1960

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Clemson University

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bobbin & beaker
summer 1960
When the P. H. Hanes Knitting Company faced the problem of increasing production to meet the growing demand for their “Knitwear for the Family,” Robert and Company Associates were called on to make a thorough study of Hanes’ present facilities. Finding existing facilities inadequate for additional production, a new plant adjacent to Hanes’ yarn mill in Winston-Salem was recommended.

This modern, 126,000 square foot plant, complete with power plant, central station humidification and air conditioned offices is integrated with the existing yarn mill. The combined operation includes facilities for spinning, winding, yarn storage and conditioning, knitting, cloth storage, bleaching, dyeing, finishing and shipping.

If your plans call for increased productivity and efficiency, draw on Robert and Company Associates’ 42 years of experience in serving the great names of the textile industry.
THE
Bobbin & Beaker
Official Student Publication
Clemson Textile School

VOL. 17 SUMMER ISSUE NO. 4 1960

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In this our first issue and following issues, we the new staff of the BOBBIN & BEAKER will do our best to publish a magazine that will be of interest to all of our readers.

In this issue, the staff has varied the source of articles from men in the Textile Industry to faculty and students in the School of Textiles.

Our one exception is the interesting and informative article on the new drawing frame.
Draw Frame
With Servo Controlled Draft

SACO-LOWELL/USTER
VERSAMATIC—ADC

The Versa-Matic—ADC machine is the first draw frame for cotton spinning with automatic draft control for compensating variation in sliver weight. The ADC servo mechanism comprises a transducer for electronic measuring of the sliver weight per unit length, a transistorized amplifier for the amplification of the measuring signal, as well as a control gear for draft control in a drafting zone, whereby the control of the RPM of the drafting rolls is done in a closed loop circuit.

The system is specially characterized by high accuracy, extremely short response time and utmost simplicity of operation. The short response time permits the control of all variations, even those of very short term nature, at high delivery speeds of the draw frame.

The ADC** servo control has succeeded for the first time, in almost eliminating the weight variations in sliver in cotton spinning. This results in a considerable saving of doublings. Less machines will be required and at the same time improvement in several important yarn characteristics is achieved.

The Development of the ADC System

Ever since spinning machines have been built, it has always been attempted to improve the evenness of the lap, sliver, roving and yarn by automatic control devices. Such a control device has been known for quite some time in cotton spinning, namely the piano evener on pickers for equalizing picker laps.

As far back as 1884, an American, A. T. Atherton, filed the first patent application for such a device for the draw frame. Since then, an enormous number of patents has been registered, according to which an improvement of the evenness of sliver and roving should be possible. However, none of these devices could cope with the practical requirements.

Therefore, in 1953, Saco-Lowell and Zellweger decided to solve this problem together and, since then, they have been working intensively on the design of a new draw frame. In so doing, it was considered an absolute must that the automatic control should in no way limit the speed of the draw frame. Furthermore, a system had to be found which needs only an absolute minimum of supervision, maintenance and service.

The ADC system is based partly on entirely new components, which were specially developed for this purpose. The concept itself is entirely new.

---

*Versa-Matic VERSAtile, automAtic Draw Frame is a registered trade mark of the Saco-Lowell Shops, Boston, Massachusetts, U.S.A.

**ADC AUTOMATIC DRAFT CONTROL is a registered trade mark of Messrs. Zellweger Limited, Uster, Switzerland.
**Working Principle of the ADC System**

The working principle of the ADC system is described below with reference to Fig. 1. The roll arrangement consists of four pairs of drafting rolls 1-4 and one pair of calendar rolls 5. The main drafting zone lies between the roll pairs 3 and 4, the draft being approximately 3-4. The transducer is located between rolls 2 and 3. Between rolls 2 and 3, there is only a tension draft. The correcting draft zone lies between rolls 1 and 2, the mean draft being 1.27. The full range for this correcting is 1.01 to 1.52, or 20% above and 20% below the mean draft. The speed of calander rolls 5 is also being controlled so that between the front rolls 1 and the calander rolls 5, there is only a tension draft.

The transducer M produces a signal S, proportional to the weight per unit length of sliver. This signal S has to be time delayed in view of the time interval Δt required for the material to pass from the measuring point to the drafting point. This is done by a special time delay circuit, whereby the the signal S (t + Δt) so produced, represents the nominal value for the RPM control. The draft is thus exactly controlled according to this signal, i.e. according to the sliver variation. The signal S (t + Δt) is fed to an error detector which, at the same time, receives a signal T = corresponding exactly to the actual front roll speed.

The error detector compares these two values and figures therefrom, the difference e, which is transformed into a so-called error signal. This is amplified in the amplifier by the multiplier K and fed to the converter C, which converts this new electrical K X e into a mechanical torque. Due to this closed loop arrangement, the RPM of the front rolls 1 and the calander rolls 5 corresponds exactly to the nominal value: i.e. to the measuring signal S (t + Δt). J represents the moment of inertia of all mechanically movable parts, and f represents the friction. The mechanical load is indicated by a circle.

The ADC system is also provided with another closed loop circuit which completely eliminates disturbing influences on the control action. In Figure 1, this circuit is shown as an Integrator followed by a transducer. This device acts at the same time as a fully automatic electric adjustment.

---

**Fig. 1.** Skeleton diagram of the servo control. The elements of the ADC-system (measuring, conversion of the measuring values and the control of the RPM) are marked in green.
The Role of the Versa-Matic ADC Drawing Frame in the Mill

The continuous, efficient and rapid action of the ADC equipped Versa-Matic represents in actual mill operation the equivalent of an extremely high number of doublings.

It enables combed yarn mills to reduce their post-combing drawing processes to one only, this remaining process being of course an ADC drawing. Whether and to what extent, substantial savings will also result in carded cotton mills, has still to be confirmed. Not all results are final as yet.

In any case, the present Versa-Matic ADC, with its 4 ends up, will allow an interesting saving in floor space compared to any conventional Drawing Frame requiring 6 or better 8 ends up.

The unusually high uniformity of the drawing sliver remains the most important, immediate characteristic of the New Versa-Matic ADC.

Corrections of the irregularity, such as those obtained with the ADC draft control, will never be achieved on conventional drafting zones owing to the fact that the latter cannot take any correcting action based on a measurement.

Technical Data for Versa-Matic ADC

1. Production Speed
   Normal operating speed: 400 ft./min.
   Both the machine and the ADC device will, however, operate satisfactorily at lower speeds of approximately 300 and 350 ft./min.

2. Range of total draft: 3 to approximately 5

3. Number of doublings: 4

4. Range of sliver count
   English: from 0.24 to 0.12
   Grains/yd.: from 35 to 70
   Metric: from 0.40 to 0.20
   Tex: from 2500 to 5000

5. Roll clearing: Mechanical or pneumatic, optional

6. Diameter of the drafting rolls (see Figure 1)
   1st: 1 1/8" 1 1/8"
   2nd: 1" 1 1/8"
   3rd: 1 1/4" 1 5/16"
   4th: 1 1/4" 1 5/16"

7. ADC Device
   Amplifiers and supervision units are fully transistorized, the life of transistors being considered unlimited.
   Power as supplied by the mill main line and any voltage between 200 and 600 V are satisfactory. No further provisions for transformers. The total power consumption of the ADC device is about 100 watts.
   All electronic components are designed as plug-in units and can easily be replaced.
   The entire equipment is self-supervising. As soon as a disturbance occurs, an alarm is engaged, the machine stops and a special control lamp lights up.

8. Maintenance and Operation
   Operating a Versa-Matic ADC frame is the same as a normal frame. The personnel has nothing new to learn and the ADC system does not limit the production or the efficiency of the frame. Maintenance is no problem. The control gearing runs in an oil bath and the ADC system does not incur additional lubrication.

Comments on Chart

The improvements which have been made on a combed yarn, on a carded yarn are shown in the chart. In each case, the breaking length has increased considerably and at the same time, the coefficient of variation of the breaking strength has dropped. The elongation is also significantly higher. Of particular note, is the fact that the variation of the yarn count has decreased considerably.

Typical Improvements Which Will Be Obtained With the Versa-Matic ADC Draw Frame in the Yarn

<table>
<thead>
<tr>
<th>Material and Yarn Count</th>
<th>Process</th>
<th>Breaking Length (mm)</th>
<th>CV Breaking Strength (%)</th>
<th>Elongation (%)</th>
<th>Count Variations CV %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sudan 1 1/16”</td>
<td>Conventional</td>
<td>15.9</td>
<td>11.9</td>
<td>7.1</td>
<td>4.8</td>
</tr>
<tr>
<td>English count 30, Versa-Matic</td>
<td>ADC as Single</td>
<td>17.3</td>
<td>8.0</td>
<td>7.5</td>
<td>1.0</td>
</tr>
<tr>
<td>Metric count 50</td>
<td>Draw Frame</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Waste Cotton 1”</td>
<td>Conventional</td>
<td>12.8</td>
<td>12.4</td>
<td>8.2</td>
<td>3.1</td>
</tr>
<tr>
<td>English count 20, Versa-Matic</td>
<td>ADC as Single</td>
<td>13.6</td>
<td>10.1</td>
<td>9.8</td>
<td>1.4</td>
</tr>
<tr>
<td>Metric count 34</td>
<td>Draw Frame</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cotton Blend 1-1 1/32”</td>
<td>Conventional</td>
<td>13.7</td>
<td>13.5</td>
<td>8.1</td>
<td>2.9</td>
</tr>
<tr>
<td>carded</td>
<td>ADC as Single</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>English count 24</td>
<td>Versa-Matic</td>
<td>14.1</td>
<td>11.3</td>
<td>8.4</td>
<td>1.5</td>
</tr>
<tr>
<td>Metric count 40</td>
<td>2nd process</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* Coefficient of variation CV % of the count variations determined between several bobbins over a length of 120 yds.

Advantages of the Versa-Matic ADC Frame and the Improvements in the Yarn

—In the case of combed stock, only one drawing process is required instead of two. Therefore, the space requirements are less and there are savings in operation and maintenance. At the same time, there is considerable increase in the quality of the yarn.

—In the case of carded stock, a considerable increase in the quality is obtained without additional processes.
Influence on the Yarn

The ADC yarn, when compared with conventional yarn, shows the following improvements of the quality characteristics:

— higher breaking strength,
— smaller coefficient of variation of the breaking strength,
— less thin spots,
— higher elongation,
— fewer ends-down on the roving frame and on the ring frame,
— fewer stoppages on the winding machine,
— fewer loom stops in weaving and less stoppages in knitting,
— produces a better woven and knitted fabric.

L. C. MARTIN
DRUG COMPANY
Clemson, S. C.

A.A.T.C.C. News

by
Ray Brock '62

The Clemson Student Chapter of the American Association of Textile Chemists and Colorists enjoyed a most successful year during the 1959-'60 term, with membership greatly exceeding that of the previous year.

Club members were given the opportunity to hear speakers with topics of wide interest in Textile finishing. A field trip to the Rock Hill Printing & Finishing Co., and Celanese Corporation plants was also very enjoyable. These activities gave first-hand information concerning the diversified operations of the ever-progressing Textile Industry.

Officers for the 1959-'60 term include: Ralph Sims, President; Roger Hinson, Secretary; and Nolan Etters, Treasurer. Mr. Joseph Lindsay, Jr., is Club Advisor.

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TEXTILE and WEAVING SUPPLIES

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Loom Reeds (Pitch Bond and All Metal, Regular and Stainless Steel Wire) • Loom Harness Accessories • Automatic and Hand Threaded Southern Shuttles (Tempered Dogwood, Persimmon and Fibre Covered) •
Warp Preparation Equipment • Electrode Rods (Fibre and Plastic Insulation) • Drop Wires • Creel Stop Motions • Pigtail Thread Guides • Tension Washers • Light Metal Stampings • Hard Chrome Plating • Hard Chrome Plated Parts • Wire Rolling.

A complete staff of field engineers to solve your problems.

Other Plants and Offices: Cranbury, Quebec, Canada—Lawrence, Mass.—Greensboro, N.C.—Atlanta, Ga.—Textile Supply Co., Dallas, Texas—Albert R. Breen, Chicago, Ill.
THE STANDARDS DEPARTMENT --
A GOOD PLACE TO START

By

J. L. Richardson
Assistant Professor of Textiles, Clemson College

It has often occurred to me that the standards department is a good place for textile graduates to gain leadership and management experience. I know of no other department where so much information can be obtained regarding the overall operation of the plant. One has the opportunity to observe management functioning from the executive level down to second hand level. This experience is valuable to one who will later serve as a department supervisor or in some executive capacity.

We need only examine some of the duties and responsibilities of this department to appreciate its potential training facilities. While the required functions of the standards department do vary from one organization to another, some of the more frequent occurring duties are as follows:

1. Make time studies
2. Improve methods through motion study
3. Determine anticipated production per machine and per operator
4. Establish piece rates
5. Determine job assignments
6. "Trouble Shooting" (isolating causes of low efficiencies and recommending corrective measures)
7. Determine correct machine speeds
8. Make machine speed checks at periodic intervals
9. Job evaluation
10. Make machinery layouts
11. Represent the company in bargaining with labor union
12. Study prospective new machinery
13. Develop periodic labor control budgets
14. Direct and evaluate physical inventories
15. Make material handling studies
16. Develop supervisory bonus plans
17. "Off job" employee training

The standards department is basically a staff department and as such must depend to a large extent on its leadership ability to work with people to get the job done. Therefore, in this department, the trainee sees the importance of such matters before being placed directly in charge of employees. It has often been said that the ability to work with people, to create cooperative attitudes and job enthusiasm among employees—all are important requisites for a good supervisor.

When making time studies the trainee works with supervisors and employees in all departments. This acquaints the trainee with both time study and the day to day problems of supervisors and operators. He is able to observe the techniques used by experienced foremen in supervising work. In the future when the trainee serves as a department head, he is able to appreciate the problems of fellow supervisors and as a result is more tolerant of their problems.

Methods analysis and motion studies made by the standards department provide the trainee with an appreciation of how to lay out jobs in the most efficient manner. This training also enables the potential supervisor to more intelligently answer questions put to him by employees concerning work of the standards department.

Experience in the standards department also brings about a more cooperative attitude towards this department since the potential supervisor understands why the standards department must have certain information or do things a certain way. This cooperative attitude is necessary if the standards department is to do an effective job. If a supervisor has the proper attitude towards motion and time study work, his employees will soon have the same attitude. All too frequently if the boss is opposed to something his employees are also opposed.

Experience in establishing the standard, determining job assignments and piece rates later gives the potential supervisor confidence in rates and job assignments in his department. Some supervisors do not understand how these things are determined and therefore are sometimes skeptical of the results. It is human nature to be somewhat skeptical of things we don't understand.

"Trouble shooting", that is analyzing low efficiency jobs, gives the trainee experience in how to systematically isolate the principal causes of low efficiency and to take the proper corrective measures.
Preparation of a weekly labor control budget causes one to appreciate the value of labor controls. Analysis of this budget shows why a particular department “went in the red” for the week. This type budget compares standard costs with actual costs.

When employee training and indoctrination is a function of the standards department the trainee realizes the importance of getting the new employee oriented on his job. An employee properly introduced to his job is a happier and more satisfied worker. Actually, supervisors often do not instruct the new worker on such matters as safety precautions and plant policies with regard to absenteeism, rest periods and smoking.

Since the standards are used by the cost department to establish cost estimates, there usually exists a rather close relationship between the standards department and this department. Therefore, the trainee gets experience in cost estimation and soon realizes that the net profit per yard is usually small in the textile industry. This emphasizes the importance of operating efficiently and indicates that large volume production is necessary for reasonable profits.

Controlling labor cost is an important element of supervision. Often the labor cost is the largest single element of the supervisor's controllable costs. Thus the supervisor is directly concerned with the time standards, work methods and working conditions which determine his labor costs. He must constantly be looking for ways to reduce labor costs and increase production. This, after all, does not vary much from the very basic reason for the standards departments existence.

The standards department—a good place to start.
Preliminary Study of Former Clemson Textile Students Made

1272 REPLIES FROM 2100 CARDS RETURNED BY MARCH 22, 1960

A statement that is constantly encountered is to the effect that the textile industry is a hazardous industry. The common saying is that it is so rough that you can't live with it. The primary purpose of the survey was to find whether there was any foundation for this talk.

I mailed out a post card questionnaire to all former students of the School of Textiles whose names and addresses were on file in the alumni office. The number was about 2100. Answers to these cards are still coming in but the results shown here are from the first 1272 answers.

The return card asked that the following information be filled in:

Name
Home address
Employer
Plant
Address
Present title

Never worked in the Textile Industry □
Left the Textile Industry entirely □ after ______ years.
Now in a related industry □

Everyone says that the fact that we have received over 1300 answers from 2100 cards is remarkable. This is 62% return when 25% return is called good. The results of this survey are produced below.

Employment History — 1272 Individuals

<table>
<thead>
<tr>
<th>No.</th>
<th>Per Cent</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Never in Textile Industry</td>
</tr>
<tr>
<td>2.</td>
<td>Left Industry</td>
</tr>
<tr>
<td>3.</td>
<td>Closely Related Industry</td>
</tr>
<tr>
<td>4.</td>
<td>Directly in Textiles</td>
</tr>
<tr>
<td>5.</td>
<td>3 &amp; 4 above together</td>
</tr>
<tr>
<td>Total</td>
<td>1272</td>
</tr>
</tbody>
</table>

Those Who Never Entered Textiles

Present Occupation — 119 Individuals

<table>
<thead>
<tr>
<th></th>
<th>No.</th>
<th>Per Cent</th>
</tr>
</thead>
<tbody>
<tr>
<td>*Government employ</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(Incl. State and Local)</td>
<td>58</td>
<td>48.74</td>
</tr>
<tr>
<td>Other Industries</td>
<td>26</td>
<td>21.85</td>
</tr>
<tr>
<td>Self Employed</td>
<td>19</td>
<td>15.97</td>
</tr>
<tr>
<td>Others</td>
<td>16</td>
<td>13.44</td>
</tr>
<tr>
<td>Total</td>
<td>119</td>
<td></td>
</tr>
</tbody>
</table>

Those Who Left The Textile Industry

Present Occupation — 205 Individuals

<table>
<thead>
<tr>
<th></th>
<th>No.</th>
<th>Per Cent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Government (Incl. State and Local)</td>
<td>64</td>
<td>31.22</td>
</tr>
<tr>
<td>Other Industries</td>
<td>60</td>
<td>29.27</td>
</tr>
<tr>
<td>Self Employed</td>
<td>40</td>
<td>19.51</td>
</tr>
<tr>
<td>Others</td>
<td>41</td>
<td>20.00</td>
</tr>
<tr>
<td>Total</td>
<td>205</td>
<td></td>
</tr>
</tbody>
</table>

*Includes members of recent classes serving their time in the Armed Services.
Many will enter the industry upon completing this service.
This shows that: (1) seventy-five percent of those heard from are still in some phase of the textile industry; (2) of those who never entered the textile industry, many are serving their time in the armed services and will enter the industry when this service is completed; (3) many have chosen the military as a result of World War II service; (4) of those who entered the textile industry and then left it, one-fourth left within a year and two-thirds left within five years.

These figures are the results of 1272 answers from 2100 cards. For this reason totals are incorrect but the percentages should be dependable.

Taken as a whole, this survey shows that the textile industry offers wonderful opportunities for permanent and satisfactory employment. The School of Textiles is proud of the success of its former students.

*Quality Control, Costing, Designing and Methods and Standards, etc.
**Largely with man made fiber manufacturers.
James Alan Bell, from Gatlinburg, Tennessee, is a Textile Engineering Senior. He is a very capable and dependable student who combines his studies with many varied extracurricular activities.

Alan has become familiar to our readers by his excellent work on the BOBBIN & BEAKER staff, of which he has been a member for the past three years. In his junior year he was Managing Editor and is now the Editor. Besides this office, Alan was the secretary of NTMS in his junior year and now leading the club as president. Alan has also been a member of Student Assembly, Council of Club Presidents, Wesley Foundation for two years, NTMS for three years, and a member of the Freshman Swimming Team. Alan is finishing his two years of Advanced Army ROTC and will be commissioned in the Quarter Master Corps. Alan has been helped with his financial expenses by the Ada Hearne Foundation Scholarship for four years. From his four summers' experience at Cherokee Textile Mills, Alan has gained valuable experience in the textile field.

Wilfred L. Robertshaw, a Textile Manufacturing major, is from Greeville, South Carolina. Before coming to Clemson, Wilfred was in the U. S. Army for two years. During his stay at Clemson, he proved himself an industrious student by maintaining good grades all the time and receiving honors in his second semester 1958-59, and first semester 1959-60. From his 2½ years at Southern Worsted Mill, Wilfred has already much valuable textile experience. Wilfred has helped defray his expenses while at school from the money he saved while in the army and from his mill work.

James C. Knox is a Textile Manufacturing major from Richmond, South Carolina. He is a capable and well-liked student who participates in several extracurricular activities. In his freshman year, James used his vocal talent in the Clemson Glee Club. Now, he is an active member of the Clemson chapter of Phi Psi, national honorary fraternity, and the NTMS. James has gained valuable experience from his two summers work at Grace Plant in Lancaster, South Carolina. He has been helped through school by a loan scholarship from Springs Cotton Mills.
to You who are about to enter the Textile Industry!

Your interest in textiles together with your background of study and training are essential elements in building the solid foundation for a successful career.

The Textile Industry is a basic industry — and a continuing one. It is an industry which provides great opportunity for initiative, growth and satisfying personal achievement so important to the development of your career.

You are welcome indeed. Your energy, your eagerness and your skills are all needed in helping the industry advance to new levels of achievement.

May every success be yours in the industry which will play such an important part in your future — and in ours.

Whitin Machine Works

Whitinsville, Mass.

Established 1831

ATLANTA, GA. DEXTER, ME.
CHARLOTTE, N. C. SPARTANBURG, S. C.

Preparatory Machinery for processing all Major Fibers: Opening, Picking, Carding, Combing, Drawing, Roving, Spinning, Twisting and Winding.
Quality Control

By
Evans A. LaRoche
Associate Professor of Textiles
Clemson College

Recent years have seen a new term come into general usage, the term “Quality Control”. We read or hear it in newspaper and television advertising, we see it on the label of products, and we even find want ads for Quality Control Engineers. Associations have been formed for the purpose of promoting Quality Control, such as the American Society for Quality Control (with its six divisions, including a Textile Division) and the Textile Quality Control Association. For those who are not familiar with the term, this article will serve as an introduction to Quality Control.

First, let us remember that manufacturers, dealers, and the consuming public have always been interested in quality, although not always agreeing on the meaning of quality, or on the quality which should be provided for a given price. Manufacturers have for many years inspected their incoming raw materials to see that they were satisfactory, their intermediate products to see that standards were being met at each stage of production, and their finished product to determine acceptability. Dealers have done routine testing, or relied on the certified tests of others, to determine whether specifications were being met. Customers have always exerted a great influence on quality by their refusal to buy, or by shopping elsewhere for a better bargain. Thus, we can see that the interest in quality, and the efforts to control quality are not new.

The increase of interest in Quality Control has been brought about largely by the addition of statistical procedures, or “Statistical Quality Control”, to the methods already in use. By statistical, we mean that numbers calculated from samples are involved. The mean of a sample, commonly called the average, is a statistic obtained by adding all measurements of the sample together and dividing by the number of items in the sample. This is the statistic most commonly used for showing the center of a sample. The statistic used to express the spread or dispersion of a sample is often the standard deviation, which has a formula (given in standard works on Statistics or Quality Control) involving the use of squares and square roots. An alternate measure of dispersion is the range, found by subtracting the smallest measurement in a sample from the largest. While the range is not as useful a statistic in someways as the standard deviation, its ease of calculation makes it desirable, and it can be used for a very good estimate of standard deviation. Other statistics may be the proportion (or fraction) of material classed as defective, or the actual count of defects of a certain type. These numbers, or statistics, are the basis of our efforts to guide or control the quality characteristic to the desired level. This quality characteristic may be weight, length, resistance to abrasion, hardness or any other property.

Behind the use of Statistical Quality Control is the idea that every type of product varies, whether the product be automobiles, nails, electric light bulbs, yarn, or animals. The product turned out by one machine will vary, just as the pigs in one litter, or the leaves on one tree, will vary. Yarn from the same bobbin will vary in size and in tensile strength; sliver from the same card will vary in weight; and cloth from the same loom will vary in several respects, such as weight and the number of imperfections. The problem, therefore, becomes one of determining how much variation is expected, or reasonable, and what amount of variation should cause us concern.

In determining a quality characteristic, we may record actual measurements, such as grains per denier for breaking strength, or weight per yard for sliver.
Or we may simply decide that an item is acceptable or not, on the basis of meeting or failing to meet specification. For example, cloth may be the proper shade after dyeing, or it may be an unacceptable shade, while filling quills may either fit or not fit into your shuttles. No measurement is necessary, but only a decision to accept or reject, to classify as first class or some other than first class. Another method of determining quality is a count of individual defects, such as fabric imperfections, where a certain number of defects are permissible and expected. The “Statistics” derived from these measurements, decisions, or counts must be handled so as to get the most benefit from them.

All of us are frequently called upon to make decisions on whether to accept a statement as being true, or to reject it as being unlikely, or false. We rely on past experience and the credibility of the source of the statement. As an everyday example, someone’s claim to have seen a cow while on his way to work would be accepted or ignored, but seldom questioned. An additional claim that the cow was purple, however, would raise serious doubts concerning the vision, sobriety, sanity, or truthfulness of the speaker. There may be purple cows, but who has seen them? Likewise, statisticians have tests to accept or reject statements in the light of the statistics obtained from samples. A question might be phrased in this fashion: “Is the statement that all card sliver in Mill A has a mean of 50 grains per yard a reasonable and acceptable statement, when a sample of 5 yards gives an average weight of 49 grains per yard?” Statistical tests would give us a basis for deciding whether this is reasonable, or unlikely.

Because most statistical tests and terms give the appearance of being “difficult” to many people, statistical procedures were not widely used by certain industries until some simplifications were made. The most important changes or additions were the substitution of control charts for more complicated statistical tests, and the use of sample ranges, rather than standard deviation, to measure dispersion (or scattering) of the measurements in a sample. The control chart technique is now in widespread use in all types of industry, and is the basis of most “Statistical Quality Control”.

Control charts may be divided into 3 types: charts for means (averages) and ranges, charts for fraction defective, and charts for defects per unit. Detailed instructions and examples of control charts of all types are to be found in the literature, and the bibliography at the end of the article includes some excellent books on the subject. For this reason, a description of the control chart for means and ranges, only, will be given here.

Control charts for means (known as X-bars) are prepared by plotting the mean of a sample, usually 4 or 5 measurements, on a graph drawn to an appropriate scale. As each succeeding group of measurements is taken the sample mean is plotted, in the order in which samples were taken. Thus, the horizontal scale shows the samples, by number, or the same element of time, in the order taken. The vertical scale shows the units (pounds, grams, inches, etc.) in which the measurements were made. Using the same sample numbers or time elements but another scale, the ranges of each sample are plotted below the corresponding mean. The two charts go together and supplement each other, and neither is complete by itself. The plotted points will vary considerably, but the majority of points on each chart should be concentrated in a narrow band, with only a few points in extremely high or low positions on each chart. No control chart, however, is complete without a center line to indicate average values, and limits to help in deciding whether variation is reasonable or unreasonable.

Basically, the control chart for means works because sample means tend to approach a normal distribution, if the sample size is large enough, regardless of the shape of the population or universe from which the samples were drawn. Samples of 4 or 5 measurements will usually be large enough to give an approximately normal distribution of sample means. Since in a normally distributed universe, practically all individuals will be found within three standard deviations on either side of the mean, we can apply three-standard-deviation limits to the control chart. A point falling beyond these limits indicates variation in excess of that normally expected. Stated another way, it is highly unlikely that a universe with a mean at the level shown by the center line would yield a sample whose mean was so far distant from the center line. Therefore, the process is said to be “out of control”, meaning that there is an unreasonable amount of variation, the cause of which should be found and eliminated. Although the range does not follow a normal distribution, control limits are likewise set on this chart to judge whether individual ranges are reasonable or excessive.

Center lines for the control charts for means and ranges are determined by averaging the sample means and sample ranges, respectively. Twenty-five samples are usually considered sufficient as a basis for this calculation. Standard textbooks on statistics or on Quality Control give factors for setting control limits on both mean and range (or X-bar and R) charts, and no tables of factors will be given here, but an example will suffice to show this calculation.

Suppose that 5 bobbins of yarn are taken from
each doff of a spinning frame and a 120-yard skein from each bobbin is weighed and recorded. Then the mean and range of each sample of 5 is computed, recorded, and plotted on a chart. After 25 doffs have been sampled, computed, and plotted the sample means are averaged giving a value of 55 grains. This is the best estimate, at this time, of the mean of all yarn from this frame, and becomes the center line of the X-bar chart. The sample ranges are averaged in the same fashion, giving an average range (R-bar) of 1.5 grains, which is plotted as the center line of the R chart. For samples of 5, the factor for X-bar chart control limits is .58, and the factors for R chart control limits are 0 and 2.11. Thus we have the following calculations and control chart:

Upper Control Limit for X-bar = 55.0 + (1.5 × .58) = 55.87
Lower Control Limit for X-bar = 55.0 − (1.5 × .58) = 54.13
Upper Control Limit for R = 2.11 × 1.5 = 3.17
Lower Control Limit for R = 0 × 1.5 = 0

From the above calculations, we would expect the means calculated from 5 bobbins each to vary between 54.13 grains and 55.87 grains. (Individual measurements will go beyond these limits much of the time; these limits apply only to means.) Ranges from samples of 5 bobbins each should vary between 0 and 3.17 grains. Any means or ranges beyond these limits indicate either that something is causing excessive variation, or that a very unlikely sample has been found, the equivalent of the purple cow in the previous example. We will seldom be wrong in assuming that the point out of control is due to excessive variation from some cause which we must now find and eliminate. Remember that these limits apply only to statistics from samples of 5, to this spinning frame only, and only as long as no change in the process is made. The control chart is a picture of the process as it exists, not perhaps as you would like it, but as it is at present.

Since it seldom does much good to determine that a process was out of control 10 days ago, the greatest value of the control chart lies in projecting the center line and control limits into the future, and comparing each statistic with the limits, as soon as it is plotted. A decision can be made with the plotting of
each sample, either to look for the cause of the variation (if the point lies beyond control limits), or to leave the process alone since the variation is reasonable. Adjustments in the center line and control limits may be made when changes are made in the process, when causes of excessive variation are eliminated, or after certain periods of time when additional samples give a better estimate of the mean value of all yarn produced by this spinning frame. Prompt attention to indications of lack of control, such as points beyond the control limits, or 7 consecutive points on the same side of the center line (like 7 consecutive “heads” in tossing coins) will enable the foremen to quickly find the cause of trouble and keep variation to a minimum.

The control chart for fraction defective (“P” chart) and the control chart for defects (“C” chart) are similar in usage to the control chart for means and ranges, although based on different statistical principles. Again, limits are plotted on the chart for fraction (or percent) defective to determine whether the day-to-day variations are excessive or within reason, and a decision is made to search for the cause, or to leave the process alone. Control limits on the control chart for defects tell us, “This number of defects is excessive, and we must find the cause”, or “This is a reasonable number of defects, and we should leave the process alone.”

These are the techniques of “Statistical Quality Control”. They may be supplemented by good sampling plans based on the theory of Probability, by refinements and adaptations of the basic charts, or by the use of more highly developed statistical procedures. Countless organizations in almost every industry have used these techniques, not as an answer to every problem, but as an aid in solving the problems by sound management and engineering decisions. The current trade journals for many branches of industry carry articles about the successful applications of Statistical Quality Control, and the well-attended meetings of organizations devoted to Quality Control attest to the interest in this subject.

With the recent changes in curricula of the Textile School at Clemson College, two semesters of Quality Control were added to all three curricula, Textile Chemistry, Textile Management and Textile Science. The first semester is concerned largely with the introduction to statistical principles and procedures, while the second semester deals primarily with the practical application of control charts and other techniques to the textile industry. A three week, no-credit, course in Quality Control was offered during the Summer of 1959, and will be offered in the summer of 1960, for mill personnel interested in this rapidly developing field.

This, then, is a very brief description of Quality Control. There is a definite place for it in any organization, as one of the tools of Scientific Management.

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The Problem of Tint Fugitivitly

by
Ray Brock '62

The problem of tint fugitivitly is becoming more apparent with the production of the new synthetic fibers which have been introduced in the textile world in the past few years. It is necessary that these new fibers have some means of identification while being processed, and the best means of doing this is to put some sort of tint on the stock in order that each different type of fiber may be recognized.

There are a number of dye companies which have done everything in their power to make tints which will shade the stock enough that it may be differentiated from cotton, and other types of fibers. Although these companies have produced a great number of tints which are satisfactory, there is still an ever increasing demand for new tints which will prove to be fugitive.

Before a textile organization can tint a certain stock they must run tests on each color of tint and type of fiber before they put that particular tint into production. There are literally hundreds of questions to be answered in a test of this type. Such questions as:
(a) Will the tint harm the fiber in any way?
(b) Will the tint come completely out, or will it leave a dull overcast on the stock?
(c) Will this tint cause unpleasant working conditions because of foul odors, etc.?
(d) Will the tint be able to be purchased easily and in sufficient quantity if it proves to be satisfactory?
(e) Is this tint the most economical one to be used?

These are only a few of the questions which the textile plants must ask before the tint is given the okay for production.

In the actual testing of a fiber in the laboratory the first problem that occurs is establishing a suitable method for applying the stock. After trying a number of different methods it was decided that the best method of application was to spray a desired solution on the stock and carding it with hand cards to make sure that the tint is sufficiently spread throughout the stock. The tint solution in the laboratory is usually mixed so as to make the solution a little more saturated than it will be when actually put on the stock. This is only the method for a cold water application. Another method is used to simulate the conditions which are present while the stock is being processed in the slasher room. This is known as the hot water application. It is believed that this method will tend to saturate the stock with as much tint as it will have in it during any process. In this method the stock is dipped in boiling water for a short period of time and then the tint is applied as it was in the cold water application. Both the cold water application and the hot water application are necessary in order that the laboratory may be completely sure that the stocks have had sufficient tint applied, and they have had just a little more than they would in the actual processing.

After the application of tint, the different samples are allowed to dry, either air dried or oven dried. It is probably best to air dry the stock, because if the stock is allowed to remain in the oven too long, it is possible to scorch it making the fiber lose its original color.

The stock, completely dried, is now ready for removing the tint. The tint is first tried to be removed by cold water. If cold water does not remove the tint, it is then tried to be removed by hot water. If hot water does not prove to be sufficient, the stock is boiled in soap and water. As a last resort, the stock is boiled in Tetra Sodium Pyrophosphate, soap, and water.

After running a number of different colors and makes of tint on a certain stock, it is then classified as to which of the above methods remove the tint from the stock. If none of these methods removed a sufficient amount of the tint, it is then classified as non-fugitive.

Most of the problems in removing tint are not concerned with the removing of the tint from one particular type of sort. Many of the “headaches” of tinting come in removing the tint from blends. Many times it is possible to remove the tint from one of the types of stock used in the blend, but the other type of stock is completely non-fugitive in that certain tint. In this case it is necessary to run the complete test on the same two types of stock over again.

As a positive check, the stock is then tested again after it has been completely processed. If the tint proves to be fugitive when the stock is in woven form, it is given the final okay, and the tint is considered to be standard for that particular blend.

Through the wide use of synthetic fibers these methods are being improved and as have most of the problems which cause the most trouble, these will soon be conquered by increased research.
Psychological Effects
Of Industrial Color

By
Harral Young. TM '81

To fully understand the value of proper color usage, we must first understand what color is, and how we see it. "Color", it is said, "is largely a physical manifestation and the psychological response of humans to such radiation."1

When we use the word "color", we do not refer to size, shape, texture, gloss, flicker, or transparency, although each of these definitely affects it. The way that we see these is called color perception.

It is common practice to speak of an article as containing color, but, in a sense, this is incorrect. The article may contain some coloring agent, but color itself does not exist in the object, rather in the brain of the observer as a psychological experience. "Color, like beauty, lies in the eye of the beholder."2

Without light, there is no color. To make a pure white light, there are seven components of different color. The components are individually colored light rays of varying wave length. They range from the invisible infrareds on one side, to the ultraviolets on the other. Between these two extremes we find the colors represented by the term "VIBGYOR". These letters represent the colors Violet, Indigo, Blue, Green, Yellow, Orange, and Red. These are the basic colors of light, although it is estimated that the human eye can distinguish some 100,000 shades of these basics.

When William Shakespeare stated that the whole world was a stage, he probably did not realize how true his statement was. As any modern movie-goer knows, the scenery and stage sets create the atmosphere and mood for the movie. Elia Kazan movies, where there is usually a depressing situation, would not be nearly so effective to the audience if it were filmed in color as it is filmed in the drab grays and blacks. This is taking advantage of the psychological effect of color. So, too, must industry use this phenomenon.

Color affects the mood and positive responses throughout the entire human organism. Two of America's most highly recognized athletic coaches took advantage of this fact. Amos Alonzo Stagg had the dressing room of his football team painted a pale, restful blue to help combat the "pre-game butterflies". Immediately before leaving the dressing rooms to go on the field, the players were given last minute instructions in a brilliant red anteroom. The color involved here, created exactly the opposite effect of what had been achieved in the blue dressing room. The players became tense, excited, and "fired up" for the game. Knute Rockne employed the same system except that he made certain that the opposing team's room was a dull, depressing color.

The primary reason for industry's sudden interest in color schemes came about with the realization that factories were not only built to house machines, but also to serve as a habitation for the workers who run the machines.

When it was found that changes in color could actually cause a rise or fall in a persons blood pressure, speed up or slow down his heartbeat, and change his entire personality under given situations, importance began to be linked with color conditions.

Consciously or unconsciously, color is a constant influence on an individual, assuming, of course, that he is not completely color blind. It is estimated that less than four per cent of the males suffer from this ailment, while less than two percent of the females have the same trouble distinguishing color. This definitely shows that males have more tendency toward color blindness than do females.

To illustrate the psychological effect that color has on an individual, a very simple experiment was con-

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2Ibid., p. 9.
ducted. Two boxes of equal size and weight were placed an equal distance from the subject. The only actual difference in the two was that one was dark brown, while the other was pale blue. When asked to move one of the boxes, the subject invariably chose to move the blue one because it gave the illusion of lightness. He was then asked to put his box on one of two tables. Here again, the tables were the same except for color. One was blue and one was red. This time he chose the red because, although they were the same distance from him, the red one appeared to be closer. The blue one gave the illusion of depth or distance. At one time during World War II, the Army warned its truck drivers to be especially careful when parking vehicles between two blue objects because the space looked larger than it actually was.

There is a proven reason for these illusions. The lens of the eye works like the lens of a camera; therefore, there is a marked degree of chromatic aberration—different wave lengths of light focusing different distances behind the lens.

Another incident which shows how this fact works in everyday life was explained by an English professor. He, after being beaten several times by an opponent in a tennis match, introduced a red ball. His opponent, not accustomed to the red ball, would consistently swing early because he misjudged the distance. Consequently, the professor won the game.

The biggest step in the crusade for color in industry resulted from a study of illumination. Illumination and fatigue are directly related. Fatigue is both physical and mental, and must be approached from both angles.

Four good, simple rules to remember when planning a lighting system are: avoid gloom, avoid glare, avoid dark shadows, avoid excessive contrast.

When deciding on lighting and color in conjunction, management must realize that, although visibility is better under bright light conditions, this is an open invitation to fatigue. An Olympic Weight Lifting Team served as the “guinea pigs” to prove this. The training room was highly illuminated for a short training period. When the lifters started their work out, it soon became evident that they were not showing top form. The members quickly became dissatisfied and tired, and started quarreling among themselves. Under these bright conditions, the psychotic make-up of humans may cause them to unconsciously rebel from their tasks.

From the physical viewpoint, the contrast caused by excessive illumination causes the pupil of the eye to dilate, and then return to normal, frequently. As insignificant as this slight muscular movement seems, it will cause fatigue to set in rapidly.

Fatigue, regardless of how it is caused, causes workers to become nervous, careless, and indifferent. Here, we can readily understand how illumination and safety are connected.

A modern research firm carried on a survey in 350 companies. The companies all followed a carefully arranged color scheme. The figures, which are an average for all the participating companies, showed that there was a 67.4% improvement in lighting conditions, 27.9% increase in production, 30.9% improvement in quality, 19.7% less eye strain and fatigue, and 14.7% less absenteeism. Figuring on this basis, the research firm showed that proper illumination and color was worth $139.25 annually, per worker. This was figured as a company saving in money alone. There is no way to compute the non-monetary value of the new system to the thousands of employees affected.

Color is not something for industry to rush right into. It holds charm and magic, but restraint, control, and direction are necessary if color is to be used intelligently. To give free rein on color usage in a factory may completely destroy the benefits that could be gained under more careful control.

“Color is not an end in itself.” If it is to be used at all, it must be used with purpose and reservation.

One thing must be clearly understood. Factory decoration should not be confused with interior decoration. True application of color does not necessarily make people work harder and more accurately. The trick is to establish a color scheme which will cause better seeing conditions. In other words, color is not a bright, outstanding thing that stands out like a cheerleader, cheering the workers on. It subtly integrates itself with the worker’s seeing problem and directs his attention rather than attracts it.

If you have ever spent any time in your living room trying to compose a letter or paper, chances are that you will find it difficult to concentrate on your subject. Regardless of how attractive the room is, your mind will constantly wander. The results will be, due to the outside attraction, a slowly, and possibly, poorly composed article. This is an example of how draperies, furniture, and pictures attract, rather than direct attention. This also proves true in a highly decorative plant.

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4Ibid., p. 50.
One of the major American oil companies allows the personnel to choose the colors that they prefer in their immediate work area. Although this may seem contradictory to the ideas already expressed, it is an altogether different situation. These workers are not required to remain at any one job for a long period of time. Because of this, their choice of color is more important than the standard, functional types used in more restricting jobs. By allowing them to choose, by vote, the colors they want, they get a feeling of importance and belonging.

The colors also serve a useful function. The orange storage tanks, formerly painted black, show the slightest signs of leakage. The workers, very proud of their selection of color, work hard to keep leaks from occurring and spoiling their color schemes.

"Bright colors in the interior create an outward attraction; soft colors direct attention inward." The industry has almost unanimously decided to use lighter, more subdued colors in the interior. Industrial techniques try to avoid distractions as much as possible. Men, who are expected to concentrate on their job, find it easier to do so in surroundings of a grayish cast.

Very often—even more so lately—the use of color on ceilings has been discussed. This is possibly a big mistake. If the ceilings are attractive, workers' attention may be drawn from their work to the ceiling. If the ceiling is attractively painted, this will tend to draw attention to unsightly girders, pipes, and conduit which will now stand out like the proverbial "sore thumb".

In actual studies, the main causes of eye fixation are movement and extreme brightness. Under equal illumination, white has far less attraction than dark hues. Unconsciously, the human eye seems to find hues interesting, while it shows almost complete indifference to white and neutral grays.

The Deering-Milliken Research center employs this technique throughout the entire work area. The walls are white with a small, black breaker strip to break the monotony. In the areas where it is practical, carpets of a grayish hue are used. Where carpets cannot be used, tile of a similar hue is employed.

The trend in modern mills is toward the gray walls because of their lack of attraction and resistance to dirt. Often the walls are dadoed. This is simply painting the lower portion of the wall a darker color, and the upper portion a lighter shade.

The selection of the proper colors is of utmost importance. A large industrial plant had two cafeterias for the personnel. Both were painted different colors. One was a deep blue, and the other was a pale blue color. Although both cafeterias were thermostatically controlled and kept at the same temperature, the employees eating in the deeper blue one complained of it being cold. New slip covers, chairs, and draperies were added. By use of "warm" colors, complaints immediately ceased, even though there was no change in the temperature.

Machinery, too, must have a well controlled color sequence to be effective. With modern industrial plants purchasing new machinery almost constantly, care should be taken not to have a motley array of color. This will result in an effect of confusion and clutter, and prove to be a detriment in efficiency and quality.

Objects of minor importance, such as bins and racks, should be kept at a low degree of color purity so that they will not stand out. Color is scientifically concentrated about the work area. No attempt is usually made to give the worker what he wants or thinks he should have, as far as color is concerned. The problem is analytical. Those colors which are most conducive to efficiency and safety are used.

The case history of a radio tube manufacturing company illustrates how color came to the rescue of the workers. Precision welding, a very tiring task, is done by women. A color engineer realized that the task could be eased, both physically and psychologically.

The work benches were painted pale blue to give a cooling effect, thus counterbalancing the heat from the welding torches. The exterior and upper portion of the machine was given a coat of orange paint to contrast with the gas jets. The undersides were painted dark blue for better visibility of the parts being welded. The idea was well received by the workers. The foremen were so enthusiastic about the idea that they did most of the painting themselves, rather than waiting for the maintenance crew to get to their departments.

The results showed a great drop in rejects all in one week! Cleanliness was also improved because of the new pride that the workers showed.

"One thing is certain. Dollars spent in improving color and lighting always means greater safety and efficiency and they pay off in less waste and larger output."


A survey, conducted over a period of several years, showed that casualties, due to fire, were greater in plants using the conventional red and white exit signs than they were in plants using green and white ones. According to the survey, red tends to create excitement and panic. Green, on the other hand, had a soothing and calming effect, thus facilitating evacuation of areas in danger.

Rest rooms, smoking rooms, cafeterias, and dispensaries should be decorated for cheerful effects. Care should be taken not to "over do" this, though. If the room is too extravagantly done, the workers may get the idea of company waste or squander.

Standardization of colors for desired effects is still in a state of underdevelopment. Industry, as a rule, does use colors that have some degree of association as guides.

Safety equipment is usually painted red, orange, or yellow. These are excitable colors that bring attention to the particular hazard that they are used to prevent.

Protective materials, such as antidotes and first aid equipment, are painted blue or green. These two colors are soothing. By soothing the person who finds it necessary to use these materials, panic and shock is suppressed.

Valuable materials are usually marked in purple. This color suggests royalty and value.

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**PHI PSI MEMBERS ATTEND CONVENTION**

By

Orren F. Hunter

Five members of the Iota Chapter, Clemson College attended the Phi Psi Convention in New York, May 29-30. Those making the trip were Aubrey Adams, Reggie Crawford, Sammy Fleming, Frank Hunter, and Gene Phillips.

Headquarters for the convention was the Hotel Roosevelt in Manhattan. The convention program included such things as job seminars, business meetings, sightseeing tours, and the annual banquet which climaxed the affair. The Clemson delegates were in good attendance at all these events and took an active part in all activities.

One of the highlights of the trip was a boat ride around Manhattan Island Friday night. The trip lasted four hours with the conventioneers being treated to refreshments and music by a Dixie-Land band.

The annual banquet closed out the Convention on Saturday night. After a delightful meal, the guest speaker, Mr. James Q. Dupont, presented a stirring speech on "The Nine Factors of Success." Afterwards, various awards were presented to chapters and individuals. Charles Bagwell, Secretary of Iota Chapter, received two of the three awards presented to individuals: one for the best written annual report and the other for the best reports submitted for the Phi Psi Quarterly.

As a whole, the convention was a great success and the ones responsible are to be congratulated. All of the Clemson delegates had a wonderful time and are looking forward to next year's convention in Washington, D. C.

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**N.T.M.S. News**

The N.T.M.S. had election of new officers at the last regular meeting of the school year. The newly elected officers are:

- **President** __________________________ Tommy Ariail
- **Vice-President** ______________________ Harral Young
- **Secretary** __________________________ Steve Saunders
- **Treasurer** __________________________ Mickey Creach

The organization had a considerable increase in membership over the previous year, and plans are now under way for a successful year for 1960-61.

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**PHI PSI NEWS**

The Iota Chapter of Phi Psi has finished a very successful year. During the year the chapter visited Deering-Milliken Research Center and Wunda Weave Carpet Company on a one day field trip. We were honored this year by a visit from the Grand Council President, Ben S. Bellemere, and Vice-President, Mr. Anderson, who joined us at a banquet at the Clemson House. We were fortunate to be able to send five delegates to the Phi Psi convention in New York. This is the largest number of delegates ever to attend the Phi Psi Convention from Iota Chapter.
**REMINDER!**

Summer short courses to be offered at Clemson College, School of Textiles for those in the textile industry.

The courses to be offered are:

- **Yarn Manufacturing**—June 13, 1960
- **Fabric Development**—July 11, 1960
- **Supervisor Development**—June 13, 1960
- **Quality Control**—August 15, 1960
- **Motion and Time Study**—July 11, 1960
- **Cotton Classing**—June 13, 1960

For additional information write:

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<tr>
<td><strong>VATROLITE</strong></td>
<td>Use this powerful concentrated reducing agent for brighter vat dyed colors on cotton, linen and rayon for faster, cleaner stripping results on silk, cotton and rayon.</td>
</tr>
<tr>
<td><strong>DISCOLITE</strong></td>
<td>A concentrated reducing agent, highly stable at high temperatures, outstanding for discharge and vat color printing. Employed successfully wherever the reducing agent must dry into the fabric and retain its reducing power.</td>
</tr>
<tr>
<td><strong>PAROLITE</strong></td>
<td>A dust-free white crystal-line reducing agent. Soluble, colorless, excellent for stripping wool piece goods and rags, shoddy, acetate or nylon fabric.</td>
</tr>
<tr>
<td><strong>DISPERSALL</strong></td>
<td>Effective retarder for dyeing vat colors, dispersing and leveling qualities, for dyeing naphthol and vat colors, useful in wool and acetate dyeing. Valuable auxiliary in stripping vat colors, naphthols.</td>
</tr>
<tr>
<td><strong>CASTROLITE</strong></td>
<td>A highly sulphonated castor oil used as a staple penetrant for dyeing or kier boiling in leading textile mills. Still used extensively in finishing.</td>
</tr>
<tr>
<td><strong>NEOZYME® HT</strong></td>
<td>Concentrated high temperature desizing enzyme. Removes starch and gelatine. Suitable for continuous pad-stream method. Remarkable stability at very high temperatures.</td>
</tr>
<tr>
<td><strong>NEOZYME® L</strong></td>
<td>Concentrated liquid desizing enzyme. Remarkable stability at very high temperatures.</td>
</tr>
<tr>
<td><strong>VELVORAY®</strong></td>
<td>A blend of sulphonated vegetable oils and selected fats for a superior, non-foaming finishing oil. High in combined $SO_3$ and stability. Excellent for compressive shrinking, will not smoke off at high temperatures.</td>
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<tr>
<td><strong>NEOZYME® HT</strong></td>
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</tr>
<tr>
<td><strong>NEOWET X</strong></td>
<td>Effective wetting agent at all temperatures from cold to boiling. Does not inhibit enzyme action in desizing bath. Good for use with resin finishes, and hydrogen peroxide bleaching liquors. Good rewetting properties. Anionic.</td>
</tr>
<tr>
<td><strong>P.S.</strong></td>
<td>A centrally located plant... strategically placed warehouses...and Royce's own fleet of trucks... mean fast, dependable delivery—always!</td>
</tr>
</tbody>
</table>

**NEOZYME's®** — Concentrated low temperature desizing enzyme. Removes starch and gelatine. Excellent for eliminating thickeners from printed goods at low temperatures.

**NEOZYME® HT** — Concentrated low temperature desizing enzyme. Removes starch and gelatine. Suitable for continuous pad-stream method. Remarkable stability at very high temperatures.

**NEOZYME® L** — Concentrated liquid desizing enzyme. Remarkable stability at very high temperatures.

**VELVORAY®** — A blend of sulphonated vegetable oils and selected fats for a superior, non-foaming finishing oil. High in combined $SO_3$ and stability. Excellent for compressive shrinking, will not smoke off at high temperatures.

**CHEMICAL COMPANY • CARLTON HILL, NEW JERSEY**

Manufacturers of Chemicals for the Textile Industry
多くの場合、米国カロライナ州ニューブリーのニューブリー・ミルズ・インクは、ニューブリー・ミルズファブリックを使用しています。