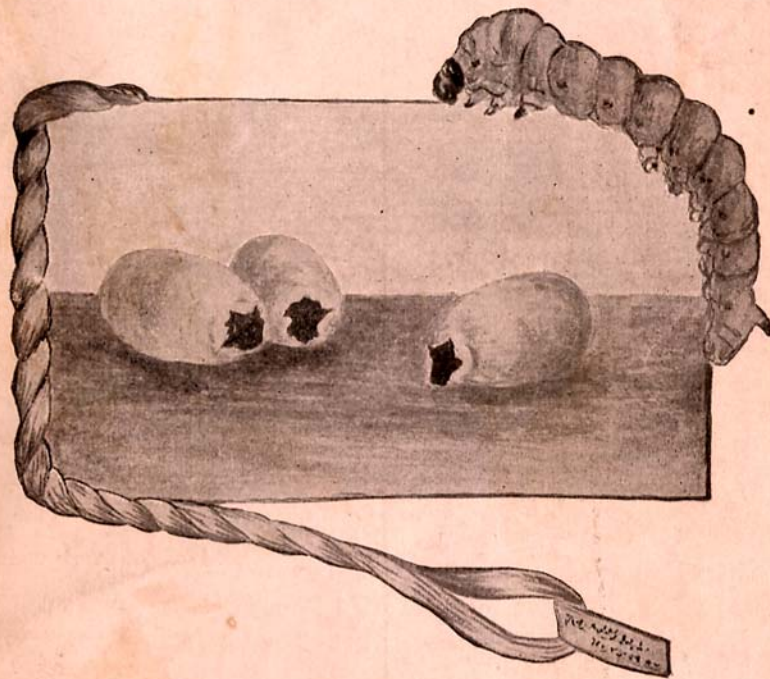


Instructor Literature Series—No. 93

STORY OF SILK



F. A. OWEN PUBLISHING COMPANY, Dansville, N. Y.

INSTRUCTOR LITERATURE SERIES

7c—Supplementary Readers and Classics for all Grades—7c

This list is constantly being added to. If a substantial number of books are to be ordered, or if other titles than those shown here are desired, send for latest list.

FIRST GRADE

Fables and Myths

- *6 Fairy Stories of the Moon—*Maguire*
- *27 Eleven Fables from Æsop—*Reiter*
- *28 More Fables from Æsop—*Reiter*
- *29 Indian Myths—*Bush*
- *140 Nursery Tales—*Taylor*
- *288 Primer from Fableland—*Maguire*

Nature

- *1 Little Plant People—Part I—*Chase*
- *2 Little Plant People—Part II—*Chase*
- *30 Story of a Sunbeam—*Miller*
- *31 Kitty Mittens and Her Friends—*Chase*

History

- *32 Patriotic Stories—*Reiter*

Literature

- *104 Mother Goose Reader—*Faxon*
- *228 First Term Primer—*Maguire*
- *230 Rhyme and Jingle Reader for Beginners
- *245 Three Billy Goats Gruff and Other Stories

SECOND GRADE

Fables and Myths

- *33 Stories from Andersen—*Taylor*
- *34 Stories from Grimm—*Taylor*
- *36 Little Red Riding Hood—*Reiter*
- *37 Jack and the Beanstalk—*Reiter*
- *38 Adventures of a Brownie

Nature and Industry

- *35 Little Workers (Animal Stories)—*Chase*
- *39 Little Wood Friends—*Mayne*
- *40 Wings and Stings—*Halifax*
- *41 Story of Wool—*Mayne*
- *42 Bird Stories from the Poets—*Jollie*

History and Biography

- *43 Story of the Mayflower—*McCabe*
- *45 Boyhood of Washington—*Reiter*
- *204 Boyhood of Lincoln—*Reiter*

Literature

- *72 Bow-Wow and Mew-Mew—*Craig*
- *152 Child's Garden of Verses—*Stevenson*
- *206 Picture Study Stories for Little Children
- *220 Story of the Christ Child—*Hushower*
- *262 Four Little Cotton-Tails—*Smith*
- *268 Four Little Cotton-Tails in Winter—*Smith*
- *269 Four Little Cotton-Tails at Play—*Smith*
- *270 Four Little Cotton-Tails in Vacation—*Smith*
- *290 Fuzz in Japan—A Child-Life Reader
- *300 Four Little Bushy-Tails—*Smith*
- *301 Patriotic Bushy-Tails—*Smith*
- *302 Tinkle Bell and Other Stories
- *308 Story of Peter Rabbit—*Potter*

THIRD GRADE

Fables and Myths

- *46 Fuss in Boots and Cinderella
- *47 Greek Myths—*Klingensmith*
- *48 Nature Myths—*Metcalf*
- *50 Reynard the Fox—*Best*
- *102 Thumbelina and Dream Stories—*Reiter*
- *146 Sleeping Beauty and Other Stories
- 174 Sun Myths—*Reiter*
- 175 Norse Legends, I—*Reiter*
- 176 Norse Legends, II—*Reiter*
- *177 Legends of the Rhineland—*McCabe*
- *282 Siegfried, The Lorelei, and Other Rhine Legends—*McCabe*
- *289 The Snow Man and Other Stories
- *292 East of the Sun and West of the Moon

Nature and Industry

- *49 Buds, Stems and Fruits—*Mayne*
- *51 Story of Flax—*Mayne*
- *52 Story of Glass—*Hanson*
- *53 Story of a Little Water Drop—*Mayne*
- *133 Aunt Martha's Corner Cupboard—Part I. Story of Tea and the Teacup
- *135 Little People of the Hills—*Chase*

- *137 Aunt Martha's Corner Cupboard—Part II. Story of Sugar, Coffee and Salt
- *138 Aunt Martha's Corner Cupboard—Part III. Story of Rice, Currants and Honey
- *203 Little Plant People of the Waterways—*Chase*

History and Biography

- *4 Story of Washington—*Reiter*
- *7 Story of Longfellow—*McCabe*
- *21 Story of the Pilgrims—*Powers*
- *44 Famous Early Americans (Smith, Standish, Penn)—*Bush*
- *54 Story of Columbus—*McCabe*
- 53 Story of Whittier—*McCabe*
- 57 Story of Louisa M. Alcott—*Bush*
- *59 Story of the Boston Tea Party—*McCabe*
- *60 Children of the Northland—*Bush*
- *62 Children of the South Lands—I (Florida, Cuba, Puerto Rico)—*McCabe*
- *63 Children of the South Lands—II (Africa, Hawaii, The Philippines)—*McCabe*
- *64 Child Life in the Colonies—I (New Amsterdam)—*Baker*
- *65 Child Life in the Colonies—II (Pennsylvania)—*Baker*
- *66 Child Life in the Colonies—III (Virginia)
- *68 Stories of the Revolution—I (Ethan Allen and the Green Mountain Boys)—*McCabe*
- *69 Stories of the Revolution—II (Around Philadelphia)—*McCabe*
- *70 Stories of the Revolution—III (Marion, the Swamp Fox)—*McCabe*
- *132 Story of Franklin—*Faris*
- *164 The Little Brown Baby and Other Babies
- *165 Gemila, the Child of the Desert
- *166 Louise on the Rhine and in Her New Home (Nos. 164, 165, 166 are the stories from "Seven Little Sisters" by Jane Andrews)
- *167 Famous Artists—I—(Landseer and Bonheur)

Literature

- *35 Little Goody Two Shoes
- 58 Selections from Alice and Phoebe Cary
- *67 The Story of Robinson Crusoe—*Bush*
- *71 Selections from Hiawatha (Five Grades)
- *227 Our Animal Friends: How to Treat Them
- *233 Poems Worth Knowing—Book I—Primary

FOURTH GRADE

Nature and Industry

- *75 Story of Coal—*McCabe*
- *76 Story of Wheat—*Halifax*
- *77 Story of Cotton—*Brown*
- *134 Conquests of Little Plant People—*Chase*
- *136 Peeps into Bird Nooks—I—*McCabe*
- *181 Stories of the Stars—*McCabe*
- *205 Eyes and No Eyes and The Three Giants

History and Biography

- *5 Story of Lincoln—*Reiter*
- *56 Indian Children Tales—*Bush*
- *78 Stories of the Backwoods
- *79 A Little New England Viking—*Baker*
- *81 Story of De Soto—*Halfield*
- *82 Story of Daniel Boone—*Reiter*
- *83 Story of Printing—*McCabe*
- *84 Story of David Crockett—*Reiter*
- *85 Story of Patrick Henry—*Littlefield*
- *86 American Inventors—I (Whitney, Fulton)
- *87 American Inventors—II (Morse, Edison)
- *88 American Naval Heroes (Jones, Perry, Farragut)—*Bush*
- *89 Fremont and Kit Carson—*Judd*
- *91 Story of Eugene Field—*McCabe*
- *178 Story of Lexington and Bunker Hill—*Baker*
- *182 Story of Joan of Arc—*McCabe*
- *207 Famous Artists—II—Reynolds and Murillo
- *243 Famous Artists—III—Millet
- *248 Makers of European History—*White*

Literature

- *95 Japanese Myths and Legends—*McCabe*

INSTRUCTOR LITERATURE SERIES

THE STORY OF SILK

BY

Harriet G. Brown



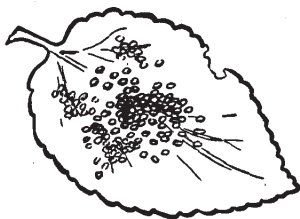
F. A. OWEN PUBLISHING COMPANY,
DANSVILLE, N. Y.

COPYRIGHT, 1907, BY
WORLD'S EVENTS PUBLISHING CO.

The Story of Silk

The Story of Silk.

I wonder what these tiny grains on this leaf are! Let us look at them very closely and see if we can find out. They are no larger than mustard or turnip seed.



Silkworm Eggs.

When first laid they were pale yellow and looked as if they were coated with varnish. Now they are gray. What can they be? Eggs?

Yes, you have guessed rightly. Did you ever see such small ones before?

I think that eggs are promises. When I find a robin's egg it promises me bird songs by and by, if all goes well.

What do you think that these little eggs promise? I am afraid that you would not guess, so I will tell you. They promise silk—silk for dresses, for curtains, for all sorts of pretty things. They promise velvet and satin, too. They promise, indeed, to supply the whole world with silk.

What big, big promises for such wee little eggs! How can they ever fulfill them? We must watch and find out how they will do it.

These tiny eggs are breathing, just as we do. So they must have good, fresh air.

A pretty white or cream-colored moth laid them last July, then she left them to take care of themselves. They will keep quite still, just as if they were asleep, until Spring comes.



Female Moth.

The warm, sunny days will awaken them, and open the doors for what lies sleeping and growing in these little eggs.

See, this little white egg is opening. It knows that Spring has come and that the leaves are green. The little sleeper wants to be out of doors now.

Are you not always glad when the Spring comes?



Worm and Egg.

I think that Spring calls,
 "Open the door! Come
 out, be glad!" Don't
 you feel her calling you?

Oh, look at that black
 head coming out of the
 little white egg! Now he is out! See what a
 beautiful, shiny black he is. That is because he is

all covered with black hairs. What do you think he is hunting for?

When you wake up in the morning, after a long night of sleep, don't you want your breakfast? That is what Mr. Worm is looking for. He smells mulberry leaves. He is a very, very hungry worm now.

If you want your silk by and by, you must feed all these worms with plenty of fresh mulberry or Osage orange leaves. That is the food they like best, and they will eat at all hours of the day and night, except when they are asleep!



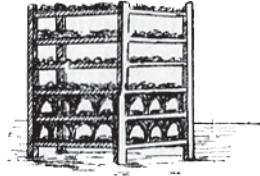
Young Silkworms Feeding

As they eat they move their heads sideways, not up and down in the usual way, and the leaves disappear very quickly.

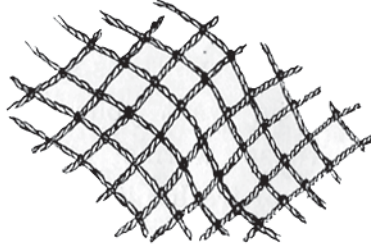
We always speak of these little silk-makers as worms, or silkworms; but they are really caterpillars. A caterpillar passes by and by into wing life. A worm does not.

When the worms are very small they pierce the leaves and suck the sap. But as they grow larger they eat all the tender parts of the leaves.

The silk-raiser keeps his worms on light, movable shelves. When he wishes to clean these, netting is placed above the worms, and fresh leaves on this.



Silkworm Frame.



Silkworm Netting.

The worms crawl up to feed, and the trays or shelves can be cleaned without disturbing or handling the worms. Isn't that a nice plan?

After the little worms have eaten all they can for about five days, they are even more hungry than at first! But on the next day they crawl slowly over the leaves, and do not care to eat at all. Their little skin jackets are very tight now.

The worms turn yellow, and then hump their bodies up and keep very still on the leaves. They look uncomfortable, don't they? We call this molting. That means that the skin is going to slip off.

The silkworms grow very fast and change their skins four times. The skin shrivels up, and first

the silkworm puts out a new head. Then he frees his legs and wiggles out of the old skin.



The Fullgrown Caterpillar.

He is tired and rests for a few moments. If he is a strong worm he

is quite rested in twenty minutes, and hungry again. He grows bigger and bigger, and paler in color, and gradually loses his hairs.

At the end of the fourth or fifth day he has lost his appetite and keeps quite still. Can you guess what he is doing now? Yes, he is molting again.

The next time he perhaps waits a little longer before molting — anywhere from five to seven days. Then after from seven to twelve more days he molts again. After he has molted four times he is about three and one-half inches long. That is very big for him.



Position of Silkworm When Molting.

When he first came out of the egg, he was so little that you would have had to put thirty-four silkworms, just like him, in line, to make one inch!



Just think of that!

His worm life is now almost over. He is growing sleepy again, and is not hungry any more.

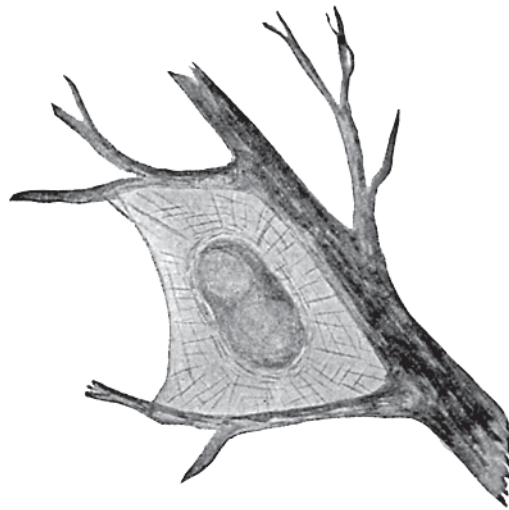
This wonderful little caterpillar has two long glands that he will use to spin the silk for his cocoon. These glands, or sacs, extend each side of the worm, and end in a single opening in the head. From this opening the silk comes out in one thread. The little sacs are called spinnerets.

While the silk is in the body of the worm it is soft like a jelly, but when it comes in contact with the air it becomes hard.

As soon as the caterpillar has chosen a place for

his cocoon, he begins to spin, and spins real silk. But, oh, the threads are so fine! While the worm is spinning his cocoon, you can hear all the time a soft little sound. When this sound stops you may know that the cocoon is finished.

When the caterpillar has chosen a place for his little



A Finished Cocoon.

silk house, he makes a network to hold the cocoon. Then his real work begins.

He forces the silk out by contractions of his body. The thin gauzy veil around him thickens until, in about

twenty-four hours, our little spinner is hidden from sight. But he is still busy at work.

It takes him about three days and nights (about seventy-two hours) to make this beautiful little silk house—a house without any door! But he only

comes out of his little house once. And then he can make the door just when he needs it.

The silk threads are fastened together with a gum. The caterpillar is inside the house, and we can not see him any more. We call this silk house that he has made, a cocoon.

Inside the cocoon another change takes place. After a few days the skin breaks and the insect which comes out of it is the chrysalis, this is still in the cocoon. It seems to have no head or feet. The four wings of the future moth are folded over the breast. It is of a light golden color at first, but turns to chestnut-brown, and grows hard.



Chrysalis,
back view.



Chrysalis,
side view.

If the cocoon is left alone, after a long sleep the chrysalis will change into a creamy white moth.



Male Moth.



A Moth Coming out of
a Cocoon.

These moths do not live long, but the lady moth lays a great many little

eggs before she goes—sometimes as many as four hundred!

If the moths come out of the cocoons themselves, they make a little hole that breaks the silk thread, and then we cannot wind and use it. So the silk-raisers open the cocoons before the moths are quite ready to come out.



Cocoons after the Moths have Come out.

The cocoons are light colored, and about as large as the egg of a pigeon. They are thrown into hot water, or are steamed. This melts the gum that fastens the threads. And now the threads can be wound.

The threads are usually about six hundred yards long. What a long thread! How it would knot, wouldn't it, if you tried to sew with such a long needleful? Some have been found twelve hundred yards long! Isn't that a long thread



Reeled Silk.

for a little caterpillar to spin?

When the threads are wound we call the silk "raw silk." This raw-silk goes to the factories and is spun and then woven into cloth.

The manufactories make from the raw silk, silk for



Osage Orange Leaves

dresses, velvets, satins, veils, and other silk goods. Often the raw silk is woven with wool, linen, or even with cotton.

So many beautiful things are made from silk! Isn't it strange to think that the little silkworm can give us so many pretty and useful things?

The silkworm commonly raised is the "mulberry silkworm," so called because it lives on the leaves of the mulberry.

The white mulberry is the best of the mulberries.

This is a small tree. The leaves are smooth and shiny on both sides.

The berries are white and grow on little slender stems. Sometimes they are pale pink, or even purplish. They are sweet, but there is not much taste to them. The wood of the mulberry is yellowish, and the trees have a milky juice.

The silkworms will eat the leaves of other species of mulberries and the leaves of our Osage orange. But the white mulberry is generally used.

The Osage orange is also called yellow wood. It grows wild in some parts of our country, thriving best in the South. It is used for hedges, being well adapted for that purpose, as it grows close and is very thorny.

The wood is elastic, and yellow in color. It takes a brilliant polish resembling satin-wood. On account of its durability and elasticity, the Indians have used it a great deal. They call it Bow-wood.



The Osage Orange.

The fruit resembles yellowish-green oranges and is full of milky juice. The leaves are used for feeding silkworms, and are considered by many equal to the leaves of the mulberry for this purpose.

The Chinese claim that the secret of making cloth

from the silk of the silkworms was discovered by a Chinese Empress, and that this discovery was made twenty-seven years before Christ was born.

This was in the reign of Hoang-Ti, the third Emperor of China. The Empress was Si-Ling-Chi.

She collected large numbers of the worms and fed them herself.

She also discovered how to reel the silk and make it into garments. The Chinese call her the "Goddess of Silkworms."

They are very grateful to the woman who made this valuable discovery. Every April, the hatching season of the silkworms, the Chinese have a festival. The Empress herself goes to the fields and prepares some mulberry leaves. She puts these in a basket holding young silkworms.

At the close of the festival she winds a cocoon. Then she distributes gifts to the persons who have been most faithful in their care of the silkworms.

The Empress considers this festival very important, and it is a great help in encouraging the raising of silkworms.

Even before the Chinese had learned to make cloth of silk they used the silk in making musical instruments.

Two of the Chinese instruments, both of them invented by the Emperor Fo-Hi, are the *Kin* and the *Che*.

They are made of tounge-wood, a soft, light and dry wood, on which cords of silk are stretched and so arranged that they give the tones of a regular stringed instrument.

Although the Chinese raised silk-worms so many hundreds of years ago, they did not want any other nation to have them. So they kept the making of silk a great secret.

But at last two monks from Persia managed to get some eggs, hid them in their clothes, and took them to Constantinople.

The Emperor Justinian was very glad that the men had succeeded in getting the precious eggs, and he encouraged them to raise silkworms. When enough were being raised he started silk manufactories in three cities, Athens, Corinth, and Thebes.

About 1130, the King of Sicily started silk-worm raising and the manufacturing of silk in Palermo and Calabria. From these countries the silkworm spread all through Italy.

Later, Spain and France took it up. And it is in Lyons, France, that the richest silks are made to-day.

In France and England there are now many

“butterfly farms”—little farms devoted only to the silkworm raising and the growing of mulberry trees.

For if you wish to raise silkworms you must have plenty of fresh mulberry leaves for them to eat.

Silkworms are raised and silk is manufactured now in France, Italy, Persia, and India. But China, the country where silk culture was first started, still leads the world.

The mulberry tree grows wild in Japan.

The most important export of Japan is her raw silk. There are silk districts and villages where almost every house is a silk-worm nursery. Often the house is a silk factory also.

The Japanese give the moths little boards to lay eggs on. When these boards are covered with eggs they look like sandpaper. They chop the leaves quite fine for the little worms, and feed them about five times a day. When the caterpillars are ready to spin their silk cocoons they feed them oftener, so that the leaves may be quite fresh.

They watch the silkworms carefully, for the birds would eat them if they could get them. The mice, and even the ants, too, are enemies. The ants sting the silkworms to death and then eat them gradually.

It is a very busy time for the silk raisers when

the worms are growing. They eat so fast, and are so very, very hungry. It takes time to gather the leaves and chop them.

The caterpillars are huddled together on mats or trays. These are kept on frames, one above another. They have to be kept very clean.

The people lift the worms on to the clean mats or trays by chopsticks. The worms are so small that it would hurt them to handle them with the fingers.

The temperature is kept at about 70 or 80 degrees. If the weather is cool they burn charcoal in little braziers that are set about the room.

When the caterpillars have stopped growing, and stand on end, waving their heads in the air they are saying as plainly as can be, "I want a nice place to fasten my cocoon to!" So they are put where there are little nests of straw or bundles of brush-wood. These are soon covered



Cocoons

with soft yellow cocoons.

The Japanese count the age of the worms by the meals they have eaten! Isn't that a funny way? They say the worms are so many meals old, not so many days old.

The Japanese unwind the cocoons fifty days after they are made. Then the cocoons are no more, but in their places are great skeins of shining silk. Sometimes these are woven in Japan and sometimes they are sold to other countries in these skeins.

In Japan all the family where the silk-worms are raised can help in the work. The children gather the leaves and the girls feed the worms. The older people often wind and sometimes spin and weave the silk.

The silkworms are not strong, and often many of them get sick and die. If they do not have plenty of food and light and good air, or if kept too warm, there are many diseases that kill them off quickly. One who raises silkworms must watch them carefully and take very good care of them. No wonder it often takes a whole family to look after a "silk farm!"

Many years ago the Portuguese thought the silk-laden ships of India the greatest prize they could win. The trade in silk has fallen off since then, but it is still quite an item in the commerce of India.

Most of the rearing is done by the people in their own homes. The wild tussus cocoons are collected by the Santels, the great jungle tribe of Bengal.

The cocoons are treated in about the same way as ours. But after the first process of steaming to soften them, the tussus cocoons have to go through a chemical bath. They are then spread out upon large trays of plaited palm leaf, and dried in the sun. The color of the cocoons varies from bright yellow to amber.

The natives are very expert in sorting the silk. The delicacy of touch by which they detect any variation of fineness is wonderful.

At Bombay the silk mills have the most modern machinery and are much like our mills. They often copy European designs and use the same colors.

Long ago, in 1622, when James I. was king of England, he thought that silk raising ought to be started in our country. So he sent to the colony in Virginia some eggs of the silkworm and some mulberry trees, and offered premiums for colonial silk. The colonists experimented for a while, but soon went back to the cultivation of tobacco.

The first settlers of Carolina and Georgia brought silkworms with them. They were more successful, and for over twenty-five years this industry flourished in both of these colonies. Some reeling was done on hand reels, and both the reeled silk and the cocoons were exported to London.

In 1750 a silk reeling mill was built at Savannah. In 1759 the raw silk exported from Savannah amounted to \$75,000.

The Huguenots who settled near Charleston, S. C., in 1677, also carried on silk culture. For nearly one hundred years the silk exported from Charleston amounted to from \$5,000 to \$10,000 a year, besides all the silk that was woven and used at home.

The War of the Revolution put an end to the silk industry in the South.

In 1660 Mr. Aspinwall introduced silk culture into New England. He had nurseries of the mulberry trees in New Haven, and on Long Island. He also furnished the people of Mansfield, Conn., with the eggs of the silkworm, and mulberry trees were planted there.

In 1783 Connecticut offered a bounty to silk growers, and obtained the first rank in amount of silk produced. She held this place for eighty years. In 1833 over four tons of silk cocoons were produced in Windham county, Connecticut. People became enthusiastic over the industry. Thousands planted valuable land with mulberry trees, paying three or four dollars for trees only one year old.

In 1844 severe frosts destroyed thousands of these

trees. Those engaged in silk culture were ruined and disappointed.

Ten years after the discovery of gold in California, a Frenchman, L. Prevost, raised excellent cocoons near San Jose. Many others started in the silk culture work, but the industry proved a failure. Probably this was because sufficient care was not taken of the worms.

Kansas tried silk culture but found that farming paid better.

The larger part of the United States is splendidly adapted to silk culture. Some day, when there is a market for it, and when there are plenty of reeling factories, this may yet grow to be one of our leading industries. Many think that this will come to pass before very many years.

WILD SILK.

The silkworm commonly kept by the silk-raisers is not the only spinner of silk.

The caterpillars of many other moths and of a few butterflies produce silk. The silk of several species of spiders can also be used for making cloth.

The catalog of the British Museum gives nearly three hundred species of silk spinners.

India claims fifty-seven native silkworms. Six of these which feed on the mulberry are domesticated, but the others are wild.

The cocoons of fourteen of the wild species are also used. Of these wild ones the Eria-worm has been successfully domesticated in France and England. Its silk is not adapted for reeling but spins well.

Mr. Wardle says that "a great future remains for this silk, now that spinning machinery has been so perfected."

Another silkworm, the *Attacus ricini*, is a native of Assam. It feeds on the castor-oil plant and several other plants of that country. The cocoons can not be reeled, but are very well adapted for spinning. They can be dyed easily and printed. The cloth made from this silk is said to be wonderfully strong,—so strong, indeed, that it is claimed that one person rarely wears out a garment of it in a lifetime.

The silk of the Mugaworm forms one of the chief exports of Assam. Five thousand acres are planted in Assam and some Tipperah villages with food for this worm.

The Tusserworm is the most important and the most widely distributed of the wild silk producers of India, and has been used for hundreds of years.

It feeds on the castor-oil and other native plants. This worm spins its cocoon in six weeks from the time of hatching.

The fibre of the Tusserworm's silk is flat and very different from that of the mulberry silkworm.

It is the most lustrous of all the silks in its undyed state, and very durable. The chief drawback is that it is very hard to color this silk. A process has been invented by which it can be dyed quite satisfactorily.

This silk is beginning to be much used in France for fabrics and trimmings which require special fineness.

SPIDER SILK

In the beginning of the eighteenth century some specimens of silk were manufactured from the cocoons of spiders.

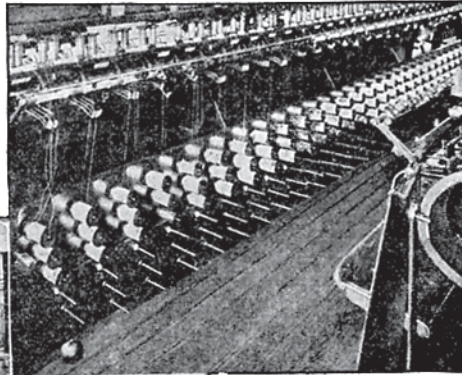
In Java and New Guinea there are large spiders, which weave immense webs several yards across and very strong.

Experiments are being made with the spider's silk. The difficulty lies in the scarcity of the supply.

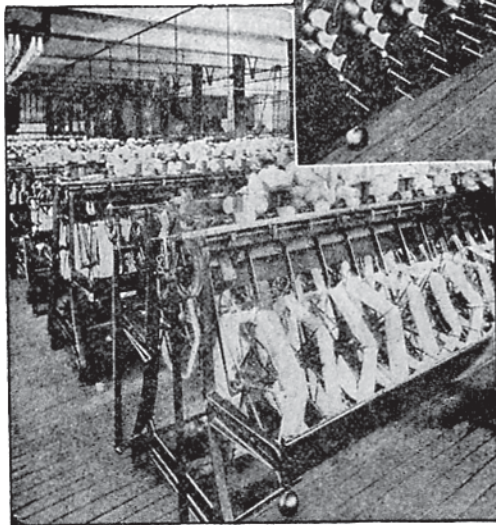
A silk has been made from the silk of the "halabe," a spider found in Madagascar. It is thought that this silk, on account of its insulating properties, will be useful in electrical work.

A VISIT TO THE SILK MILLS.

For years we have thought of sunny France as the best place to see the wonderful work of weaving the raw silk into beautiful silk goods. Now every kind of silk cloth, except a few fancy specialties, are made in the American silk mills, and the finished



Machine Winding Raw Silk on Spools.



Doublers Twisting the Silk for Weaving.

is sold in the New York market than in any city except Shanghai.

goods are equal to those made in France.

Very few cocoons are raised in this country, so we buy raw silk. More silk

There are over five hundred and fifty active silk mills in the United States. These give work to about seventy-five thousand people, and use more than eleven million pounds of raw silk each year. Would you think that the little silk-worms could keep so many people busy?

Now that you have watched the silk worm grow up and spin its wonderful cocoon, and know that the silk is all reeled ready for the factory, don't you want to find out how this raw silk, as we call it, is made into the silk cloth that you know?

It is so much work to get this raw silk ready to spin, and to color and weave it, that usually the mills divide the work up and each mill does only one part of the work. So we must visit several establishments if we wish to see it all.

At the first mill the silk goes to the "throwster," who twists and doubles the raw silk into a stronger yarn. To do this the silk is placed on light reels called "the swifts," and wound on bobbins, or spools, about five inches long.

Then these bobbins are taken to the spinning room and put on the spindles of the spinning machines. The spindles run in rows across a frame. There are, perhaps, a hundred spindles in each row. A big belt

runs along behind the frame and sets all the spindles in motion. These spindles go around, or revolve, very fast—about ten thousand times in one minute. And every time the spindles revolve, they give a twist to the thread.

One girl can look after five or six hundred spindles, and in a single day spin enough thread to reach from New York to San Francisco if the threads were stretched out in one long line.

After the throwster has spun the silk, it goes to the dyeing house. This, again, is usually a separate business. If you feel of the silk now, you find that it is covered with a kind of gum which makes it stiff; it looks dull, too, and will have no lustre unless this gum is taken off.

Sometimes, when the lustre is not important, the silk is dyed at once without removing the gum. The silk is then hard and firm, and is called "souple." When the lustre is desired, the silk yarn goes through a process of boiling off the gum. This is called "scouring."

In the dye-house you will see large tanks of hot water in which a great deal of fine white soap has been dissolved. Strong soaps would injure the delicate threads. The men put the hanks of silk on wooden

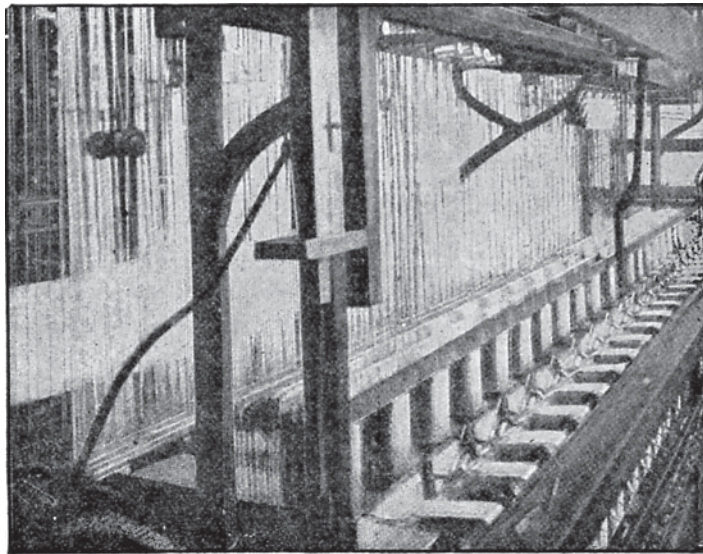
rods and place these rods in the hot soapsuds so that the silk is quite covered. After the gum is boiled off, its weight is much less than it was before; but it may be made very lustrous.

Most of the people who buy the finished goods want cheap silks, and are not willing to pay for pure silk; so, in the dyehouse, the silk must go through a process of "loading" or "dynamiting." This is done to make the silk weigh more; it also gives body, or firmness to it. This is usually done by dipping the skeins, after the gum is boiled out, into a solution of tin crystals which have been dissolved in an acid. These crystals cost only about one-quarter as much as pure silk.

Each dip makes one pound of silk weigh two ounces more. If dipped twice, it weighs just as much as before the gum was removed. Light colors are rarely dipped more than twice. For blacks, the silk may be dipped as many as four times.

After this bath something must be done to destroy the effect of the acid; otherwise, it would eat the silk and ruin it. If this is not properly done, the silks wear very poorly. Sometimes they have even begun to fall to pieces on the shelves of the merchants before the cloth was sold.

Long ago, as early as the third century, in the old city of Tyre, the people were famous for their skill in dyeing. The most beautiful of all their colors was a rich purple, known all these years, as the wonderful "Tyrian purple." The color was made from certain pink shell-fish.



The Frame Used for Dyeing Silk Threads.

For many years the chemists studied how to get beautiful colors. When the new coal-tar, or aniline, dyes were discovered, it was a splendid thing for the silk trade.

These dyes, the brightest ever seen, have given us more beautiful colors than were ever known before. Colors even more beautiful than the famous old Tyrian purple are made now from the coal-tar. They are used for silk, wool, cotton or linen; for our walls, and even the pictures in our books.

The dyeing is usually done in the yarn, but sometimes, for plain goods, it is done after being woven. Every year the dyers are learning to do better work and with the new coal-tar colors beautiful results are now possible.

Now that we have seen the silk made by the silkworm, and spun by the throwster, and dyed beautiful colors by the dyer, we are ready to go to the last mill and see the silk yarn woven into cloth.

Many machines have been used for weaving silk, but the best and most wonderful one is called the Jacquard loom. You will find it in all modern mills; though in faraway places in India and China and other countries, too, you may still see men weaving on very simple little hand-loom. They can weave good cloth, but of course very slowly.

Any machine that forms cloth out of thread is called a loom. The wonderful Jacquard loom was invented in 1800, by Joseph Jacquard, a Frenchman.

He noticed that all the weavers of his time, after working a few years with the hand-loom that made brocade or figured silk, became deformed. This was because they had to work in a strained position. It was hard and painful for the weavers.

Jacquard felt sorry for them, and thought and planned how to help the poor weavers. After a while he made a machine that could do the work better and quicker than the men could.

But the people he had tried so hard to help did not understand that the machine was going to do the hard work for them. They thought that it would rob them of their daily work; so they were very angry and treated Jacquard badly. They broke his beautiful machine that he had worked so hard and long to make, burned the wood from it and sold the iron part for old iron.

Jacquard was brave and would not give up, but made another. After a while his machine was used, and the people learned to appreciate his splendid invention.

Now this kind of loom has been changed and improved; but it still bears his name, and is used in all the big mills. In the city of Lyons alone more than twenty thousand Jacquard looms are now used.

The Jacquard loom is a wonderful machine with a great many perforated cards that keep the threads in place. It weaves any kind of figured or brocaded silk. This invention has done more than anything else to help the silk industry.

Ribbons are woven just as the other silks are, only narrower. The narrower the ribbons, the more of them can be woven at once. They are cut off in ten yard lengths and wound on a roller with a strip of paper to protect them. The largest ribbon factory in the world is in Paterson, New Jersey.

There are all grades of silk today; some are worth a *hundred dollars a yard*. Others may be bought for only twenty-five cents or so a yard. Of course these latter are made partly of other material.

Long ago silk was very valuable and only worn by emperors, or very extravagant people. In the third century, among the Romans, silk was really worth its weight in gold. One pound of gold was the market price for one pound of silk.

The emperor Aurelian refused to let his wife have a single shawl of purple silk for which she coaxed him, on account of its great cost.

Now even dolls have silk dresses! And it would be hard to find a poor person who did not own at least some silk.

INSTRUCTOR LITERATURE SERIES--Continued

- *90 Fifteen Selections from Longfellow - (Village Blacksmith, Children's Hour, etc.)
- *108 Stories from the Old Testament—*McFee*
- *111 Water Babies (Abridged)—*Kingsley*
- *159 Little Lame Prince (Cond.)—*Mulock*
- *171 Totmi of the Preetops—*Grimes*
- *172 Labu the Little Lake Dweller—*Grimes*
- *173 Tara of the Tents—*Grimes*
- *195 Night before Christmas and Other Christmas Poems and Stories (Any Grade)
- *201 Alice's First Adventures in Wonderland
- *202 Alice's Further Adventures in Wonderland
- *256 Bolo the Cave Boy—*Grimes*
- *257 Kwasu the Cliff Dweller—*Grimes*
- *291 Voyage to Lilliput (Condensed)—*Swift*
- *298 Hansel and Gretel, and Pretty Goldilocks
- 304 Story Lessons in Everyday Manners—*Bailey*
- *312 Legends from Many Lands—*Bailey*
- 314 The Enchanted Bugle and Other Stories—*Bailey*

FIFTH GRADE**Nature and Industry**

- *92 Animal Life in the Sea—*Reiter*
- *93 Story of Silk—*Brown*
- *94 Story of Sugar—*Reiter*
- *96 What We Drink (Tea, Coffee and Cocoa)
- *139 Peeps into Bird Nooks—II
- 210 Snowdrops and Crocuses
- 233 The Sky Family—*Denton*
- *280 Making of the World—*Herndon*
- *281 Builders of the World—*Herndon*
- *283 Stories of Time—*Bush*
- *290 Story of King Corn—*Cooley*

History and Biography

- *16 Explorations of the Northwest
- 80 Story of the Cabots—*McBride*
- *97 Stories of the Norsemen—*Hanson*
- *98 Story of Nathan Hale—*McCabe*
- *99 Story of Jefferson—*McCabe*
- 100 Story of Bryant—*McFee*
- *101 Story of Robert F. Lee—*McKane*
- 105 Story of Canada—*McCabe*
- *106 Story of Mexico—*McCabe*
- *107 Story of Robert Louis Stevenson—*Bush*
- 110 Story of Hawthorne—*McFee*
- 112 Biographical Stories—*Hawthorne*
- *141 Story of Grant—*McKane*
- *144 Story of Steam—*McCabe*
- *145 Story of McKinley—*McCabe*
- 157 Story of Dickens—*Smith*
- *173 Story of the Flag—*Baker*
- *185 Story of the First Crusade—*Mead*
- 190 Story of Father Hennepin—*McCabe*
- 191 Story of La Salle—*McCabe*
- *217 Story of Florence Nightingale—*McFee*
- *218 Story of Peter Cooper—*McFee*
- *219 Little Stories of Discovery—*Halsey*
- 232 Story of Shakespeare—*Grimes*
- *265 Four Little Discoverers in Panama—*Bush*
- 274 Stories from Grandfather's Chair—*Hawthorne*
- *275 When Plymouth Colony Was Young—*Bush*
- *287 Life in Colonial Days—*Tillinghast*

Literature

- *8 King of the Golden River—*Ruskin*
- *9 The Golden Touch—*Hawthorne*
- *61 Story of Sindbad the Sailor
- *108 History in Verse (Sheridan's Ride, Independence Bell, the Blue and the Gray, etc.)
- *113 Little Daffydownilly and Other Stories
- *180 Story of Aladdin and of Ali Baba—*Lewis*
- *183 A Dog of Flanders—*De La Ramee*
- *184 The Nurnberg Stove—*De La Ramee*
- *186 Heroes from King Arthur—*Grimes*
- 194 Whittier's Poems—Selected
- *199 Jackanapes—*Ewing*
- *200 The Child of Urbino—*De La Ramee*
- *208 Heroes of Asgard—Selected—*Keary*
- *212 Stories of Robin Hood—*Bush*
- *234 Poems Worth Knowing—Book II—Intermediate—*Faxon*
- *244 What Happened at the Zoo, and Other Stories—*Bailey*

- *250 At the Back of the North Wind, Selection from—*Macdonald*
- 255 Chinese Fables and Stories—*Feltges*
- *309 Mori the Goat Boy—*Spyri*
- *313 In Nature's Fairyland—*Bailey*

SIXTH GRADE**Nature and Industry**

- *109 Gifts of the Forests (Rubber, Cinchona, Resins, etc.)—*McFee*
- 249 Flowers and Birds of Illinois—*Patterson*
- *298 Story of Leather—*Peirce*
- *299 Story of Iron—*Ogden*

Agricultural

- *271 Animal Husbandry, I—Horses and Cattle
- *272 Animal Husbandry, II—Sheep and Swine

Geography

- *114 Great European Cities—I (London-Paris)
- *115 Great European Cities—II (Rome-Berlin)
- *168 Great European Cities—III (St. Petersburg-Constantinople)—*Bush*
- *246 What I Saw in Japan—*Griffis*
- *247 The Chinese and Their Country—*Paulson*
- *285 Story of Panama and the Canal—*Nida*

History and Biography

- *73 Four Great Musicians—*Bush*
- *74 Four More Great Musicians—*Bush*
- *116 Old English Heroes—*Bush*
- *117 Later English Heroes (Cromwell, Wellington, Gladstone)—*Bush*
- *160 Heroes of the Revolution—*Tristram*
- *163 Stories of Courage—*Bush*
- 187 Lives of Webster and Clay—*Tristram*
- *188 Story of Napoleon—*Bush*
- *189 Stories of Heroism—*Bush*
- *197 Story of Lafayette—*Bush*
- 198 Story of Roger Williams—*Leighton*
- *209 Lewis and Clark Expedition—*Herndon*
- *224 Story of William Tell—*Hallock*
- 253 Story of the Aeroplane—*Galbreath*
- *266 Story of Belgium—*Griffis*
- 267 Story of Wheels—*Bush*
- *286 Story of Slavery—*Booker T. Washington*
- *310 Story of Frances E. Willard—*Babcock*

Stories of the States

- 508 Story of Florida—*Bauskett*
- 509 Story of Georgia—*Derry*
- 511 Story of Illinois—*Smith*
- 512 Story of Indiana—*Clem*
- 513 Story of Iowa—*McFee*
- 515 Story of Kentucky—*Eubank*
- 520 Story of Michigan—*Skinner*
- 521 Story of Minnesota—*Skinner*
- 523 Story of Missouri—*Pierce*
- *525 Story of Nebraska—*Mears*
- *528 Story of New Jersey—*Hutchinson*
- 533 Story of Ohio—*Galbreath*
- *536 Story of Pennsylvania—*March*
- *540 Story of Tennessee—*Overall*
- 542 Story of Utah—*Young*
- 546 Story of West Virginia—*Shawkey*
- 547 Story of Wisconsin—*Skinner*

Literature

- *10 The Snow Image—*Hawthorne*
- *11 Rip Van Winkle—*Irving*
- *12 Legend of Sleepy Hollow—*Irving*
- *22 Rab and His Friends—*Brown*
- *24 Three Golden Apples—*Hawthorne* †
- *25 The Miraculous Pitcher—*Hawthorne* †
- *26 The Minotaur—*Hawthorne*
- *118 A Tale of the White Hills and Other Stories—*Hawthorne*
- *119 Bryant's Thanatopsis, and Other Poems
- *120 Ten Selections from Longfellow - (Paul Revere's Ride, The Skeleton in Armor, etc.)
- *121 Selections from Holmes (The Wonderful One Hoss Shay, Old Ironsides, and Others)
- *122 The Pied Piper of Hamelin—*Browning*
- 161 The Great Carbuncle, Mr. Higginbotham's Catastrophe, Snowflakes—*Hawthorne*
- 162 The Pygmies—*Hawthorne*
- *211 The Golden Fleece—*Hawthorne*
- *222 Kingsley's Greek Heroes - Part I. The Story of Perseus

(Continued on Next Page)

INSTRUCTOR LITERATURE SERIES--Continued

- *223 Kingsley's Greek Heroes - Part II. The Story of Theseus
- *225 Tennyson's Poems--Selected (Any grade)
- 226 A Child's Dream of a Star, and other Stories
- 228 Responsive Bible Readings--Zeller
- *258 The Pilgrim's Progress (Cond.)--Simons
- *264 The Story of Don Quixote--Fush
- 277 Thrift Stories--Benj. Franklin and Others
- *284 Story of Little Nell (Dickens)--Smith
- 294 The Dragon's Teeth--Hawthorne
- *295 The Gentle Boy--Hawthorne

SEVENTH GRADE

- *13 Courtship of Miles Standish--Longfellow
- *14 Evangeline--Longfellow †
- *15 Snowbound--Whittier †
- *20 The Great Stone Face--Hawthorne
- 123 Selections from Wordsworth (Ode on Immortality, We are Seven, To the Cuckoo, and other poems)
- 124 Selections from Shelley and Keats
- 125 Selections from The Merchant of Venice
- *147 Story of King Arthur, as told by Tennyson
- *149 Man Without a Country, The--Hale †
- *192 Story of Jean Valjean--Grimmes
- *193 Selections from the Sketch Book--Irving
- 196 The Gray Champion--Hawthorne
- 213 Poems of Thomas Moore--(Selected)
- 214 More Selections from the Sketch Book
- *216 Lamb's Tales from Shakespeare--Selected
- *231 The Oregon Trail (Condensed)--Parkman
- *235 Poems Worth Knowing--Book III--Grammar--Faxon
- *238 Lamb's Adventures of Ulysses--Part I
- *239 Lamb's Adventures of Ulysses--Part II
- *241 Story of the Iliad--Church (Cond.)
- *242 Story of the Aeneid--Church (Cond.)
- *251 Story of Language and Literature--Heilig
- *252 The Battle of Waterloo--Hugo
- 254 Story of "The Tallman" (Scott)--Weekes
- *259 The Last of the Mohicans (Abridged)
- *260 Oliver Twist (abridged)--Dickens
- *261 Selected Tales of a Wayside Inn--Longfellow
- *296 Uncle Tom's Cabin (Condensed)
- *297 Story of David Copperfield (Condensed)
- *307 The Chariot Race--Wallace

Price 7 Cents Each. Postage, 1 cent per copy extra on orders of less than twelve. The titles indicated by (*) are supplied also in Limp Cloth Binding at 12 cents per copy.

- *311 Story of Jerusalem--Heilig
- *315 The Story of Armenia--Heilig

Nature

- *278 Mars and Its Mysteries--Wilson
- *279 True Story of the Man in the Moon--Wilson

EIGHTH GRADE

- *17 Enoch Arden--Tennyson †
- *18 Vision of Sir Launfal--Lowell †
- *19 Cotter's Saturday Night--Burns †
- *23 The Deserted Village--Goldsmith
- *126 Rime of the Ancient Mariner †
- *127 Gray's Elegy and Other Poems
- *128 Speeches of Lincoln
- *129 Julius Caesar--Selections--Shakespeare
- 130 Henry the VIII--Selections--Shakespeare
- 131 Macbeth--Selections--Shakespeare
- *142 Scott's Lady of the Lake--Canto I †
- *154 Scott's Lady of the Lake--Canto II †
- 143 Building of the Ship and other Poems--Longfellow
- 148 Horatius, Ivry, The Armada--Macaulay
- *150 Bunker Hill Address--Selections from Adams and Jefferson Oration--Webster †
- *151 Gold Bug, The--Poe
- 153 Prisoner of Chillon and other poems--Byron †
- 155 Rhoecus and Other Poems--Lowell †
- 156 Edgar Allan Poe--Biography and selected poems--Link
- *158 Washington's Farewell Address
- 169 Abram Joseph Ryan--Biography and selected poems--Smith
- 170 Paul H. Hayne--Biography and selected poems--Link
- 215 Life of Samuel Johnson--Macaulay †
- *221 Sir Roger de Coverley Papers--Addison †
- *236 Poems Worth Knowing--Book IV--Advanced--Faxon
- 237 Lay of the Last Minstrel--Scott. Introduction and Canto I †
- 276 Landing of the Pilgrims--(Orations)--Webster
- *305 Wee Willie Winkie--Kipling
- *306 Howe's Masquerade--Hawthorne

† These have biographical sketch of author, with introduction or explanatory notes.

EXCELSIOR LITERATURE SERIES

- 1 **Evangeline.** Biography, introduction, oral and written exercises and notes.....18c
- 3 **Courtship of Miles Standish.** Longfellow. With introduction and notes.....18c
- 5 **Vision of Sir Launfal.** Lowell. Biography, introduction, notes, outlines.....12c
- 7 **Enoch Arden.** Tennyson. Biography, introduction, notes, outlines, questions.....12c
- 9 **Great Stone Face.** Hawthorne. Biography, introduction, notes, outlines.....12c
- 11 **Browning's Poems.** Selected poems with notes and outlines for study.....12c
- 13 **Wordsworth's Poems.** Selected poems with introduction, notes and outlines.....12c
- 15 **Sohrab and Rustum.** Arnold. With introduction, notes and outlines.....12c
- 17 **Longfellow for Boys and Girls.** Study of Longfellow's poetry for children.....12c
- 19 **A Christmas Carol.** Charles Dickens. Complete with notes.....18c
- 21 **Cricket on the Hearth.** Chas. Dickens. Complete with notes.....18c
- 23 **Familiar Legends.** McFee.....18c
- 25 **Some Water Birds.** McFee. Description, and stories of, Fourth to Sixth grades.....12c
- 27 **Hiawatha.** Introduction and notes.....30c
- 29 **Milton's Minor Poems.** Biography, introduction, notes, questions, critical comments and pronouncing vocabulary.....18c
- 31 **Idylls of the King.** (Coming of Arthur, Gar-

- eth and Lynette, Lancelot and Elaine, Passing of Arthur.) Biography, introduction, notes, questions, comments, pronouncing vocab.....24c
- 33 **Silas Marner.** Eliot. Biography, notes, questions, critical comments. 238 pages. 30c
- 35 **Lady of the Lake.** Scott. Biography, introduction, pronouncing vocabulary.....30c
- 37 **Literature of the Bible.** Heilig.....18c
- 39 **The Sketch Book.** (Selected) Irving. Biography, introduction and notes.....30c
- 41 **Julius Caesar.** Edited by Thomas C. Blaisdell, Ph.D., LL.D. Notes and questions.....24c
- 43 **Macbeth.** Edited by Thomas C. Blaisdell. Notes and questions.....24c
- 45 **Merchant of Venice.** Edited by Thomas C. Blaisdell. Notes and questions.....24c
- 47 **As You Like It.** Edited by Thomas C. Blaisdell. Introduction, notes, questions.....24c
- 49 **Hamlet.** Edited by Thomas C. Blaisdell. Notes and Questions.....24c
- 59 **Poe's Tales.** (Selected) Biography, introduction and notes.....24c
- 61 **Message to Garcia and Other Inspirational Stories.** Introduction and notes.....12c
- 63 **Lincoln-Douglas Debates.** Edited by Edwin Erie Sparks, Pres. Pa. State College.....24c
- 65 **The Man Without a Country.** With introduction and notes by Horace G. Brown.....12c
- 67 **Democracy and the War.** Seventeen Addresses of President Wilson, with others.....24c