CHANGES IN TEXTILES
AND
CHANGES CAUSED BY TEXTILES
As They Can Be Found in the Fibers Used
From the Earliest Times to the Present

A Thesis Presented for the
Degree of Master of Arts

by

Eleanor Chamberlin Burton, B.S., B.A.E.

The Ohio State University
1946

Approved by:
PREFACE

For over five centuries, weaving played an important part in the lives of men, but consisted of the use of a mere handful of fibers. The most important of these were linen, silk, cotton, and wool. Of less importance were gold, hemp, and yucca.

In the last thirty years, the whole picture has changed. Scientific experiments have brought forth many new fibers which have found places alongside the ancient ones. The degree of progress of a country may well be judged by the fibers it is using. The backward countries still use the fibers which they have used for centuries. The countries which are highly developed scientifically, use synthetic fibers as well as natural ones. There are also countries in an in-between stage, which use limited quantities of synthetic fibers.

In gathering information as to the fibers used in different parts of the world at different times, it has been apparent that the history of the country and the history of the fiber ran parallel courses.

To those who have so generously given their assistance to me in my search for the changes in fibers, I wish to express my gratitude: to Mrs. Dorothy Wright Liebes of San Francisco, California, to Miss Edna Anderson of
Milwaukee-Downer College, Milwaukee, Wisconsin, to Mr. Lou R. Strauss Jr. of Flexon Inc., to Mr. Sylvan I. Strock, President of S. Strock & Co., Inc., to Mr. F. W. Koster, assistant director of chemical research for the American Viscose Corporation, to Mr. J. L. Flynn of the Dobekman Company, to Miss Jocelyn De Gance of John Matouk & Company, to Mrs. Barbara S. Edmonds of E. T. de Pont de Nemours & Company, to Miss Leone Ann Heuer, Textiles & Home Furnishings Editor, Household Finance Corporation, to Aralac, Inc., and to the guiding hand behind all this, Mr. Ralph Fanning, professor of Fine Arts at the Ohio State University. There should also be mentioned the many friends who offered endless amounts of interest and encouragement. To all who have helped me, I wish to express my appreciation.

Eleanor Burton
INTRODUCTION

Textiles have played an important part in the progress of civilization, sometimes causing very definite changes in the lives of men, and sometimes being changed by the developments man has made. Just as the fibers make a web, so textiles and man are interwoven. It is one of the most important of the arts from that standpoint. It is a fact we cannot escape, and should not overlook.

Weaving in its simplest form means the interlocking of threads in one direction (the weft) with threads at right angles (the warp) to make a fabric. While the variations are many, the types of weaving fall into a very few categories:

1st. Plain or tabby weaving. Every other warp thread is raised to form a shed through which the weft is passed. A shuttle, with weft threads wound around it, is thrown or passed through the shed. The weft thread is then beaten firmly back with a batten, beater or stick. For the next row, the threads formerly raised are lowered and the alternate threads raised. Another row of weft is passed through and beaten back. The process is continued, making a simple over and under web.

2nd. Pattern weaving. A variable group of threads is raised in rhythmic arrangement. The
loom must be threaded so that the proper threads will come up when desired. It is usual to thread the loom in such a way that a plain or tabby thread can be woven in every other row to strengthen the web.

3rd. Pile weaving. Pile is formed by either knotting in extra threads, or manipulating the warp or weft so as to form loops. The web of the background may be either plain or small-patterned weave.

4th. Tapestry weaving. A small part of the warp is woven in sections, instead of throwing a shuttle clear across the warp. Small balls of yarn are carried only as far as a particular colour is desired. If the tapestry is woven by machinery, threads are carried across the back where it is not desired that they show in front. This makes so much excess thread on the back side, that if wool were used, the piece would be very bulky. For this reason, machine-made tapestries are usually cotton or linen. Certain of the ancient weavers - notably the Peruvians - concealed the ends in such a way that the front and back of the tapestry are equally beautiful. The Gobelin, Arras, Aubusson, Mortlake and other famous tapestries have cut ends showing on the back side.
The intention herein is not to give scientific and indisputable facts and dates, but to show the changes which have occurred, how they came about, and what the effect of those changes has been on the lives of men. Dates which have been given should not be accepted as authoritative but considered as approximate, used to help clarify the all-over pattern.

A definite time or place for the first weaving is not known. It seems likely that weaving was a natural development which began in various parts of the world with materials which were native and suitable for the requirements of the time.

Linen was probably woven in Egypt about 4000 B.C., (1) silk and perhaps kashmir wool in China about 2689 B.C., (2) cotton in India since very ancient times, (3) wool in France about 600 B.C., (4) wool in England about 200 B.C., (5) wool and cotton in Peru about the 1st C. A.D. (6)

(2) Introduction to An Encyclopaedia of Textiles by Ernst Fleming
(3) The Romance of Textiles by Ethel Lewis
(4) The Romance of French Weaving by Paul Rodier
(5) A Short History of Decorative Textiles and Tapestries by Violetta Mauratan
(6) A Study of Peruvian Textiles in the Museum of Fine Arts - Boston by Phillip Ainsworth Means
Since the changes in textile fibers throughout the world came about in different ways and at different times, those changes can perhaps best be studied by tracing them through one country at a time, mentioning techniques and designs only occasionally.
CHANGES IN TEXTILES
AND
CHANGES CAUSED BY TEXTILES

As They Can Be Found in the Fibers Used
From the Earliest Times to the Present

EGYPT

The earliest weaving known, is that done in Egypt
about 4000 B.C. At that time they were already raising
flax, preparing and spinning it, and weaving fine linens
with as many as 540 threads to an inch. England is now
able to do only 350 threads in its finest linen. (1) The
Egyptian linen was woven in plain or tabby weaving, depending on its fineness and the use of multiple folds for dec-
orative quality. (2) Tapestry weaving was done with a
coarser linen, and used for cushions, covers, and tent
hangings. (3) Wool was not used by the Egyptians for a
long time, because it was considered unclean. (4) Silk and
cotton were apparently unknown in the earliest days.

The first indication of a change in the fibers
used by the Egyptians came during King Solomon's time
(1015-975 B.C.). (5) Cotton material which was in Egypt

(1) The Story of Textiles by Perry Walton
(2) Man is a Weaver by Elizabeth Chesley Batty
(3) The Story of Textiles by Perry Walton.
(4) The Romance of Textiles by Ethel Lewis
(5) The Story of Textiles by Perry Walton
at that time was probably imported from India. The knowledge of how to raise and spin cotton seems to have come in 327 B.C., when Alexander returned from India, bringing cotton with him. Cotton was then grown, spun, and woven in upper Egypt, garments being made of it for the Egyptian priesthood and peasants.\(^1\)

During the 1st C. A.D., silk weaving was introduced to Egypt through trade relations with China.\(^2\) The threads were imported, since China was closely guarding its secret of sericulture – the raising of silkworms, and spinning or reeling of silk. China was able to keep her secret from going north until 536 A.D.\(^3\)

From the 1st C. B.C. on, wool was used in Egypt. At first it was only used as the weft thread on a linen warp.\(^4\) Since the warp threads are the ones firmly attached to a frame, and since the constant strain, due to beating back the weft threads, necessitates a strong warp, making warp threads strong enough to withstand the hard usage has been a limiting factor all through the development of textiles.

When the Arabs conquered Egypt in 750 A.D., weaving

---

(1) Ibid.
(2) Introduction to An Encyclopaedia of Textiles by Ernst Fleming
(3) The Story of Textiles by Ferry Walton
(4) Art Through the Ages by Helen Gardner
was neglected. The Moslems had no Art of their own, and the weaving done by the conquered Egyptians was inferior in quality. It was not until the 10th C. A.D., when the Fatimides came into power and promoted developments along the Nile, that Egypt resumed its fine weaving of silk, wool, and linen. During the 11th C., they were using a silk weft on the linen warp, and many more colours than they had previously. During the 12th C., court privileges were done away with, and luxury became available to everyone.

CHINA

As far back as 2669 B.C., silk was known and used in China. It is said that the Empress Si-ling-chi (wife of Huan-ti) was sitting in her garden one afternoon, tying with a cocoon, when she discovered that she could unravel the thread of it. China was careful with the secret of sericulture, and kept it for many years. It was not until the time of Justinian that the secret really travelled, although in the 3rd C. A.D., several Chinese

(1) The Story of Textiles by Perry Walton
(2) Late Antique - Coptic & Islamic Textiles of Egypt by W. P. Volbach and Ernst Kuenkel
(3) Ibid.
(4) Introduction to An Encyclopaedia of Textiles by Ernst Fleming
(5) The Romance of Textiles by Ethel Lewis
girls were kidnapped by the Japanese and taken to Japan to teach the art of sericulture.\(^{(1)}\) There are other stories as to the means by which the rest of the world were able to have their own silk. One is that in the 3rd C. A.D., a Chinese princess, who was marrying a prince of another country, concealed the eggs of silk worms in a silk bag hidden in her hair, and mulberry seeds in her garments and took the secret to her new country.\(^{(2)}\) The most commonly accepted theory seems to be that in 556 A.D., during the reign of Justinian II, two monks returning from China concealed silk worm eggs and mulberry seeds in the staves which they carried, and brought them to Justinian.\(^{(3)}\) No longer did China have a monopoly on silk.

No examples have been found of early Chinese silk. The oldest specimens date from the Han Dynasty (206-220 A.D.). They are soft in texture, brilliantly coloured, and delicate in design.\(^{(4)}\) The finest silk of all was woven during the Tang Dynasty (618-906 A.D.).\(^{(5)}\)

The first cotton used in China seems to have been carried over the old caravan routes from India.\(^{(6)}\) Since earliest times, the Chinese have also woven with camel

\(^{(1)}\) The Story of Textiles by Perry Walton
\(^{(2)}\) The Romance of Textiles by Ethel Lewis
\(^{(3)}\) The Story of Textiles by Perry Walton
\(^{(4)}\) A Short History of Decorative Textiles and Tapestries by Violetta Thurstan
\(^{(5)}\) Ibid.
\(^{(6)}\) The Romance of Textiles by Ethel Lewis
hair, (1) kashmir (with wool so fine, silky, and soft it is difficult to distinguish from silk), (2) hemp, (3) and ramie. Ramie is also known as rhea or Chinese grass. It is a wiry Chinese nettle which bleaches well, although it is difficult to degum and weave. (4) Attempts have been made to use it in other parts of the world, but have not been successful. Recent experiments in Brazil, Australia, and Florida seem to be good, although the procedure is still expensive for general use. (5)

There was a great deal of elegance in the court of Kublai Khan in the 13th C. A.D. The Great Khan wore robes of cloth of gold, and the nobles and officers wore gold colored silk garments. (6) In 1517, Portuguese traders arrived in Canton and found the Chinese using gold threads overlaid on parchment. (7)

JAPAN

Late in the 3rd C. A.D., the Japanese learned of silk through the Koreans. (8) Up until then, Japanese fabrics had been woven of hemp and of fibers from under the

(1) Textiles by Mary Schenck Woolman and Ellen Beers McGowan
(2) Handweaving Today by Ethel M. D. Mairet
(3) Textiles by Mary Schenck Woolman and Ellen Beers McGowan
(4) Ibid
(5) Ibid.
(6) The Romance of Textiles by Ethel Lewis
(7) A Short History of Decorative Textiles and Tapestries by Violetta Thurstan
(8) The Story of Textiles by Perry Walton
bark of trees.  

(1) Chinese girls were kidnapped and taken to Japan to teach silk weaving.  

(2) Between 300 and 400 A.D., other Chinese weavers settled in Japan. During the 5th C., Emperor Yuriaku developed weaving as an industry in Japan.  

(3) Prince Shotoku introduced Buddhism to Japan in the 6th C. Rich hangings were woven for the temples to Buddha. Sumptuous textiles were woven, using silk and metal threads as well as embroidery. They were known as "Suiko Art"—named for the Empress Suiko.  

(4) Wool was used for the first time.  

(5) Cotton was introduced in Japan during the 16th C.  

After Commodore Perry opened Japan to trade, the factories were modernized and more and finer silk and cotton woven. To obtain raw materials to use in production of fabrics for its extended markets, Japan conquered Manchuria and is trying to take over China.  

Japan has used the coco fiber from the husk of coconuts, linen, and along with the other progressive  

(1) The Romance of Textiles by Ethel Lewis  
(2) The Story of Textiles by Perry Walton  
(3) A Short History of Decorative Textiles and Tapestries by Violetta Thurstan  
(4) Ibid.  
(5) The Romance of Textiles by Ethel Lewis  
(6) Ibid.  
(7) Man is a Weaver by Elizabeth Chesley Saity  
(8) Handweaving Today by Ethel N. D. Hairet
countries, has been experimenting with synthetic and other new fibers. They are producing "Shonna" from soybeans, super-ammonium rayon from cotton linters, copper sulfate, and aqua ammonia, and another synthetic from fish and whale proteins.\(^{(1)}\)

**INDIA**

Cotton has been woven in India since ancient times. Their delicate muslins have not been duplicated elsewhere, since the weavers of other countries don't have the skillful fingers and unlimited patience. Cotton was well known and commonly used in India in 800 B.C., probably before.\(^{(2)}\)

During the 2nd C. A.D., cotton was taken from India to China by the old caravan routes\(^{(3)}\) and raw silk brought back to be woven into fabrics in India. One of the legends concerning the Chinese princess who hid silk worm eggs and mulberry seeds is that she married an Indian prince.\(^{(4)}\)

That may have been the beginning of sericulture in India.

Jute, hemp, and coco fiber (from the husk of coconuts) have long been used for weaving in India.\(^{(5)}\)

---

\(^{(1)}\) Textiles by Mary Schenck Woolman and Ellen Beers McGowan
\(^{(2)}\) Handweaving Today by Ethel M. B. Mairret
\(^{(3)}\) The Romance of Textiles by Ethel Lewis
\(^{(4)}\) Man is a Weaver by Elizabeth Chesley Bailey
\(^{(5)}\) Textiles by Mary Schenck Woolman and Ellen Beers McGowan
hair\(^{(1)}\) and kashmir have been used a great deal. The Moghul Dynasty in India (1526-1818 A.D.) was noted for its fine kashmir shawls which were made from the finest wool of the Tibetan goat.\(^{(2)}\)

In 1800 A.D., Indian cotton became very popular in England. To protect the English wool industries, cotton was forbidden to be imported between 1720 and 1774.\(^{(3)}\) In 1736, raw cotton was exported to England.\(^{(4)}\) With the mechanical inventions of the late 18th C., more raw materials were needed by the English so they expanded into India, building dams on the Indus, and forcing the natives to raise cotton, prohibiting them from spinning and weaving.\(^{(5)}\)

**PERSIA**

Persian traders brought cotton cloth from India, and silk cloth from China. The silk cloth was unravelled, and rewoven. Some of it was traded to Byzantium and Italy.\(^{(6)}\) Between the 3rd and 6th C. draw-lobms were brought from China, enabling the Persians to do more.

---

\(^{(1)}\) Ibid.  
\(^{(2)}\) *A Short History of Decorative Textiles and Tapestries* by Violette Thurstan  
\(^{(3)}\) *English Decorative Textiles* by W. Gordon Huntin  
\(^{(4)}\) *Homespun Handicrafts* by Ella Shannon Bowles  
\(^{(5)}\) *Man is a Weaver* by Elizabeth Chesley Bailey  
\(^{(6)}\) Ibid.
elaborate weaving and export their silk. (1) This was during the reign of the Sassanian Kings (226-641 A.D.) when there was a high degree of luxury. (2) Weaving was encouraged, and much was learned from the Egyptians as to technique for silk weaving. (3) As in Egypt, the silk threads were imported from China. Sapor II brought weavers from Mesopotamia to further the art of skilful weaving. (4)

During the 2nd and 3rd C. A.D. (5) the Persians wove tapestries and began the knotting of rugs for which they have become so famous. Even after the entrance of the Moslems in 642 A.D., the quality of the weaving remained high, although there was less weaving for a short time. (6) The weaving of satin was developed, fine silks and fine cotton were woven, and some linen. (7)

During the reign of the Fatimid caliphs (969-1171) beautiful rugs were made. (8) The Mongolian Invasion in the latter half of the 14th C. brought even greater elegance to the fabrics. Gold or silver wound threads were

(1) Bulletin of the Metropolitan Museum of Art vol. 34-5
(2) Introduction to An Encyclopaedia of Textiles by Ernst Fledming
(3) A Short History of Decorative Textiles and Tapestries by Violetta Thurstan
(4) Introduction to An Encyclopaedia of Textiles by Ernst Fledming
(5) Bulletin of the Metropolitan Museum of Art vol. 34-5
(6) Ibid.
(8) Bulletin of the Metropolitan Museum of Art vol. 30-1
often used to make "camocas" which resembled "niello" (incised metal). (1)

The 15th and early 16th C. (the Safavid period) was one of great richness. (2) The most beautiful rugs of all time were made then, and silks, damasks, and velvets with gold threads. That was the peak of the Persian weaving. Gold brocades of the 16th and 17th C. were beautiful, but by the 16th C., European influence was felt, and the silks woven during that century are not considered valuable. (3) Beautiful shawls were made in the 19th C.

GREECE

From the 5th - 1st C. B.C., linen was woven in Greece. The material was closely woven in a plain or tabby weave in narrow strips which were joined together. A border was woven in tapestry weave, using gold tinsel. (4) Later wool was used for the same simple garments (chitons). (5) Silk fabrics have been found in Greece, dating back as far as 325 B.C. However they were probably brought in from Persia. (6) Until the 4th C. A.D., Chinese silk was

(2) Bulletin of the Metropolitan Museum of Art Vol. 30:1, 34-5
(4) Introduction to An Encyclopaedia of Textiles by Ernst Fleming
(5) A Short History of Decorative Textiles and Tapestries by Violetta Thurstan
(6) The Romance of Textiles by Ethel Lewis

14
traded through Persia, and unravelled and rewoven by the Greeks.\(^{(1)}\) Trade was halted temporarily by the Graeco-
Persian wars, but at the end of those wars, Emperor Con-
stantine brought raw silk in for the weavers.\(^{(2)}\) Since
the Byzantine weavers were highly skilled, elaborate weav-
ing for dresses took the place of the simple Roman toga.\(^{(5)}\)
During the 5th C. A.D., the Persians were at war with the
Romans, halting the exportation of silk once again. Ju-
stinian II limited the use of silk to the imperial ladies.
As a result, many of the weavers migrated to Persia.\(^{(4)}\)
According to legend, in 556 A.D., two monks returning from
China, brought silk worm eggs and the seeds of mulberry
trees, concealed in their staves, to Justinian II. This
broke the monopoly China had had on raw silk for four thou-
sand years or more. Soon the silk industry spread from
Turkey to Greece, and also through Persia by the Arabs and
Saracens to North Africa, Spain, Portugal, Sicily, and
so on to Italy, France, and eventually the rest of the
world.\(^{(5)}\)

During the 9th - 12th C. A.D., silk and gold
threads were used in brocades and damasks. The Cyprian
gold used was a gold leaf on animal membrane, wrapped

\(^{(1)}\) *Man is a Weaver* by Elizabeth Chesley Baity
\(^{(2)}\) *A Short History of Decorative Textiles and Tapestries*
   by Violetta Mihrustan
\(^{(4)}\) *Man is a Weaver* by Elizabeth Chesley Baity
\(^{(5)}\) *The Story of Textiles* by Perry Walton
around linen thread. Gold wire was used only for embroidery.\(^1\)

**SPAIN**

Although wool weaving in Spain undoubtedly dates back before the Christian era, the first mention of wool weaving in Spain occurs in the 1st C. A.D. in connection with the Morino sheep from which a fine quality of wool comes. The sheep were bred by crossing Tarentine ewes from Italy with African rams.\(^2\) Further breeding has improved the wool still more, making it the most desirable of sheep's wool in the world.

During the 8th C. A.D., the Saracens conquered the Visigoths in Spain.\(^3\) Since the Saracens were already familiar with silk weaving through their conquests in Egypt and Persia, they brought with them that knowledge. Magnificent mixtures of silk and gold were woven during that period.\(^4\) The Moors also raised and spun cotton in Spain,\(^5\) and wove a fine linen which they exported to India and Constantinople.\(^6\)

\(^1\) *The Romance of Textiles* by Ethel Lewis
\(^2\) *The Story of Textiles* by Perry Walton
\(^3\) *A Short History of Decorative Textiles and Tapestries* by Violetta Thurstan
\(^4\) *Introduction to An Encyclopaedia of Textiles* by Ernst Fleming
\(^5\) *The Story of Textiles* by Perry Walton
\(^6\) Ibid.
Because of the lack of a heating system, hangings were used as a protection against the cold. A coarse wool serge was used for those until in the 13th C., when the nobles imported tapestries to use for their hangings.(1)

Late in the 13th C., Spanish wool from the Merino sheep, was exported to France, displacing the English wool which had been used. As a result, finer cloth was then woven in France.(2)

The Moors were ousted from Spain in the 15th C. by Ferdinand and Isabella. Silk weaving in Spain declined due to heavy taxes which were imposed, and the laws and regulations restricting sales and equipment, as well as competition from Italy which was flourishing in the Renaissance of the 15th and 16th C.(3) Elaborate brocades were still woven, but were not fine.(4) Gold and yellow silk were combined to make a kind of fake cloth of gold.(5)

Due to the religious intolerance of Philip II, many of the best weavers left the country during the 16th C.(6) In the 17th C., Philip IV promoted weaving. The first tapestry factory in Spain was established, although

(1) A Short History of Decorative Textiles and Tapestries by Violetta Thurstan
(2) The Romance of French Weaving by Paul Rodier
(3) A Short History of Decorative Textiles and Tapestries by Violetta Thurstan
(4) Bulletin of the Metropolitan Museum of Art vol. 30-1
(5) Ibid.
(6) Introduction to An Encyclopaedia of Textiles by Ernst Fiebiger
it was another century - between 1776 and 1792 - before
good tapestries were woven. Designs by Goya were used
for them.(1)

Following the popularity of India prints in the 17th
C., cotton was raised seriously in Spain in an effort to
capture part of the market.(2)

In 1786, George III of England gave a pair of cream-
colored horses to the wife of the Spanish Ambassador to
England, and was given in return some Merino sheep.(3)
Hitherto the exportation of Merino sheep had been forbidden
by Spain.(4) That gift had far-reaching effects in the de-
velopment and breeding of sheep throughout the world.

SICILY

In the 9th C. A.D., when the Arabians conquered
Sicily, they brought skilled weavers with them, thus begin-
ing weaving as an industry in Sicily. Gold threads were
interwoven with the silk.(5)

In 1071 A.D., the Norman, Roger Guiscard, conquered
Sicily. From there he invaded Greece and brought back
skilled weavers from Corinth and Thebes.(6) He also

(1) A Short History of Decorative Textiles and Tapestries
   by Violetta Thurstan
(2) The Romance of Textiles by Ethel Lewis
(3) Man is a Weaver by Elizabeth Chesley Baity
(4) Ibid.
(5) The Romance of Textiles by Ethel Lewis
(6) Ibid.
brought back silk worms, thus adding sericulture to Sicilian industries.

In the 13th C., Sicily was once again conquered. This time by Charles of Anjou. Silk weaving practically stopped, because so many weavers migrated to Italy. Lucca replaced Palermo as the center of European silk weaving.\(^1\)

**CRETE**

Discoveries of Arthur Evans of England showed that cities of Crete, which were wiped out in 1000 B.C., had a highly advanced civilization. The costumes worn by the people of that time were probably of wool or linen, and cotton or silk.\(^2\)

**ITALY**

Silk weaving had been known in Italy since the 4th or 5th C. A.D., but the silk fabrics were probably imported.\(^3\) Silk weaving may have begun in the 6th C. A.D., when silk weavers left Greece and went to Rome. There was silk weaving in Lucca during the 9th C., and wool and linen weaving too.\(^4\) Silk weaving could not become an important industry in those days without sericulture, since the few countries who produced silk kept it under their control. In

---

(1) *A Short History of Decorative Textiles and Tapestries* by Violetta Thurstan

(2) *Man is a Weaver* by Elizabeth Chesley Baity

(3) Ibid.

(4) *The Romance of Textiles* by Ethel Lewis

19
the 11th C., sericulture was introduced in Italy. No longer was there need for the costly and hazardous trips bringing silk in from China. (1) With the Venetian conquest of Constantineople in the 12th C., and the bringing back of skilled weavers, the finest silk was then made in Italy. (2) Florence, where fine woollens had been woven up until the 14th C., prospered under Lorenzo di Medici (3) and more luxurious fabrics were woven, such as velvets, damasks, brocades, taffetas, and Cloth of Gold. (4) The gold thread was imported from either Cyprus or Sicily. (5)

During the 14th C., cotton weaving spread into Italy from Spain. The warp threads were usually of linen, since the Italians had not yet learned how to spin a strong cotton warp. (6)

The importance of the various cities in Italy as weaving centers changed from time to time, as each city made an effort to promote weaving, or as weavers became dissatisfied and moved from one city to another. In the 15th C., farmers were required to plant mulberry trees so that the supply of silk would be increased. Late in the 15th C., the exports of Italian silk were diminished. Trade routes were

(1) Man is a Weaver by Elizabeth Chesley Baity
(2) The Story of Textiles by Perry Walton
(3) The Romance of Textiles by Ethel Lewis
(4) Introduction to An Encyclopaedia of Textiles by Ernst Flemming
(5) The Romance of Textiles by Ethel Lewis
(6) The Story of Textiles by Perry Walton

20
shortened, and it was easier for ships from England, France
and the Netherlands to make the trip to India and China.\(^{(1)}\)

The first experiments to obtain a casein fiber from
skimmed milk, were made by Antonio Ferretti in 1935.\(^{(2)}\)
The United States Department of Agriculture and the Na-
tional Dairy Association became interested, and in 1937,
Aralac Inc. was formed.\(^{(3)}\) "Aralac" is a registered trade
name, but "Azlon" has been chosen for the generic name of
man-made, protein-based fibers.\(^{(4)}\)

Italy also manufactures cuprammonium rayon,\(^{(5)}\)
which is made from cotton linters, copper sulfate, and aqua
ammonia,\(^{(6)}\) and a modified viscose rayon called "Cisalpha"\(^{(7)}\)
which is made from wood pulp or cotton linters, caustic
soda, carbon bisulfide and casein.\(^{(8)}\)

FRANCE

When the Ionians founded Marseilles in 600 B.C.,
they found sheep already there. Although it is not known
exactly when the Gauls settled in France, there is a theory

\(^{(1)}\) *The Romance of Textiles* by Ethel Lewis
\(^{(2)}\) *Textiles* by Mary Schenck Woolman and Ellen Beers McGowan
\(^{(3)}\) Ibid.
\(^{(4)}\) *The Story of Aralac* by Aralac Inc.
\(^{(5)}\) *Textiles* by Mary Schenck Woolman and Ellen Beers McGowan
\(^{(6)}\) *Fibers and Fabrics of the Future* by L. C. Chase & Co.
\(^{(7)}\) *Textile Fibers and Their Use* by Katharine Faddock Hess
\(^{(8)}\) *Fibers and Fabrics of the Future* by L. C. Chase & Co.
that they came up through Spain from Africa, accounting for the similarity between their early weaving and that of the Libyans in Africa. (1) When Caesar conquered France in 479 B.C., the weaving of wool, which was already flourishing, was greatly increased to furnish the Romans with woolen materials. (2)

Tapestry weaving, which had been done at Arras during the life of St. Jerome but had died out, was renewed under the Merovingian Kings in the 7th C., particularly through the interest and patronage of King Dagobert. (3)

When the Saracens invaded France in the 8th C., Charlemagne had an asbestos table-cloth which he threw into the fire after a banquet, impressing Haroun El Raschid with his supernatural powers. (4) The Saracens were defeated, but some of the Saracen men stayed on in France. Weaver's Guilds were formed, which prohibited the weaving of linen. Tapestries were woven of silk and wool, this being the first silk used for weaving in France. The Saracens both wove and taught weaving of tapestries, thereby changing France's position in the Arts. (5) At first tapestries were woven in Monasteries only, later in houses.

(1) The Romance of French Weaving by Paul Rodier
(2) Ibid.
(3) A Short History of Decorative Textiles and Tapestries by Violette Thubetan
(4) Textile Age - Jan. 1946
(5) The Romance of French Weaving by Paul Rodier

22
by the women, and eventually by men in factories.[1]

The Monks of the Abbey at Picardy, during the 10th C., taught the people to spin and weave finer yarn. Linen weaving was developed, leading to the famous Bayeux Tapestry, which was embroidered in wool on coarse linen 20" x 231".[2]

In the time of Louis IX - in the year 1280 - an organization of merchants known as Hansa controlled weaving in Paris, establishing rules for quality of woolen materials, the hours during which a weaver might work, and the number of looms he might possess.[3]

A temporary set-back came to wool weaving in France, when Philip the Fair disregarded an agreement made by Louis IX with the King of England. As a result, no wool was shipped to France. To regain the good favor of England, and the importation of wool, it was necessary for Philip's daughter to marry the King of England.[4]

The Crusaders brought home a great deal of booty, including a Persian broadcloth known as "Scarlet". The yarn used in weaving that broadcloth was finer than any used in Europe, and inspired the French and Flemish weavers

(1) A Short History of Decorative Textiles and Tapestries by Violetta Thurstan
(2) The Romance of French Weaving by Paul Rodier
(3) Ibid.
(4) Ibid.
to procure finer wool and yarn. Wool was imported from Spain, and more expert spinning and weaving was done. This led to other experimentations, and in 1300 the first sheet linen woven in Europe was woven in the Baptiste of Cambrai. (1)

From 1307-1377, the Popes were forced to live in Avignon. Gregory XI brought silk weavers from Italy, starting the silk industry in France. (2)

When Louis XI took over the throne of France, the city of Arras tried to prevent his doing so. In anger, Louis killed some of the citizens, and forced others to scatter throughout France. Since the weavers of Arras had been superior to other weavers, decentralizing them meant that French weaving in general was improved, knowledge passing on to other towns. Italian weavers (highly skilled in silk-weaving) were brought to replace the citizens in Arras. Gold was combined with silk in their weaving. (3)

Francis I brought more Italian weavers into France. Efforts which had been made to start sericulture, were unsuccessful. Silk still had to be imported from Italy. (4)

One of the greatest political mistakes made in

(1) Ibid.
(2) The Romance of Textiles by Ethel Lewis
(3) The Romance of French Weaving by Paul Rodier
(4) The Romance of Textiles by Ethel Lewis
France was the Edict of Nantes, taking away certain privileges which Protestants had had. Among those who fled, were many weavers. They settled in Germany, England and Ireland. Ireland alone gained 600 linen weavers who, under the expert Master Weaver Louis Crommelin, marked the beginning of Ireland's famous weaving center in Belfast. (1)

The importation of printed cotton was banned in 1667 so as to protect the wool and silk industries. Smuggling was the only direct result of the ban, since the French ladies loved the fine soft cotton. (2)

Silk weaving, begun under Gregory XI in Avignon, continued, but the silk threads were imported. Experiments with raising silk-worms had been attempted for five centuries, but didn't succeed until Henry of Navarre's reign in the late 16th C. when Colbert guarded the raising of silk. (3) Claude Dangou - a very clever weaver - set up schools for spinning and weaving silk, and introduced many improvements. (4)

During the 17th C., the Baroque period, France reigned supreme in the making of silken fabrics. During the revolution the silk industry declined. (5)

(1) The Romance of French Weaving by Paul Rodier
(2) Ibid.
(3) The Story of Textiles by Perry Walton
(4) The Romance of Textiles by Ethel Lewis
(5) A Short History of Decorative Textiles and Tapestries by Violetta Thurstan
In 1694, Monsieur de la Rue of Rouen tried spinning and dyeing cotton. At first he tried using it in combination with a silk warp. That didn't work, so he tried a linen warp, which was better. That materials from that combination were called "Siamoises". They were woven in stripes, plaid, and checks suggested by a silk and cotton fabric which was brought to court by the Siamese ambassadors. (1)

In 1734, Rene de Reamur predicted that filaments of resins could be made, but he didn't produce them. (2)

John Holker, a political refugee, fled England in 1751, and went to France, bringing with him the knowledge of weaving cotton velvet and blue jeans. He was particularly important because of his ability to organize weaving and spinning establishments. (3)

In the early 18th C., foreign cotton, which was flooding the market, was prohibited; French decorated cottons were permitted, and silks and woolens were made lighterweight and cheaper. (4) Georges Antoine Simonet persuaded a Swiss weaver to come to France. Attempts at equaling fine Swiss muslin failed, but he left spinning wheels, and

(1) The Romance of French Weaving by Paul Rodier
(2) America's Fabrics by Zelma Bendure and Gladys Pfeiffer
(3) The Romance of French Weaving by Paul Rodier
(4) Ibid.
faith to his people. Swiss regulations were lifted, permitting fine cotton to be sent to France. Fine muslins were then woven in France, and before long a spinning-mill, used for spinning silk by hydraulic power, was converted to spin fine cotton. (1) Napoleon had promised a reward for the discovery of a means by which linen could be spun mechanically. In 1810, Philippe Girard invented a spinner, but when the time came, Napoleon had no money for it. The French people weren't interested in the invention, so Girard took it to Austria to make money enough to pay his debts. However, his helpers in France stole the plans and took them to England to apply for patents. The patents were refused, but the secret was out, so Girard could not realize financial reward for his invention. (2) In spite of the complications, Napoleon had revived the weaving industry during the Empire period, and elegant silks were woven again. By decree, all robes of state had to be of silk. (3) Hangings in the chapel of Napoleon's Tomb, were woven with a spun glass weft and silk warp. (4)

In 1833, Hilaire de Chardonnet produced artificial threads from a solution of nitrocellulose. The process is no longer used, but his discovery was the forerunner of

(1) The Romance of French Weaving by Paul Rodier
(2) Ibid.
(3) The Romance of Textiles by Ethel Lewis
(4) The Romance of French Weaving by Paul Rodier
present day rayon.\(^{(1)}\)

In 1890, Despaissis invented cuprammonium rayon process for making synthetic fibers from cuprammonium which had been discovered in Germany. Experiments continued, and "celanese" was developed commercially in 1918.\(^{(2)}\)

**GERMANY**

From the earliest times, linen and wool have been woven in Germany.\(^{(3)}\) The earliest tapestries known were woven in the 11th C. A.D., on small looms in convents and homes. They were long and narrow, and never as fine as Flemish, French, or English.\(^{(4)}\)

The earliest known silks in Germany were the Regency Brocades, about 1132 A.D. They were woven with a thick linen warp, and thin silk weft, or silk warp and weft, and were interwoven with gold threads made from gilded linen or Cyprian gold.\(^{(5)}\)

During the 16th C., more weaving was done in Germany than previously, patterned linen in particular,\(^{(6)}\) but there was almost no weaving done during the 17th C., when

---

\(^{(1)}\) *American's Fabrics* by Selma Bendure and Gladys Pfeiffer

\(^{(2)}\) *Fibers and Fabrics of the Future* by L. C. Chase & Co.

\(^{(3)}\) *Introduction to An Encyclopaedia of Textiles* by Ernst Fleming

\(^{(4)}\) *A Short History of Decorative Textiles and Tapestries* by Violetta Thurstan

\(^{(5)}\) *Introduction to An Encyclopaedia of Textiles* by Ernst Fleming

\(^{(6)}\) *A Short History of Decorative Textiles and Tapestries* by Violetta Thurstan
Germany was busy with wars. Following the Edict of Nantes (1685) many of the French weavers fled their country, some of them going to Germany where they contributed greatly to the weaving.\(^1\) Frederick the Great, in the 18th C., encouraged weaving. Much fine weaving of wool, linen and silk was done during his reign.

In 1857, Schweitzer, a German scientist, discovered that he could make a material called "cuprammonium" from copper sulfate, ammonium hydroxide and a cellulose material. The material was not developed into a fiber until 1890, when Despaisses of France invented the means for doing so. Its first commercial use was by J. P. Benberg A.G. in Germany, after World War I, and in the United States in 1926.\(^2\)

The Bauhaus was started in Germany in 1918 with Walter Gropius as director. One of the weaving teachers was Frau Sharon Stetzi, who taught the study of material for its aesthetic implications and for feeling through experimentation. As in all the Bauhaus work, the importance of a material in respect to its use was emphasized. Various ways for obtaining a desirable texture through the use of materials were reached through knowledge of the materials and its potentialities as well as limitations.\(^3\)

\(^1\) Introduction to An Encyclopaedia of Textiles by Ernst Flesch
\(^2\) America's Fabrics by Zelma Bendure and Gladys Pfeiffer
\(^3\) Handweaving Today by Ethel M. D. Mairat
Other synthetic fibers used in Germany include viscose (made from wood pulp or cotton linters, caustic soda, carbon bisulfide),\(^{(1)}\) basified viscose (viscose with synthetic resins added to make it resemble wool, known as "Vistralon", "Cupralan", or "Artiland"),\(^{(2)}\) vinyon (made from vinyl resins made with coke, lime, water and salt),\(^{(3)}\) casein fiber (made from skimmed milk),\(^{(4)}\) and a fiber made from a mixture of fish and whale proteins.\(^{(5)}\)

SWEDEN

Loom weights from the Bronze Age in Sweden have been found, indicating that weaving was done then. It was probably of wool. The oldest piece which has been found was woven in the 9th C. A.D., and is all wool.\(^{(6)}\) From early times, however, the Scandinavians wove with linen as well as wool.\(^{(7)}\) By the 11th C., they were weaving knotted tapestries. In order to get finer ones, King Gustaf Vasa brought Flemish weavers to Sweden in the 15th C. The technique was modified and spread to the peasant homes under King Erik XIV.\(^{(8)}\)

---

\(^{(1)}\) Fibers and Fabrics of the Future by L. C. Chase & Co.
\(^{(2)}\) Textile Fibers and Their Use by Katharine Paddock Hess
\(^{(3)}\) Textiles by Mary Shenck Woolman and Ellen Beers McGowan
\(^{(4)}\) Ibid.
\(^{(5)}\) Ibid.
\(^{(6)}\) A Short History of Decorative Textiles and Tapestries by Violetta Thurstan
\(^{(7)}\) Homecrafts in Sweden by Maj Sterner
\(^{(8)}\) Ibid.
Linen woven in the province of Angermanland in the 18th C. was said to be the best in the world. The weaving in Sweden has always been mainly wool or flax. In 1763, the parishers in Mora, Dalarna, were pledged not to use silk since it hadn’t been used before.\(^1\)

During the 19th C., due to the cheapness of machine-made materials, hand-weaving took a slump.\(^2\) This was revived in the 20th C., and Sweden takes great pride in its weaving.\(^3\) There are two classifications in which the weaving falls. One is the Home-craft which weaves linen and wool in the patterns used for centuries. The other is known as Modern Textiles, a foremost exponent of that craft being Elsa Gullberg who works with Carl Malmsten in the designing of new homes.\(^4\)

RUSSIA

Russia has never done a great deal with weaving, having no Russian style, and being concerned primarily with being a trading center.\(^5\)

From the 5th - 3rd C. B.C., they wove a little with wool and gold, then almost none at all until the Viking

\(^1\) Ibid.
\(^2\) Ibid.
\(^3\) Handweaving Today by Ethel M. D. Mairet
\(^4\) Modern Swedish Arts & Crafts in Pictures by Dr. Mils B. A. Mollin
\(^5\) A Short History of Decorative Textiles and Tapestries by Vicentia Thirstan
period, when they used gold and silver threads. Most of their cloth was imported. (1)

In 1716, Peter the Great brought weavers from Flanders and the Gobelin factory in France, hoping to develop a weaving center in Russia. (2) Later Catherine of Russia established sericulture, hoping Russian textiles would develop. Both efforts were fruitless. (3)

ENGLAND

Evidence has been found that wool was woven in England during the Bronze Age. The Lake-dwellers of Meare and Somerset, about 200 B.C., used spindle-whorls. Although they were found in great abundance, no fibers or fragments of materials have been found. Since sheep-skulls were found, it has been concluded that the weaving was of wool. (4)

The weaving was of inferior quality when the Roman Conquerors came in 43 B.C. Caesar set up the first cloth factory in England, and taught the English how to spin better wool and weave better material. (5)

(1) Russian Art by Gurney & Jackson
(2) A Short History of Decorative Textiles and Tapestries by Violetta Thurstan
(3) Russian Art by Gurney & Jackson
(4) A Short History of Decorative Textiles and Tapestries by Violetta Thurstan
(5) The Story of Textiles by Perry Walton
In 1066 A.D., William the Conqueror brought Flemish weavers to England. They made a homespun linen, and improved the quality of wool weaving. However, most of the English wool was still woven in Flanders and imported.\(^{(1)}\) During the 13th C., England became a great wool producing country and furnished the Flemish weavers with most of their wool. England excelled in weaving fine linens.

Edward III established silk weaving in London in the 14th C. It was not equal to Italian silk.\(^{(2)}\) The first silk weaving was done by women, but later by men (about 1480).\(^{(3)}\) James I attempted sericulture, but it failed due to the kind of weather to be found in England, and the lack of skill among the weavers.\(^{(4)}\)

Cotton was never an important industry in England, although efforts were made from the 18th C. on.\(^{(5)}\)

Following the Sack of Antwerp in 1585, Flemish refugees went to England. Their skill made the silk industry grow. The English were glad to have their skill, but insisted that one English apprentice be in each house. Thus the English learned much of the Flemish technique.\(^{(6)}\)

\(^{(1)}\) The Romance of Textiles by Ethel Lewis
\(^{(2)}\) Ibid.
\(^{(3)}\) Homespun Handicrafts by Ella Shannon Bowles
\(^{(4)}\) The Romance of Textiles by Ethel Lewis
\(^{(5)}\) Ibid.
\(^{(6)}\) A Short History of Decorative Textiles and Tapestries by Violette Thurstan

33
Foreign weavers were exempted from taxation for five years. (1)

One of the reasons colonists left England in 1620, was that the landowners turned farms into sheep-raising. As a result there were fewer jobs available for farmers. In order that the colonists should remain dependent on the mother country, they were forbidden to buy sheep, wool, or yarn. (2)

In 1664, Dr. Robert Hooke suggested the possibility of making an artificial silk. However, he didn't carry out the idea. (3)

In 1677, spinning schools were started in England to teach the spinning of linen. These were patterned after the spinning schools which were operating in Germany at the time. (4) The Edict of Nantes, which was issued in France in 1685, caused many French Protestants to flee to England. They wove with a silk warp, and wool, cotton, or linen weft. (5) The cotton was imported from Cyprus and Smyrna, and after 1747, from South Carolina. (6) The English production of cotton goods was difficult and not very good. So as to please the silk, wool, and linen industries

---

(1) *Man is a Weaver* by Elizabeth Chesley Baly
(2) Ibid.
(3) *America's Fabrics* by Zelma Bendure and Gladys Pfeiffer
(4) *The Story of Textiles* by Perry Walton
(5) *A Short History of Decorative Textiles and Tapestries* by Violetta Thurston
(6) *Man is a Weaver* by Elizabeth Chesley Baly
a ban on the using or wearing of cotton was made in 1700. (1) The ban was lifted in 1736 to permit the use of a cotton weft on a linen warp. (2) A large cotton factory was opened in Manchester in 1740, but the cloth made was not equal to Indian cloth. (3)

In 1697, the importation of silks from France was forbidden. In 1701 it was extended to include China, India and Persia. (4) In 1717, John Lombe, of Derby, disguised himself as a workman and obtained a job in a silk factory in Italy. He wanted to discover the Italian method of spinning silk threads. To do this, he bribed Italian workers to permit him to see and study the machine. His trickery was discovered, and he had to flee Italy, but managed to bring valuable knowledge back to England. (5)

The 18th C. in England was one of great change, due to many inventions - the fly-shuttle, the spinning-jenny, the power-loom, the cotton-gin, roller-spinning, a mule for spinning fine threads. The results of these inventions worked hardships on the people which at least temporarily changed the prosperity of a great many people. Master weavers prospered, but most workers wove at home for

(1) The Romance of Textiles by Ethel Lewis
(2) English Decorative Textiles by W. Gordon Hunt
(3) The Romance of Textiles by Ethel Lewis
(4) Ibid.
(5) The Story of Textiles by Perry Walton
Starvation wages. More raw materials were needed, so the Empire expanded. Englishmen went to Australia, New Zealand, Canada and South Africa to raise sheep. Cotton was bought from India and Egypt. Dams were built on the Indus and the Nile, making the land more fertile. Egypt became bankrupt due to loans she had become involved in. England took over, and the farmers planted more cotton. Native craftsmen in India were forbidden to spin and weave, and were forced to raise cotton. England had markets for cotton in India, Egypt, Africa, China, Japan and tried to in the United States.

In the 18th C., George III gave a pair of cream-colored horses to the wife of a Spanish nobleman who was ambassador to England. The Spaniard then presented him with some of the fine Merino sheep for which Spain was so famous, and which had hitherto not been permitted to be sent out of the country. This greatly improved the quality of English wool, and as the English empire expanded, and Englishmen took sheep to various parts of the world, the quality of the wool improved elsewhere too.

In the 19th C., the ban on imported silks was lifted. Silk weaving dwindled until there was very little

(1) A Short History of Decorative Textiles and Tapestries by Violette Khosravan
(2) Man is a Weaver by Elizabeth Chesley Bailey
(3) Handweaving Today by Ethel M. D. Mairet
silk weaving done in England. (1)

For a period during the 20th C., wool weaving was inferior, but when trade slackened, the quality was quickly restored. (2)

In 1885, Dr. Charles S. Gibson, of Guy's Hospital in London, discovered a process by which he could make a delicate, flexible, thin, light-weight Cloth of Gold by dipping sheer lawn in a gold dye. (3)

In 1887, Sir Jos. Swan made filaments which were woven and exhibited. He was interested in electricity, not in the development of weaving, so he did nothing more with his discovery. (4) However, in 1892, Hazara Cross and Bevan invented the viscose process for making artificial silk threads. (5) Production began in 1910 in the United States. The viscose method of making rayon threads involves the use of wood pulp, cotton linters, caustic soda, and carbon bisulfide. (6) England also makes a basified viscose by adding synthetic resins. Basified viscose resembles wool. It is produced in England under the names "Courtland's Rayolanda X" and Courtland's Rayolanda W.D. (7)

(1) The Romance of Textiles by Ethel Lewis
(2) Handweaving Today by Ethel M. D. Mairat
(3) The Story of Weaving by Louise Lamprey
(4) Textiles by Mary Schenck Woolman and Ellen Beers McGowan
(6) Ibid.
(7) Textile Fibers and Their Use by Katharine Paddock Hess

37
In 1894 Cruss and Bevan invented the cellulose-acetate process for making rayon.\(^1\) In 1865, the material cellulose-acetate had been discovered in Germany,\(^2\) but Cruss and Bevan invented the method of producing fibers from it. Cellulose-acetate is made with cotton-linters, acetate anhydride, and acid.\(^3\) The first commercial use of cellulose-acetate rayon was in 1914.\(^4\)

Other synthetic fibers used in England include cuprammonium rayon (from cotton linters, copper sulfate, and aqua ammonia),\(^5\) a casein fiber (from skimmed milk),\(^6\) and alginate fibers (a rayon from seaweed from the coast of Scotland and Ireland).\(^7\)

PERU

Earliest Peruvian fabrics seem to have been network rather than woven fabrics.\(^8\) At the beginning of the Christian era, and for the next five-hundred years, weaving was of two distinct kinds in Peru. The coastal (Chimu and Nazca) Indians wove with a wild cotton which was either white or reddish brown, and gaizes from a cactus

---

(1) *Fibers and Fabrics of the Future* by L. C. Chase & Co.
(2) *America’s Fabrics* by Zelma Bendoré and Gladys Pfeiffer
(3) *Fibers and Fabrics of the Future* by L. C. Chase & Co.
(4) *America’s Fabrics* by Zelma Bendoré and Gladys Pfeiffer
(5) *Textile Fibers and Their Use* by Katharine Paddock Hess
(6) Ibid.
(7) *Textiles* by Mary Schenck Woolman and Ellen Beers McGowan
(8) *Handweaving Today* by Ethel M. D. Mairet
They used human hair when they wished a little black. The Highlanders (Tiahuanaco) Indians wove with wool from the small llama, alpaca, vicuna, and guanaco. The Tiahuanaco I period (1-600 A.D.) marked the beginning of tapestry weaving.

In the Tiahuanaco II period (600-900 A.D.), the work of the highlanders overshadowed that of the coastal Indians, although there was an interchange of materials, the highlanders learning of cotton, and the coastal Indians learning of wool.

Late Chinu weaving (from 900-1400 A.D.), added feather work to the cotton weaving done earlier. Fine textiles were woven in both cotton and wool, slit tapestries being distinctive.

From 900-1100 A.D., culture disappeared from the Tiahuanaco Indians completely. It is known as the neocarchaic period.

From 1100-1400 A.D., Incaic was built on neocarchaic. Tapestries were woven again, and plain cloths and voiles. At first the tapestries had interlocked weft, later slit.

(1) Peruvian Textiles by Philip Ainsworth Means
(2) Ibid.
(3) Ibid.
(4) A Study of Peruvian Textiles in the Museum of Fine Arts - Boston
(5) Ibid.
(6) Peruvian Textiles by Philip Ainsworth Means
(7) Ibid.
tapestries were woven again.(1) Wool from the vicuna (the most silky of all the llama family) was used only for the robes of the Inca. (2)

1400-1530 was a period in which the Coastal and Incaic Arts were mixed. The Conquistadores conquered Peru in 1539 and encouraged a new kind of weaving. Silk was introduced for the first time. The techniques and styles were a combination of native and Spanish. (3) This was known as the Hapsburg period. (4) The Spaniards, in their greed, killed so many vicunas that the species became scarce. In 1921, Peru passed protective laws, making it illegal to manufacture and sell fabrics of Vicuna. In May 1939, the Bolivian government issued a similar decree, and the United States Government refuses to permit entry of the fur from either Peru or Bolivia. (5)

Henequen (a hemp fiber) and maguey (a cactus fiber) are also used for weaving in Peru. (6) Flax is not used, because it will not grow in a tropical, dry, climate. (7)

(1) Ibid.
(2) Old Civilizations of Inca Land by Charles W. Mead
(3) Peruvian Textiles by Philip Ainsworth Means
(4) A Study of Peruvian Textiles in the Museum of Fine Arts - Boston by Philip Ainsworth Means
(6) Man is a Weaver by Elizabeth Chesley Bailey
(7) America's Fabrics by Zelma Bendure and Gladys Pfeiffer
THE UNITED STATES

The first weaving in the United States, was probably that of the Cliff-dwellers in 927 A.D., using yucca fibers. (1) The Mound-builders along the Mississippi and into Ohio used a cloth of a plant fiber which may have been cotton which found its way up from Mexico. (2) The Mohave Indians soaked rabbit skins in water, cut them in strips, rolled and twisted them into threads, and wove blankets. (3) According to John Smith, the Virginia Indians used the feathers of turkeys in their fabrics. (4) The Algonquin Indians around Lake Champlain wove hemp with turkey and other bird feathers, and the white hair of moose. (5) In the 17th C. Coronado found the Pueblo Indians wearing cotton garments made from cotton they had grown, spun and woven. He brought sheep with him and taught the Indians spinning and weaving of wool. The Navahos picked it up from the Pueblo Indians and wove blankets and rugs from then on. (6) The North West coastal Indians wove Chilkat blankets from wool they spun and wove after the Spaniards brought in sheep. The women wove the blankets which were designed by men. (7)

(1) The Story of Textiles by Perry Walton
(2) Man is a Weaver by Elizabeth Chesley Baity
(3) The Story of Weaving by Louise Lamprey
(4) The Romance of Textiles by Ethel Lewis
(5) The Story of Textiles by Perry Walton
(6) Textile World vol. 91, pt. 2
(7) Art Through the Ages by Helen Gardner
When the colonists arrived from England in 1609, they brought sheep with them and began weaving their own fabrics of wool.\(^1\) In 1619, James I ordered silk cultivation in Virginia, offering premiums for the silk. Although silk was raised for awhile, when the Bounty was withdrawn, the culture was abandoned.\(^2\) Other colonies took up sericulture - South Carolina in 1735, Connecticut in 1762, and Georgia in 1760. There were many difficulties and the efforts were spasmodic.\(^3\) Hemp was used early by the colonists,\(^4\) and linen combined with wool to make linsey-woolsey (linen warp, wool weft). In 1636, cotton was brought from the W. Indies for spinning and weaving. Wool was imported from both Spain and England, and textile factories were established.\(^5\)

In 1654, England forbade the exportation of sheep, wool, or yarn from England. The colonists bought wool from Spain and Holland, raised more sheep themselves, wove linsey-woolsey, and wrote to their friends in England, urging them to bring sheep when they came.\(^6\) By 1675, the colonists were able to export to France.\(^7\)

(1) *Man is a Weaver* by Elizabeth Chesley Bailey
(2) *The Story of Textiles* by Perry Walton
(3) Ibid.
(4) *Homespun Handicrafts* by Ella Shannon Bowldes
(5) *Early American Textiles* by Frances Little
(6) Ibid.
(7) Ibid.
England soon became worried over losing her market for wool. In 1699, the first of a number of regulations restricting the manufacture and sale of woolen goods was made.\(^1\) That was one of the grievances which led up to the Revolution by the colonists.

In 1750, Signor Ottolenghi, an Italian, taught reeling, cleaning, and twisting of silk threads in Georgia. By 1759, Georgia was producing the best silk in the world, but production ceased in 1772. It was taken up in Philadelphia in 1770, slowed down during the years around the Revolution, then spurted again.\(^2\)

During the Revolutionary period, wool and linen were raised, and woven quite generally throughout the colonies. Most of it was done in the home by the women, but there were a goodly number of professional weavers, and they were men. Many attempts were made to spin threads from various grasses, but they were not successful.\(^3\) Jute and hemp were used for certain kinds of things.\(^4\)

In 1785, Jamaican cotton seeds were given to Frank Lovett, who settled off the coast of Georgia. Other people in Georgia were given seeds by friends in the Bahamas. From this start came the best cotton there is - Sea-island

\(^1\) *Man is a Weaver* by Elizabeth Chesley Beity

\(^2\) *The Story of Textiles* by Perry Walton

\(^3\) *Early American Textiles* by Frances Little

\(^4\) *America's Fabrics* by Zelma Baudure and Gladys Pfeiffer
cotton - with long silky fibers.\(^1\)

Cotton, which had been slow and tedious to prepare for spinning, and so not used extensively, took a spurt with Eli Whitney's invention of the cotton gin, in 1793.\(^2\) From then on, cotton weaving progressed rapidly in the States.

The first Merino sheep were brought into the United States for commercial use in 1801.\(^3\) In 1849, Angora Goats (Mohair) were brought from Turkey, and have done well. The Cashmere goat from Tibet and India has not thrived, when attempts have been made to raise them in the United States.\(^4\)

Raw silk is still imported for silk-weaving in the United States, because it is cheaper. However, California and Texas are now experimenting with sericulture and machine reeling of silk, hoping to find a cheap means of production.\(^5\)

Linen has been an expensive material because hand-pulling was needed, and labor is expensive in the United States. After World War I, the Vessott flax puller was invented in Canada. Oregon bought some of them, and rented

---

(1) The Story of Textiles by Perry Walton
(2) Ibid.
(3) Man is a Weaver by Elizabeth Chesley Baity
(4) America's Fabrics by Zelma Bendure and Gladys Pfeiffer
(5) Ibid.
them to farmers. The World Fiber Corporation has invented a machine to separate the fibers of linen. (1)

Angora rabbit, which is a difficult fur to handle, is usually mixed with other fibers before spinning. Musk-rat, raccoon, and mink have also been used in conjunction with other fibers. Fine wool is woven from vicuna, camel hair, kashmir, guanaco, llama, suri, alpaca, misti, and huarizo, which are imported from India, China, and South America. (2)

Science has brought an entirely new group of fibers to the world. The most important group of these is the rayon group, which is produced in three different ways, cuprammonium, viscose, and cellulose-acetate.

In 1894, Messrs. Cross and Bevan found the cellulose-acetate process for making fibers. (3) Cotton-linters or wood chips (hemlock, pine, or spruce) or even corn or sugar cane stalks (4) are transformed by the use of acetate anhydride and acid (5) to produce long filaments which are spun together like silk. (6) Camille and Henry Dreyfuss began spinning threads in 1914, were interrupted because of the

(1) Men is a Weaver by Elizabeth Cheale Baily
(2) Textiles by Mary Schenck Woolman and Ellen Beers McGoogan
(3) Fibers and Fabrics of the Future L. C. Chase & Co.
(4) Textiles by Mary Schenck Woolman and Ellen Beers McGoogan
(6) The Romance of Textiles by Ethel Lewis

45
war, continued their research, and aided the beginnings of plants in both England and the United States. In 1924, threads were made in a Cumberland, Maryland plant (now the Celanese Corporation of America).(1)

Cellophane is a yarn made from slit-cellulose film by the Du Pont Cellophane Company and the Eastman Kodak Company.(2)

In 1887, Schweitzer of Germany discovered the synthetic material - cuprammonium - which was made from cotton linters, copper sulfate, and aqua ammonia. In 1890, Despaisses of France invented the process for making threads of cuprammonium. The first commercial use was by the J. P. Bemberg A.G., in Germany. In 1926, the American Bemberg Corporation was founded in Elizabethtown, Tennessee.(3)

In 1892, Mesara, Cross and Bevan, of England, invented the viscose method of making synthetic fibers.(4) Wood pulp (from spruce pine or slash pine)(5) or cotton linters, is used with caustic soda and carbon bisulfide to make viscose.(6) In 1910, viscose rayon was first

(1) New Benefits for the World from Synthetics Celanese Corp. of America
(2) Textile Fibers and Their Use by Katharine Paddock Hess
(3) Textiles by Mary Schenck Woolman and Ellen Beers McGowan
(4) Fibers and Fabrics of the Future L. C. Chase & Co.
(5) Textiles by Mary Schenck Woolman and Ellen Beers McGowan
manufactured in the United States by the American Viscose Corporation, in Marcus Hook, Pennsylvania.(1)

Modified viscos fibers have casein added to the solution. They are known as "Cisalpina" in Italy, and as "Fibramine" in Belgium.(2)

Basified viscos fibers have synthetic resins added to the solution, which makes the fibers resemble wool. In England they are known as "Courtland’s Rayolanda W.D.", and "Rayolanda X". In Germany they are "Vistralon", "Cupralan", and "Artiland".(3)

Spun rayon is a rayon fiber made from short filaments which are spun like cotton.(4)

Soybean fiber, which is cut in 1/2-6" lengths, and has a natural crimp, has been developed by the Ford Motor Company, in Dearborn, Michigan. It is also made in Japan where it is called "Showa".(5)

The Pacific Lumber Company, on the west coast of the United States, has developed a fiber from the bark of the Redwood. It is combined with wool and known as "Falco".(6)

(1) Textiles by Mary Schenck Woolman and Ellen Beers McGowan
(2) Textile Fibers and Their Use by Katharine Paddock Hess
(3) Ibid.
(4) The Romance of Textiles by Ethel Lewis
(5) America’s Fabrics by Zelma Bendure and Gladys Pfeiffer
(6) Textiles by Mary Schenck Woolman and Ellen Beers McGowan

47
Scientific experiments, aimed at no particular goal, at the E. I. du Pont de Nemours & Co., Wilmington, Delaware, under the direction of W. H. Carothers, led to the development of nylon fibers from coal, water, and air.\(^1\)

Recent experiments by du Pont, have suggested the possibility of replacing coal with waste products such as corn cobs and oat hulls, and perhaps peanut shells, hulls of cottonseed and rice, and bagasse (left after sugar is extracted from canes and beets).\(^2\)

The Dow Chemical Company, Midland, Michigan, has developed a synthetic fiber known as "Saran" from petroleum and brine.\(^3\)

The same fiber under the name "Velon" is made by the Firestone Tire and Rubber Company of Akron, Ohio.\(^4\)

"Vinyon", made from vinyl resins produced with coke, lime, water and salt, is produced by the American Viscose Corporation, Marcus Hook, Pennsylvania.\(^5\)

Corn Products makes zein fibers out of the protein zein which is derived from corn.\(^6\)

"Plexon" is a rayon, cotton, silk, or nylon, or other fiber, coated with a resin plastic to suit a

\(^{(1)}\) About du Pont Nylon E. I. du Pont de Nemours & Co.
\(^{(2)}\) Newsweek vol. XXIX, no. 15
\(^{(3)}\) America's Fabrics by Zelma Bendure and Gladys Pfeiffer
\(^{(4)}\) Ibid.
\(^{(5)}\) Ibid.
\(^{(6)}\) Textiles by Mary Schenck Woolman and Ellen Beers McGowan
particular need. The plastic may be one of seventeen, ranging from cellulose acetate to soybean. The process was invented in France in 1924, by Girard and Roumazilles, and was patented there in 1925. It was first patented in the United States, and manufactured in 1938. During the war there were many developments and improvements to make it a more useful product.\(^{1}\)

In 1935, Antonio Ferretti, of Italy, experimented with making a casein fiber from skimmed milk. The United States Department of Agriculture became interested in experimenting with casein fibers, and in 1937, the National Dairy Products Association formed "Aralac, Inc." at Taftville, Connecticut. "Aralac" is usually combined with other fibers in weaving.\(^{2}\) Casein fibers are now used in Italy, Germany, Poland, Belgium, Holland and England as well as in the United States.\(^{3}\)

In 1895, Edward D. Libbey drew coarse fibers of glass which he combined with silk in weaving. Both England and Germany took out patents in the 20th C., for glass fibers, but their fibers were too coarse for use in weaving. In 1931, research by the Owens-Illinois Glass Co., and the Corning Glass Works led to the development of Fiberglas,

1. Plastics Catalog, 1944
2. America's Fabrics by Zelma Bendure and Gladys Pfeiffer
3. Textile Fibers and Their Use by Katharine Paddock Hess
which was used in war materials, beginning in 1938, and is now used commercially. The Owens-Illinois Fiberglas Corporation produces Fiberglas from silica sand and limestone. (1)

Asbestos fiber, which comes from "Serpentine" asbestos, known as chrysotile, mined mainly in Canada and Arizona, although some in Russia and South Africa too, (2) was patented under the name "Asbeston" in 1937, by the U. S. Rubber Co., at Hogansville, Georgia. It is mixed with cotton (not over 18% if it is to remain fireproof), for easier spinning and weaving. Since 1895, asbestos fibers had been used, but were very bulky. (3)

In 1939, the first experiments began, which led up to the development of a bright aluminum foil between two films of plastic, known as "Lurex", and produced by The Dobeckmun Company, in Cleveland, Ohio. (4)

In connection with weaving with new materials in the United States, much credit must be given to Mrs. Dorothy Wright Liebes of San Francisco, California. As her hobby turned into a business, her name came to be associated with the decoration of modern buildings and steamships, as she worked directly with the architects in most cases, to suit

(1) America's Fabrics by Zelma Bendure and Gladys Pfeiffer
(2) Ibid.
(3) Textile Age January 1946
(4) The Dobeckmun Company, Yarn Division
the materials to the designs. She designed materials for many manufacturers, and has been asked to design materials for most of the others. She is a director of the San Francisco Museum of Art, on the advisory board of the New York Museum of Modern Art, is in on discussions of the Metropolitan's new textile wings, was placed in charge of the Skilled Arts division of the American Red Cross during the war. Full of ideas, and having the strength to carry them out, endowed with a charming personality, she is unquestionably the leader in the use of the new materials scientists are developing. (1)

And so, as man's life is simple, luxurious, classical, or scientific, the materials he uses and wears are simple, luxurious, classical, or scientific. As his life demands changes in fabrics, the fabrics change his life. This can be seen in the formation of the Guilds in Europe, restricting the hours he might work; in the industrial development of the late 18th C., when machinery replaced to a large extent the individual worker; and brought about congested areas for living, with the formation of large

(1) Colliers vol. 117 April 12, '46
factories; in the rebellion at restrictions which led to revolutions; with the recent scientific developments which have enabled a great variety of fabrics to simplify and enrich the lives of so many people.
Baity, Elizabeth Cheley - Man is a Weaver
The Viking Press, N.Y. 1946 1st ed.
328 pp. 125 ill. biblio. pp. 324-6

Bendure, Zelma, & Pfeiffer, Gladys - America's Fabrics
The Macmillan Co. N.Y. 1946 1st printing
677 pp. 12 colored plates 797 ill. biblio. pp. xi-xii

Bowles, Ella Shannon - Homespun Handicrafts
pp. 39-84 13 ill. biblio. pp. 10, 11

Earle, Mrs. Alice Morse - Home Life in Colonial Days
The Macmillan Co. N.Y. 1913 12th ed.
pp. 166-251 25 ill.

Fleming, Ernst - Introduction to an Encyclopaedia of Textiles
E. Wayne 794 Lexington Ave. N.Y. 1927 1st ed.
36 pp. 325 plates

Gardner, Helen - Art Through the Ages
Harcout, Brace & Co. N.Y. 1935 rev. 1936

Gilroy, Clinton G. - The Art of Weaving
George D. Baldwin 35 Spruce St. N.Y. 1844 1st ed.
pp. 1-68 3 ill.

Hess, Katherine Paddock - Textile Fibers and Their Use
J. B. Lippincott Co. N.Y. 1941 3rd ed.
386 pp. 394 ill.

Hunton, W. Gordon - English Decorative Textiles
(Tapestry & Chintz)
John Tiranti & Co. Maple St. Tottenham Court Rd.
w.l London 1930 1st ed.
pp. 1-9 181 plates biblio. p. 10

Russian Art chapt. on Textiles - A. F. Kendrick
Gurney & Jackson 33 Paternostre Row E.C.
London 1935 1st ed.
pp. 86-94 no ill.
Lamprey, Louise - The Story of Weaving
Stokes N.Y. 1939 1st ed.
276 pp. 49 il.

Lewis, Ethel - The Romance of Textiles
The Macmillan Co., N.Y. 1938 2nd ed. (reprint)
358 pp. 40 il. biblio. pp. 359-364

Little, Frances - Early American Textiles
pp. 3-169, 256-6 60 photographs biblio. pp. 249-253

Mairiet, Ethel M. D. - Handweaving Today
150 pp. 8 il. biblio. pp. 130-140

Mead, Charles W. - Old Civilizations of Mexico
American Museum of Natural History Handbook No. 11
1924 1st ed.
109 pp. 54 il. biblio. pp. 110-111

Means, Philip Ainsworth - Peruvian Textiles
Metropolitan Museum of Art N.Y. 1930 1st ed.
pp. 7-27 24 plates

Means, Philip Ainsworth - A Study of Peruvian Textiles
in the Museum of Fine Arts, Boston
Museum of Fine Arts Boston 1932 1st ed.
pp. 7-73 91 plates biblio. 74-82

Pope, Arthur V. - A Survey of Persian Art vol. III
chap. 52
Ackerman, Phyllis - Textile of the Islamic Periods
Oxford University Press London 1939 1st ed.
pp. 1995-2154

Rodier, Paul - The Romance of French Weaving
Frederick A. Stokes Co. N.Y. 1931 1st ed.
349 pp. 101 il.

Sternor, Maj. - Homecrafts in Sweden transl. by
Alice S. Von Holstein
F. Lewis, Ltd. The Tithe House, Leigh-on-sea
1929 1st Eng. ed.
319 pp. 9 colored plates 334 il.

Thurston, Violetta - A Short History of Decorative
Textiles and Tapestries
Pepler & Sewell Bitchling, Hassocks, Sussex
1954 1st ed.
101 pp. 46 il.
Van Cleve, Kate - Hand Loom Weaving for Amateurs
Beacon Press Boston 1935 1st ed.
pp. 1-5

Volbach, W. F. & Kuehnel, Ernst - Introduction to
Late Antique - Coptic & Islamic Textiles of Egypt
E. Wayne 764 Lexington Ave. N.Y. 1928 1st ed.
pp. 8-15 100 plates

Walton, Ferry - The Story of Textiles
Tudor Publishing Co. N.Y. 1935 2nd ed.
225 pp. 48 il. biblio. pp. 5, 6

Weeden, William Babcock - An Economic & Social History
Vol. I pp. 167-201, 204-7, 287-94, 403

Wellin, Dr. Nils Gustaf Axelsson - Modern Swedish Arts
And Crafts in Pictures
Scribner's Sons N.Y. 1931 1st ed.
pp. 24-6

Woolman, Mary Schenck & McGowan, Ellen Beers - Textiles

PAMPHLETS AND PERIODICALS

about Du Pont Nylon
Nylon Division E. I. du Pont de Nemours & Co. (Inc.)
1946 Wilmington 98, Del.
18 pp. 16 il. 3 diagrams

Bulletin of the Metropolitan Museum of Art vol. 32 1937
Dimand, M. S. "Two Syrian Silk Weaves of the VII C."
pp. 259-262

Bulletin of the Metropolitan Museum of Art vol. 30-31
1935-6
Phillips, John Goldsmith - "Recent Accessions of
Textiles"
p. 83 1 plate

Bulletin of the Metropolitan Museum of Art vol. 34-35
1939-1940
pp. 11-15, 90-95, 206-7
Bulletin of the Metropolitan Museum of Art 1944-5
pp. 24-25, 21-2

Colliers vol. 117 April 15, 1946
Carson, R. "Weaver of Dreams: D. Liebes"
pp. 17-18
1 col. photograph

The Dobeckmun Company Yarn Division Cleveland 1, Ohio
4 pp.

Fibers and Fabrics of the Future
L. C. Chase & Co. 295 Fifth Ave., New York 16

New Benefits for the World from Synthetics
Geleese Corporation of America 180 Madison Ave.
N.Y. 16 1945
20 pp. 27 il. 7 diagrams

Newsweek vol. XXIX n. 15 March 31, 1947
"Science"

Plastics Catalog 1944
3 pp. 4 il.

Textile Age Jan. 1946
"A New Fabric from the World's Oldest Fiber"
6 pp. 13 il.

Textile World vol. 91 part 2 December 1941
p. 74 1 il.

The Story of Vicuna by Sylvan I. Strock
S. Strock & Co., Inc., N.Y. 1946 5th printing
23 pp. 6 il. 2 colored plates

The Story of Aralac
Aralac, Inc., 71 Vanderbilt Ave., N.Y. 17
14 pp. 23 il.

56
LIST OF ILLUSTRATIONS

Plate I
Egyptian cotton
Bonesho-Shaidmagle (retail) Milwaukee, Wisconsin
Kashmir
S. Strock & Co. Inc. (manufacturer)
404 Fifth Ave. N.Y.

Plate II
Alpaca
S. Strock & Co. Inc. (manufacturer)
404 Fifth Ave. N.Y.
Llama
S. Strock & Co. Inc. (manufacturer)
404 Fifth Ave. N.Y.

Plate III
Vicuna
S. Strock & Co. Inc. (manufacturer)
404 Fifth Ave. N.Y.
Camel Hair
S. Strock & Co. Inc. (manufacturer)
404 Fifth Ave. N.Y.

Plate IV
Huacizo and wool
S. Strock & Co. Inc. (manufacturer)
404 Fifth Ave. N.Y.
Shetland wool
S. Strock & Co. Inc. (manufacturer)
404 Fifth Ave. N.Y.

Plate V
Mohair (44% mohair, 10% rayon, 37% cotton)
Goodall-Sanford, Inc. (manufacturer) Sanford, Maine
Horsehair (combined with cotton)
Zazarus (retail) Columbus, Ohio

Plate VI
Mink (6% mink fur, 10% animal fur, 85% wool)
Bonesho-Shaidmagle (retail) Milwaukee, Wisconsin
Angora Rabbit (white angora fur, and new wool)
Macy's (retail) New York

Plate VII
Linen (theatrical gauze)
Schuster's (retail) Milwaukee, Wisconsin
Linen (made in Jugoslavia)
Gimbels (retail) Milwaukee, Wisconsin

57
Plate VIII
Bisso Linen (made in Ireland)
Schuster's (retail) Milwaukee, Wisconsin
Linen & Rayon Chapman's (retail) Milwaukee, Wisconsin

Plate IX
Pongee (purchased in 1828)
Carson-Pirie-Scott & Co. (retail) Chicago, Illinois
China Silk (purchased in 1940)
Loebs (retail) Lafayette, Indiana

Plate X
Real Silk
Gimbel's (retail) Milwaukee, Wisconsin
Spun Silk
Boneho-Shaidnagle (retail) Milwaukee, Wisconsin

Plate XI
Hemp
Carson-Pirie-Scott & Co. (retail) Chicago, Illinois
Hemp and cotton
Carson-Pirie-Scott & Co. (retail) Chicago, Illinois

Plate XII
Sisal (made in Haiti)
Chapman's (retail) Milwaukee, Wisconsin

Plate XIII
Jute
Shrier (retail) Washington, D. C.
Jute (burlap)
Source unknown

Plate XIV
Copper
Moore & Kemple (retail) Lafayette, Indiana
Galvanized Iron
Moore & Kemple (retail) Lafayette, Indiana

Plate XV
Asbestos fiber
United States Rubber Co. 1830 Ave. of the Americas N.Y.
Plate XVI
"Aralac" (casein fiber)
Aralac, Inc. (manufacturer) 71 Vanderbilt Ave. N.Y.
"Aralac" (combined with rayon)
Gimbels (retail) Milwaukee, Wisconsin

Plate XVII
Tinsel and rayon
The Dobeckmun Co. (manufacturer) Cleveland, Ohio
Lurex with cotton
The Dobeckmun Co. (manufacturer) Cleveland, Ohio

Plate XVIII
Tinsel with rayon
Tinsel with rayon and cotton (Hafnor fabric)
W & J Sloane (retail) Fifth Ave. at 47th St. N.Y.

Plate XIX
Viscose rayon
Gimbels (retail) Milwaukee, Wisconsin
Acetate rayon
Fabric Shop (retail) Milwaukee, Wisconsin

Plate XX
"Celanese" (cellulose-acetate)
W & J Sloane (retail) Fifth Ave. at 47th St. N.Y.
"Bemberg satin" (cupramonium rayon)
Gimbels (retail) Milwaukee, Wisconsin

Plate XXI
Nylon and rayon (60% nylon, 40% rayon)
Gimbels (retail) Milwaukee, Wisconsin
Spun rayon
Gimbels (retail) Milwaukee, Wisconsin

Plate XXII
Nylon with rayon pattern burned out
Gimbels (retail) Milwaukee, Wisconsin
Nylon filling, cotton warp
Macy’s (retail) N.Y.

Plate XXIII
Nylon
"Nylonene" (nylon)
Gimbels (retail) Milwaukee, Wisconsin
Plate XXIV
"Vinyon"
  American Viscose Corp. (manufacturer)
  Marcus Hook, Pa.

Plate XXIV
"Saran" (Dow Chemical Co., Midland, Michigan)
  Sears (retail) Milwaukee, Wisconsin
"Valon" (Firestone Tire & Rubber Co., Akron, Ohio)
  (Harner Fabric)
  W & J Sloane (retail) Fifth Ave. at 47th St. N.Y.

Plate XXIV
Leather, raw silk, cotton
  Dorothy W. Liebes Textiles 545 Sutter St.
  San Francisco 2 Calif.
"Flexon"
  Flexon Inc. (manufacturer) 212 Fifth Ave. N.Y.

Plate XXVII
"Fiberglas" (Owens-Illinois Fiberglas, Newark, Ohio)
  Bonero-Shaidnagle (retail) Milwaukee, Wisconsin
  Nylon (Harner Fabric)
  W & J Sloane (retail) Fifth Ave. at 47th St. N.Y.

Plate XXVIII
Cotton, cellophane, Lurex
  Jos. Brandt & Bros., Inc. (manufacturer)
  551 E. 72 St. N.Y.
Cotton and cellophane
  Jos. Brandt & Bros., Inc. (manufacturer)
  551 E. 72 St. N.Y.

Plate XXIX
Cotton, rayon, cellophane, opaque cellophane
  Jos. Brandt & Bros., Inc. (manufacturer)
  551 E. 72 St. N.Y.
Cotton, and opaque cellophane
  Jos. Brandt & Bros., Inc. (manufacturer)
  551 E. 72 St. N.Y.
EGYPTIAN COTTON

KASHMIR

Plate I
HEBRIZO
and wool

SHETLAND WOOL

Plate IV
Mohair
44% mohair
17% rayon
37% cotton

HORSEHAIR
combined with cotton

Plate V
MINK
5% mink fur
10% animal fur
85% wool

ANGORA RABBIT
white angora fur
new wool

Plate VI
POISON
coconut of wild silk worm

REAL SILK
unreeled from a single cocoon of domesticated silk worms
36-50 filaments spun together to make a single fine thread

Plate IX
REAL SILK
unreeled from a single cocoon
of domesticated silkworms
36-50 filaments spun together
to make a single fine thread

SPUN SILK
spun from short ends as cotton is spun
from waste on the outside of cocoons
and from broken cocoons and from waste in the mills

Plate X
HEMP

COTTON

Plate XI
SISAL

Plate XII
"ASBESTOS"

asbestos fiber

Plate XV
"ARALAC"
Casein fiber from skimmed milk

RATON
"ARALAC"

Plate XVI
TINGEL
with rayon

LUXEX
aluminum foil between plastics
with cotton

Plate XVII
VISCOSE RAYON
wood pulp or cotton linters,
celulose soda, and carbon bisulfide

ACETATE RAYON
wood chips or cotton linters,
acetate anhydride, and acid

Plate XIX
"CELANESE"
CELLULOSE-ACETATE"
cotton linters or wood chips
or corn stalks or sugar cane
and acetate emulsion
and acid

"REMBERT SATIN"
CUPRASONICUM RAYON
cotton linters, copper sulfate, and aqua ammonia
60% NYLON
40% RAYON

SPUN RAYON
short filaments spun like cotton

Plate XXI
NYLON
rayon pattern
burned out chemically

NYLON
and cotton

Plate XXII
"NYLON"
coal, water, air

Plate XXXII
"VINYLON"
vinyl resins
from
coke, lime, water, salt

Plate XXIV
"SARAH"
petroleum and brine

"VELON"
petroleum and brine

Plate XXV
LEATHER
RAW SILK
COTTON

FLEXON
resin plastic coating

Plate XXVI
"FIBERGLAS"
glass fibers

"NYLON"
cell, water, air
"COTTON FRILL"
"CELLOPHANE"
slit cellulose film yarn
"LINEN"
two plies plastic, one ply gold plated aluminum foil

COTTON
"CELLOPHANE"
slit cellulose film yarn

Plate XXVII
"COTTON FRILL"
"NURSE RAYON"
"CELLOPHANE"
"OPAQUE CELLOPHANE"
slit cellulose film yarn

COTTON
"OPAQUE CELLOPHANE"
slit cellulose film yarn

Plate XXIX