1965

The Bobbin and Beaker Vol. 22 No. 4

Clemson University

Follow this and additional works at: https://tigerprints.clemson.edu/spec_bobbin

Materials in this collection may be protected by copyright law (Title 17, U.S. code). Use of these materials beyond the exceptions provided for in the Fair Use and Educational Use clauses of the U.S. Copyright Law may violate federal law.

For additional rights information, please contact Kirstin O'Keefe (kokeefe [at] clemson [dot] edu)

For additional information about the collections, please contact the Special Collections and Archives by phone at 864.656.3031 or via email at cuscl [at] clemson [dot] edu

Recommended Citation
University, Clemson, "The Bobbin and Beaker Vol. 22 No. 4" (1965). Bobbin and Beaker. 211.
https://tigerprints.clemson.edu/spec_bobbin/211

This Book is brought to you for free and open access by the Engineering, Computing and Applied Sciences, College of at TigerPrints. It has been accepted for inclusion in Bobbin and Beaker by an authorized administrator of TigerPrints. For more information, please contact kokeefe@clemson.edu.
bobbin and beaker
Special
TEXTILE DICTIONARY
for BEST RESULTS
in Textile Processing

C
Curobes (Kúr'-ó-bes)
A durable anti-bacterial additive for textiles. Provides fixed, lasting protection against germs, mildew, perspiration odors, and other odors of bacterial origin.

Easily applied during dyeing or finishing operations. Will cause no shade change in dyed and printed colors, no yellowing of whites. Does not affect the hand of the finished goods. Compatible with most types of finishing materials.

D
Discolite1 (di'sko-lí'te)
Concentrated sodium sulphate formaldehyde available in lump, pea, rice or powder form.
A powerful reducing agent, stable at high temperatures. Widely used to effect reduction and solution of vat colors, and for discharge effects when applied to colored grounds. Effective when mixed with vat colors and discharge pastes wherever the reducing agent must retain its reducing power after being dried into the fabric.

Dispersall (dis-púr'sal)
A long chain ethylene oxide condensate in the form of a colorless, neutral, somewhat viscous liquid. Fully resistant to hard water, and miscible with water in all proportions. A retardant and leveling agent in vat dyeing.

Used widely as a dispersing agent in dyeing synthetic fibers with dispersible dyes and for fast color salts and bases in Naftol dyeing and printing.

Effective in stripping to prevent redeposition of the color on stripped goods.

N
Neofinish (Ne'o-Finish)
Non-ionic softener dispersible in hot water, suitable for all textile fibers, both natural and synthetic. Compatible with all types of finishing materials, including resin finishes. No development of color or odor in goods finished with Neofinish, even in storage. No yellowing at time of application.

Neowet (nó'wet)
Complex Polyethylene Ether in the form of a pale yellow, slightly viscous liquid.
A non-ionic surface active wetting agent, effective at all temperatures. Completely compatible with enzymatic desizing agents and readily soluble in water. Contains 92% active ingredients. Widely used in scouring all types of textile fabrics and for general wetting purposes.

Neowet X (nó'wet-X)
Organic Ether Sulphonate in the form of a water white slightly viscous liquid.
An anionic surface active wetting agent, effective at all temperatures. Does not affect enzyme activity in finishing. Compatible with hydrogen peroxide and resin finishes. High detergent value. Contains 20% active ingredients.

Neozymes1 (né'-o-zíms)
Desizing agents made up of amylolytic, proteolytic and fat splitting enzymes available in the form of crystalline powder or liquid concentrate for high or low temperature requirements.

Neozyme quickly removes all trace of starch glue or gelatin sizing without danger of damage to even the most delicate fabrics. For best results, use with NEOWET to speed saturation.

P
Parolite1 (par' Có-lí'te)
Zinc sulphate formaldehyde in the form of white crystalline powder. A highly concentrated stripping agent for all forms of wool and modern synthetics.

Completely soluble in water. Leaves stripped goods soft, completely free of zinc dust and in most receptive condition for further processing.

Often completely strips goods where other stripping agents fail. Very effective in discharge printing on acetate rayon.

V
Vatrolite1 (vat'rólí'te)
Concentrated sodium hydroxylate in the form of white crystalline powder. A powerful reducing agent for vat colors, ideal for dry feeding because of its free flowing, dustless character. Completely soluble in water.

Effective stripping agent for direct, sulphur and vat colors on cellulosic fabrics.

Quickly removes rust stains from cotton goods. May be stored indefinitely.

Available with optical whites and in buffered formulas for high temperature use without excessive alkalinity.

Velcro Softener (vel'kro)
A highly sulphonated tallow in the form of a creamy white paste, easily dispersed in water.

Used in general finishing of all types of textile fabrics. Will not "smoke off" or change color in high temperature operations such as calendering or drying. Has no effect on light fastness of colors.

Strategically placed warehouses plus company owned trucks add up to fast dependable delivery, every time.

ROYCE
CHEMICAL COMPANY
EAST RUTHERFORD, NEW JERSEY
THE
Bobbin & Beaker
Official Student Publication
Clemson School of Industrial Management and Textile Science

VOL. 22   SUMMER ISSUE 1965   NO. 4

The Staff

Editor
Sanders E. Goodman
Salisbury, N. C.

Advertising Manager
W. Wesley Connelly
Spartanburg, S. C.

Circulation Manager
Bruce R. Edwards
Tryon, N. C.

Junior Staff
Ronald W. Rogers
Hemingway, S. C.
Eugene A. Deladdy
Spartanburg, S. C.

* * * *

Faculty Advisers

D. P. Thomson, Jr.
D. R. Gentry
Dr. C. H. Whitehurst, Jr.
Wallace D. Trevillian, Dean

In This Issue

From the Editor ........................................ 4
Color Measurement ..................................... 6
Today's Textile Industry ............................... 14
Outstanding Seniors ................................ 19
Professional Development Courses ................. 21
Research Abstracts ................................... 22
Radar—In a New Setting ............................... 24
Turning a Corner ...................................... 24
Why Research? ......................................... 26
Index to Advertisers .................................. 26

THE BOBBIN & BEAKER. Organized in November, 1939, by Iota Chapter of Phi Psi Fraternity, and published and distributed without charge four times during the school year by students of the Clemson University School of Industrial Management and Textile Science. All rights reserved.

Address: The Bobbin and Beaker, School of Industrial Management and Textile Science, Clemson University, Clemson, South Carolina.

POLICY—
The views and opinions expressed in all guest articles are those of the writers themselves, and must not be construed to necessarily represent the views and opinions of the Editors of this magazine or of the faculty of the Clemson University School of Industrial Management and Textile Science. No article in BOBBIN & BEAKER, or any part thereof shall be reproduced in any form without permission of the editor. Requests may be forwarded to Editor, THE BOBBIN & BEAKER, School of Industrial Management and Textile Science, Clemson, South Carolina.

THE BOBBIN & BEAKER is a non-profit magazine organized to serve Clemson students and the textile industry. We ask our readers to consider favorably our advertisers when buying.
In this, the first issue by the new staff, we think we have a good variety of articles. There is a report on this year’s Professional Development Program and also several research abstracts.

The new staff would like to express its appreciation to the members of the old staff and faculty whose patient help made this issue possible. We hope that our tenure of service will be as successful and rewarding as those of the past.

Our thanks go out to the Textile Quality Control Association for their generous gift of one hundred dollars to be used for the purchasing of new books for the Sirrine Library.

— S. E. G.
A Symbol of Satisfaction

THIS TRIANGLE, a mark of distinction, guarantees dyed and bleached yarns with superior knitting and weaving qualities. Wherever you see THIS TRIANGLE, you can be sure that quality fabrics are being produced.

Substantial investments in modernization and expansion projects in recent years have resulted in increased sales of yarns produced at this plant.

The continued growth of Piedmont is ample proof that modernization is imperative in today's competitive markets.
FUNDAMENTALS
OF COLOR MEASUREMENT

Edward S. Olson
Associate Professor of Textile Chemistry

The textile industry has for many years worked on the periphery of the requirements to measure color. The past ten years has witnessed a rise in the interest of color measurement, specification of color, and the establishment of acceptable tolerances. For the present it is possible that the state of the industry may be characterized in three different levels. Mills in the first category are either unaware of the strides being made in color measurement or are completely ignoring it. The second category are those attempting to evaluate various measuring instruments to determine the feasibility of the installation of a color measurement system in the mill. The third type of mill are those having made a sizeable investment in one or more different instruments and have found that these instruments are acceptable for their individual purposes. These mills are now attempting to set up systems to constantly monitor and correct conditions and dyestuffs being applied to a textile fabric in a continuous manner.

In general, light falling upon a transparent body will be partially reflected, partially absorbed, and partially transmitted. In the case of opaque bodies it is found that radiant energy may be absorbed and reflected but not transmitted. The common denominator of both materials is the characteristic of absorption so that while measuring solid bodies, such as textile fabrics, one is primarily concerned with the magnitude of reflection. On the other hand, when solutions are measured, the primary concern is the transmission qualities of the solution. It should be agreed upon that a certain magnitude of radiant energy falls upon the textile surface. In order to account for the total energy, a certain proportion of the light is absorbed or scattered as the rest is reflected. For solution measurements a certain proportion of the light is absorbed while the part not absorbed must be transmitted. Since absorption is the common denominator for both systems, it must be recognized that absorption, in its simplest terms, simply removes certain wavelengths of light from the total light falling upon the surface. Through this property our terms of colors and colorants are defined.

When sunlight falls upon different surfaces, one recognizes that these surfaces are either blue, green, yellow, or red, as the case may be. Since the same light is incident upon the different surfaces, it is concluded that the color observed is due to the constitution of light itself. Certain spectrum regions are absorbed while others are reflected. A colorant is generally regarded as being dyestuff or other absorber. Different hues are the result of a different chemical constitutions. The reason that a dyestuff is red is because the colorant absorbs portions of the visible spectrum while reflecting or transmitting red. The red that we see is a function of the incident light upon the surface.

Whether we measure color by visual or instrumental methods, four basic requirements are essential in either case. The four essentials are:

1. illuminant,
2. object,
3. receptor, and
4. interceptor.

Each of these four elements will be considered in its capacity to contribute to a color measurement system in the order listed above. The physical attributes of color and color measurement are within the concept of electromagnetic energy. The electromagnetic spectrum is, in its simplest terms, a continuous extension of wavelengths from that of long form radiant waves through cosmic energy. At an intermediate point between 400 to 700 millimicrons the visible portion of the spectrum is located. Since the human eye responds in this area, our primary concern is with the quality and spectral attributes of the radiant energy within this boundary.

The infrared is located in the long wavelength side of the electromagnetic spectrum. In the short wavelength portion of the visible spectrum is that portion which we define as the ultra violet. Both of these areas—the infrared and the ultra violet—have for many years been accepted, recognized, and used for chemical qualitative and quantitative analysis. The radiant energy emitted in the area of the visible spectrum is intermediate to that of the infrared and ultra violet. In the portion to which the human eye is sensitive, the basic energy characteristics are similar.
Since the electromagnetic spectrum is fundamentally one continuous progression, the principle variation is that of wavelength or its reciprocal frequency. Many of the properties of light can be accounted for by considering it as a wave motion which is also capable of mathematical expression and therefore of quantitative and qualitative treatment. This mathematical expression may be expressed as the frequency = velocity/wavelength. Figure 1 is a representation of the wave motion of light. It is to be noted that the distance a-a' is the wavelength traveling in the direction d-d'. The wavelength, therefore, is the distance between repeats of the wave. The sine wave depicted in Figure 1 is the curve given by a particle moving in the direction u-u' for a distance on either side of this axis. This particle also moves at constant speed approximating $3 \times 10^{10}$ cm/sec.

![Figure 1.—The wave motion of light.](image)

When a beam of light passes through a prism, light is refracted and emerges as a continuous spectrum containing all colors except purple. The angle of light least bent or refracted is that of the longest wavelength, approximating 700 millimicrons, and is the red end of the spectrum. The light at the other end of the spectrum is that which has been bent the greatest and is violet. When white light is passed through a prism and separated into various colors, these colors can be recondensed and emitted as white light. Upon this concept is based the additive color system. The additive system selects spectral colors in the form of light which when added together, match other colors. This concept is part of Grassam's Laws.

In direct contrast to the additive system is that of the subtractive system. The subtractive is based upon the fact absorption of light by colorants. Colorants are classified as being dyestuffs, pigments or other agents capable of absorbing selected areas of the visible spectrum and reflecting those not absorbed. A red dyestuff or colorant absorbs selected quantities of violet, blue and green while reflecting the red.

It is axiomatic that the light source used to view a given sample must contain all of the spectral colors.

A sodium lamp emits its light in the 580-590 millimicron region of the spectrum. It will be observed that differently dyed samples of fabric (pink, grey, blue, and tan) are essentially ecru under these conditions. True colors are achieved only when lights containing all colors are turned on. In order to properly view a sample, lights of a distributed energy level containing all elements of the spectrum are essential for the correct assessment of shade.

The relative energy of a light source must be considered at any time samples are to be matched. For color measurement three light sources have been standardized and are known as illuminants A, B, and C. Illuminant A is a tungsten incandescent light source operating at 2,850° K. Illuminant B represents noon sunlight operating at 5,000° K. Illuminant C is that of daylight having an over cast sky operating at 6,800° K. The Figure 2 represents the curve of these illuminants and compares the relative energy of each throughout the visible spectrum of 400 - 700 millimicrons. A comparison of these curves indicates that illuminant A contains a relatively low level ultra violet and blue with excess amounts of energy in the red end of the spectrum. On the other hand, illuminant C contains greater amounts of energy in the blue and green areas of the spectrum with lower quantities in the red region. If two samples of fabric were compared after being dyed using identical systems, no color differences should be readily apparent when either light source is used. However, in actual practice this is not what happens. While the same substrate may be used, such as 160 x 60 cotton broadcloth, in order to match a given shade, different dyestuffs have been used. As a result of this, if one of the dyestuffs produced a red flare in the 650 millimicron region and the other did not, differences in dyeing would readily be observed when illuminant A was the incident light. If differences existed on the other end of the spectrum, at 450 millimicrons, differences would be readily discernible when illuminant C was used. It is, therefore, necessary that samples must be viewed under the same lamps of relative energy in both the dye house as well as in the salesroom. Unfortunately, most of the color matches made in the dye house are metameric matches. (Metamerism occurs when two or more samples, spectrally dissimilar match visually under a given light source.) These samples when compared by spectrophotometric methods show that curve dissimilarities exist. On the other hand, if two samples are compared by the same method and the curves are identical, the two samples match. This, in all probability, will exist only when identical dyestuffs are used to dye identical fabrics. The curve shape of a given dyestuff can be utilized to identify individual dyestuffs.
The incident light upon the surface of an object is important. Of equal importance is the interpretation and identification of the color by the observer. While the response of given observers to different lights and colors may generally be the same, it is not definitely known that everyone sees the same color at any given time. If everyone sees the same differences, there should be neither a problem in matching a sample with a standard, nor should there be disagreement between individuals concerning dyes-stuffs necessary to match a given sample.

Many factors intervene which distort or otherwise upset man's ability to match colors. Among the problems involved are those of the age of the individual, his psychological outlook, the physical state of the individual, and the activity of the eye and brain. A designer of photo electric colorimeters stated that the human eye is much too good for designers to compete with at reasonable cost. The eye is provided with thermostatic equipment keeping it at constant temperature ± 1°C. The eye comes equipped with cleaning devices (the lids which clean off the surface). The cornea has correct spectral sensitivity. It comes supplied as standard equipment with no extra charge. The main problem is that it happens to be attached to an erratic computer—the brain. It is possible that the brain is at fault, but the make up of the eye and its response vary with individuals.

The eye consists of two essential elements. The focusing element contains the cornea, pupil, lens, and the vitreous humor. The color sensitive elements are the rods and cones. These rods and cones are the sites in and around the foveal pit collecting the energy and forwarding it to the brain. The rods are scattered about the periphery of the foveal pit and respond to very small amounts of light. These are the elements of the eye enabling the distinction between degrees of brightness. The rods are responsible for night vision in which the ability to discern between achromats is essential. Rods transmit light sensation to the brain via bundles of optic nerves and thus remove the sensation of color. On the other hand, more nearly centered in the foveal pit are the elements known as the cones. The cones require higher levels of illumination. As light collects on the cones, a message is transmitted to the brain which is reinterpreted as color. Figure 3 indicates the relative areas of maximum activity of both the rods and the cones. It is seen that maximum response to relative illumination is attained in the central portion of the visible spectrum. On the other hand, the rods respond at shorter wavelengths. The curve for the cones is similar to the luminosity curve of the standard observer.

When an object is viewed the relative amounts of absorption and/or reflection of light incident upon the object surface must be carefully weighed. Basically, without an object there can be no sensation of light. The sensation of light is achieved only when light has been deflected from its normal path. Light can be seen only as a contrast. Since light travels in a straight line, some portion of the light will be reflected or absorbed when it strikes an object. If the object is transparent, the light beam is refracted and thus changes occur in the optical parameters of the sample being viewed.

When a sample is viewed or compared with another sample, the background against which they are
SONOCO leadership meets the challenge...

...the only yarn carrier research facility!

The only yarn carrier research facility in the world is located at the Sonoco plant in Hartsville, S.C. Thus, Sonoco stands alone with the modern equipment and the experience needed to solve the industry's yarn carrier problems. This valuable service is always available to Sonoco customers at no charge.

Continuous research at Sonoco covers all phases of yarn processing and the related utilization of paper cones, tubes, cores and spools. This effort is specifically directed toward developing better, more economical yarn carriers for use in the production of improved textiles.

Every Sonoco product has this extra ingredient of research background, representing more than 60 years of leadership. That's why you can always look to Sonoco for the best in yarn carriers!
viewed must be taken into consideration. The incident light is absorbed and reflected by the background. The background colorant absorbs lights and thus contributes to the samples viewed. This action may cause illusionary effects. A red color viewed against a blue background may appear yellowish. The same red viewed against a yellow background may appear bluish while an orange viewed against a blue background may appear brighter. A green viewed with a yellow background appears bluer. On the other hand, achromats tend to maintain more nearly uniform rendition of the color.

Lord Kelvin made the statement that a subject is not fully understood until it has been reduced to mathematical terms. The CIE Color System, commonly used for the interpretation of data, is an attempt to follow this concept. The derivation of the CIE Chromaticity Diagram is based upon colorimetry.

It should now be apparent that a given observer is capable of matching samples by mixing the three primary colors in selected combinations. However, instead of converting the equal energy spectrum into lumens per watt and then matching with the primaries on a lumen per lumen basis the matching might be applied directly to the energy of the of the equal energy spectrum. The results are expressed in terms of lumens of red, green, and blue required to match the unit energy at each wave band. The red, green, and blue primaries are directly related to the x, y, and z bar values of the tristimulus specification of the spectrum stimuli. Figure 4 is a graphic representation of the x, y, and z bar values necessary to match a given color at any given wavelength. However, since there is no color unless there is an illuminant, the values of the illuminant at any given wavelength must also be considered. A mathematical expression may therefore be derived involving the illuminant, the spectral reflectance of the sample, and the tristimulus specifications of the energy spectrum. The energy distribution of the illuminant is expressed in watts per wave band. The spectral reflectance of the sample is dimensionless while the tristimulus specifications of the equal energy spectrum are expressed as lumens of red, green, and blue per watt. The final dimensional analysis of the CIE method therefore becomes the product of these three factors, and the total reflected (or transmitted) red, green, and blue for all of the wave bands equals the tristimulus values for the samples or their equivalent stimuli in terms of the primary. The mechanics of the system are the products of the relative energy of the illuminant, the tristimulus specifications, and the transmittance or reflectance of the sample at selected wavelengths. If this system is followed wavelength by wavelength then the addition of the bar values of x, y, and z are product values yielding the X, Y, and Z values. These values are the total area under the curve. If these values are now plotted, a tridimensional graph must be used. However, by reducing these values to unity, a planar diagram can be utilized. The Chromaticity Coordinates of the CIE Chromaticity Diagram are found by the following equations:

\[
X = \frac{X}{X + Y + Z}
\]

\[
y = \frac{Y}{X + Y + Z}
\]

\[
z = \frac{Z}{X + Y + Z}
\]

It is seen that the values of x, y, and z should now total unity or 1.00. The precision of the CIE Method is usually adequate for the subtle distinction of color. However, the Chromaticity Coordinates by themselves do not provide complete information. A case in point is that white, grey, and black are of equal energy and should have the same coordinates (x = 0.33; y = 0.33). The difference here is one of reflectance and not of chromaticity. Therefore provision must be made for including these attributes.

As stated before, color description is a tridimensional affair consisting of hue, purity, and lightness. In the CIE terms these attributes are designed respectively as dominant wavelength, excitation purity, and luminous reflectance. Each of these may now be specified in Figure 5.

Using the Chromaticity Diagram, it is theoretically possible that a straight line connecting any two
if you're looking for...

an opening / an opportunity / a career / a break / a future / a spot / a chance
a beginning / a position

in the textiles / fibers field in...

marketing / sales / research / administration / engineering / management
technology / merchandising / design

you should know what Beaunit has to offer!
Tell us about yourself now and your plans for the challenging years ahead.

BEAUNIT CORPORATION
Dept. B, 261 Fifth Avenue, New York
points of specification producible by the additive combination of the terminal colors. Therefore, colors may be specified in terms of the Wavelength represented.

A straight line is drawn from the chromaticity point of the illuminant through the chromaticity coordinates so as to intersect the perimeter of the Chromaticity Diagram. The point of intersection is known as the dominant wavelength and is stated as such.

![Chromaticity Diagram](image)

**Figure 5.—Chromaticity Diagram**

The ratio of the distance from the sample point to the distance from the spectrum locus to the illuminant point to the distance from the spectrum locus to the illuminant point is called the excitation purity. This represents the proportion of spectrum color of specified dominant wavelength in a mixture of spectrum color and illuminant color required to duplicate the same color. A pure color would have its coordinate points near the spectrum perimeter while a dull color should be located near the illuminant. The luminous reflection is the ratio of the Y tristimulus value for the sample to the value which Y would have if the reflectance were 100% for every wave band of the spectrum. The product of the energy of the illuminant and tristimulus specification of Y at selected wavelengths is calculated. The sum total of these values equals the Y values for the tristimulus specifications of a given illuminant. This value is then divided into the Y value of the sample.

A further attribute of the chromaticity diagram is that purples are apparently not possible in this diagram. Purples are not present in the spectrum. However, purple is the complement of green. If straight lines were drawn from the locus of illumination to the 400-700 millimicrons points of the Chromaticity Diagram, a triangle is formed. Within the confines of this triangle are located the purple and other blue red mixtures. In order to determine the dominant wavelength of a purple sample a straight line is drawn from the chromaticity coordinates of the sample through the locus of illumination. The line is then extended to the perimeter of the Chromaticity Diagram. A purple should pass through the green area of the diagram. In order to specify this color, a subscript c is used immediately following the dominant wavelength criteria. An illustration is that if the point of intersection were at 550 millimicrons the dominant wavelength should be written as 550 c.

Analysis of the Chromaticity Diagram reveals the fact that equal changes in chromaticity coordinates are not directly relatable in color spacing throughout the entire Chromaticity Diagram. (Attempts to make these spacings more uniform have been made by transformation to the Munsell, Hunter, and Mac-Adams Systems.) For detailed treatment of the various transformations the book *Color In Business Science and Industry* authored by Deane B. Judd and Gunter Wyszecki is recommended. This book should be in the library of anyone concerned with color measurement.

Color measurement is a complex system of variables currently being used to advantage in the textile industry. Anyone approaching the subject of color measurement should analyze each spectral curve with regard to the sample measured so that a series of mental images may be formed over a period of time. The neophyte should approach color measurement with the knowledge and assurance that errors will be made. However, the object is to reduce or minimize these errors over a period of time so that definitive relationships are formed and may be used to advantage despite any system or instrument being used.
What are your plans after graduation?

When you cross from a life of preparing to one of performing, what kind of career should you choose? Are you thinking about research—academic or industrial? Or production, or sales, or management?

While you still have time to decide, why not have a talk with men who might offer new slants? These are men with a background of unusual accomplishment in textiles, chemistry, physics and other sciences—the men at Leesona.

Leesona Corporation is well known to every progressive textile man as the developer of the Unifil Loom Winder, the Uniconer Automatic Cone Winder, and other cost saving equipment that contribute much to improved textile production.

Leesona is known too, in other fields, for achievements that include:

**Nuclear Batteries and Timing Devices**, used in military and space systems.

**Coil Winding Machinery**, serving in control, communications, and automotive fields.

**Research and Development**, in such diverse areas as fuel cells . . . ICBM components . . . infra-red devices . . . electro-chemical power sources.

In expanding its activities in such areas, Leesona needs talent competent for scientific investigations. If you feel that the Leesona program may have potential for you in your own career, why not have a talk with a Leesona representative?

There are opportunities at Leesona for graduates whose chief talents and interests are in the fields of textiles, physics, mathematics, metallurgy, ceramics, electronics and all engineering disciplines. Just write to Personnel Director, Leesona Corporation, Warwick, Rhode Island.

To help you decide—talk to Leesona!
ALL OF US recognize the great heritage of the textile industry.
It was the industry which made the industrial revolution successful.
It was the industry which began the American factory system.
It is the industry which has met every challenge thrown to it in times of national crisis.
It is the industry which has borne the brunt of our concern for reshaping the world's industrial structure since the end of World War II.
It is the industry to which the emerging and developing nations of the world seem inclined to turn as their first, tentative step toward industrialization.
But the textile industry as it exists today is not the industry we knew a generation ago.
It is not the industry the emerging nations believe it to be.
Despite our best efforts to tell the true story of modern American textiles, it is not the industry so many of the American people think it is.
Fundamentally, the difference lies in a change of pace, a change of direction, a change of philosophy. It lies in a move toward mechanization and automation—the use of brains instead of brawn—a greater emphasis on the skillful use of capital rather than a massive use of labor.
From its earliest days, the textile industry has always been a machinery-conscious industry. But it was machinery-conscious with limitations. Hands had to be involved. There were mental and physical barriers to speed and efficiency.
For more than 150 years, this philosophy prevailed in the industry’s higher echelons. It was reflected in the view that the expedient thing in capital spending was to limit expenditures to no more than depreciation allowances—woefully inadequate as they were in an inflationary economy. That meant little more than the maintenance and modernization of installed machinery and equipment, with a sprinkling of replacements. That philosophy has disappeared in the past few years.

SPENDING AT ALL-TIME HIGH
In 1963, the textile industry’s capital spending hit an all-time peak of $640-million, an increase of 40 percent over 1950. In 1964, more than $760-million was invested in new plants and equipment, another record and 19 percent higher than the previous year. It is astounding to note our industry is spending 14 percent of its net worth on expansion—the highest percent of capital expenditure of any major industry in the United States.
This spending is a deliberate, calculated, positive step into the future. It is part of a movement that has brought us to a point where we have spent, including this year, more than five billion dollars for modernization and expansion since 1952.

The money is going for bricks and mortar, refrigeration and high-speed, high-efficiency machinery and equipment which will produce what you say
your customers need and want. It is going for the development of a thoroughly modern capacity to meet an anticipated increased demand as the average of the nation’s population drops in the next few years.

In short, the money is going into the development of the physical plant and frame of mind we would have thought impossible only a few years ago.

RESULTS HAVE BEEN DRAMATIC

In the years immediately prior to World War II, spindle speeds were 8,700 revolutions per minute. Today for the same yarn we get 13,500 revolutions. Drawing is three-and-a-half times faster, combing has increased 40 percent in production.

The preparation of yarn for weaving can be done three times faster, with greater quality control, than was possible only a few years ago.

Weaving speeds have been increased more than 100 percent with the shuttleless loom.

Color selection and control in the finishing processes can now be handled faster and with greater efficiency and accuracy by computers.

The net effect of these and other developments can be measured in many ways. One of the most effective is to consider that the number of processes necessary to produce print cloth has been reduced from 11 separate operations in 1920 to just six in 1964.

Even this is not enough, for the focus in technical development now is on the refinement of such things as a continuous automated spinning system which will lead to further consolidation of the number of production processes. In fact, the whole idea of process development is an exciting one among machinery manufacturers and textile production personnel.

PRICE TAG vs. PROFITS

In terms of cost, this revolution in the textile industry’s technical structure carries a high price tag.

At the turn of the century, investment in a cotton cloth mill amounted to about $13 per spindle. That is: a 50,000 spindle mill would cost about $650,000.

Today, the same size mill would mean a total investment of about $295 per spindle, or a total of nearly $15 million.

Put another way, the investment per employee in a cloth mill in 1900 was about $1,300. This covered buildings, machinery, land and working capital. Compare this with Dan River’s recent announcement of their new plant in Alabama. Mr. Erwin estimates an investment of about $10 million to create approximately 200 jobs—a cost of $50,000 per employee.

All of this is an impressive record of accomplishment for an industry which has, unfortunately, become accustomed to a net profit of about two cents out of each sales dollar. This fundamental limitation of capital makes modernization and expansion a strain more often than not, but we have no alternative for at least two reasons.

COMPETITION FORCES US TO CONTINUE

The first reason is the competitive element. I don’t need to tell you about competition and how to sell textiles in the fact of it.

I think, however, that it would have raised the hackles on even the most hardened and realistic of you if you could have sat with us in Zurich, Switzerland at the annual meeting of the Committee of Management of the International Federation of Cotton and Allied Textile Industries. Practically the entire time was devoted to reviews of the structure of the textile industry in IFCATI’s 21 member nations.

We listened to country after country, developing as well as industrialized, report the structural changes taking place: the age of their equipment, the rate of modernization, the degree of verticalization, the percentage of capacity being used, the change in skill requirements of employees, and the awesome capital necessary to move ahead.

A few of the countries present complained about the way in which the United States government was implementing the Geneva arrangements. You will all recall the purpose of the arrangements was to accomplish three things:

(A) Control soaring imports into certain countries that were bearing more than their share of the load;

(B) Open up closed or restricted markets in countries;

(C) Provide a means of an orderly expansion of trade by the developing countries to the developed countries—or, in other words, a participation in the growth of these markets.

No fair-minded person should criticize our administration of these arrangements as being too far restrictive. On the contrary, we can point out many instances where certain categories of imports have gotten completely out of control.

When we started down this arrangement route in the summer of 1961, imports were running at an annual rate of 813 million yards. In the first year of the long term arrangement they increased to 1,122 million—more than 309 million yards. And, of far more importance, our increase alone is greater than the
total imports of many other developed countries. Not a single country has had their access to our market lessened. Everyone has the right to import more than they were doing. Many have been given increases through bilateral agreements, the latest example being the unjustified favorable treatment of Hong Kong when they were given increases in two critical categories; corduroy and duck.

Always remember—nothing in the long term arrangement guarantees any exporting country a share of an importing country’s market. It has to be competitively earned.

The arrangement is in force and it opens our market to overseas manufacturers in any country which has a textile industry, and they fully intend to exploit these openings to the limit.

**INDUSTRY HAS BECOME MARKET-ORIENTED**

In addition to this competitive basis for our modernization and expansion, there is an additional reason for continuing our high rate of capital improvement. That is to acknowledge the shift within the textile industry from one of manufacturing orientation to one of market-orientation. We have at last begun to operate with our emphasis on the production of goods which will sell, as opposed to selling products whose only virtue is that they can be made efficiently.

Of course, efficiency continues to be a prime ingredient in our total effort. However, the fundamental truth remains that our goal is the satisfaction of demands for quality from our customers, from the consumers of textile products.

**ATMI’S NEW TEXTILE MARKET DIVISION**

Our experience with two-price cotton has provided us with some harsh lessons in the importance of orderly marketing. These lessons have served too, in focusing attention on the concept that the pressures we will continue to face make it mandatory that the textile industry develop itself increasingly as a market-oriented activity.

Selling yarn and cloth has never been a bed of roses. It is a world of few secrets, a multitude of companies making similar products, and quicksilver price points which have a habit of disappearing in the face of a competitor’s lower offer.

But has there ever been a time when we were closer to market hysteria than as we waited for Congress to settle the cotton question?

There is nothing worse than ignorance. We didn’t know what was going to happen and our only comfort lay in that we had plenty of company.

Fortunately, we had some cool heads operating in the market and we rode their knowledge through the
crisis. We made the necessary price adjustments to accommodate shifting inventories, reluctant buyers, fluid price structures, and the prospects of a cotton cost reduction.

With the survival has come a precious knowledge of many things.

**WHAT WE LEARNED**

Primarily we learned that the textile market—like textile production—has been in a state of continuous evolution and that it is not the market we knew a generation ago.

We have learned something of inventory management. We have learned that no one can afford to carry massive inventories at current prices, and that pipelines must be shorter and freer-flowing.

We have learned something about balancing supply and demand, moving closer to the mainstream of American business in terms of business cycles and the effect of marketing on them. We are adapting to our marketing structures the latest developments in cost accounting, systems controls, electronics, and the more refined aspects of selling, including the base for effective advertising.

Underlying all of these is the seemingly simple knowledge that we are no longer a captive of a single fiber. We are, in fact, a multi-fiber industry with a wide range of fiber and product interests. We have a wider range of higher quality products to sell. We have a broader raw material base to choose from, and we are involved in a surge of technical development which is providing both the equipment and the knowledge to accommodate this new production concept.

These are radical changes in a structure which for so many years was little more than a glorious tradition. But their very nature creates for us the opportunity to make something of the textile industry that it has never been before.

**WHERE WE STAND TODAY**

The industry at the moment is a solid, sound, progressive industry which has its eye on tomorrow and the day after tomorrow. Because it is a healthy industry, it has the necessary capital to make needed improvements and the necessary resources to stimulate the discovery of new concepts. We have, in fact, no more problems than any other major industry in this country.

Our competition will not lessen. In terms of international trade, our competition will grow since the developing nations are demanding and they will get a better standard of living and a wider share of the world’s trade. But, as the president of the International Federation of Cotton and Allied Textile Industries stated: “No permanent solution to a social or economic problem has ever been found by taking away from the rich and giving to the poor. It is much more complex than that.”

The solution to the whole question of competition lies in the skillful use of resources to create a broader, more vigorous market place. It lies in better earnings, better representation in the securities market, a better return on investment and more skillful people throughout the system.

The number of production jobs in the textile industry has been reduced about a third in the past 17 years. The jobs which remain demand more skillful people and their rewards are commensurate with their ability.

Textile marketing has always been, it is now, and it probably will always be a rewarding occupation. But the rewards of the years ahead will go to those who move with the concepts—adapting, progressing, learning constantly.

**OUR CHALLENGE OF TOMORROW**

Within the framework of our industry, we take a great pride in our record as realists and we speak very freely of the opportunities which may lie before us. We can take advantage today of both these traits by facing squarely the biggest opportunity of them all, and that is: to move this whole industry of ours into the mainstream of our time.

---

**Ralph E. Loper Co.**

**INDUSTRIAL ENGINEERS**

SPECIALIZING IN TEXTILES FOR OVER FIFTY YEARS

- Cost Systems
- Work Load Studies
- Cost Reduction Reports
- Management Problems
- Plant Layouts
- New Mill Planning
- Modernization Programs
- Confidential Reports

**GREENVILLE, S. C.**
P. O. Box 996, Tel. 232-3868

**FALL RIVER, MASS.**
P. O. Box 2109, Tel. 676-8261

**SUMMER ISSUE 1965**

SEVENTEEN
For 174 years the textile industry has been a major industry and a basic one. But for two many of those years, we have merely flirted with the potential greatness that lies within the industry’s structure.

In the past decade-and-a-half, we have learned to stop tilting at windmills and to start smashing barriers. Since 1950, the technology of textile manufacturing has been an impressive period of accomplishment.

In the years that lie ahead, the progress will continue only as long as we learn to market what we have learned to manufacture. The opportunity will be fulfilled only as long as we justify the new concept of a market-oriented industry, the belief that it is here—with the orders and the sales—that the process both begins and ends.

Geographical Range: About 8,000 plants are located in 42 states, with greatest concentrations of the Atlantic Seaboard and in the Southeast.

* * *

Employment and Payroll: 900,000 employees in the textile mill products industry earn nearly $3,700,000,000 or almost 3.75 billion.

---

CRAWFORD MILL SUPPLY CO., INC.

1317 Union St.

Dial 582-8165 SPARTANBURG, S. C.

Gates Textile Products

Sylvania Lighting

Anti-Friction Bearings

and

Other Power Transmission Items

---

Stehedco THE QUALITY LINE

The World’s Most Complete Line of
TEXTILE WEAVING SUPPLIES

You must have the best quality equipment of the most advanced design to produce the finest quality fabrics consistently and with true operating economy.

Every Stehedco Product is quality engineered to weave perfect fabrics most economically and with least possible down time or replacements.

Remember Stehedco for quality and perfection. Ask at any time to have one of our qualified Sales Engineers help you to solve your problems.

STEEL HEDDLE MFG. CO.

PHILADELPHIA 32, PENNSYLVANIA

Greenville, South Carolina—Greensboro, N. C.—Atlanta, Ga.

Lawrence, Mass.—Granby, Quebec, Canada—Textile Supply Co., Dallas, Texas—Albert R. Breen, Chicago, Illinois.

---

THE BOBBIN AND BEAKER
RICHARD ALLEN HILES

Richard Allen Hiles is a twenty-one year old Textile Chemistry major from Asheville, North Carolina. He has received honors since his sophomore year at Clemson.

To aid with his expenses at Clemson, Richard has received a Massengill-De Friece Foundation Scholarship, a South Carolina Manufacturer’s Association Scholarship, and a Calloway Mills Company Scholarship.

While at Clemson, Richard has been a member of the American Association of Textile Chemists and Colorists and Phi Psi Fraternity.

Richard has gained valuable experience in the field of Textile Chemistry by working for American Enka Corporation in Enka, N. C.

After graduation he has an assistantship and plans to do graduate work in Biochemistry at Michigan State University.

EDGAR C. CROW

Edgar C. Crow, from West Palm Beach, Fla., is a twenty-two year old Industrial Management major. Ed has received a tennis scholarship while at Clemson.

On campus Ed has been on the Atlantic Coast Conference Honor Roll his sophomore, junior, and senior years. He received high honors his freshman and sophomore years and highest honors his junior and senior years. Ed has also been a member of Phi Eta Sigma, Phi Kappa Phi, the varsity tennis team, Pre-Law Society, Industrial Management Society, and the Society for Advancement of Management.

During vacations Ed worked for the West Palm Beach Recreation Department and has served as tennis instructor and program director at Camp Carolina in Brevard, North Carolina.

Ed plans to do graduate work in the School of Finance, University of Pennsylvania after graduation.

FRANK BUIST EAVES

Frank Buist Eaves, a twenty-two year old Textile Management major, is a native of Barnwell, South Carolina.

To aid in his expenses at Clemson, Buist has received an Allied Chemical Foundation Scholarship.

Buist is enrolled in Army ROTC and will receive his commission upon graduation. He is also a member of American Association of Textile Technology and Phi Psi.

He has gained valuable experience in the textile industry by working three summers at Barnwell Woolen Mill, a division of Deering, Milliken, Inc., located in Barnwell, South Carolina.

After graduation, Buist is planning to accept a position with Burlington Industries after two years duty in the Army.

SUMMER ISSUE 1965
Always open

At Whitin, the doors are always open for new ideas and to new people. The success of any organization is directly proportional to its willingness to base its growth on the thinking of dynamic, creative, forward-looking people — people with the special knowledge and abilities to translate new ideas into practical plans and programs. Whitin has welcomed many. Each has made significant contributions to the improvement of Whitin products and services.

From this "open door policy" Whitin expects to provide additional benefits for its customers — "extra" values to make their mill operations more profitable.
Professional Development Courses

As of June 14, 145 applications were on hand. These were from many different industries, and represented 16 states and Canada. All indications are that the summer of 1965 will see, by far, the largest number of persons taking a Professional Development course of any one summer since the program began in 1958.

The courses are for individuals in industry. They are created, and revised, to comply with requests and suggestions from management of the various industries.

SCHEDULE OF COURSES, 1965

June 7 through 18:

P. D. 43—Basic Textile Chemistry

June 21 through 25:

P. D. 22—Introduction to Textile Manufacturing, Dyeing and Finishing.

June 21 through July 2:

P. D. 25—Yarn Manufacturing
P. D. 38—Supervisor Development
P. D. 41—Methods Analysis and Time Study
P. D. 44—Advanced Textile Chemistry

July 12 through 23:

P. D. 25—Yarn Manufacturing (a repeat)
P. D. 41—Methods and Time Study (a repeat)
P. D. 47—Quality Control
P. D. 56—Weaving: Fabric Design and Development
P. D. 79—Graduate Seminar in Industrial Administration

Plans are already in the making for the 1966 Professional Development program. Anyone wishing to be placed on the mailing list for professional development catalogs, and other information, should write Prof. C. V. Wray, Coordinator, Sirrine Hall, Clemson University, Clemson, S. C. 29631.

This picture shows one student from each state represented in Professional Development enrollment, of 90 persons. June 21-July 2, 1965.


Industrial Management
Undergraduate Research Abstracts

Rigid Polyvinyl Chloride, A Thermoplastic
Pearce W. Hammond

This report consists of four main sections. Section One consists of an introduction which concerns itself with the characteristics of Rigid Polyvinyl Chloride. In Section Two the present applications of this thermoplastic are discussed showing the various fields in which it has found present employment. The Third Section deals with fields in which Rigid Polyvinyl Chloride shows great promise for the future. The last section embodies the conclusion in which Rigid Polyvinyl Chloride is compared with the entire plastic field, revealing the fact that Rigid Polyvinyl Chloride is rapidly growing both in applications and usage and, indeed, is a desirable and worthwhile material.

An Analysis of Radio Advertising in Retail Selling
Ralph F. King, Jr. and David P. George, Jr.

This study was undertaken to determine the patterns and practices followed by retailers in employing radio as a medium of advertising. In order to determine these practices, a standardized list of questions was asked selected retailers in Greenville, South Carolina.

The findings of this survey were then compared with theoretical practices which were obtained from texts on the subject. Having done this, the medium of radio was compared with its largest competition—newspaper.

From the findings of the survey and the study of its related areas, it was concluded that there are certain practices which are necessary for effective radio advertising. Although radio is not as effective as other media, it was found that it could be used profitably.

Synopsis of Milliken Tetra Pak, a Division of Deering Milliken
Stephen K. Long and George E. Davis

From observations of operations at Milliken Tetra Pak in Spartanburg, South Carolina, we gained most of our material for the report. Additional information was obtained from dairy companies and pamphlets on the subject.

The purpose of this report is to point out the effect that Milliken Tetra Pak will have on the packaging industry. Our purpose is achieved by describing the structure and operations of Milliken Tetra Pak. The value of Tetra Pak, uses, advantages and disadvantages, and future, add more proof that Tetra Pak will probably be the greatest invention in the packaging industry since the tin can. And since Milliken Tetra Pak has complete rights to the machines in this country, they should profit immensely.

Paul J. Wessinger and Ray W. Crenshaw

The purpose of this paper is to examine the Contract Department of Jantzen Southern, Inc., and to outline its procedures and relationships to the Receiving, Inspection and Packaging Departments. This research was not entered into with the intention of making deductions or improvements, but rather to determine and explain the operations of the Contract Department as it exists today.

The primary source of information for all data was a series of personal interviews with Contract Department Management. Further information was obtained through personal observation of the Jantzen facilities at Seneca, South Carolina, and examination of company manuals, information sheets and forms.

A chronological order was utilized in composing the material, and some assumptions and restrictions were made. The discussion was limited to knitwear because Jantzen's other lines are handled in a very similar fashion. We assumed the contracting of a new Jantzen manufacturer since the recontracting of a present manufacturer would be a greatly simplified version of the same procedure. Approximations were also made where any confidential figures were encountered.

While analyzing the activities of the Contract Department, several interesting facts were noted. Jantzen is somewhat unique in requiring a written contract of all manufacturers who produce garments for it. Secondly, Jantzen does not manufacture all of the garments which it markets. There are three main reasons for this: 1. Through the utilization of other manufacturers, Jantzen can obtain a greater volume of production and a more diversified line than could otherwise be produced; 2. Quality is higher when garments are produced on specialized machines by specialists; and 3. There is a great cost and capital investment savings recognized through the utilization of contracting.

TWENTY-TWO
The Growth of the Ceramics Industry in South Carolina
Frank C. Falls

This paper is intended to bring to light the growth of an industry in South Carolina which has a bright future, not only in South Carolina, but the entire United States—the ceramics industry. This paper begins with a brief history of the industry and continues to give information relating to the raw materials of the industry, the feasibility of a ceramics plant locating in South Carolina, and the growth of the industry in South Carolina over the past ten years.

The portion of the paper on the raw materials of the ceramics industry was taken for the most part from the library books. The information on the industrial resources of South Carolina came from correspondence with state governmental agencies and ceramics plants located throughout the state.

An Analysis of Aviation in Industry in the Southeast
William O. Martin and John M. Quarles

This is a study of the use of Aviation in Private Industry. It covers all phases of aviation with primary emphasis placed upon the use of private aircraft. The information was obtained in the most part from a questionnaire sent to 197 firms in the southeastern United States, from personal interviews, and from data furnished by various segments of the Transportation Industry in the form of timetables and rate charts. The information obtained was both statistically and qualitatively interpreted. The results were as follows: (1) Aviation in some form is used by over 99% of the firms contacted; (2) The use of company-owned planes is not widespread but is growing; (3) The main advantage of using private planes is the speed they have, and the main disadvantage in using them is the high cost of acquiring and maintaining them.

A Statistical Profile of Sewing Machines Operators in Garment Plants
Walter C. Ronemous

Industry of today is placing greater emphasis on increasing the efficiency of its workers through various means. One such method is the screening of applicants for employment. In this method applicants with the greatest amount of potential are selected to fill vacancies.

This paper is concerned with a study of the employees of four local garment plants in order to arrive at a stereotype description of an ideal sewing machine operator.

Though this study is not conclusive, it does bring to light many of the things which are related to a worker’s efficiency and the degree of his efficiency.

Adams
Durst
Harris
Ninety-Six
Plants

Chalmers
Greenwood
Sloan
Mathews

76 Years of Progress
1889 - 1965

GREENWOOD MILLS
“FABRICS WITH THE CHARACTER OF QUALITY”
A Survey of Dormitory Student Parking
Donald R. James and Kenneth F. Stovall

The purpose of this report was to present facts and data concerning the dormitory student with a car on campus. This report contains the G.P.R. of dormitory students owning cars, the type of car they own, and the present and proposed solution for solving the parking problem of dormitory students.

Information was obtained from the Traffic Office, Office of Student Affairs, the Campus Police Department, and a questionnaire distributed to students owning cars.

Based on information and data collected and evaluated, it was found that the parking problem is increasing as enrollment of students increases. To meet the demand for more parking space, it is necessary that permanent parking lots be constructed immediately and major proposals contained in this report adopted.

Analysis of Economic Growth of Anderson, S. C. 1940-1965
R. J. Carter, W. M. Lineburger and T. E. Martin

This paper is a study of the locational development of Anderson, S. C., in order to determine if von Thunen’s classical theory of plant location is applicable to the economic development of that city.

Our decision is based on information obtained from the following sources: The city directory, the telephone directory, material from City Hall and the Chamber of Commerce, personal interviews, and a survey of Anderson enterprises.

From the information compiled, and from maps drawn from this information, we were able to conclude that von Thunen’s theory does apply very well to Anderson. Although von Thunen’s theory was originally established for an agricultural area, we found only slight discrepancies in applying it to Anderson.

The Operations of the Anderson County Airport, Anderson, S. C.
Jerry P. Brown

This paper discusses the Anderson County Airport from its beginning to the present date. The history of the airport has been shown, and the present operations of the airport discussed. The major portion of the paper deals with the operations of Carolina Aero Service, Incorporated; Southern Airways, Incorporated; and the Flight Service Station at Anderson. All of the information in this paper was obtained from persons employed at the airport through interviews or materials supplied by them.

Radar — In a New Setting

Radar in a textile mill or a home laundry?

Not only possible but probable, according to engineering researchers at Georgia Tech, if certain discoveries can be made regarding the moisture-drawing ability of microwaves. The scientists already know that cotton and man-made fibers will dry faster when exposed to microwaves of radio wave length than when exposed to ordinary household radiant heat. Radar wave lengths are even shorter than radio wave lengths, but no one has ever been able to utilize them for bulk drying of textiles and textile products because no one knows exactly why microwaves withdraw moisture.

Textile manufacturers have utilized microwaves of radio frequency for several years to dry man-made fiber materials such as rayon. The cost is several times that of radiant heat, thus reducing cost efficiency, but the system makes a spectacular reduction in the amount of drying time required.

Radiant heat drying is slow because temperatures must be kept very low to prevent scorching. The use of microwaves eliminates much of the heat problem and the Georgia Tech scientists think that they can eventually build ovens which will utilize radar waves to cut the drying time for spools of yarn from several hours to as little as ten minutes.

For some of the initial experiments, the researchers are using a small microwave oven that is being produced commercially and sold to restaurants for reheating pre-cooked foods.

Turning A Corner

Much is being made these days of the revival of interest in the textile industry among the nation’s professional money managers.

For many years, these people turned their noses up at the mere mention of textiles. In more recent times, however, they have shown an increasing willingness to accept the fundamental truth that there is no industry more modern, dynamic and progressive than textiles.

In the language of Wall Street, the textile industry has “turned the corner.”

The textile industry has turned the corner because it never lost faith in itself. It has been beset by imports, two-price cotton, changing times and a host of other worries — but the firm foundation provided by almost a million loyal, hard-working people has kept the industry from sinking when few others shared its faith in the future.

“Turning the corner” in the eyes of the professional money managers is a major accomplishment. More than that, it is the proof of an industry’s ability to fight and win against seemingly overwhelming odds.

The Bobbin and Beaker
FLETCHER SHUTTLES look like most other shuttles

One shuttle looks and feels like most any other shuttle of the same type. Almost makes you think one's just as good as another.

How come then, that Fletcher, the booming, fast-growing youngster of the industry is already one of the "Big 3"? (Only third, mind you, but up there and moving right along.)

Being something of a late comer, Fletcher knew from the start that just to make a dent in the market you had to make a better product. Put more in it. Give better service.

One thing in our favor from the beginning: We didn't have to wait for old machinery to be amortized. New plants (two in the last three years, in fact) had temperature and humidity controls built in. Modern plant layout lets you operate at top efficiency. Keeps handling and maintenance to a minimum so savings can go into research and product.

An example is the plastic shuttle shown here. The materials used are especially engineered and fabricated for shuttles exclusively. They must pass our rigid quality control. Samples of the finished product undergo brutal durability tests. The result is a minimum weight shuttle with longer wearing qualities.

When you're third, you must be first in quality.

All Fletcher Shuttles are Fully Guaranteed for Quality and Performance.

FLETCHER SHUTTLES
Southern Pines, North Carolina
WHY RESEARCH?

Attention to research and development programs within the textile industry has received its greatest emphasis within the past few years. In the last eight years alone, the National Science Foundation says that textile companies, combined with the apparel industry, have increased their research and development spending from $13-million to more than $35-million annually.

Parallel with the striking increase in money allocated to research, the combined textile-apparel industry has almost doubled the number of full-time research and development scientists and engineers since 1957.

Thus, the trend is an upward one. In fact, more than half of all the industrial expenditures for research and development in the United States since 1776 has been made since the end of the Korean War.

For most of us, research sometimes seems so remote and far-fetched that we overlook much of what it means to us in practical, everyday terms.

Research keeps manufacturing products and processes up to date and competitive. It plants the seed for future growth, and it creates new jobs while it creates new products. There is no better illustration of these three points than the growing textile machinery company which said recently that about three-fourths of all its products didn't even exist in 1956. The company is completely dependent upon a modern and dynamic textile industry for its sales.

The white-coated men and women who work in the company labs may seem remote and withdrawn from the everyday problems of the production line. But they, and what they are doing, may very well be the best insurance policy the company has.

Index to Advertisers

American Enka Corporation ........................................ 27
Beaunit Corporation ................................................... 11
Crawford Mill Supply Company, Inc. .............................. 18
W. F. Fancourt Company ............................................. 26
Fletcher Industries ..................................................... 25
Gaston County Dyeing Machine Company ...................... 5
Greensboro Loom Reed Company, Inc. ......................... 21
Greenwood Mills ....................................................... 23
Leesona Corporation .................................................. 13
Ralph E. Loper Company ............................................ 17
North Chemical Company, Inc. .................................. 16
Pioneer Heddle and Reed Company, Inc. .................... 28
Royce Chemical Company ........................................... 2
Simmons Machinery Company, Inc. .............................. 12
Sonoco Products Company ......................................... 9
Steel Heddle Manufacturing Company ......................... 18
Whitin Machine Works .............................................. 20
So many good things begin with ENKA

- NYLON YARNS: Continuous filament yarns, Crepeset® nylon—the yarn with the "crepe" built in! • Blanc de Blancs® (white of whites) nylon yarn • Enkatron® and Enkalure® • Enkaloft® textured continuous filament carpet yarn • INDUSTRIAL NYLON YARNS • for tires, seat belts and other uses • TEXTILE RAYON YARNS • Natural continuous filament rayon yarns • Jetspun® solution-dyed continuous filament rayon yarn • Softglo® mellow luster rayon yarn • Skyloft® textured yarn • RAYON STAPLE FIBERS • Enka Zantrel® Polynosic® fiber • Kolorbon® solution-dyed carpet staple • Textile staple • High crimp carpet staple • Skybloom® super-crimp and high-crimp rayon fibers • Fiber I. T.® improved tenacity staple • INDUSTRIAL RAYON YARNS • Suprenka® high tenacity rayon yarns • Suprenka HiMod® high modulus rayon yarn • Tyrex® rayon tire yarn • POLYESTER tire yarn.

*Patents pending

AMERICAN ENKA CORPORATION

Return Requested

Pioneer

HEDDLE & REED CO.

PIONEER—
SERVING THE TEXTILE INDUSTRY—QUALITY PRODUCTS—EXCELLENT SERVICE

DRAW-RITE FRAMES AND HEDDLES
CONVENTIONAL FRAMES AND HEDDLES
PITCH BAND REEDS
DURAFLEX REEDS
DROP WIRES
ACCESSORIES

A southern manufacturer — prompt delivery — Full staff of Sales engineers at your service.

PIONEER HEDDLE AND REED CO., INC.
P. O. Box 10586, Atlanta, Georgia