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THE

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In This Issue

Textile Schools and Research Abroad ........................................ 6
The Structure of Fibers ......................................................... 9
Selling and Manufacturing Coordination .................................... 13
Processing Intimate Blends of "Dacron" Polyester
Fiber and Cotton .............................................................. 15
Textile School Gets Coed ....................................................... 19
Phi Psi News ................................................................. 20
William J. Martin Employed as Cotton Utilization Specialist ........ 21
N. T. M. S. News ............................................................. 23
Summer Work Occupies Various Members of the
Textile School Faculty ....................................................... 24
American Viscose Expands College Program .............................. 24
Southern Textile Association Meets at Clemson ......................... 25
Index to Advertisers ........................................................... 30

THE COVER: "Composition of Lines and Textures." This composition was created through the use of cotton roving for the lines, and a broadweave drape for the texture. ...... Ted Pappas '87

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Textile Schools and Research Abroad

Hugh M. Brown, Dean
School of Textiles

In April and May the National Council for Textile Education held its Spring meeting in England with its associate members from the British textile schools. The twelve American textile schools were represented by eight school heads or officials that were able to go. The trip was sponsored almost completely by textile and textile machinery companies. The group toured in the countries of France, Switzer-
land, Germany, Belgium and England, visiting mainly the outstanding textile schools and textile research organizations, and was extended a most gracious welcome and generous hospitality at every stop.

To me the most outstanding impressions were:

1. Evidence of a tremendous belief in textile education and research, as shown by the large expansion in building equipment and personnel that has been made since our last trip in 1949.
2. The faith in the schools and research programs is shared by the industry and state to such an extent that in several countries a government levy is collected from the industry and passed back to the schools and research organizations.
3. The schools are almost universally carrying on extensive research programs on fundamental as well as applied research.
4. The research organizations are amply staffed with able, young, well trained scientists.
5. There was a greatly increased trend toward electronic controlled devices and automatic machinery.

The first conferences were held in Paris with a delegation from the French schools and industry, which gave us a picture of textile education throughout the country. The textile education seems to fall in four different categories: (1) Training foremen and lower echelons of management; (2) Professional training of young workers; (3) Technical and professional schools to prepare graduates for positions as mill managers; (4) Newly established training for top management.

The principal schools in France are two in Roubaix, one each in Malhouse, Epinal, Lyons and Rouen, which are all headed up by the Institut Textile in Paris, France, which offers advanced studies. The financial support comes from a legislated tax amounting to 1.23% of each company's payroll.

The starting salary for graduates ranges upward from $150.00 per month. The program in France did not give us an opportunity to visit the schools or mills, devoting the time to conferences with key personnel.

In Switzerland the Zellwegger-Uster Company gave a dramatic demonstration of their various testing and textile machines including the Evenness Tester, Automatic Yarn Strength Tester, Varimeter for measuring picker lap evenness, tying-in-machine, wire-dropping machine and a Spectograph device to quickly show any periodic variations in textile strands. In the display of the Varimeter, part of the equipment was mounted on pickers in a local mill from which signals were brought to a central system by telephone and results recorded on charts in the one laboratory. The system could record results from different mills at any distance by telephone connections.

At a visit at the shops of the John and Jacobs Rieter, textile machinery manufacturers, the group was shown their excellent manufacturing facilities for manufacturing precision cards, combers and drawing and spinning equipment. They stated that several million dollars worth of orders were on hand from the United States.

Though it was not planned to visit many mills, the group did see one of Stoffel's mills in Switzerland. This is the largest cotton manufacturer in Switzerland. The work is concentrated on high style cotton fabrics, a great many of them being clip-spot patterns. Though their labor cost was much higher than in the United States and the orders most of the time so small that only one loom would be put on a style often from one to a few weeks, they stated nevertheless that they were able to sell 20% of their specialty fabrics in the United States.

Professor Honegger, Head of the Swiss Federal Institute of Technology showed much excellent research work especially in the field of x-ray of electron microscopy and some very excellent work with the electron microscope. An interesting feature of their large new chemical laboratory was outdoor laboratories around the side of the building for work with poisonous chemicals.

The Swiss were very friendly toward the United States and the director at Rieter paid high tribute to the contribution in the rehabilitation of Europe by the United States.

In Germany the first visit was to the textile school at Reutlingen, which was celebrating its hundredth year as a textile school and was being given many excellent pieces of equipment by various machinery manufacturers. They had over 700 pupils enrolled in three types of programs: (a) Preparing overseers which required one-half year training after three years practical experience in the plant and a special recommendation from his company (the program for dying overseer requires one year study); (b) A program to prepare technicians in spinning, knitting and weaving for applicants having had two years practical experience plus college training; (c) An engineering program for applicants having had two years experience, four years in public school, six years in high school or college. Foreign students are received on the basis that they will encourage purchase of German machinery in their own countries.

There are four other textile schools in Germany, all more narrowly specialized by fiber; wool, spinning and weaving at Aachen; silk, rayon and chemistry at Krefelt; and two schools near Cologne and Wuppertal which specialize in cotton.

For fifty years Reutlingen has specialized in research for the industry. Funds for research come from Wurtemberg and the Federal Republic at Bonn, with some aid from the industry.

The equipment at Reutlingen is highly diversified, having a finishing laboratory of mill size scale re-
sembling a small plant. To obtain the tremendous amount of material required to operate the machines, small job lots for finishing are done for the industry. In the weave room were 60 looms, all different, made by manufacturers in all countries.

In Germany, also, one mill was visited having 70,000 all new spindles operating on two shifts, 42 hours per week each shift. One outstanding machine was a German built roving frame running practically noiselessly and vibration free.

A short visit was made to the great Farbwerke Hoechst A. G., which is a division of the I. G. Farben combine. This is a tremendous chemical concern working in various fields similar to the American DuPont Company, doing over a billion Marks in sales.

The first stop in England was at the Knitting school at the Leicester School of Technology and Commerce. The work is directed largely by College committees, one working with the textile school called, "The Textile Trades Advisory Committee", which is made up of representatives of the employers, trade associations and trade unions. Support comes 40% from Leicester and 60% from the Government plus help from the industry for purchase of equipment. Here, as in all schools visited, the demand for graduates far exceeds the supply. As a direct result of the visit of the American Textile heads to Great Britain in 1949 and a return visit from the British School heads to the United States in 1950, they have formed a British Association of Textile School heads which is a counterpart of our National Council in which it has associate membership. The two groups met at Harrogate for a conference, at which the problems, aims, goals and successes of the various British schools were brought out. The meeting showed very forcibly the greatly increased interest in the British schools and in textile research manifested by much expansion at practically every school since 1950. From the meeting at Harrogate the group continued its tour to visit several of the outstanding schools.

At Leeds University, which is headed by Professor Speakman and Nissan, the group saw building and equipment that has been greatly enlarged, here again having the most excellent textile chemistry and finishing laboratory. Leeds has a total enrollment of 3300 students of which 300 are in textiles. Research funds total more than $100,000 per year and provide for the textile department by University grants from the Wool Research Council and Wool Secretariat. Many fundamental studies are in progress as well as practical studies on moth proofing, wool deterioration, prevention of wool shrinkage and various other modifications to improve the dyeing properties and properties tending to greater consumer service and comfort. In addition to the work on wool there are a great many mechanical developments on yarn manufacturing. Much study is given applications of electronics for use in the industry.

On a visit to the Wool Industry Research Association at Torridon it is found that the industry subscribes $280,000 and the Government $122,000 for research. The Government collects a levy based on the number of operative in the industry and also a levy based on the bales of wool used. Torridon also carries on studies of sheep-breeding at Harrogate. The work at Torridon is carried on with a staff of 200, including 60 with advanced degrees. In addition to fiber research there were many studies on processing equipment, one outstanding device being the Raper-Auto-LEVELLER Draw Box for levelling variations in wool tops. An interesting study on the molecular study of wool was being made with radioactive tracers.

Again, at Bradford Technological College, they have added a fine new building doubling the size of their plant using funds totaling about $290,000. There the group saw research on x-ray diffraction, infrared spectroscopy, continuous molten metal dyeing, and this school too had a complete finishing range with full scale equipment. The equipment was provided by grants from the industry, the largest from Courtauld’s.

The next stop was at the University of Manchester where in the technological college they had added a complete new dyeing and finishing plant with the addition of 50% expansion for a technological department underway. The finishing plant uses full scale machinery and requires ten to twenty thousand yards of cloth per year for instructional purposes on the machines. There are several items of excellent research being carried on and the department spent $122,000 on new equipment during the last year.

The Shirley Institute is the research center for the British Industry Research Association and here we saw a large new, very modern laboratory. They are operating on a budget of approximately one million dollars a year with 1400 supporting members. When the industry raises $500,000, there is a Government grant of $84,000 and the Government matches all contributions, thereafter. There is a tremendous amount of excellent research going on at this institution, which has developed so many successful instruments that a commercial company has been formed to manufacture and sell the developments to the industry and other laboratories.

The last laboratory visited was the British Rayon Research Association at Heald Green. The rayon producers (Courtauld, Celanese etc.) appropriate ap-

(continued on page 22)
This is the first in a series of articles concerning the Structure of Fibers which Dr. A. N. J. Heyn has consented to write for THE BOBBIN & BEAKER. Being a comparatively new field of study in textiles, it should prove of great interest to our readers.

Another series will deal with the damage to cotton.

The structure of fibers has many different aspects and comprises, for instance, such relatively crude details as the microscopic properties as well as such fine details as the molecular configuration. The latter structures cannot be directly observed with the ordinary light microscope and are therefore referred to as sub-microscopic or "fine" structures. Although the outer microscope features are important, for instance, in connection with special properties such as friction and gloss; the inner sub-microscopic features are of far greater importance since they determine the main physical and physical-chemical properties of the fiber, such as strength, elongation, density, water and dyestuff absorption, etc.

The microscopic structures have been extensively studied in the last century, mainly by botanists and zoologists who described an endless variety of microscopic features of natural fibers. Fibers were found to be built from the same structural units that compose all living matter, namely cells. Animal fibers, and many vegetable fibers are built of a great number of such cells but some vegetable fibers consist only of a single cell, for instance, the cotton fiber.

The fine structure of fibers could not be revealed at that time although various indirect approaches were made. In 1858, Naegeli formulated his famous micellar hypothesis according to which most materials formed by living cells, such as starch grains and cell walls, are built up of small crystalline particles, so called micelles. These particles are larger than molecules but too small to be observed with the light microscope, and were at that time fully hypothetical. Figure 1 illustrates the original theory.

FIGURE 1. Representation of the original micellar theory of Naegeli. (a) longitudinal section and (b) cross section of organized matter.

The crystalline micelles are black; the fixed intermicellar "fluid" is white; the "mobile fluid" between the micelles is shaded. (from C. Naegeli, 1858).
Ambrohn has highly contributed to this theory by studying certain optical phenomena of cell walls and plant fibers investigated with polarized light. Such light vibrates only in one plane, whereas ordinary light vibrates in all different planes perpendicular to the direction of propagation. By using this special type of visible light, he obtained indirect proof for the existence of these invisible structural components. He found, for instance, that the absorption and refraction of polarized light by fibers differs as to whether the vibration direction is parallel or perpendicular to the long axis. The same behavior of polarized light was known of crystals. On the basis of these and other ingenious experiments, carried out in the years between 1900 and 1925, Ambrohn concluded that some type of crystalline structure must exist in fibers. Since no crystallites could be directly observed under the microscope, he concluded that the crystallites must have sub-microscopic dimensions, thus supporting the micellar theory of Naegeli.

Not until the discovery of x-rays by Roentgen was it possible to further disclose the fine structures of fibers. The reason is that ordinary visible light has too large a wave length for revealing such fine structures. Ordinary light washes around them almost like a hurricane wave around a man on the beach. Since the waves are not affected by the structure they can inversely not give indications for such structures. The fine x-rays, however, which measure about a thousand times less than the visible light do interfere with these fine structures. If they are sent through a crystal, they do not merely pass straight through as ordinary light but by the inter-action with the molecular network of the crystal part of the radiation is directed into other directions. This phenomenon is called diffraction. A photographic plate placed behind the irradiated crystal shows a pattern of very typical spots around the original beam. In this way, Von Laue first succeeded to prove the wave nature of x-rays.

The discovery of x-rays offered an opportunity for testing Ambrohn's theory of the structure of fibers. In 1920, Scherrer set a fine beam of x-rays across a bundle of cellulose fibers mounted perpendicular to the beam. He obtained a typical diffraction pattern consisting of many arcs and dots around the central beam, similar to the pattern obtained with crystals. This was a magnificent confirmation of the theory of the crystalline structure of fibers.

In the next article we will more extensively discuss the molecular structure of fibers which has been almost completely revealed in the meanwhile by this method and it will be described how, by “looking at fibers with x-rays,” it has been possible to determine how the molecules are arranged in the microcrystalline domains of the fiber.

One great gap remained in the exploration of the fine structure of fibers. Ambrohn had an indirect grounds already concluded that the crystalline domains in fibers must have sub-microscopic dimensions. It remained unknown, however, how these crystalline areas are exactly building up the fiber. It was already assumed by Naegeli that they are embedded in non-crystalline or amorphous material (which latter component he believed to be fluid) so that crystalline and amorphous areas would alternate in the fiber. But nothing distinct was known so far about the detailed configuration of this microcrystalline structure. The extent of the microcrystalline areas, their shape, and their relation to the amorphous areas remained largely unknown.

This important aspect of fiber structure has been investigated in the last few years at Clemson College as part of a program on the structure of fibers. A new x-ray technique was applied for this research study. In the last few years, x-rays had already been successfully used for measuring the size and dimensions of small particles like carbon-black and other fine powders. It had been found that such small particles cause a complete different phenomenon to occur, than when crystals are irradiated with x-rays. Instead of a crystal diffraction pattern consisting of distinct spots and lines, the radiation is diffusely scattered in this case over a certain area around the original beam, causing a halo around this beam. This phenomenon can be compared with the production of a corona around the moon by the interference of ordinary light with the water droplets of mist. In connection with the narrow angular distance over which the scattering takes place in the case of x-rays, this type of scattering is often called “small angle x-ray scattering.”

Especially Guiner, in France, developed the theory underlying this phenomenon and related the features of the scattering image with the size of the particles which cause it. The mathematical theory is rather complicated and not fully worked out for all cases and will not be discussed here.

In a systematic study of fibers with x-rays at Clemson College, a similar scattering at small angles around the primary beam was observed with fibers but instead of extending in all directions so as to form a circular halo, the radiation extended only along the equator forming a short horizontal line or, in some cases, the pattern of a cross. These observations were the beginning of an extensive study of all different types of fibers with the new small angle

(1) The electron microscope has been recently also used for the study of such structure, but is less suitable in so far that the sample has to be disintegrated by mechanical or chemical means for the investigation. This preparation destroys most of the very structures of interest here.
x-ray technique. In connection with the small angles within which the observations had to be made a very refined x-ray technique had to be used in which the radiation was focused with crystals so that a very narrow beam was obtained even at the long distance from the fiber.

Figure 2 shows the scattering of x-rays obtained with flax fibers in this way. The width of the scattering zone is .60 of a radians. Using the mathematical formulas worked out for this case, it is possible to calculate the exact size and shape of the scattering microcrystallites, and to construct a model as if they were directly seen by the human eye. The study of cellulose fibers with this technique shows that these fibers are built of micro-crystallites of a diameter from 20 to 200 Angstrom units and a length about six or ten times this value. For different fiber types, these dimensions differ but they are extremely constant with the same type of fiber. For instance, the diameter of the microcrystallite of jute and flax is 28 A units; of ramie, 45 A; of cotton 55 A. A study of rayons showed that the diameter varies here from 23-45 A depending upon the type of rayon, i.e., the manufacturing process.

FIGURE 2. Photograph at natural size of the x-ray radiation scattered by a flax fiber at a distance of 200 mm. The white center corresponds to the place of the intercepted beam. The black areas on both sides correspond to the scattered radiation. The total width of the scattering zone is .60 radians (about 3° on both sides).

The scattering is caused by the microcrystallites of the fiber. Their size and distance is determined from the distribution of scattered radiation (from A. N. J. Heyn, 1955(2)).

A serious difficulty in evaluating the scattering in terms of crystallite size was originally that the microcrystallites are so tightly packed in the dry fiber that the scattering by the individual particles interferes which causes complications which exclude a simple evaluation. This difficulty was overcome by studying the fiber in swollen condition. By comparing the scattering from the fully swollen and dry material, it was moreover found possible to calculate also the distance between the microcrystallites or more correctly, their distribution in space. This distance (measured from center to center of the microcrystallites) was found to depend on the extent of swelling. With jute it was, for instance, 35 A in dry state and 53 in the water swollen condition. With Fortisan rayon, the distance was 45 A in the dry state, 68 in the water swollen condition and 80 A in a solution of alkali. Figure 3 is a schematical representation of the size and distribution of microcrystallites in these two fibers in different conditions. Such absolute quantitative measurements of their microcrystalline components of the fiber has never been possible before.

FIGURE 3. Schematic representation of size and distribution of microcrystallites in Fortisan (above) and jute (below). (A) Fortisan dry; (B) same swollen in water; (C) same swollen beyond the water swollen state; (D) jute dry; (E) swollen in water (scale on the right 100 A). The circular and equal cross section of the microcrystallites is schematical; their shape and size will actually more or less deviate from this average.

Note different size and distance of the microcrystallites in the different cases (from A. N. J. Heyn, 1955(2)).

A fourth feature of the microcrystalline structure of the fiber that could be concluded from the scattering is the orientation. As stated in the beginning, the scattering generally extends in horizontal direction along the equator, forming a short horizontal straight line. In some cases however, a cross was found instead of a single line (Figure 4). This pattern could be related to the orientation of the microcrystallites. If the microcrystallites are oriented ex-

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(2) See reference to footnote.
(3) An Angstrom unit (A) is 10^-8 cm or 10^-1 microns^3.
By combining the data in this way on diameter, length, distance and orientation of the microcrystallites, a complete picture of the microcrystalline or micellar structure of the fiber has been obtained by this new x-ray method. The results are not only direct proof of the old theory of Naegeli, but also develop this theory quantitatively and modify it on a modern basis.

In the next article, we will discuss a still finer structure of the fiber, namely, the configuration, an arrangement of the molecules in the microcrystalline domaines of the fiber.

REFERENCE TO FOOTNOTE

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Selling and Manufacturing Coordination

Within the family framework of American industry, the textiles producing segment has always stood out as being among the most competitive.

With the exception of comparatively brief periods, for all practical purposes the unusual rather than the normal, competition within the textile industry has been constant, leaving only to the alert organization a fair return for their efforts and expenditures.

This is most apparent today as America's manufacturing industries contribute to, and the overwhelming majority share in, the high economic peaks now being realized. While many companies within one overall industry may be enjoying a good profit picture, only a limited number of organizations within the textile industry are showing any appreciable return.

This being the case, the importance of coordinating the very best thinking of the manufacturing and selling staffs, is more than ever a vital part of a company's overall operation. This holds true particularly where you have an integrated operation from yarn to finished fabric.

But, to be most effective, this merchandising-manufacturing program must be flexible. The program that bends, moves forward, always ready to meet demand at the moment a market trend takes form, is the one that will bring results in the profit column. Such is the opinion gathered from the merchandising staff of Burlington Industries and which is reflected in various points covered in this article.

Flexibility, rather than standardization and rules, therefore, must be the key theme. Obviously a program of non-deviation cannot succeed when one realizes that a single company and one loom can produce literally thousands of fabrics, and every fabric, week by week and month by month, is subject to constant change and improvement.

While selling textiles, in the broad sense, does consist of certain axiomatic principles, these are subject to new interpretation as market conditions change. There is no one factor that can be termed most important. Each of the many factors, by themselves, are as important as the other and, in combination, make up a strong, progressive and flexible sales program.

To begin with, and as the hub around which the wheel of the program must revolve, is the inter-rela-

tion between the manufacturing and selling staffs, increasingly important in a competitive market.

Conditions being as they are, it is no longer possible to say, as may have been the case during the war years, that what the mill makes, the salesman will sell. On the other hand, the selling staff, being in a sensitive position to understand and spot in advance, market demand and trends, must bring this to the attention of the manufacturing staff. However, it is most important that the selling staff recognize manufacturing limits, including available machinery and yarn supply, as well as other problems faced at the mill level in the production of fabric.

In addition, today's mill operation, as flexible as it may be, is nonetheless taxed considerably by such factors as increased use of blends and marked trends away from the staple type of cloths to the semi-novelty items, both in the gray and finished fabric.

With recognition by the selling staff of the problems faced at the manufacturing level and vice versa, sound judgement can be applied to the individual phases of a flexible merchandising-manufacturing program. They include:

1—Diversification: A sound program of product diversification is one of the strongest forces in a highly competitive market. Where one particular market, for a brief or extended period, lags, the slack can be taken up in other areas, thereby maintaining efforts towards appreciable returns by the overall organization.

2—Market Qualifications: The apparel market is a strict master and the textile producers that serve it must gear production to individual rather than overall areas. A flexible, sound merchandising-manufacturing program must be cognizant of the fact that each area within the overall apparel market is made up of many areas from the standpoint of price and utilitarian requirements. Each price bracket has its individual requirements, each area demands specific cloth, both in construction and style.

3—Research and Development: A glance at your wardrobe will, in itself, be an indication of the importance of this particular area in the overall scheme of manufacturing and merchandising. While many industries continually work with the same basic materials year in and year out, the textile industry, in just the past few years, has introduced a multitude
of fabrics from the man-made fibers, either 100 percent man-made or in combination with the natural fibers.

As far as the textile mill is concerned, the development and eventual production of a new fiber is just the beginning. At this point, concentrated and lengthy research and development effort is required before it can be turned into a proper fabric for proper end use.

And, once this is achieved, this flexible area, coordinating its thinking with other areas within the program, must constantly seek out new combinations, all aimed at producing a fabric that will have better wear and appearance characteristics. Obviously, the company with the more alert, aggressive research and development department will be first with the most and, as a result, capture a healthy share of the market.

4—Styling: Though the fabric itself has all the wear characteristics desired by the consumer, it will get nowhere without the excitement of style in either the weave, pattern or color. Perhaps more so than in other areas, flexibility is absolutely essential here. Styling, to be of the maximum value, should not only spot trends, but initiate them as well.

Once again, the intimate knowledge of individual market areas, its likes and dislikes whether it be a staple, semi-novelty or novelty market and, whether a departure from previous market demand in styling would meet with appreciable acceptance is important.

5—Quality: The good name of the company rests on the quality of the products it produces. In a highly competitive market, there will be found those companies that will sacrifice quality for immediate gain. In the final analysis, however, debasing a product will eventually result in the debasing of the good name of the company. In this phase of the overall merchandising-manufacturing program, rigid control rather than flexibility is the rule. Quality and the company name will be synonymous only when the product produced offers the very most at fair price levels.

6—Promotion: The various promotional methods, when employed in planned, coordinated manner, act as a vital support to the selling effort by stimulating customer interest. If effective, promotions can place a company's product above the competition and, by creating initial or by maintaining market excitement, it will make the selling job that much easier.

7—Personnel: In the final analysis, it is the individual, who along with his co-workers, forms the backbone of the company and whose energies, skill and allegiance will determine the well-being of the organization. In a period where flexibility is a necessity, an all-around knowledge of the textile industry makes for the greatest individual success and progress.

The day of the specialist is drawing to a close. The salesman, the technician or the manufacturing man who has a working knowledge of all phases of the company operation will reap greater returns.

While the textile industry demands breadth, quick thinking, knowledge and flexibility on the part of personnel, it does offer in return considerably greater rewards to those who get to the top than the averages of other vocations and industries.

While all phases described — diversification, market qualifications, research and development, styling, quality, promotion, personnel — make up the major segments of a flexible manufacturing-sales program, there are others as well. To mention but a few — efficient system of delivery, insuring, where possible, delivery of goods at a previously specified time; meeting individual demands of a customer on specific items; sales training programs, etc.

Without coordination, the various phases that make up a merchandising-manufacturing program have just minimum effectiveness. In combination with each other, however, they serve as a company's most effective weapon in its efforts to capture a fair share of business in a highly competitive market.
Processing Intimate Blends of
"Dacron" Polyester Fiber and Cotton

W. Deane Belcher
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Textile Fibers Department
E. I. du Pont de Nemours & Co.

This is the first of two articles concerning the blending of Dacron and cotton prepared by the E. I. du Pont de Nemours & Co., for THE BOBBIN & BEAKER. The second article will cover such points of interest as dyeing, finishing, heat setting, singeing and compression shrinkage.

The article should prove of great interest to our readers, students and those directly in the field because of the great part the blending of synthetic and natural fibers has come to play.

Let it not be said that the natural fibers have one foot in the grave and that they are slowly dying out. This is not true and from all available evidence, it will never come true. But it has been proven that with the addition of synthetic fibers with the still popular natural fibers, that the latter can be improved in strength and durability.

The Editor

The trend toward blends of "Dacron" polyester fiber with cotton to combine functionality with aesthetic appeal in shirts, dresses, blouses, and lingerie has aroused widespread interest in techniques for producing quality fabrics and garments in this new and important field. In the production of 100 per cent spun fabrics blended of "Dacron" and cotton for such end uses as shirts, lingerie, blouses and dresses, studies by the Du Pont Company show that a minimum level of 65 per cent "Dacron" is necessary to gain substantial performance benefits from the synthetic.

The 65/35 ratio of "Dacron" and cotton has been widely adopted by mills. At this level there is a good balance of price and performance, with desirable aesthetic qualities in hand and cover.

Production of satisfactory fabrics and garments using a 65/35 blend of "Dacron" and cotton poses no major problems for mill or cutter. As the result of extensive laboratory and production studies, backed by wear tests of finished garments, however, certain specific procedures have been found necessary in the production of fabrics and garments to meet recognized standards of performance and aesthetics.

COTTON SYSTEM PROCESSING

At the present time, both 1.5 denier and 3.0 denier, 1½" "Dacron" are being spun in blends with cotton in various yarn counts:

<table>
<thead>
<tr>
<th>Yarn Count (c.c)</th>
<th>Denier of &quot;Dacron&quot;</th>
<th>Cotton Staple</th>
</tr>
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<tbody>
<tr>
<td>up to 30/1</td>
<td>3.0</td>
<td>1-1/8&quot; combed</td>
</tr>
<tr>
<td>30/1 to 40/1</td>
<td>1.5</td>
<td>1-1/8&quot; combed</td>
</tr>
<tr>
<td>40/1 and up</td>
<td>1.5</td>
<td>1-7/16&quot; - 1-9/16&quot;</td>
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Pima or Egyptian

Opening and Blending

"Dacron" staple, as received, is in a moderately opened condition and does not require use of standard cotton opening machinery. However, it can be readily processed through synthetic blenders and opening equipment. Whenever possible, it is desirable to blend three or more bales of staple behind the opening or picking line.

Picking

"Dacron" polyester staple can be processed on either one or two process standard synthetic or cotton pickers. Kirschner beaters give better opening and subsequently more even laps than pickers equipped with blade or Buckley beaters.

Where high drafts are to be used in roving and spinning, it is advisable to use lubricants on the staple to improve draftability, yarn evenness, and yarn strength. Approximately 0.25% to 0.50% of the lubricant, based on the weight of the stock, can be sprayed on at the picker hopper. For uniform application, two or more spray nozzles should be placed well above the stock as it is being fed into the hopper.

To prevent excessive fiber breakage and elongation, the following picker settings are suggested:

Beater speeds (Kirschner) — 800 to 900 rpm
Fan speed — 1500 to 1600 rpm
Beater to feed roll — 3/8" (first section)
Beater to evener pedal — 5/16" (second section)
Sargent comb to vertical apron — 3/16"
Lap pin pressure — 30 to 40 pounds
Lap weight — 12 oz./yd.
Lap length — 30 yards

If laps have a tendency to split during carding, it is advisable to: (1) regulate air currents in the cage section so the bulk of the stock is deposited on the top screen, (2) use split lap preventers behind calendar rolls, (3) increase pressure on calendar rolls,
(4) reduce weight on lap pin by decreasing weight on logger head mechanism or by reducing air pressure if pneumatic loading is used.

Carding
Since properties of “Dacron” polyester staple and cotton are not alike, especially crimp and elongation blending of the fibers is done after “Dacron” polyester staple and cotton are picked and carded separately.

A rayon type lickerin and a fancy roll are highly desirable for carding 1.5 denier staple. However, three denier staple may be carded without a fancy roll if optimum settings are used. This normally requires a more open flats-to-cylinder setting, closer doffer-to-cylinder settings, and higher lickerin speeds. Cards set up as follows (using fancy rolls) will produce sliver of excellent quality from both 1.5 denier, 1½" and 3 denier, 1½" staples.

1.5 Denier 1½"  3 Denier 1½"

1. Clothing wire count
   a. Cylinder  110's  100 to 110's
   b. Doffer     120's  110 to 120's
   c. Lickerin  No. 1 Rayon wire  No. 1 Rayon wire
   d. Fancy     Continuous Knee  Continuous Knee

2. Speeds of: (R.P.M.)
   a. Cylinder  165 - 170  165 - 176
   b. Lickerin  400 - 450  400
   c. Doffer    4.8 to 6.0  8 to 12
   d. Fancy    1525 to 1600 1525 to 1600
   e. Speed of Flats  2" per minute  2" per minute

3. Settings in thousandths of an inch:
   a. Lickerin to cylinder .007 .007
   b. Feed plate to lickerin .012 .012 to .015
   c. Screen to cylinder
      (front) .168 .168
      (center) .058 .058
      (back)  .029 .029
   d. Back plate
      to cylinder .029 .029
   e. Front plate (top)  .034 .034
      to cylinder .029 .029
   f. Front plate (bottom) to cylinder .029 .029
   g. Flats to cylinder .012 .012 to .015
   h. Doffer to cylinder .005 - .007 .005
   i. Doffer comb to doffer .015 .015
   j. Fancy to cylinder 1-3/16" strip 1-1/8" or with no fancy use .022 flats to cylinder setting

With these settings, three denier staple has been carded successfully at 8 to 10 lbs./hr. and 1.5 denier at 5 to 6 lbs./hr.

Drawing and Blending
“Dacron” polyester staple is usually blended with the cotton at the breaker drawing. Normally four ends of “Dacron” are blended with two ends of combed cotton, placing slivers of “Dacron” to the outside.

THE BOBBIN AND BEAKER

In breaker drawing, the sliver will have a wavy appearance caused by the difference in fiber characteristics. However, this waviness will disappear after the finisher drawing.

If the cotton sliver tends to wrap on the top front roll, it may be necessary to rearrange the slivers so both ends of the cotton sliver are fed together in the center. This will minimize any unequal tensions in the web and produce a slightly more even sliver. The tube gear in the coiler head mechanism should be as clean as possible to minimize coiler head jams.

The blending does not necessarily have to be done on the breaker drawing. In some cases, “Dacron” is blended with combed cotton on the sliver lapper if lap back drawing is used.

Blends of “Dacron” polyester staple and cotton have been processed satisfactorily on both “3 over 4” and “4 over 4” drawing frames. For a homogenous blend, both breaker and finisher drawings are usually necessary to prepare a suitable sliver for the roving frame, at the following roll settings:

3 over 4 Drawing
   1st to 3rd  3"
   3rd to 4th  1½"

4 over 4 Drawing
   1st to 2nd  1-5/8"
   2nd to 3rd  1-3/4"
   3rd to 4th  1-7/8"

Slivers of excellent quality have been produced using a 1-3/8" diameter front roll at a speed of approximately 325 rpm. Tensions should be adjusted to avoid drafting the sliver between the front roll and the trumpet.

Roving
Standard draft and long draft roving equipment is suitable for processing blends of “Dacron” polyester fiber and cotton. The normal front roll speeds for cotton may be used. For counts coarser than 40/1 c. c., one process roving is usually adequate. For the finer counts, (40/1 c. c. and up) two or more roving processes should be used. No more than the minimum twist necessary to hold the roving together should be used. However, it is advisable that a number of twist levels be tried before settling for a given twist multiple.

Spinning
Blends of “Dacron” and cotton can be spun efficiently on all types of cotton spinning frames including frames equipped with conventional drafting elements. As in drawing and roving, roll settings should be carefully checked to avoid any fiber stretching. Front roll and spindle speeds normally used for cotton have been found generally acceptable for blends of “Dacron” and cotton. Travelers should be changed approximately every 72 spinning hours to avoid cut and bruised yarns.

Usually high twist multiples are essential for fabric pill control. A twist multiple of 4.25 or above is suggested as a starting point. Whenever fine counts are
being spun, and whenever it is practical a double creel roving improves yarn evenness.

Yarns made from either 100 per cent “Dacron” or 100 per cent cotton are slightly stronger than yarns made from blends of “Dacron” and cotton, particularly blends containing low percentages of “Dacron.” This reduction in yarn strength is caused by the differences in fiber elongation and surface characteristics of the two fibers.

**Twisting**

Spun yarns of “Dacron” polyester staple and cotton can be plied and twisted on all conventional twisting equipment. However, if kinkiness is encountered, it may be necessary to twist set the singles yarn before plying.

**Twist Setting**

Oven temperatures of 180°F. dry bulb, 170°F. wet bulb, for one hour or longer, depending on package size, will prevent kinkiness and liveliness in most yarns. The yarn shall be wound on paper tubes or cones to permit it to relax when heated. The packages should be uniform in size and weight. It is not advisable to vary the time in the oven from lot to lot without segregating the production involved.

**SIZING**

Spun yarns of “Dacron” polyester staple and cotton have been sized successfully with several formulations. However, it is very difficult, if not impossible, to give an exact slaming formula that will be optimum for all warps. The formula will vary with the yarn count, yarn twist, percentage of “Dacron” in the blend, number of warp ends, type and condition of the slaming equipment, etc.

This formulation has given good results when sizing fine count singles yarn:

- “Elvanol” 72-60 polyvinyl alcohol
- Nu-Film R
- Seyco-wax
- Water

To make 100 gallons

The specific brands of starch and wax that are mentioned are not necessarily the only ones which will give satisfactory results. Further work may show that other brands are equivalent or even superior.

To prepare, add about 2/3 of the total volume of cold water to the make-up kettle and start the agitator. A paddle type agitator is preferred. Add the “Elvanol” polyvinyl alcohol slowly and stir the slurry for five minutes. Wash down the residue that collects on the sides of the kettle. Add the Nu-Film R and stir the slurry for fifteen minutes. Heat the mixture to the boil and stir it at the boil for thirty minutes to dissolve the Nu-Film R. (Heating with live steam rather than a closed coil gives the best results.) Stir in the wax, and add water to make 100 gallons.

Five- and seven-can slashers have given the best results. However, satisfactory results have been given by a two-can slasher. The following slasher conditions can be used for the initial experiments with changes being made as necessary according to the results obtained:

- **Quetsch roll pressure**: 900 - 1,000 lbs.
- **Leases**: A wet split is highly desirable in addition to the dry split.
- **Drying can temperatures°F.**: 160, 180, 200, 200, 180, 160, cold
- **Speed**: 25 - 30 yards/minute
- **Stretch**: 0%
- **Size Pan Temperature °F.**: 195 - 200

If the yarns pick up too much size, the amount of solids in the size can be reduced. The wax content can be adjusted to give the desired amount of lubrication.

**WEAVING**

Minimum and uniform tensions should key-note the entire approach to weaving yarns blended of “Dacron” polyester staple and cotton. In general, they will weave well provided (1) the yarns have sufficient strength, (2) the warps have been properly sized, (3) the loom is correctly timed, and careful consideration has been given to (4) the condition of the shuttle, (5) boxing of the shuttle, and (6) the condition of the race-plate. The race-plate should be felt covered.

**DYING**

The object of dyeing and finishing any fabric is to improve its attractiveness and serviceability. Since “Dacron” polyester fiber in many fabrics has a tendency to pill, the dyeing and finishing operations should be designated to increase the pilling resistance as much as possible. This is true for blended fabrics of “Dacron” and cotton as well as others. In spun fabrics, the pilling potential will vary with the length and denier of the “Dacron” staple and with yarn twist and construction of the fabric. Thus, the steps necessary in finishing a given fabric will depend largely on its inherent pill resistance.

**Desizing**

Normal cotton desizing enzymes can be used to remove starch from blended fabrics of “Dacron” polyester fiber and cotton with good results.

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(1) “Elvanol” is the trade-mark for Du Pont’s polyvinyl alcohol; Selco-wax is a product of Seydel-Wooley & Co; Nu-Film R of National Starch Products. The use of polyvinyl alcohol as a textile sizing agent is governed by U.S. patents owned by General Dyestuffs Corp. This information is not to be taken as a license for operation or a recommendation to infringe any existing patents.
Scouring

Most processing sizes and oils and many types of soil are easily removed by mild scouring methods. However, certain types of stains and greases may prove very difficult to remove by standard procedures and more severe treatments may be necessary. The fabric can be padded with an emulsion prepared with 90 parts of a solvent such as Varsol (") or xylene and 10 parts of a nonionic detergent, (") and allowed to stand for several hours prior to scouring. Severe grease stains can be spot cleaned with dry cleaning solvents such as "Perclene" (") perchlorehylene or with solutions of Fels Naphtha soap (") or "Shasta" (") shampoo. The soaps should not be allowed to dry and harden on the fabric but should be scourd out soon after treatment. The use of "Hydraphthal" (") textile processing agent is also suggested for cleaning and spotting fabrics soiled with greases. Two per cent "Hydraphthal" (based on the weight of the goods) can be padded on the goods in emulsion form. The goods are lagged for several hours and then given a regular scour.

Since high temperatures tend to set certain stains in "Dacron," the use of a lukewarm (100-120°F.) pre-scour is important in removing a large portion of the size, dirt, oil, and grease. Very dirty greige goods should not be heat-set prior to scouring. The preferred scour bath for "Dacron" polyester is a water solution of the chemicals listed in this typical scouring formula:

0.1 to 0.2 oz./gal. of a nonionic detergent
0.1 to 0.2 oz./gal. TSPP (tetrasodium pyrophosphate)
0.1 to 0.2 oz./gal. sodium metasilicate
0.003 to 0.006 oz./gal. carboxymethyl cellulose (prevents soil redispersion)

The use of 10 percent "Duponol" (") RA surface active agent together with 2.0 per cent tetrasodium pyrophosphate (based on the weight of goods) should be satisfactory in the above formula in place of the nonionic detergent.

The fabric should be pre-scoured for 20 minutes at 100-120°F. The bath is dropped and the fabric scoured in a fresh bath at 180-200°F. For badly soiled goods the amount of detergent is increased, or one percent to two percent by volume of a solvent such as xylene or Varsol is added. It is most important to rinse out all of the xylene since it has a moderate carrier effect in dyeing. The solvent should be emulsified with a nonionic detergent prior to adding it to the scour bath.

Stains that resist normal scouring can sometimes be removed with stripping agents or bleaching agents. A treatment with 0.1 to 0.2 oz./gal. of oxalic acid is effective in removing iron or rust stains.

Mercerizing and Kier Boiling

It may be desirable to mercerize the cotton in the blend to increase the fabric luster. Normal cotton mercerizing, including the treatment with highly concentrated caustic, is not harmful to "Dacron" polyester fiber as long as the temperatures are kept low. Since caustic soda solutions at high temperatures gradually dissolve "Dacron," kier boiling should be avoided.

Bleaching

Following preparation, the blend can be bleached with "Textone" (") and nitric acid. In this process, the goods are run for about one hour with two grams per liter of "Textone" and 0.5 grams per liter of 61 per cent nitric acid at 180°F. to 190°F. This treatment gives good bleaching with a minimum degradation of the cotton. Mineral acids, on the other hand, can injure cotton if the concentration is not kept low. Laboratory tests also show that the pitting of type 304 or 316 stainless steel by "Textone" is reduced by nitric acid.

Hydrogen peroxide and sodium metasilicate are suggested where only the cotton is to be bleached and will produce an acceptable white by itself. Optical bleaches and blue tints can be used in the same way as they would be for all cotton fabrics. A small amount of "Latyl" (") Violet BN may be included if it is desired to tint the "Dacron" also.

Any bleaching procedure should be tested under actual conditions of use before adoption to a commercial scale. Deterioration of the fibers as well as the effectiveness of the bleach should be considered.

(") Product of Standard Oil Company.
("Energetic") — product of Armour & Company, Chicago, Ill.
"Sterox" 6 — product of Monsanto Chemical Company, Boston, Mass.
"Nepal" CO 630 — product of General Dyestuffs Corp., N.Y., N.Y.
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(Trade-mark for Mathieson Chemical Corp.'s sodium chlorite. Sodium chlorite is a vigorous oxidizing agent which may be hazardous when improperly used. To avoid accidents, careful attention should be given to the manufacturer's suggestion for handling.
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THE BOBBIN AND BEAKER

EIGHTEEN
Textile School Gets Coed

By S. J. Reeves, Circulation Manager

During the past year, Clemson has undergone several major changes. Along with the abolishment of the cadet corps there was another change that raised a few eyebrows. Girls were to be admitted to Clemson as regularly enrolled students for the first time. In September of this year, something else happened that was without precedence. A girl enrolled in the Clemson Textile School for the first time. This was a pleasant surprise to all the textile students. Her name is Alma Gamble and she hails from Greeleyville, South Carolina. She has chosen Textile Manufacturing as her major.

Now for a little background. From her high school days come the following facts and accomplishments. She was Miss Greeleyville High of 1955, Treasurer of the Beta Club and a member of the Junior Home-makers of America. From a graduating class of seventeen, she was honored with five of seven superlatives. These included Best Looking, Best-Dressed, Best All-Around, Personality Plus and Most Athletic. Also during her Senior year, she was Art Editor of "The Tiger", the school annual.

Since arriving at Clemson, she has been accepted to sing with the girls ensemble with the Glee Club.

After graduating from Clemson, she wants to become a buyer, either for a retailer or wholesaler. By getting knowledge of textiles through her studies at Clemson, she hopes to know more about what she will be buying and in this respect, make a better buyer.

Alma, THE BOBBIN & BEAKER and the School of Textiles welcomes you cordially. You have the distinction of being the first girl student to brighten the halls and classrooms of Sirrine Hall. Good luck to you during the remainder of your stay at Clemson.
Iota Chapter brought to a close a fairly successful year this past June. The fraternity can remember bringing in thirty-two new members and losing, with hope and success for them all, twenty-eight members by graduation.

During the year we had our usual banquets. The spring banquet was held in the Gold Room of the Clemson House. The banquet was a great success and the members benefited from a fine talk of things for young men in textiles to look for in the next few years.

The social activities of Iota Chapter were limited to these two banquets, but it is planned to expand this year.

Near the end of the session, Iota Chapter, without too much deliberation, changed its requirements for eligibility for membership. It was decided to set the requirements on a percentage basis rather than on previous grades. It is believed that the Phi Psi and its members will benefit from the raising of these standards.

At the meeting of May 9, 1955, officers for the year were elected. They are: President—Thomas E. Boyce; Vice-President—Ronald L. Childress; Secretary—Robert J. Tisdale; Treasurer—Bobby A. Painter; Senior Warden—Bobby Holmes; Junior Warden—Odell Bragg. These officers were installed at a special meeting.
Martin Employed as Cotton Utilization Specialist

William J. Martin has been employed by the Federal Extension Service, U. S. Department of Agriculture, to serve as Cotton Utilization Specialist.

Mr. Martin has been with the Agricultural Marketing Service of the USDA doing research on market outlets for cotton in cooperation with cotton manufacturers. Previously he did similar research work with the Cotton Branch of the former Production and Marketing Administration. Prior to coming to Washington, D. C., he was located at the Cotton Ginning Laboratory at Stoneville, Miss., working on cotton fiber testing and cotton ginning problems. He entered the Army November 25, 1940 and was released with the rank of Colonel December 31, 1945.

Mr. Martin is a graduate of the Georgia School of Technology in textile engineering with a major in textile chemistry and dyeing. He also has had a year of post graduate work at Georgia Tech. Before joining the U. S. Department of Agriculture in 1930 he worked with textile manufacturing plants in the Southeast.

During the past two years he has served on two foreign missions in Europe and Asia sponsored by the National Cotton Council and the U. S. Department of Agriculture dealing with textile manufacturing and marketing problems.

The educational program on cotton utilization will deal mainly with problems of the textile industry in the South, New England, and other appropriate sections of the country. Mr. Martin now has his official headquarters with the Federal Extension Service at Clemson College, South Carolina. He is assigned to the General Crops Marketing and Utilization Branch of the Division of Agricultural Economics Programs of the Federal Extension Service and will work closely with the Southern Utilization Research Branch of the Agricultural Research Service at New Orleans in conducting educational programs.

The purpose of this new line of work is to help acquaint the cotton textile industry on a timely basis with the results of new research which contribute to a more effective and expanded utilization of cotton. Such results will come largely from research conducted by the Southern Regional Research Laboratory of the Agriculture Department, the State textile schools, and other cotton improvement agencies. Many research findings of practical value are currently available to the cotton industry and it is expected that the entrance of an Extension Specialist into this area will help materially to disseminate this information as it becomes available.

State and Federal research studies on cotton production, ginning, marketing, and textile processing are all directed toward reduction of cost and improvement of the quality of cotton products. Mr. Martin will work to widen the application of available research information by the users of cotton, which should help improve cotton's competitive position and benefit all phases of the industry from cotton producers through cotton consumers.

The results of cotton utilization research will be disseminated through national and local industry organizations, textile schools, and contacts with individual mills. In order to keep the program on a manageable basis, the initial work will be limited to single new developments bearing on such utilization problems as:

1. Opening and cleaning cotton at the mill.
2. Nep control and increased card production.
3. New tightly woven cotton fabrics to meet special consumer needs.
TEXTILE SCHOOLS AND RESEARCH ABROAD

(continued from page 8)

approximately $500,00 per year which is matched by a Government grant of $250,000. Various spinning and weaving firms contribute smaller amounts. The institution has 290 members on the staff to perform fundamental and technical research. Our group was there on the opening of their new plant costing approximately $280,000. The laboratory was carrying on most excellent research in textile testing, electronics, static problems, infra-red spectroscopy, electron microscopy and making new machine developments for testing and processing. Some of the new electronic devices were yarn patterning predictor, a strainometer, tensiometer, cloth profile recorder, electronic indicator for loom sets, prototype fluid motion beds of air driven sand for drying of textiles and ultra-sonic cleaning for spinnerettes and for oil spots on fabric.

Before closing the tour the group had a conference at the International Wool Secretariat, which operates in fourteen different countries and cooperates with the Wool Bureau in the United States. For promotion of wool the Secretariat has collected more than three million dollars from a bale tax on the wool produced in the cooperating countries. The funds are used to promote continuous, even life time fellowships in Leeds and other universities in England and a certain amount is spent with institutions in the United States.

In view of the new work and expansion seen by the group, there should be tremendous advancement in textiles in most of the European countries and the whole world will indirectly reap much benefit.

THE BOBBIN AND BEAKER
An officers meeting of the National Textile Manufacturing Association was held October 4 with Mr. E. A. LaRoche, Faculty Advisor, to discuss and outline the coming year's programs and project.

The N.T.M.S. is proposing this year to equip the Textile School with a much needed directory of professors, their offices, room numbers of the different departments, etc., which was considered to be a very worthy project. To raise funds for such a project, it was suggested that members might sell fancy socks or ties and also this would be a means of advertising our Textile School.

As in the past, we hope to have some outstanding personalities of the textile industry and other industries to participate in our programs, as it is a primary function of N.T.M.S. to give the textile students a little more than can be obtained from textbooks. A showing of this year's football games will be an added feature to the program.

Membership to N.T.M.S., the Clemson Textile School's only professional fraternity is open to all textile students of the upper three classes: Sophomores, Juniors and Seniors. It is hoped that all members and prospective members will take a renewed interest in the N.T.M.S. to make the coming year a most successful one.
SUMMER WORK OCCUPIES VARIOUS MEMBERS OF THE TEXTILE SCHOOL FACULTY

By J. P. Campbell, Managing Editor

Many of us are under the impression that a professor's job is confined to nine months of teaching. This is not the case for most of our textile professors. Many of them find research work in the various fields of industry.

Such was the case of Professor T. A. Campbell, Jr., who spent the summer setting up a cost accounting system in Bogota, Columbia, South America.

Another professor, Dr. W. T. Rainey, Jr., confined his summer activity to working in the Chemistry Section of the Deering-Milliken Research Corporation. He was not at liberty to reveal the exact nature of his work, but he was permitted to disclose that it involved organic synthesis of various types of finishing agents.

Also, Professors LaRoche, Jameson, Tarrant, Richardson and Whitten were doing research work here in the School of Textiles on a project for the E. I. du Pont de Nemours & Co., Inc. Others working here were Professors Lindsay and Langston for the B. F. Goodrich Company and Professor Breazeale for the Diversay Corporation. The J. E. Surrine Foundation employed D. P. Thomson and J. H. Marvin on a single and double creel project; Professor J. L. Thompson on a card waste study; and Professor J. C. Hubbard, Jr., producing a nylon tube for artery replacement and surgery. Dr. A. N. J. Heyn was working on an x-ray project.

One of the advantages of summer work for professors is that they have the opportunity to catch up on the latest developments. It is also of value to students as their professors are able to present to them the latest improvements in an ever-changing industry.

AMERICAN VISCOSE EXPANDS COLLEGE PROGRAM

Five more institutions will be included in the College Relations Program of American Viscose Corporation for the academic years 1955-56 than in 1954-55. The new total is thirty-four and reflects Avisco's continued interest in encouraging advanced education for the youth of America.

Nineteen fellowships, given for graduate work, have been established in the fields of chemistry, accounting, chemical engineering, and pulp technology. Nineteen scholarships, awarded primarily to undergraduates entering their junior year, are divided among chemistry, engineering, physics, textiles, accounting, chemical engineering, business administration, textile technology, and mechanical engineering.

American Viscose's college program is designed to encourage the study of science, engineering and business administration. Actual selection of recipients is left to the faculty of each institution and the individuals selected are under no obligation of any kind to the Corporation.

Located in 14 states and Canada, the following institutions have been invited to take part in the program this year: Akron University, Allegheny College, Bucknell University, Carnegie Institute of Technology, Case Institute, Clemson Agricultural College, Cornell University, Duke University, Georgia Institute of Technology, Jefferson Medical College, Lehigh University, Lowell Technological Institute, Massachusetts Institute of Technology, McGill University, Michigan State University, New York State College of Forestry at Syracuse, New York, North Carolina State College, Northwestern University, Ohio State University, Pennsylvania State University, Roanoke College, Swarthmore College, Texas State College for Women, University of Delaware, University of Maine, University of North Carolina, University of Pennsylvania, University of Rochester, Virginia Polytechnic Institute, West Virginia University and Yale University.

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TWENTY-FOUR THE BOBBIN AND BEAKER
SOUTHERN TEXTILE ASSOCIATION
MEETS AT CLEMSON

By Emil Stahl, Editor

The annual meeting of the South Carolina Division of the Southern Textile Association met October 1 at the Clemson House. Approximately three hundred members attended.

Most of the members witnessed a thrilling climax to the day by watching Clemson defeat the University of Georgia, 26-7.

Dr. R. F. Poole welcomed the visitors at the Clemson House and asked them to offer constructive criticism to the School of Textiles at Clemson.

Dr. Hugh M. Brown, Dean of the School of Textiles at Clemson emphasized to the group that the demand for textile graduates at Clemson was at an all-time high.

The various speakers were introduced by Mr. Joe Jenkins, Chairman of the South Carolina Division of the Southern Textile Association, and Superintendent of the Kendall Mill's upper Pelzer plant. Some of the speakers included Mr. Sam S. Rice, representative of the West Point Foundry Machine Co., who spoke on “Air-Dri” slasher; Mr. Donald Marshall, Divisional Manager of the Draper Corporation, who gave a talk on “What to Look Forward to in the Way of Loom Developments”; Superintendent of Joiana Mills, Mr. Joe Delaney, talked on “What the Mills are Doing in the Way of Improvements on Processing and Other Equipment.”

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THE BOBBIN AND BEAKER
School of Textiles
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Position

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FALL 1955
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Index to Advertisers

American Monorail Company ............................................. 5
Amerotron Corporation ...................................................... 28
Bullard Clark Company .................................................... 18
Eisenberg Fibers, Inc. ....................................................... 22
Gaston County Dyeing Machine Company ............................... 26
Greensboro Loom Reed Company ........................................ 24
Ideal Industries & Machine Shops ....................................... 31
Lockwood-Greene Engineers .............................................. 12
Ralph E. Looper Company ............................................... 25
L. C. Martin Drug Company .............................................. 29
New England Bobbin & Shuttle Company ............................... 14
Proctor and Schwartz ..................................................... 12
Robert & Company Associates ........................................... 2
Royce Chemical Company ............................................... 4
J. E. Sirrine Company ..................................................... 27
Slip-Not Belting Corporation .......................................... 25
Smith, Drum & Company ............................................... 27
B. Snowiss Fur Company ................................................. 22
Sonoco Products Company .............................................. 28
Terrell Machine Company ............................................... 32
Woodside Mills .............................................................. 29

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