winter issue

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COVER: Russ Campbell.

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Guest Article

YOUR COLLEGE CAREER

Alfred G. New, Plant Manager
Judson Mills
Greenville, S. C.

The young man who is entering college today has before him a wonderful opportunity to prepare himself for a successful career in many fields of endeavor. He is entering one of the most important periods of his life and should establish definite plans and goals for accomplishment. To a great extent, the type of job which he will obtain when he graduates will be governed by the record that he has made during the four years of his college career. For this reason, I will offer a few remarks that I hope will be of some assistance to the young man who is ambitious and seeking to get ahead. In presenting these thoughts, I make no claims to being either sage or philosopher, but am only passing on to you my observations and those of others in our company who have had experience with the placement and training of college graduates.

For the first time, in many cases, the college freshman is released from the ties of his home and family. He has the freedom to choose the way he is to spend his time during the evening and on the week ends. It is most important that this time be used wisely. Moral values must not be thrown aside. Affiliation with the campus church of his choice is highly desirable, for there he will have the opportunity of developing one phase which is not always covered in the classroom. Low moral standards have caused the downfall of many otherwise successful businessmen. Enough emphasis cannot be placed on this phase of the development of the college student.

Another ability which all of us constantly seek to develop is that of getting along with other people. Lack of ability in this area has caused the failure many times of capable and intelligent men. We constantly strive in our company to develop this ability in our supervisors, engineers, and management. The college student has many opportunities to develop his ability to deal with other people. The courses which are offered in psychology reveal the motivating impulses of man. Too often the student engineer passes over these courses lightly with the feeling that, after all, he plans to be engineer and not a psychologist. True, this is the case; however, we have not been able to locate a job in which the individual will not have to deal with other people. I would not hesitate to say that over 90% of our problems pertain to personnel, with the remaining small percentage being technical problems. The student who does not recognize this situation and does not do everything in his power to prepare for it is faced with a difficult road ahead. Study and practice the art of getting along with your fellow man.

There is another segment of your college education which I am afraid too many students take lightly. The courses offered to you in English, Public Speaking, and the allied fields are most important. Although, the engineering and technical students are often criticized for not placing proper emphasis on these subjects, surprisingly enough we find many graduates of liberal arts schools who are woefully weak in this area. When the college graduate becomes employed, he can expect to be called upon for various types of reports. At first, these reports may concern primarily his experiences in the company; however, as he progresses, he will become more and more responsible for preparing other types of business reports. In many cases, he will be appraised by the type of reports that he submits. It is not always easy to prepare these reports in a concise, informative manner. A good background in English is essential. The same remarks would pertain to public speaking. Most of us do not plan to make careers of public speaking; however, none of
us can avoid the responsibility of verbal presentation of our thoughts and work as we embark on a business career. Learn to speak and write well and practice what you have learned.

The three areas of possible development which have been discussed are most important in your college career. The college student who recognizes these areas and takes advantage of every opportunity to improve himself will be rewarded.

Participation in extra curricular activities is desirable. When the student graduates and becomes eligible for employment, the application which he will be asked to fill out will probably request that he list the record of his extra curricular activities. Do not join organizations for the sake of joining. Become a participant in the activities rather than just a member of an organization. The student who has participated to the extent that his fellow students have elected him to an office of responsibility has gained considerably from his affiliation with the organization. He is developing strong leadership potential and a sense of responsibility which will carry him far. Belong to and participate in worthwhile organizations.

The student should not overlook his responsibility to his parents and himself to attain the best possible scholastic ratings. It is likely that most students can, with a little more diligence and application, attain better grades at the same time that they are participating in a well rounded program of self-development. The graduate’s scholastic standing will be one of the factors considered by the potential employer. You will note that I state “one of the factors” and do so purposely, for I do not want to leave the impression that it is necessary or desirable for the student to become a “book worm.” Develop those talents which God has given to you.

Another suggestion which could be offered is that the student seek to spend the summer vacation periods in work that will relate to his chosen field of endeavor. Most progressive companies offer college students the opportunity of working with them during the summer months. Disregarding the financial advantages of such opportunities, the experience by the student in such work will be most valuable. The contacts with the people on the job will help to develop the ability of getting along with other people. The student will have the opportunity of evaluating the company which has employed him and the company, in turn, will have the opportunity of evaluating the performance of the student. Certainly, the company will feel an obligation to consider for permanent employment upon graduation, the student who has served well during the summer months prior to graduation.

While the young man is in college, he has the opportunity of developing his sense of loyalty. Things will not always go to suit each individual; however, the man who remains loyal to his associates when conditions are somewhat rough will move ahead with a feeling of pride rather than dropping back with a feeling of frustration. Constructive criticism is always desirable. Unjust or destructive criticism will harm the individual offering the criticism more than anyone. Be loyal to your family, be loyal to your college, and, when you go into business, be loyal to your company and business associates.

The opportunity is yours. There are two roads ahead for college students. One road offers the so-called easy way. He can take the line of least resistance and emerge with a college diploma and little else. The other road calls for a planned program and hard work. From this road, he will emerge with a diploma and a four-year record of achievements of which he may well be proud. When the student has traveled this road, he will have developed a way of life which will carry him far. Industry will seek him. He will have the opportunity of opening the door into a successful future.

To you, the college student, I pose the challenge. Which road will you take? What will you make of your college career?

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SIX

THE BOBBIN AND BEAKER
On the first day of July this year, after the retirement of Dean Brown, Professor Gaston Gage was appointed Acting Dean of the School of Textiles, Clemson College, Clemson, South Carolina.

Professor Gage was born in 1898 at Chester, South Carolina, attended Chester’s graded schools and graduated from Chester High School. He attended the University of South Carolina, served briefly in World War I, and entered Clemson College in January, 1919, after being discharged from the Army. He graduated from Clemson College in Textile Engineering in 1921.

After leaving Clemson, he went to work for Baldwin Mills at Chester, which later became one of Aragon-Baldwin group of J. P. Stevens & Co., Inc. Mr. Gage worked here until the summer of 1932, serving as paymaster, second hand of the weave room and overseer at various times of the card room, spinning room and cloth room. He returned once more to Clemson in September 1932, as an instructor in the Yarn Manufacturing Department of the Textile School. He was promoted to Associate Professor in 1943, a full professor in in 1946, appointed head of the Yarn Manufacturing Department in January 1949, and was appointed Acting Dean of the School of Textiles on July 1, 1957.

Professor Gage has served on the Faculty Athletic Committee and on the class schedule committee for over twenty years, and has also served one six-year term as Trustee of the Calhoun-Clemson School. He is also proud of the fact that he was at the organizational meeting of IPTAY, was a Charter Member, and has been a continuous member ever since.

Mr. Gage was married to Ruth Vardell on April 9, 1927. They have two sons, both of whom graduated from Clemson in Textile Engineering, one in 1951, the other in 1955.

Professor Gage is a member of the Kappa Alpha Order, Phi Psi Fraternity, the American Society for Testing Materials, the International Organization for Standardization, the American Society for Quality Control, and the Southern Textile Association. He is also an active member of the Clemson Methodist Church.

“For a good many years,” said Professor Gage, “fox hunting has been my hobby, but the nights got a bit too cold and long, and so I have now concentrated on bird watching.”
Clemson Chapter Receives S.A.M. Charter

By Alan Bell

Clemson's Chapter of the Society for Advancement of Management received its charter in a very impressive meeting held in the Gold Room of the Clemson House November 12.

Mr. Alfred New, President of the Senior Chapter of S.A.M. in Greenville, presented Mr. Norville Spearman, President of Clemson's student chapter, with the charter. Mr. New is known for his outstanding work toward the Greenville Chapter's advancement; also, he is Plant Manager of Judson Mills, a part of the Deering-Milliken chain.

Mr. Hezz Stringfield was principal speaker at the meeting. He is National Vice-President of S.A.M. Southeastern Region, and is Executive Assistant to the Director of Oak Ridge National Laboratory. Union Carbide Nuclear Company.

Clemson Chapter members were the dinner guests of the Greenville Chapter at the presentation-dinner meeting. President Spearman of the Clemson Chap-

ter conducted the meeting and he expressed the student members' gratitude to the Greenville Chapter for the interest its members had shown in coming from Greenville for the charter presentation.

Possession of this charter for Clemson's S.A.M. group will give added recognition to its members as they go out into their individual fields and will give the remaining members and future members of the organization a closer tie with other similar groups in numerous colleges and universities throughout the nation.

Phi Psi Tours Wunda Weve and Steel Heddle

By Wayne Freed

Seventeen members of Phi Psi, accompanied by Professor E. A. LaRoche and Mr. Deolindo Dominguez Vicente, Department Head, Federal Technical School of Chemistry and Textile Industry, Rio de Janeiro, Brazil, spent a day in Greenville touring the Wunda Weve Carpet Company and Steel Heddle Manufacturing Co., Southern Shuttles Division.

The group toured Wunda Weve first and were met by William Pate, Jr. Billy gave a brief background talk to the group in the conference room of the plant. He explained that the company made cotton, synthetic, and wool-synthetic blend rugs at their plant. The company employs a sales staff of about 35 who cover the nation.

Billy then went on to explain the basic processes in their rug manufacturing which include in their proper order: beaming, quilling, weaving, inspection and burling (repairing defects), finishing, inspection, latex coating of back, re-inspection, and shipping. Special sizes and colors are also made to order. An explanation sheet was also distributed in conjunction with the talk.

William Pate, Sr., President of the company was introduced and he welcomed the group. R. W. Crouch and D. L. Latham of the research and development department were also present to broaden the explanation of the workings of the plant.

The group was divided into three parties led by Mr. Latham, Mr. Crouch and Mr. Pate. Each party then toured the entire plant, watching all the processes and asking their guides many questions.

The tour ended when the parties again met in the conference room. Mr. Alex Mumford, Public Relations Director, talked informally with members of the group, and then souvenir pens and pocket notebooks were distributed to all.

The group then proceeded to Steel Heddle where they were welcomed by Joe Leaphart, the Personnel Director, and Clarence Frye, the Assistant Personnel Director. The group proceeded to the plant cafeteria where they had a very pleasant dinner.

The group then split into two parties led by Mr. Leaphart and Mr. Frye. The parties went through the plant and saw all the processes that are undergone in the manufacture of shuttles.

The group first went through the machine shop where the shuttle eyes are made. Then it proceeded through the electroplating lab where much contract work for automobile dealers with chrome plating is done.
Next the group went through the shuttle plant where the many processes in making the actual shuttle body were carried on. The group viewed each individual process through to the finished product.

The group also viewed the plant foundry in operation before returning to the conference room. Mr. Leaphart closed the tour by giving each of the Phi Psi group a souvenir shuttle with a thermometer.

**Mills Suffer on Cotton Program**

The federal government’s two-piece cotton system, which has been torturing textile mills for some time now, got a lusty verbal batting around from the first vice president of the American Cotton Manufacturers Institute recently.

The ACMI official, Halbert M. Jones, president of Waverly Mills, Laurinburg, N. C., said in a speech here that the government policy is “ridiculous” and that it “hurts everybody concerned.”

Under the two-price system, the government takes U. S. cotton under the price support program and sells it on the overseas market at a price 20 per cent below that which American mills must pay. Mr. Jones said:

“American manufacturers and consumers, of course, are the big losers because they must pay the higher price for their cotton and cotton fabrics. The manufacturers are forced to compete with foreign imports manufactured by extremely low-wage labor using cheaper raw material.

“Even foreign textile men, who are permitted to buy this cheaper cotton, say the policy is harmful because it makes market unstable.

“This program also has injured the cotton farmer. The artificial price of cotton has been a dominating factor in the sizable reduction in the amount of cotton consumed in the United States.

“Cotton’s position in the textile markets will continue to weaken unless and until there is a realistic one price system for American cotton throughout the world.”

The ACMI leader said that he is hopeful that the session of Congress starting in January will find a satisfactory solution to the problem.

**Phi Psi Pledges Twelve**

This year Iota Chapter of Phi Psi had 12 initiates who, through their hard work, have shown excellent grades in their scholastic reports. These men have been chosen from the upper one-fifth of the junior class and upper one-third of the senior class. The top two men from the sophomore class were also eligible for consideration.

The new brothers of the honorary textile fraternity are: Seated (L. to R.) Jack Lynch, TC; Inman; John D. Turner, TC; Inman; Cecil Hunter, TC; Green Mountain, N. C.; William J. Allred, TC; Clement; Charles Woodhurst, TE; Williamson; Ronnie D. Eaddy, TE; Johnsonville. Standing (L. to R.) are Dong Wha Kim, TE; Seoul, Korea; William Emory, TE; Spartanburg; Wayne Freed, TE; Aiken. Not present for the photograph were Robert Barker, TC; Washington. D. C.; Melvin Caldwell, TC; Rock Hill; and Harold Lingerfelt, TM; Morristown, Tenn.

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Celoriver Plant at Rock Hill

By Wayne Freed

Recently, a group of fifty-one students and four faculty members visited the Celoriver Plant of the Celanese Corporation of America located at Rock Hill, S. C. This trip was organized by the Clemson Chapter of the National Textile Manufacturers Society.

Immediately upon arrival, the group was conducted to the plant conference room where they were greeted by members of the plant management including B. H. Sands, Personnel Manager; J. C. Richmond, Training Director; and H. M. Parsons, Production Engineer.

Mr. Parsons gave a complete run-down on the preparation of "cellulose-acetate" with particular emphasis on the parts of the process from which the textile students might get the most benefit. The chart which Mr. Parsons used in his talk is shown, and a breakdown of his talk is as follows:

The basic process at Celoriver is divided into two sections: the chemical processing section where the raw material, cellulose acetate, is manufactured; and the textile section where the yarn is made and prepared for shipment.

Cellulose Acetate Preparation. The raw material for acetate yarn is cellulose acetate flake which is manufactured from the basic raw materials, cellulose and acetic acid. Cellulose is received in large rolls of wood pulp which are produced by a Celanese affiliate in British Columbia. The wood pulp is highly purified and contains about 99 percent alpha cellulose. The wood pulp is ground in attrition mills to make it more accessible for the reaction to follow. The first step in the reaction is the pre-swelling of the cellulose fiber with acetic acid to make the cellulose more reactive. This step is known as pretreatment. The pretreated cellulose is reacted with a mixture of acetic acid and acetic anhydride together with a suitable catalyst. During this reaction cellulose triacetate is formed. Cellulose tri-acetate is not soluble in acetone and a reverse or de-acetylation must be accomplished to obtain an acetone soluble product. This de-acetylation is called by the general term of ripening.

At the Celoriver Plant, two types of cellulose acetate are made. They are normal or secondary acetate and tri-acetate which is presently sold under the trade name "Arnel". The main difference in the process is that tri-acetate flake does not undergo the ripening step described above and, as will be described in the textile section to follow, is not spun from an acetone solution.

When the cellulose acetate leaves the ripeners, it is in the form of a thick dope. This dope is composed of cellulose acetate dissolved in acetic acid. It is necessary to separate the C. A. and the acid. This is done by precipitating the flake from the acid solution. Cellulose acetate is soluble in acetic acid as long as the acid concentration stays above 55 per cent. Therefore, to precipitate the cellulose acetate from the acid, sufficient water is added to the dope to reduce the acid concentration to 30 per cent. At this point, the majority of cellulose acetate leaves the solution as a white flake, somewhat resembling asbestos. This flake is washed acid free and dried for transfer to the Spinning Department.

Considerable quantities of weak acid are obtained during the preparation step. This acid is concentrated to 100 per cent by a solvent extraction distillation process and is reused in the process.

Spinning and Textile. The asbestos like cellulose flake is dissolved in acetone and given a thorough filtration, preparatory to yarn spinning. A thorough filtration is necessary to remove all foreign particles...
as the acetone dope solution must be forced through a spinnerette containing holes as small as 40 microns. The spinning operation is basically an evaporation procedure. The spinnerette through which the acetone dope is pumped is placed at the top of a heated cabinet. The streams of solution from the filaments fall through the heated cabinet and the acetone is evaporated leaving a filament of cellulose acetate. These filaments are passed over a feed roll to control the speed and are taken up on bobbins.

The bobbins from the spinning machine are transferred to the Twisting Department where the desired twist is put into the yarn. After twisting the yarn is put on cones or bobbins for shipping to the customer.

This process just described was the preparation of continuous filament yarn. Staple fiber is made in approximately the same way through the spinning section; however, the yarn from the spinning machine is not taken up on bobbins as in the case of continuous filament. The continuous stream of yarn from the spinning machine is processed through a crimer where a crimp is added to the yarn and then to a cutter where the yarn is cut into the desired staple length. Any length staple can be produced. After cutting, the staple fiber is baled and wrapped for shipment.

Arnel or tri-acetate yarn is manufactured in the same way as acetate yarn, except that another solvent must be used in place of acetone as the tri-acetate is not soluble in that solvent.

Following the talk, the group was divided into seven parties which then took a complete tour of the textile section of the plant. The individual groups were guided by Coy Hewett, D. B. Mattox, R. G. Higgins, H. H. Williams, W. C. Wylie, J. W. Free, and Dennis Betts. Questions were asked the guides as the tour progressed, and were answered to the satisfaction of everyone.

Following the tours, the group reassembled in the plant cafeteria for a lunch provided by Celanese. Further questions were answered, following the lunch, and then the group returned to Clemson.

J. P. Stevens Scholarship

Through the South Carolina Textile Manufacturers' Association, the J. P. Stevens Scholarship is awarded to a Freshman. The scholarship pays $500 per year for four years. The first of these scholarships went into effect last year and continues through four years. Another scholarship was awarded this year and grants will be awarded annually until four $2000 scholarships are in effect.

Prof. H. B. Wilson, Field Representative, School of Textiles, congratulates Vernon Gaskins, winner of the first J. P. Stevens & Company scholarship in the School of Textiles at Clemson. Mr. John K. Cauthen, Vice-President, S. C. Textile Manufacturers Association looks on.

Money in Cotton?
Ask J. Harris

It isn’t fair to call Jack Harris of Fresno, Calif., a “typical” cotton farmer. He isn’t. With 12,00 acres of land to plant, his “patch” is big business.

But Jack Harris concedes what many a colleague denies—there’s plenty of profit in cotton at 36 cents a pound. And Jack Harris proves it.

Earlier this year, Harris took 1,600 acres of his land out of production under the soil-bank subsidy program. The government paid him $209,000 for leaving the acreage idle.

On the rest of the land, he raised 10,436 bales of cotton beyond his authorized allotment.

The government cracked down and assessed a penalty of 18½ cents a pound on the “excess cotton.” Harris paid $965,995. Almost cheerfully.

It cost him about 15 cents a pound to produce the lint, he reports. He sold it at 36 to 37 cents. Even after the penalty charge, he made a lot of money.

And what does he think about crop controls and price supports?

“Ridiculous,” he says. “I believe we need some kind of cotton support for domestic consumption, but I think we should be able to compete on world markets without controls or guarantees.”

Jack Harris isn’t typical. But he makes an interesting point.
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Where Are They Now?

A survey was made of the Class of 1947 from the School of Textiles. Listed below are the names, positions and home addresses of the graduates who were located.

Abernethy, Ernest E. Jr., Sales Manager, International Textile Machine Co.; 400 Allendale Place, Charlotte, N. C.

Brady, John L., Manager Southern Accounting Office, Reeves Brothers, Inc.; 206 Foxcross Rd., Spartanburg, S. C.

Broadwell, William E., Quality Control Engineer, Deering Milliken Service Corp.; 503 E. Cohen St., Union, S. C.

Christenberry, T. E., Salesman, Bemis Brothers Bag Co.; Box 3364, Station A, Greenville, S. C.

Clark, James R., Jr., Superintendent, Woodside Mills, Greenville Plant; 3 Charles St., Woodside, Greenville, S. C.

Clark, W. D., Gen'l Sales Mgr., Textile Division, Celanese Corp. of America; 2628 Danbury St., Charlotte, N. C.

Crawford, Lewis A., Assistant Sup't., Joanna Cotton Mills Co., Box 147, Joanna, S. C.

Crowther, R. R., Exec. Vice-Pres., Fort Hill Bank & Trust Co.; Sunset Dr., Clemson, S. C.

Davis, Joseph W., Dept. Overseer—Weaving, Dan River Mills, Inc.; 427 Hampton Dr., Danville, Va.

Deaton, James E., Foreman, General Electric Co., Little Mountain, S. C.

DeLoach, Francis B., Sales, Seydel-Woolley & Co., Atlanta, Ga.; 205 E. Park Dr., Spartanburg, S. C.

Ellis, Paul B., Jr., Technical Staff, Springs Cotton Mills, P. O. Box 484, Fort Mill, S. C.

Garvin, Noel E., Plant Mgr., Cascade Mills, Burlington Industries; 146 Park St, Mooresville, N. C.

Goodman, M. Riggs, Sup't., Burlington Industries, Box 161, Shannon, Ga.

Heaton, Mack D., Ass't. Sup't., Columbia Mills Co.; 820 "K" Ave., Cayce, S. C.

Jackson, Fowler, Jr., Engineer, Standard-Coosa-Thatcher Co.; 404 E. Ladiga St., Piedmont, Ala.

Josey, H. A., Cost Engineer, Dan River Mills; 301 Randolph St., Danville, Va.

King, William Harry, President, IPA Southern, Inc.; 205 South "C" St., Easley, S. C.

Lee, David Carlisle, Supervisor of Production Engineering, Utica-Mohawk Cotton Mills, Division of J. P. Stevens & Co.; Route 5, Seneca, S. C.

Lindsay, William Edward, Planning, J. P. Stevens & Co.; 10 Maple St., Great Falls, S. C.

Littlejohn, W. M., Supervisor, Cost Section, Woodside Mills; 23 N. Garden Circle, Greenville, S. C.

Lowman, John B., Foreman, General Electric; 716 Arrowwood Road, Columbia, S. C.


Merritt, Carl F., Sales Representative, The Hubinger Co.; Box 346-A, Piedmont, S. C.


Phillips, Robert M., Leader, Nylon Development Unit, American Enka Corporation; 10 Hillcrest Rd., Enka, N. C.

Robinson, Grady P., Overseer, Carding Department, Springs Cotton Mills, Eureka Plant; 884 Robbins Circle, Chester, S. C.

Rogers, Frank C., Jr., Vice-President, Reeves Brothers, Inc.; 132 Fairmount Ave., Chatham, N. J.

Seacord, James E., Jr., Ass't. Southern Mgr. & Salesman, Ashworth Bros., Inc., 4013 Hough Roard, Charlotte 9, N. C.

Sinclair, Carl W., Production Control Supervisor, Oak River Mills, Bennettsville, S. C.; 12 N. Main St., Clio, S. C.

Sutherland, A. C., Salesman, E. I. du Pont Co.; 1710 North Erb St., Appleton, Wisconsin.

Tigler, Leon, Technical Director, Eagle & Phenix Division, Reeves Bros., Inc.; 3025 Melrose Dr., Columbus, Ga.


Turner, T. A., Jr., Vice-President (in charge, Southern Division, N & W Industries, P. O. Box 809, Jackson, Mississippi.

Turner, H. Barrow, Vice-President, N&W Industries, Inc., 3005 Peakland Place, Lynchburg, Va.

Waits, James Kelly, Head, Stnd's Dept., Jonanna Cotton Mills; Joanna, S. C.

Walker, David W., Industrial Engineer, Eagle & Phenix Div., Reeves Bros., 3224 Camden Dr., Columbus, Georgia.

Watson, D. A., Chief Chemist, the Springs Mills, Grace Bleachery; 723 W. Grace Ave., Lancaster, S. C.

Whitten, Wm. C., Jr., Associate Professor, Clemson College; Box 656, Clemson, S. C.
Sírrine Library Serves School and Industry

By
C. Lamar Greene

A year ago, the Textile School Library was opened in its new location in the west wing of the Textile School. During that time, the Library acquisitions have grown considerably and the Library has been a source of reference for the Textile students and faculty, other departments of Clemson College, and members of various textile organizations. The J. E. Sírrine Textile Foundation provides funds for the library, which is operated as a sub-division of the Clemson College Library.

To accommodate those who are unable to use the library during the day and to provide a place of study for the textile students, the Library is open twice a week, on Tuesday and Thursday evenings from 7 until 10 P.M. A typewriter and a calculator are available in the work-room adjoining the library for the use of the students throughout the day and during the evening hours.

A Library Committee, headed by Dr. James H. Langston, and including a member of the faculty from each department, meets with the librarian to select new material to be added to the library. The latest available texts in the fields of textiles, management, chemistry, physics and related subjects have been acquired during the past year. In addition to its own collection, books that the library does not have, or cannot secure, are available through interlibrary loan from other libraries. Any suggestions regarding material to be added would be appreciated.

The library would also be grateful for any donations of books from its readers.

Currently received, and annually bound, are the following publications. Many of these are indexed according to subject, author and title and are a valuable source of reference. Listed below are those periodicals bound in the Library:

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<tr>
<th>Periodical</th>
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<tr>
<td>Advanced Management</td>
<td>1955 through 1956</td>
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<td>American Society for Testing Materials Bulletin</td>
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<td>The Bobbin &amp; Beaker</td>
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<td>Ciba Review</td>
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<tr>
<td>Instruments &amp; Automation Journal of the Textile Institute</td>
<td>1949 through 1956</td>
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<td>The Knitter</td>
<td>1943 through 1956</td>
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<td>Modern Textiles Magazine Personnel</td>
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<td>Textile World</td>
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<td>Whitin Review</td>
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Other sources of reference include the trade journals, technical service department publications, textile association publications, and the latest catalogs of textile and textile finishing machinery. Listed below are some of these publications which are on file in the textile library:

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<td>Agricultural Newsletter (du Pont)</td>
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<td>American Cotton Manufacturers Institute Bulletin</td>
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<td>American Cotton Manufacturers Institute Economic Report</td>
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<td>Amino Laboratory News</td>
<td>BCA News</td>
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<td>Apparel Manufacturer</td>
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<td>Avisco News</td>
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<td>Celanese Corporation of America—Technical Bulletins</td>
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<td>Chemstrand Corporation—Technical Processing Manual</td>
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<td>Cyanamid Pigment News</td>
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<td>Globe Review</td>
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<td>Good Year Chemical Division Manual</td>
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<td>Hosiery Industry Weekly</td>
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<td>Knitted Outerwear Times</td>
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<td>Rohm &amp; Haus Technical Service Bulletins</td>
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<td>Science &amp; Engineering</td>
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<td>Saco-Lowell Bulletin</td>
<td>Textile Machinery Society of Japan</td>
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<td>Underwear News</td>
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<td>U.S.D.A. Agricultural Research Bulletins</td>
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<td>Wright Air Development Center Technical Reports</td>
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THE BOBBIN AND BEAKER
Outstanding Textile Seniors

By
Charles Bagwell

David J. Spearman, is a Textile Manufacturing Senior and he and his wife are presently living in Greenville, S. C. David has received many honors during his first three years here at Clemson.

David is a member of the Clemson R.O.T.C. unit in which he has served as Cadet M/Sgt. and is presently a company commander with the rank of Cdt. Captain. David was recently awarded the Distinguished Military Student medal which is one of the highest honors that can be given in the Cadet program.

He is also a member of the Clemson Chapter of Phi Psi, and this year is president of the Clemson Chapter of N.T.M.S. He was awarded the Textron Foundation Scholarship for the period of 1954-1958. This scholarship pays $500 per year to the holder.

Robert E. Foster, Jr., better known around the campus as “Bob”, is a Textile Manufacturing major from Union, S. C. Bob has gained valuable experience working with the Excelsior Mill in Union where he has been employed by the Finishing and Industrial Engineering Departments for the past five summers. As well as experience, Bob has used his summer work to pay part of his expenses here at Clemson. He received honors the activities include his membership in the Clemson Chapter of N.T.M.S. Bob is also enlisted in the Army Reserve Program and a member of one of the local units.

Henry E. (Jack) Jennings, is a Textile Manufacturing Senior from Newberry, S. C. He and his wife are presently making their home here at Clemson.

Jack has been working during the summers to pay part of his school expenses and has worked one summer at the Oakland Plant of Kendall Division. He has served four years in the Navy.

His activities include membership in S.A.M., the Society for the Advancement of Management, and also in the Clemson Chapter of Phi Psi. Jack is also a member of the staff of THE BOBBIN & BEAKER and is presently Business Manager. He received honors both semesters of his Sophomore and Junior years.

WINTER ISSUE 1958
Looking at Fibers with X-rays

By
Dr. A. N. J. Heyn
Professor of Natural and Synthetic Fibers
School of Textiles
Clemson College, Clemson, S. C.

This article is a second one in the series on fiber structure by Dr. A. N. J. Heyn. The first article appeared in the fall, 1955 issue.

The most important physical properties of textile fibers such as strength, elongation, density, water and dyestuff absorption directly depend on the molecular structure. This structure is too fine for being directly seen with the light microscope being revealed by the visible light, which is too "coarse" for this purpose. In order to resolve particles of atomic dimensions, radiation of much smaller wave length than that of the visible light must be implored; electron beams or x-rays are suitable. The best method for studying atomic structures is, at the present time, the x-ray method, which is described in the present article.

X-rays are similar in nature as ordinary light, the only difference is that their wave length is about 10,000 times shorter. The x-ray method differs from light and electron microscopy in the following point: In light and electron microscopy, the radiation scattered by the sample is re-united by a lens system to form an enlarged image of the structure. In the x-ray method this last step is omitted; instead of looking at an image, one looks here directly at this radiation itself. This is necessary because no lenses exist yet which can refract x-rays to form an image. A model of the structure corresponding to an image, however, can be reconstructed by mathematical methods from this distribution of radiation. Scientists are working now to construct a real x-ray microscope in which special curved mirrors form an image just as the light microscope does with visible light, but this instrument has not yet been realized, so far, so that the laborious method of mathematical reconstruction has to be followed if one wants a complete model of the structure.

Such mathematical treatment, however, is by no means always necessary in order to make conclusions. On the contrary, in most cases important conclusions can be readily read directly from the diagram, if one knows the underlying principles.

The way in which a fiber is investigated with x-rays is illustrated by Fig. 1. (a) represents the x-ray tube, (b) a set of pinholes to obtain a fine x-ray beam (primary beam) which irradiates the fiber, (c) mounted in front of the pinhole system, perpendicular to the direction of the beam; a photographic film is placed at (d).

![Figure 1. Arrangement for x-ray investigation of fibers.](image)

When the beam of x-rays strikes the fiber, some of the energy is absorbed and then re-radiated. If the atoms in the fiber have no particular order, the re-radiated waves haphazardly, but if the atoms are organized in crystalline form, reflection of part of the x-rays in very definite directions takes place. This reflection occurs on the internal structures of the fiber, almost in the same way in which visible light is reflected by mirrors. The mirrors are, in this case, the crystalline planes in which the molecules of the fiber are arranged.

Figures 2 illustrates how the atoms or molecules of the crystalline areas of the fiber are lying in regularly spaced and recurring planes. If these planes are in the proper position to the incident x-ray beam part of the radiation is reflected in (Fig. 3), so that an exposed spot will be found on the photographic film behind the fiber. The composite of such spots form the characteristic x-ray diagram or diffraction pattern of the fiber. From the location of the spots on the film it is possible either to establish the complete structure of a crystalline material, locating the posi-
The diagram of cotton (Figure 6) is about intermediary between the diagram (a) and (b) of nylon, in that it shows arcs. This can be explained by the spiral structure of cotton in which the microcrystallites have preferent orientation, a state which is intermediary between random and perfect orientation.

The Bureau of Plant Industries has carried out extensive investigation on x-ray diagrams of cotton and found that the extent of the arcs varies in different varieties and indicates a different spiral structure in these cottons. It was found that this feature is directly correlated with the strength of the fiber and therefore is of great importance in cotton breeding. The x-ray method has therefore been extensively used by experts in agriculture and has lately been adopted in cotton testing. The bureau of plant industries has standardized the method so that any technician can rapidly carry out the x-ray examination.

Another example of the use of the x-ray method for quick solving of specific questions is the study of chemical modification of cotton. An example is mercerization. Since native and mercerized cellulose have different x-ray diagrams it can be directly seen from the x-ray picture.

Since each fiber has a different diagram, it will be very easy to distinguish and recognize different natural and synthetic fibers directly from their x-ray diagrams by comparison with a standard diagram.

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GREENSBORO, N. C.
A well-known application in rayon industries is the determination of the proportion of the crystalline and non-crystalline components from the x-ray diagram of the fiber; this quality determines many fiber properties.

The great importance even of the simplified x-ray method for the study of fibers will be clear from the above examples. At the present time, the synthetic fiber and rayon industries recognize the use of x-rays as one of the most important proofs in the evaluation of their products. It appears that this method, originated in basic research, is more and more being used in the applied field of fiber testing, and quality control.

Figure 4. X-ray diagram of ramie fiber.

Figure 5. X-ray diagram of nylon. (a) before cold drawing, (b) after cold drawing.

Figure 6. X-ray diagram of Upland cotton. (a) "Empire" x-ray angle 32°, and (b) variety Coker. 100 wilt. x-ray angle 44.2°.
A Study of Warp and Filling Ondule

By

W. E. Tarrant, Associate Professor
Weaving & Designing Department
School of Textiles

Specific Objectives: 1. To produce filling ondule from one beam using a new and simpler method.
2. To produce warp ondule from one beam without using special reeds and complicated attachments.

Reason for Project: According to some magazines and books, the added high cost of attachments prevents ondule from being produced in this country. The demand has been small and uncertain but I feel that the fabrics can be made cheaply and promoted for use in summer clothing and window curtains.

J. H. Strong, in his book on Fabric Structure, has this to say: “Weftway ondule has not been used to the extent it might be. The warp-way ondule is not produced on a large scale, but the dictates of fashion may bring it into favor at any time.”

Definition: “Ondule—a weaving term derived from the French word onduler meaning to wave.” Ondule is a plain weave fabric in which either the warp or the filling weaves out of line while weaving in a relative normal plane.

Background: The ondule principle is not of recent origin, similar goods having been made to some extent in the early 19th century. Filling ondule fabrics are of more recent origin than warp ondule fabrics. Ondule is placed in the novelty class as production is limited in cotton goods by several factors among which are: (1) costly loom attachments, (2) small and uncertain demand. In the early twenties, some New England mills manufactured ondule fabrics but the consumers refused to pay the high price and production was soon abandoned.

Filling Ondule: In this plain weave fabric, the warp is woven in a straight line and the filling is waved, or woven out of line. This is accomplished by varying the tension on the warp threads which in turn causes the picks per inch to vary in a warpwise direction. The method used and the manner in which it is used can produce three different types of filling ondule. Sample A consists of the thick and thin spot type made by varying the tension on a few ends every so often in the cloth. Sample B is an over all effect type made by varying the tension on adjacent groups of warp ends in alternating, or plain weave order. In sample C, the filling is waved with no thin spots.

This is made by using less tension and releasing the tension more gradually.

Filling Ondule Effect in Cloth: I found that I could vary the tension on a group of ends and produce filling ondule from one beam. Referring again to samples A and B on page 5. What causes the thick spot or place? What causes the thin place? With the loom running—first, I pulled a group of ends up quickly between the drop wires and whip roll. This pulled the picks back out of line at the fell of the cloth. Second, I held the group of ends up for six picks which allowed those six picks to beat up out of line since they were back of the fell. This made the thick place—more picks to inch. Third, I released the group of ends quickly and the warp ends and picks went forward beyond the fell of the cloth. And this made the thin place when the next few picks were put in the cloth. Repeating, the method is to pull the ends up quickly, hold them for several picks, and release them quickly. Pulling the ends up quickly and holding them up for several picks gives a thick place. Releasing the ends quickly gives a good thin spot. If you release the tension on the ends gradually you may not get a thin spot at all. The number of picks the group of ends is held up will depend on the tension of the warp and prominence of the spot wanted usually holding the ends up for two picks will not give a thick and thin place. This method appears to be different and simpler than the previous methods used. The next step was to find the best and simplest place to work it and how.

List of Places and Methods Tried or Considered:

1. At the fell of the cloth—pushing down on the cloth and releasing quickly produced irregular filling ondule. Objections: (1) could not control a definite number of ends every pick. (2) the temples were in the way.

2. Between fell of cloth and harness—a side pull—or upward pull—using various things. Objections: (1) anything here would interfere with shuttle and shed. (2) would be in the way of the weaver drawing threads. Exception, an ondule reed which is described on page 17. Perfected but not used.
3. Between drop wires and harness (a) a back harness with vertical bars—moving sidewise. Objections: (1) this would crowd the ends and since the opening position for the threads has to be held for several picks this would interfere with the ends changing position in the shed. (2) the pull would be too great to get the desired size spot. (b) a group of ends drawn thru two sets of harness. Back harness to give the extra tension only. This seemed to be a good idea. It had been done but not used. Why? I guess that the end breakage was too great — as the article said: "Some ends in the groups have a greater tension than others."

4. Between drop wires and whip roll. (a) a bar with vertical pins moving horizontal. Objection: (1) would crowd ends at the drop wires for several picks. (2) Too much pull to get the correct size spot. (b) two bars, odd group of ends over one bar and even group over the other. Moving up holding for several picks, and releasing quickly. Looked O.K. if bars could be worked from dobby. Objection: An extra bar would have to be used to pull the ends against to tighten them quickly. My type 3 opener is like this method.

5. Between whip roll and beam. (a) two bars pulling back on groups of warp ends—alternate pulls. Objection: (1) would be out in alley, (2) or would be in the way of a full beam. (b) Do away with whip roll and have two back rests—which could move back and tighten the groups of warp ends alternately. This had been tried but not used. Reason: Probably (1) due to variation in tension. (2) required too many adjustments. (3) too long a distance to tighten ends — beam to drop wires. (4) variable distance from full to empty beam—uneven spots — It appears that the best place to operate a device for making filling ondule will be between drop wires and whip roll.

**What device to use?** Although I am convinced the above place is the best place to work a device, I am considering other places and methods as they come to my mind. Hence, the following things are in no definite order.

1. Two leno type slackness—objections—(1) will not work using one beam as drop wires will stop loom when yarn slackens, (2) will be in the way.
2. Two leno type slackness—worked in reverse—to tighten yarn then slacken. Objections: (1) takes takes too much space—in the way, (2) leverage too great.
3. Easier bars—like those for leno when slackners are not used. It has been tried. Objections: according to book (1) spots are uneven, (2) has to be

adjusted to a “nicety” and kept in good shape, (3) too much checking and resetting.

4. Whip roll on loom with two back rests. Odd groups of ends over one rest even groups of ends over other rest. Objection—too much pull (2) in the way.

5. Rubber hose with core, spiraled around revolving whip roll. This makes wavy filling ondule but not the spot type. I tried this with a one half inch hose and the ends slipped off. I even put pegs varied, although the pegs were the same distance apart. The cloth was ragged. According to Textile Industries magazine, April, 1955, this has been done. My hose was too large for the diameter of whip roll used. Since I was interested in making the spot type filling ondule, I put off the making of waved type to a later date.

6. Rope around a moving whip roll—about the same as No. 5.

7. Half of garden hose around a revolving whip roll. About the same as No 5.

8. Two whip rolls, alternate groups of ends over each. About the same as No. 4.

9. Sectional reeds—sections moved backward or forward. Bennett in his book entitled "A Cotton Glossary" gives this method, but I did not find out about it until after I had spent much time thinking about it. This probably gives a line in the cloth at the beginning of each section.

10. A non-moving sectional reed—used with a raising and lowering false reed—this has been done. See Bennetts' Book.

11. Concave and convex reed used with false reed—has been done. See reference page 17.

12. Pull rolls — one pulls up, one pulls down, two rolls per spot. Objection—too much rigging.

13. Two oscillating rolls worked up and down by cams or eccentrics. Two cams to a roll. Four cams to weave two spots. Works but too much rigging. This has been made.

14. High reed—two sections—dividing line in center. Lower half of one section concave, upper half straight, or convex.—next section just the opposite. A similar reed has been made. Objections—(1) has to work up and down and have a false reed to guide the shuttle.

15. Float or pull bars—working in racks, at each end. Pull down by springs, pulled up by dobby. Objections: (1) too much rigging, (2) not supported in center. Will buck and spots will be uneven.

16. Embossed whip roll—waved ondule probably—
trouble, each raised part will not pick up the same number ends.

17. Spiral grooved whip roll covering—waved ondule. Grooves will have to conform to diameter of revolving whip roll, or else slack yarn will stop off loom.

13. Notched opener—2½ inch flat wooden bar with notches—the ends in the cut part will not have tension. Objection: Will not pick up same number ends each time.

**Devices Built:** Three devices were built and operated from the dobby head on a C-6 loom. The samples of cloth are included in this report. I like to call them openers because the idea originated from the old type flat wooden bar that was used to open up the ends on a stuck warp. Type 1 opener consisted of two wooden harness frame bars taken from a regular harness. These were mounted, one above the warp and one under the warp. They were mounted in stands at the ends of the loom where they would be top over bottom. The top opener bar was pivoted at the back edge so that the front edge could move up and put tension on the ends over it. The bottom opener bar was also pivoted at back edge so it could swing down and put tension on the ends under it.

The odd groups of 20 ends were put over the top opener so they could be tightened when opener raised.

The even groups of 20 ends were put under the bottom opener where they could be tightened, when bottom opener was pulled down. Each opener was operated from a separate harness lever and the chain was pegged so that the top opener would be up for six picks, then the bottom opener would be down for six picks. Sample B shows the cloth for this particular type opener. The trouble with this opener was that the bars, or boards, bowed in the middle as they had no center support and the ondule spots were not very good in the center of the cloth. I rigged up the bars where they would operate from both ends, still boards bucked in the center. Finally, this idea was abandoned for type 2. Type 2 opener consisted of two 5/8 inch rods mounted 2 inches above the warp—one about 3 inches in front of the other. These rods were supported by metal stands at each end. On these rods were mounted adjustable "U" shape fingers made out of 1/8 inch steel rods. These fingers were shaped at the bottom where each finger would allow 20 or 30 ends to lay flat on the bottom horizontal part of the "U" shape finger. The openers were connected to the dobby harness levers and the chain was pegged the same as for number one type opener. This type operated fine. The fingers were made adjustable so they could be set to get the same size spot in case the overheads rods bowed. I decided
this type opener would be all right for weaving a few spots here and there in the cloth, but that another type would have to be developed for the overall effect.—filling ondule—hence, type No. 3.

For type number 3, I used the same stands and the two 5/8 inch rods mounted 2 inches above the warp. Instead of the fingers, a long rod 1/4 inch in diameter was used for each opener. Each rod was fastened to the over head bar by four adjustable fingers—one on each end and the other two spaced to give equal support to the lower part of the opener which pulled the ends up. The main trouble with this opener was that the back bar would pull the front bar up. Instead of building another set of stands and separating the bars more, I placed one opener underneath. This worked satisfactorily after the lower bar was braced in the center. See diagram of this opener in figure 1.

Size of Spots: Length of spots, filling wise, depends on the number of ends used in a group over the opener bar. Height of thick spot depends on the number of picks the ends are held up. Height of thin spot depends on the tension of the ends and a quick release.

### Points for Making an Opener

I would suggest working both opener bars above the warp between the drop wires and whip roll. I am sure this can be done for a light constructed fabric. See Bennets' construction for filling ondule, page 13. To operate both opener bars above the warp, more space may be needed between the opener bars to keep the back bar from interfering with the front bar. To get this space, the whip roll may be moved back and the drop wires moved forward if necessary. Instead of having both bars pulling up from the front edge, it would probably be better to have the back bar pulling up from the back edge of the bar. I would suggest using similar type bars, but larger ones. The large rods two inches above the warp should probably be one inch in diameter or larger. The pick-up rod, the ends go over, should be one-fourth inch or larger. The support rods, connecting the two above rods, should be adjustable in order to get the same pick up of ends due to minor variations. The stands should have bearings for the opener bars to work freely. Each opener bar will need a stationary bar to pull the ends against in order to tighten the ends quickly with a minimum lift of the opener bar. Overhead opener bar. Overhead opener bars may be supported from underneath the loom by a thin strip of hard steel if the bars bow in center. One support for each bar placed near the center should be enough. In connecting up the opener bars to doby harness levers, use the minimum tension to get the desired spot. The opener bars can be connected to the doby harness levers in a less complicated manner. I have worked out two ways in which this could be done. The position of the various parts of the opener has a great deal to do with the amount of lifting force needed to give a good ondule spot. I suggest that this force be kept to a minimum to eliminate end breakage and excess strain on doby. The distance between the pull up bar (bar the ends go over) and the stationary bar (bar the ends pull up against to tighten) should be approximately two inches in order to get the proper tightening quickly. The distance between the front of whip roll and the stationary bar should not be over eight inches as this will also effect the tightening of the ends quickly. See diagram of opener, page 11.

### Loom Stops

In using my type opener for weaving filling ondule, I find that the slackening of the ends, in this method, does not cause loom stops. It appears that varying the tension on the ends, in this method, would increase end breakage; but to date, I have had but two ends down in the groups of ends where the tension was varied, and these breaks were due to large slubs.

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**THE BOBBIN AND BEAKER**
In regard to this, I quote Mr. Bennett in his book entitled “A Cotton Fabrics Glossary”. “Of course good yarn has to be used in making a fabric in this method, but if care be used the tension on the various threads will not be great enough to cause any large amount of breakage.” Mr. Bennett was referring to several of the previous methods. I am inclined to believe my device will cause less end breakage than the previous methods, provided it is set up to produce the spots with a minimum tension.

**Cam Loom Observations:** (1) While experimenting on an X-2 loom, I noticed that I could make just as good filling ondule with half the number ends, every other one, in a group over the opener bar. I assumed the conditions were too extreme and did not spend anytime trying to make it work. If it was possible to do this, the dobbey would have less strain on it.

(2) I also noticed with the above “set up” every other end over the opener bar for a group of ends, that the picks could be spaced evenly in groups of two’s by working the opener bar every other time. This could lead to a new type cloth.

(3) Next, I noticed with the same “set up”, that a line could be made down the center of the filling ondule spots by not putting the two center ends in a group over the opener bar.

**Preliminary Work:** This work was done on an X-2 loom weaving plain weave. The cloth construction is given under the title, Filling Ondule Cloth Constructions. The work sheets contained about 100 items, samples of cloth, and ideas I tried as to how to make filling ondule. I am not including all these elementary things in this report but they may be obtained. However, I am including the important findings at various places in this report.

**Filling Ondule Cloth Constructions:** Just one construction was found in reference books. The other two constructions given below are for the looms I experimented on.

(1) Bennett, in his book entitled, “A Cotton Fabric Glossary”, gives the following information: “27 inch width cloth, 48 x 48, warp 50/1 combed American cotton mercerized, filling 2/40s sea island cotton. 696 ends bottom beam, including 48 selvage, 648 ends top beam.” I feel sure that the warp and filling need not be of such a fine quality to produce filling ondule.

(2) **Information for Cam Loom Experiments:** X-2 loom, plain weave, 44-72 x 40, 30 warp, 22 filling. (I understand from information found in the various books that the filling should be larger than the warp in order to accentuate the effect).

(3) **Information for Dobby Loom Experiments:** C-6 loom, cram stripes—plain weave between stripes.
cloth 43 inches wide, ground construction: 70 x 58 black warp 20/1, pink warp 30/1, white warp 28/1. Filling 30/1 cotton. This construction was too heavy but I figured if filling ondule could be made between the warp cam stripes for this construction, it could be made using a lighter construction. Also this was the best warp available. Samples A and B were made on a C-6 loom with above construction.

**Warp Ondule:** In this plain weave fabric, the filling is woven in a straight line and the warp is waved, or woven out of a straight line. Sketch A illustrates how warp ends will be waved out of line. Five beams, with different counts of warp yarns, and a fan shaped reed are needed to produce a cloth like this sketch. The fan shape reed varies the ends per inch in a vertical direction in the cloth. A sectional reed twice the height of an ordinary reed is used. The dents in one section are close together at the bottom and wide apart at the top. The other section is just the reverse. Two sections usually make one repeat, and the number repeats in the reed depends on width loom. The reed is moved up and down slowly to produce the waved effect. In this type of warp ondule, the lines are not very prominent unless colored yarns are used. Sketch B illustrates the other type of warp ondule which has open spaces in the cloth. Here again, the reed is twice the height of an ordinary reed. The principle here is to have diamond open spaces in the reed which weaves the warp ends out of line producing open spaces in the cloth. In one section, the diamond in the reed will be at the bottom with dents just above it straight. In the next section, the diamond will be at the top with the dents just below it straight. The reed is moved up and down slowly to weave the diamond in plain weave motif order. This type ondule requires several beams and leno attachments in order to weave leno around the open spaces in the cloth. The third over all effect type warp ondule has not been made.

**My Objective:** To produce the over all effect warp ondule from one beam.

**Ideas Limited:** I have tried out many things and find that there is just one thing with which to work and that is the reed. Many special type reeds with their complicated attachments for raising and lowering have been made. To date, I see but one way to make the open spot type warp ondule and that is to have something to spread the dents in the reed when the reed beats up. Of course, this is contrary to what should be done. Can it be done? Is it practical?

**Ideas Tried:** 4. Punch wires in at fell of the cloth and beat up pick. Objections: (1) Small wires will not give a wide enough open place. (2) Large wires break the picks. (3) In the way at temples, and when looms slams with shuttle in the cloth. 2. Front harness with fine wires fastened at top of harness—passing down thru small heddle eye, then thru reed, and fastened to a fix rod under cloth. Wires stay in bottom of dent. Harness jumped up at front center so wires would be in center of dent. Harness moved to side at front center to spread dents when warp ends were level in shed. Objections: (1) Front harness too far away from reed. (2) Had to move too far to open up dent. Same as No. 2, except use two harnesses—one wire to each harness, two wires per dent, one harness moving to right and other to left would open dent up better. Objections: Same as for No. 2. 4. Spread dents with drop wires mounted on rod at front and rear top of reed. Drop wires pass thru reed. Drop wires lowered at front center and pulled to side to open dents. Objections: (1) It is too complicated. (2) It is in the way. 5. Pull strings on a bar thru dents in reed, fastened below reed at back bottom. Bar moved to one side spreading dents. Objection: (1) Too complicated. (2) Strings in the way. 6. Punch holes in reed at front center to spread dents—Fiber fingers mounted on rod stands fix position above fell—fingers swing in opening reed when reed is near fell of cloth. Objections: (1) In the way. (2) Finger will not hit in the same dent. (3) Will ruin reed. 7. Punch fingers, mounted on rod back of reed near top. Fingers bumped in by spring. When reed is near fell of cloth. This was developed. See page 17 device developed. 8. Small vertical rods mounted
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on horizontal pull rod, rod pulled to side when reed was at front center—forcing ends to spread dents. Objections: (1) This gives filling ondule. (2) Vertical rods in way. (3) Too much pull to get correct spot. 9. A coiled spring with core in center. Back of reed positioned at bottom of reed. Spring in a movable case. Lifting or push rods brought it up on each pick before reed reached fell of cloth. Cords from dobby working around pulleys, running up lay swords, pulled lever to force spring in at fell of cloth. Objection: (1) Type spring used selected the dents, O.K., but did not open up reed enough to make a good spot. 10. Vertical pins working up thru race plate near bottom of reed. When reed is at the fell. Objections: (1) Break picks and ends. (2) Too small to give a good size spot. 11. Reed back of reed—back reed skeleton reed two wires every so often—back reed, moves to one side. Objections: (1) Would make filling ondule. (2) Too much movement required. 12. Fine wires fastened to rod under cloth. Two wires thru a dent—fastened to two pull bars at back bottom of reed—wires stay in bottom of dent—move up when reed is at fell of cloth. One rod pulls to right, other to left, and opens up dent. This looks possible. Objections: (1) Wires and reed wear out. (2) Wires would have to be very small and strong. 13. Pull barbs at top, front of reed—light weight hard plastic cone shape barbs with fine points. Point of cone toward reed. A small wire goes thru each barb. The front end of the wire fastened to a light horizontal wire which rests on top part of shed. The top part of shed raises and lowers these barbs every pick. The fine wire thru the barb passes thru a dent and is fastened to a pull rod at top, back, part of reed. The pull rod is connected to dobby harness lever which causes the barbs to be pulled into the reed as reed approaches the fell of the cloth.

**Device Developed:** Sharp pointed brass conical fingers were used to spread the dents and produce warp ondule. These adjustable fingers were mounted on a movable rod at the top of the reed on the back side. A spring bumped the fingers into the reed, opening up the dents, just before the fell of cloth was reached by the reed. The dobby harness chain was pegged to raise a lever to prevent the spring from bumping the fingers when no spots were wanted. Objections: (1) The fingers did not open up the reed far enough to get a good size spot. (2) Fingers did not hit in same dent every time. (3) Fingers damaged the dents when made to open up wider.

**Reference on Filling Ondule Methods:** Bennett, in his book entitled “A Cotton Fabric Glossary”, page 593, gives four ways in which filling ondule has been made. 1. Using an ondule reed. This reed is twice the height of an ordinary reed. One section is concave at bottom and convex at the top. The next section is just the opposite. All the dents are uniformly spaces. This reed is moved up and down slowly to get the filling ondule effect. A false reed has to come into place to guide the shuttle. 2. Another type of sectional ondule reed, where a section is made fast on one end and loose on the other so it can swing backward. A section may contain as little as three dents. An engraved or grooved roller is made to change the position of the sections. (3) A unique method is to have two sets of harnesses—front and back. The ends are drawn thru both sets. Four back harnesses are arranged at different heights and bound together tightly.—(Probably 4 back harnesses for each spot). The four back harnesses are raised and lowered slowly as a unit. Objection: The highest harness in a unit gives a greater tension than the lowest harness. 4. Two easier bars on slackers, like for leno. Quote, “Two beams used, probably one could be used—not as good as using an ondule reed. It cannot be depended on. Cloth spots not prominent, have to be adjusted to a “nicety.” Also has to be adjusted often and kept in good shape.”

**Nesbitt** in his book entitled “Grammar of Textile Design,” page 258, gives a sectional reed just like the first one described by Bennett. He also gives a method where two oscillating bars slowly move in opposite directions—operated by cams or eccentrics. Two warp beams used—thinks one could be used.

**Strong** gives the following method in “Fabric Structure”, p. 212. Movable back rests—moving away from heddles and back, alternately.

**References on Warp Ondule Methods:**


**Nesbitt.** “Grammar of Textile Design”, page 258, gives three types of ondule reeds: Number 1. Lower 1/3 of reed has dents sloped to give a “V” shape with half diamond open spaces between sections. Upper 2/3 or reed dents are straight. Number 2. Dents are angle to give open inverted “V” from top to bottom—ever so often. Number 3. A fan shape reed like Bennett’s No. 1.

**Strong:** “Fabric Structure”, p. 212, gives a fan shape reed like the one described by Bennett.

**Textile World Magazine.** April 30, 1932. Ondule reed—reed twice height of ordinary reed. Wires straight except where open space diamonds are formed in reed. One diamond or open space at bottom of reed—20 dents over another diamond at the top. This reed like all the other warp ondule reeds has to be moved up and down slowly.
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