiberglas bonded with a phenolic plastic are used. Formerly these were covered with a woven glass fabric. It is reported that rayon is now to be used for the fabric covering.

Textile Research Organizations Plan Coordination Through An

Inter-Society Council

As a result of the greatly increased interest in textile research and of the growing number of organizations participating in it, the need for coordination and avoidance of unnecessary duplication has been recognized. To meet that need, an informal conference of representatives of the major organizations was held recently, at which plans were laid for the formation of an Inter-Society Council for Textile Research. A steering committee was appointed, composed of Giles E. Hopkins, of the Textile Research Institute, Inc., chairman; William D. Appel, of the National Bureau of Standards; A. G. Ashcroft, of Alexander Smith & Sons Carpet Co., and John T. Wigington of The Cotton-Textile Institute, Inc.

The purpose of the Council is to provide a clearing-house for all types of research on textiles; to steer new textile research problems to the agencies best equipped to handle them; and to cooperate with other research organizations and societies.

The plans, as tentatively outlined by the steering committee, provide that the Council would be an informal group representative of all the organizations, meeting infrequently—possibly once a year. The interim functions, to accomplish the purposes outlined above, would be performed by an executive committee to be appointed at a later meeting of the group.

Organizations represented at the original meeting included the American Association of Textile Chemists and Colorists; the American Association of Textile Technologists; Committee D–13 of the American Society for Testing Materials; The Cotton-Textile Institute, Inc.; the Industrial Fiber Society; the Institute of Textile Technology; the National Bureau of Standards; the National Cotton Council of America; the Textile Foundation; the Textile Research Institute, Inc. and the Southern Regional Laboratory and the War Food Administration, both of the U. S. Department of Agriculture. Other organizations interested in, and promoting textile research, both technical and economic, will be invited to participate.

One of the functions of the Council suggested by the meeting is the maintenance of a continually revised and up-to-date list of research organizations, and of the various projects being conducted by them, or in prospect. This list and its revisions would be circulated concurrently among all the various organizations participating.

The group meeting at which the plans for the Council were laid was characterized by complete frankness of discussion, and a unanimous disposition on the part of those present to do everything feasible, and within the limits of the policies of the individual organizations, to work together toward the common goal: the advancement of textile research.

More Research and New Fabric Constructions Are Requirements for Increased Use of

Cotton Textiles for Plastic Laminates

The following is a brief digest of a report prepared by Charles K. Everett, director of merchandising, The Cotton-Textile Institute, Inc. Copies of this report are being made available to members of the cotton-textile industry. Inquiries should be sent to The Cotton-Textile Institute, Inc., 320 Broadway, New York 7, N. Y.

This report is based on the author's personal investigations and discussions with research, manufacturing, and sales executives of representative producers of plastic laminates as well as with other experts competent to evaluate current and prospective application of laminated plastics in many fields.

For those textile manufacturers desirous of synchronizing some part of their own post-war production plans with the possibilities for future expansion of consumption of cotton fabrics in the plastics industry, this report is intended to help visualize:

(1) how wartime exigencies have affected the demand for plastic laminates, with resultant changes in the character of products and manufacturing operations. (2) what are—from the laminators viewpoint—the deficiencies and shortcomings of cotton textiles in relation to competing materials, and (3) what are some of the outstanding problems presenting themselves for basic and applied research study if cotton textiles are to improve or even hold their present place as the reinforcing elements in plastic laminates.

In the post-war world plastics will, in many cases, supplant metals, rubber, plywood, and other materials. Perhaps one of the most promising post-war outlets for increased cotton consumption is in combining fabrics with synthetic resinous compounds in laminated product form. In the production of laminated plastics reinforcing materials or "fillers" are used. Partly because today's production is for war purposes with quality the dominant consideration and price secondary, 80 percent or more of all filler material is cotton textiles. It is estimated that up to 50 million pounds of cotton fabrics ranging from 4 oz. per square yard up to 4 lb. duck will be consumed by the plastic laminators. Thus the use of cotton has reached such proportions that the impetus must not be lost through complacency or inertia. As a matter of fact the forward motion of this impetus to the use of cotton fabrics is now being slowed down perceptibly as a result of intensive research and promotional activity on the part of the paper industry, the fiberglass interests, and the processors of other textile fibers, including sisal and jute, as well as synthetics.

(Continued on Next Page)

Thermosetting Laminates

A development which makes secure the future applications of laminated plastics is the recent successful introduction of a new range of thermosetting resins which, because they can be cured with the application of low pressure, now make it feasible to produce molded laminated products in all manner of trick shapes without the need for intricate, costly equipment. It is therefore likely that there will be a large expansion of manufacturing sources for this type of laminates.

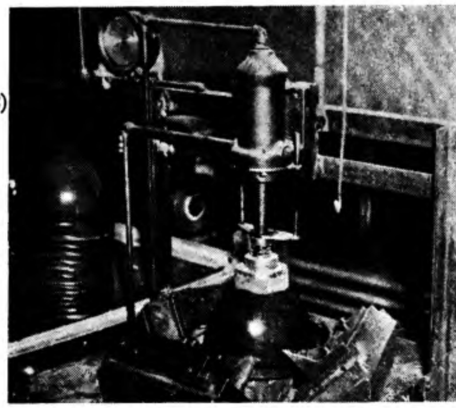
The flexibility of cotton fabric and its drawing qualities over compound curves give it a natural advantage to a pronounced degree over its chief competitor in the plastics industry, viz., paper. The potentialities, however, need to be immediately explored in the interest of making cotton fabrics of optimum constructions.

The laminators feel that there has been a lack of a really thorough understanding by the textile industry of their peculiar needs. The suppliers of principal materials other than cotton textiles provide an engineering service which is a contributing factor to the growth of the plastics industry and many of the laminators deplore their lack of contact with cotton-textile mill technicians, save for exceptions so few that they are conspicuous.

There is a striking unanimity of opinion among the laminators that cotton fabrics have never had a full chance because standard constructions have been, in the main, the goods principally used by them. They feel that closer collaboration by the cotton-textile manufacturers will accelerate the introduction and acceptance of many new fabric constructions that

(1)

(2)



(3)

Manufacturing steps in production of laminated plastic helmet-liner. (1) Smoothly finished helmet liner is released from the mold by air. (2) Two machines punching 6 holes each, prepare liner for its fittings. (3) Suspension harnesses are rapidly riveted in.

are especially suited to specific needs.

Because of the engineering collaboration on the part of the suppliers of laminating papers and the fiberglass fabrics, it undoubtedly has been much easier than it would otherwise have been for these manufacturers to develop the high strength products which have been seized upon by the laminators as offering the means for getting plastic products of even higher tensile strength.

However, in spite of the fact that through intensive research laminating paper of exceptional strength has been produced there are many drawbacks to its use. Fiberglass fabrics also have serious drawbacks, not the least of which is their present extremely high cost compared to the cotton fabrics they would replace.

The laminators assert that primarily, the cotton fabrics supplied today provide practically no greater tensile strength for the finished plastic products than did the goods supplied ten or more years ago. Today because the physical and mechanical properties of plastics vary so widely, textile goods need to be designed and manufactured with an adequate understanding of their end use. Some fabrics should be designed to overcome rigidity in certain applications, just as in other instances fabrics designed to yield higher impact strength or in others high compressive strengths are needed.

Better control of such factors as stretch and moisture absorption would assist in overcoming dimensional instability. Likewise there is a call for better electrical qualities. Here glass has an advantage because of its insulating properties. Certain applications indicate a need for more and better fabrics of high unidirectional strength warpwise or fillingwise.

Thermoplastic Laminates

That laminates of thermoplastic materials are destined for a broad and rapid development is the opinion of competent observers. This type of production is likely to take on sizeable proportions in the automotive industry, perhaps in the aircraft industry, and most probably in the rubber industry. Thermoplastic laminates, although more costly than the thermosetting laminates, are definitely superior for those applications where their higher impact strength and greater toughness make them superior.

Among the applications offering promise for peacetime development is the shoe sole. One of the largest shoe manufacturers has recently purchased 50,000 pairs of these soles combining cotton fabrics and thermoplastic resins. Cotton fabrics and this type of resin have the common characteristic of flexibility, and when combined they possess an exceptional strength that is not present in either alone.

Thermoplastic resins present peculiar difficulties in fabric impregnation. It therefore is apparent that fabrics need to be designed with particular consideration for the high viscosity of that type of resin.

One eminent scientist in the plastics industry points to the urgent fundamental need for a thorough investigation of the factors governing fabric strength and their relationship, if any, with the strength obtained from a fabric when used as a filler in a laminated plastic. It may well be found that the relationship is a remote one for, as pointed out in the report, while twist and crimp in yarns are important elements in the strength of textiles, there is good evidence that both are harmful in goods destined for laminating purposes. Again, it seems very unlikely that the same importance attached to fiber length with respect to the strength of cotton yarns and fabrics generally, hold in the case of textiles entering into the production of plastic laminates although this is not to say that fiber length is wholly without importance or significance. These two illustrations cited make clear that the peculiarities of the plastics industry are not those of the textile industry and these differences will have to be recognized and understood if most advantageous utilization of cotton textiles is to be realized in laminates.

Both the plastic laminators and the manufacturers of molding and laminating compounds are anxious to meet and work with technicians from the cotton mills. They point to the fact that although the strength of the cotton fiber ranges upward from 60,000 pounds per square inch, the general range of finished plastic laminates using cotton fabric as a filler is but from twelve to sixteen thousand pounds in most instances. They question if cotton textiles are being supplied in their optimum form. An official of one of the largest enterprises in the plastics industry has stated that it has been definitely determined by experiment that one of the causes for low tensile strength in laminated textile fabrics is the crimp of the fiber. A glass fabric where the crimp of the warp threads has been reduced to a low percentage leaving the crimp to a lightweight filling thread has raised the tensile strength of laminated glass products to more than six times the glass fabric where the warp yarns are allowed to possess normal crimp.

The possibility of producing a cotton fabric with minimum crimp in the warp yarns and with the stretch of the cloth confined mostly to the filling direction so intrigues certain laminators that they would like to see textile manufacturers tackle this problem ahead of all others.

Suggestions have been made that cotton-textile manufacturers wishing to safeguard their present outlet in the plastics industry should study the feasibility of combining cotton with other fibers, first in yarns and subsequently combining in fabrics all-cotton yarns with yarns of other fibers. Chemical treatment of the cotton has also been suggested.

Some of the other specific problems of applied research as posed by the laminators are presented in this report for the consideration and study by cotton-textile mill executives and technicans.

It is a fact as wartime applications have proved, that the replacement of metal, rubber, and plywood by plastic laminates has meant the introduction of not inferior, temporary substitutes but actually superior products in many directions and it is conceded that cotton-textiles have been an important factor. The notable advances that are constantly being made in devising new combinations of components in plastics not only compel the discard of preconceived notions about the limitations of laminated plastics but also provide for the cotton-textile industry an impetus for research that assures an adequate pay-off for whatever measure of success is had in producing more and better laminating cotton fabrics.

Research Aids

The Textile Industries of China and Japan*

An understanding of the textile industries of China and Japan is important to us for three reasons: (1) Japan may become a serious competitor of the American Textile industry—not in cotton alone, (2) the Chinese textile industry may offer a splendid post-war opportunity for American capital and management, and (3) the textile industry is at the core of the economic problem of the Orient—which will require solution at the peace conference.

A report which will lead to a clearer understanding of the post-war opportunities for the United States textile industry in the Far East and the problems created for America by the textile industries of China and Japan has just been published by the Textile Research Institute, Inc. This report reviews the history of the textile industries and their importance in the economic life of these countries; the factors that have led to the great strength of the industries in Japan; and those factors which have held back the textile industries of China—but which, if overcome, will make China a great textile manufacturing nation. Included in the report is an appendix which tabulates a great deal of important statistical information and includes a comprehensive list of bibliographical references. This report gives a picture of the position likely to be occupied by these nations in respect to textiles after the war, and will furnish the basis of understanding necessary to intelligent planning for the period to come after the war.

* THE TEXTILE INDUSTRIES OF CHINA AND JAPAN. Fessenden S. Blanchard, *Textile Research Institute, Inc., 10 East 40th Street, New York 16, N. Y. Printed, 70 pp., price $1.00.*

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Directory of Textile Testing Laboratories*

In order to meet the needs of textile manufacturers and consumers at a time when test methods and specification requirements are all-important, the Textile Foundation has made a complete revision of its directory of commercial and educational textile testing laboratories. The arrangement of the directory gives a separate listing of the commercial testing laboratories and laboratories connected with educational institutions. The laboratories are listed in three groups: (1) alphabetically, (2) according to tests which they are equipped to perform, and (3) geographically. The information presented, describing the services and scope of activities of the organizations listed is based on the latest information furnished by the laboratories listed.

* DIRECTORY OF TEXTILE TESTING LABORATORIES. *The Textile Foundation, Publication Office, Kent, Conn., 20 pp., price 25¢ each, 5 copies for $1.00.*

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Fiber Testing Service

The importance of the fiber and spinning testing service as demonstrated by the results obtained since the work was first started in 1941 is described in a recent bulletin issued by the Department of Agriculture. Cotton manufacturers are making increased use of the testing service because it has been demonstrated that laboratory results can be interpreted in terms of mill results. It has been found that laboratory results were reliable in determining quality difference as a basis for selecting the cottons most suitable for their particular uses. Instances can be cited where mills have found that it is possible to use short staple cotton at considerable saving in cost and still maintain the quality of their manufactured goods. In such instances purchases have been made on the basis of specific varieties and growths. At present, 24 different types or combinations of tests, ranging from simple tests of fiber properties to combined fiber and spinning tests of both carded and combed yarns are provided. Tests are made on a fee basis. For further information write Cotton and Fiber Branch, Food Distribution Administration, U. S. Dept. of Agriculture, Washington, D. C.

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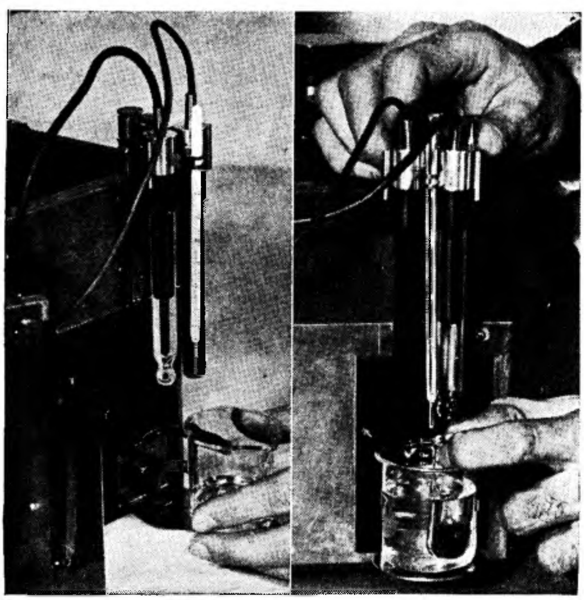
New Portable Universal pH Indicator

Several important added advantages over its predecessor are cited for the new and improved portable universal pH indicator, direct reading with glass, hydrogen and quinhydrone electrodes. Some of these improvements are: (1) self-contained electrodes of new and improved design (see illustration), (2) in addition to the standard 50 ml sample beaker, a small volume holder for samples of approximately 2 ml, (3) a reduction in the number of knobs and switches used in standardizing and measuring, and (4) a polarity reversing switch for the volt range.



To change test solution, electrodes lift easily as a unit and beaker slides out. **Glass electrode lowers into small sample holder until test solution covers bulb.**

Compactly housed in a light weight carrying case, it is said to be easily accessible because of the quickly removable lid, and the hinged end of the case. The convenience of this portable indicator is further enhanced by the 15-inch leads supplied, which make it possible to use the electrodes outside of the case.

Anyone in laboratory or plant who needs to measure pH by means of a convenient, speedy and accurate portable indicator should be interested in this indicator which is manufactured by Leeds & Northrup Company, 4934 Stenton Avenue, Philadelphia 44, Pennsylvania.

The American Society for Testing Materials Offers for Textile Industry's Consideration

The Grex Universal Numbering System

At the recent fall meeting of Committee D–13 of the American Society for Testing Materials, it was decided by Subcommittee B–2 on Nomenclature and Definitions to place before the Textile Industry for its consideration a proposal for a universal yarn numbering system. The following is a digest of an article by A. G. Scroggie which explains the proposed system, outlines the need for such a system, names its advantages, and suggests methods for facilitating its adoption and use.

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The confusion caused by the use in the textile industry of various yarn numbering systems based on hanks, cuts, runs, leas, typps, deniers, spyndles, etc., is being intensified by the advent of rayon and synthetic yarns and fibers into the old line textile mills. This and the growing tendency toward the overlapping of different branches of the industry is resulting in the use of two or more numbering systems in one mill.

The difficulties caused by the use of various unrelated yarn numbering systems, warrant the textile industry making a serious attempt to establish a universal yarn numbering system, and the standing committee on textiles of the American Society for Testing Materials is currently considering for this purpose, the "Grex" unit—defined as grams per 10,000 meters.

Yarn numbering units are based on either "length per unit weight," or "weight per unit length," the latter being referred to as direct systems. Direct units are characterized by small numbers for fine yarns and large numbers for coarse yarns or cords. Direct units are natural for the reason that yarn numbering is invariably carried out by measuring or reeling a fixed length of yarn and weighing it. Such units can be added directly and a specified difference in yarn number has the same meaning, in size or weight, at any place in the scale.

It can be demonstrated that easily decimalized units can be calculated much more rapidly than any system dependent on common fractions. Decimalized units make it easy to measure and weigh one thousandth of the standard length or weight, which is difficult when using pounds and yards and its adoption does not prevent continuing the practice of selling the product by the pound.

Reciprocal Units

The disadvantages have been recognized of using reciprocal units (length per unit weight). Cotton counts, woolen runs, linen leas, etc., have large numbers for fine yarns and small numbers for coarse yarns and heavy cords, which are extremely unhandy at both ends of the fineness scale and are particularly so in measurement of single fibers. The count for a single, one denier rayon filament is 5,315 and the woolen (cut) number for a wool fiber of equal fineness is 14,882.

For research purposes also, recent investigators have been obliged to express their results in terms of grams per denier. The textile industry is currently embarking on a greatly enlarged research program and it is fitting that a universal yarn number be adopted to promote the exchange of information between industries based on different fibers.

It has been suggested that there be generally adopted one of the present direct systems. However, the spyndle unit which is equivalent to pounds per 14,400 yards, cannot be readily decimalized. The denier unit is based on 9000 meters and multiplies or submultiples are not so easy to handle as the "Grex." (For example, 90 cm. or 1.8 meter lengths and reels of 1.125m. are in common use.)

Advantages of "Grex"

As the best solution of the existing problem, subcommittee B–2 of the A.S.T.M. D–13, is considering for adoption by the textile industry as a whole, the direct "Grex" numbering system. It meets all of the requirements for a simple, easily handled unit some of which are noted below:

1. It is a DIRECT unit with the following inherent advantages:

(a) Numbers can be determined by direct weighing. Weights of standard length skeins on metric balances will be in "Grex" units. Weights on grain balances will require a conversion table.

(b) It has a large number for coarse yarns and cords, a small number for fine yarns, and unit numbers for single fibers or filaments.

(c) A specific yarn number difference has the same value at all parts of the scale and not an indefinite value, as in reciprocal systems.

(d) The equivalent single yarn number of plied and corded structures can be determined by direct addition of the numbers of single yarns, whether or not they are of the same fineness.

(e) The adjustments required in laps, slivers, or draft to correct variations in finished yarns will be strictly proportional to the variation observed in the yarn.

2. It is a decimalized unit with certain additional inherent advantages, such as:

(a) Easy determination of fractional units.

(b) Slivers, tops, rovings and other large "yarns" can be handled by using as the unit a Kilogrex = 1,000 grex (kgx.).

(c) For single filaments and fibers a small unit can be used—the Milligrex = 0.001 grex (mgx.).

Conversion from reciprocal or direct units to Grex and vice versa, is readily done by the use of conversion factors which have been worked out and can be supplied. The accompanying table gives a comparison between Grex units and other systems.

It is conceded that the introduction of any universal yarn numbering system will cause more or less trouble for a short time, particularly in the cotton, woolen, worsted, and other industries, if a direct unit is established, and it is probable that no one system will prove ideal for all branches of the textile industry. It is contended, however, that the physical changes would not be difficult to effect, since all operations now connected with yarn numbers could be changed by the use of specially prepared yarn conversion tables. These are easily and cheaply made. Testing instruments could be changed on a new or replacement basis if desired, and old and new units could be used during a transition period to insure a minimum of misunderstanding.

It is believed, moreover, that the temporary difficulties would be a small price to pay for the advantages which would be secured and the troubles that would be eliminated in the indefinite future. The effort that will have to be made, however, does demand that a careful review of existing and proposed systems be made, to be sure that the best possible system is being adopted.

The committee urges that textile men give serious consideration to the proposal and present their views to the committee in order that action may be taken at the spring meeting. There are three questions that should be considered:

1. Is a universal yarn numbering system desirable?

2. Is this the best, or a suitable time to adopt a universal numbering system?

3. Is the "Grex" the best system for this purpose?

For further information address A. G. Scroggie, Chairman Subcommittee B–2, c/o E. I. du Pont de Nemours & Co., Box 1477, Richmond 12, Virginia.

Comparison of proposed "Grex" universal numbering systems with other systems now in use.

Universal Grex Grams/ 10,000 m.	Woolen Run 1600 yds/lb	Cotton Hank 840 yds/lb	Worsted Hank 560 yds/lb	Linen Lea 300 yds/lb	General Typp 1000 yds/lb	Rayon Denier Grams/ 9000 m.	General Grains per yd.
1	3100.34†	5905.41†	8858.11†	16535.15†	4960.55*	0.9	0.0014
100	31.00	59.05	88.58	165.35	49.61	90.0	.14
200	15.50	29.53	44.29	82.68	24.80	180.0	.28
1000 (1 Kgx)	3.10	5.91	8.85	16.54	4.96	900.0	1.41

* Calculated from $10{,}000 \times 1.09361 \times 453.59243 = 4{,}960{,}545.6$ yds./lb.

† Calculated from $\dfrac{4{,}960{,}545}{\text{Yds. per hank (run)(lea)}} = \text{Yarn number}$

Tests Indicate Extent to Which Irregularities In the Feed Lap are Absorbed by

The Evening Action of the Cotton Card

By R. W. VOSE AND C. H. PLUMMER*

As part of a general project to evaluate the irregularity of the intermediate products through various phases of cotton yarn manufacture and to discover the sources of these irregularities, an investigation was made of the extent to which the conventional cotton card averaged out the irregularities present in the picker lap. Previous work had been done in evaluating the irregularity of the conventional picker lap and the irregularity of the card sliver, but the comparison of these failed to disclose the separate actions of the card in averaging out lap irregularities and in introducing new irregularities of its own.

An experimental procedure was devised in which identifiable lap irregularities of known amounts were introduced and the resulting irregularity was traced in the card sliver. In this way the irregularities of the card sliver which originated in the lap could be segregated from those which originated in the card. A comparison between the magnitude of the original lap irregularity and the corresponding sliver irregularity was then used as an index of the amount of evening which could be expected of the card.

Experimental Methods

In order to produce known and identifiable irregularities in the amount of cotton fed to the card it was found more practical to alter the linear rate of feed of a uniform lap than to form a lap with definite irregularities in weight from point to point. From the standpoint of the card, irregularity from either cause should result in the same kind of irregularity in the sliver, and therefore the irregular feed of a uniform lap was adopted as being equivalent to the irregular lap found in practice.

Since doubler laps formed of card sliver are very uniform, these were utilized in place of the regular picker lap. These were made up in such a way as to give a lap of the conventional weight, and thus to conform to operating practice. The card itself was conventional in all respects and was operated at the recommended speeds.

A differential mechanism was introduced to control the irregularity in the feed of the lap to the card, replacing the regular draft gear and large feed roll gear. This mechanism, shown in Fig. 1, consists of a small 14-tooth draft gear on the side shaft meshing with a loose feed roll gear. This loose gear was a spare gear mounted on the feed roll shaft so that it could turn independently of this shaft. From it the motion was transferred to a differential pinion, utilizing a 24-tooth draft gear, to a second feed roll gear fixed to the feed roll shaft in the regular manner. The differential pinion was

* A contribution of the Research Division, Chicopee Mfg. Corporation.

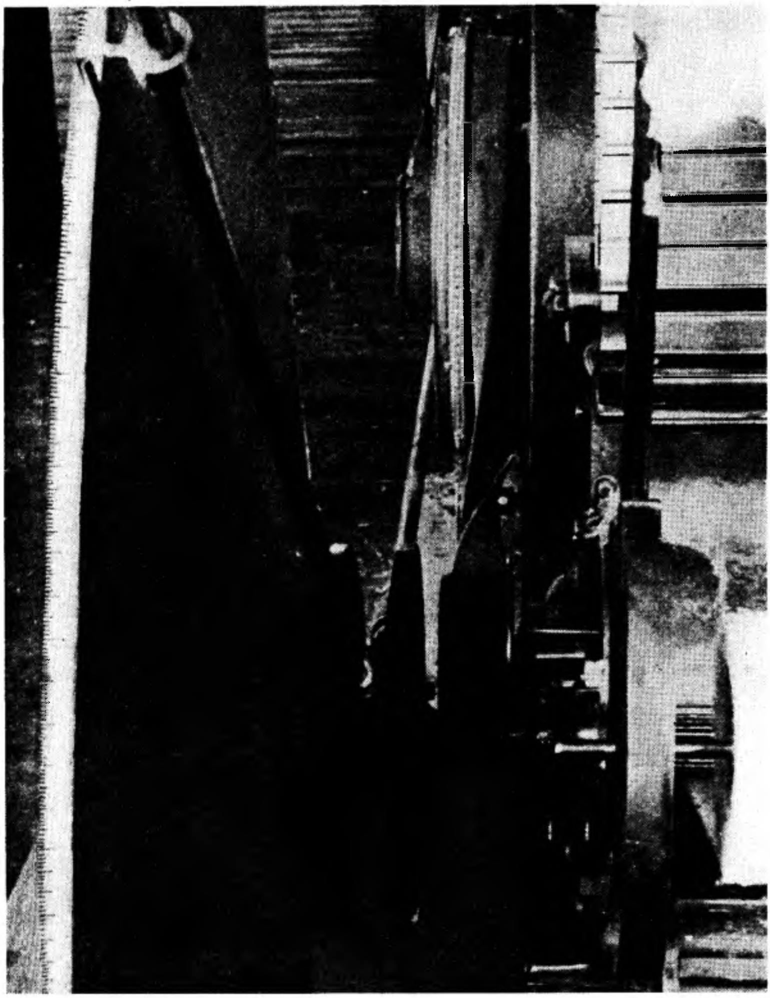

Fig. 1. Differential feed mechanism controls irregularity in the feed of lap to card at Chicopee Mfg. Co. in investigation of the evening action of cotton card.

mounted on a handle rotatable about the axis of the feed roll and movable by hand along a graduated circular scale shown to the left in the picture.

In operation, if the handle controlling the differential pinion remained fixed the motion of the side shaft was transmitted first to the loose gear, then to the differential pinion, and finally to the regular feed roll gear so that the feed roll would be driven in the regular manner and at the regular speed. If, however, the handle controlling the differential pinion were moved in either direction it would add to or subtract from the feed motion so that a greater or lesser amount of lap could be fed for a short interval of time. By calculation, the amount of motion required to give any desired irregularity of lap feed could be determined. For the tests, the position of

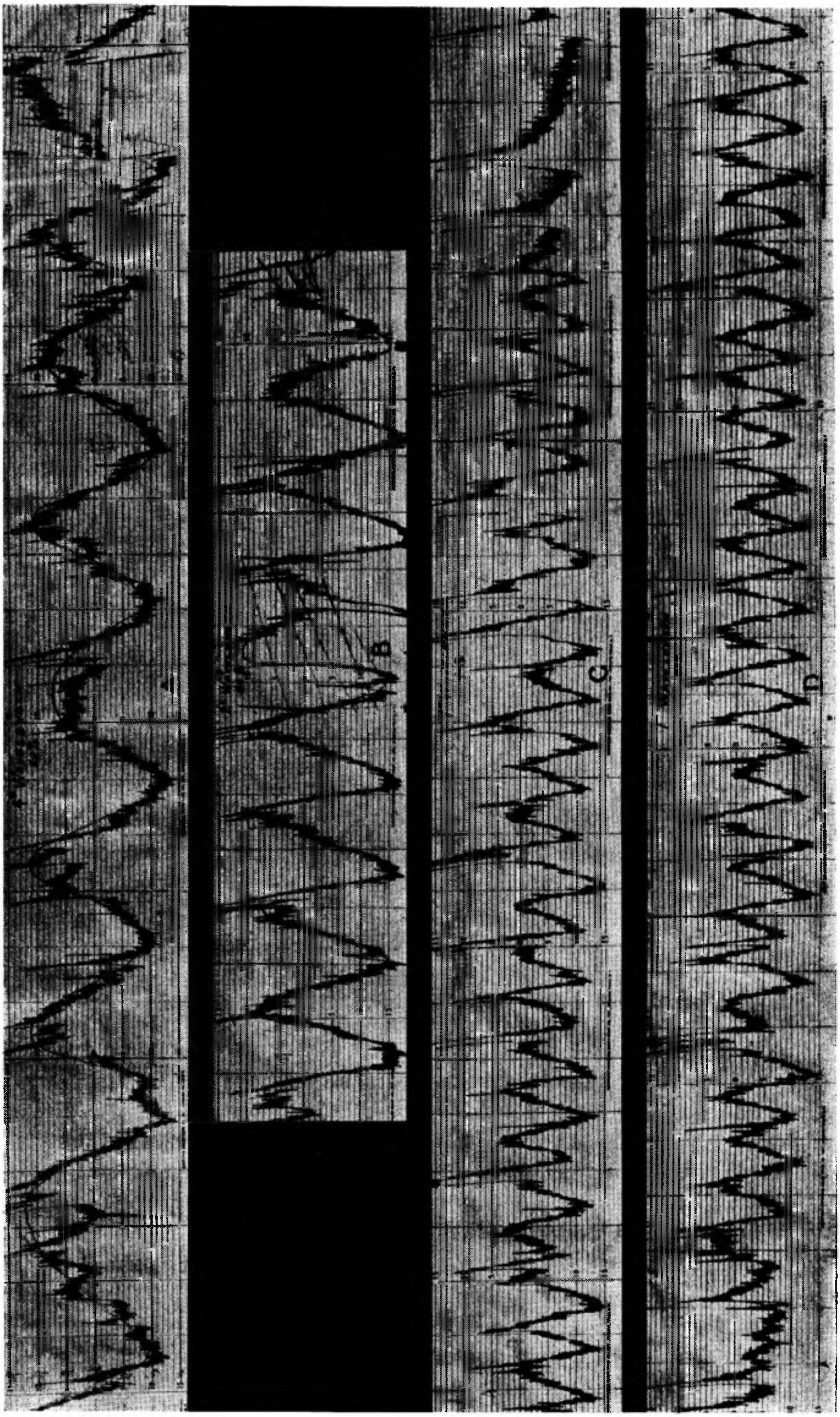

Fig. 2. These sample charts indicate the distinctness with which the sinusoidal variation in lap feed is reproduced in the sliver.

the handle was calculated at equal two-second intervals and hand motion was utilized in conjunction with a time clock to give a reasonably regular control. Obviously a better arrangement would have been to use a crank and connecting rod arrangement to guide this handle, but the additional mechanism did not seem warranted by the requirements of the tests.

The card sliver produced was evaluated by means of a Saco-Lowell Sliver Tester. In order to be more versatile in special applications this particular Tester has been equipped with gear changes which provide for slower chart speeds than normal. Whereas the instrument was originally equipped with gear changes which gave a choice of 1:1 or 1:12 ratios between the chart speed and the sliver speed, the additional gears permit two other choices, namely 1:144 and 1:1728. For the tests at hand the 1:144 chart speed was used, and when this speed is compared to the one hundred draft in the card it will be seen that the irregularities as reproduced on the Sliver Tester chart are approximately the same length as the original irregularities introduced into the lap.

Test Procedure

In order to have identifiable irregularities in the lap which could be traced through to the card sliver, the increase and decrease in lap feed was made in a sinusoidal manner above and below the average lap weight. The average lap weight and the amplitude and wave length of the sinusoidal variation were sufficient to define the feed to the card, and the wave length multiplied by the mechanical draft gave the wave length of the variation in the sliver. The amplitude of the variation, in both the lap feed and in the sliver, was expressed as standard deviation in percent.[1]

Tests were run introducing variations in the feed having five different wave lengths, namely, 1″, 2″, 4″, 8″, 16″, and at each wave length four different amplitudes were run, namely, 5%, 10%, 20%, and 40% standard deviation. In the results, the variations having small amplitude and short wave lengths showed essentially no variation in the card sliver, while some of those of long wave lengths and large amplitude broke the sliver, consequently the useable results lie in the middle range of the test conditions.

The sliver produced was run through the Saco-Lowell Sliver Tester, using a chart speed of 1:144. Sample charts reproduced in Fig. 2 show the sinusoidal variation in sliver weight plus superimposed irregularities of much lesser magnitude evidently originating in the card. To definitely segregate the irregularity originating in the feed a line was drawn by hand to represent the sinusoidal variation of the chart and readings were taken on this line alone. In all charts at least a hundred readings were taken spaced in such a way as to adequately measure the sinusoidal curve. The standard deviation of these readings was then calculated and expressed as a percent of the average sliver weight, as previously described.

To obtain an index of the card action in reducing the sinusoidal irregularity of the lap as fed, the irregularity of the sliver was compared with that in-

[1] Throughout this work the term standard deviation will be used regardless of whether it is expressed in absolute units or in percent. The term coefficient of variation is thus avoided.

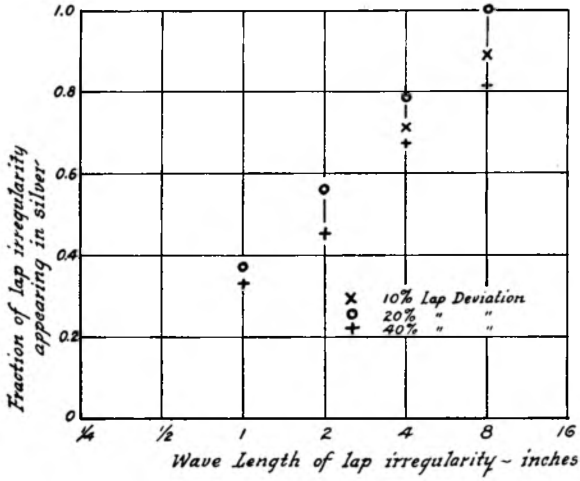

Fig. 3. Evening action of card indicated graphically.

troduced in the feed. The percent standard deviation of the sliver was divided into the percent standard deviation of the lap feed to obtain a decimal fraction indicating that part of the feed irregularity which passed through the card and appeared in the sliver.

Results

Sample sliver tester charts are shown in Fig. 2 and they indicate the distinctness with which the sinusoidal lap feed is reproduced in the sliver. However, they show numerous additional irregularities, some of which are undoubtedly due to irregularities produced by the card itself while the others are due to imperfections in the feed mechanism and difficulties in operating the differential with perfectly regular motion. The 1″ wave length tests at low amplitude gave no distinguishable irregularities in the sliver (not shown in photograph), while the long wave length tests at high amplitude broke the sliver, therefore only the more moderate range gave useable results.

The fraction of the irregularity in the lap feed which passed through the card and appeared in the sliver has been plotted against the wave length of the irregularity. This plot is shown in Fig. 3 with points from 10%, 20%, and 40% standard deviation of lap feed indicated. These all seem to fall within a rather small band indicating a trend which is a definite function of the wave length of the irregularity and largely independent of the amplitude of that irregularity.

It will be seen that irregularities of shorter than ½″ wave lengths in the lap are largely absorbed by the card and do not appear in the sliver. Those irregularities of longer than 8″ wave lengths are reproduced essentially completely, without any modifications by the card. In the range between these two lengths the card exerts a partial evening action. While it is beyond the scope of these particular experiments, it may be stated that the shorter wave length irregularities in a lap are likely to be due to poor sheet formation on the screen of a picker or to irregular drive on the screen, while the longer wave length irregularities are traceable to poor evener motion action.

The authors wish to acknowledge their indebtedness to Mr. N. L. Smith and Mr. John F. Shaw, respectively president and plant manager of the Chicopee Manufacturing Corporation, for their interest and support; to Mr. Fred Yates, assistant superintendent, for his helpfulness in this and other work; and to Mr. John Frydryk and Miss Alta King, respectively, mechanician and secretary of the Research Division, for their technical assistance.

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.*

NOTE: *A list of the periodicals that are being abstracted for* TEXTILE RESEARCH, *together with their standard abbreviations, appears on page 32 of this issue. This list will not be carried as a regular feature.*

ANALYSIS: TESTING LABORATORY METHODS

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Spectrophotometric Analysis

A spectrophotometric method for the analysis of multicomponent mixtures and its infra-red application. R. R. Brattain, R. S. Rasmusson and A. M. Cravath. *J. Applied Phys.* 14, 418–28 (Aug., 1943).

A method is presented for the spectrophotometric analysis of multicomponent mixtures of either vapor or liquid. The method is based on the assumption that the optical density of a mixture equals the sum of the optical densities of the components although the transmissions of the individual components may not follow Beer's Law. An explanation is given of the application of the method to infra-red absorption of vapor mixtures. Advantages stated for the method are rapidity for routine work, accuracy at least equal to standard gas analysis methods, and only practical method of performing certain analyses of specific isomers. Limitations are stated such as: a general qualitative composition of the sample must be known, and considerable time is involved in calibration for a mixture with a large number of components.

Starch Analysis

Spectrophotometric analysis of starches. Ralph W. Kerr and O. R. Trubell. *Paper Trade J.* **117**, 25–8 (Oct. 7, 1943).

The utility of starch as a size or adhesive depends upon the characteristics of the component polysaccharides in the starch. All starches, particularly modified ones, do not exhibit the same relative proportions of constituents. A method of analysis is developed for the two major components of starch called "amylose" and "amylopectin." This method involves staining with iodine and a spectrophotometric analysis of the color produced. The method is based on the observation that the linear polymer "amylose" stains blue, whereas the branched polymer "amylopectin" stains a reddish purple. The fundamental as well as the practical significance of the analytical results obtained is discussed.

Viscometers

Industrial viscometers. Ruth N. Weltmann. *Interchem. Rev.* 2, 43–52 (Autumn, 1943).

The how and why of different viscometers used by industrial laboratories are described. The principles upon which various viscometers operate are explained and illustrated by diagrams. The viscometer designed by Interchemical Corp. is described. Flow curves are shown and essential equations given relating to the use of rotational viscometers.

CHEMICAL AND PHYSICAL RESEARCH

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Acids and Bases

Modern theories of acids and bases. H. I. Stonehill. *J. Soc. Dyers and Colourists* **59**, 171–76 (Aug. 1943).

Reasons for rejection of the ionic theory of acids and bases are outlined and the several modern theories of acids and bases are presented and discussed. The first of these, the Solvent-System Theory (which in general defines an acid (base) as a solute giving rise to cations (anions) characteristic of the solvent), is in agreement with experiment but fails because it limits acid-base behavior to solvent systems and to ionic substances. The Lowry-Brönsted Proton Theory defines an acid as a substance having a tendency to lose a proton and a base as a substance capable of accepting a proton. It is a useful working tool, but since it emphasizes the importance of protons to the exclusion of existing aprotonic acid-base systems, it cannot be regarded as general. The Lewis Electron Theory includes the above mentioned theories as specialized aspects of the whole and is capable of fully explaining and correlating a wide variety of chemical facts. This theory is discussed at some length and it is stated that its generality may suggest reactions leading to new developments in syntheses of dyes and intermediates and in the treatment of textiles.

Azo Dyes

A simplified discussion of color and the constitution of azo dyes. W. B. Reynolds. *Am. Dyestuff Reptr.* **32**, 455–6, 465–7 (Oct. 25, 1943).

A discussion of the relation of the chemical structure to the nature of azo dyes is presented and it is pointed out that, given a certain knowledge of resonance, insulating groups, and the properties of the intermediates employed, the color of synthesized azo dyes may be predicted with considerable accuracy. For example the number and type of resonance structures that can be written for any molecule will tell much about the hue and intensity to be expected. Insulating or blocking groups are atoms or groups of atoms which diminish the contribution of resonance structures involving conjugation between parts of the molecule, and the nature of such groups is important in predicting shade. The effect of various auxochromic substituent groups (which increase color strength) varies greatly according to ring position; for example, they are much more effective in the ortho and para positions to the azo chromophore than in the meta position. Tables are presented listing a number of intermediates according to the depth of shade to be expected from them.

Hygroscopicity of Cellulose Acetate

Effect of acetylation on water-binding properties of cellulose—relation between physical properties and hygroscopicity. William H. Aiken. *Ind. and Eng. Chem.* **35**, 1206–10 (Nov. 1943).

Experiments with both rag and wood stocks show that the strength and hygroscopicity of pulp sheets are increased by acetyl contents up to 3–4%. With higher acetyl contents the strength falls off rapidly. If water is replaced by acetone as a heater medium, sheets of improved strength are obtained with higher acetyl contents up to 20 or more per cent. The addition of up to 10% xylan resulted in increased strength but acetylated xylan had the opposite effect. It is suggested that the acetylation opens up the micellar structure to make a greater number of hydroxyl groups active and give greater hydration. Maximum hydration appears to correspond with maximum strength. Upon further acetylation the strength and hygroscopicity decrease because of the blocking of the hydroxyl groups. Xylan increases and acetylated xylan decreases the strength because of the mutual binding between the hydroxyls of xylan and cellulose.

Wool Fiber Structure

Structure of the wool fiber as revealed by the electron microscope. Charles W. Hock and Howard F. McMurdie. *J. Research, Natl. Bur. Standards* **31**, 229–36 (Oct. 1943). TEXTILE RESEARCH **13**, 15–20 (Oct. 1943).

An investigation of the wool fiber with the electron microscope was undertaken in order to get more data on the structure of the fiber and its constituent cells, and to correlate this information with results previously obtained by other methods. Specimens were prepared for examination by various physical and chemical procedures.

Over a wide range of magnifications the cortical cells always showed a distinctly fibrous structure. Whereas with the optical microscope only fibrils were observed within the cortical cells, the higher resolving power of the electron microscope made possible the resolution of still finer microfibrils. The scale cells, on the other hand, showed little internal organization. This difference in structure between the fibrous cortex and the nonfibrous or amorphous cuticle is believed to be of fundamental importance in interpreting many of the properties of the fibers.

DYEING: BLEACHING: FINISHING

★

Defects in Piece-Dyed Worsteds

Color and distortional defects in piece-dyed worsteds. "Concord," *Textile Colorist* **65**, 383–86 (Sept. 1943). (From Textile Mercury and Argus.)

Most frequently encountered color faults in worsted piece-dyeing other than off-shade, are listedness (gradation of color near selvedges), unevenness and stains, while distortional defects may occur as creases, cockles and crimps. Causes of listedness are said to be (1) permitting residual alkali scouring liquor to drain toward lists while awaiting further treatment, (2) exposure of the lists of a grey partially dry piece to circulating dry air, thus changing the dye affinity of the exposed portions, (3) non-uniformity in exposure of the piece to hot liquor while under tension, caused by defective heating, (4) roping of the piece during hot wet processing, and (5) overloading of the dyeing machine. Rectification of listedness usually involves at least a certain amount of stripping, and it is advisable to redye to shade with some other type of dyestuff, if possible, than the one originally used. Proper choice of dyestuff will often mask structural defects in the goods, and in this respect it is stated that the metachrome process should be avoided where such defects are suspected. Distortional defects are almost always due to faulty processing while the fabric is in a hot plastic condition, such as allowing to cool while piled unevenly or cooling too rapidly in a machine. Bagging the goods prior to scouring will usually prevent distortions. Distortions may often be removed by steaming, passing through hot water, or by a mild milling process.

Reduction During Dyeing

The alkaline reduction of dyestuffs during dyeing. A. Carbone. *Am. Dyestuff Reptr.* **32**, 415–18 (Sept. 27, 1943).

It was found that when a dyebath for half-wool Army Hose O.D. No. 9 was allowed to remain somewhat alkaline due to residual alkali in the hose, the shade was partially destroyed. Investigation showed that a number of dyes were destroyed or to some degree affected by the reducing action of cellulose or wool in an alkaline medium, cotton being less active in this respect than viscose or wool. The presence of an oxidizing agent such as sodium chlorite inhibited the color reduction, but the addition of ammonium sulfate appears to be a practical means for avoiding dyeing irregularities of this nature in the plant. A table is presented showing the effect of alkali in the dyebath on the shade of sixty-six direct dyes on cotton-wool union material.

Wool Dyeing

The dyeing of wool with chrome dyes—Part I. The metachrome process. C. B. Stevens, F. M. Rowe, and J. B. Speakman. *J. Soc. Dyers and Colourists* **59**, 165–71 (Aug. 1943).

Because the metachrome process for dyeing wool constitutes saving of time and labor and lessens the chance of damage to the fiber an investigation has been made of the mechanism of the metachrome process and the characteristics of metachrome dyes with a view toward increasing the number of dyes applicable by this method. In a study of the reactions occurring in the metachrome dyebath the following points were noted: (1) when wool is boiled in the metachrome mordant bath chromic acid is taken up by the wool and as the boiling proceeds the amount of chromium that can be extracted with a pH 8 buffer gradually diminishes until after four hours boiling, although practically all the original chromium has been deposited on the wool, no "oxidized" chromium and only a negligible amount of "reduced" chromium can be removed; (2) the particular dye used has no apparent relationship to the rate of evolution of ammonia, the deposition of chromium nor the fall in pH of the dyebath.

(*Continued on Next Page*)

Experiment does show however that the suitability of a dye for use by the metachrome process should be assessable in terms of its rate of exhaustion from either the usual metachrome mordant dyebath or from a potassium sulfate-ammonium sulfate dyebath, the latter being useful because it does not interfere with determination of residual dye content by the titanous sulfate titration method. The reliability of the potassium sulfate-ammonium sulfate substitute dyebath for evaluating rates of exhaustion was confirmed by the use of a Hilger-Nutting Industrial Spectrophotometer on the residual dyebaths from actual metachrome process dyeings.

Reducing Dye Affinity of Wool

A new method of reducing the affinity of wool for acid dyes. G. H. Elliot and J. B. Speakman. *J. Soc. Dyers and Colourists* **59**, 185–91 (Sept. 1943).

During an investigation of the acetylation process for producing a resist on wool it was determined that the presence of sulfuric acid in the acetylation treatment gave superior results, not, as might be expected, due to its action as a catalyst, but to reaction with the wool itself, apparently with formation of sulfamic acid side chains. The negative potential thus conferred on the fibers, as well as the blocked basic side chains, plays a part in reducing affinity for acid dyes. As a result of a search for reactions which would serve this double purpose, it was found that treatment with a mixture of glyoxal-bis-sodium bisulfite, glyoxal and glacial acetic acid produced a resist only slightly inferior to that given by acetylation in the presence of sulfuric acid. The process should be (unlike the acetylation process), capable of convenient and economical application on a large scale.

Carbonizing of Overcoating

A study of the sulfuric acid carbonizing bath used in carbonizing the Government 32 oz. olive drab overcoating. K. S. LaFleur. *Am. Dyestuff Reptr.* **32**, 474–6, 485–9 (Nov. 8, 1943).

Examination of uncarbonized overcoating shows numerous scattered specks, ninety percent of which are cotton hard-ends and the rest burr fragments, and proves the need for carbonizing. An investigation has been made in order to aid in establishing uniform carbonizing procedure for army overcoating. It was found that a carbonizing bath containing 3.25% acid should produce consistently satisfactory results on overcoating, the residue of cellulosic impurities after such treatment running about 0.25%. Charts are presented which show the rate of exhaustion of carbonizing baths, and the effect of immersion time on acid retention, for several initial acid concentrations. A consideration of carbonizing penetrants is made, but it is pointed out that if the pieces are delivered to the carbonizer containing over 60% moisture no penetrant is necessary. In determining the relationship between Baumé hydrometer readings and percent acid content over the life period of the bath, it was found that even if the acid content was kept constant, the Baumé readings (and the percent acid in the pieces) varied considerably for the first few days and then a near-equilibrium was reached after which Baumé readings were constant. It was also noted that the amounts of suspended and dissolved solids remained approximately constant following a similar initial period of variation.

Damage in Finishing

Notes on damage to textile fibers and fabrics in finishing. "Technicus," *Textile Colorist* **65**, 379–82 (Sept. 1943).

The various types of damage to fiber and fabric which may be produced in a finishing plant are outlined and classified as chemical or physical. Carelessness at critical phases and unsatisfactory employee relations are said to account for a large amount of damage in processing. Neglect of and improper choice of mechanical equipment are other easily remedied sources of trouble. Methods of desizing and the importance of this operation as well as proper boiling-out, are discussed.

Textile Printing

Textile printing. Part I—The rise in temperature of the ager. A. B. Meggy. *J. Soc. Dyers and Colourists* **59**, 192–6 (Sept. 1943).

When saturated steam is fed into an ager through which prints are being run, it will after contact with the prints, become superheated to a temperature equal to the boiling-point of the solution on the prints, thus accounting for the rise in temperature during the ageing process. An investigation has been made of the relationship between boiling-point and concentration for various mixtures of the four principal constituents of a vat printing paste, and it has been confirmed that, although other factors are also involved, the boiling-point elevation effect of these constituents is sufficient to account for temperature increases encountered in actual ageing.

FIBERS: YARNS: FABRICS: MECHANICAL PROCESSES

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Cotton Spinning and Fiber Tests

Spinning and fiber test results for some cottons grown in Texas and Oklahoma, crops of 1941 and 1942. Report by the Research and Testing Division, Cotton and Fiber Branch, Food Distribution Administration, U. S. Dept. of Agriculture. Supt. of Documents, Washington, D. C. 8 pp. (Oct. 1943).

This report summarizes for cottons produced in the given areas during the 1941 and 1942 seasons their important physical characteristics. Fiber length and length uniformity ratio were determined by the fibrograph method; fiber tensile strength based on Pressley tester results; fineness in terms of weight per inch of fiber; percentages of mature fiber; and cellulose alignment by the X-ray method. Manufacturing tests were made and data is given of the waste removed, yarn strengths, and yarn appearance. Manufacturers should find this report helpful in becoming acquainted with the more outstanding characteristics of varieties that are widely grown in Oklahoma and Texas.

Glass Fibers

Glass fibers offer possibilities in chemical process equipment. Anon. *Chem. Ind.* **53**, 501 (Oct. 1943).

A number of uses or potential uses of glass fibers are described. Among these are: packing for rectifying columns; evaporation, diffusion and fractionation applications which take advantage of the large surface of the glass fibers; use in the filtration of air, gases and liquids; use as a binder for plastics; as an ingredient of papers or fabrics; and as an insulating material.

Fillers for Plastics

Fillers in the Plastics Industry. W. C. Gangloff. *Chem. Ind.* **53**, 512–14 (Oct. 1943).

Fillers are added to plastics in the nature of an extender for some particular purpose, e.g. to change the density, strength, surface, bulk, weight, electrical properties, viscosity or appearance, or, from the processing angle, to speed fabrication and reduce costs. In every case their use is definite and carefully worked out. Among the textile materials used as fillers are: cotton fibers, yarns and fabrics; ramie, animal hair, sisal, redwood fibers, and asbestos. Each has its place and its niche is governed by the various factors involved, in the processing details and requirements of the finished product. In general, the use of textile fillers leads to enhanced tensile and impact strengths.

Military Fabrics

Manual of military fabrics, Part VIII—9 oz. Sateen. Anon. *Textile World* **93**, 94–5 (Sept. 1943).

Manufacturing and processing details are given for new wind-resistant, cotton, 9 oz. Sateen, covered in Specification PQD 245 D which is being considered for use as a standardized fabric construction for field garments used by special forces of the Army, such as mountain troops and cold climate troops. An abstract of the specification is given.

Manual of military fabrics, Part IX—No. 6 Cotton Duck, Type I. Anon. *Textile World* **93**, 90–1, 138–40 (Oct. 1943).

An abstract of Specification JQD 208C which relates to numbered duck is given, also manufacturing details. A mill organization for No. 6 Cotton Duck, Type I is shown and certain necessary techniques for proper loom adjustment and operation on heavy duck are described.

Parachute Fabrics

Parachutes and the new fabrics they require. Anon. *Textile World* **93**, 65–8 (Oct. 1943).

Textile mill executives are constantly on the search for new fabrics they can manufacture to assist the armed forces of this nation in their all-out struggle. This article is intended to present an over-all picture of the many different types of parachute fabrics currently being procured. Sufficient information is given on fabric construction to permit textile manufacturers to determine which of these fabrics they are in a position to produce.

Impregnated Fabric for Shoe Soles

Substitutes for sole leather. Wilfred Gallay. *J. Am. Leather Chem. Assoc.* **38**, 250 (July 1943).

A new shoe-sole material, superior to leather in many ways, was made from medium cotton duck and polyvinyl butyral. The plastic was friction calendered into the fabric, and layers of the impregnated duck were laminated together. This material was used in factory production of shoes, without change from usual methods of handling. It is superior to leather in resistance to water, coefficient of friction on smooth surfaces, and resistance to abrasion, and is not inferior in any important feature. Service tests of the material on several hundred pairs of Canadian Army shoes are in progress. The author believes that this and similar materials will compete seriously with leather for use in shoe soles.

Cotton Card Speeds

Effect of card speeds and production rates on the quality of yarn manufactured from various grades of cotton. John M. Cook and A. Y. Willis, Jr. Bulletin of U. S. Dept. of Agriculture, Food Distribution Administration. Supt. of Documents, Washington, D. C. 16 pp. (Sept. 1943).

A study was made to determine the practicability of varying card cylinder and doffer speeds in such a way that lower grades of cotton could be utilized without sacrificing yarn quality or card production. Cotton ranging in grade from Good Middling to Low Middling and including Middling Gray from a one variety area in Mississippi were selected for the study. Staple-length differences were small, ranging in length from 1⅓₂ to 1³⁄₃₂ inches. Tests were run at cylinder speeds of 168 r.p.m. and with doffer speeds of 8, 10, 12, 14, and 16 r.p.m. also cylinder speeds of 199 r.p.m. and with the same range of doffer speeds. As doffer speeds were increased there was a proportionate increase in the speed of feed roll and production per hour. At both cylinder speeds the number of neps in the card web rapidly increased and the yarns became poorer in appearance as the doffer speeds were increased. With a cylinder speed of 168 r.p.m. the first significant decrease in appearance occurred when the doffer speed increased from 10 to 12 r.p.m. while with cylinder running at 199 r.p.m. this change occurred when doffer speed increased from 12 to 14 r.p.m. Using lower grades of cotton caused greater decrease in yarn appearance and increased neppiness of web than by greater doffer speeds. It is shown that when good appearance is essential it is necessary to use higher grades of cotton. Higher cylinder and licker-in speeds were found most beneficial to yarn appearance when productions of 12 or more pounds per hour were being run. Yarn strength was not affected by greater heating in the pickers or by increasing doffer speeds. With the exception of badly weather-damaged cotton the results indicate that lower grades may be substituted without sacrificing yarn strength. Manufacturing waste was greater for the lower grades of cotton. This waste as well as web neppiness and yarn appearance were poorer for those cottons having the greater fiber irregularity. The machinery required about three times as much cleaning after the low grades were run.

Neps, Naps and Specks

Control of neps, naps, and specks. E. H. Helliwell. *Textile World* **93**, 84–5, 150 (Sept. 1943).

A review is given of Technical Publication No. 396, U. S. Dept. of Agriculture. The origin and type of these defects are described. It is shown that the processing during manufacture is a large factor in the number of specks which show in the final product. Some causes of defects appearing in the manufacturing processes are given, also suggestions for methods to keep them down to a minimum.

High-Frequency Heating

High-frequency heating for plastics. Anon. *Brit. Plastics* **15**, 322–26 (Nov. 1943).

The principles of high-frequency heating are explained in considerable detail. It is emphasized that this method of heating is not as efficient as either electrical resistance heating or fuel heating. However, there are special cases, particularly with plastics, where high-frequency heating may be used with great advantage. Numerous examples are cited. Some of the advantages claimed are: saving of time, more uniform heating, thicker materials may be molded or cured, and greater temperature control. High-frequency heating has also been successfully utilized in the manufacture of plastic-coated fabrics for raincoats, tarpaulins and packaging materials.

MISCELLANEOUS

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Measurement of Elongation

Use of effective gage length in elongation measurement. E. R. Kaswell and W. J. Hamburger. *Rayon Text. Mo.* **24**, 53–8 (Nov. 1943).

A new method is suggested for measurement of elongation characteristics of textile materials. The technique described permits precise measurements of sample properties independent of gage length and jaw characteristics. This is accomplished by determining an "Effective Gage Length" factor which is the ratio of elongation indicated by the autographic load-elongation diagram to the *percent inherent elongation* in the free gage length of the sample. Results are given of tests conducted on yarns, cords, braid, and woven fabrics for several types of jaws and various gage lengths. In addition, the influence of yarn complexity as it affects the elongation is described for the conventional capstan type jaws as well as flat jaws. Errors introduced by ordinary methods of elongation determinations are indicated. It is suggested that the method is pertinent to the determination of absolute elongation as applied to control and research investigations.

Outline of practice for knitting rayon hosiery. N. F. Lahr. *Textile Age* **7**, 48–58 (Sept. 1943).

This article by the vice-president of Cooper, Wells & Co., describes the experience of that company in knitting rayon hosiery and outlines methods used at that plant.

Surface-Active Agents

Outline of surface-active agents. Earl K. Fischer. *Interchem. Rev.* **2**, 53–60 (Autumn, 1943).

Surface-active agents of which there are now roughly 300 on the market are frequently given such terms as wetting, penetrating, dispersing, emulsifying, or foaming agents. All surface-active agents are characterized by a comparatively large molecule formed usually with a water-soluble or hydrophilic group attached to a water-insoluble or hydrophobic group. The chemical personality is determined by the character of each of these components. An important factor requiring consideration in aqueous systems is the ionization of the molecule. There are three ionic types each with distinct uses. Synthetic surface-active agents avoid the problems connected with the use of soap. For water systems they can be evaluated by physical measurements. Methods in common use for evaluating the properties and efficiency of surface-active agents are described. Some common applications are considered.

Rheological Terms

Glossary of rheology. Earl K. Fischer, Henry Green, and Ruth N. Weltmann. *Interchem. Rev.* **2**, 9–15 (Spring, 1943).

Rheological terms describing the flow properties of surface coatings are coming into common usage. An explanation of these terms and their relation to practical applications is given.

List of Periodicals

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American Journals

Am. Dyestuff Reptr.	American Dyestuff Reporter
ASTM Bull.	American Society for Testing Materials, Bulletin
Chem. Abstr.	Chemical Abstracts
Chem. & Eng. News	Chemical and Engineering News
Chem. and Met. Eng.	Chemical and Metallurgical Engineering
Chem. Ind.	Chemical Industries
Cotton	Cotton
Ind. Eng. Chem.	Industrial and Engineering Chemistry
Ind. Eng. Chem. Anal. Ed.	Industrial and Engineering Chemistry, Analytical Ed.
Interchem. Rev.	Interchemical Review
J. Am. Chem. Soc.	Journal of the American Chemical Society
J. Am. Leather Chem. Assoc.	Journal of the American Leather Chemists Assoc.
J. Applied Phys.	Journal of Applied Physics
J. Chem. Phys.	Journal of Chemical Physics
J. Org. Chem.	Journal of Organic Chemistry
J. Phys. Chem.	Journal of Physical Chemistry
J. Research Natl. Bur. Standards	Journal of Resch. Nat'l Bureau of Standards
Modern Plastics	Modern Plastics
Paper Trade J.	Paper Trade Journal
Rayon Text. Mo.	Rayon Textile Monthly
Rev. Modern Phys.	Reviews of Modern Physics
Rubber Chem. Tech.	Rubber Chemistry and Technology
Science	Science
Soap San. Chem.	Soap and Sanitary Chemicals
Textile Bulletin	Textile Bulletin
Textile Colorist	Textile Colorist
Textile Research	Textile Research
Textile World	Textile World
Phys. Rev.	The Physical Review

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British Empire Journals

Brit. Plastics	British Plastics
Can. Text. J.	Canadian Textile Journal
Chemistry and Industry	Chemistry and Industry
The Engineer	Engineer, The
Indian Text. J.	Indian Textile Journal
J. Chem. Soc.	Journal of the Chemical Society
J. Soc. Chem. Ind.	Journal of the Society of Chemical Industry
J. Soc. Dyers and Colourists	Journal of the Society of Dyers and Colourists
J. Text. Inst.	Journal of the Textile Institute
Proc. Phys. Soc.	Proceedings of the Physical Society
Proc. Roy. Soc.	Proceedings of the Royal Society
Silk and Rayon	Silk and Rayon
Silk J. Ray. World	Silk Journal and Rayon World
Text. Mfr.	Textile Manufacturer
Text. Recorder	Text. Recorder
Trans. Faraday Soc.	Transactions of the Faraday Society