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THE COVER: This backing is quite similar to the last issue . . . a study with light and textile forms . . . an interesting arrangement can do quite a bit for a cover and I hope they have been effective, for this is the last by me via graduation.

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Stretch Yarn Developments
In The School of Textiles

DR. HUGH M. BROWN
Dean, School of Textiles

This is a preliminary progress report on some methods by which so called “stretch” yarns have been made at Clemson.

After development of more of these methods it was found that they had already been proposed or patented, so it is not known but that more of them have been tried, and some may be in commercial use. The work has been going on intermittently over the past two years, having been started when men’s stretch hose first appeared on the market.

The methods of manufacture of the stretch yarns mentioned at that time included both twisting and crimping processes, and the "Twist-Untwist" type seemed to dominate the picture. In this process, as most often described, two nylon (or other thermoplastic) yarns are plied with high twist, steam set at suitably high temperatures, and then untwisted. Finally one strand with S twist and one with Z twist are plied with a low twist. This twist gives a yarn, which, if never heated to a high temperature tends
to forever contract to a fairly small fraction of its original length. Furthermore, the individual filaments tend to act more or less independently, and in the relaxed state form small coils and loops which give the fabric a texture and lack of shininess that is normally characteristic of fabrics made of the normal nylon filament yarn.

The reason for pairing a strand having S twist with one of opposite twist, is that either strand alone acts as a very highly twisted yarn that has not been set, and if conditioned to kill the "liveliness", it loses much of its elastic effect.

It is seen that the process is expensive since much time is required to insert the high twist and also to remove it. It is an intermittent process consisting of several steps.

At about the same time a stretch yarn was being made by a non-twisting, crimping method in which a fabric is knitted, given a steam treatment, then ravelled to produce yarn, which is then knitted into the final form. The elastic effect is produced by the first knitting tending to stay in the yarn, and thereby distorting the course formation when knitted into the final fabric. The process gives much elastic effect and a crepe-like fabric instead of one with smooth, shiny surface.

The process is intermittent and somewhat costly due to the repetition of knitting. Sometimes in knitting, trouble arises from the old loops getting in and out of phase with the new ones, causing patterning.

At this point, the first work of studying the problem of making stretch yarns by continuous, single process methods, was begun at Clemson.

Wrapping on Fine Rotating Wire—One of the first methods tried was the wrapping of nylon yarn closely on a section of rotating, advancing, cord or wire.

The yarn under suitable tension is fed on to the wire at the top of the wrapped section and unwound from the bottom end, and thence, passed on to a wind-up device. The wire advances at the correct rate to keep the yarn entering and leaving at constant positions. Around the top part of the wrapped section the yarn is heated above its thermoplastic setting temperature. After passing through the heater the yarn is cooled below the setting temperature before it reaches the unwrapping position.

The cord or wire on which the nylon yarn is wrapped may be a section in one side of a continuous loop, or a section of cord or wire advancing from a package above to one below, both of which turn with the rotating cord or wire. Thus, stretch yarn may be made continuously. Of course, two strands spiraled in opposite direction must be used together to make a balanced yarn that will knit well and not cause the finished hosiery to wind or twist.

The yarn made by this method acts as if it had been twisted, though no net twist has been inserted. The smaller the cord or wire on which the coil is wrapped, the higher the elastic effect. The rate of production of the system depends on the fineness of the wire, and on its speed of rotation, but could probably be made to exceed the rate of the "Twist-Un-twist" method.

False Twisting Methods—A false twisting method was tried wherein two strands of nylon yarn, after passing through a thread guide, are twisted together for a short distance by means of a special rotating trumpet through which the yarn passes. The section between the trumpet and the guide is given a very high twist. The yarn is heated in the first part of the twisted section to set the twist and then cooled in the remaining part of the twisted section before passing through the trumpet. The twist (as in all false twisting devices) comes out of the strands as they pass through the trumpet and the two strands can be separated and wound up on different spools. Yarn made in this manner has the same characteristics as that made by the twist-untwist method and, strands with S and Z spiral are paired to make the final yarn. This is a single process method and since the trumpet can be easily driven at very high speeds, it seems a rather high production rate may be possible. There are some disadvantages, however, which may be the reason the method is not in more general use. With multifilament yarn, a broken filament may go with the wrong strand at the point where the untwisting occurs and cause a stoppage. Though this difficulty does not occur with mono-filament yarns, it seems that the twist has to be exceedingly high for such small strands, and that they will sometime break rather than untwist at the point of separation. It seems that both of these difficulties can be somewhat reduced by simultaneously twisting many strands instead of only two. Of course, this gives less stretch effect for a given intensity of twist. Using many strands seems to improve the operation on the fine mono-filament yarns more than it does on heavier multi-filament strands.

In a method using a Hot-Cold Wire, a short piece of wire passes from a heated metal block to a cool metal block and the yarn is given several turns around this wire, entering on the hot end and leaving on the cold end. When the yarn is pulled, it simply slides around the wire, being set into small spirals while passing around the hot section and being cooled before leaving the cold section. If the wire is made fine, a very good stretch yarn is formed, especially with mono-filaments. Multi-filament yarns give some difficulty by individual broken filaments staying wrapped around the wire and "skinning back" as the strand moves on, thus causing stoppages. It is believed a previously inserted low twist may eliminate this trouble with multi-filament yarns. As in the twist-untwist method, to make a completely bal-
anced yarn, two strands with opposite spiral must be used together.

After the above studies had been made it was found that quite a number of false twisting methods of producing stretch yarn had already been patented as well as the crimping of yarns by passage through heated gears. An obstacle to attaining high production from heated gears is the removal of the hot yarn from the gears causing the crimp to be easily pulled out with only slight tension. A method of avoiding this limitation was developed and is described below.

A Pre-heating Method in producing stretch yarns was used in a number of devices in which the yarn is drawn through a pre-heating chamber and immerses through a hot nozzle. With this arrangement the pre-heated yarn may be drawn around a cold wire which is kept cold by contact with two cooled metal blocks. By using 1 or 2 turns around the cold wire, the yarn is set in the desired small coils even when drawn over the wire at quite high speeds. There is no longer any problem of de-crimping while pulling the yarn away from the deforming device since it is already cooled before being withdrawn. The maximum rate at which the yarn may be drawn over the wire depends on how fast the wire can carry away the heat it receives from the yarn. The shorter the wire between the blocks and the colder these blocks, the faster the yarn may be pulled over the wire. To keep the wire from wearing out too rapidly, it is arranged to advance slowly through the blocks so that it is not always worn in the same place.

By the use of Sharp Edges, it was found that considerable spiral effect in yarn could be produced by pulling pre-heated yarn from the heated nozzle over a fairly sharp corner, or edge of a cold bar. Drawing the yarn slightly diagonally across a cold edge gives it a coiled effect as if it had been drawn around a wire. The direction of such coiling can be reversed by reversing the angle at which the yarn is drawn over the cold edge. Due to this coiling effect, the yarn produced is very lively and acts as if it had a twist effect, snarling when slackened. Of course, this effect can be cancelled by using two strands having opposite spiral.

Oscillating Forming Edge:—Another way liveliness in stretch yarn can be eliminated is to oscillate the edge over which the yarn is being drawn so that at very short distances along the yarn, the coiling direction is alternated back and forth so that in any appreciable length of the yarn there is no net twist effect.

Crimping with Cold Gears:—The pre-heating principle works very well for crimping with cold gears. The nozzle of the yarn heater is mounted very close to the gears so that the heated yarn can be drawn into the gears at such rate that it is not cooled until it has been formed between the meshing gear teeth. Here again, the colder the gears, higher the rate at which yarn can be drawn through with permanent crimping. There is no problem of decrimping the yarn by tension on the output side since the deformations have already been set before leaving the gears.

The elastic effect of the cramped yarns does not seem to be as great as it is for yarn having the spiral or twist deformation, but it does have the disadvantage of running very nicely in the knitting machines, and has no tendency to stretch and to snarl when not under tension. It is believed that the size of the crimps produced by the gears should be much shorter than the loops formed in the knitted garment. Fabrics from such yarn have a delustered appearance that is much smoother than fabrics made from yarn produced by the knit-ravel-knit method. The cramped yarn has an outstanding advantage in that there is no necessity for pairing two strands. In ladies’ hose it seems to produce ample elastic effect and has a more pleasing appearance than the extremely creped yarn.

Yarn Its Own Knife-Edge:—By passing pre-heated yarn under a small rod and back over the top and one-half turn around the incoming yarn, a very tight spiral effect can be produced by simply pulling the yarn around the rod and around itself. The size of the spiral can be somewhat controlled by the tension of the incoming and outgoing yarn. The method seems to work excellently on mono-filament but not so well on multi-filament which, due to its greater size, cannot be bent around itself as sharply as the single filament.

Hot Rotating Blade:—It has also been found possible to produce stretch yarn by winding yarn from the pre-heater over a hot rotating blade or small triangle. The yarn is given one turn around the blade and carried on to the wind-up mechanism. A small blade or triangle (less than 1/32 inches wide) can be run at high speeds though probably the limiting speed is again determined by how fast the blade may heat yarn. By making the blade very short and mounting it in an arbor having high heat conductivity (such as copper or aluminum), the heating rate can be made quite high and in all probability could be augmented even further by pre-heating the yarn. Although the yarn from this device has some twist effect, it is not so pronounced and could be removed by a second twisting operation which would leave the sharp crimp for elastic effect.

A summary of patents shows that several other methods of making cramped yarn have been proposed. Two general principles have been used by a number of workers; in one, the yarn is forced by

(continued on page 18)
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Is This the Year of Decision?

Editorial by Mr. William J. Erwin, President and Treasurer, Dan River Mills, Danville, Virginia, for The Bobbin & Beaker Magazine, Clemson School of Textiles.

All signs point to 1955 as a year of momentous decision for the textile industry of the United States. It may be momentous, too, for millions of cotton farmers, chemical producers, machinery makers, transportation workers — for all who supply and service our nation's textile mills.

Within a matter of months, the American people will face a showdown on foreign trade policy. The decision will have to be made between one of two major courses. Which choice will the Congress make? The future of a great industry, linked with many other industries vital to the nation's economy, hangs on the answer.

One choice will be to continue the kind of "free trade" doctrine that virtually limits the abolition of tariffs to the United States alone, ignoring the many different barriers to trade which foreign countries erect. In essence, this doctrine blames the American tariff system as the "root of all evil" and assumes that throwing the doors wide open to American markets will solve the world's economic problems.

Since the middle 1930's the official U.S. policy has been to reduce American tariffs and thereby induce other countries to do likewise. The United States has accelerated that policy by turning over its tariff negotiations to a supra-national agency known as GATT (General Agreement on Tariffs and Trade). But, as so often happens, practice proves different from policy. The rules and regulations of GATT actually invite the repudiation of trade agreement commitments. GATT, in practice — and this is the factual bitter experience of the textile industry — fosters the continuation of trade discriminations and artificial trade barriers of every type.

This, then, is the course of futility and disaster. As far as international trade in textiles is concerned, this policy has already proved itself futile. It has promoted the flow of foreign-made goods to richly provisioned America instead of to the destitute regions where people need clothing most. And insofar as the United States economy is concerned — the mills and allied manufacturing and agricultural industries involving millions of American wage earners — this is truly the course of disaster.

Whether the U.S. textile industry surrenders its markets, production and employment piecemeal, bit by bit over the years as has been done during the past decade, or suddenly, overnight, the consequences will be equally disastrous. And make no mistake about it, the reduction or elimination of tariffs under present world conditions has only one outcome — the transfer of American production to the industries of foreign countries.

Current government reports on industry earnings amply demonstrate the precarious economic position of the textile industry today. American mills simply have no unexpended margin of profit that can help them meet the lower prices of low-wage foreign industries on competitive goods. Present tariff rates, already whittled down a full one-third on textiles, have long since proved inadequate to stem the inrush of fabrics from foreign mills whose productive efficiencies are rapidly increasing.

Already the American market is the most accessible, the easiest to enter, in the world. Yet the pressure is on to throw the doors open still wider. How can mills of this country survive under such circumstances? The fundamental dynamic of all American industry is growth, expansion today based on tomorrow's promise. All the building of new plants, the installation of new machinery, all the research to develop new products which will create new sales and new jobs, all the efforts to advertise and promote the distribution of goods — all such planning stems from confidence in the future. But how can an industry like textiles make such plans when facing the uncertain future, as dictated by our foreign trade policy?

Stagnation, at best — complete collapse, at worst — can be the only prospect for the textile industry of this country if our government decides to follow the course of unrequited ground-giving in foreign trade. Meanwhile, the world-wide economic sickness — bad money, non-competitive production and maldistribution of goods — can only become worse.

The time is long overdue for the new vision, a change of spirit, in American foreign trade policy. There is a second choice which the Congress and our trade policy officials can make. They can decide on a course of action to wipe out artificial trade barriers and exorbitant tariffs, eliminate discriminatory practices, and persuade foreign governments to put their own economic houses in order.

Such a course will be one of promise for the entire world, and for the basic industries of America as well. It involves the establishment of true reciprocity in international trade affairs. It will require
tariff bargaining strictly on a country-by-country basis so as to maintain the principle of mutual exchange and to restore the sanctity of international contractual obligations.

If such a choice is to be made, many people must remove their blinders. They must understand that complete access by foreign industries to American markets is far from being a panacea which will automatically cure the world's economic ailments. They must see that offering the United States as a substitute market for foreign textile industries will in no way help the people of Asia, Africa and South America become better clothed. They must recognize the folly of discussing American tariff reductions as a material factor in correcting trade distortions so long as economic affairs are dominated by socialistic theories of controlled currencies, cartels, monopolistic prices, inconvertible money, discriminatory export and import duties, and all the rest.

Whichever choice is finally made, the decision will be momentous. One course portends the loss, soon or later but eventually, of the textile industry as we know it in the United States. The other course, one which will require courage and foresight of a high order, offers America both the responsibilities and rewards of leadership toward building a richer, stronger, happier world.

It must be quite clear what course you should support.
It is my understanding that THE BOBBIN & BEAKER is published primarily to serve the Clemson Textile students and as a result, the thoughts in this article are being directed to that group of readers.

In the past few years there has been a great deal of concern among the textile industry and its leaders about the great scarcity of technically trained young men and women going into the textile industry and of its phases. The leaders of the textile industry recognize the great need that our industry has for this type of person and are seeking to find ways and means to interest more young people in a career in the textile industry.

One of the many reasons why the demand has increased for college trained men and women, particularly those trained in the technical arts, has been the rapid expansion of all our industries and their need and demand for more technically trained people. Some of these industries have been in a position to offer to the college graduate a somewhat better starting rate of pay than the textile industry has been able to offer, primarily because their entire wage structure has been further advanced than the textile industry. This has had considerable appeal to the young men and women coming out of college in recent years because it enabled them to start off with a little better standard of living than could be managed on a starting salary for college graduates in the textile industry. There have been exceptions to this, of course. It also enabled the college graduate to start a home at an earlier date and to get married at an earlier age. Statistics show that there has been a considerable increase in marriages among college graduates immediately after leaving college in recent years, and this trend has even gone into the colleges among the students, so that we now find college graduates coming out of school in many cases with considerable more responsibilities and financial burden than they had in previous years.

This has probably caused a greater percentage of the college graduates to go into the other industrial fields in preference to the textile industry; however, it is my belief based on information that I have read from time to time that this factor may be misleading to a lot of college graduates. In studying the progress that has been made in the textile industry in the last twenty years we find that the minimum wage in the textile industry has increased at a much higher rate than any other industry in the country, having increased approximately 500% during that period of time with further increases in the minimum wage being discussed at the present. In many of the other industries because they have, over the period of time since World War II, secured a higher percentage than the textile industry, their demands for college graduates have fallen off somewhat and also their requirements are not quite as great as previously.

While we have not made a study in any detail of the other industries, except through casual observations, we have made studies in the textile industry and know that of the college graduates entering into the textile industry, by and large progress has been very rapid for those people who apply themselves diligently to their jobs. In the Fall Issue of the BOBBIN & BEAKER, you will recall an article by Dr. R. G. Carson, Jr., setting forth very clearly a study he had made concerning salaries of textile graduates from Clemson and I quote from this article: "Seven years after graduation, at least fifty percent of the graduates were earning more than $6,000.00 per year, and nineteen years after graduation at least fifty percent were earning more than $10,000.00 per year, and fourteen percent of the graduates out of school twenty years were earning more than $20,000.00 per year." This indicates that there is a tremendous amount of opportunity in the textile industry for college graduates to earn considerably more than the average for all industrial groups. This is one way of measuring the "opportunity unlimited" in the textile industry.

By E. H. Hines, Jr.
General Manager
McCormick Spinning Mills, Inc.
In the last twenty years there has been what could be considered a revolution in textiles. This was caused by the advent of the man-made fibers; the first successful man-made fibers being rayon. This was followed by nylon and in recent years Dacron, Orlon and others, and it looks as if there will be many new fibers yet coming out of the test tubes. Along with these man-made fibers came a multitude of problems for the textile industry in general. First of all, the producers of these fibers had considerable problems to overcome before the fibers could be produced commercially and even after the producers considered they had the fibers at the commercial stage, the problems were just beginning for the manufacturers of yarns and fabrics from these fibers. The dyers and finishers of these yarns and fabrics then had to create suitable dyeing and finishing techniques so that these fibers would have sufficient appeal to the consumer in order that they would sell successfully.

When one stops to realize that the natural fibers have been in use for hundreds of years and with all of the progress that has been made in the processing and manufacturing of the natural fibers, there still remains many problems unsolved in connection with these fibers, it is very evident that the man-made fibers must have a multitude of problems yet unsolved in their use because they are still infants in the textile field, however, growing at a rapid rate. Consumer's acceptance of these fibers and fabrics made from them, either in 100% form or in blends with the natural fibers, during the last ten years has been phenomenal. Any person in industry knows that opportunity for an individual lies where there are vexatious and multiple problems to be solved. In the manufacture and use of the man-made fibers, the textile industry does not have past experience of many years to guide them and the solution of the problem in using these fibers must be pioneered from the beginning and new methods and techniques worked out. For that reason alone, the need for technically trained people has increased greatly in the textile industry.

During World War II our textile industry expanded their production in order to take care of not only the needs of our armed forces but those of our allies in many instances. During the same time, the population of our country increased considerably and it is forecast a further considerable increase during the next twenty years. With this expansion of our industry came the requirements for additional people to manage and supervise the departments finishing the increased production along with a considerable demand for increase in selling personnel in order to merchandise this increased production that be-

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came available for civilian use after the end of World War II. This created a further demand for people who had college training and background that would be in a position to manage and supervise an industry that had grown to be very technical and highly productive, creating further opportunity for college graduates in the textile industry.

In the last twenty years, there has been more effort devoted to improving textile machinery even to the introduction of new types of equipment and processes to handle the man-made synthetics that we had had in the previous fifty years. This type of equipment requires in many cases a highly trained person who understands this improved machinery and how to get the best from it and the care and maintenance and operation that is required in order to have the production more effective. It also required technically trained supervisors to operate a more complex, higher productive type of machinery. Tremendous amounts of money are continuing to be spent in the development of new machines and improvements of the processes, and we shall see great strides in this direction in the coming years as the textile industry has lagged considerably behind other industries in the development of their machinery. This is going to offer opportunity unlimited to the college graduates in the textile industry.

The age in which we are living has been frequently referred to as the machine age and for many, many years the prime concern of industry in general was the development and utilization of better and better machinery. In recent years there has become a great awareness on the part of the leaders of industry that possibly too much attention has been devoted to the human elements in industry. Industry has found that in spite of the best machinery that can be developed there still has to be people capable of operating this equipment for it to produce efficiently and that while a machine can be set up on a standard method of operation and every machine of that same type can be set up on similar standard, each person is an individual and no two can be treated in the same manner and the same results be produced. There has been a great amount of research and study devoted to learning more about the human element in industry and how it can be utilized for the greatest good to all concerned. During these studies it has been found that here we are dealing with the most complex element of all in industry. As a result, we have seen more and more effort devoted in our colleges and universities towards training the students in the direction of understanding psychology and how this can be used properly. The need for people in industry who have an understanding of this element has increased tremendously. There was a period of time in industry when the supervisor had only to speak and the employee carried out the command. This is no longer true in the bulk of industry, and this fact is being recognized more and more every day by the leaders of industry everywhere. Today in order for a person to be successful in industry, if he is going into an operation where he will have supervision of people, he must have the ability, understanding and knowledge of how to lead people and not drive them if he expects to accomplish results. Here again is a problem that creates "opportunity unlimited" in the textile industry.

During the few years that I have been in the textile industry, I have seen and known many college graduates to make the mistake of considering their starting rate of pay when they were entering industry as being the outstanding factor in their decision as to what type of job they elected to accept. In my opinion regardless of the industry into which any college graduate might enter, this is a very serious mistake. In many cases when this factor is considered first, it prevents industry having the opportunity to move the college graduates around into the various operations allowing that person to gain a well-rounded knowledge of the many different phases that go into making up the whole operation and unless this kind of experience is obtained it is a handicap to later progress on the part of any individual. This well-rounded experience cannot be secured from text books or purchased with money and can only come through industry having the opportunity to shift the college graduate from job to job so that that person can have the opportunity to acquire the actual experience. The greatest lack that we have today in the textile industry among our college graduates now employed is a well-rounded experience and background that enables them to see the overall operation and problems instead of the individual small part that they might be concerned with. For that reason, I would like to recommend that when one is considering his initial employment that his prime consideration should be to go along with a company who has a policy of offering opportunity of the nature outlined above.

It has further been my observation that only in the initial few years of industry can any person afford to accept a job in this light for the further along one gets, the greater are the responsibilities of home and family, thereby creating a greater requirement for more financial security. So it is doubly important that this be considered in the first few years in industry.

I hope the reader has noticed that at no place in this article have I mentioned that this opportunity was confined to textile school graduates. We have found in the textile industry whether it be in busi-
ness administration, engineering, arts or science, there has become an increasing awareness in our industry that we have a much better balanced unit if we take the graduates from all of the various branches of educational institutes.

The textile industry is one of the basic industries and therefore should continue to grow and expand with our economy.

In my opinion today the textile industry offers the greatest possibility for opportunity and rapid progress for every individual entering into it, and I hope enough facts have been presented here to get this message across to every reader of this editorial.

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*Patent Nos. 2,610,363; 2,490,544; 2,412,357. Other patents pending.

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Outstanding Seniors

Fred H. Hope—A twenty-one year old senior from North Augusta, S. C., is a textile manufacturing major at the School of Textiles. As a hobby, Fred builds speed boats. He holds the rank of Cadet Colonel and is Battalion Commander.

Fred is a member of the Scabbard and Blade, Phi Psi, Business Manager of THE BOBBIN & BEAKER, and Executive Officer of the Pershing Rifles. He was also listed in this year's edition of "Who's Who Among Students in American Colleges and Universities".

During the summer he has been employed by the Seminole Mills at Clearwater, S. C. He plans to enter the Army immediately upon graduation.

Allston T. Mitchell—a textile engineering student from Spartanburg, S. C., is one of the many people that have joined the civilian ranks here at Clemson. In order to learn more about textiles, Allston has worked three summers at Judson Mill in Greenville. He has also worked one summer at Carbide and Carbon Chemical Company in Charleston, W. Va.

Allston is a member of the Varsity Track Team and was also on the Freshman Basketball Team. Naturally, his hobby is sports, both participating and watching.

As President of the Student Body, he is well-known over the entire campus. Allston is a member of the Blue Key, Phi Psi, Block "C" and Phi Kappa Phi. He was also listed in "Who's Who Among Students in American Colleges and Universities".

Allston has won the Owens-Corning Fiberglas scholarship both his Junior and Senior years. Upon graduation in June, he plans to continue his studies as a graduate student.

Donald S. Harrison—a twenty-one year old senior from Brunson, S. C., is one of the outstanding seniors in the School of Textiles. He is a textile manufacturing major and will finish Clemson in June, 1955. After receiving his commission in Armor, he plans to enter the Army on July 1, 1955.

Don is an active member of many clubs on the campus. He is Vice-President of the Senior Class, editor of the Blue Key Directory, and secretary-treasurer of the Central Dance Association. He is also a member of Tiger Brotherhood, Scabbard and Blade and the Senior Platoon.

After his stay in the Army, Don plans to enter the sales division of the textile industry.
Richard Coker — Traveling is the hobby of Richard Coker, twenty-one year old textile manufacturing senior from Bauta, Cuba. For the past five summers he has been a horseback riding instructor at Camp Pinnacle, camp for boys. Last summer he attended Infantry summer camp at Fort Meade, Maryland.

Richard belongs to N.T.M.S. and Phi Psi, a textile honorary fraternity. He will finish in June and will enter the Army in July.

As advice to freshmen studying textiles, Richard stresses the need of a foreign language, preferably Spanish, because of the fact that more and more jobs in textiles are becoming available in South America.
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means of precision fitting rollers into a heated chamber which has a quantity of stored yarn that impedes the entrance of additional stock. This causes the entering stock to be randomly crimped. At the other end of the chamber the cramped yarn is forced out as rapidly as new yarn is forced in. Adjustment of the pressure of the output gate, and of the rate at which the yarn is removed, determines how tightly the chamber will be "stuffed" with cramped yarn. The plan is sometimes called a "stuffing box" method. It is understood that this method is in commercial use. Another principle employed in several patents may be described as a "shrinking belt" type. In an over simplified form, it employs an elastic rubber-like belt around a driver and driven pulley. Rotation of the driven pulley is controlled by means of a brake so that before it can be turned the belt is tightly stretched on the tight side and then shrinks on the loose side. The polished driver pulley is heated, and if the yarn is fed under the belt on the stretched side, it will be crimped as the belt shrinks in passing to the loose side, and may be taken off the belt in the region between the two pulleys. Another variation of this method is to run a thick belt around a small pulley which causes the inside surface to be compressed while making the bend around the small radius. If yarn is fed under the belt, it will be crimped by the compression of the inner surface of the belt as it passes around the pulley. It has been reported that in one European method, yarn is fed into one end of a heated, small bore rotating tube which revolves it into small coils before it is removed from the other end.

This list of methods for making stretch yarn, though by no means covering all the experiments tried at Clemson or methods used in other places, does include those thought to be most promising. Though interesting, some of these may prove to be impractical.

Making Stretch Fabric From Regular Yarn:—Another very interesting development in the School of Textiles is a method of producing stretch fabrics by treatments applied after the fabrics has been knitted from regular yarns. It seems on ladies hose, gloves, etc., made from mono-filament yarns, this can be done very effectively. The method is simplicity itself and entails very little additional costs over the manufacturing of normal hosiery. If the hose is preboarded at 275° to 300° F. on a form only a little over half as wide as the normal form, but proportionately longer, the loops are distorted from the usual rounded form into an elongated, rectangular form. The hose on removal from the form may be as much as 40% to 50% longer and correspondingly smaller in circumference than it will be when worn. Since the elastic effect is primarily lateral, it gives the fabric a one-way stretch, and there is a marked tendency for the hose to resist slipping downward. In a number of trials it was found that the hose made by this method remained snug around the ankle and calf of the leg even though not fastened up at all. The wearer could walk or even stamp without the hose spilling down. It has been found that both normal hosiery and hosiery made from stretch yarns will immediately loosen even at the ankle when unfastened, while the one-way stretch hosiery does not loosen below the knee even when the welt slips down around the knee. This method does not produce sufficient elastic effect to permit one size hose to fit an extremely wide range of sizes, but from the customers standpoint, they are not necessarily interested in their hose fitting all persons.

When this method is used on mens' multifilament hosiery, considerable elastic effect can be produced, giving a better fit around the ankle and the calf of the leg, but it is not as pronounced as with monofilament, since it is impossible to bend the multi-filament loops as sharply as the single filaments can be bent.

In this method it is essential that the fabric be held tightly in longitudinal direction while the loops are being set, otherwise the fabric will simply shrink due to actual shortening of the yarn in the fabric. The best result is obtained when there is no actual shortening of the yarn and only distortion of the loops occurs. In this method it seems that oversized stockings can be preboarded on the lengthened narrow forms and that they will fit just as well as regular size smaller hose made of normal yarn. This should tend to increase the life of the hosiery manufactured by this method.

It was found that the method works fairly well on finished hose though not quite as much elasticity is given as when they are pre-boarded in the gray.

By using thin lengthened forms hose can be set by means of steam pressing machines or even with ordinary steam irons by using higher than normal temperatures.

It was found that when tricot is given a high tension in the longitudinal direction, letting the width come in accordingly, the loops can be heat set just the same as if garments had been made from such fabrics and heat set on long narrow patterns. The garments, when worn, will give the same type fit as if they had been made from stretch yarns.

Another interesting application of this method was the heat setting of longitudinally stretched knitted tubing, which when unraveled, gives an improved stretch yarn. The crimps in the yarn look very similar to those made by the rectangular toothed gear crimping method.
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