9

COMPTON'S ENCYCLOPEDIA

F

Flori

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VOLUME

9

F–Flori
pages 1-248

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and Fact-Index

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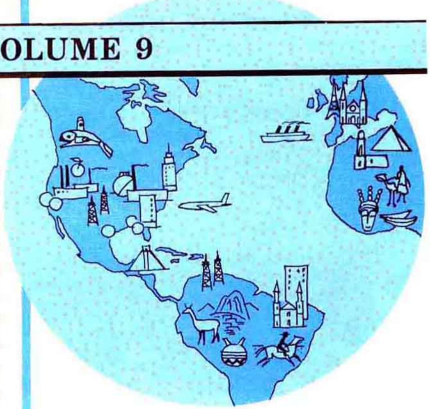
"Let knowledge grow from more to more and thus be human life enriched"

HERE AND THERE IN VOLUME 9



AT ODD TIMES when you are just looking for "something interesting to read," without any special plan in mind, this list will help you. With this as a guide, you may visit faraway countries, watch people at their work and play, meet famous persons of ancient and modern times, review history's most brilliant incidents, explore the marvels of nature and science, play games—in short, find whatever suits your fancy of the moment. This list is not intended to serve as a table of contents, an index, or a study guide. For these purposes consult the Fact-Index and the Reference-Outlines.

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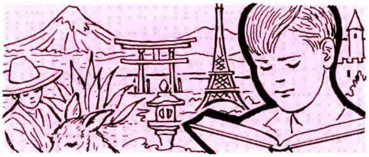

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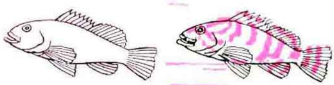

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F

CHARACTERS IN ANCIENT FABLES

Shown here are the grasshopper, sly foxes, and vain crows. Each tells a story with a moral, or object lesson. This wood engraving appears in 'Fables of Esope' (Aesop) (Gregynog Press).

FABLES. Stories that point out lessons are called *fables*. Nearly everyone knows the fable about the three little pigs. They leave home and go out into the world to make their fortunes. Of course, they have to build places in which to live. The first little pig makes his house of straw. The second little pig also takes things easily—he builds his house of sticks. The third little pig works hard and long to make a house of bricks—a good, sturdy house.

Along comes a wolf. He blows down the house of straw and the house of sticks—and eats the two lazy little pigs. All his huffing and puffing and chuffing, however, cannot blow down the house of bricks.

In this fable the three little pigs show human characteristics. Two little pigs are shiftless and meet an unhappy end through their own fault. The hard-working little pig earns the reward of a good life.

Famous Fables by Aesop

The greatest teller of fables was Aesop (*see* Aesop). He was a slave in ancient Greece. His stories are simple moral lessons illustrated usually by the actions and speech of animals. Some of his best-known fables are 'The Lion and the Mouse', 'The Fox and the Stork', 'The Hare and the Tortoise', 'The Wolf in Sheep's Clothing', 'The Fox and the Grapes', 'The Frogs Desiring a King', and 'The Shepherd Boy and the Wolf'.

In Aesop's 'The Lion and the Mouse' the great, strong lion is tired of hunting. He lies down to sleep under a shady tree. A mouse runs over his face and awakens him. The angry lion is about to crush the tiny mouse with his huge paw, but the mouse begs so to live that the lion lets him go.

Some time later the lion is caught in a hunter's trap. He roars with surprise and fury. The little mouse recognizes the roar and races to the trap. He gnaws the ropes and sets the lion free.

The powerful lion is very grateful for the help that his tiny friend gave him. The "king of beasts" throws back his great mane and thinks to himself, "Sometimes the weakest can help the strongest."

Fooling the Fooler

Aesop's 'The Fox and the Stork' shows that a tricky person does not always win. A fox invites a stork to dinner. The fox serves soup in a shallow dish. The poor stork can only wet the end of his long narrow bill in the soup. The sly fox makes false apologies and laps up all the food.

The stork pretends to be satisfied and invites the fox to dinner. When the fox comes a few days later, he finds the food served in a tall jar with a narrow neck. Down in the jar goes the stork's long bill. All the fox can do is lick his chops. This fable may have suggested the old proverb that "he who laughs last laughs best."

Many proverbs and maxims are expressions of the wisdom found in fables. Some of these sayings and the fables from which they come are listed in the table on the following page.

Fables by La Fontaine

Another great *fabulist*, or teller of fables, was Jean de la Fontaine (*see* La Fontaine). He wrote in France in the 17th century. La Fontaine based many of his fables on those of Aesop.

In the writings of both men are 'The Fox and the Crow', 'The Dove and the Ant', 'The Fox and the Grapes', 'The Maid and the Pail of Milk', and 'The Fox and the Stork'. Some of La Fontaine's titles vary slightly from Aesop's.

'The Fox and the Crow' tells how a fox sees a crow with a piece of cheese in her beak settle in a tree. The fox wants the cheese. He looks up at the crow and says, "Good day, Mistress Crow. How well you look today! I feel sure that your voice must surpass that of other birds, just as your figure does. Let me hear you sing but one song so I may greet you as queen of the birds."

The crow begins to caw her best. As soon as she opens her mouth, the piece of cheese falls to the ground and is snapped up by the fox. "That will do," he says. "That was all I wanted. In exchange for your cheese, I'll give you a piece of advice for the future. Do not trust flatterers."

Another of La Fontaine's fables is 'The Animals Sick of the Plague'. The lion, who is king of the beasts, asks all the animals to confess their sins. The guiltiest will be sacrificed to save the rest. The lion begins by confessing that he has "devoured an appalling number of sheep" and even "the shepherd, too."

Reynard the Fox defends the king. His plea is applauded by the lion's flatterers. Finally a poor donkey is sacrificed after he confesses that he has eaten grass on the monastery grounds. The moral of the tale is: "Thus do the courts acquit the strong and doom the weak as therefore wrong."

American Fables

The folk tales collected by Joel Chandler Harris are versions of fables (*see* Harris). These are the 'Uncle Remus' stories. An old Negro gardener tells of the contests of wit between such animals as Brer Rabbit and Brer Fox. The helpless rabbit always wins over the crafty fox.

THE TINY MOUSE BEGS THE ANGRY LION FOR HIS LIFE
The mouse has disturbed the lion. The lion spares him. Later the mouse saves the lion's life. Wood engraving by Boris Artzybasheff from 'Aesop's Fables' (Viking).

Another great American teller of fables is Walt Disney (*see* Disney). He "tells" them in comic strips and animated cartoons. He created Mickey Mouse, Donald Duck, Pluto, and Dumbo. His cartoons are shown in motion-picture theaters and on television all over the world. (*See also* Cartoons.)

In the 1950's a new kind of American fable appeared. It was in the form of newspaper comic strips. Animals played a large part in them.

These fables were written not for children but for adults. Their sophisticated humor depended largely upon puns and satires on politics, sports, and fads. One of the most successful of these comic fables was "Pogo," created by Walt Kelly. Pogo was a gentle opossum who lived in a swamp with a delightful assortment of animal friends.

History of Fables

Modern fables follow the tradition set hundreds of years ago. In very early times people told stories in which animals talk. By their actions the animals show how foolish or wise people can be. Folklore scholars

FABLES CREATE FAMILIAR SAYINGS

The race is not always to the swift. In 'The Hare and the Tortoise' the slow tortoise wins the race because the hare is so sure of himself that he takes a nap on the way.

Killing the goose that lays the golden eggs. In 'The Goose with the Golden Eggs' the owner of the goose is not satisfied with one golden egg a day. He cuts the goose open to see if there is gold inside.

Sour grapes. In 'The Fox and the Grapes' the fox cannot reach the grapes. Disappointed, he says that the grapes are sour and that they are "not fit for a gentleman's eating."

Don't count your chickens before they're hatched. In 'The Maid and the Pail of Milk' a girl carries a pail of milk on her head. She dreams about the eggs she will buy when she sells the milk. The eggs will hatch; then she will sell the chickens. With the money she has earned, she will buy fine clothes for herself. Thinking about the new clothes, the girl becomes so happy that she tosses her head gaily and spills all the milk.

One good turn deserves another. In 'The Dove and the Ant' a dove saves an ant from drowning in a river. Later the ant saves the dove's life by stinging a hunter in the foot, making him miss his aim at the dove.

Practice what you preach. In 'The Wolf and the Ass' a wolf urges the animals to share their food with one another. An ass then informs them that the wolf is hiding a fat sheep in his den.

Familiarity breeds contempt. In 'The Fox and the Lion' a fox is terrified when he first meets a lion. Each succeeding meeting with the lion, however, makes the fox less afraid.

Pulling chestnuts out of the fire. In 'The Monkey and the Cat' the monkey wants some chestnuts that are roasting in the fireplace. He does not want to burn himself, so he persuades the cat to reach into the coals. The cat, of course, scorches his paw, while the monkey eats all the nuts. From this fable comes the expression "cat's-paw," meaning a dupe, or a person who does someone else's disagreeable work.

think that fables probably originated among the Semitic peoples of the Middle East. The tales spread to India and then west to Greece.

Many fables go back to an ancient Sanskrit collection from India called 'The Panchatantra' (The Five Books). These stories were told and retold through many generations. Eventually they reached Greece. (*See also* 'Panchatantra' in the Fact-Index.)

The Greeks added more detail and action. Aesop was the master of them all (*see* Aesop). The Romans translated Aesop's fables into Latin. They were translated into French in the 13th century. Even earlier—about the 12th century—appeared the first of many versions of the long folk tale of 'Reynard the Fox'. (*See also* Folklore; Fox.)

Books About Fables

Duke, Francis, trans. The Best Fables of La Fontaine (Univ. Press of Va., 1965).

Jacobs, Joseph, ed. The Fables of Aesop (Macmillan, 1964).

Thurber, James. Fables for Our Time and Famous Poems (Harper, 1952).

White, A. T., ed. Aesop's Fables (Random, 1964).

FABRE (*fà'br'*), **Jean Henri Casimir** (1823–1915). One of the greatest naturalists was Henri Fabre. He was born at St. Léon, a village in the mountains of southern France. His grandparents were peasants who could not read or write. His father, Antoine, wanted to live in town but could not make a living there. In trying to do so he moved from St. Léon to Rodez, from there to Toulouse, and then to Montpellier. He opened a café in each place but always failed.

When Henri was 15, Antoine could no longer support him or his younger brother, Frederic. He sent Henri off to earn his own living. For a year the boy wandered about, working at odd jobs. He never had enough to eat. He often slept outdoors.

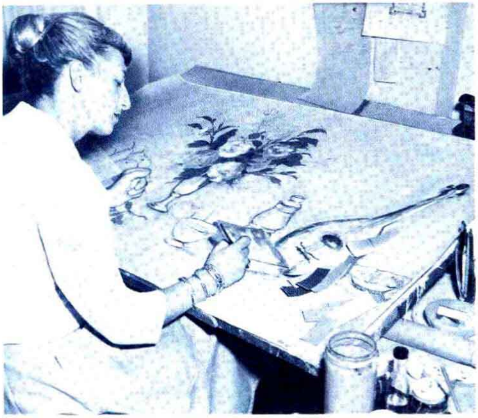
At Avignon he won a scholarship at the Normal School. After graduation two years later, Fabre taught

1823	**Fabre born**
1840	Telegraph patented
1859	Darwin's 'Origin of Species' published
1870	Franco-Prussian War
1879	**Fabre's major work, Volume 1**
1903	First airplane flight
1914	World War I begins
1915	**Fabre dies**

in elementary and high schools at Carpentras, Ajaccio (Corsica), and Avignon. He was popular as a teacher, for he made everything interesting. He taught himself the sciences and won university degrees at Montpellier and Toulouse. He published reports of his observations on the habits and instincts of insects, and these brought him fame among scholars. He was always underpaid, however. Since he had married at 21 and had five children, he was very poor.

When Fabre was 46 years old he stopped teaching and supported his family by writing textbooks. Soon he bought a small stone house at Serignan with enough land to provide a garden home for thousands of insects. Here he wrote most of his great 10-volume 'Souvenirs entomologiques'.

THIS ARTICLE IS IN THE FACT-INDEX
Fabricius, Hieronymus



The stylist is at work designing a fabric, in this case a drapery and upholstery material. Her drawings may be reproduced by screen printing.

FABRICS—In Great Variety

FABRICS. Clothmaking is one of the oldest crafts. The people of ancient Egypt wove fine linen. The Stone Age lake dwellers of Europe wove cloth of wool and flax and dyed it with vegetable dyes.

Wherever people became civilized, clothmaking developed. They used the raw materials in their locality. The Egyptians made chiefly linen, the Mesopotamians wool, the people of India cotton, the Chinese silk (*see* Textiles). When trade among countries developed, ships and caravans carried fabrics from one part of the world to another. Knowledge of how to raise and use the various raw materials spread.

How Clothmaking Became Specialized

In ancient times people made their fabrics by hand. Women spent long hours spinning and weaving. When people began to live in towns, the steps in clothmaking became separate crafts. One group of workers prepared fiber for spinning, another did the spinning, another the weaving, and still another the dyeing. Clothmaking was still a long, tedious process, however, and cloth was expensive.

A revolution in the ways of making cloth began in the latter part of the 18th century. It was due to the invention of power machinery for spinning and weaving (*see* Spinning and Weaving; Industrial Revolution). Factories were soon turning out large quantities of cloth. The price came down. Most people could afford to buy enough machine-made fabrics to supply all their needs. Clothmaking by hand methods disappeared except as a special craft.

The 20th century brought changes of another sort. Chemists and engineers, working together, discovered how to make fibers. Today there is a wide range of fabrics from which to choose.

To understand fabrics, something about the raw materials that go into them must be known. These materials are fibers—fine threadlike substances that can be spun into thread or yarn. The product of spinning is usually called yarn if it is to be made up into cloth and thread if it is to be used for sewing.

At first all fibers used in clothmaking were natural fibers; that is, they came from animal or vegetable sources. Linen, wool, cotton, and silk are natural fibers. Others include jute, hemp, kapok, ramie, and sisal. Today many fibers are man-made. Rayon and nylon are examples.

The Textile Fiber Products Identification Act requires manufacturers to label their products, giving the names and percentages by weight of the fibers used. (*See also* Fibers, Man-Made; Fibers, Natural; Plastics.)

Processing Fibers

Fibers go through many processes before being spun into yarn. Some of these give the fabric certain characteristics. Carding and combing are examples.

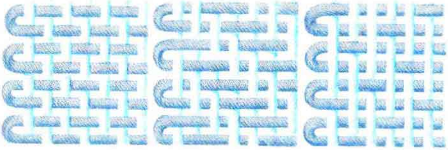
Carding is a cleaning and partial straightening out of a mass of fibers. It leaves most of the short fibers in the mass. Carded fibers receive a comparatively loose twist during spinning. The resulting yarn, known as carded yarn, is soft and fairly thick. It has a surface fuzz consisting of the protruding ends of many short fibers.

Combing is an additional straightening-out process. It removes the short fibers and lays the long ones parallel. These long fibers receive a tight twist during spinning. Combed yarns, therefore, are smooth, even, and strong.

Muslin sheets show a slight fuzz on the surface. This is because they are woven of carded yarn. Percale sheets, on the other hand, are smooth and fine. The yarn in them is combed yarn. Among other cotton fabrics made of combed yarn are fine organdy, broadcloth, and batiste. Most cheap cotton fabrics are made of carded yarn. Some cotton materials carry a label to show whether they have been made of carded yarn or of combed yarn.

Carded wool yarn makes soft, warm, resilient woolen cloth. In contrast, combed wool yarn makes worsted, a smooth, strong cloth. Flax fibers, the raw material of linen, are combed but not carded (*see* Linen).

Carding and combing produce long, ropelike lengths of fiber masses called slivers. These go through several drawing-out processes until they are pencil thin and lightly twisted. Then they are known as rovings. Rovings wound on bobbins go to spinning ma-



ALL WEAVES ARE VARIATIONS OF THESE

From left to right, these diagrams show the plain, twill, and satin weaves. The text tells how they are done and how they are varied and combined.

chines. There they receive a final drawing out and twisting. Fibers leave spinning machines as yarn or thread of any desired size and twist.

Lightly twisted yarns make fabrics with a soft surface. More tightly twisted yarns make firm, smooth fabrics with some elasticity and resistance to wrinkling. The yarns that go into crepes are very tightly twisted; in the same fabric, some may have a right-hand twist and some a left-hand twist.

Yarns of different weights woven together produce novelty effects, such as nubby weaves. Several strands of yarn twisted as one form ply yarns. Fabrics woven of ply yarns are especially durable. Duck and good broadcloth shirting are examples.

Natural and Man-Made Filaments

Most natural fibers grow to characteristic lengths. This is true of cotton, linen, and wool. Some fibers, however, are made into an almost endless strand. These are filaments, from the Latin verb *filare*, "to spin." The silkworm spins filaments of silk to make its cocoon, ejecting a gummy substance through two tiny, tubelike openings in its lower jaw (*see* Silk). The apparatus for making man-made fibers imitates this process. It pumps a thick chemical solution through holes in a spinneret, a device that looks like a miniature shower-bath nozzle. The streams of solution solidify into filaments in the air or in a liquid bath. The diameter of the holes in the spinneret varies according to the size filaments the manufacturer wants to make (*see* Rayon; Nylon).

Silk and man-made filaments are usually thrown, or twisted, to make yarns with many filaments. Filaments may be cut into lengths similar to those of cotton, wool, or flax fibers. The yarns that result are called spun yarns. Manufacturers make spun silk yarns chiefly to use up broken filaments. Spun silk is not as strong or as elastic as yarn made of reeled silk filaments. Nevertheless, it makes attractive fabrics, including tub silk.

The short lengths of rayon and nylon filaments are called staple fibers. Manufacturers can blend them with each other or with natural fibers. Thus they can combine desirable features of two or more fibers in one spun yarn.

Weaving Yarns into Fabrics

Weaving is an interlacing of yarns or other fibers at right angles. Fabrics are woven on looms (*see* Spinning and Weaving). The principle in all looms is the same. A frame holds a set of lengthwise yarns. These form the warp. A shuttle laces a weft yarn through the warp yarns, back and forth, to fill out the fabric. (Weft yarns are also known as woof yarns or filling yarns.)

Harnesses with attachments to individual warp yarns raise and lower different sets of these for each passage of the filling yarn. The grouping of warp yarns as the harnesses raise and lower them determines the pattern of weaving. There are three basic weaves—plain, twill, and satin.

In a *plain weave* the filling yarn passes under one warp yarn and over the next. Every other row is alike. Any lines that are visible run straight across or straight up and down the cloth. Percale, taffeta, and organdy are examples of the plain weave. They differ from one another because the yarns in them are different. Basket weave is a variation of the plain weave in which two or more filling yarns pass together over and under similar groups of warp yarns. Rib weaves are also variations of the plain weave.

In the *twill weave* the filling yarn passes over and under groups of warp yarns in such a way as to make diagonal lines across the surface of the fabric. This weave appears in cheviot, herringbone, covert cloth, serge, gabardine, denim, drill, and in some tweeds and flannels. It makes strong, firm cloth.

In the *satin weave* the filling yarn passes *under* the warp yarns at widely separated intervals. In a variation called the sateen weave, the filling yarn passes *over* the warp yarns at similar intervals. In the first case warp yarns "float" on the surface; in the second case filling yarns "float." In both cases the surface is lustrous (if a smooth yarn is used) because the floating yarn, lying nearly continuously on the surface of the fabric, catches and reflects light.

How Weaves Are Combined

A manufacturer can put designs into cloth by combining two or more basic weaves. He may do this by attaching a "dobby head" to an ordinary loom. A dobby is a chain mechanism to control the raising and lowering of as many as 25 harnesses for one weaving. It makes possible the weaving-in of small, regular designs. In an over-all diamond pattern, for example, the background might be in plain weave and the diamonds in satin weave.

For a large and complicated design the manufacturer uses a Jacquard loom. This has a perforated-card mechanism which operates on somewhat the same principle as a player piano. It controls the warp yarns individually, raising and lowering them according to the holes in the cards. (For picture, *see* Rugs and Carpets.) The Jacquard loom produces such fabrics as matelassé, damask, and brocade.

In pile weaving the loom may carry an extra set of warp yarns. These are thrown to the surface, usually over wires, to form loops. If the wires have

FINISHES FOR BEAUTY AND SERVICE

Singeing: Rapid passing of fabrics over gas flame or hot plates to burn off lint, threads, fuzz, and fiber ends. The process is done to all fabrics of short-fiber yarns.

Mercerizing: Chemical treatment which adds luster, strength, and absorbency to cotton thread or cloth.

Bleaching: Removal of natural color, usually by chemicals. Bleaching makes white goods whiter and prepares cloth for printing. The process tends to weaken fabrics somewhat.

Preshrinking: Returning to their original shape fibers that have been stretched by tension on yarns during weaving. Soaking in cold or hot water, steaming and treating with chemicals are some of the methods used. Fabrics may shrink more later.

Fulling: Cleaning, scouring, and compressing wool. The Romans trod on woolens in tubs containing water and fuller's earth. Modern methods include the use of cold or hot water, soap, chemicals, and hydraulic pressure.

Tentering: Lining up a fabric pulled out of shape. A roller feeds damp cloth to a machine which has clamps (tenterhooks) that grip the selvages and then jerk the cloth into shape.

Sizing: Starching to provide body and weight. In permanent sizing a chemical treatment changes the fiber's cellular structure and gives lasting stiffness.

Glazing: Use of starch, glue, mucilage, or shellac to produce a high polish. Synthetic resins give a permanent glaze.

Calendering: Ironing fabrics by passing them through heavy, polished, heated rollers.

Napping: Brushing up a fuzz on cloth of lightly twisted yarns. The Romans used plant burrs (fuller's teasels). Modern manufacturers use teasels for fine fabrics, wire brushes for cheaper cloth.

Anticrush Finishing: Impregnation of linen or cotton yarns with synthetic resins to give elasticity; makes fabric crush resistant.

Waterproofing: Coating with rubber or plastic. Synthetic resins or waxes make fabrics water repellent.

blades at the ends, these cut the loops as the wires are withdrawn, making a "cut pile." Examples of cut-pile fabrics are velvet, plush, and most rugs and carpets. Brussels carpets have an uncut pile.

The pile of corduroy and velveteen is produced with an extra set of filling yarns. These float on the surface as in the sateen weave. The fabric leaves the loom as a flat material. Then a machine cuts the floating yarns midway between their intersections with the warp yarns, and they stand up as pile.

By varying the basic weaves, by combining them, and by using the many textile fibers in the various weaves, manufacturers can produce hundreds of different fabrics. It would be impossible to tell about all of them here. Short articles about the most important ones can be found in the Fact-Index.

Knitted Fabrics Have "Stretch"

Knitting is an interlooping of one yarn or a set of yarns to form a fabric. It contributes flexibility, elasticity, and warmth. There are two types of knit fabrics: weft knit (also called filling knit) and warp knit. Both are done on flat-bed machines to form flat fabrics and on circular machines to form tubular fabrics (*see* Knitting Machines).

Weft knit, done with one yarn, has three basic stitches—plain, purl, and rib. Plain-knit fabrics show chainlike rows of stitches running lengthwise on the face and crosswise ridges on the back. They have considerable crosswise elasticity. Balbriggan and jersey are examples.

Purl-knit fabrics have crosswise ridges on both sides. They are elastic in both directions but more so lengthwise. Rib knit combines plain and purl stitches to create groups of lengthwise ridges, or wales, alternately on the two sides of the fabric. This type of knitting produces the most elastic fabric.

Warp knit, done with many yarns, makes great variety in construction and design possible in knit fabrics. Lengthwise rows of loops characterize the type. Well-known examples are tricot and Milanese. Tricot looks like plain-stitch weft knitting. For this reason it is sometimes called jersey. Milanese has a fine, diagonal, twill-like rib. Its elasticity lies in the direction of the ribs. Warp-knit fabrics are stronger, firmer, and more run-resistant than weft knit, but they are less elastic.

Other Ways of Making Fabrics

Although cloth is usually thought of as either woven or knit, there are other ways of making fabrics. *Felting* is a matting together of fibers by means of moisture, heat, and pressure.

Braiding is an interlacing of three or more strands of yarn or other fiber so that each strand passes over and under one or more of the other strands. Braid may be flat or round. Manufacturers use all the textile fibers, as well as metal, tinsel, straw, wire, and leather in braids. They use the braids to make hats of straw or other fiber, small rugs, dress accessories, and many other articles.

Netting is an intertwining of yarns at each point where they cross so they form a mesh type of fabric. Netted fabrics vary from a coarse, open, fish-net type to fine handmade or machine-made lace (*see* Lace).

The chemist and engineer have used their modern magic to produce fabriclike plastics. These can hardly be called cloth. They are not made by any of the clothmaking processes. Yet they serve many of the uses of cloth. Like all plastics, they are molded. They are waterproof and dustproof. Some are chemical resistant. They appear as "yard goods" and in draperies, shower curtains, upholstery, raincoats, dust covers for dishes and kitchen appliances, and clothesbags. They have many trade names, including Pliofilm, Krene, Elasti-glass, and Vinylite (*see* Plastics; Rubber).

COLOR AND DESIGN IN MODERN WOOLEN FABRICS

From left to right: plaid tweed of homespun yarn; a yellow basket weave; a basket weave of medium-sized strands in color pairs; a plaid cheviot; a soft, green tweed; a nubby tweed woven with threads of unequal thickness; a blue wool crepe closely woven with unequal tension on warp and weft. The cheviot is a twill. All others are variations of the plain weave.

GLASS MARBLES FOR FIBERGLAS
Glass for fibers is first formed into glass marbles. From one marble, 97 miles of glass filament can be drawn. Glass fabrics, used for window curtains and draperies, are nonflammable.

Putting Color into Fabrics

Dyeing gives color to cloth by immersion of the fiber, yarn, or fabric in a solution of dyestuffs (*see* Dyes). Stock dyeing, or dyeing at the fiber stage, and yarn dyeing produce yarns for plaids, stripes, and other designs worked out in different colored yarns. If a fabric is a solid color, it was probably piece dyed as a completed fabric.

Printing applies dyes in paste form to produce a color effect on the surface of a fabric. In block printing a craftsman carves the design on a wood or metal block. He applies paste dye to the block. Then he presses the block down on the fabric. Each color requires a separate block. In screen printing workers use lacquer to block out all but the design on a copper or fabric screen. Then they force color paste through the design onto the fabric. They use a different screen for each color.

Roller printing is a machine process and can print thousands of yards in a short time. The design is engraved on copper rollers, with a separate roller for each color. Workmen feed the fabric through the rollers, which print the design on the fabric.

Photographic printing of fabrics is done by sensitizing them with photographic compounds and exposing them to light under a design negative. Developing the fabric makes a single-color design in all gradations of that color.

SCREEN PRINTING A FINE FABRIC
Screen printing done by hand is a fine art. The workers in this factory are applying color paste through a screen. They have blocked out everything on the screen except the design itself.

KINDS OF FABRICS

(*See in Index* topics below.)

Alpaca
Art linen
Asbestos fabrics

Baize
Balbriggan
Barracan
Basket cloth
Batiste
Beaver cloth
Bengaline
Bobbinet
Bolivia cloth
Bombazine
Bouclé
Broadcloth
Brocade
Brocatel
Buckram
Burlap

Calico
Cambric
Camel's-hair cloth
Canton crepe
Cashmere
Cassimere
Challis
Chambray
Charmeuse
Cheesecloth
Chenille
Cheviot
Chiffon
China silk
Chinchilla cloth
Chintz
Corduroy
Covert
Crash
Crepe
Crepe de Chine
Cretonne
Crinoline

Damask
Denim
Dimity
Drill
Duck
Duvetyn
Dynel

Eiderdown

Faille
Felt
Flannel
Foulard
Frieze
Frisé
Fustian

Gabardine
Gauze
Georgette crepe
Gingham
Grenadine
Grosgrain
Gunny

Habutai
Holland cloth
Homespun
Hopsacking
Huck

Jean
Jersey cloth

Kersey
Khaki

Lace
Lamé
Lawn
Linen
Linsey-woolsey
Longcloth

Mackinaw
Madras
Malines
Marquisette
Matelassé
Melton
Milanese
Mohair
Moiré
Moleskin
Mosquito netting
Mousseline de soie
Mull
Muslin

Nainsook
Ninon

Oilcloth
Organdy
Osnaburg

Peau de soie
Percale
Piña Cloth
Piqué
Plissé
Plush
Pongee
Poplin
Prunella

Ratiné
Rep

Sateen
Satin
Scrim
Seersucker
Serge
Shantung
Sharkskin
Surah
Swiss

Taffeta
Tapa cloth
Tarlatan
Terry cloth
Ticking
Toile de Jouy
Tricot
Tulle
Tweed
Twill

Velours
Velvet
Velveteen
Vicuña Cloth
Voile

Worsted goods

TEXTILE FIBERS AND THE FABRICS THEY MAKE

FIBER*	FABRIC	BURNING TEST FOR IDENTIFICATION
Cotton: Vegetable; $\frac{3}{8}$–2 in. long; flat; with spiral turn; rough surface; finer than linen or wool; stronger than rayon or wool; heat conductor; not absorbent; not elastic; not injured by alkalies.	**Cotton:** Usually soft and smooth; strength depends upon yarn and weave; dull unless mercerized; cool; clammy when wet; dries quickly; without affinity for dyes but can be made colorfast; wrinkles easily; can stand strong soap; mildews.	**Cotton:** Burns quickly with yellow flame; odor like burning paper; feathery gray ash; if mercerized, black ash.
Flax: Vegetable; 12–40 in. long; coarsest next to wool; next in strength to silk; cylindrical, with nodes; heat conductor; very absorbent; least elastic; not injured by alkalies.	**Linen:** Strong; durable; lustrous; cool, absorbs moisture readily, and dries with cooling effect; least affinity for dyes; wrinkles very easily; can stand strong soap; subject to mildew.	**Linen:** Burns quickly with yellow flame; odor like burning paper; light ash.
Silk: Animal; about 400–1,000 yd. long; double-cylindrical filament; finest, strongest, most lustrous natural fiber; nonconductor of heat; more absorbent than linen; next to wool in elasticity; harmed by alkalies.	**Silk:** Strong; lustrous; warm; absorbs and holds moisture without feeling wet; takes dye well; drapes successfully; resists crushing; injured by strong soap; may require dry cleaning.	**Silk:** Pure dye silk burns slowly with hairlike odor, leaves crisp black ash balls; weighted silk chars, does not flame, leaves ash in shape of burned sample.
Wool: Animal; about 1–14 in. long; coarsest; weakest; nonconductor of heat; most absorbent; most elastic natural fiber; easily harmed by alkalies.	**Wool:** Soft or firm, depending upon yarn and weave; dull surface; very warm; extremely absorbent; highest affinity for dyes; resilient, holds a press; usually requires dry cleaning.	**Wool:** Burns with sizzling flame; does not smolder; strong animal odor; irregular, crisp black ash.
Rayon: Man-made, from cellulose in the form of cotton linters or wood pulp; diameter varies; $\frac{1}{2}$–$\frac{1}{3}$ the strength of silk when dry; weaker when wet; two types, one made by the viscose process, the other by the cuprammonium process; both similar in characteristics; viscose rayon a good heat conductor, very absorbent, not harmed by alkalies.	**Rayon:** Filament yarns usually make lustrous, cool fabrics; spun yarns, dull, warm, crush-resistant fabrics. *Viscose rayon:* cool, absorbs moisture like silk, not harmed by strong soaps, subject to mildew. Fabric made by the cuprammonium process known by trade name *Bemberg*, product of a firm that produces practically all such rayon; used in sheer and semisheer fabrics for lingerie, blouses, summer dresses, coat linings.	**Rayon:** Burns like cotton.
Acetate: Man-made, from cellulose in the form of cotton linters or wood pulp; made by cellulose acetate process; resembles rayon in appearance but has different physical and chemical properties.	**Acetate:** Does not absorb moisture readily and so dries quickly; feels silky; drapes well; washable but must be pressed at low heat; resists wrinkling more than rayons; can be dyed deep brilliant colors but subject to fume or gas fading; tends to accumulate static electricity.	**Acetate:** Flares, sputters, and melts; odor like vinegar; brittle black ash.
Vicara: Man-made, from corn protein; is not a strong fiber and so is usually blended with other fibers to make clothing fabrics.	**Vicara:** Softness resembles cashmere; elastic, giving wrinkle resistance; absorbent; does not shrink; can be dyed in wide range of colors that are fast to light, perspiration, washing, and dry cleaning.	**Vicara:** Burns like cotton.
Nylon Group: Man-made, chemical in origin; includes nylon, Orlon, Dynel, Dacron, Acrilan.	**Nylon Group:** All share following qualities: strong but lightweight; resistant to moths and mildew; fairly fast to color; washable and quick to dry, for they do not absorb water; sensitive to heat, hence require pressing with cool iron; resist shrinking and stretching, hence need special styling to make them comfortable to wear; take heat-set "permanent" pleats; often combined with other natural and man-made fibers. Each has special qualities; Dynel, for example, is resistant to many chemicals and so is used for some types of work and industrial clothing.	**Nylon Group:** Undyed, unfinished fabrics are flameproof; melt at 480° F. if a flame is applied; materials added in finishing may flame.
Glass: Man-made, from glass mixed with sand, limestone, and other mineral ingredients.	**Fiberglas:** Used for curtains and draperies; fireproof; can never stretch or shrink; impervious to deterioration from sun's rays; should never be dry-cleaned or ironed; subject to breakage of threads if continuously rubbed against some object or wrung in laundering. Fiberglas aerocor yarn is fluffed or bulked in manufacture by shooting jets of air into yarn, which makes yarn resemble linen or wool.	**Glass:** Does not burn.

*For lists of other fibers, *see* Fibers, Man-Made; Fibers, Natural.

Definitions for the Buyer

A person buying fabrics and articles made of fabrics encounters several terms that need understanding.

The cloth count, also called the thread count, is a measure of the closeness of weave. It indicates the number of warp and filling yarns to the square inch. A standard percale sheet has a count of 96×84 (96 warp and 84 filling yarns). It is called type 180 (the sum of warp and filling counts). A heavy muslin sheet, type 140, has a count of 74×66. Cloth count is a factor in durability but so is the size of the yarn. The muslin sheet will probably outwear the percale. The cloth count is lower but only because the yarn is heavier; the weave is firm. Percale is finer and smoother, and it will outwear muslin with a lower cloth count than that of type 140.

In modern fabrics the cloth count ranges from 20×12 in the coarsest cheesecloth to 160×165 in fabric for the finer typewriter ribbons. The Egyptians made linen mummy cloths with 540 warp yarns to the inch.

A high cloth count and heavy yarn do not mean a warm fabric. A fabric that has air spaces is warm, because the air spaces provide insulation. Cloth loosely woven of soft yarn has more air spaces than firm, tightly woven cloth. Thus it is warmer. Napping adds to the warmth of a fabric by creating air pockets.

The term gauge has a significance similar to that of cloth count but refers to knitted fabrics. It is important to the buyer chiefly in connection with hosiery. It indicates the number of stitches in each $1\frac{1}{2}$ inches. The gauge in women's full-fashioned nylon stockings varies from 45 to 75, the fineness of knit increasing as the number rises.

Denier (*dĕn'yẽr*) is a measure of fiber or yarn size. It is used chiefly to describe man-made textile fiber products. The denier of a yarn is numerically equal to the weight (in grams) of 9,000 meters of that yarn. An extremely fine one denier yarn 9,000 meters long would weigh one gram. Continuous filament nylon yarns are produced in the United States in deniers from 7 to more than 10,000. These yarns are made either as single filaments or as multifilament yarn bundles. Most yarns used for clothing are less than 200 denier. Women's nylon stockings vary from 7 denier (very sheer) to 30 denier (service weight).

THESE ARTICLES ARE IN THE FACT-INDEX

Fabrikoid
Face

FACSIMILE (*făk-sĭm'ĭ-lē*). One of the fastest methods of communication is by facsimile. It is used to send fixed or printed images by wire or radio between two stations. These images can be photographs, maps, or designs. They can also be reproductions of typewriting, handwriting, or printing. It is possible to transmit printed messages by facsimile in picture form at the almost unbelievable speed of 3,000 words a minute, or 180,000 words an hour. (For a picture of a facsimile printer, *see* Radio.)

Three steps are required to send a picture by facsimile. It must be scanned, it must be transmitted, and it must be reproduced.

To scan an image, it is first wrapped around a cylinder on the sending, or transmitting, set. This cylinder is rotated at an even speed. As it turns, a tiny spotlight scans the material on it. Light and dark areas are reflected by the light beam to a phototube. Through this phototube the material is converted into a strong current of lines or dots. Wire or radio circuits then transmit this current to the receiving set. (*See also* Telephotography.)

The receiving cylinder turns at the same speed as the transmitter. The image it receives may be formed in one or more ways. In the receiving of newspaper pictures, for instance, a photographic process may be used. The image is first reproduced on a film which is then developed like an ordinary photograph. Newspapers and press associations generally use this kind of facsimile system. More often, however, the material is reproduced through a stylus which writes directly on chemically treated paper. This method is used largely by business firms and manufacturing companies.

There are a number of facsimile systems operating under various trade names. Most of them are privately leased from the telegraph companies. Each is designed for high speed, for accuracy, and for greater control over a company's operation by its management.

Small desk-size systems known as *Desk-Fax* are used to send telegrams and messages in picture form. (For picture, *see* Telegraph.) Other larger systems such as *Telefax* serve mostly in connection with electronic data-processing machines. Companies spread over a wide area use the *Intrafax* system to interconnect headquarters, branches, plants, warehouses, or shipping departments.

Latest Developments

In 1954 the International News Service (now a part of United Press International) introduced a new use for facsimile communication. It began sending pictures and voice recordings simultaneously. In this process the voice is recorded on tape at the same time a picture is made. While the receiving station is recording the voice on tape, the picture is also being reproduced.

In 1959 the first nationwide facsimile system—the Strategic Facsimile Network—began operating. It connects 57 air weather stations at Air Force bases throughout the United States. Weather charts and maps transmitted by the stations relay important information to the Air Force Strategic Command.

In 1959 the United States Post Office (now the Postal Service) began testing a facsimile mail service. In 1960 a facsimile message was sent from Washington, D.C., to Hawaii, using the moon as a relay station. Rapid transmission of reconnaissance pictures was important during the Vietnam conflict.

FACTOR AND FACTORING. When two or more numbers are multiplied, factors are being used. A factor is any one of the quantities or numbers that are multiplied together to get a product. Two and three are factors of six because three multiplied by two is six ($2\times3=6$). Five and seven are factors of 35; 2, 3, and 5 are factors of 30.

Prime Numbers as Factors

Factoring is the process of breaking down a larger number into its factors. The numbers 2, 3, 5, and 7 are important as factors and in the process of factoring, because each one is a *prime number*, or "prime." This means that it cannot be divided by any number except itself and 1. From this fact comes the rule: *a number is factored completely only when all the factors are prime numbers.* For example, 4 and 9 are factors of 36; but these are not prime numbers. The prime factors of 4 are 2 and 2, and the prime factors of 9 are 3 and 3; therefore, the prime factors of 36 are 2, 2, 3, and 3.

This result of factoring is commonly written as $2^2\times3^2$. The small numerals written high and to the right of the numerals are called *exponents*. They tell how many times the number is to be used as a factor (*see* Powers and Roots).

Some numbers cannot be factored by 2, 3, 5, or 7. This means that all the factors of the number are prime, and each factor has more than one digit. Prime numbers that have more than one digit are called "higher primes." Illustrations of these are 11, 13, 17, 19, and 23. Higher primes occur as the only factors in numbers such as 121 ($11\times11=121$) and 391 ($17\times23=391$).

Helps in Recognizing Factors

There are simple rules for recognizing the single-digit prime numbers except 7. Two is a factor of any number which is an even number—that is, one which ends in 2, 4, 6, 8 or 0. Three is a factor of any number in which the sum of the digits in the number is divisible by three. For example: in the number 23631 the sum of the digits is 15 ($2+3+6+3+1=15$). Since 15 is divisible by 3, so is 23631.

Five is a factor of any number that ends in 5 or 0. If the last digit is 0, both 5 and 2 are factors, since 0 is part of 10, 20, or other multiples of 10. There is no rule for recognizing 7 as a factor. If a number cannot be factored completely into other single-digit primes, then 7 should be tried.

It often helps in solving problems to recognize nine as a factor, even though nine is not one of the prime numbers. This can be done by following this rule: if the sum of the digits in a figure is divisible by 9, the number itself is divisible by 9.

Uses of Factoring

Factoring is a help in working division problems involving rather large numbers. For example: 1365 divided by 42. The first step is to think of this division problem as $\frac{1365}{42}$ instead of $42\overline{)1365}$. Now factor each of the numbers completely, thus: $1365=3\times5\times7\times13$; $42=2\times3\times7$. Next, "cancel out" every factor which occurs in both numbers:

$$\frac{1365}{42}=\frac{\cancel{3}\times5\times\cancel{7}\times13}{2\times\cancel{3}\times\cancel{7}}$$

This leaves 5×13 or 65 to be divided by 2. The answer is $32\frac{1}{2}$. This example makes it plain that factors need not be whole numbers. Fractions and mixed numbers may also be factors.

Factoring also helps in "reducing fractions"—that is, simplifying fractions expressed in large numbers—by changing them to smaller numbers. If $\frac{30}{39}$ is the fraction to be reduced, the numbers can be factored as follows:

$$\frac{30}{39}=\frac{3\times2\times5}{3\times13}$$

The factor 3 is common to both terms, so it is canceled out. This leaves $\frac{2\times5}{13}$; thus the reduced fraction is $\frac{10}{13}$.

This process changes the form or the statement of the fraction in numbers but not in value. When the 3 is canceled from both the numerator and the denominator, it is the same as taking out the fraction $\frac{3}{3}$. But this fraction or any one like it ($\frac{2}{2}$, $\frac{4}{4}$ or $\frac{11}{11}$) has the value of 1; and canceling out "one" does not change the value of the fraction. It just states the same value in simpler numbers.

Finding Common Denominators

When adding or subtracting unlike fractions, it is necessary first to find a common denominator—that is, the same denominator for each fraction. For example: add $\frac{4}{15}$ and $\frac{7}{18}$.

A common denominator can be found by multiplying the denominators of the fractions ($15\times18=270$); but this would mean dealing with large numbers. It is better to find the *least common denominator;* that is, the smallest number that will work.

By factoring each denominator the results are $15=3\times5$, and $18=3\times3\times2$. The least common denominator will contain *all the factors in each set*, and no more. The factors which will do this are 3, 3, 2, and 5. Multiplying these factors gives 90, the least common denominator of $\frac{4}{15}$ and $\frac{7}{18}$.

The numerators of each fraction are converted in the same way as the denominators. Canceling out the factors of 15 (3 and 5) from those of 90 leaves 3 and 2; and $3\times2=6$, the other factor of 90. Multiplying 6 by the numerator 4 changes the fraction $\frac{4}{15}$ to $\frac{24}{90}$. The same steps convert $\frac{7}{18}$ into $\frac{35}{90}$. This solves the problem, as follows:

$$\frac{4}{15}+\frac{7}{18}=\frac{24}{90}+\frac{35}{90}=\frac{59}{90}$$

The fraction $\frac{59}{90}$ cannot be reduced, since 59 is a prime number. (*See also* Fractions.)

Factors in Algebra

In algebra letters are used to represent quantities, and algebraic equations are often complicated in form. Factoring the equations whenever possible is a help in solving algebraic problems (*see* Algebra).