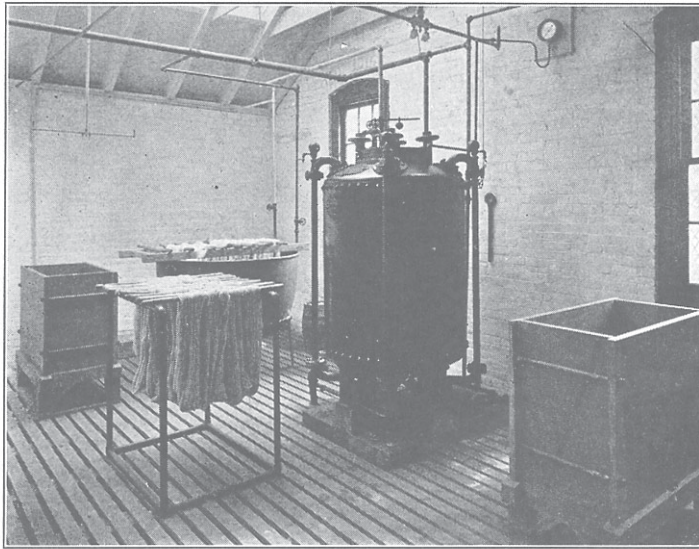


## COTTON COURSE

### COTTON YARN MANUFACTURE

The work of this branch of instruction will consist of a more detailed study of some of the processes covered in the First Year Course (see page 45), and a careful study of pickers, combers and the self-acting mule. Considerable attention will be devoted to the theory underlying the construction of these three machines.

General explanation of processes following the spinning, such as reeling, doubling, gassing, twisting, spooling, warping and balling yarn for the trade.—Engineering features to be considered in the construction of cotton mills: Power transmission, methods of heating, ventilation, plumbing, humidifying.



VIEW IN BLEACH HOUSE, SHOWING BOILING KIER

fire protection, etc.—Calculation on production, cost, methods and organization.—General mill management.

The course will be conducted by means of lectures and recitations, and several essays on assigned topics will be required throughout the year. Winchester's "Cotton Yarn Manufacturing" will be used as a text-book.

### PLAIN HOSIERY KNITTING

This subject is studied throughout the course with the aim of giving the student, not only a general knowledge of the principles and construction of the knitted fabrics, but a familiarity with the

practical workings of many of the best makes of knitting machines—ribbers, loopers, etc.

The principles and construction of the circular rib top knitting machines, and the knitting of the different classes of tops, with all kinds of the best welts for half hose, wrist and ankle cuffs. Plaiting of all kinds—silk, cotton, etc.; making of legs for children's ribbed stockings; also the principle and construction of seamless hosiery knitting machines; the assembling, setting and adjusting of all parts of the different well-known types employed in making infants', boys', and misses' stockings, men's half hose, ladies' stockings, including the different styles of reinforcing, high splice, double sole, reinforced heel and toe, plaiting of the different colors, etc.

#### WARP PREPARATION AND WEAVING

The study of the power loom and weaving calculations will follow the outline found on page 51. The fabrics produced will be from the student's designs, and will include a line of goods of a varied and instructive nature. Doupe weaving will be performed on different styles of heddles. The student will perform all the necessary operations of dressing, beaming, twisting or drawing-in, reeding, chain building, etc.

#### CHEMISTRY AND DYEING

For outlines of these subjects, see pages 51 and 52.

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## Wool and Worsted Course

This course, covering a period of two years, has been planned with the idea of providing for students who intend to engage in some form of the manufacture or the selling of the products of wool; hence, all reference to other fibres is eliminated, and where this course is described as following the outline of some other course, it is only done in so far as it applies to woolens or worsteds. The results to be attained by taking this course are by no means as comprehensive as those which the three-year textile course makes possible, but in certain cases it is best suited to the needs of the student. The following gives an idea of the studies which it includes.

### Subjects of Study—First Year

In the first year the studies follow the general outline given for the first year of the three-year textile course in all but cotton-yarn manufacture. Woolen and worsted yarn manufacture is included in this course, and is described on page 50.



LECTURE ROOM FOR WOOL SORTING AND GRADING

### Subjects of Study—Second Year

#### WEAVE FORMATION

The instruction in this subject embraces the application of the general principles taught in the preceding year. The elementary weaves are applied to fabrics composed of two warps and one filling, one warp and two fillings, and to full double cloths, attention being paid not only to general underlying principles, but also to their use in connection with the requirements of definite fabrics. A brief outline of the course follows:

The manner of forming what is termed a double cloth weave and the principles involved.—Methods of stitching the two fabrics together either invisibly or for the purpose of utilizing the stitching in the production of figured effects.

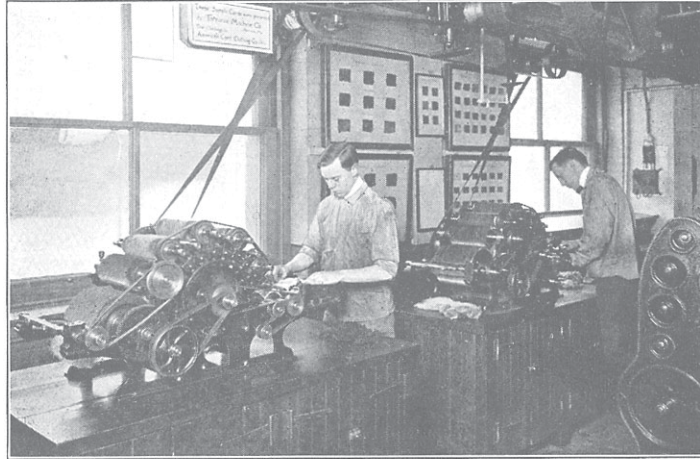
Weaves for fabrics having invisible stitching, such as certain forms of trouserings and suitings, beavers, kerseys, meltons.—Weaves for fabrics in which stripes are formed by means of the stitching, such as hairlines, matelassés, cords, etc.—Figured effects produced by means of the stitching.—Weaves in which the face and back fabrics interchange, producing figures.—Weaves for crepon and other special forms of dress goods.—Weaves for chinchilla and similar styles of overcoatings.—The method of placing weaves for three-ply fabrics.

### ANALYSIS AND STRUCTURE OF FABRICS

For an outline of this subject, see page 49, which is followed in all that relates to woolen and worsted yarns and fabrics.

### WARP PREPARATION AND WEAVING

For outline of this subject, see page 53.



PLAIN AND COLORED, WOOL FIBRE BLENDING, BY THE AID OF  
TORRANCE SAMPLING CARDS

### WOOL AND WORSTED YARN MANUFACTURE

The work in this subject will consist of advanced study of the subjects outlined for the previous year. Particular attention is paid, however, in this, the last year of the course, to the mechanical adjustments necessary to produce the different characters of yarn and the adaptability of these adjustments to the different qualities and characters of the raw materials from which the yarn is made. An intimate knowledge of the different parts and the methods of working of the "mule" is drilled into the student by the practical handling of the machine itself. The same general idea is carried out in the study of the machinery employed in worsted yarn manufacture. The following is an outline of the subjects:

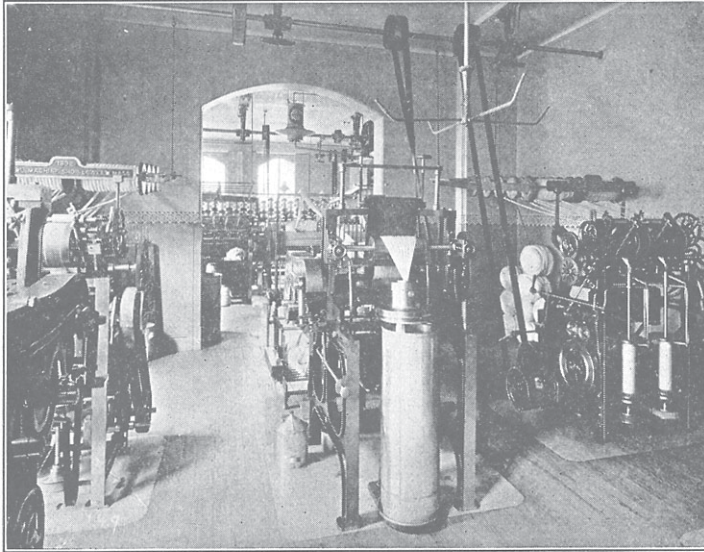
#### WOOL SORTING AND BLENDING

Sorting.—Uses of the sorts.—Different qualities of wool.—Calculations on shrinkages and yields in different grades of stock.—The term "Noil."—Various kinds of noils.—Mungo and shoddy.—Kinds and qualities of shoddies.—Extracts.—Wastes.—Garnetted and other forms.—Flocks.—The methods or processes by which they are produced.—Uses and clothing properties of wool substitutes.—Consideration of the size and nature of fibres which may be blended in order to produce required results in the yarn and in the finished fabric.

## WOOL AND WORSTED COURSE

### WOOLEN YARNS

SPINNING.—The history and development of spinning.—Hand jack.—Self-operator and self-acting mule.—Present perfection of the mule.—The mule head.—Means of actuating the rolls, spindles and carriage.—Backing off.—



WORSTED GILLING AND DRAWING ROOM

One of the series of rooms devoted to Worsted Drawing and Spinning

Winding mechanism.—The quadrant and its functions.—The builder rail and method of regulating it.—Automatic regulation of the fallers.—Changing the speed of the various parts.—Calculations for twists and drafts.—Calculations for finding the labor cost of carding and spinning.—Calculations as to net cost of stock used.—Calculations as to allowance for waste and time.—Features to be considered in laying out and equipping a woollen carding and spinning room, including power transmission, heating, ventilating, humidifying and fire protection.—Speed for the different grades of yarn.

### WORSTED YARNS

SPINNING.—Principles of spinning on the flyer, cap and ring spinning frames.—Worsted mule spinning.

DOUBLING AND TWISTING.—Principles of twisting.—Twisting, as performed on the flyer, cap, throstle and ring frames.—Effect of too much or too little twist in first or second operation.

CALCULATIONS IN FULL.—Drafts, doublings, stop motion for gilling and drawing.—Working out a set of drawings for any given count.—Gauge points or constants for all practical purposes.—The slide rule, and how to use it in

## SILK COURSE

working out drafts and other calculations.—How to find “constant” and how to use, and why.—Twisting.—Reeling.—Straight and cross reeling, also weight yarn.

GENERAL.—Oiling of the wool.—Breaking wool.—Fallers.—Ratch-drag of bobbins, lifter motion or builders.—Stop motions.—How to weigh yarn.—Averaging slubbing to make yarn weigh even.—Causes of imperfect yarn.—Lumps.—Slugs.—Double.—Single.—Twitty.—Overdrafted.—Dragged too hard.—Too much or too little speed.—Features to be considered in laying out and equipping a worsted mill, including power transmission, heating, ventilating, humidity and fire protection.

### CHEMISTRY AND DYEING

For an outline of these subjects, see pages 53 and 54.

### FINISHING

WORSTED AND WOOLENS.—(Same as Second Year Regular Class.)  
—For outline of subjects, see page 55.

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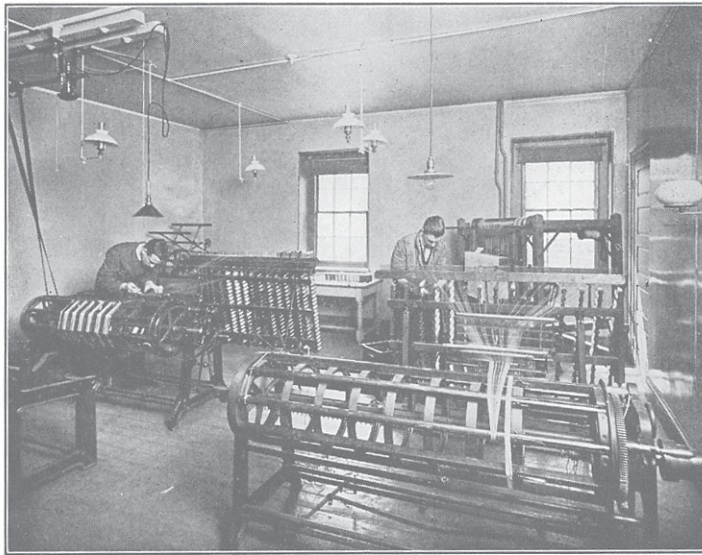
## Silk Course

The recent surprising growth in the silk industry, especially in Pennsylvania, has prompted the School to pay particular attention to this course, which requires two years of study of silk and matters pertaining to its intelligent manufacture. The raw material is considered with its many peculiarities, together with the methods of converting it into forms suitable for wearing. A thorough training is given in the weaves used in silk fabrics, attention being called to the manner in which the various forms of interlacing appear in the goods. The manner in which silk takes dyestuff, together with its affinity for weighting materials and their effect on its strength, wearing qualities, etc., are fully considered. The many varieties of silk and mixed fabrics are carefully studied, and by analysis the student is enabled to form accurate estimates of the size and quality of the raw materials which they contain, together with the amount of loading present. The following gives an idea of the subjects included in the course, and where reference is made to other courses it is intended that the work thus referred to shall be studied in its application to silk.

## SILK COURSE

### Subjects of Study—First Year

The subjects studied during the first year of this course include weave formation, analysis and structure of fabrics, textile coloring, free hand drawing and figured design, warp preparation and weaving, chemistry and textile fibres. The ground covered in these subjects is the same as in the case of the Regular



CORNER OF SILK WARPING ROOM

made in the first year, it being recognized that the fundamentals are the same for all types of materials. Experience has shown that the student takes hold of the problems of silk in his second year to decidedly better advantage, if he has had the opportunity of the greater breadth of the first year work of the Regular course, rather than to have been hampered by having handled nothing but silk.

### Subjects of Study—Second Year

#### WEAVE FORMATION

The second year of this subject includes a study of the higher forms of weaves applicable to silk, due attention being given to those

which can be used to advantage in the production of Jacquard effects. Weaves for two or more ply fabrics are studied and planned upon squared paper, each of the two or more systems of warp and filling being considered in its proper place.

Methods of producing figured effects by the use of the multiple fabric principle of weaves.—Reversible and interchangeable multiple fabrics.—Figured weaves having warp and filling flushes.—Broché effects.—Weaves for cannelé forms of ornamentation—Satin gros grains.—Taffeta backed satins.—Double faced satin ribbons.—Pearl, flat and pico edges.—Repp and bayadere weaves.

### ANALYSIS AND STRUCTURE OF FABRICS

This subject is considered largely on the general lines laid down on page 49, application being made to such fabrics as taffeta, gros grain, faille, satins, peau de soie, and rhadime; as well as to such more intricate constructions as satin damasse, brocaded taffetas, brocaded gros grains, etc.; for both ribbons and broad silks.

Methods of determining the size and quantity of silk in different samples. Ascertaining the reed and ends per dent. The number of



A SILK BROCADE IN THREE COLORS, MOTIF TAKEN FROM AN OLD PRINT. AN EXAMPLE OF ADVANCED CLASS PRODUCTION

shafts used and heddles per inch per shaft. Correct drafts. The dram and denier systems of grading silks as to size. Lectures on the origin and source of silk. Thrown silk, organzine and tram. The process of throwing explained. Spun silks. Lectures on the





SILK BROCADE IN THREE COLORS, MOTIF FROM NATURE STUDIES. TYPICAL  
EXAMPLE OF FABRIC PRODUCED BY THIRD YEAR CLASS



SILK DAMASK IN TWO COLORS, MOTIF FROM ANTIQUE FABRIC. A TYPE OF  
FABRIC PRODUCED BY ADVANCED CLASSES



SILK FABRIC IN FOUR COLORS AFTER FRENCH MOTIF, PRODUCED BY  
MEMBERS OF ADVANCED CLASS

## SILK COURSE

production of silk threads from the waste of throwing and reeling operations. Cost finding systems for ribbons and for broad silks.

### FIGURED DESIGN AND TEXTILE COLORING

While the work in this subject covers the points outlined on page 50, additional time is spent as follows:

**MOUNTINGS.**—Mountings are prepared and the practice of placing them in the loom and in tying-up is afforded for fancy silk fabrics, such as novelty dress goods, necktie stuffs, upholstery fabrics and more complex forms of fabrics. Mountings with shafts in the neck cords, and with shafts below the comberboard.

**DESIGNING.**—Designs are made in color, cloth size, and enlarged to workable state for card cutting for such highly ornamental fabrics as brocades, damasks, chair coverings, labels, dress goods, etc. Determination of weighting, estimation of size of silk before boiling off and of amount of weighting.

**CARD CUTTING.**—Cards are cut for the designs which the student makes, and card-cutting directions are worked out from various fabrics.

### WARP PREPARATION AND WEAVING

For outline of study in this subject, see page 53.

### CHEMISTRY AND DYEING

For outline of study in these subjects, see pages 53 and 54.



## Figured Design Course

This course has been provided to meet a growing demand of those who desire instruction relating directly to such necessary knowledge as is required in the production of the various kinds of figured textiles, such as damask, dress goods, draperies, floor coverings, etc.

Two years are required for its completion.

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### Subjects of Study—First Year

In the studies of weave formation, analysis and structure of fabrics, textile coloring, free-hand drawing, figured design and warp preparation and weaving, the class follows the outline given for the first years of the Three-Year Textile Course. (See pages 39 to 41.)

#### FIGURED DESIGN

The course of instruction in this subject has been arranged with the view of providing the student with the necessary means of planning figured effects and adapting to them the knowledge of weave formation and structure of fabric.

**THE JACQUARD MACHINE.**—A thorough study of the machine, such as is pursued by students in the regular course, page 45, is augmented by carefully measured drawings of the various types of Jacquards, and provision is made for a study of the machine in sections.

**MOUNTING.**—The methods of mounting according to the French and English systems are carefully studied, and practical work in the threading of comberboards and calculations for same is provided for.

The methods of obtaining enlarged repeats of pattern and fancy effects in the fabric are explained, and drawings are made of the various forms of tie-ups to produce these results.

Such forms of tie-ups and mountings are prepared as straight through, point or center tie, combinations of straight and point, repeated effects in one repeat.—Original schemes of tie-ups for fancy effects in single cloths.

**DESIGNING.**—Original sketches for various styles of ornamentation, from historical and floral motives, are made in the color to be used in the woven fabric.



CLASS ROOM FOR FIGURED DESIGNING

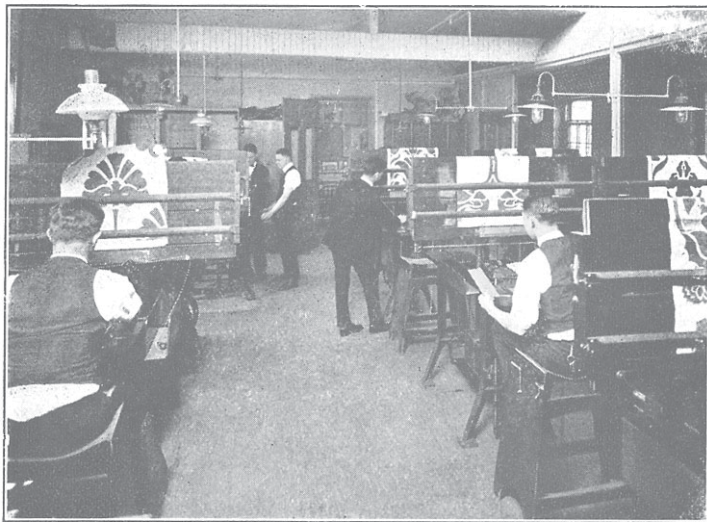
The great value of drawing becomes apparent to the student, as the commercial value of his production is increased by artistic method

## FIGURED DESIGN COURSE

Calculations for design or point paper for the various textures are made, and designs are enlarged to workable state from the cloth-size sketches.

The filling in and placing of weaves on the enlarged design is made an important feature, and the effect the change of weave produces on the finished fabric is carefully explained.

Designs are made for such fabrics as damask, table covers, dress goods, draperies, etc.



FOOT AND POWER CARD STAMPING

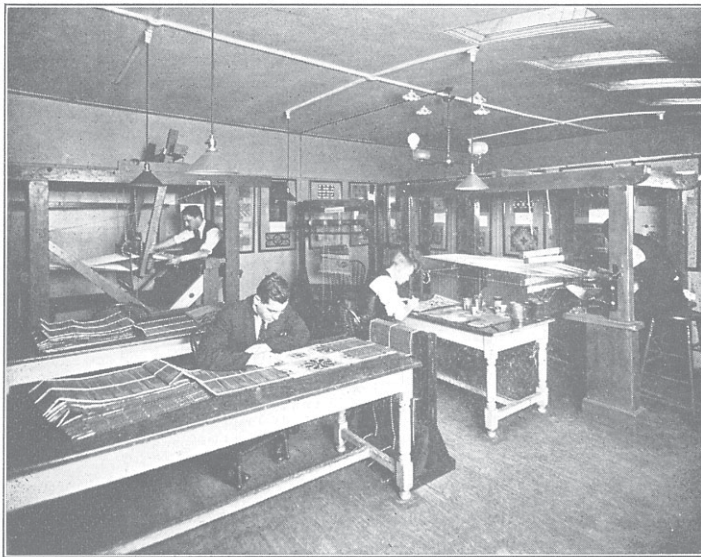
**CARD CUTTING.**—Considerable study is given to the fingering for French, American and fine index stamping machines, together with the practice of cutting cards for the designs made by the student.

Card-cutting directions are worked out for various effects in single and extra filling fabrics.

## Subjects of Study—Second Year

### WEAVE FORMATION

The work of the second year of this course being confined largely to figured effects, all the higher forms of weaves are studied in their application to the Jacquard machine. Weaves for two or more ply fabrics are studied and planned upon the squared paper, each of the two or more systems of warp and of filling being considered in its proper place. Methods of producing figured effects by



RUG AND TAPESTRY WEAVING

the use of the multiple fabric principle of weaves.—Figured weaves having warp and filling flushes.—Weaves for brocatelles, and two or three filling brocades and damasks.—Pile fabrics for floor coverings.—Weaves for all fancy figured fabrics.

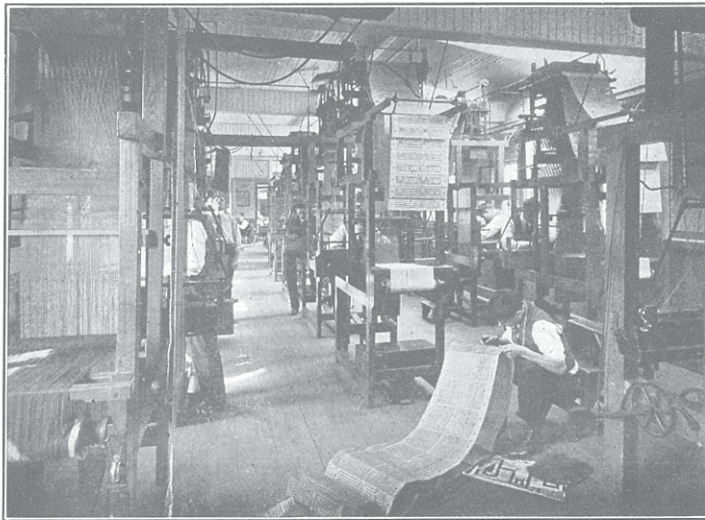
### ANALYSIS AND STRUCTURE OF FABRICS

A general outline of the work as followed is given on page 40. The yarns and fabrics covered include those of cotton, wool, worsted and silk of a higher and more intricate nature. Fancy figured fabrics are studied and calculations made for the production of brocatelles, figured ribbons, shoe pulls, brocaded effects, carpets, and all classes of Jacquard fancy fabrics.

### FIGURED DESIGN

The studies of the first year are continued, and work of an advanced nature is followed. Especial attention is paid to the actual processes of producing figures in more complex fabrics, and producing designs in the cloth for the higher grades of stuffs.

**THE MACHINE.**—The special machines devoted to increasing speed and easier action on the warp are carefully analyzed, and measured drawings of the parts made. Machines devoted to the production of special effects are studied and their advantages noted.



HAND WEAVING LABORATORY—JACQUARD LOOMS

The machines treated are: Raise and drop, double lift, double and single cylinder, twilling machines, drop shed machines, leno and the working of doupes and slackeners, ingrain and Brussels machines.

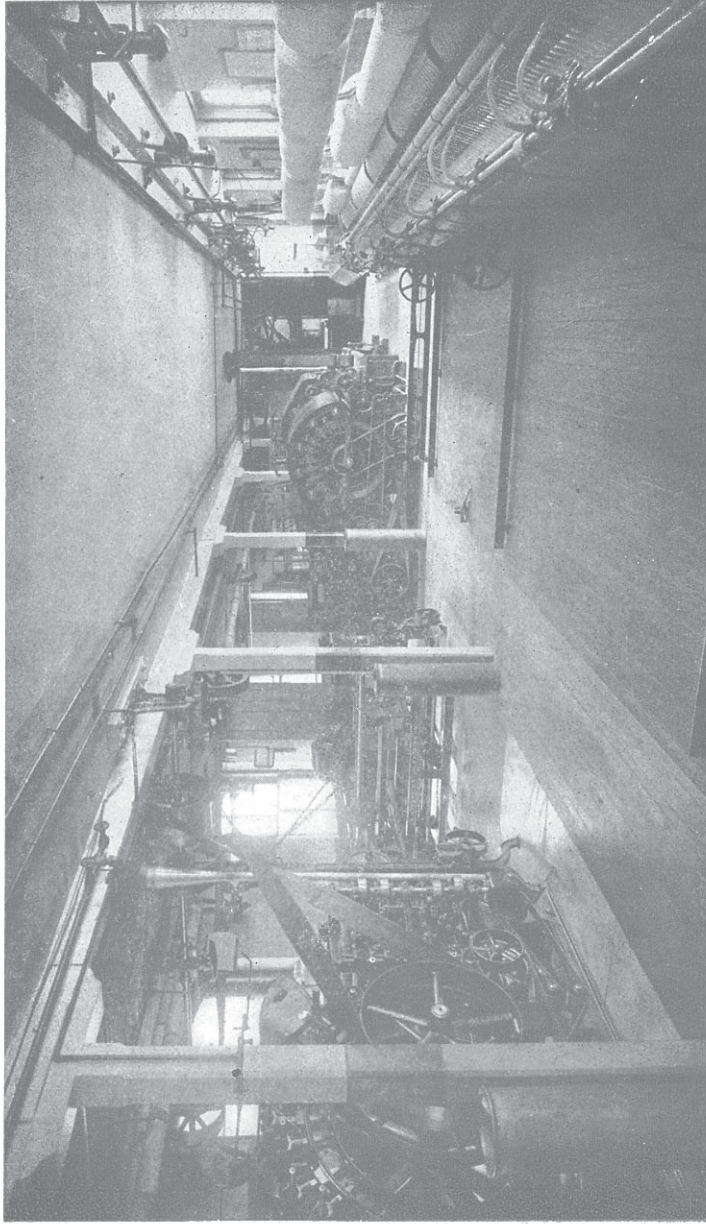
**MOUNTING.**—The opportunity is afforded for the student to thread the comberboard and tie up looms for varied effects of design.

Mountings for controlling two or more warps and the placing of shafts in the neck cords and below the comberboard are prepared and drawings made.

The mounting of Brussels and ingrain machines are treated at length, and opportunity is afforded the student to study the details closely.

Such mountings are prepared as follows: Section ties.—Combination of harness and Jacquard.—Shaft lashing.—Compound harness.—Carpet ties.





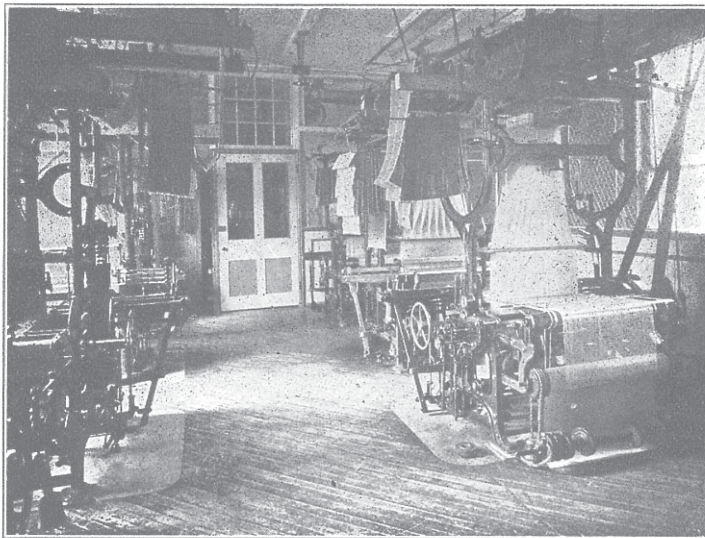
WOOL CARDING, SPINNING, TWISTING AND REELING LABORATORY

## FIGURED DESIGN COURSE

**DESIGNING.**—As color is one of the essential features of a design, it is used to a great extent in the origination of elaborate designs.

The planning on squared or point paper of fabrics having two or more warps and fillings and the calculations for the proper size papers for the enlarged working designs are given considerable attention.

Designs are prepared in a commercial way for brocades, brocatelles, reversible robes, blankets, two and three filling damasks, gobelins, terries, ingrain carpets, Brussels, tapestry, moquette, etc., carpets, coat labels, shoe pulls, etc.

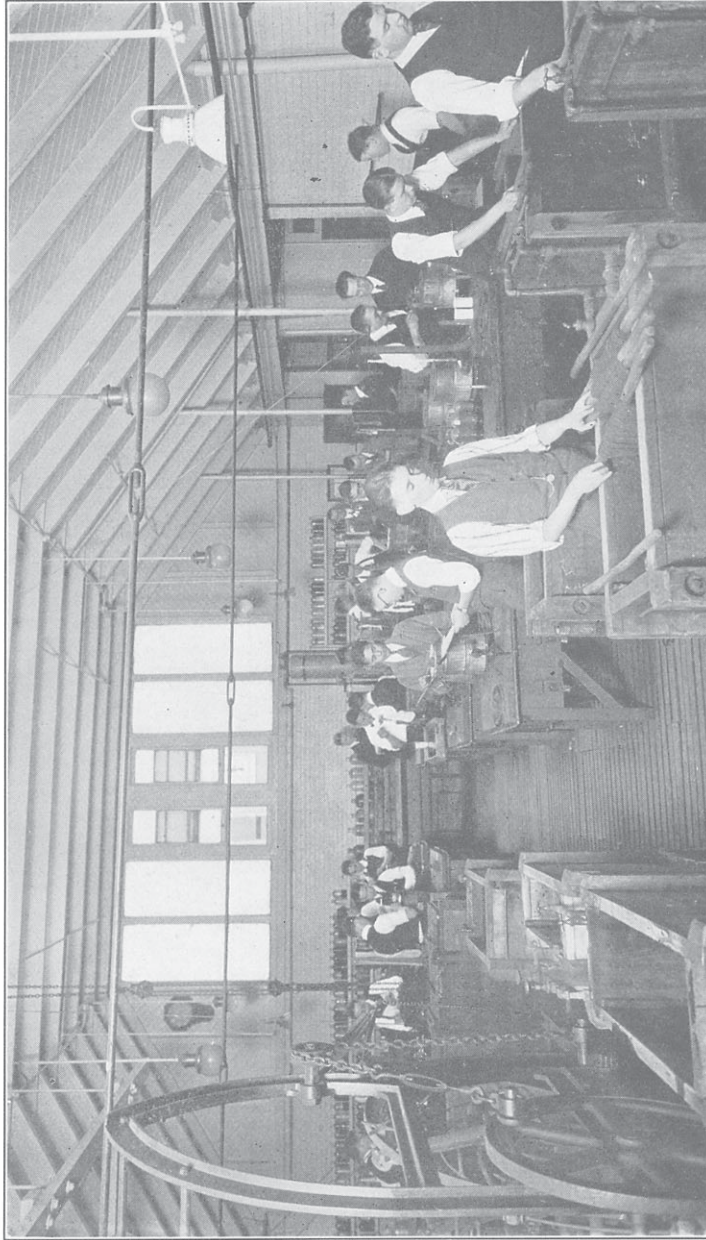


For silks and draperies  
POWER WEAVE ROOM—JACQUARD LOOMS

**CARD CUTTING.**—Cards are cut for the designs made, and all the card-cutting directions are worked out, both from designs and the woven fabric. Mechanical methods of repeating cards and automatic devices for cutting are explained.

### WARP PREPARATION AND WEAVING

For outline of this subject, see page 53.



SHOWING SECTIONS FOR EXPERIMENTAL DYE TESTING, SKEIN YARN AND PIECE GOODS DYEING

CHEMISTRY, DYEING AND PRINTING

DIPLOMA COURSE

The full course in Chemistry, Dyeing and Printing extends over a period of three years, and is especially designed to give a scientific technical education to those who desire to embrace in their profession these branches of industrial technology.

Dyeing is an art immediately associated with chemistry and is one of the chief ramifications of that fundamental science. As an art it has long been practiced, but it is only of comparatively late years that scientific methods have been introduced into this study, and through this means of development it is rapidly assuming a position in the front rank of applied science.

The study of dyeing in this School is carried on with the idea of inculcating into the mind of the student a scientific conception of what he is doing; he is taught to experiment in an intelligent manner—not to take things for granted, but to know the reason why. Moreover, his experiments are not limited to the laboratory pot and kettle, where his results are often deluding, but the student carries on his dyeing in a manner that enables him to encounter and overcome the petty difficulties and changing conditions of the mill and dye house.

The technical examination and valuations of commercial products is given especial attention and a high standard of manipulative skill and accuracy in experimental work is insisted upon, for it is such training that fits the student for accurate and scientific results in after years, when he is called upon to make a practical application of his knowledge in an intelligent and skillful manner.

NOTE.—See page 92 for two year Dyeing and Color Matching course—upon completion of which certificate is given.

COURSES IN CHEMISTRY, DYEING AND PRINTING

**Subjects of Study for the Three-Year Course**

**FIRST YEAR—FIRST TERM**

Chemistry I.—General Inorganic.  
Chemistry VI.—Chemical Calculations.  
Dyeing I.—Physical and Chemical Properties of the Textile Fibres.  
Dyeing II.—Technology of Scouring and Bleaching.  
Dyeing III.—Principles of Dyeing; Elementary Course.

**FIRST YEAR—SECOND TERM**

Chemistry II.—Qualitative Analysis.  
Chemistry VI.—Chemical Calculations.  
Dyeing II.—Technology of Scouring and Bleaching.  
Dyeing III.—Principles of Dyeing; Elementary Course.  
Dyeing IV.—Principles of Shade Compounding and Matching.

**SECOND YEAR—FIRST TERM**

Chemistry IIIa.—Quantitative Analysis; Gravimetric.  
Chemistry IVa.—Organic Chemistry; Aliphatic Series.  
Chemistry IXa.—Textile Chemistry; Analysis of Fibres, Yarns and Fabrics.  
Dyeing Va.—Color Mixing and Spectroscopy.  
Dyeing VI.—Principles of Dyeing; Intermediate Course.

**SECOND YEAR—SECOND TERM**

Chemistry IIIb.—Quantitative Analysis; Volumetric.  
Chemistry IVb.—Organic Chemistry; Aromatic Series.  
Chemistry V.—Industrial Chemistry.  
Chemistry IXb.—Textile Chemistry.  
Dyeing Vb.—Practical Color Matching and Its Problems.  
Dyeing VI.—Principles of Dyeing; Intermediate Course.

**THIRD YEAR—FIRST TERM**

Chemistry V.—Industrial Chemistry.  
Chemistry VII.—Technical Analysis.  
Chemistry VIII.—Chemistry of Dyestuffs.  
Chemistry IXc.—Textile Chemistry.  
Dyeing VII.—Textile Printing.  
Dyeing VIII.—Principles of Dyeing; Advanced Course.

**THIRD YEAR—SECOND TERM**

Chemistry V.—Industrial Chemistry.  
Chemistry VII.—Technical Analysis.  
Chemistry VIII.—Chemistry of Dyestuffs.  
Chemistry IXd.—Textile Chemistry.  
Dyeing VII.—Textile Printing.  
Dyeing VIII.—Principles of Dyeing; Advanced Course.

## COURSES IN CHEMISTRY, DYEING AND PRINTING

### CHEMISTRY I. General Inorganic

The several properties of matter.—Simple and compound bodies.—Laws of chemical combination.—Elements, atoms and molecules.—The atomic theory.—Chemical calculations.—Preparation, classification and chemical behavior of the chief elements and their compounds, comprising the non-metals and metals, with special reference to those of commercial importance.

This course is carried on by means of lectures and recitations coupled with a large amount of laboratory work on the properties and preparation of chemical elements and their compounds.

### CHEMISTRY II. Qualitative Analysis

The analytical classification of the metals.—Characteristic tests for the different elements.—Detection of bases and acids in their compounds.—Solving of analytical problems.—Writing of reactions.

This course is arranged with a view of making the student thoroughly familiar with the characteristic reactions whereby the different chemical elements may be recognized and distinguished from one another in their numerous combinations. The work is carried on largely by experiments, and the student is required to solve problems given to him for analysis.

### CHEMISTRY III. (a) Quantitative Analysis: Gravimetric

General procedure in analytical methods; sources of error and their prevention.—Preliminary manipulations; use of analytical balances.—Preparation of pure salts.—Methods of precipitation and treatment of precipitates.—Typical gravimetric analyses of the metals; aluminum, chromium, iron, calcium, copper, lead, etc.—Analysis of compounds containing several metals.—Gravimetric estimation of the acid radicals; sulphuric acid, chlorine, carbon dioxide, etc.—Exercises in the analyses of alloys, minerals, etc.—Principles of electrolytic analysis.

This course is conducted by lectures, recitations and a large amount of laboratory work, at first on pure chemicals and later on commercial products.

### CHEMISTRY III. (b) Quantitative Analysis: Volumetric

General principles of volumetric procedure.—Classification of volumetric methods.—Use and calibration of graduated apparatus.—Preparation of normal and standard solutions.—Use and limitations of indicators.—Alkalimetry and acidimetry; typical analyses of acids and alkalis.—Volumetric methods by oxidation and reduction.—Volumetric methods of precipitation.—Analyses of carbon compounds by combustion.

This course is a continuation of the preceding. The subject is conducted on as practical lines as possible, and commercial methods are given wherever advisable.

### CHEMISTRY IV. (a-b) Organic Chemistry

General properties of the compounds of carbon.—Recognition and estimation of carbon, hydrogen, oxygen, nitrogen, the halogens, sulphur and phosphorus in organic bodies.—Calculations of percentage composition and molecular formulas. Classification of organic compounds.—The aliphatic series; the

## COURSES IN CHEMISTRY, DYEING AND PRINTING

hydrocarbons; halogen derivatives; alcohols; ethers; aldehydes; ketones; the fatty acids and their derivatives.—The theory of organic radicals.—Study of the esters; sulphur compounds; amines and cyanogen compounds; metallic compounds.—The unsaturated hydrocarbons and their derivatives.—The carbohydrates, and dibasic acids.—Nitrogenous and proteid substances.—The aromatic compounds: benzene and its homologues.—The aromatic nitro and amido compounds.—Diazo and azo compounds.—The aromatic acids and their derivatives.—Triphenylmethane derivatives.—Naphthalene and its compounds.—Anthracene and its compounds.—Heterocyclic compounds; the alkaloids.

This course is conducted by lectures, recitations and laboratory work. It covers in a comprehensive manner the whole field of organic chemistry, though special stress is laid on those portions particularly relating to the textile industries.

The analysis and synthesis of typical bodies is undertaken with the view of illustrating the methods of building up artificially the numerous derivations of carbon which find such an extended application in the manufacturing industries.

### CHEMISTRY V. Industrial Chemistry

Industrial processes in chemical manufacture.—Fuels; water.—Sulphur and its compounds; technology of sulphuric acid.—Salt and hydrochloric acid.—The soda industries.—The chlorine industry, and chlorine compounds; bleaching agents.—The nitric acid, ammonia, and potash industries.—Fertilizers; cements and glass.—Ceramic industry.—Pigments.—Minor chemical preparations; peroxides, oxygen and sulphates; cyanides; permanganates.—The organic industries.—The destructive distillation of wood, bones, and coal.—Mineral oils.—Vegetable and animal oils, fats and waxes.—Soap, candles and glycerine.—Resin and gums.—Starch, dextrin and glucose; sugar.—The fermentation industries.—Explosives.—The textile industries; fibres, bleaching, mordants; dyestuffs; dyeing; printing.—Paper and leather industries.—Glue.

This course is based on text-book study, supplemented when necessary by lectures. Supplementary reading on special topics under discussion, and numerous drawings of industrial apparatus are required.

### CHEMISTRY VI. Chemical Calculations

Calculations of mass, volume, density and weight.—Gas pressure.—Thermometry and barometry.—Chemical formulas; molecular weight and percentage composition.—Chemical equations.—Calculations concerning heat changes.—Strength of solutions; hydrometry.—Calculations relating to the dye-house and mill, and to technical chemistry in general.

In this course particular attention is given to the solution of technical problems.

### CHEMISTRY VII. Technical Analysis

The analysis and valuation of commercial articles occurring in the dye-house and mill.—Acids, alkalies, bleaching agents, soaps, oils, tannins, mordants, and dyeing and scouring materials.—Analysis of water for industrial purposes.—Analysis of finishing materials.—Fuel and Gas.

This course offers to the student a means of becoming acquainted with chemical technology and the valuation of commercial products.

## COURSES IN CHEMISTRY, DYEING AND PRINTING

A considerable number of technical analyses must be completed by each student under the direction of the instructor.

### CHEMISTRY VIII. Chemistry of Dyestuffs

Distillation of coal tar.—Intermediate products used in the manufacture of dyestuffs.—The nitro and nitroso dyes.—Azo dyes.—Hydrazones.—Stilbene dyes.—Diphenylmethane and Triphenylmethane dyes.—Xanthene colors.—Acridine dyes.—Anthracene dyes.—Quinone-Imide dyes.—Indigo and Indigoid dyes.—Thiazol colors.—Sulphur dyes.—Aniline black.—Coloring principles of the chief natural dyes.

The object of this course is to give the student the chemical principles underlying the manufacture of dyestuffs. Before this study can be pursued, a knowledge of organic chemistry must be acquired. The technology and chemistry of the coal-tar colors is studied in a course of lectures, supplemented by considerable experimental work in the laboratory, in which the student is required to prepare many of the intermediate compounds and dyestuffs.

### CHEMISTRY IX. (a-b-c-d) Textile Chemistry

Chemical examination of textile fibres.—Analysis of mixed yarns and fabrics, consisting of wool, silk, cotton, linen, artificial silk, etc.—Conditioning of textile materials.—Determination of sizing, and estimation of oil and grease in fabrics.—Estimation of mineral matters in fabrics.—Examination of bleached goods for quality.

Determination of the nature and estimation of the amount of mordants on wool and cotton fabrics.—Determination of the nature of sizings and other ingredients in fabrics.—Determination of the nature and amount of weighting on silks.

Identification and estimation of adulterants in dyestuffs.—Determination of proper classification of dyestuffs.—Capillary speed of dyestuffs; detection of mixed dyes.—Testing of dyestuffs on the fibre for the purposes of identification.—Practice in the analysis of dyes in bulk and on the fibre.

This course is very essential to the student who desires to fit himself thoroughly for the position of dyer, chemist in a textile mill or commission house, or chemist in a dyestuff manufactory, and has been specially designed with these ends in view. A large amount of practical work in the analysis and testing of the various materials given is required of each student.

### DYEING I. Physical and Chemical Properties of the Textile Fibres

Classification of textile fibres.—Study of the physical and chemical properties of the various animal and vegetable fibres.—Microscopy of the fibres.

This course is intended to make the student familiar with the various fibres that are employed for textile purposes. He is required to study the microscopy of typical fibres and in this manner become familiar with the structure of fibres of different origin. Numerous samples must be analyzed to determine the character of the fibres present. Photo-micrographs of specimens are made.



## COURSES IN CHEMISTRY, DYEING AND PRINTING

### **DYEING II. Technology of Scouring and Bleaching**

Study of the impurities occurring in raw wool.—Steeping and scouring wool.—By-products from scouring liquors.—Scouring cloth and yarn.—Water for scouring purposes.—Study of the solvent methods for scouring wool.—Soaps for scouring purposes.—Influence of different scouring agents and conditions on the physical properties of wool.—Scouring and boiling-out of cotton.—Bleaching of wool; stoving with sulphur dioxide; bleaching with sodium and hydrogen peroxides, potassium permanganate, etc.—Bleaching of cotton: use of chloride of lime; study of the proper conditions for bleaching.—Linen bleaching.

A thorough course of lectures on the subject is given. A constant reference is made to the chemistry of the processes with a chemical study of the materials employed and the by-products obtained. A considerable amount of experimental work supplements the lecture course.

### **DYEING III. Principles of Dyeing: Elementary Course**

#### **Acid, Basic, Substantive, Developed, Sulphur and Mordant Dyes**

General methods of wool dyeing; use of neutral and acid baths.—After-treatment of acid dyes with metallic salts.—Methods of applying badly leveling dyes.—General method of applying acid dyes to cotton.—Application of basic dyes to wool.—Methods of mordanting cotton and the dyeing with basic colors.—Study of the different metallic salts used for fixing.

General methods of dyeing wool with substantive colors.—After treatment of substantive dyes on wool with metallic salts.—General methods of dyeing cotton with substantive dyes.—Increasing the fastness of cotton dyes.—Formation of developed colors.—Nature and application of sulphur dyes.—Various methods of mordanting wool.—Comparison of different assistants.

The method of using the different dyestuffs is thoroughly studied in a course of lectures. The student carries out a large number of experiments with different dyes on small test skeins. In this way he becomes familiar not only with the different methods of applying the dyestuffs but also acquires a fund of knowledge respecting the relative shades and values of a large number of dyes. The student receives detailed criticism of all his experiments.

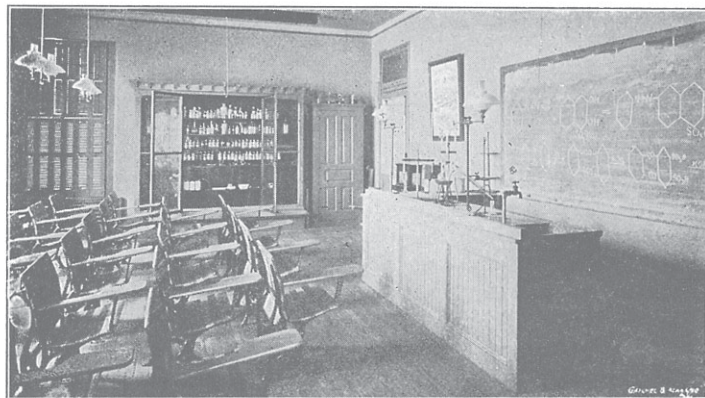
Besides the experimental dyeing of small test skeins, each student is required to help in the dyeing of larger quantities of various classes of goods which are operated upon in the well-equipped dye house of the school. Lots of from 1 to 50 pounds are constantly being dyed, including loose stock, yarns and piece goods, so the student has the opportunity of doing considerable practical dye-house work.

## COURSES IN CHEMISTRY, DYEING AND PRINTING

### DYEING IV. Principles of Shade Compounding and Matching

Primary, secondary and tertiary colors.—Preparation of tints of single dyes.—Compounding of two dyes in different percentages.—Preparation of colors containing three dyestuffs.—Matching of samples on wool; on cotton.—Matching colors from one class of fabrics to another.

In this course the student becomes familiar with the mixing qualities of dyestuffs and obtains a good idea of just how to synthesize a compound shade by the use of a few dyestuffs. The value of shade matching is early impressed on the student and, as aptitude and accuracy in this can only be acquired by practice, each student is required to match a large number of shades on different classes of goods and with different classes of dyes. Throughout the dyeing course he is constantly called upon to match colors to be dyed on large lots of materials.



LECTURE ROOM—CHEMISTRY AND DYEING

### DYEING V AND Vb. Color Mixing and Spectroscopy

Study of the phenomena of light and the nature and cause of color.—Nature of color in dyestuffs and pigments.—Color absorption in the mixing of dyes.—The spectroscope; its construction and use; its application to the study of color in dyeing and in dyestuffs.—The tintometer and its use.—Dichroism in dyes.—Effect of dichroism in compounding dyes and in color matching.—Effect of character of surface on colors of dyed goods.—Effect of artificial light on colors.

The laboratory is equipped with the very best forms of spectroscopes, together with a Lovibund tintometer especially designed for textile work. The spectra of a number of representative dyes are plotted by the student. This scientific work is supplemented by

practical dye tests in the laboratory. These spectroscopic studies show the nature and properties of different dyestuffs which cannot be gained by any other means. The practical use of colors and problems arising in practical color matching are given much attention.

**DYEING VI. Principles of Dyeing: Intermediate Course**

**Sulphur Dyes, Mineral Dyes and the Natural Dyewoods, Dyeing Union Goods; Half-Silks; Gloria; Preparation and Dyeing of Chloro Wool; Dyeing of Artificial Silk and Jute**

Chemistry of the sulphur dyes; general methods of applying the same.—Precautions to be taken with sulphur dyes; functions of the different agents in the dye-bath.—Methods of aftertreating and topping the sulphur dyes.

General principles of applying mineral pigments in dyeing; their advantages and disadvantages.—The principal natural dye woods still in use; logwood fustic, archil, cochineal.—Methods of applying these to wool and cotton.—The minor vegetable coloring matters; cutch, etc.

General principles to be followed in dyeing cotton-wool fabrics.—Adaptability of the different classes of dyestuffs.—Cross-dyeing of cotton warp goods.—Production of single color and novelty effects.—The general methods employed in dyeing cotton-silk material.—Production of single or solid colors; multi-colored effects.—The methods of dyeing gloria or wool-silk fabrics.

Action of chlorine and bleaching powder on wool.—Properties of chloro wool; unshrinkable wool.—Action of chloro wool towards dyestuffs; production of novelty effects.—Methods of dyeing artificial silk.

In this course, the work pursued is largely an extension of Dyeing III.

While the mineral and vegetable dyes are at present but little used in comparison with the extensive application of the coal-tar dyes, their historical importance is very great, and in certain cases some of them still possess considerable value.

The dyeing of materials containing more than one fibre is mainly carried out with those dyestuffs which will have been studied in detail in previous work. On account of the importance of this branch of dyeing, much time is spent thereon and numerous color-matches to given samples are required.

**DYEING VII. Textile Printing**

The essential elements in printing.—The machine; study of its different parts.—The different thickening agents used in printing pastes; study of their different properties and values.—Comparison of the different styles in printing.—The pigment style.—The direct printing style.—Steam style with basic colors.—Mordant style.—Aniline black printing.—Developed style with diazotized colors.—Printing of indigo and other "vat" dyes.—Resist style.—Discharge style; white and colored discharges.

There is a larger number and greater variety of chemicals and chemical processes used in printing than there is in dyeing, and it is the object of this course to give the student the underlying principles of the different methods of printing. The printing laboratory of the school is furnished with two experimental printing machines

## COURSES IN CHEMISTRY, DYEING AND PRINTING

and a number of engraved rollers adapted to the various styles of printing. The course consists of an extensive series of lectures and considerable laboratory work in the preparation of different colored patterns illustrating the different styles and methods in vogue and the use of the different classes of dyestuffs.



PRINTING LABORATORY

### DYEING VIII. Principles of Dyeing: Advanced Course

**Developed Dyes; Indigo and other Vat-dyes; Aniline Black; Turkey Red; Silk Dyeing and Weighting; Resist Dyeing; Preparation of Pigment Lakes; Methods of Softening, Scrooping and Weighting Cottons; Methods of Waterproofing**

The chemistry of the developed dyes; study of the dyeing, diazotizing and developing processes.—Coupled colors.—The naphthol colors.—History of indigo dyeing; methods of extraction and preparation of the dyestuff.—The chemical principles of indigo dyeing.—Methods of dyeing cotton with indigo; of dyeing wool.—Comparison of natural indigo with the synthetic product.—Preparation and use of indigo extract.—Vat dyes other than indigo.—The chemical principles involved in the dyeing of aniline black.—One-bath black; steam and aged blacks.—The chemical principles of Turkey-red dyeing.—Comparison of old process and new process Turkey red.

Application of different classes of dyes to silk; the acid dyes; basic dyes; substantive dyes; mordant dyes.—Methods of brightening, lustering and scrooping silk.—Use of different mordants on silk for purposes of weighting.—Dyeing of weighted blacks; iron and tannin weighting.—Weighting of silk for dyeing colors; tin weighting.—Methods of producing white and colored resist effects in woolens and worsteds.—The chemistry of lake pigments.—Use of coal-tar dyes in the preparation of pigments.—The minor uses of dyestuffs.

This course embraces the study of those dyes requiring special methods of application and considerable knowledge of organic chemistry. Also methods of producing special effects are given considerable attention.

### Dyeing and Color Matching Course

In addition to the three year Diploma Course in Chemistry, Dyeing and Printing, a two year Dyeing and Color Matching Course has been provided, upon the satisfactory completion of which a certificate is given.

This course is essentially dyeing, with sufficient chemistry and allied subjects added to give the student that proper fundamental knowledge so requisite to the modern dyer's art; that will enable him to cope with, and satisfactorily overcome, the many difficulties and changing conditions daily arising in the mill and dye house.

The requirements for entrance are the same as for all the Certificate Courses, and this information is given on page 28.

#### FIRST YEAR

Chemistry I, II and VI;  
Dyeing I, II, III and IV; and

#### SECOND YEAR

Chemistry III, a and b; IX, a, b, c and d;  
Dyeing IV; V, a and b; VI, VII and VIII

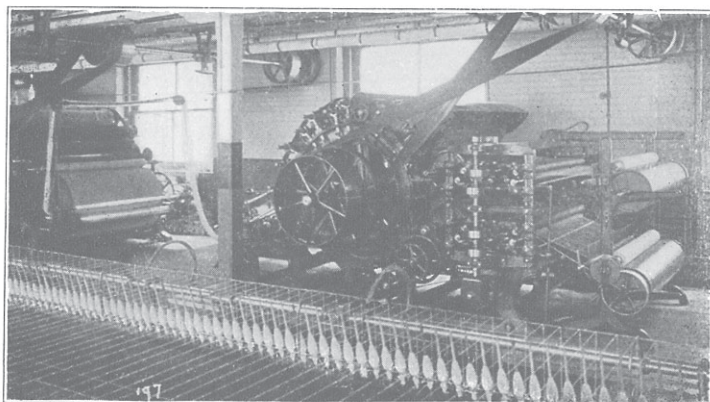
Descriptions of above subjects are to be found on pp. 85-91.



VIEW IN ONE OF THE CHEMICAL LABORATORIES

## Equipment

The School can now lay claim to an equipment excelling that of any similar institution. The numerous machines and appliances have been added from time to time as their necessity became apparent. Wherever it was seen that a new apparatus would assist in the demonstration of a subject, that apparatus was obtained, and where an improvement was made in machinery already in the School, either that improvement was attached or the old machine was replaced by an entirely new one. In this manner, the institution has kept pace with the development of the times, and we feel



SECTION OF WOOL CARDING AND SPINNING ROOM

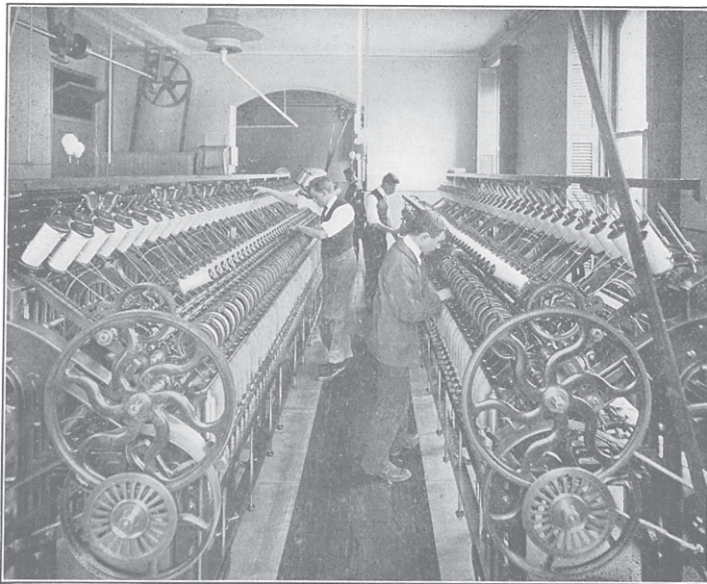
assured that but a glance at the following will reveal the opportunity for practical instruction which is afforded.

### WOOL PREPARING, CARDING AND SPINNING LABORATORIES

The two rooms in which the practical work of woollen yarn manufacture is carried on are most admirably laid out for the purpose intended. One of the rooms is devoted to the dusting, burr extracting and mixing of the wools, which is accomplished by the use of the Wm. Schofield improved willow, the C. C. Sargent's burr picker and the Wm. Schofield mixing picker. The other room is devoted to carding, spinning, twisting and reeling. The machinery employed consists of two sets of cards, one 48-inch Furbush, and the other 60-inch Gessner, both equipped with the latest-improved feeds

of the Apperly and Bramwell make; two small Torrance sampling cards for the making of fancy mixes; a 400-spindle self-acting mule, Platt pattern, Furbush make; floor and traverse grinders, Furbush and Roy make. The finisher card of the Furbush set is equipped with the latest improved Barker apron rub motion, to which is attached the latest improved Chapman Electrical Neutralizer. All the clothing in use on the above cards is from the American Card Clothing Company. The finisher card of the Gessner set has what is known as the strap dividing condenser.

A 72-spindle latest improved trap twister, Lowell machine shop make, and a 36-inch combination yarn reel of the Lindsay, Hyde & Co. make. The room in which the preparing machines are installed



SECTION OF WORSTED SPINNING ROOM, SHOWING WORSTED SPINNING FRAMES

is thoroughly equipped with the General Fire Extinguisher Company's automatic sprinklers.

#### **WORSTED DRAWING AND SPINNING LABORATORIES**

The four rooms devoted to this branch contain what is practically known as one complete set of English open drawing and spinning machinery. The set is composed of 12 machines, which are not working models, but are typical of what are found in any well-equipped worsted mill. All of the above machines were made by the Lowell Machine Shop, Lowell, Mass. In addition to the

foregoing, the department contains twisting, spooling, reeling and bundling machinery of equally high standard, the makers being Furbush, Easton & Burnham, Lindsay, Hyde & Co., and A. W. Allen, respectively. The rooms are also equipped with a complete humidifying system, installed by the American Moistening Company, Boston, Mass.

#### **COTTON CARDING AND SPINNING LABORATORY**

This, the third department mentioned for the manufacture of raw materials into yarns, contains a full line of machinery necessary for the processing of cotton into yarns of varying counts of fineness. All of this machinery was made especially for the school by the following well-known makers, and is up to date in every respect. It consists of revolving flat card, railway head and drawing frames from the Saco & Pettee Machine Works, Newton Upper Falls, Mass.; slubbing and roving frames from the Woonsocket Machine and Press Company, Woonsocket, R. I.; warp and filling spinning frames from the Fales & Jenks Machine Co., Providence, R. I., and Whitin Machine Works, Whitinsville, Mass.; self-acting mule, Platt Bro. make, Oldham, Eng.; spooling, twisting, reeling and band making machinery, from the Easton & Burnham Machine Co. and Fales & Jenks Machine Co., Providence, R. I., and the Draper Company, Hopedale, Mass. The department is fully equipped with humidifiers from the American Moistening Company, Boston, Mass.

#### **KNITTING LABORATORY**

This branch is carried on as an adjunct to the yarn-spinning department, and is calculated to fit the student to not only know the practical requirements of plain knitting, but to be more fully competent to judge of the yarn required to produce the knitted article desired.

The installation of machines consists of seven-eighths and full automatic knitters of the latest improved types. The following makes are represented: The Wildman spring needle body machine from the Wildman Mfg. Co., Norristown; the "Invincible," from the E. Jenckes Mfg. Co., Pawtucket, R. I.; the "Acme," from the Mayo Knitting Machine Co., Franklin Falls, N. H.; the Acme Mayo, from West Branch Knitting Co., Milton; the "Standard" full automatic, from Standard Machine Co., Philadelphia; the "Banner," full automatic, from Hemphill Manufacturing Co., Pawtucket, R. I.; the Brinton "Model C," full automatic, from H. Brinton & Co., Philadelphia; the Paxton & O'Neill, three-quarter automatic from Paxton & O'Neill, and Branson, seven-eighth automatic, from Branson Machine Co., Philadelphia; the "Lamb," from Lamb Knitting Machine Manufacturing Co., Chicopee Falls, Mass.; "Ribbers," from Branson Machine Co., and Scott & Williams, Phila-



delphia, and McMichael & Wildman, Norristown, and Brinton & Co., Philadelphia; "Underwear Machine with Crawford Stop Motion," from Scott & Williams, Philadelphia; "Loopers," from Hepworth & Co., Philadelphia, and William Beattie, Cohoes, N. Y.; "Cone Winders," from Universal Cone Winding Co., Boston, Mass.

#### **WINDING, SPOOLING, TWISTING, REELING WARPING, ETC.**

For the purpose of proper administration, the various machines devoted to the preparation of cotton, wool and worsted yarns for the loom are grouped in one large room, so that the very best advantage in the way of instruction and practical usefulness may be obtained. The machines in use in this work are recognized among the best to be had. The following makers are represented:

Bobbin winders for cotton, wool and worsted from the Fairmount Machine Works and W. W. Altemus & Son; drum and upright spoolers for cotton, wool and worsted from W. W. Altemus & Son, and Easton & Burnham; ring twisters, for plain and fancy twisted yarns, from Collins Bros., the Draper Co., and the Philadelphia Textile Machine Co.; cop winders for carpet, backing and upholstery yarns from A. W. Allen and W. W. Altemus & Son; yarn reels, six in number, straight, cross and combination, from the Draper Co. and Lindsay, Hyde & Co. Machines devoted to warping and beaming include, in addition to the numerous pin warping frames and creels, upright and sectional warpers for cotton, worsted and woolen yarns, and a T. C. Entwistle chain beamer and six specially constructed beaming frames.

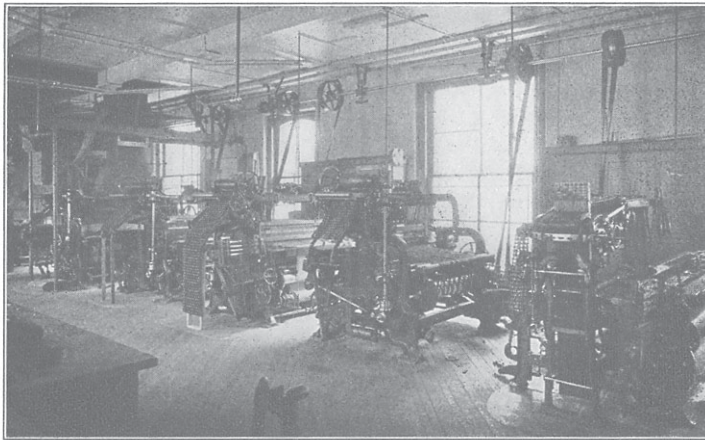
#### **SILK REELING, WINDING AND WARPING**

Particular attention has been given to the equipment of this department of reeling, winding and the preparation of silk for weaving purposes. The machinery installed includes soft silk skein winders, doublers and Swiss quill-winding machines, warpers and creels, as well as beamers for above warpers. All this machinery is from the Atwood-Morrison Co., Stonington, Conn. Additional quill-winding machinery is from the Schaum & Uhlinger Co., Philadelphia, the Universal Winding Co., Boston, Mass., and two reels for winding direct from the cocoon. The silk department also possesses the entire collection of the Women's Silk Culture Association of America, which in itself is a most valuable aid to those making a study of the silk fibre.

#### **HAND-WEAVING LABORATORY**

The rooms devoted to hand weaving and related branches are three in number. These rooms contain upwards of 90 looms,

specially designed and constructed, adaptable to the weaving of all classes of textures. Groups or sections of looms are formed, each section being devoted to some special class of goods, such as cotton or union fabrics, wool and worsted fabrics for both men's wear and women's wear, Jacquard and special stuffs in cotton, wool and worsted, as well as those for plain and fancy silks, furniture coverings and draperies. Several looms are devoted to such narrow fabrics as laces, bindings, ribbons, elastic and non-elastic webbings.



HEAVY WORSTED AND WOOLEN LOOMS

#### POWER-WEAVING LABORATORY

The four laboratories in which the equipment for power weaving is installed are arranged so as to admit of satisfactory administration in accordance with the organized courses of instruction. The completeness and variety of this equipment is unexcelled by that of any similar institution. The machinery is of American make, from the best makers, thoroughly up to date and exceptionally well assorted. The breadth of the School's field of instruction necessitates this extensive collection of machinery, the policy being to teach by means of that which is best adapted to the fabric in question, and when a loom builder brings out an improvement, the new is substituted for the old or new attachments added.

The looms in most frequent use by the classes are located in a large, well-lighted room, and the purposes for which they are intended range from the finest gingham to the heaviest worsted and woolen of the harness type, including various looms with leno attachments. The production of fabrics of a more highly ornamental

character, including the finest silk damask, dress goods, draperies and heavy woolen robes, is provided for by a large collection of suitable looms equipped with Jacquard machines. Three other laboratories, not as large as the one mentioned, are fitted up on the same general plan, and contain looms for special purposes, but which are not apt to be in as common use. Included in the equipment for fine cottons are three filling magazine looms with warp stop motions, showing that the school is keeping apace with progress in this line. The narrow goods, elastic and non-elastic, are amply provided for, as well as fabrics to which the swivel and lappet principles are applied, also terry or Turkish toweling.

The following well-known makers of looms are characteristically represented in the school's power-weaving plant :

The Crompton & Knowles Loom Works, Worcester, Mass., from which shops the school has obtained a large proportion of the looms for silks, cottons, worsteds, woolens, upholstery, fabrics, carpets, towels, lappets, lenos, etc.

From the Draper Co., Hopedale, Mass., three automatic looms for plain and fancy cottons.

From Schaum & Uhlinger, Philadelphia, looms for silks, swivel dress goods, draperies, ribbons, narrow webbings, etc.

The looms from the following makers are intended for fine cotton fabrics: The Whiting Machine Works, Whitinsville, Mass.; the George W. Stafford Co., Readville, Mass.

#### JACQUARD CARD CUTTING AND LACING LABORATORY

The large number of Jacquard machines possessed by the school (27 in number, ranging from 200 to 1,200-hook capacity) has necessitated a proportionately large number of card-cutting machines to facilitate the work of Jacquard design. Very few factories possess the facilities for card stamping as are found in this department.

The room in which these machines are contained is exceptionally well lighted, having both top and side lights, and is equally well provided in other essential features. The equipment consists of the following machines :

One American and one French index, foot power card stampers, from Schaum & Uhlinger, Philadelphia.

Four latest improved French index, foot power, card stampers, from John Royle & Sons, Paterson, N. J.

Two latest improved mechanically driven French index card stampers, from John Royle & Sons, Paterson, N. J.

Two latest improved (1915) electrically driven French index card stampers, from John Royle & Sons, Paterson, N. J.

The American index machine is intended for ingrain carpet work alone. Each of the others is adjustable to 200, 400 and 600 cards, and is also equipped with the latest improvements in the way of racks, escapements, reading boards and other features indispensable to the production of good work.

The department also possesses several sets of punching plates for side Jacquards, a power card-lacing machine for 200, 400, 600 and ingrain cards, as well as several hand card-lacing frames. Also braiding machines from New England Butt Co., for the manufacture of lacing cord used.

#### **CHEMICAL LABORATORIES**

The three rooms devoted to practical work in pure and applied chemistry are admirably equipped with all necessary glass, porcelain and platinum ware, etc.

Besides his individual outfit, the student has the use of such forms of special apparatus as his work may require.

#### **DYEING LABORATORY**

A large number of bench lockers provided with necessary apparatus for experimental dyeing and dyestuff testing.

A number of copper and wooden dye vats for dyeing yarn and piece goods in lots of 1½ pounds up to 50 pounds.

Scouring tubs, soap boiler, scouring and dyeing bowls for loose stock.

Klauder & Weldon scouring and dyeing machine for yarns of all characters; also Klauder & Weldon machine for dyeing of loose stock; Granger jig-dyeing machine; Butterworth warp-dyeing machine; Psarski model dyeing machine with pump complete; Hussong dyeing machine for lots up to 50 pounds; Schaum & Uhlinger hydro-extractor; one Mulhausen laboratory printing machine, and one Mather & Platt laboratory printing machine; steaming cottage; hot-air dryer. All the water used in the dye house is clarified by the aid of a large filter, installed by the Philadelphia Water Purification Company and softened to zero hardness by aid of softener equipment installed by the Permutit Co., of New York.

One Allen circulating Kier for boiling out, under pressure, cotton and other vegetable fibres in the form of yarn or piece goods.

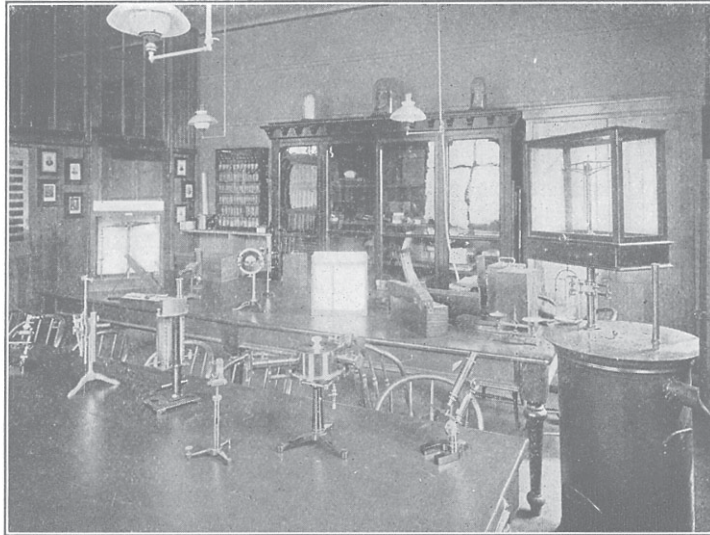
One sample Electrically Driven Hosiery Dyeing Machine (Monel Metal) from Liberty Copper Smelting Co. of Phila.

#### **MICROSCOPIC FIBRE-TESTING AND COLORIMETRIC LABORATORY**

This is well equipped with a number of microscopes and apparatus for the preparation of slides and sections; photographic apparatus for the making of photomicrographs; Lovibund tinto-

meter, with set of standard glasses and large number of gelatine films of various dyestuffs; a Zeiss comparison spectroscope and a Zeiss universal spectroscope, with all accessories for the spectroscopic study of dyestuffs; a Reeser & Mackenzie fibre-testing machine, for determining tensile strength and elasticity.

The laboratory is also supplied with a conditioning oven of the latest pattern, capable of rapidly and accurately giving the amount of hygroscopic moisture contained in any class of fibre in any form.



MICROSCOPIC AND COLORIMETRIC LABORATORY

raw or manufactured. Tests on small or large samples can be made with equal facility.

#### CLOTH FINISHING LABORATORY

The facilities for finishing of the various fabrics produced in the school are quite in keeping with those of other departments, and consist of one three-quarter combination washing and rotary fulling mill, and one small fulling mill for samples; both from the James Hunter Machine Co., North Adams, Mass.; a Gessner improved push mill, with lateral side movement; single-cylinder upright gig, Curtis & Marble make; Parks & Woolson cloth shear, with patent listing motion; Parks & Woolson double-cylinder cloth brush, with steamer attachment; Gessner improved cloth press; Morris & Tasker hydro-extractor, tenter bars, frames, etc.

## Evening School

In order to allow those employed during the day to receive some of the benefits and profit by the facilities for study which this School may afford, courses covering all branches of general textile instruction have been arranged to be carried on in the evening. In preparation of these courses, the aim has been to cover, in a general way, what is given in the day classes; the shortness of time, however, renders it impossible to treat exhaustively any particular branch, and it is expected that the instruction given in the classes will be supplemented by a considerable amount of home study.

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### GENERAL INFORMATION REQUIREMENTS FOR ADMISSION

Applicants for admission to any of the evening classes should be at least 18 years of age and prepared to satisfy the Director of the School or Head of the Department that they will profit by attendance at any of the classes to which they may be admitted.

Applications for enrollment may be made in person or sent to the School by mail at any time after July 1st, but preference for enrollment will be given to those applicants who make payments between 9 A. M. and 4 P. M., September 1st to 27th, inclusive. The evening of September 29th, from 7 to 9 P. M., is set apart for the receipt of applications and fees for places in classes not previously filled.

### TUITION FEE—COURSES

The Tuition Fee for the various courses outlined on pages 104 to 106 is \$45 for the year or term. The fees for individual studies are given under the different subjects on pages 106 to 114. *All fees are payable in advance.* See page 30.

### DEPOSITS

Students of the Evening Classes in Dyeing, Elementary Chemistry and Qualitative Analysis make, on entering, a deposit of \$15, from which sum is deducted fixed laboratory

## EVENING SCHOOL

charges of \$2 to partially cover costs for yarns and materials used in dyeing, \$1 for locker rental, \$1.50 for special chemicals, and in addition a minimum charge of \$1.50 is made for depreciation of apparatus used.

Students of the course in Quantitative Analysis make a deposit of \$20. After deducting the aforesaid charges, including breakage, the balance, if any, is returned at the close of the school session.

### LOCKER DEPOSITS

Students of the Regular Textile Evening School make a deposit of \$1.50 when they are supplied with a locker. Fifty cents of this amount is refunded, provided the key is returned within thirty days after the close of the school year.

### HOURS OF STUDY

The Evening Classes are in session from 7.30 until 9.30 on Monday, Wednesday and Friday evenings.

### EXAMINATIONS

Examinations are held at the close of year or term in all subjects taken in the Regular Courses.

### CERTIFICATES

Two grades of certificates are awarded, as follows: *A Full Course Certificate* to those students who have completed three years of study in any of the following courses: A, B, C, D, E, F, G, and H, in a satisfactory manner. Among the requirements are a complete orderly record of the work as given by the instructor; an attendance of at least 75 per cent. of the time the classes are in session; and the passing of the final examinations. *A Partial Course Certificate* to students who have completed in a satisfactory manner, including the final examinations, the following special studies:

Weave Formation . . . . .	three years
Figured Design . . . . .	two years
Fabric Analysis and Calculation . . . . .	three years
Cotton Yarn Manufacture . . . . .	two years
Wool Yarn Manufacture . . . . .	two years
Worsted Yarn Manufacture . . . . .	one year

EVENING SCHOOL SCHEDULE

Silk Fabric Analysis.....one year  
 Raw Materials of the Wool Industries..one year

**MERIT SCHOLARSHIPS**

A merit scholarship is awarded to the evening student attaining the highest rating for the year's work, including the final examinations, in both the first and second year Regular Textile Course.

**SUPPLIES**

Students must provide themselves with the necessary note books, designing paper, paints, brushes, and other materials, as indicated by the Lecturers and Instructors in the respective classes. These materials are for sale in the School at less than retail prices.

**Evening School Schedule**

Showing the evenings on which are taught the subjects stated on pages 107 to 109 inclusive.

MONDAY	WEDNESDAY	FRIDAY
Elementary Weave Formation and Fabric Structure	Intermediate Weave Formation and Fabric Structure	Advanced Weave Formation and Fabric Structure
Intermediate Calculations and Fabric Analysis	Advanced Calculations and Fabric Analysis	Elementary Calculations and Fabric Analysis
Woolen Yarn Manufacture (Advanced)	Silk and Fine Cotton Fabric Analysis and Calculations	Loom Fixing and Study of the Power Loom
Special and Advanced Jacquard Design and Card Stamping	Elementary Warp Preparation and Weaving	Elementary Jacquard Design
Raw Materials of the Wool Industries and Calculations	Advanced Cotton Yarn Manufacture	Worsted Yarn Manufacture Drawing and Spinning
Advanced Design Coloring	Woolen Yarn Manufacture (Elementary)	Cotton Yarn Manufacture
Elementary Hosiery Knitting	Elementary Design Coloring	Advanced Hosiery Knitting
Chemical Laboratory	Chemical Laboratory	Lecture in Elementary Chemistry
Lecture in Elementary and Advanced Dyeing	Dyeing Laboratory	Dyeing Laboratory



COURSES OF STUDY—EVENING SCHOOL

### Courses of Study

The following are the regular courses and are recommended as advantageous outlines of study. If, however, a person does not desire to follow any of these courses, preferring to confine his attention to certain of the subjects which are given on pages 107 to 114, he can do so in accordance with the schedule shown on page 103.

See pages 114 and 115 for special Jacquard and silk work.

#### Course A

(Annual Fee \$45)

This course is recommended to those who are interested in cottons.

	MONDAY	WEDNESDAY	FRIDAY
<b>First Year</b>	Elementary Weave Formation and Fabric Structure	Elementary Warp Preparation and Weaving	Elementary Calculations and Fabric Analysis
<b>Second Year</b>	Intermediate Calculations and Fabric Analysis	Intermediate Weave Formation and Fabric Structure	Cotton Yarn Manufacture
<b>Third Year</b>	Hosiery Knitting	Advanced Cotton Yarn Manufacture	Advanced Weave Formation and Fabric Structure

#### Course B

(Annual Fee \$45)

This course is recommended to those who desire to study the application of Jacquard Designs to Textiles in general.

	MONDAY	WEDNESDAY	FRIDAY
<b>First Year</b>	Elementary Weave Formation and Fabric Structure	Woolen Yarn Manufacture (Carding)	Elementary Jacquard Design
<b>Second Year</b>	Advanced Jacquard Design	Intermediate Weave Formation and Fabric Structure	Worsted Yarn Manufacture
<b>Third Year</b>	Advanced Design Coloring	Elementary Design Coloring	Advanced Weave Formation and Fabric Structure

COURSES OF STUDY—EVENING SCHOOL

**Course C (Annual Fee \$45)**

This course is recommended to those who are interested in both cottons and woolens.

	MONDAY	WEDNESDAY	FRIDAY
<b>First Year</b>	Elementary Weave Formation and Fabric Structure	Elementary Warp Preparation and Weaving	Elementary Calculations and Fabric Analysis
<b>Second Year</b>	Intermediate Calculations and Fabric Analysis	Intermediate Weave Formation and Fabric Structure	Loom Fixing and Study of the Power Loom
<b>Third Year</b>	Raw Materials of the Wool Industries	Advanced Calculations and Fabric Analysis	Advanced Weave Formation and Fabric Structure

**Course D (Annual Fee \$45)**

This course is recommended to those who are particularly interested in wool and worsted stuffs.

	MONDAY	WEDNESDAY	FRIDAY
<b>First Year</b>	Elementary Weave Formation and Fabric Structure	Woolen Yarn Manufacture (Carding)	Elementary Calculations and Fabric Analysis
<b>Second Year</b>	Intermediate Calculations and Fabric Structure	Intermediate Weave Formation and Fabric Structure	Worsted Yarn Manufacture
<b>Third Year</b>	Raw Materials of the Wool Industries	Advanced Calculations and Fabric Analysis	Advanced Weave Formation and Fabric Structure

**Course E (Annual Fee \$45)**

This course is arranged for those who desire to give special attention to upholstery and similar Jacquard work.

	MONDAY	WEDNESDAY	FRIDAY
<b>First Year</b>	Elementary Weave Formation and Fabric Structure	Elementary Design Coloring	Elementary Jacquard Design
<b>Second Year</b>	Advanced Jacquard Design	Intermediate Weave Formation and Fabric Structure	Elementary Calculations
<b>Third Year</b>	Special Jacquard Design Card Stamping and coloring	Silk and Fine Cotton Fabric Analysis and Calculations	Advanced Weave Formation and Fabric Structure

COURSES OF STUDY—EVENING SCHOOL

**Course F (Annual Fee \$45)**

This course is recommended to those who desire to couple the study of Jacquard design with that of general fabrics.

	MONDAY	WEDNESDAY	FRIDAY
First Year	Elementary Weave Formation and Fabric Structure	Elementary Design Coloring	Elementary Calculations and Fabric Analysis
Second Year	Intermediate Calculations and Fabric Analysis	Intermediate Weave Formation and Fabric Structure	Elementary Jacquard Design
Third Year	Advanced Jacquard Design	Advanced Calculations and Fabric Analysis	Advanced Weave Formation and Fabric Structure

**Course G (Annual Fee \$45)**

Breakage Deposit, \$15. See Deposits, page 101.

This course is arranged for those who desire to specialize in the study of chemistry and dyeing, both in theory and practice

	MONDAY	WEDNESDAY	FRIDAY
First Year	Chemical Laboratory	Chemical Laboratory	Chemistry Lecture
Second Year	Lecture Elementary Dyeing (8-9 P.M.)	Dye Laboratory	Dye Laboratory
Third Year	Lecture Advanced Dyeing (8-9 P.M.)	Dye Laboratory	Dye Laboratory

**Course H (Annual Fee \$45)**

		MONDAY	WEDNESDAY	FRIDAY
First Year	Elementary Chemistry	Laboratory 7.30-9.30 P.M.	Laboratory 7.30-9.30 P.M.	Lecture 8.00-9.00 P.M.
Second Year	Qualitative Analysis	Lecture 8.00-9.00 P.M.	Laboratory 7.30-9.30 P.M.	Laboratory 7.30-9.30 P.M.
Third Year	Quantitative Analysis	Laboratory 7.30-9.30 P.M.	Laboratory 7.30-9.30 P.M.	Lecture 8.00-9.00 P.M.

## Subjects of Study and Fees

The following fees are for individual studies. The fee for the regular courses, as outlined on pages 102 to 104, is \$45 (for the term of approximately six months) according to the character of the subjects included.

### WEAVE FORMATION

Divided into Elementary, Intermediate and Advanced, each division requiring one year. For details, see pages 40, 46 and 55. Fee for this subject, two hours per week for the term, \$15.

### ELEMENTARY WARP PREPARATION AND WEAVING

Requiring one year. For details, see page 43. Fee for this subject, two hours per week for the term, \$15.

### ELEMENTARY, INTERMEDIATE AND ADVANCED CALCULATIONS AND FABRIC ANALYSIS

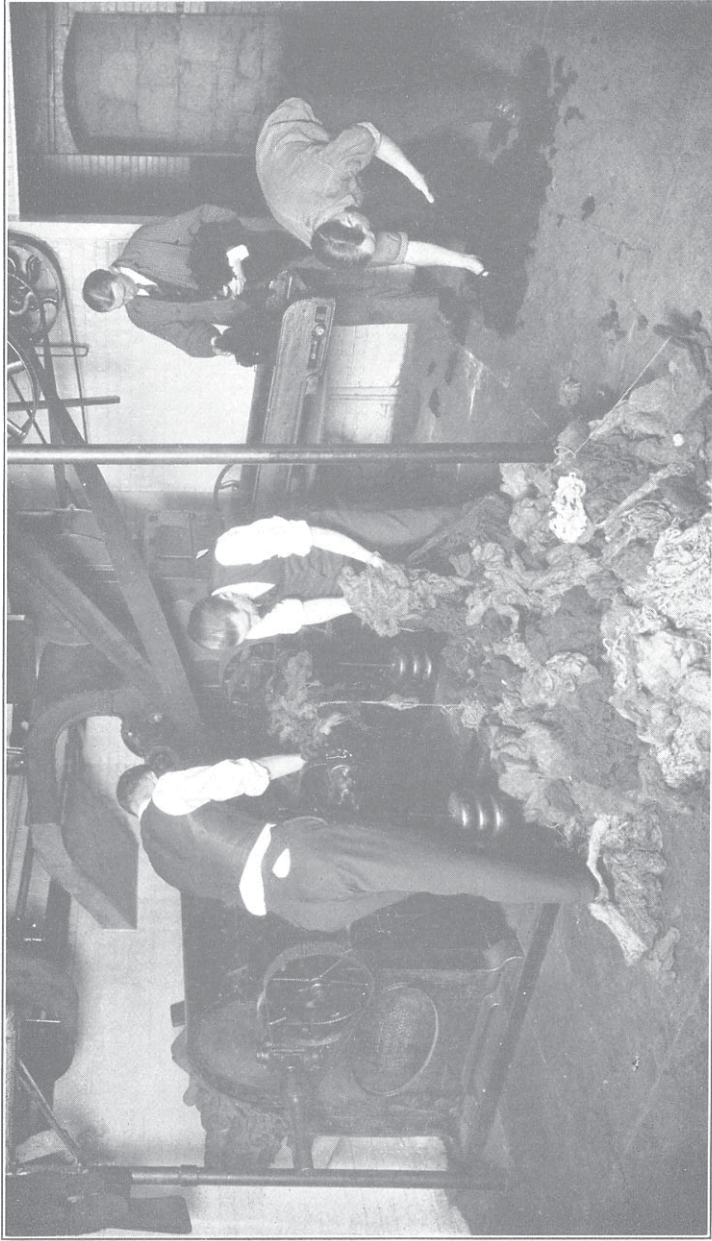
Each division requiring one year. For details, see pages 40, 47 and 54. Two hours per week for the term, \$15.

### THE STUDY OF THE POWER LOOM (Special Loom Fixing Class)

This course covers a period of one term or year, and is carried on by means of Lectures and practical Demonstrations. The subjects considered are partly covered by the following:

The Power Loom.—The principles governing its parts.—Relation and timing of the parts.—The various shedding mechanism, cam motion, cam and scroll motion, dobby motion.—Open and closed shed looms, and the advantages of each.—The various picking motions, the alternating pick, the pick and pick, cam and cone, sliding pick motion.—Shuttle box motions, raise and drop box, skip box, circular box, boxes controlled by cams, by a chain and by the Jacquard.—Rules and calculations for change gears for the various take-up motions.—Ascertaining desired speed of shafting and size of pulley for given speed of loom.—Timing and setting of the box motions of the Knowles, Crompton, Wood, Furbush, Schaum & Uhlinger, Stafford and Whitin looms.—Knock-off motions.—Fast and loose reeds.—Harness and box chain building and care of stock.—Multiplier box chain building.—The Jacquard machine and its many forms of use.—Mounting and adjusting of single-lift, double-lift and special Jacquards.

Fee for this course, two hours per week for the term (six months), \$15.



SECTION OF WOOL PREPARING ROOM—SHOWING BURR AND MIXING PICKERS

### COTTON YARN MANUFACTURE

Two years are required. First Year.—For details, see page 44. Second year.—Advanced work, particularly with regards to pickers, combing, spinning, twisting, and the self-acting mule. Fee for this subject, two hours per week, for term, \$15.

### RAW MATERIALS OF THE WOOL INDUSTRIES

Instruction in this subject—requiring an attendance of one year—is given by means of illustrated lectures and practical demonstrations, which occur weekly, on Monday evenings. The year's work is divided into two portions, designated as elementary and advanced, and includes the discussion of such topics as may be found under "Raw Materials, etc.," on page 51. Fee for this subject, two hours per week for the term, \$15.

### WORSTED YARN MANUFACTURE

This course covers a period of one year, and is carried on largely through lectures and practical demonstration on the machines themselves. The following is an outline of the scope of the subject.

PREPARING.—Explanation of the process.—Gill box and Faller motion.—What wools are prepared and why they are not carded.—Preparing medium staple wools before carding.

CARDING.—Comparison of the card used for worsted with that commonly used for wool.

COMBING.—Original method of combing.—Hand combing.—Combing by machines.—The Noble, Lister, Holden and Little & Eastwood machines duly considered.

BALLING OR TOP MAKING.—Explanation of the workings of the necessary machines used in forming the top.—The Can Finisher and Balling Finisher.—The conditioning of tops.

DRAWING.—The principles of drawing duly explained.

CALCULATIONS.—All the necessary calculations required in the above processes.

SPINNING.—Principles of spinning on the flyer, cap and ring spinning frames.—Worsted mule spinning.

DOUBLING AND TWISTING.—Principles of twisting.—Twisting, as performed on the flyer, cap, throstle and ring frames.—Effect of too much or too little twist in first or second operation.

CALCULATIONS IN FULL.—Drafts, doublings, stop motion for gilling and drawing.—Working out a set of drawings for any given count.—Gauge points or constants for all practical purposes.—The slide rule, and how to use it in working out drafts and other calculations.—How to find "constant" and how to use, and why.—Twisting.—Reeling.—Straight and cross reeling, also weight yarn.

GENERAL.—Oiling of the wool.—Breaking wool.—Fallers.—Ratch-drag of hobbins, lifter motion or builders.—Stop motions.—How to weigh yarn.—Averaging slubbing to make yarn weigh even.—Causes of imperfect yarn.—Lumps.—Slugs.—Double.—Single.—Twitty.—Overdrafted.—Dragged too hard.—Too much or too little speed.—Features to be considered in laying out and

## EVENING CLASSES

equipping a worsted mill, including power transmission, heating, ventilating, humidity and fire protection.

Fee for this subject two hours per week for term, \$15.

### WOOL YARN MANUFACTURE

This course covers a period of two years. It has been so planned through lectures and practical demonstrations as to make it possible to give the student a most comprehensive idea of all the necessary means and methods required in the production of good and serviceable yarn by the woolen process. The following is an outline of the scope of the subject.

**PREPARATORY PROCESSES.**—Burring and picking.—Consideration of the various burring and picking machines in general use.—Preparation of mixes and methods adopted in laying down mixes according to desired percentages.—Oiling the mix.—Testing and selection of oils.

**CARDING.**—Theory of carding.—Explanation of the term "set of cards."—Names and uses of the various rolls and cylinders.—Truing up of cylinders.—The necessary settings and adjustments, together with calculations for changes in the speeds of the different parts.

**CARD CLOTHING.**—The essentials of good clothing.—Construction, classification, and uses.—Methods of clothing the various rolls and cylinders.—The principles of grinding and the practical accomplishments thereof.—Frame, traverse and roll grinders.

**FEEDS.**—Hand, ball, creel, and automatic feeds carefully considered.—The construction and adjustments necessary for the satisfactory operation of the Bramwell, Apperly, Scotch, Tindel, Fischer, etc.

**CONDENSERS.**—The various forms of condensers in general use.—Ring system.—Single and double doffers.—Bolette single doffer.—Steel blade dividers.—German single doffer strap dividers.

**RUBBING MOTIONS.**—Rolls.—Aprons.—Aprons and rolls combined.—Single, double and quadruple bank apron rubbers thoroughly studied, together with the methods and appliances used in the making of the various woolen novelty yarns.

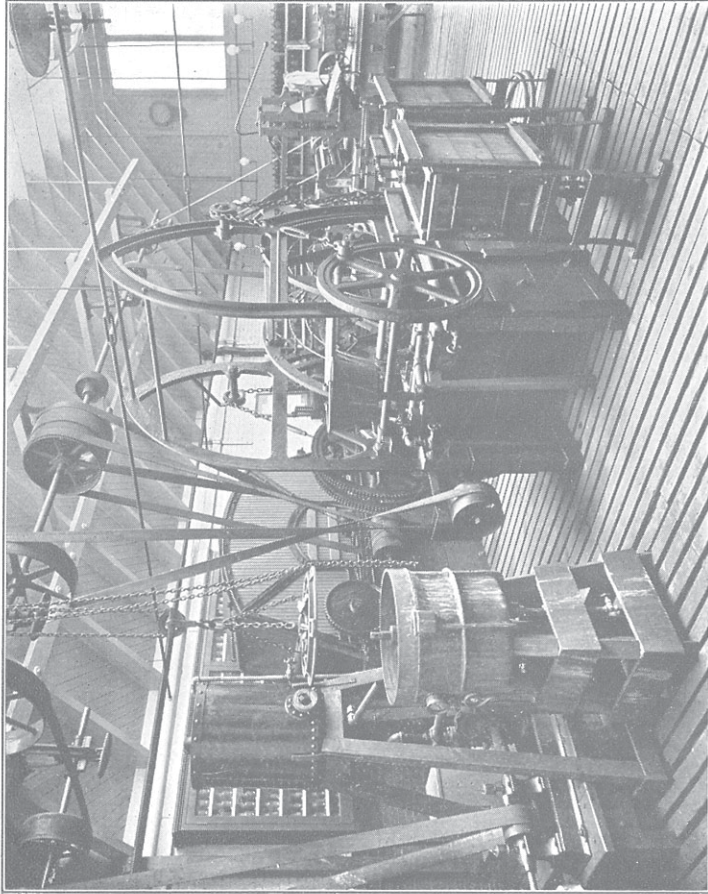
**SPINNING.**—The history and development of spinning.—Hand jack.—Self-operator and self-acting mule.—Present perfection of the mule.—The mule head.—Means of actuating the rolls, spindles and carriage.—Backing off.—Winding Mechanism.—The quadrant and its functions.—The builder rail and method of regulating it.—Automatic regulation of the fallers.—Changing the speed of the various parts.—Calculations for twists and drafts.—Calculations for finding the labor cost of carding and spinning.—Calculations as to net cost of stock used.—Calculations as to allowance for waste and time.—Features to be considered in laying out and equipping a woolen carding and spinning room, including power transmission, heating, ventilating, humidifying and fire protection.—Speed for the different grades of yarn.

Fee for this subject two hours per week for term, \$15.

### PLAIN HOSIERY KNITTING

This Course, covering a period of two years, has been planned with the aim of giving the student not only a general knowledge of the principles and construction of knitted fabrics, but a familiarity with the practical workings of many of the best makes of Knitting Machines, Ribbers and Loopers.

A brief outline of the work follows: Yarn calculations.—Grading yarns with regard to size.—Considering the various systems in their relation to one another.



SECTION OF DYE HOUSE SHOWING STOCK AND SKEIN DYEING MACHINES



## EVENING CLASSES

—The relation of count, weight and length of different threads.—The principles and construction of the circular rib top knitting machines, and the knitting of the different classes of tops, with all kinds of the best welts for half hose, wrist and ankle cuffs. Plaiting of all kinds—silk, cotton, etc.; making of legs for children's ribbed stockings; also the principle and construction of seamless hosiery knitting machines; the assembling, setting and adjusting of all parts of the different well-known types employed in making infants', boys' and misses' stockings, men's half hose, ladies' stockings, including the different styles of reinforcing, high splice, double sole, reinforced heel and toe, plaiting of the different colors, etc.

Fee for this subject, two hours per week, for the term, \$15.

### Chemistry and Dyeing—Course G

One year is required for chemistry and two years for dyeing.

#### ELEMENTARY CHEMISTRY

Consisting of practical laboratory experiments and lectures.

Introductory ideas on scientific methods of study and experimentation.—Simple manipulations in the use and handling of apparatus.—Chemical action.—Study of hydrogen and oxygen.—Acids, bases and salts.—Chemical notation, symbols, formulas and equations.—Study of typical compounds, with characteristic experiments illustrative of the same.—Chemical laws and calculations.—Solutions of problems.—Preparation and examination of the chief elements and their important compounds by means of laboratory experiments.

Fee for this subject, six hours per week for the term, \$45. See "Deposits," page 101.

#### ELEMENTARY DYEING

Covering the application of the various colors to wool, cotton and silk.

Scouring and preparation of loose wool, yarn and cloth.—Bleaching.—Application of the acid colors.—The basic colors.—The mordant colors.—The natural dyes.—Compounding shades.

Scouring and bleaching of cotton.—Methods of applying substantive colors.—Developed colors.—Basic colors.—Alizarine and natural colors.—Methods of mordanting and fixing.—Compounding of shades.

#### ADVANCED DYEING

Color mixing and matching.—After-treated colors.—Mineral colors.—Natural dyes.—Aniline black.—Naphthol colors.—Silk dyeing.—Union dyeing.—Half-silk dyeing.—Gloria dyeing.—Indigo and other vat dyes.—Sulphur colors.—Developed colors.—Resist dyeing.—Comparative money-value of dye stuffs.

In connection with laboratory work in experimental dyeing, a course of lectures is given once a week, covering the chemical and physical technology of the fibres, scouring and bleaching, methods and theory of dyeing, and special lectures on soaps, mercerizing, etc.; the lecture course covers a period of two years.

Fee for each year of the dyeing course, six hours per week, \$45. See "Deposits," page 101.

**LECTURE COURSES IN DYEING**

Students may take the course of lectures in elementary or advanced dyeing, without the supplementary laboratory work. The course consists of twenty-three lectures of one hour each, and no certificate is given.

The fee for the course of lectures in either elementary or advanced dyeing is \$20.

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## Chemistry—Course H

**FIRST YEAR—ELEMENTARY CHEMISTRY**

Introductory ideas on scientific methods of study and experimentation.—Simple manipulations in the use and handling of apparatus.—Chemical action.—Study of hydrogen and oxygen.—Acids, bases and salts.—Chemical notation, symbols, formulas and equations.—Study of typical compounds, with characteristic experiments illustrative of the same.—Chemical laws and calculations.—Solution of problems.—Preparation and examination of the chief elements and their important compounds by means of laboratory experiments.

This course is elementary, and is carried on by means of lectures and recitations, coupled with considerable laboratory work in experimentation on the properties and preparation of the chemical elements and their compounds.

The tuition fee for this subject is \$45 for the term of 6 hours per week. See "Deposits," page 101.

**SECOND YEAR—QUALITATIVE ANALYSIS**

The analytical classification of the metals.—Characteristic tests for the different elements.—Detection of bases and acids in their compounds.—Solving of analytical problems.—Writing of reactions.

This course is arranged with the view of making the student thoroughly familiar with the characteristic reactions whereby the different chemical elements may be recognized and distinguished from one another in their numerous combinations. The work is carried on largely by experiments, and the student is required to solve problems given to him for analysis. He is taught how to test materials with regard to purity and the methods of detecting adulterations in the various commercial products with which he is apt to come in contact.

The tuition fee for this subject is \$45 for the term of 6 hours per week. See "Deposits," page 101.

**THIRD YEAR—QUANTITATIVE ANALYSIS**

General procedure in analytical methods; sources of error and their prevention.—Preliminary manipulation; use of analytical balances.—Preparation of pure salts.—Methods of precipitation and treatment of precipitates.—Typical

## EVENING CLASSES

gravimetric analyses of the metals.—Analyses of compounds containing several metals.—Gravimetric estimation of the acid radicals.—Principles of electrolytic analysis.

General principles of volumetric procedure.—Classification of volumetric methods.—Use and calibration of graduated apparatus.—Preparation of normal and standard solutions.—Use and limitations of indicators.—Alkalimetry and acidimetry; typical analyses of acids and alkalis.—Volumetric methods by oxidation and reduction.—Volumetric methods of precipitation.—Exercises on commercial products.

In this course the student learns, by means of actual demonstration, the methods of determining quantitatively the composition of various chemical compounds. He is well drilled in the use of the balance, and is taught habits of precision, accuracy of observation and delicacy of manipulation, so necessary for success in chemical analysis. The objects employed for the analyses, as far as possible, are selected from commercial products, and are those best adapted to the immediate needs of the individual student.

The tuition fee for this subject is \$45 for the term of 6 hours per week. See "Deposits," page 101.

### TEXTILE COLORING

One year is required. The particular something which makes a textile fabric attractive. A point of utmost importance to every one who helps to manufacture or market the product of the mill. Without color, good patterns become flat and possess no charm; with good color, inferior patterns become leaders.

Theories are treated as applied to the textile fabric. Practical work with pigments showing the action of colors on each other, and the modification due to mixtures of raw materials and yarns, furnish much of the work in this subject.

Matching of colors in yarns and fabrics, training the eye to detect differences in tone and quality of color. Fabrics are studied with reference to the effect of weave and textures on color combinations.

Colored sketches for dress goods, shirtings, Jacquard fabrics, carpets and rugs are made, showing the application of the various principles laid down.

Fee for this subject, two hours per week for the term, \$15.

**FIGURED DESIGN**

**ELEMENTARY**—Includes instruction in the use of the Jacquard Machine to control the warp, its construction and method of operation, arranging the various parts of the harness to produce fancy effects, threading of the comber-board for the main forms of tie-ups, as well as arranging of design on point paper, and card cutting directions to operate the Jacquard.

Work in this course includes calculations to produce fabrics on Jacquard looms with reference to both the yarns, textures, etc., and the size of machines necessary, how the different textures are laid out on point paper, and the weights of materials necessary to produce same in cloth.

One year is required, two hours per week.

**ADVANCED**—The advanced work is intended for those who are already familiar with the elementary work, through outside experience or owing to having taken it in the School, and whose ambition is to fit themselves for positions in which greater skill is demanded. One year is required, which is devoted to higher Jacquard design and card stamping. Fee for these subjects, two hours per week for the term, \$15.

**SPECIAL FIGURED DESIGN**

This course has been arranged for the benefit of those students who desire to specialize in rugs, ingrain, tapestry, brussels and similar floor coverings, as well as other lines of Jacquard work.

**SILK ANALYSIS AND CALCULATIONS**

Requiring an attendance of one year.—This course (which will not be given unless there is a sufficient enrollment) has been arranged for the benefit of those students who are employed in the silk industry during the day, and who wish to become more familiar with the construction, analysis and calculation of silk fabrics. The studies pursued include such subjects as may be found under Analysis, etc., on page 71. Fee for this subject, two hours per week for the term, \$15.

## Donations

### To the Institution During the Year

- AMERICAN CARD CLOTHING COMPANY, Philadelphia—12 ft. 3 inch No. 24 D. P. Leather Retention Band; 6 Workers, 7 x 48 in., D. C. Flex.
- THE ROOT COMPANY, Bristol, Conn.—One Demonstration Board of Pick Counters.
- ABERFOYLE MANUFACTURING COMPANY, Chester, Pa.—333 lbs. of various kinds and quantities of Yarns.
- CHAMPLAIN SILK MILLS, New York, N. Y.—40 lbs. Silk Noils.
- JAMES H. BILLINGTON COMPANY, Philadelphia—30 Wooden Skewers.
- DUNEAN COTTON MILLS, Greenville, S. C.—8 Cotton Laps.
- FLETCHER WORKS, INC., Philadelphia—3 Cylinder Reverse Catch.
- FOLIMER, CLOGG & COMPANY, Lancaster, Pa.—5 lbs. 180/2 Black Mercerized Cotton; 5 lbs. 180/2 Gray Mercerized Cotton.
- E. L. MANSURE COMPANY, Philadelphia—5 lbs. Linen Cord.
- THE VISCOSE COMPANY, Marcus Hook, Pa.—40 lbs. of Rayon Yarn.
- GENERAL CHEMICAL COMPANY, Philadelphia—9 Carboys of Commercial Acids; 1 Bbl. Glaubersalt.
- NEWPORT CHEMICAL WORKS, Passaic, N. J.—26½ lbs. various samples of Dyes; 2 lb. Vat Dyes.
- SCHUYLKILL CHEMICAL COMPANY, Philadelphia—5 Gal. Hydrogen Peroxide.
- ROHN & HAAS COMPANY, Philadelphia—12 lbs. Hydrosulphites.
- AMERICAN DYEWOOD COMPANY, Philadelphia—60 lbs. Dyewood Extract.
- ELLIS JACKSON & COMPANY, Philadelphia—100 lbs. Caustic Soda; 100 lbs. Chloride of Lime.
- NATIONAL ANILINE & CHEMICAL COMPANY, INC., Philadelphia—68½ lbs. various samples of Dyes; 10 lbs. of Sodium Nitrate.
- E. I. DU PONT DE NEMOURS & Co., Philadelphia—12—4-oz. product samples; 4 lb. Dye Solvent; 33 lbs. various samples of Dyes; 5 lbs. Hydrosulphite Conc.
- JOHN CAMPBELL & COMPANY, New York—5 lbs. various samples of Dyes.
- J. B. FORD COMPANY, Philadelphia—1 Bbl. WYANDOTTE Textile Soda.
- GENERAL DYESTUFFS CORPORATION, New York—54 product samples of Dyes.
- CARBIC COLOR & CHEMICAL Co., INC., New York—4 lb. various samples of Dyes.
- LAUREL SOAP MANUFACTURING COMPANY, INC., Philadelphia—1 Gal. Turkey Red Oil; 40 lbs. Palm Soap.
- HELLWIG SILK DYEING COMPANY, Philadelphia—Services dyeing 7½ lbs. Silk Yarns various colors.

### Courtesies Extended

Fletcher Works, Philadelphia.—Erben-Harding Co., Philadelphia.—Aberfoyle Mfg. Co., Chester.—Firth & Foster Co., Philadelphia.—J. R. Foster & Sons, Philadelphia.—“Fibre and Fabric,” Boston, Mass.—“Textile-World Journal,” New York, N. Y.—“American Silk Journal,” New York, N. Y.—“Daily News Record,” New York, N. Y.—“Men’s Wear,” New York, N. Y.—“Cotton,” Atlanta, Ga.—Saco-Lowell Shops, Lowell, Mass.—Thomas Halton’s Sons, Philadelphia.—Proctor & Schwartz, Inc., Philadelphia.—John Royle & Sons, Paterson, N. J.—Crompton & Knowles Loom Works, Worcester, Mass.—Sauquoit Silk Mfg. Co., Philadelphia.—American Card Clothing Co., Philadelphia.—Chas. Bond Co., Philadelphia.—American Moistening Co., Boston, Mass.—R. H. Hood Co., Philadelphia.—H. W. Butterworth & Sons Co., Philadelphia.—Jacob Miller, Sons & Co., Philadelphia.—E. L. Mansure Co., Chicago and Philadelphia.—Standard Machine Co., Philadelphia.—Stead & Miller Co., Philadelphia.—The Moss Rose Mfg. Co., Philadelphia.—The Linen Thread Company, Philadelphia.—American Textile Banding Company, Inc., Philadelphia.—J. E. Barbour Company, Paterson, N. J.—Hellwig & Co., Philadelphia.—“Color Trade Journal,” New York City.—Gimbel Brothers, Philadelphia and New York City.—Walker Manufacturing Company, Philadelphia.—George H. McFadden & Bro., Philadelphia.—Dunker & Perkins, Boston, Mass.—Main Belting Company, Philadelphia.—American-British Chemical Supplies, New York, N. Y.—Philadelphia Quartz Company, Philadelphia.—Ciba Company, New York, N. Y.—Sandoz Chemical Works, Philadelphia.—Lindsay Light Company, Chicago, Ill.

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### Influence of the School

#### A Summarized Estimate of the Work of the School

Some idea of the influence of the School in this mighty industry may be gleaned from the following:

Establishments in which students have become owners or partners: Capitalization, \$10,000,000; Broad Looms, 3,500; Narrow Looms, 7,580; Narrow Fabric Looms, 200.

Establishments in which students have become managers or superintendents: Capitalization, \$18,000,000; Looms operated, 20,240, to which must be added the necessary spinning, dyeing, and finishing labor and machinery.

Establishments in which students have become designers: Capitalization, \$5,575,000; Looms operated, 15,000.

A considerable number of students have engaged in the marketing of goods, having become commission men, manufacturers’ agents, salesmen and styler of fabrics. A like number have become managers, chemists and foremen dyers in establishments representing a capitalization of \$6,000,000.

## A Partial List of Former Students of the School, with their Occupations

For a corresponding list of former students of the School of Industrial Art  
see the circular of that School

*Pupils are requested to assist the Director in correcting the list*

### A

ABBOTT, CLARENCE J., Jr., with Columbiaville Woolen Company, Columbiaville, Mich.  
ABERLE, H. C., Treasurer, Fidelity Knitting Mills, Philadelphia, Pa.  
ACKERMAN, GILBERT E., with Ackerman & Foster, New York, N. Y.  
ADAMS, EUGENE V., with Goodman Brothers & Hinline, Art Silks and Trimmings, Philadelphia, Pa.  
ADAMS, WALTER S., with Waterloo Worsted Corporation, Waterloo, N. Y.  
AICHELMANN, FRED. J., with The Schwarzenbach-Huber Co., Altoona, Pa.  
ALGEO, BRADLEY C., Assistant Director, Philadelphia Textile School.  
ALLEN, LEE R., Insurance Broker for textiles and textile plants, Philadelphia.  
ALOE, EDWARD, Edward Clothing Company, Philadelphia, Pa.  
ALPER, DAVID H., with Pequa Mills, Philadelphia, Pa.  
ALTHOEN, HARRY, Textile Inspector, Ordnance Corps.  
ALTHOUSE, C. SCOTT, President, Neversink Dyeing Co., Reading, Pa.  
AMSDEN, KENDRICK M., Boss Spinner, Queensbury Mills, Worcester, Mass.  
AMSTERDAM, GUSTAV, with Friedman & Krieger, New York, N. Y.  
ANDREAE, FRANK W., President and Supt., Yale Woolen Mills, Yale, Mich.  
ANDREAE, RUDOLPH E., with Yale Woolen Mills, Yale, Mich.  
ANDREAE, WALTER W., Assistant Superintendent, Yale Woolen Mills, Yale, Mich.  
ANDREW, CARRIC A., with Appalachian Mills, Knoxville, Tenn.  
APELDORN, ERNEST F., Jr., United States Army.  
ARCHER, B. KENDALL, Salesman of Dyestuffs, General Dyestuff Corporation, Philadelphia, Pa.  
ARNOLD, W. W., Superintendent, Brookside Mills, Knoxville, Tenn.  
ARONSOHN, MILTON, Aronsohn Silk Mills, Coatesville, Pa.  
ASHE, EDWARD J., Superintendent, Standard Knitting Mills, Knoxville, Tenn.  
ASPDEN, NEWTON J., Collins & Aikman Company, Philadelphia, Pa.  
ATTIX, CHARLES E., Attix Hosiery Mills, Knoxville, Tenn.  
AUNGST, J. T., Dyer, with R. Wolfenden & Sons, Attleboro, Mass.

### B

BACHARACH, LEROY, L. Bacharach, Inc., Braids and Trimmings, Philadelphia, Pa.  
BACHMAN, ARTHUR W., with American Viscose Company, Lewistown, Pa.  
BAENY, ROBERT M., Superintendent, Bengal Silk Mills, Central Falls, R. I.  
BAKER, JOEL R., Wool Batt Manufacturer, Lyons, N. Y.  
BAKER, ROBERT C., of Reclaimed Wool Company, Worcester, Mass.  
BAILEY, GORDON P., with Arcola Silk Company, Tie Silks, Paterson, N. J.  
BALDWIN, ABRAHAM R., Export and Commission Merchant, Chicago, Ill.  
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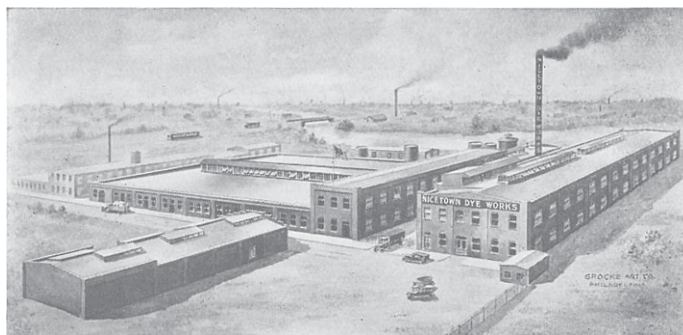
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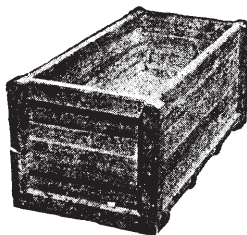
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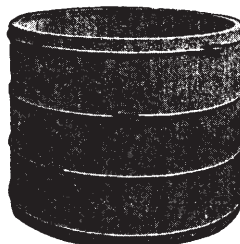
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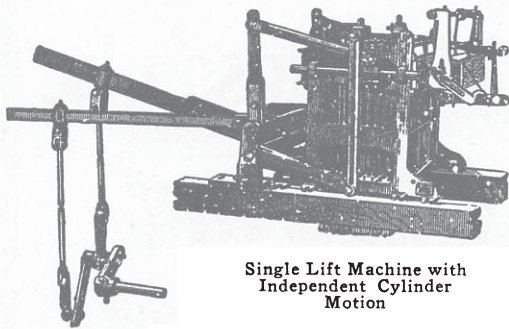
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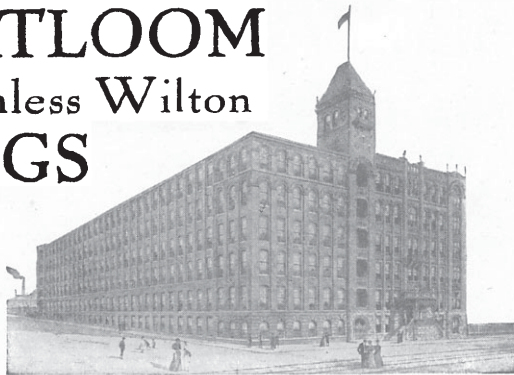
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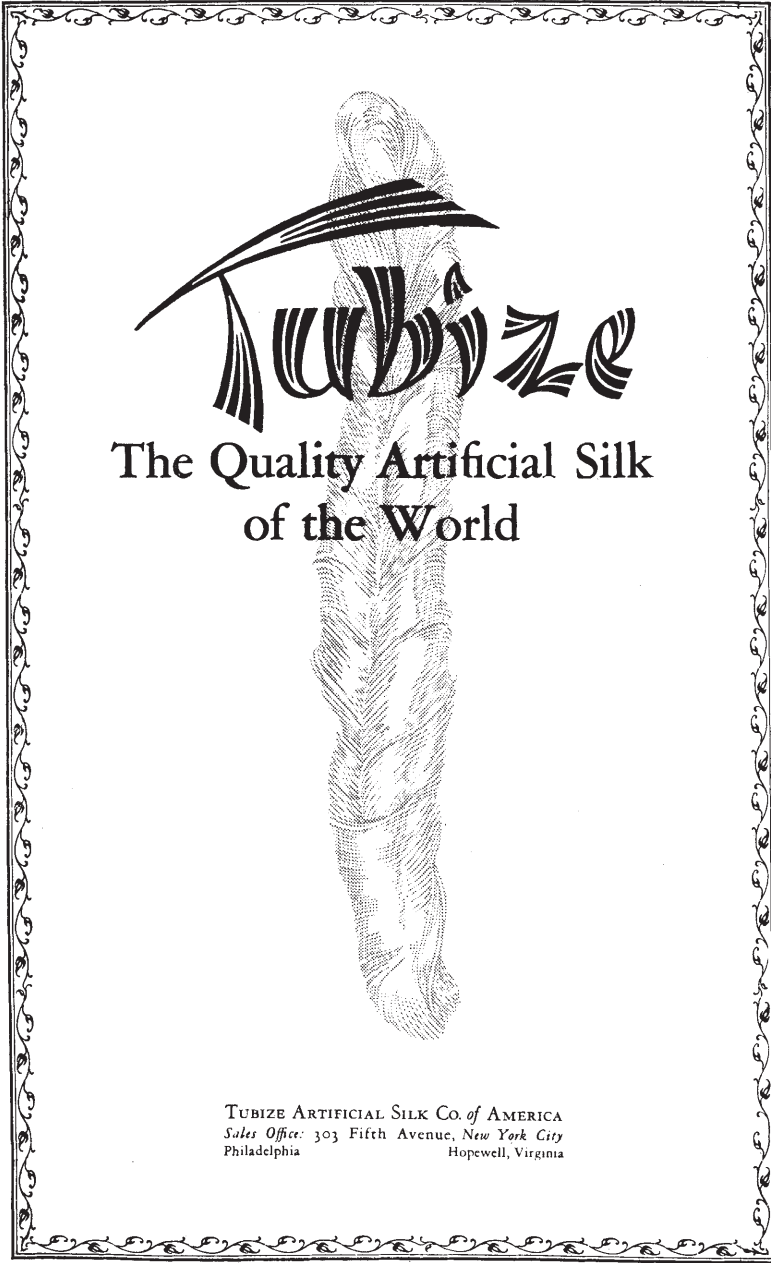
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