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M. Grace Fickett and Gertrude L. Stone**

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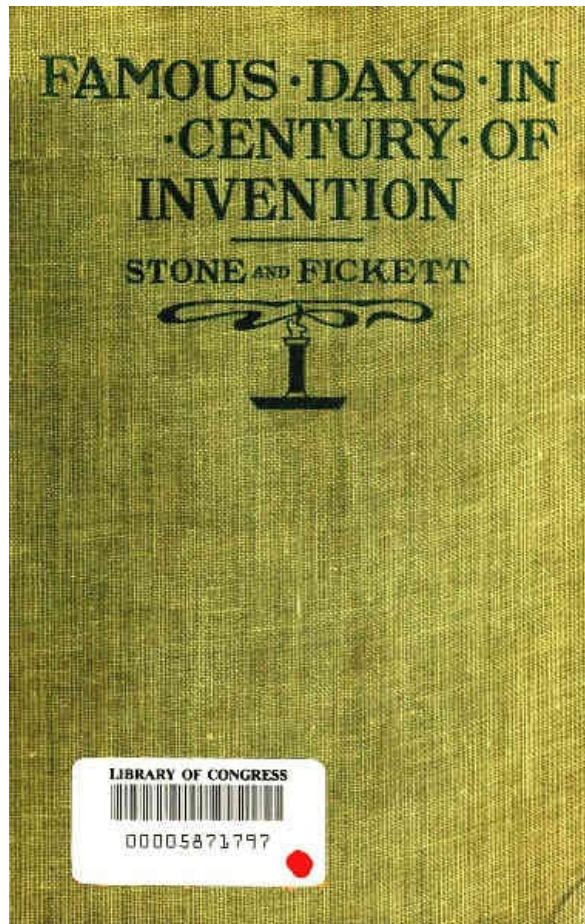
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*** START OF THE PROJECT GUTENBERG EBOOK FAMOUS DAYS IN THE CENTURY OF
INVENTION ***



BOOKS

*BY GERTRUDE L. STONE AND
M. GRACE FICKETT*

EVERY DAY LIFE IN THE COLONIES

DAYS AND DEEDS A HUNDRED YEARS AGO

FAMOUS DAYS IN THE CENTURY OF INVENTION

D. C. HEATH & CO., PUBLISHERS

FAMOUS DAYS IN THE CENTURY OF INVENTION

BY

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FAMOUS DAYS IN THE CENTURY OF INVENTION

[Pg 1]

HOW THE SEWING MACHINE WON FAVOR

PART I

"It is! It is!" chattered the robins at half past three on an early June morning in 1845. Jonathan Wheeler sat up in bed with a start. This was the morning he had been waiting for all the spring, the morning he was to start for Boston with his father, mother, and Uncle William, and ride for the first time on a railway train.

"Is it really pleasant?" was his first thought. "It is! It is!" chirped the robins again. And Jonathan's eyes by this time were open enough to see the red glow through the eastern window. In a second he was out of bed, hurrying into his best clothes that his mother had laid out for him the night

before.

Jonathan lived in a little town only thirty miles from Boston; but traveling was not then the easy and familiar experience of to-day. The nearest railway station was at South Acton, fifteen miles away. The Wheelers had planned to start from home in the early morning, and after dining with some friends in the railroad town, leave there for Boston on the afternoon train.

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But in those days the Fitchburg railroad had not crossed the river, and had its terminal at Charlestown. From there passengers were carried by stage to the City Tavern in Brattle Street. It would be six o'clock that night before Jonathan could possibly see Boston.

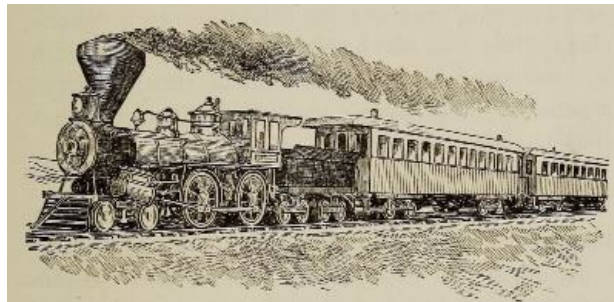
But he lost no moment of his longed-for day. The bothersome dressing and eating were soon over; and Jonathan felt that his new experiences were really beginning when, at seven o'clock, from the front seat beside his father in the blue wagon, he looked down on his eight less fortunate brothers and sisters and several neighbors' children, who, with the hired man, were waiting to see the travelers depart.

"Good-bye! Good-bye, everybody!" called Jonathan, proudly. "I shan't see you for three days, and then I shall be wearing some store clothes!"

For the first few miles the conversation of his elders did not interest him much. He was so busy watching for the first signs of a railway train that the smoke from every far-away chimney attracted his attention; but after a while, when there was nothing to see but the thick growths of birch and maple each side the road, he heard his father saying:

[Pg 3]

"Well, Betsey, I think thee has earned this holiday. Thee has had a busy spring."



AN OLD-FASHIONED TRAIN OF CARS

"It has been a busy time," agreed Mrs. Wheeler. "But all the house-cleaning is done and every stitch of the spring sewing. Since April I've cut and made sixteen dresses and six suits of clothes."

"Did thee read in the Worcester *Spy* last week, Betsey," inquired Uncle William, "of a sewing machine that bids fair to be a success?"

"A sewing machine!" echoed Mrs. Wheeler. "Does thee mean a machine that actually sews as a woman sews? That's too good to be true!"

"But it's bound to come, Betsey," said her husband reassuringly. "We're keeping house to-day much as the early settlers did. We've found better ways of travel, and labor-saving inventions are the next thing." Then, turning to his brother, he added, "Tell us, William, what the *Spy* said."

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"Well, it seems there's a young man in Boston who has a good deal of ingenuity, and he actually has a sewing machine on exhibition at a tailor's there. For some days he's been sewing seams with it, the paper said, at the rate of three hundred stitches to the minute. Perhaps we shall find that tailor's shop to-morrow."

"I should like nothing better," answered Mrs. Wheeler. "Maybe we can buy Jonathan's trousers there."

Jonathan had been an interested listener to this conversation; but just then he caught sight of a moving column of smoke, and for the rest of the drive he thought of little else but the engine he could scarcely wait to see. By ten o'clock came South Acton; then the long hours while his elders ate slowly and talked much; at last the wonderful, puffing, noisy engine and the strange, flat-roofed houses on wheels with their many little windows. Jonathan's world had grown very large indeed when he went to sleep that night at the City Tavern in Brattle Street.

The next morning at the breakfast table, with the aid of the *Morning Advertiser* and the Boston *Transcript* of the night before, the Wheelers made their plans for the day's shopping and sight-seeing.

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"We'll do the shopping first," decided Mrs. Wheeler. "Here's an advertisement of ready-made clothing." And she read aloud what was, for those days, a rather startling advertisement, beginning:

PERPETUAL FAIR
AT
QUINCY HALL
OVER QUINCY HALL MARKET
BOSTON

"Let's go there," advised Uncle William. "Quincy Market isn't far from here." So the Wheelers' first stopping place that morning was Mr. Simmons's establishment at Quincy Market.

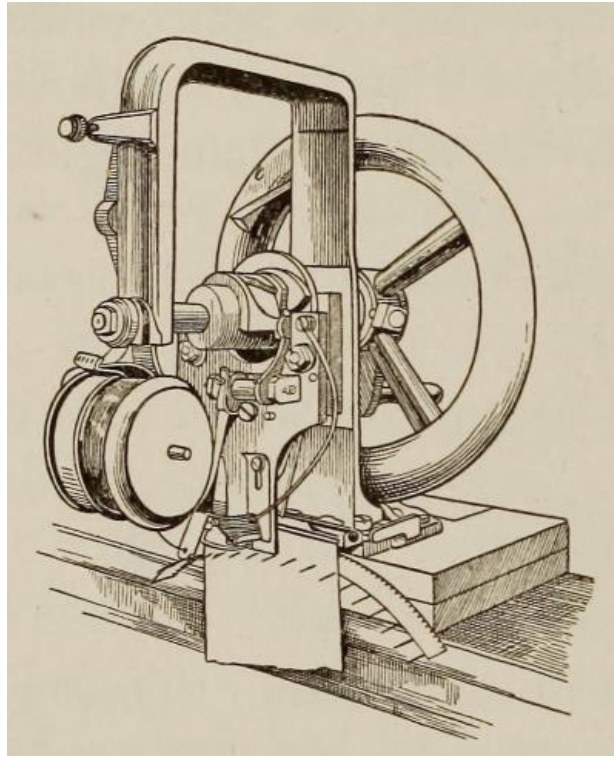
"Has thee any linen trousers for this little boy to wear with the dark blue jacket he has on?"

inquired Mrs. Wheeler of the young man who came forward to serve them.

"We have, madam, I am sure." And deftly the polite young man picked out a pair of dark blue and white striped linen trousers from the middle of a neat pile of garments. Sure enough, the trousers were of the right size; and, to the Wheelers' astonishment, the price was less than they had expected to pay. [Pg 6]

"There must be some profit, madam, you see," explained the clerk; "but if we could make these garments by machine, as a young man in the next room says he can, we could afford to sell them for almost nothing."

"We have heard of that young man and his machine. Will it be possible for us to watch him sew with it?" replied Mrs. Wheeler.



HOWE'S FIRST SEWING MACHINE

"Certainly, madam. Just step this way, if you please." And he ushered the Wheelers into an adjoining workshop, well filled with men and women, many of the men, as Jonathan found out later, being dealers in ready-made clothing in the larger towns near Boston.

"Oh, mother, there he is!" whispered Jonathan excitedly, and he hurried forward to see better.

A kindly-faced young man, not more than twenty-five years old, sat at a table before what seemed to Jonathan a sort of little engine without wheels. With one hand he was turning a crank and with the other he was guiding a seam on a pair of overalls. A bright needle flashed in and out of the blue cloth till it reached the end of the seam. Then the sewer stopped the machine, cut the thread, and handed the garment about for inspection. [Pg 7]

"That took just one minute, Mr. Howe," announced a man who stood near, watch in hand.

"One minute!" echoed a woman standing beside Jonathan. "I could not sew that seam in fifteen minutes."

"How long would it take thee, mother?" whispered Jonathan, aside.

"I'm not sure, little boy," his mother whispered back. "I think I could do it in ten minutes."

"An experienced seamstress could not sew that seam in less than five minutes," then spoke Mr. Howe, as if in answer to a question.

"I don't quite believe that," objected one man.

"Well, why not have a race?" challenged Mr. Howe. "Mr. Simmons," he continued, addressing the proprietor, "will you let five of your best sewers run a race with me? I'll take five seams to sew while each of them does one. Are you willing?"

"Agreed!" said Mr. Simmons. And it was but the work of a moment to select an umpire and prepare the seams. Then the umpire gave the command to start and the race began.

It was an exciting contest. The girls sewed "as fast as they could, much faster than they were in the habit of sewing." Mr. Howe worked steadily but carefully. [Pg 8]

"If he wins, how many times as fast as each girl is he sewing?" asked Jonathan's uncle suddenly, of the little fellow. Jonathan was too bright to be caught and answered quickly, "More than five, isn't he?"

"That's right, Jonathan. And he really is sewing more than five times as fast. Look!"

It was true. Mr. Howe held up his finished seam. Every girl was still at work. "The machine has

beaten," announced the umpire. "And moreover," he added after careful inspection, "the work on the machine is the neatest and strongest."

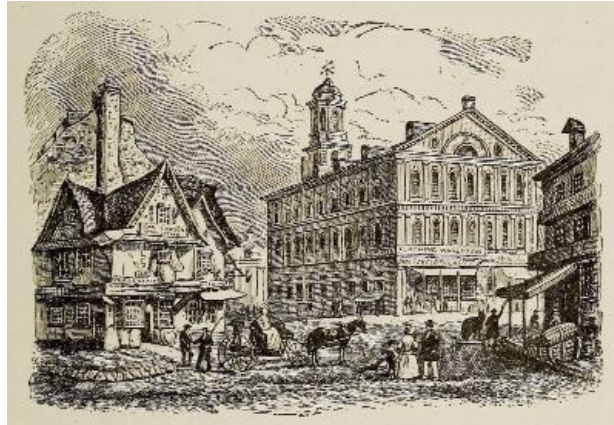
"Now, gentlemen," said Mr. Howe, "may I not have your orders for a sewing machine? See what a money-saver it will be! I can make you one for seven hundred dollars. It will pay for itself in a few months, and it will last for years."

Jonathan expected to hear many of the tailors present order a machine at once. But he was witnessing, although he did not know it till years afterward, "the pain that usually accompanies a new idea." The invention which was to make the greatest change of the century in the manufacturing world lay for several years unused and scorned by the public. The short-sighted tailors over Quincy Hall Market made one objection after another. [Pg 9]

"It does not make the whole garment."

"My journeymen would be furious."

"Truly, it would beggar all handsewers."



FANEUIL HALL, BOSTON, ADJOINING QUINCY MARKET
"The Cradle of Liberty."

"We are doing well enough as we are."

"It costs too much."

"Why, Mr. Howe, I should need ten machines. I should never get my money back."

Jonathan was sorry for Mr. Howe. "I'll buy a machine some day," he announced.

"Thank you, little boy," answered Mr. Howe. "I've no doubt you will." [Pg 10]

But the tailors laughed and shook their heads.

Before they left the workshop, Jonathan's party had a long talk with Mr. Howe.

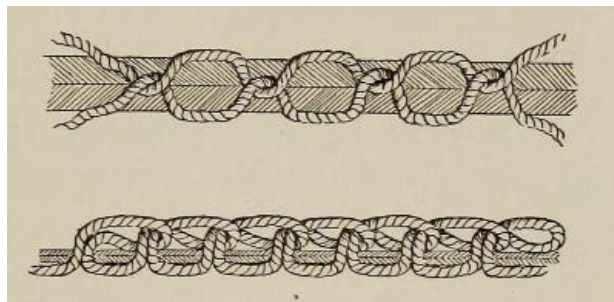
"We are from the country," they said, "with no money to buy a machine of this sort. But we are interested in it, and we believe it has a future. Will thee tell us more about it?"

"Gladly," said Mr. Howe. "I've been at work on the machine most of the time for the last five years—ever since I was twenty-one, in fact. I was born up in Worcester County, in Spencer. When I was eleven, I was bound out to a farmer, but I liked machinery better. I went to Lowell as soon as my parents were willing, and worked a while in a cotton mill. But I did not like that very well, it was so monotonous, and I came down here to work for Mr. Davis in Cornhill. One day a man who was trying to construct a knitting machine came in to see if Mr. Davis could make him a suggestion. But Davis really made the suggestion to me. 'Why don't you make a sewing machine?' he asked.

"I wish I could," the man answered, 'but it can't be done.'

"Oh, yes," cried Davis, 'I could make one myself.'

"Well," was the rejoinder, 'you do it, Davis, and I'll insure you an independent fortune.' [Pg 11]



LOCK STITCH (above) AND CHAIN STITCH (below)
The lock stitch is made with two threads, and the chain stitch with one.

"Now I don't know that Davis or the other man has thought of the matter since. As for me, I've thought of little else. A year ago last October I had planned out the chief parts of the machine—the two threads, the curved, eye-pointed needle, and the shuttle. A rough model that I made

convinced me that such a machine would work; and last December I prevailed upon my friend, Mr. Fisher of Cambridgeport, to let me, with my wife and children, live at his house and construct my machine in his garret. He gave me five hundred dollars besides for material. In return for those favors, I've agreed to give Fisher half my profits. But," he added rather gloomily, "so far it's been a bad bargain for Fisher."

"Is the machine patented?" inquired Uncle William.

"Not yet," answered Mr. Howe. "I need some money first, for, you know, I shall have to make a model to deposit at Washington."

The Wheelers thanked Mr. Howe for his kindness in satisfying their curiosity and wished him all good fortune. [Pg 12]

"Sometime," added Jonathan's father, "I expect thy machine will find its way into homes as well as into shops."

"Indeed, Mr. Howe," added Mrs. Wheeler, "it would be the greatest boon the farmer's wife could ask."

"I prophesy, Betsey," said Uncle William, "that before many years thee will make Jonathan some overalls with a machine of thine own. Meantime," turning to Mr. Howe, "I want to buy him the pair thee sewed in the race. They were boys' trousers, were they not?"

"Yes," answered Mr. Howe, "and I'm sure Mr. Simmons will be glad to sell them to you. He does not put too high a value on them, you know," he added soberly. "Anyway, I shall be glad to know that my machine has sewed for so engaging a little fellow," he finished, with a pleasant smile.

As for Jonathan, he was almost too excited to speak. Two new pairs of "store" trousers in one day, and one of these sewed by a machine! "Thank you, Uncle William," he gasped. And he must say something to Mr. Howe. "Thank you, too, Mr. Howe. I shall surely buy a machine some day."

Jonathan returned to the country the next day, a much traveled little boy for the year 1845. All his experiences remained vividly in his memory: the wonderful railway train, the stage coach clattering over the city pavements, the waiter at the hotel who stood politely near the table and anticipated his wants—all these recollections made his farm life happier and his farm tasks easier. Of all his Boston memories, however, none were more vivid or more persistent than the sight of that marvelous sewing machine and its exciting race with the skilled sewers. [Pg 13]

"What has become of Mr. Howe?" thought Jonathan more than once. "Has he given up trying to persuade people that sewing by hand was often a needless drudgery?" For a year and a half Jonathan could only wonder. Then, one day in February, 1847, Uncle William read in the *Boston Advertiser* that Elias Howe and his brother had taken passage in a packet for England to interest Londoners in the curious machine that could work faster and more skillfully than human fingers.

PART II

Three years later Uncle William took Jonathan on another journey, this time to a small town west of Worcester and about thirty miles from home. The trip was made, so Uncle William said, to consult with a county commissioner there about the prospect of a much needed road; but Mrs. Wheeler, when she remembered that Mr. Howe had mentioned Spencer as his birthplace, remarked knowingly to her husband: [Pg 14]

"Not that I would question Brother William's motive, but thee knows, Daniel, that he was the most interested man in that room over the Quincy Hall Market. He may need to see the commissioner, but I think he's more interested in the fortunes of young Howe."



JONATHAN AND HIS UNCLE WILLIAM IN THE ONE-HORSE CHAISE

"I believe thee's right," answered her husband. "And I hope," he added, "that William will come back with good news about that young fellow and his machine." [Pg 15]

There was no railway train this time for Jonathan. It was an interesting journey, nevertheless, through a beautiful hill country with varied scenery. Jonathan and his uncle both enjoyed their ride in the comfortable one-horse chaise and their dinner at the Worcester inn. In the afternoon

they drove out to Spencer and put up at the tavern there; and after supper they went to bed in the very room where President Washington once had slept.

"Now, if I could only see Mr. Howe on the street to-morrow morning!" thought Jonathan as he dropped asleep.

Mrs. Wheeler would not have been greatly surprised at Uncle William's procedure the next morning. The visit to the county commissioner was made immediately after breakfast and the information that Uncle William desired easily and quickly obtained.

"By the way," inquired Uncle William when the business interview was over, "do you know anything of a young fellow named Elias Howe?"

"Elias Howe? Why, yes, I believe so. There are so many Howes here I had to think a minute. You mean Elias, Jr., I guess. They did live down in the south part. The young fellow had some scheme of sewing by machinery. Couldn't make it work, I believe."

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"Is his father living here?"

"No, not now. Another son invented a machine for cutting palm leaf into strips for hats and Howe moved to Cambridge to help the thing along. Don't believe he'll ever come back."

"My nephew and I saw young Howe in Boston four years ago with his sewing machine. We've both been much interested to hear more about his fortunes. Has he some relatives here who could tell us?"

"Why, yes, his uncle Tyler lives here, his father's brother. His house is right over there. Better call on him. He's a pleasant fellow—every Howe is—and he likes to talk."

"Shall we?" asked Uncle William of Jonathan.

Jonathan's feeling in the matter was not uncertain, but all he said was, "I should like to, Uncle."

"Glad to see you both," was the hearty greeting of Mr. Tyler Howe, upon hearing Uncle William's introduction of himself and his nephew. "Well, Elias is a smart boy and a good one, but he's pretty well down on his luck just now. So you saw him in Boston? Four years ago, wasn't it? Since then he's had a discouraging time.

"After he exhibited his machine in the shop where you saw him, he spent three or four months in Fisher's garret, making another machine to deposit in the patent office. The next year he and Fisher went to Washington, where they had no trouble in getting a patent, but no luck at all in interesting people in the sewing machine. They exhibited it once at a fair, but the crowd was amused, that's all.

[Pg 17]

"By the time Fisher got back to Cambridge, he washed his hands of the whole matter. I don't much wonder. He'd spent all of two thousand dollars and hadn't had a cent in return. Then Elias had only his family to turn to. With his wife and children he moved to his father's and began to plan how to interest England in the invention America had rejected.

"He made a third machine, and with that as a sample, his brother Amasa sailed for England in October, about a month after Elias came back from Washington. For a time it seemed as if the trip would be worth while. Amasa showed the machine to a William Thomas, who had a shop in Cheapside, where he manufactured corsets, umbrellas, carpet bags, and shoes. You can see that the sewing of such articles must be extremely difficult, and Thomas was really interested in the machine.

"But Amasa, I'm afraid, hasn't proved himself much of a business man. He sold Mr. Thomas outright for two hundred fifty pounds sterling (that's twelve hundred fifty dollars of our money, Jonathan) the machine he had brought with him and the right to use as many more as were necessary in the business."

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"Then the notice in the paper was a mistake. So Elias didn't go to Europe?" inquired Uncle William.



CHEAPSIDE IN LONDON

"Yes, the notice was true. You see, the man Thomas did most of his trade in corsets, and the machine was better adapted to sewing overalls and shirts. So Thomas agreed to give Elias three pounds a week if he would go over to London and adapt the machine for use on corsets and other stiff material. Thomas also agreed to pay the expenses of workshop, tools, and material.

"Amasa came back to America with this news, and then he and Elias, with the precious first

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machine, started together for London in February, just as the paper said. They had so little money that they had to go in the steerage and cook their own food. But in London things went well for a time, and Thomas even advanced the money for Elias's family to join him. However, the good fortune was short-lived. In eight months Elias had adapted his machine to Thomas's requirements, and then Thomas ungratefully discharged him for good and all.

"Things were pretty dark for Elias by this time. Thomas had agreed, but only by word of mouth, to patent the invention in England, and to pay Elias three pounds on every machine that was sold. There are scoundrels everywhere, I suppose; but that Thomas has proved one of the meanest men I ever heard of. Sewing machines are fairly common in London now, and on every one of those Thomas has realized about ten pounds, but Elias hasn't had a shilling.

"Of course, when Thomas discharged him, he had nothing to do but move his family into cheaper quarters, borrow a few tools, and begin the construction of a fourth machine. He could not finish it without more money, so he moved his family into one very small room and worked as fast as he could. But even then he could not buy food for his wife and children and material for his machine. There was nothing to do but send his family home and work at the machine till he could sell it and get his own passage money.

[Pg 20]

"Elias has been in a good many straits for a young fellow, but he has a marked gift for making friends. At this time he grew to know pretty well a coach maker, named Charles Inglis, who unfortunately was a poor man too, but who often lent him what money he could during those evil days, and what was better, kept faith in him.

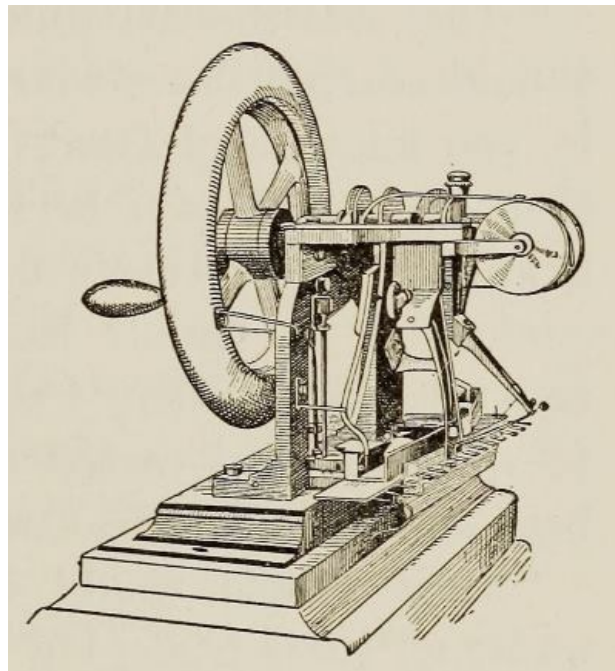
"The night that Mrs. Howe and the children left England, it was so very wet and stormy that Mrs. Howe, who was almost in consumption, could not walk to the ship. Inglis lent Elias a few shillings for the cab hire, and Elias promised him some clothing in return. The clothing was what the washerwoman had brought home that morning, but had taken away again, because there was no money to pay her.

"Then came days of pinching poverty for Elias; but not quite such unhappy ones, I think, now that the wife and children were soon to be with the relatives in Cambridge. Elias knew that the Howes were too proud to let his family starve; and as for himself, he would borrow a shilling at a time of Inglis and buy beans to cook in his own room.

"Finally he finished the machine. Instead of getting the fifty pounds that it was worth, he had to sell it for five pounds, and even then for a mere promise to pay. Inglis soon managed to get four pounds of the money in cash for him, but that four pounds was by no means enough to pay Elias's debts and buy his passage. There was nothing to do but pawn his precious first machine and the letters-patent. That done, he drew his baggage on a hand cart to a freight vessel, and he and Inglis took passage in the steerage of another ship bound for America.

[Pg 21]

"Elias reached New York last April with half a crown in his pocket, but he found employment in a machine shop almost at once. Then came the sad news that his wife, who had been ill when she left England, was dying in Cambridge.



HOWE'S IMPROVED SEWING MACHINE

"Elias had no money for a railroad journey. He had to wait friendless, except for Inglis, in a great city, wholly despairing of ever seeing his wife again and feeling that he had risked everything to gain nothing. His father, however, as soon as he knew of his destitution, sent him ten dollars, and Elias reached Cambridge just in time to speak to his wife before she died. He had no clothes, though, but his shabby working suit, and could not have gone to the funeral if his brother had not lent him a coat.

[Pg 22]

"That was the last time I saw Elias, and then I should scarcely have known him. By nature, he is, you know, a pleasant-faced, happy fellow; but then he looked as if he had had a long, painful

sickness. There wasn't a trace of his old self left. And as if he hadn't had trouble enough, word arrived before I left Cambridge that the vessel to which he had carted his household goods had been wrecked off Cape Cod.

"Most people would have given up, I think, under all these trials, but Elias has a good deal of the Howe perseverance. He immediately got a position in Boston as a journeyman machinist at weekly wages."

"And where is he now?" inquired Uncle William sympathetically.

"I had a letter from him the other day. Should you like to hear it?"

Taking the answer for granted, Mr. Howe opened his desk and took out the letter. Then he read as follows:—

CAMBRIDGE, MASS., *June 20, 1849*

[Pg 23]

My dear Uncle,

You will be interested, I know, in what I have to write; and I think you will agree with me that I shall yet retrieve all my ill-luck. Any advice you may have for me I shall cheerfully receive.

First look at the enclosed hand bill.

And Mr. Howe interrupted the reading to pass Uncle William and Jonathan a small hand bill like this:—

A GREAT
CURIOSITY!!
THE
YANKEE SEWING MACHINE
IS NOW
EXHIBITING
AT THIS PLACE
FROM
8 A.M. TO 5 P.M.

He then went on with the reading:—

That was posted about in Ithaca, N. Y., just a few weeks after I came back from England.

Some fellow made a machine from the description he heard of mine, and he has been giving exhibitions of its work in various places. He says his machine can do the work of six hands and make a pair of pantaloons in forty minutes. And I have no doubt he tells the truth.

Only, Uncle Tyler, don't you see it's *my* machine and he is infringing on *my* patent? And more than that, right here in Boston machines have been built on my model and are in daily use. Now I know that I am without resources and that I have pretty well exhausted the patience of my friends. But surely my claims are valid.

[Pg 24]

Getting money to push them is the task I dread. Still I have already raised a hundred dollars to get my machine and letters patent out of pawn in London; and I have every hope that Mr. Anson Burlingame, who is soon to sail for England, will deliver them safely to me in the fall.

The next step is to see if the lawyers can find any flaws in my claims. If they can't, the suit I propose to bring is already in my favor; and I am sanguine enough to believe that the Howe sewing machine will yet be a household convenience.

Yours respectfully,
ELIAS HOWE, JR.

"Well," commented Mr. Howe, as he folded the letter slowly, "I didn't know how to answer that. He said he wanted advice. I know he wants money more, but of course he hates to ask for it. I deliberated a good while; but finally I wrote him that if the lawyers gave him assurance that his claims were valid, I would advance what money I could spare to further his suit."

There was silence in the room for a little while. Then Jonathan said earnestly:

[Pg 25]

"I wish I had some money to give Mr. Howe. Would he take my five dollars, do you think?" he asked of the inventor's uncle.

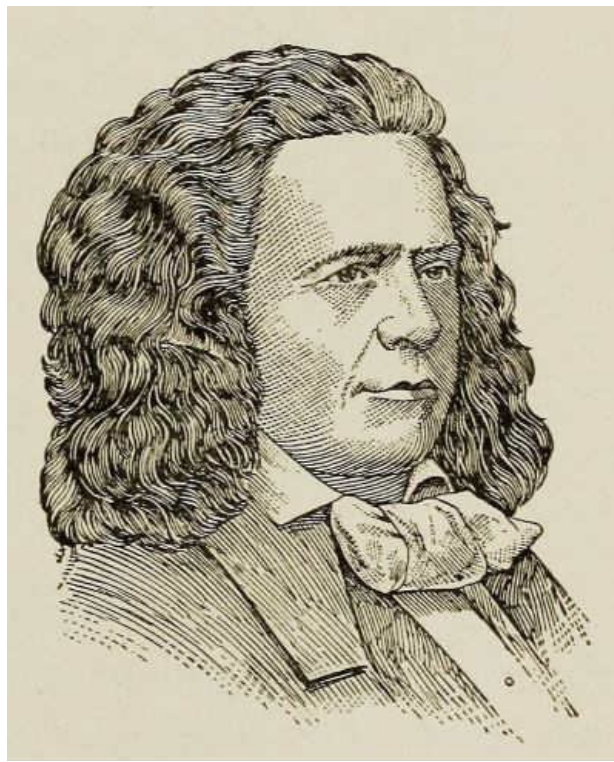
"See, I have it here; and I should be glad to give it to him without waiting to hear what the lawyers say. Do you think it would be all right to send it, Mr. Howe?" he inquired.

"And may I, Uncle William?" he added quickly, for he had almost taken his uncle's permission for granted.

Uncle William nodded; and Mr. Howe said, "You may never get it back, you know."

"I think I shall," answered Jonathan confidently. "And anyway I want to help Mr. Howe."

"Do you want to send it now?" inquired Mr. Howe.



ELIAS HOWE

"If you please," replied Jonathan.

"Then you may write your letter here, while your uncle and I go for a walk."

SPENCER, MASS.,
15th 9th mo., 1849.

[Pg 26]

*Mr. Elias Howe, Jr.,
Cambridge, Mass.*

My dear Mr. Howe:—

Perhaps thee remembers the boy who saw thee run a race with thy sewing machine against five seamstresses over Quincy Hall Market four years ago. Thy uncle told me of the hard time thee has had since. I am very sorry. I want to buy a sewing machine and I want to help thee. I am sending thee five dollars. It is all the money I have. I hope thee will use it to win thy suit. Sometime when thee sells sewing machines, I hope thee will sell me one for my mother five dollars less than the usual price. Thee can see thee will not have to pay this back for a long time, for it will be a good many years before I shall have money enough to buy a sewing machine.

Thy friend and well-wisher,
JONATHAN WHEELER

There is little more to tell of Jonathan's visit to Spencer. After dinner that day he started with his uncle for Worcester, where they stayed all night. The next morning, after an early breakfast, they set out again, reaching home before the forenoon grew very hot.

PART III

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Not many days after Jonathan's return, the first letter he ever received his father brought him from the post office. It hardly needed the post mark, Cambridge, to make Jonathan sure who had sent it. Let us open it with him:—

CAMBRIDGE, August 26, 1849.

My dear friend Jonathan,

Your letter with its inclosure of five dollars has been gratefully received. I remember you and your uncle, your father and your mother, with much pleasure. Ever since I ran that race in Boston I have been sure that the machine would work its way to success.

I am more confident now than ever. I have found some one who will buy out Mr. Fisher's interest; Mr. Burlingame will bring my old machine and letters patent from London; and every lawyer I have consulted says my claims are valid and I shall win my suit.

When I have succeeded, and the manufacture of sewing machines is under my control, I shall send for you to pick out a machine for your mother.

Again thanking you for your substantial interest, I am

Very faithfully yours,

This was in 1849. Mr. Howe's darkest days were over; but even then success came slowly and in rather a strange way. Mr. Howe's chief enemy was a Mr. Singer, who built machines and advertised them with remarkable success.

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"You are infringing my patent," wrote Howe to Singer, upon hearing of the latter's activity.

"But you are not the inventor," replied Singer. "The Chinese have had a sewing machine for ages; an Englishman made one in 1790; a Frenchman built one in 1830; and what is more to the point, in 1832, a man named Walter Hunt, living in New York, invented a sewing machine with a shuttle stitch like yours. I can find Walter Hunt and prove my statement."

Well, Mr. Singer did find Walter Hunt and the fragments of his old machine. But "not all the king's horses nor all the king's men" could put those fragments together again so that the machine would sew. For four years, however, the trial in the courts continued. But at last, in 1854, when Mr. Howe had waited nine years after completing his first machine, the Wheelers and many others read with great satisfaction in the Worcester *Spy*:

"Judge Sprague of Massachusetts has decided that the plaintiff's patent is valid and that the defendant's machine is an infringement. Further, there is no evidence in this case that leaves a shadow of a doubt that, for all the benefit conferred upon the public by the introduction of a sewing machine, the public are indebted to Mr. Howe."

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In 1855, Jonathan, now grown into a tall, manly youth of twenty, started with Uncle William on another journey, longer and more interesting than either had ever taken before. This time they went to New York, where they found Mr. Howe at the head of a prosperous business; and when they returned, they brought with them a Howe sewing machine of the very latest model, "a present from the inventor to Mrs. Wheeler, in gratitude for the sympathy and encouragement of her family."

LONG-DISTANCE TALKING

[Pg 30]

PART I

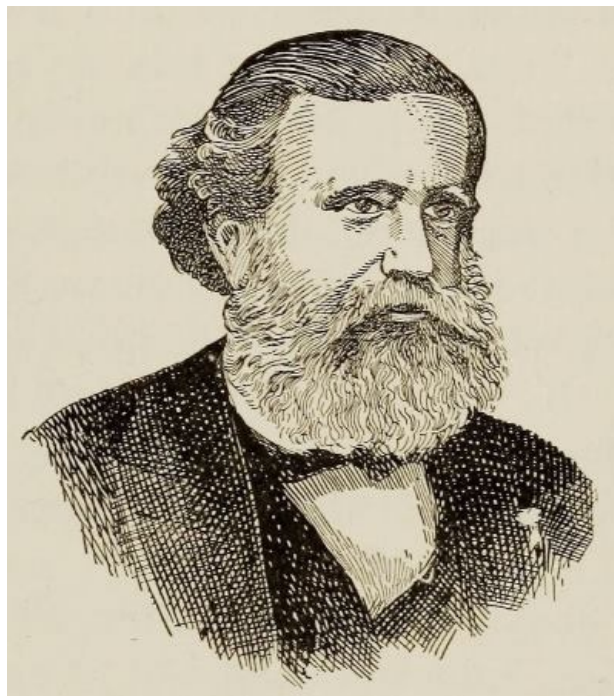
Late one June afternoon Arthur Burton was leaning against a table in the eastern gallery of the main hall at the Philadelphia Exposition. It had been a wonderful day, but it was past dinner time, and he was hot, tired, and hungry. He had seen more wonders that day than he had witnessed in all his life before; but now his uncle and the other judges were in the midst of the Massachusetts educational exhibit, which wasn't half so interesting as the first electric light, or the first grain reaper, or the iceboats. So Arthur had moved away from the new-fashioned school desks and the slate blackboards, and was waiting rather wearily.

Suddenly he straightened up. Entering the door near by was the most distinguished visitor at the Centennial, the tall, handsome Dom Pedro, Emperor of Brazil, with the Empress and a bevy of courtiers. To Arthur's amazement, His Majesty walked directly up to the table against which he himself was standing; and looking beyond the little boy, he said with outstretched hand and a pleasant smile:

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"How do you do, Mr. Bell? I am very glad to see you and your work."

Till then Arthur had scarcely noticed a sallow, dark-haired young man who had been sitting behind the little table, nor had he paid the slightest attention to some pieces of wood and iron with wire attached lying on the table. But now, the young man and his material had become decidedly interesting.



DOM PEDRO II

"I remember very pleasantly," continued Dom Pedro, "my visit to your class in Boston University when you were teaching deaf mutes to speak by means of visible speech. You were working out a new method, I remember. I suppose this is apparatus that you have devised in that connection."

"I thank Your Majesty," stammered the surprised young man, who for a moment had been at a loss to recall who his royal visitor might be. "I shall be delighted to explain my apparatus. But it has nothing to do with teaching deaf mutes to speak. It is more wonderful than that. It speaks itself; that is, it reproduces sounds. It is the improvement on the telegraph that the world has awaited for years." [Pg 32]

"You see, I found in my experiments that I could transmit spoken words by electric current through a telegraph wire so that those words could be reproduced by vibrations at the other end of the wire. I suppose my invention might be called a speaking telegraph."

By this time all the judges had joined the Emperor's party. Arthur fell back to his uncle's side, but he could still hear and see everything.

"Now, Your Majesty," continued Mr. Bell, "if you will press your ear against the lid of this iron box, I think in a moment you will have a surprise."

At these words, Mr. Bell's assistant, who had come up to the group during the conversation, went to another table several rods away and quite out of hearing. The Emperor bent down expectantly. The judges looked rather incredulous, but they were all interested.

"Is the man that went off going to talk over the wire so that the Emperor can hear?" whispered Arthur to his uncle.

"Mr. Bell says so," was the reply, "but we shall see." [Pg 33]

Suddenly the Emperor gave a start, and a look of utter amazement came over his face.

"It talks! It talks!" he exclaimed excitedly.

It was quite true. Mr. Hubbard, Mr. Bell's assistant, had spoken in a low voice at the other end of the wire and his exact words had been reproduced. The Emperor's excitement was contagious. Everybody forgot how hot and hungry he was. One after another of the judges listened at the magic box to hear Mr. Hubbard or another of their number speak into the instrument at the other end.

"Oh, Uncle, do you suppose I can listen too after a while?" inquired Arthur, when he could no longer keep still.

Just then Mr. Bell himself interposed.

"Now it must be the little boy's turn."

The grateful little boy was not slow in stooping over to the receiver.

"What does he say, Arthur?" asked his uncle.

"Why, he says, 'To be or not to be,' whatever that means."

"You don't know your Hamlet very well yet, little boy."

"But I have heard a speaking telegraph, and that is better," replied Arthur.

By this time Mr. Hubbard was returning with the apparatus he had been using at the other end. [Pg 34]
It was time to see how the marvel had been wrought.

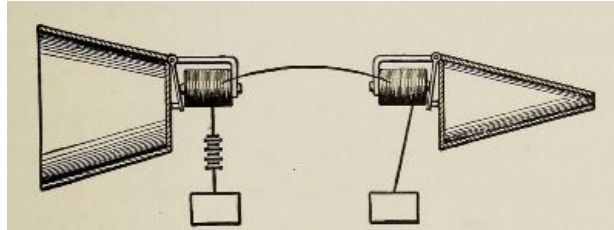
"Now tell us how it works, Mr. Bell," commanded Dom Pedro.

"It is very simple," Mr. Bell explained. "You know, of course, that for some years it has been possible to transmit articulate speech through India rubber tubes and stringed instruments for short distances; but I worked, as you see, to transmit spoken words by electric current through a telegraph wire.

"Here on the table before you is the instrument I call the transmitter, into which Mr. Hubbard spoke. This projecting part is only a mouth-piece. Inside is a piece of thin iron attached to a membrane, and this piece of iron vibrates whenever one speaks into the transmitter. For you know, gentlemen, that if you hold a piece of paper in front of your mouth and then sing or talk, the paper will vibrate as many times as the air does.

"Now, of course, if I could reproduce those sound or air waves at a distance, a person listening would hear the same sounds that caused the first vibration. I have accomplished that by making and breaking an electric current between two pieces of sheet iron. My assistant spoke into the cone-shaped mouth-piece. At the end of it, as you could see if I took off the cover, is the first thin plate of sheet iron. Near that iron, but not touching it, is a magnetized piece of iron wound around with a coil of wire.

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BELL'S TELEPHONE IN MARCH, 1876.

"This magnet is connected by this wire with another magnet that also has a coil of wire around it. On the other side of the second magnet is the other thin plate of sheet iron. This last part makes what I call the receiver. It is the part at which you listened. It looks, you see, like a metallic pill box with a flat disc for a cover, fastened down at one side and tilted up on another. When you put your ear to that, you heard the reproduction of the original sound."

"Marvelous!" "Wonderful!" "Stupendous!" "Incredible!" were some of the exclamations.

"But, gentlemen," confirmed one of the judges, a man named Elisha Gray, "it is perfectly true. I myself have an invention of a similar sort, by which I can send musical sounds along a telegraph wire."

There was a moment of amazement and congratulation for Mr. Gray. Then came a question addressed to Mr. Bell.

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"Could you talk into the iron box and hear at the transmitter?"

"Yes, but not easily. So far I have had to use different instruments at each end of the circuit. I shall remedy that some day," continued Mr. Bell, confidently.

"I am sure you will," agreed the questioner. "We want to see this again, sir," spoke one of the group. "May it not be transferred to the Judges' Hall?"

"Certainly, as far as I am concerned," was the reply. "Mr. Hubbard will see to that, I am sure. I myself must return to Boston to-night."

"My young friend," now spoke Sir William Thomson (who later became Lord Kelvin), perhaps the most noted of all the scientists present, "is it not possible to arrange for a test with your apparatus over a considerable distance? If so, I shall be glad to go to Boston also to witness such an experiment."

"I shall be most delighted, Sir William," answered Bell. "I will make the necessary arrangements and telegraph you at once."

After more congratulations for the young inventor, the group dispersed, the judges going away to the dinner they had for a while forgotten. But during the meal and through the evening they talked of little but the new invention; and Arthur distinctly remembers to this day the enthusiastic remark of Sir William Thomson: "What yesterday I should have declared impossible I have to-day seen realized. The speaking telegraph is the most wonderful thing I have seen in America."

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PART II

When Arthur went back to his home in one of the country towns of Massachusetts, he had many things to tell his family and his friends. To him the Exposition had been a veritable fairy land. But the most wonderful genie there was Electricity, and his most remarkable work was the speaking telegraph.

"And you could really hear through that wire?" questioned more than one incredulous person.

"I really could, and as plainly as I hear you," insisted Arthur.

"Sho, now!" remonstrated a farmer neighbor, "you only thought you could."

"Well, maybe," commented another, cautiously, "but of course there was a hole in the wire that you didn't see."

Arthur's own family were more thoughtful and intelligent people.

"I knew," said Grandfather, "that the marvels of electricity were not all understood. When I was a young man, the telegraph was the greatest wonder the world owned. But using that was somehow like talking at arm's length; the telephone brings your friend almost beside you."

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"To me," said Arthur's mother, "the telephone, in comparison with the telegraph, seems like a highly finished oil painting. The old invention is like a page of black and white print."

"Why, I have seen Mr. Bell," remembered Arthur's older sister, who was studying to be a teacher, after she had heard the story. "He came to the normal school last year to explain his system of teaching deaf mutes to speak."

The Burtons heard no more of the telephone for six months or more; but the next winter, when Herbert, the older brother, came home from Tufts College to spend a week end, he exclaimed:

"Well, Arthur, I've talked through a telephone, too!"

"You have!"

"Where?"

"Tell us about it!" were the quick replies.

"Professor Dolbear, the physics instructor, has made one in his laboratory. It's a little different from Professor Bell's. Your professor, Arthur, had a battery, you know, to make the electro-magnet. My professor has a permanent magnet instead."

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Early in February Herbert came home with more news and an invitation: "Professor Bell is going to give a public lecture and exhibition of his telephone at Salem next Monday evening. He expects to carry on a conversation with people in Boston. Want to go back to college with me Monday morning, Arthur, and go down to Salem in the evening?"

So it happened that on Monday evening, February 12, 1877, Arthur and Herbert, with about five hundred others, were at Lyceum Hall in Salem. It was an eager audience, full of curiosity.

Upon the platform and well toward the front was a small table, on the top of which rested an unimportant-looking covered box. From this box wires extended above to the gas fixture and out through the hall. At the back of the platform was a blackboard on a frame, and at the side a young woman, an expert telegrapher, who was to help Mr. Bell.

"Rather an unpromising set of apparatus!" Arthur heard a man behind him whisper to his neighbor.

"I'm not expecting much," returned the neighbor. "They say Professor Bell's going to talk to Boston. That's nonsense!"

But just then Professor Bell began. He briefly explained the instrument upon the table, which, Arthur saw, varied but little from that at Philadelphia.

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"Only," thought Arthur, "he uses it now as he said he should, for transmitting and receiving too."

Then Professor Bell gave a brief account of the studies he had made since 1872, when he came to Boston to teach speech to deaf mutes.

"I made up my mind," said he, "that if I could make a deaf mute talk, I could make iron talk. For two years I worked on the problem, but unsuccessfully. At last, about two years ago, while a friend and I were experimenting daily with a wire stretched between my own room at Boston University and the basement of an adjoining building, I spoke into the transmitter, 'Can you hear me?' To my surprise and delight the answer came at once, 'I can understand you perfectly.' To be sure," continued the lecturer, "the sounds were not perfect, but they were intelligible. I had transmitted articulate speech.

"My problem was a long way toward its solution. With practically those same instruments, improved with a year's experimenting, I went to the Exposition, where, as you know, I interested many people. Since last June Sir William Thomson and I have succeeded in talking over a distance of about sixty miles. Moreover, I have talked, but not so successfully, between New York and Boston, a distance of over two hundred miles. To-night I expect to establish a connection between this hall and my study in Exeter Place in Boston, eighteen miles away. My colleague, Professor Watson, is there, in company with six other gentlemen."

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Then, in an ordinary tone, as if speaking to some one a few feet away, Professor Bell inquired, talking into the transmitter:

"Are you ready, Watson?"

Evidently Watson was ready, for there came from the telephone a noise much like the sound of a horn.

"That is Watson making and breaking the circuit," explained Professor Bell.

Soon Arthur heard plainly the organ notes of "Auld Lang Syne," followed by those of "Yankee Doodle."

"But that's not the human voice," objected Arthur's neighbor to his companion. "Musical sounds we know can be telegraphed."

Just then Mr. Bell spoke again into the transmitter.

"Watson, will you make us a speech?"

There came a few seconds of silence. Then, to the astonishment of all, a voice issued from the telephone. All the five hundred people could hear the sound, and those less than six feet from the instrument had little difficulty in making out the words:

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"Ladies and gentlemen: It gives me great pleasure to address you this evening, though I am in Boston and you are in Salem."

"I wonder what those men think now," reflected Arthur.

But the answer was forthcoming.

"We can no longer doubt. We can only admire the sagacity and patience with which Mr. Bell has brought his problem to a successful issue."

At the conclusion of the lecture many of the audience went to the platform to examine the wonderful box more closely. Arthur and Herbert were of the number, you may be sure.

"Is it all right for me to speak to Mr. Bell, Herbert?" whispered Arthur.

"Certainly, if you don't interrupt."

Arthur watched his chance.

"Mr. Bell," he said finally, "you did make the receiver into a transmitter, didn't you? I saw you at Philadelphia, you know."

Mr. Bell's puzzled look wore away.

"Why," he exclaimed, "you're the boy I saw at the Exposition that Sunday afternoon last June, aren't you?" Then he added, before turning away to answer a question that a man was asking, "Better buy a Boston *Globe* in the morning. You'll find a new triumph for the telephone there."

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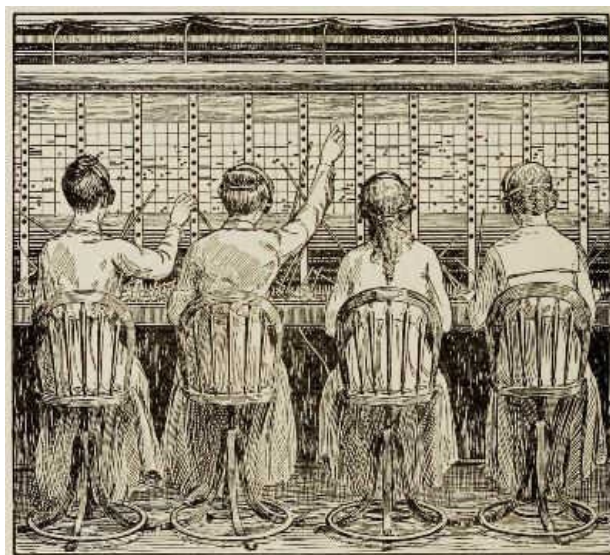
Arthur bought his *Globe* the next morning before breakfast. Mr. Bell was right. The paper recorded even more successes than the boys had witnessed the night before. Its account of the evening ended with these words:

"This special by telephone to the *Globe* has been transmitted in the presence of about twenty, who have thus been witnesses to a feat never before attempted: that is, the sending of a newspaper despatch over the space of eighteen miles by the human voice, all this wonder being accomplished in a time not much longer than would be consumed in an ordinary conversation between two people in the same room."

Probably no child who reads this story can remember when the telephone was not so common an object as a lawn mower or an elevator; but those of us who lived through the years when its wonders were slowly developing can never forget our strange, almost uncanny feeling when the voice of a friend who, we knew, was miles away actually came out of a little iron box.

From that day of the *Globe* report Arthur watched the telephone grow rapidly into public notice. Salem people invited Mr. Bell to repeat his lecture; leading citizens of Boston, Lowell, Providence, Manchester, and New York within a few weeks clamored for demonstrations in their cities.

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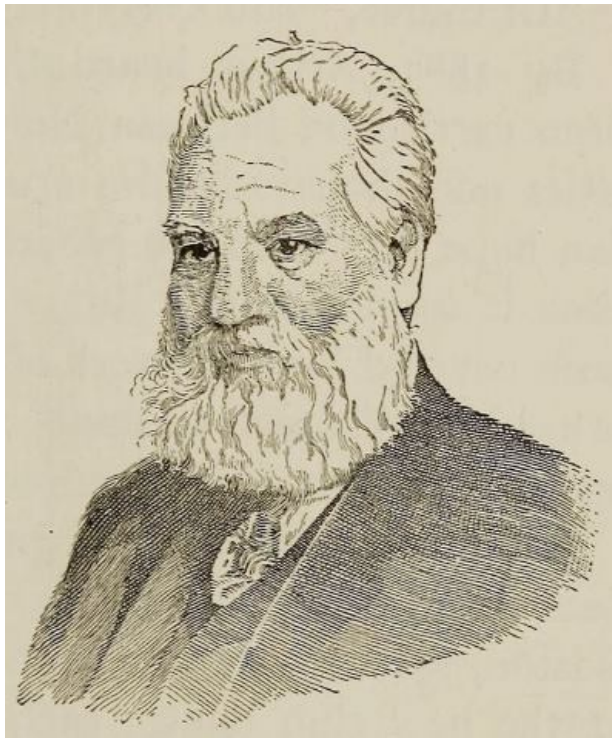


PART OF A TELEPHONE EXCHANGE.

By September, 1878, a telephone exchange was set up among the business houses of Boston, with about three hundred subscribers. Two years later the telephone found its way to the little town where Arthur lived, and two instruments were installed—one at the railroad station and another at the lawyer's office.

The next day came the presidential election; and in the evening the lawyer's office was filled with curious men and boys, eager to see whether the telephone would really work or not. Arthur and his father were there, of course. But before any message came, the lawyer had to see a client for a few minutes.

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ALEXANDER GRAHAM BELL IN 1900.

"Here, Arthur, you've used a telephone before. Take my place at the receiver, will you?"

There was no need to ask. Arthur was at the receiver when the lawyer's question was finished. No message came for some time; but at last the bell rang, and Arthur announced proudly:

"He says Florida has gone Republican."

"I knew the thing couldn't be trusted," sputtered an old voter then. "As if the solid South were broken! I'll get my news some other way." And off he went.

"You didn't hear right, I fancy," said the lawyer, returning. "The operator couldn't have said that."

"But he did," insisted Arthur. "I'm sure he did."

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"And why not?" quietly asked the school teacher from one corner of the room. "He means the town of Florida, not the state."

"Of course," said everybody.

By 1883, Arthur heard that conversation had been carried on between New York and Chicago, cities one thousand miles apart. "That is all we can hope for," was the general verdict. For a long time it seemed true. But when the country had been covered by a network of wires, there came another long-distance triumph. Communication was open to Omaha, five hundred miles farther west.

And not long ago, Arthur, now a prosperous business man of fifty, a member of the City Club of Boston, sat with several associates around a table at the new club house, each with a telephone in front of him; and over the wires, across three thousand miles of mountain, lake, and prairie, came clearly the voices of the governor of Massachusetts and the mayor of Boston, speaking from the Panama Exposition at San Francisco.

What will be the next triumph of the telephone? To transmit speech around the globe, perhaps. Anyway, here is a newspaper paragraph that asks an interesting question:

"The *Mayflower* has been called the last frail link binding the Pilgrims to man and habitable earth. With its departure from Plymouth in America that frail link was severed. The Atlantic cable has surely bound the countries together again. Will the telephone and the aeroplane make the desert of the Pilgrims a popular London suburb?"

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A NEW ERA IN LIGHTING

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PART I

"Uncle John, I've decided to go to Wellesley College."

"I'm glad to hear it, Dora. Have you money enough?"

"That's just the trouble, Uncle John. I have exactly twenty-four dollars that I've earned picking berries the last three summers. But I'm only eleven, you know, and I shan't try to go before I'm eighteen. That will give me seven more summers to work. Only I can never pay my college expenses if I can't earn more than eight dollars a summer."

"That's true, Dora. I wish I were rich enough to send you myself. But school teachers are not wealthy, you know."

"Oh, I don't want anybody to give me the money, Uncle John. I want to earn it. Don't you know of something that's more profitable than berry-picking?"

"I'll think about it, Dora."

This conversation took place in 1878, when Dora's Uncle John, who was a high school principal in New Jersey, was spending his Christmas vacation at Dora's home in a little village on the Maine coast. Nothing more was said about the college money then; but when Uncle John came again in February, he showed that he had interested himself in the ambitious plans of his little niece.

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WELLESLEY COLLEGE IN 1886.

"Dora," he inquired, "do you want to go to college as much as ever?"

"Yes, more, Uncle John. Have you thought of anything for me to do this summer?"

"I know something you can do, Dora, if you want to."

"Oh, Uncle John, what is it?"

"How should you like to work for me?"

"I should like to ever so much. But I don't know enough yet to correct high school papers. All I can do is housework."

"And that's just what I want of you, Dora. You didn't know I had leased the Atlantic House, did you?"

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"No, indeed, Uncle John. Do you mean you're coming here summers to manage that hotel?"

"Yes, for the next ten years, anyway, I expect. Do you like to fill lamps and clean chimneys, Dora?"

"Why, that's the part of the housework I can do best."

"That's good. Will you work for me twelve weeks this summer for three dollars and a half a week?"

"Oh, Uncle John, of course I will. But isn't there gas in that hotel?"

"No, just kerosene lamps. I know some people like gas better, but I don't. It's too dangerous and it's bad for one's eyes. So even if I could spare the money this summer, I shouldn't pipe the house for gas. It can't be many years before there will be a cleaner and better light. The Wizard will soon attend to that."

"What do you mean, Uncle? Who is the Wizard?"

"The most wonderful man in America, Dora. His name is Thomas Alva Edison, and he lives in Menlo Park, New Jersey, not far from where I teach. I know him a little. He is the man who, I think, best represents the scientific spirit of the nineteenth century. He's an inventor, but a systematic one. He doesn't trust to chance."

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"What has he invented, Uncle? I don't think I ever heard of him."

"I fancy not, Dora. So far his work has been largely improvements on inventions already made. Just now, as I said, he is experimenting to find a way of lighting buildings by electricity. He will succeed, I know; and I shall wait for his electric light. I expect, though, to wait a number of years yet, for even though he should discover the secret within a few months, no one can supply the necessary apparatus. It will take years, I'm sure, before electric lighting is cheap enough to be common."

"How did you get acquainted with such a wonderful man, Uncle?"

"I knew him first when I was getting ready for college. Like you, I had my own way to pay; and I learned to be a telegraph operator. The summer before I entered Harvard I had a place in the Boston office of the Western Union Telegraph Company. Mr. Edison was a young man too, and he came to work in the office while I was there."

"The night he came we tried to play a joke on him, but the joke was decidedly on ourselves. Edison wore an old linen duster, and looked so much like a country boy that we thought he couldn't know much about taking messages. So we arranged with a skillful New York operator to send a long message faster and faster, and we saw to it that the new boy had to take it. To our surprise, he proved the fastest operator we had ever known and very carelessly and easily handled the quick dots and dashes. The joke was on the New York operator, too, for after a while Edison signaled, 'Say, young man, why don't you change off and send with your other foot?'"

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"An operator like that didn't stay long in the office. He went to New York, and almost at once got a position at three hundred dollars a month because he was bright enough to repair a stock-indicator in a broker's office. Soon afterward he improved the indicator so much that the president of the company gave him forty thousand dollars for his new idea.

"Next he proved his value to the telegraph company again by locating a break in the wire between New York and Albany. The president of the Western Union had promised to consider any invention Edison might make if the young man would find the trouble on the line in two days. Edison was not two hours in locating the break; and ever after that the Western Union people were glad enough to be told of all his new ideas."

"Is he working for the Western Union now?"

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STOCK INDICATOR OR "TICKER"

"No, not now. Just as soon as he had enough money in the bank so that he could afford time to experiment, he opened a factory and laboratory of his own. He made stock tickers for a while; but he cared more about improving them than selling them. 'No matter,' I have heard him say, 'whether I take an egg beater or an electric motor into my hand, I want to improve it. I'm a poor manufacturer, because I can't let well enough alone.' So, instead of making stock indicators, he went to work to improve the telegraph. He saved the Western Union Company millions of dollars by making a device for sending four messages at the same time over one wire. So you see he made their one hundred thousand miles of wire into four hundred thousand without using any more wire. That's a wizard's work, I think."

"I should think so, too," agreed Dora. "That seems to me as hard as singing two notes at once."

"But it can be done, nevertheless; and Edison was so pleased with that invention that he put his factory at Newark into the hands of a capable superintendent and established a laboratory at Menlo Park, where he is now, about twenty-five miles from Newark. Then he began to think about the telephone. Do you know what that is, Dora?"

[Pg 54]

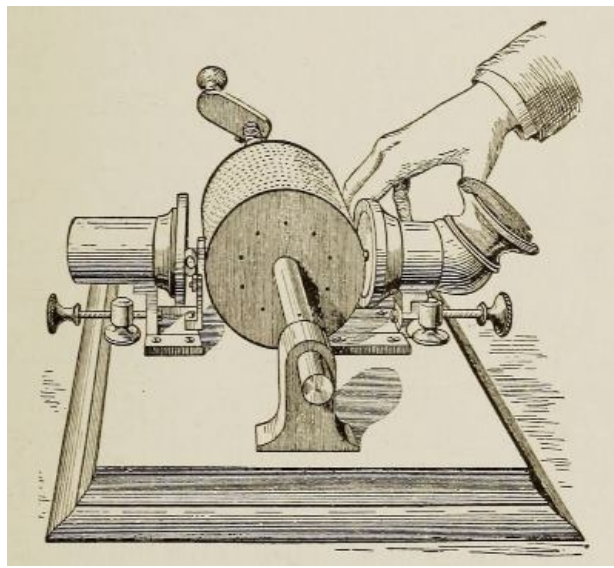
"I've heard about it, of course, but I never saw one. There are some telephones in Portland, though."

"Yes, and there's going to be one here. I'm going to connect the hotel with the telegraph office at the station this summer, and sometime I'll give you a chance to talk over the wire. It's easier to use the telephone now than it was at first, for in the beginning there was a continual buzzing that was very annoying; but Edison has stopped all that by improving what we call the transmitter."

Dora's idea of a telephone was indistinct; but she was satisfied with the explanation to come, and she wanted to hear more of Mr. Edison. "Has he made anything else?" she asked.

"Oh, yes," replied Uncle John. "What I think is the most wonderful thing Edison has done is the phonograph. Next to the telephone, that to me is the biggest marvel in the world of science. Think, Dora, of speaking into a machine that makes a picture of the sound waves produced by your voice, and then, a day or a year or a century later, letting the instrument work backward and hearing your own voice exactly as it sounded at first. Such a mechanism almost frightens me. It makes me sure that if a man like Edison can keep the idle words men speak through centuries, the Master Mind of this universe can keep them for us forever."

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EDISON'S FIRST PHONOGRAPH.

Dora must have caught a little of her uncle's thought, for she said, slowly, "Do you mean that everything I say I shall hear again sometime?"

"I don't know exactly, Dora. But I am sure that God, who gave you power to speak, knows how to keep your words forever; and I am sure you will never cease to be glad for all the kind words you may speak for human ears to hear.

"But I'd almost forgotten about the electric light, Dora. Let me tell you what Edison said about that the last time I saw him. He told me of seeing in Philadelphia what is called an arc lamp—two pieces of carbon that electricity has heated white hot and that give off a powerful light, much more powerful than any gas lamp you ever saw could give. But a lamp like that, though it makes a fine street lamp, is not suitable for lighting a house. It's too bright and too big. Edison says it needs to be subdivided so that it can be distributed to houses just as gas is now.

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"That's Edison's present problem, Dora. He is such an untiring worker that I don't believe it will take many months; and when the process is perfected and the implements for generating the electricity can be secured, I mean to make my hotel the prettiest place at night on the Maine coast. But meantime, Dora, suppose you learn to wipe lamps so dry and polish chimneys so bright and trim wicks so even that every summer visitor at the 'Atlantic' will be glad to get away for a while from the flaring, ill-smelling, poisonous gas light."

"I will, Uncle John, I will! I'll be the best lamp-trimmer on the whole Maine coast!"

"That's the spirit that will take you to college, Dora," answered her uncle. "Don't lose a bit of it."

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PART II

For all the long hot weeks of the next summer Dora worked faithfully every day on the hotel lamps. She had to be at her work at eight o'clock every morning, and she seldom finished before two in the afternoon. But every week her uncle paid her three dollars and a half, and by the end of the season she had forty-two dollars carefully put away. When the hotel closed, her uncle made her a present of eight dollars, so that when she started for school in the fall she rejoiced in the thought of fifty dollars put away in the savings bank as a college fund.

She was happy, too, in the prospect of making as much money the next summer. For the Wizard, Uncle John told her, had not the secret yet. He had succeeded in making a platinum wire, encased in a glass globe, give a light equal to that of twenty-five candles without melting. But he needed to exhaust all the air from the glass globe, and still one one-hundred-thousandth of the original volume remained.

"But that's not sufficient," commented Uncle John. "I know enough about the matter to be sure that so much air as that would prevent the platinum from giving out the light it ought to give. Still, within a short time, Dora, I expect even the Portland papers will describe Mr. Edison's success with the electric light."

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Uncle John's prediction was fulfilled. By the first of October the vacuum was so nearly perfect that only one-millionth part of the original air was left in the glass bulb. By the last of that same month, moreover, the whole secret was practically in Edison's grasp. He had stopped experimenting with platinum for a burner and had gone back to carbon, on which he had pinned his faith at first.

But this time he used the carbon only as a coating for a piece of cotton thread that he had bent into a loop and sealed up in the almost perfect vacuum of glass. When this lamp was connected with the battery, it flashed forth with the brightness that the inventor had so long waited to see. But how long would it burn? There was no sleep for Edison till that question was answered; and it was not answered for forty hours—nearly two days of growing delight and diminishing anxiety.

Such a discovery meant the end of all fruitless experimenting. The secret of the incandescent light was revealed; and the newspapers all over the country—the *Daily Eastern Argus* of Portland

among them—spread the knowledge of the great event in science and prophesied the speedy conquest of kerosene and gas. Late in November Uncle John sent Dora a copy of the *Scientific American* which gave the authoritative account of what had been accomplished.

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EDISON IN HIS LIBRARY.

"But," wrote Uncle John in the letter accompanying the paper, "now the real work has only begun. The Wizard knows that some carbonized material is what he needs, but he is sure that carbonized cotton thread is not the best thing. Now he is carbonizing everything he can lay his hands on—straw, tissue paper, soft paper, all kinds of cardboard, all kinds of threads, fish line, threads rubbed with tarred lampblack, fine threads plaited together in strands, cotton soaked in boiling tar, lamp wick, twine, tar and lampblack mixed, and many other materials that I can't remember. Why," finished Uncle John, "so far he has examined no fewer than six thousand different species of vegetable growth alone. Somebody said something to him the other day about his wonderful genius. 'Well,' modestly answered the great man, mopping his forehead with his handkerchief, 'genius, I think, is one per cent *inspiration* and ninety-nine per cent *perspiration*.'"

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In December there came into Dora's life the most happy and exciting experience of her childhood. The letter from Uncle John in November had ended with this paragraph:

"I am looking forward to my visit to Maine next month, but I'm sorry to say it must be earlier and shorter than usual. I have an important engagement here for the twenty-fourth, and I'm planning to reach Maine on Saturday, the twentieth, spend Sunday with you, and leave there the twenty-second. But I have thought of a way of making my visit last longer and of giving you a new kind of Christmas present. That way is to take you back with me to Jersey and let you see what Christmas and New Year's in the neighborhood of New York are like. If you approve my new idea for Christmas, I want you to let me know at once."

If any twelve-year-old child who lives fifty miles from a city and has never been farther from home than that city in her life is reading this, she will know how Dora felt at the prospect of such a Christmas journey, and she will understand, too, how Dora had her answer ready for the post office in less than an hour after she had read her letter.

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The only event of Dora's wonderful vacation that this story has a right to tell is her visit to Mr. Edison. It happened that in the *Herald* Uncle John bought as the train was nearing New York, there was a long article describing the lighting system that Mr. Edison had put into successful operation at Menlo Park. "Interest is getting so great in the incandescent light," remarked Uncle John, "that I shouldn't wonder if Mr. Edison let the public see it in operation. If he does, you and I are going to Menlo Park."

The prophecy was a true one. On New Year's Mr. Edison opened his grounds to the public, the railroad ran special trains, and over three thousand people visited Menlo Park. Here is the enthusiastic letter that Dora wrote next day to Maine:

NEWARK, N. J.
Jan. 1, 1880

Dear Father and Mother,

I have been to Fairyland. The enclosed clippings will tell you all about it. I saw the king of the fairies too—I mean Mr. Edison—and he said, "Good evening, little girl," to me. He talked with Uncle John quite a while, and I heard all they said. Some one asked Mr. Edison when New York would be lighted by electricity and he answered, "I'm working night and day, but you see I have to produce not only a practicable lamp, but a whole system. I haven't found the best material for filaments yet, and there's not a place in the world where I can buy the dynamos (those are machines for making the electricity, Uncle John told me) and the smaller appliances."

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Then Uncle John said, "Well, Edison, I'm waiting patiently till you make electric lights cheap enough for me to wire my hotel on the Maine coast. Can you make a prediction?"

"None that's safe," Edison answered. "You know the opposition of the gas companies, and you know the present high cost of the experiments. I've spent already over forty

thousand dollars without returns, and my lamps are costing almost two dollars apiece. The public won't take them till they can be sold for forty cents or less. Moreover, I'm not satisfied with my paper carbon lamps. No, there is much work left; but I shall work day and night till New York has a central station and every appliance we need is manufactured at small cost."

"I suppose eating and sleeping don't bother you much just now," some one said.

"Not very much," answered Edison. "I eat when I'm hungry, and I sleep when I have to. Four hours a night are enough, for I can go to sleep instantly, and I always wake up rested."

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Uncle John says that Mr. Edison is the greatest inventor the world has known. Just think of that! And I have seen him!

Yours affectionately,
DORA

Here are two newspaper clippings that Dora enclosed in her letter:

I

A NIGHT WITH EDISON

*Menlo Park, N. J.
Dec. 30, 1879*

All day long and until late this evening, Menlo Park has been thronged with visitors coming from all directions to see the wonderful "electric light." Nearly every train that stopped brought delegations of sightseers till the depot was overrun and the narrow plank walk leading to the laboratory became alive with people. In the laboratory the throngs practically took possession of everything in their eager curiosity to learn all about the great invention. Four new street lamps were added last night, making six in all, which now give out the horse shoe light in the open air. Their superiority to gas is so apparent, both in steadiness and beauty of illumination, that every one is struck with admiration.

II

The afternoon trains brought some visitors, but in the evening every train set down a couple of score, at least. The visitors never seemed to tire of lighting the lamps upon the two main tables by simply laying one between the two long wires. Most were content to ejaculate "Wonderful!" But no amount of explanation would persuade one old gentleman that it was not an iron wire that was inside the glass tube. "It could not be the carbon filament of a piece of paper, for," said he, "I have seen some red hot, white hot iron wire, only it was not quite so bright, but it looked just like that. That's no filament!"

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"This is a bad time for sceptics," I said to Edison.

"There are some left," he answered. "They die harder than a cat or a snake."

Dora's New York visit colored all the next five years that she worked and waited for college. Her interest in the electric light never wavered for an instant. Like many another, she marveled at the thoroughness of Mr. Edison's search for the right sort of filament and followed expectantly reports of those men whom he sent around the world in search of it.

She read with a bit of almost personal pride the item in the Portland paper that told how, on September 4, 1882, at three o'clock in the afternoon, electric light was supplied for the first time to a number of New York customers; and when, in 1884, that same paper stated that at Brockton, Massachusetts, the first theater ever lighted by electricity from a central plant had been thrown open, she wrote her uncle:

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"I'm sure you'll have to discharge your lamp trimmer pretty soon. But I don't care now, for with father's help, I think I can enter Wellesley in the fall. Of course I hope to work one more summer for you."

Uncle John answered that letter in person, for he needed to go to Maine to make arrangements for the summer.

"I congratulate you, Dora," said he. "You deserve a college course. But I shan't discharge you yet. I expect now to wire the hotel by 1889; but even if I shouldn't need a lamp trimmer all the time till then, I shall always be glad of a capable waitress.—Will you work for me the next three summers?"

"Of course I will, Uncle John," replied Dora as eagerly and gratefully as she had made the same reply six years before. "With the money I can earn the next three summers, I can lessen college expenses a good deal."

So it happened that the ambition of Dora's girlhood; largely through her own pluck and persistence, was realized in due season. Still, she always felt that Mr. Edison unknowingly had a large share in the making of her career; for when in after years she became an instructor in physics at an influential school, she could easily trace back her love for her subject to her interest in the early experiments upon the electric light.

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PART I

In March, 1852, Lucy Hobart began a six months' visit with her grandparents who lived just outside Trenton, New Jersey. One morning at the breakfast table, Grandfather Hobart, whom most people called Lawyer Hobart, said to Lucy, "Little girl, a most important case is being tried at the court house this week. It may not be very interesting to a child, but I think that you, as well as Grandmother, ought to attend this morning. I want you to be able to say that you have heard the great Daniel Webster make a plea."

"Do you mean Daniel Webster of Massachusetts, Grandfather?" inquired Lucy. "I thought," she resumed rather timidly, for she feared Grandfather might think she was contradicting him, "I thought people didn't like him any more."

"You come from a strong anti-slavery family, Lucy, the worst kind," answered Grandfather, good-humoredly. "Webster did seem to many people to sacrifice his ideal in that seventh of March speech two years ago, but he's a keen lawyer yet. His health is broken, though, from the criticism he has suffered. I don't believe he will live much longer. That's why I think you had better go to-day."

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"I should like to ever so much," replied Lucy.

"Is it the Goodyear case?" inquired Grandmother.

"Yes," replied Grandfather. "It's his case against Horace Day, who, I think, has been outrageously infringing his patents."

"It's raining a little," remarked Grandmother. "Shall you take us if it keeps on?"

"If you feel like going. If it hadn't been for Mr. Goodyear, you know, you couldn't have gone anyway on such a day," Grandfather added.

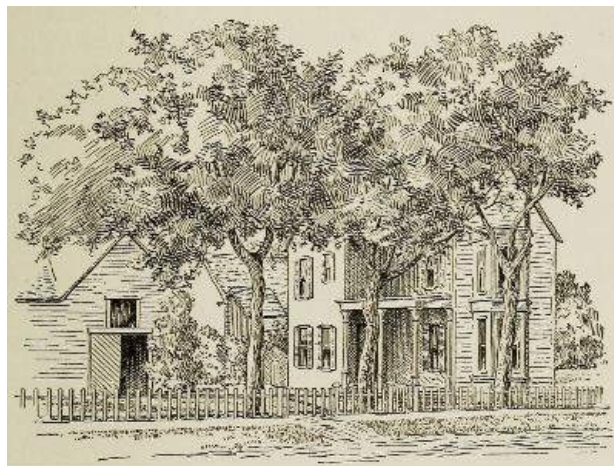
"Why couldn't we?" inquired Lucy, after trying to think it out a few seconds.

"My stars! Don't you, a Boston girl, know about Goodyear and his rubber goods?"

"I don't believe so," answered Lucy. "Unless," she added after a pause, "you mean the man that advertises in the *Transcript* every night. Ever since I could read, I've seen advertisements in the paper about rubber that's been heated to two hundred and eighty degrees."

"Yes, Lucy, that's an advertisement of the Charles Goodyear I mean. I've known him a good many years (he's only a little younger than I, and we were both born in New Haven), and he's had a hard, sad life so far. To be sure, he's reckoned now as one of New Haven's prosperous business men; but unless he wins this suit, his poverty will come back again. Shall I tell you a little about him so that you'll understand some of the references you'll be sure to hear at the trial?"

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BIRTHPLACE OF CHARLES GOODYEAR

"Oh, I wish you would, Grandfather."

Breakfast was over then; and as Grandmother went to the kitchen to give her orders for the day, Grandfather said:

"You and I, Lucy, will sit in front of the fire a little while and talk about Mr. Goodyear. But first you'd better go with Grandmother and let her give you my galoshes and my rubber cap, and her rubber shoes and your own."

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A little girl of to-day, on hearing that request, might not know exactly what she had been sent for. Rubber goods were too expensive then to be common, and "rubber shoes" had not been shortened to our "rubbers." The awkward *galoshes* was just a name for high rubber shoes, or overshoes.

Lucy came back soon, her arms full. The cap she placed on a table, and the three pairs of rubber shoes she put carefully down to warm in front of the fire.

"It wouldn't have been safe to put my galoshes that I had twenty years ago so near the fire," commented Grandfather, as Lucy drew up her chair beside his. "Can you guess what would have happened to them?"

"Would the fire have burned them, Grandfather?"

"Not exactly, but it would have melted them,—at least have made them as soft as suet. What Goodyear has done is to invent a way of preparing rubber or gum elastic so that it can be used in various thicknesses without being stiff as iron in cold weather or softening like wax with the heat." Then Grandfather interrupted his statements with a question:

"Do you know where we get gum elastic, Lucy?"

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"Let's pretend I don't know anything about rubber," answered Lucy judiciously, after a pause. "You begin at the beginning, Grandfather."

Grandfather smiled at the little girl's strategy and began at the beginning.

"Gum elastic is really the dried sap of the South American rubber tree. To get it, the trees are tapped, just as maple trees are tapped here. But the rubber sap is yellowish white and thick as cream. The natives of Brazil long ago discovered that this sap, when hardened, would keep out water. So they made bottles from it and sent the bottles to Europe and the United States. Finally the Portuguese settlers in South America made the hardened sap into shoes; and in 1820 I saw in Boston the first pair of rubber shoes ever brought into the United States. They were as clumsy looking as Chinese shoes. They were gilded, too, not so much to make them beautiful as to keep the rubber from melting."

"Oh, but they must have been handsome," commented Lucy. "They must have looked just like gold slippers. How much did they cost, Grandfather?"

"I don't know, Lucy. I'm not sure that they were intended to be sold. Two years afterward, though, when there were five hundred pairs for sale in Boston, the price was pretty high. I paid five dollars for mine, I remember. These were not gilded, but they were just as thick and unshapely as the first ones were. They were better than nothing, though, when the weather was not too hot nor too cold.

"During the next few years I suppose there were at least a million pairs of rubber shoes brought into this country and sold for four or five dollars a pair. Then, of course, enterprising New Englanders began to think that if people wanted rubber shoes so much, there would be a good deal of profit in manufacturing them. Then rubber companies prospered for a while; but customers soon found that the rubber shoes they bought were spoiled by heat or cold, and every rubber company went rapidly out of existence.

"It was just about this time that Mr. Goodyear sent for me to come to Philadelphia. He was in the jail there, I'm sorry to say, but for no fault of his, and he needed a lawyer's advice. The hardware firm he belonged to had failed, owing thirty thousand dollars; and though he could in no way be blamed for the disaster, on account of our poor debtors' laws he had been sent to prison. In spite of his misfortune, he was not downcast. 'It's unfair, Hobart,' he said; 'but there's a way out. Look into this kettle. That's gum elastic I've been melting. The secret of rubber will pay that thirty thousand dollars and give the world the most important commercial product of the century.'

"I was glad he was so cheerful, for I couldn't give him much encouragement about keeping out of prison. Our laws were unfair, just as he said, and I knew that his creditors were likely to send the poor fellow to prison again and again. And so they did for ten long years. But his faith in rubber never wavered. Just after he had been released the first time, I called on him again. 'Here's the means of good fortune, Hobart,' he cried cheerfully; and he showed me a mass of rubber he was pressing into shape with his wife's rolling-pin."

"I'm afraid there was always more rubber than bread under that rolling pin!" commented Grandmother, just then passing through the room on an errand.

"I'm afraid so," agreed Grandfather. "But, Lucy, your grandmother never had much patience with Mr. Goodyear's experiments. I remonstrated a good many times, myself. 'Goodyear,' said I, when I found him once in a little attic room in New York, boiling his gum with all sorts of chemicals, 'why not give it up? You can't do it without money, and nobody believes in rubber now.'

"Don't try to discourage me,' he answered. 'I know I shall succeed. What is hidden and unknown and cannot be discovered by scientific research will most likely be discovered by accident; and it will be discovered by the one who applies himself most perseveringly to his task.'



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TAPPING A RUBBER TREE

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NATIVES DRYING RUBBER

"No one could dissuade him. He borrowed money and made several hundred pairs of handsome rubber shoes that, when summer came, melted and smelled so bad they had to be buried; he won a prize for his beautiful rubber tablecloths and piano covers, but a drop of acid stained and spoiled them. The story of these years was disappointment and poverty. Once, to pay the house-rent, Mrs. Goodyear had to sell the household linen that she herself had spun; and many times, if kind friends had not sent food and money, the little Goodyear children would have had nothing to eat.

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"Still, even in those dark days, there were moments of rejoicing. Three times Goodyear thought he had succeeded: once, when he mixed magnesia with the rubber; once, when he boiled the rubber in quicklime and water; and once, when he cured the surface of his rubber with what chemists call nitric acid. Moreover, another experimenter gave him a valuable clue. Some one in Massachusetts, a man named Hayward, I believe, claimed that in a dream, he had been told to use sulphur in rubber-curing. He obeyed the dream, patented the process, and sold the patent to Goodyear. After that, Goodyear could make thin rubber fabric that could withstand both heat and cold. But he wanted to cure rubber in masses, not in films."

"Couldn't he sell the things he made of the thin rubber, Grandfather?"

"Yes, he sold a number of aprons and tablecloths and such articles, but they didn't bring him much money. They attracted attention to him, though, and pretty soon the national post office department gave him an order for one hundred and fifty mail bags. Here was his opportunity. He was almost sure of success this time, for it was summer, and the heat did not seem to affect the rubber at all. Still, when the bags were finished, he hung them up for hotter weather to test, and took a vacation. When he returned, the mail bags were dropping from their hooks in shapeless, ill-smelling lumps. The world said, 'We told you so.' But Goodyear said to me after that failure, 'It wasn't the curing, Hobart, that ruined those bags. It was the coloring matter. That made them decompose.'

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"This failure only made Goodyear redouble his efforts. He moved his family to Woburn, in Massachusetts, where he had been experimenting, and began to work night and day. People who had heard of his persistence would come to see him, and he would tell them of his discoveries and his certain hopes. Finally, one night, when he was talking to such a group, quite by accident he dropped upon a hot stove a piece of rubber that had been mixed with sulphur. To his surprise and delight, the rubber did not melt, but charred like leather. He had found the secret. And what a simple secret it was! Rubber could be cured by mixing it with sulphur and heating it very hot.

"This happened in 1839, when Goodyear was thirty-nine years old. He had practically solved his problem; but for nearly two years more no one would help him or even believe him.

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"There, Lucy, I've told you the story from the beginning. I haven't finished it yet; but I want you to have a chance to say a word. Do you know what this process of curing rubber is called? We tan leather, you know. What do we do to rubber?"

"I don't believe I know, Grandfather."

"I saw you reading about the Latin gods and goddesses yesterday. Who was the god that hammered and made tools?"

"Vulcan, wasn't it?"

"Yes; and we use that word to help name the process of curing rubber. Just add the suffix *-ize* and what do you have?"

"Vul-can-ize," spoke Lucy, slowly.

"That's it. And now can you tell when rubber has been vulcanized?"

"When it has been treated with sulphur and heated very hot."

"And what were the unsuccessful ways of vulcanizing that Goodyear tried?"

"He used magnesia, quicklime and water, and nitric acid."

"Good. That shows you listened and understood. Now I'll tell you the rest. It's a sad story. But Goodyear is prosperous now, you know; and I think Mr. Webster will bring justice back."

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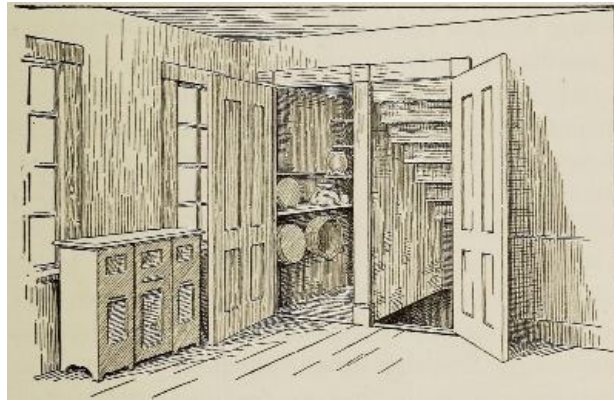
PART II

"When Goodyear dropped that piece of rubber on the hot stove, he lost no time in putting the new process to the test. He nailed the rubber outside the kitchen door in the intense cold. In the morning he brought it in, holding it up exultantly. It was as flexible as when he had put it out the night before. Then he cut a square yard of thick rubber, treated this new piece with sulphur, and with the help of his wife and children cured it in front of his bedroom fire.

"The experiment was a thorough success; and from this piece of rubber he made a cap for himself that has never been injured by any heat or cold or rain or acid. But the process was far from perfect; and Goodyear saw that the changeful heat of an open fire must be replaced by something hotter and steadier and something that he could control. But how hot must the fire be and how long must the heat be applied? Hopefully he set about answering these questions.

"He would toast a lump of rubber over the kitchen fire sometimes an hour, sometimes a whole day; he would hold rubber against the steaming nose of the tea-kettle; he would put a batch of it into the oven of the cook stove and bake it, sometimes two hours, sometimes six. Indeed he would often sit up till long past midnight to watch his baking pans.

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KITCHEN IN WHICH GOODYEAR MADE HIS EXPERIMENTS

"Often he begged his friends in a Woburn factory to lend their oven for his rubber; and they, considering his experiments useless but harmless, would grant his request. Day after day, however, the truth eluded him; and day after day food for his family grew scarcer and scarcer. He pawned everything he could spare, even his children's school books.

"At last one morning after a heavy snow storm, with the secret almost within his grasp, he awoke to find that there was not one particle of food in his house nor one penny in his purse. Besides, he was sicker than most people are when they decide to stay in bed till they feel better. But he had a wife and four children that must be fed. He got up and stumbled through the drifts for nearly five miles, so tired and hungry that many times he almost fainted.

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"Luckily, the friend he went to see proved a real friend, and lent him money enough to support his family and keep on with his experiments during those winter days. But though with this assistance he found out just the details he needed to know for vulcanizing the rubber, ill-health and poverty, instead of growing less, increased with the certainty of his discovery. He was constantly troubled with dyspepsia. He was so deeply in debt that people had no faith in him. They remembered the rubber shoes and the mail bags; but they forgot the splendid courage that had never accepted defeat. As so often happens, Goodyear was a genius without the power of persuasion. He had to wait for his discoveries to be his mouth-piece.

"But his waiting time was his testing time and proved his honesty and his single-heartedness. A French concern offered to pay for the privilege of using his first important discovery—that rubber could be cured by nitric acid—his acid-gas treatment, he called it. What a temptation that offer was, Lucy, it is impossible to realize; but Goodyear was too honest to sell a half truth for a truth, and he wrote to France that he was almost in the possession of a greater secret which he would gladly sell when he had learned it all.

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"Just a little money now stood between Goodyear and assured success; and the quest for a paltry fifty dollars, which would pay his fare to New York and provide for his family during his absence, took him through the darkest days of his life.

"He thought of a friend in Boston who might be willing to lend the money. So, having prevailed upon a Woburn shop keeper to give his family credit for a while, he set out to walk the ten miles to Boston on his pitiful errand. But the friend (perhaps I ought to call him by another name) refused the loan; and, worse luck, while Goodyear was still in Boston, he was sent once more to prison for those debts so long ago forced upon him. His father somehow brought influence to bear for a release; and then Goodyear spent a week tramping about Boston streets, inviting this man and that to lend him a little money, sleeping and eating the while at a small hotel. But every one turned him only a deaf ear; and when the hotel bill came, he had to leave in disgrace.

"That night he walked to Cambridge, where, to his great relief, he found shelter with a friend; and the next morning, more discouraged than ever before, he walked wearily back to Woburn. But a greater trouble awaited him at his threshold. His little boy, two years old, who had been perfectly well when he went away, was dying. His wife was sick in bed; the faithless store keeper had refused further credit, and the family were literally starving. Was there ever a more pitiable case? There was just one friend left, and to him Goodyear turned. That friend sent seven dollars and a reprimand. Moreover, a sympathetic man, happening to hear the story in the friend's office,

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sent the Goodyears a barrel of flour.

"The money and the flour helped, of course, but they could not save the little son's life. Still, those precious dollars must be spent on the living, not the dead; so they carried the little body on a wagon to the grave, and the sorrowing father walked behind.

"I'm glad to say that this is the darkest part of the story. Somebody finally lent Goodyear the fifty dollars he wanted; and the inventor went to New York, interested the right people, proved to a rich brother-in-law that success was in sight, and perfected his rubber.

"When people found that Goodyear had really succeeded with his problem, rubber became even more popular than it had been fifteen years before. Rubber goods began to be manufactured in large quantities; and Goodyear, having patented his process, made the profits he deserved. Do I need to tell you, Lucy, what the honest man did first with his money?"

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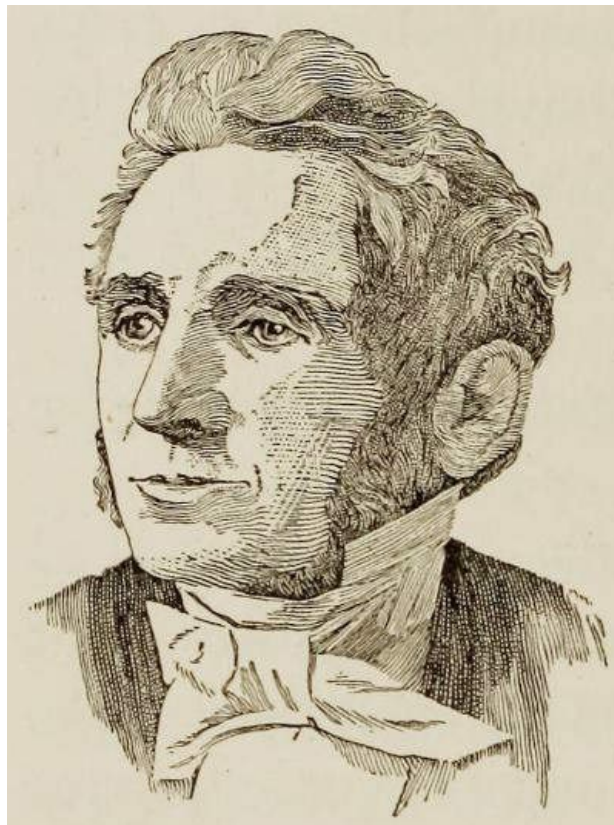
"I don't believe so, Grandfather. Of course he paid his debts."

"Indeed he did. And besides, he's been able to maintain his family comfortably ever since. But Goodyear will never be an enormously rich man. He's been wickedly cheated and his patents have been infringed again and again. Of course he's been fighting for his rights, but the case has been dragging on these seven years. His opponent is a man named Day, who is trying to prove that, although he once promised Goodyear not to manufacture any such articles of rubber as must be completed by the use of artificial heat and sulphur, that agreement is invalid because Goodyear is not the inventor of the process."

"He couldn't say so, Grandfather, if he knew all you have just told me, could he?"

"It seems perfectly plain to you, Lucy, as it seems to me, that only Goodyear is entitled to credit for the invention. But I think I have shown you that Goodyear hasn't been much of a business man. He's always been so unfortunate in protecting his own rights that perhaps there will be found some legal flaw in his patents. I sincerely hope not, but the distinguished Rufus Choate has been taking charge of Day's claims; and if those claims have any force, Choate will find it. We shall hear this morning only Webster. Mr. Choate and his partner Mr. Cutting, have already presented their arguments for Day."

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CHARLES GOODYEAR

PART III

It was only a short drive to the court house, and Lucy, with her grandparents, was in her seat promptly at ten o'clock. It was the little girl's first visit to a court room; and the sight of the judges in their gowns and the other solemn-looking officials was strange to her. But she had eyes mostly for two people—Mr. Goodyear and the great Webster. She expected to know Webster, for she had seen many pictures of him; but on the drive over she had asked her grandfather how she should recognize Mr. Goodyear.

"I'll tell you," he replied, "what one of Goodyear's acquaintances once said in answer to a similar question: 'If you meet a man who has on an India rubber cap, stock, coat, vest, and shoes, and carries an India rubber purse without a cent in it, that is he.'"

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Though Lucy had been amused at the description without expecting to profit by it, she now

pressed her grandfather's arm and asked excitedly:

"Is that Mr. Goodyear—that man with the rubber cap and the rubber vest?" indicating a tall, rather thin, kindly, but keen-eyed man who was talking earnestly at the front of the room.

"Yes, it is. And see, there come Mr. Webster and the judges!"

Silence now settled over the court, and Lucy watched and listened eagerly. The formalities of opening were quickly over. It was announced that the counsel for Mr. Day having spoken previously, the court would listen to that for Mr. Goodyear.

Then slowly and with dignity the great Webster stood up to make what proved to be his last speech in any court room. To Lucy and to many another who looked for the first time upon the most eloquent orator of the century, he was a handsome, scholarly man, with conviction behind every word. Others, however, like Lawyer Hobart, who had known Webster in the earlier days, before he had experienced the humiliation of wide-spread public distrust and the bitterness of repudiated friendships, felt that the once sturdy frame had weakened and that in the depths of those dark eyes the fire of righteous resentment burned less fiercely. But, though crushed in spirit, the great man was still keen and invincible in intellect; and the calm vigor of his mind that morning immortalized in human annals the rugged honesty, the sublime patience of the inventor who, despite discouragement, despite temptation, never stepped aside from his high purpose of bestowing a great good upon mankind.

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Mr. Webster made a long speech, during the technical parts of which, even though Lucy knew that she was listening to the greatest orator in the country, her attention wandered in spite of herself. But, young as she was, she appreciated the straightforward and convincing argument and could follow easily its main points.

"Whatever may be Mr. Goodyear's claims," declared Mr. Webster early in his speech, "to the great invention now spread out to the ends of the earth and known to all the world, this record shows, other records show, everybody knows that he is a man of inquisitive, ingenious, laborious mind."

Then Webster summarized the history of Goodyear's long struggle, referring first to the days when India rubber was useless in weather that was either very hot or very cold.

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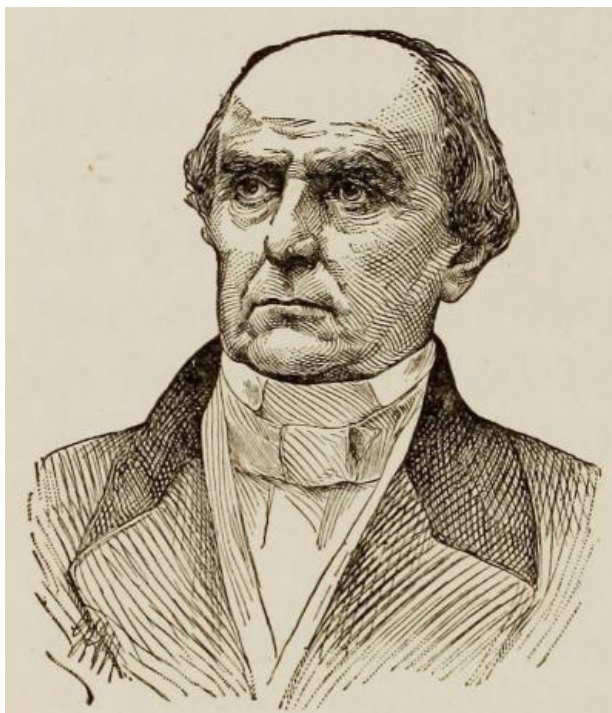
"I well remember," he asserted, "that I had some experience in this matter myself. A friend in New York sent me a very fine cloak of India rubber and a hat of the same material. I did not succeed very well with them. I took the cloak one day and set it out in the cold. It stood very well by itself. I surmounted it with the hat, and many persons passing by thought that they saw on the porch the farmer of Marshfield."

Next the speaker reminded his hearers of the present improvements in such articles, all due to the perseverance of his client, and made a prophecy which our day is rapidly fulfilling:

"I look to the time when ships that traverse the ocean will have India rubber sails, when the sheathing of ships will be composed of this metallic vegetable production. I see, or think I see, thousands of other uses to which this extraordinary product is to be applied."

Then with delicate irony the great lawyer attacked the argument of Mr. Choate. "Those observations are all very eloquent and very pathetic, but they have one drawback. Nothing is beautiful that is not true. The invention exists. Everybody knows and understands it, and everybody connected in former times with the manufacture of India rubber has been astonished and surprised at it.

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DANIEL WEBSTER

"If Charles Goodyear did not make this discovery, who did make it? They do not meet Goodyear's claim by setting up a distinct claim of anybody else. They attempt to prove that he was not the inventor by little shreds and patches of testimony. We want to know the name and the habitation and the location of this man upon the face of the globe who invented vulcanized rubber, if it be not he who now sits before us."

"Well," queried Grandmother on the drive home, "will Goodyear win, I wonder?"

"It's a peculiar case," returned her husband. "Day's in the wrong, I know. But I wish Goodyear had had the vision of the sulphur himself instead of paying Hayward for it."

"But he paid for Hayward's patent," objected Grandmother.

"Yes, luckily. And Webster never pleaded better. It will come out right, I think."

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"Of course Goodyear will win," decided Lucy to herself without knowing she was prejudiced. But aloud she asked, "When will the judge decide, Grandfather?"

"Oh, no one can say," was the reply. "Probably not for some weeks, anyway."

It proved to be six whole months, however, before the decision was rendered. Lucy's visit was almost at an end when one day in September Grandfather came in with the newspaper. "Well, here's good news for Goodyear," he exclaimed. "Hear this." And he read aloud the article which concluded with these words:

"It is due to Mr. Goodyear to say that I am entirely satisfied that he is the original inventor of the process of vulcanizing rubber as stated in his bill; and that he is entitled not only to the relief which he asks, but to all the merits and benefits of that discovery."

"I wonder how much money Goodyear had to pay for his victory," commented Grandmother.

"Oh, Webster will make money. Of course Goodyear won't have to pay it all, for several rubber firms united with him against Day to protect their own interests. The talk among the lawyers when I came away was that Webster would get somewhere in the vicinity of twenty-five thousand dollars. I don't believe Goodyear even in these last years has made so much as that above his expenses. But he's generosity itself when he has anything to give. What do you suppose he's sent to Mr. Webster for a present?"

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"Oh, I don't know. He's so unpractical that he'd give his house away if some one wanted it," answered Grandmother, whose own good judgment could not be denied.

"I think you're a little severe," answered her husband. "But you won't be surprised to know that he's sent to Marshfield that handsome thoroughbred that he drove Webster to the court house with, because Webster admired the animal so much."

"Just exactly like him!" was the response. "He'll probably wish some day he had the money that colt would bring."

Lucy did not go to Trenton again for eight years. On her next visit, strangely enough, Grandfather's household was again talking of the beloved, unpractical dreamer, who by this time had sacrificed his life in the interests of humanity. For Mr. Goodyear had come to the end of his useful, honored, but difficult career. In spite of his triumphant success, his health had been permanently broken by hard work and worry, and his last years had not been entirely free from the occasional threatenings of poverty.

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Indeed, by an unlucky circumstance, again his misfortune but not his fault, he was thrown once more for a short time into a debtors' prison when he was visiting France on a business trip. But the friends who knew him pitied him, trusted him, and honored him to the end; and though Lucy Hobart is now almost seventy-eight years old and has seen most of the prominent Americans of the later nineteenth century, she remembers no one who worked harder or suffered more for the good of humanity than the undaunted Goodyear who insisted, "If it is to be done, it must be done and it will be done. Somebody will yet thank me for it."

THE EASIER WAY OF PRINTING

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PART I

On the very first day of a Christmas vacation about forty years ago Jimmie Granger broke his leg coasting. That meant six weeks in bed and no more of the wonderful coasting of that winter. Jimmie was only twelve years old, and he found it hard to lie still and be cheerful while the other fellows were having so much fun. Every day seemed a week long until he was allowed to sit up; even then each seemed three times as long as usual.

Jimmie's Uncle Francis was so sorry for his unlucky little nephew that he always brought something "to kill time" when he came to spend Sunday at Jimmie's home just outside the big city. Two weeks after the accident Jimmie received from his Uncle Francis the present he liked best of all. It was a small printing press, something entirely new to Jimmie, who had never seen

one before, and never had thought very much about how books and newspapers are actually made.

"If you'll print me every week until you can walk again the *Home Record*, a newspaper page four columns wide and ten inches long, giving the news of the house, and of the neighborhood, too, if you like, I'll give you another double runner, a better sled than the old broken one." [Pg 93]

"Oh, not another double runner! You don't want him to break the other leg!" cried Jimmie's mother.

"Of course not; but you don't want him to stop coasting, do you?" Uncle Francis asked his sister.

"N-o-o," replied Jimmie's mother.

"And we both think he has learned never to take the risk he took before, don't we?"

"Yes," answered Jimmie's mother.

Jimmie wanted a new double runner more than anything else, and so he went right to work on his little newspaper. The printing press was not large enough to print the paper all at once, and so it was printed in parts and these were pasted on a large sheet of paper of the size ordered.

Uncle Francis was specially interested in newspapers, because he was editor of a big city daily called the *Record*. Jimmie felt that of course his uncle would be very critical and that the little *Home Record* must be just right. The morning after he started the paper he had a bright idea: he would ask his mother to be head proof reader—Jimmie felt pretty shaky about spelling and punctuation; and he would ask Tom Frazer, when he came over to see him, if he would not be head reporter and tell him what was happening outside—Tom always knew what the fellows were doing. He could give Tom the rear sled of his old double runner, which was not broken in the accident. Tom had said he should have to have a new sled, and that was really a very good one. [Pg 94]

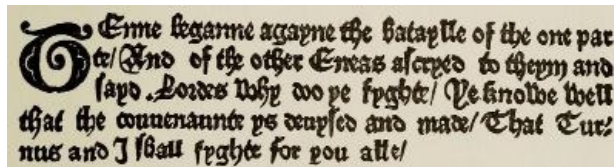


A MONK COPYING MANUSCRIPT BOOKS

Both assistants seemed glad to serve and the work began merrily. When Jimmie's father came home that night he said he would be the "printer's devil." [Pg 95]

"What's that?" asked Jimmie.

"Don't believe they have them now," said his mother.



THE FIRST PRINTING LOOKED LIKE THIS

"They don't need so many of them in these days of steam perfecting presses as they used to, but surely the printer has to have assistants even to-day," said his father. "Perhaps now that machinery does so much of the work the men do not get black and inky enough to be called 'devils.' While Jimmie has to lie with that leg fixed as it is now, he will want some one to run that press when he gets everything ready for the printing. Don't you think so, son?"

Jimmie agreed with his father, as he looked at the leg so straight and stiff.

"I shall be glad to have your help as a—what is it they call it—a pressman? I think that I shall have something ready to print to-morrow night," said Jimmie—and he did.

As Jimmie was the whole newspaper force except the head proof reader, the head reporter, and the head pressman, he had both to set the type and to write the newspaper himself. Writing [Pg 96]

compositions Jimmie detested, but writing a newspaper he found was not half bad.



A TYPE ENLARGED

"Don't see what you can write about," his father said jokingly. "There's nothing doing in this house when *you* have to keep still."

Jimmie did not, however, suffer from any lack of news. In fact, his friends brought him so much that the second day he started a baseball column and the third day a society column.

The type setting was interesting to Jimmie because it was all new to him. His type was just like the type in a printing office. Each piece was a thin bar of metal with a raised letter on the end, unless it had a punctuation mark instead of the letter, or was blank in order to make proper spaces between the words. Each letter of a word had to be picked up by itself out of the case of type and put in place before the next letter of the word could be placed where it belonged.

It was slow work and it was a little hard at first to be spelling a line of words with every letter upside down, but Jimmie found out the very first thing that it had to be so if the words were to be right side up on the printed page. It made *Widow* look like this: $\Delta\text{!}^{\text{Q}}\Delta$ but it did not take long to learn to read the words that way to make sure they were right.

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When the type for the first column of the paper was in order and securely locked into the form which held it, there were two things more to be done—inking the type and pressing the paper on it. Jimmie did the inking and his father put on the paper and took off the impression. The first printing showed that Jimmie had been too lavish with his ink, but the second was so good they put it away for his Uncle Francis.

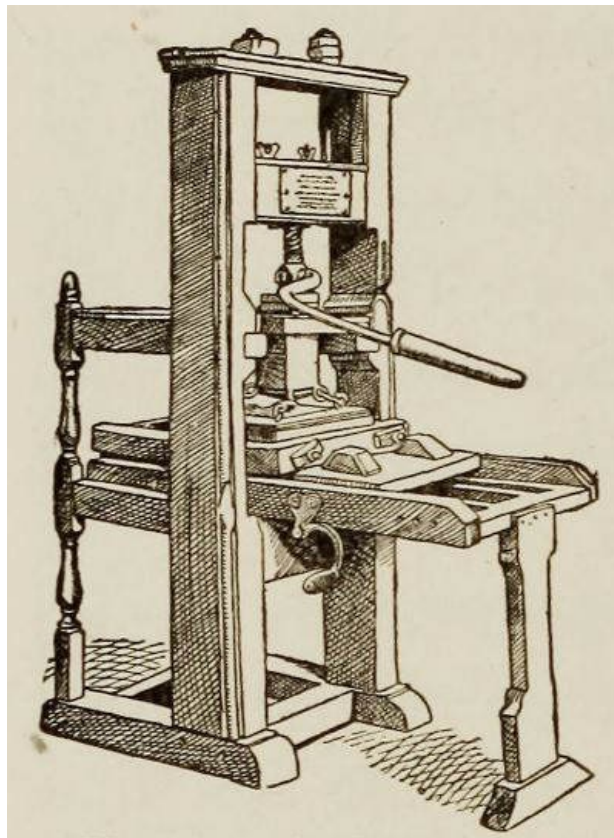
"Our history says that Benjamin Franklin learned the printer's trade. Did he set the type and print this way?" Jimmie asked his uncle the first time he came out after Jimmie became a printer.

"Yes, just that way," answered his uncle. "In Benjamin Franklin's time and most of the time ever since, each letter has had to be picked up by hand and put in place. There is a little type-setting machine now which is quite a help, but we need something better."

"I don't see how you ever get a daily paper ready," exclaimed Jimmie. "It must take millions of letters."

"Not so many, I think," replied his uncle, "but enough so that it does take a good many girls to set the type. There is going to be a great change soon, however, because in a short time there is going to be an entirely new type-setting machine. Mr. Ottman Mergenthaler of Baltimore has been working on one for ten years and it is almost ready for us. When that is perfected it will be as wonderful as the big presses though it is not a large machine. He will call it the linotype (line-of-type). It will work somewhat like a typewriter. When the operator strikes a letter on the keyboard that same letter in the type will be freed from its place in the type case and come sliding down a path, or channel, to take its place in the word and line that is being set. When this machine is perfected one person will be able to do as much as four now can."

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FRANKLIN'S PRINTING PRESS

"If Benjamin Franklin could visit our newspaper office at the present time," continued his uncle, "what would astonish him most are the big steam cylinder presses. He never saw anything but a hand press of the simplest kind."

"Mine is a hand press, isn't it?" asked Jimmie. "Yes, a very small hand press. Many of the old hand presses were taller than a man. One that Benjamin Franklin actually used is in the patent office in Washington. You'll see it some day probably. I think I can describe it so that you can get a picture of it. Did you ever see your Grandmother Manter's cheese press? No? Do you remember the linen press that your Great-aunt Caroline has for decoration now in her dining room? I don't suppose you do. Well, the old hand presses were made on the same principle as the cheese and the linen presses and the cider press. They stood high like the cheese press, and were made of two upright beams with two cross beams between them, like a capital H, only there were two cross pieces instead of one. The lower cross beam served as a support, or table, on which to place the type in the page 'form' when ready for printing.

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"Over the type, after it was inked, was laid the paper, slightly dampened; over this was laid a blanket. Then a heavy weight had to be put on top the blanket and pressed down hard on the inked type in order to make a good print. This weight was a large wooden block fastened to the lower end of a great wooden screw which extended up through the upper cross piece. To turn this screw so that the block was pressed hard enough on the blanket and the paper to get a good clear print, and then to loosen the screw so that the printed sheet could be taken out and dried was no easy matter. The printer must use a long iron bar to turn the screw. This he would fit into a hole, or socket, in the screw and then, using this handle, turn the screw as far as he could."

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"I know," said Jimmie. "There's a picture of that in my history. The poor fellow is just breaking his back to get more of a turn on that screw."

"Yes, that's it. There were several sockets around the head of the screw. The printer would turn the screw as far as he could with the bar in one socket, and then fit the bar into the next to get more of a turn. How I should like to see Franklin or Gutenberg or any other famous old-time printer examining the new press that will be ready for use in the *Record* office in a month or so. I think he would be speechless."

PART II

The day before his uncle's next visit Jimmie set his type to say, "Much interest is felt in the new Hoe press which will be installed in the *Record* office early next month. It is the first of the kind to be used by any newspaper in the city and will mark a revolution in newspaper printing. This new 'perfecting press' will make it possible to print 24,000 eight-page papers an hour—a thing not dreamed of a few years ago. People are anxious to see this fast press printing, cutting, folding, and delivering the papers all ready for the newsboys."

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"You really know of somebody who is anxious to see the press, do you?" asked his uncle with a twinkle in his eye when he read the item in Jimmie's paper.

"Guess I do," said Jimmie. "Honestly, I won't be any bother; I won't be *any* bother; I won't ask any questions except about the press—cross my heart and hope to die."

Uncle Francis laughed. He knew Jimmie too well to think he would not be any bother, but he said, "All right; as soon as you have two good legs again I'll invite you to see the new machinery."

Jimmie's leg mended as fast as the leg of any boy should, and he was able in March to take the trip to the city. Jimmie's mother went with him.

"I want to see the big press, too," she explained to her brother.

"I'm glad you came," said Uncle Francis as he greeted her. "I should think every man and woman in the United States would be interested in this new kind of printing press. Do you know, it will bring down the price of a paper from a nickel to three cents! They have just begun to print the afternoon edition. Shall we go now to see the new Hoe rotary perfecting press? It is the most wonderful thing in printing that has ever been invented since Gutenberg invented movable type more than four hundred years ago. It seems as though it must mark the limit in fast printing, but who knows? Surely Gutenberg and Faust would have thought our old press with the pages of type on a stationary flat bed over which rollers and paper passed, the limit of wonders. Come and see this new press eat up the paper!"

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THE EARLIEST PRINTERS AT WORK

They soon stood before a great throbbing monster, a mystery of wheels within wheels and of gleaming steel. At one end was a huge roll of white paper; at the other was an unceasing stream of newspapers. Jimmie watched in wide-eyed wonder. He heard his uncle say that the huge roll, or web, of white paper was being fed into one end of the press, was being printed on both sides, the newspaper sheets were being cut apart, folded, and finally delivered, counted, at the other end of the press. How could it be done!

"Well, what do you think of it all?" asked Uncle Francis, turning to Jimmie.

Jimmie hardly took his fascinated gaze from the great whirring monster.

"It's great! It's a hundred times more wonderful than I thought it would be! Now that I've seen what this press can do I think I shall run one of these instead of being an editor."

His uncle laughed. "All right," he said; "you see how this runs, do you?"

"Not *all* of it," admitted Jimmie.

"Probably the type part bothers you," said his uncle, "because you are accustomed to seeing the type in a flat steel frame, or chase, as we call it. Here it is on the outside of one of those huge rollers, or cylinders, as we call them. Do you see it?"

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"Yes," said Jimmie, "but there isn't any type on the cylinder just under it."

"No," answered his uncle, "the other is the impression cylinder. Those two big cylinders work together like the rollers of a clothes wringer. That broad ribbon of paper, just as wide as our newspaper, goes between the two cylinders as clothes pass between the rollers of the wringer. The impression cylinder rolls the paper hard against the inked type cylinder and prints one side of the paper. If one of the rollers of a clothes wringer had ink marks on it they would be printed on the clothes as they went between the rollers, wouldn't they? That is the way this press works. Can you see the paper as it goes on?"

"Yes, and there are two more cylinders like the other pair!" cried Jimmie.

"That's right," answered his uncle. "I think you can see that when the paper passes between the second pair the other side of the paper is printed. Just get your eye on the paper as it is unwound from that enormous spool, or web, and watch as far as you can. The white paper in that web is a strip four miles long and as wide as two pages of the *Record*. The type cylinders turn so fast you can't see what is on them, but there is enough type to print four pages of the newspaper on each cylinder."

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"Why do they need such a quantity of small black rollers?" asked Jimmie's mother.

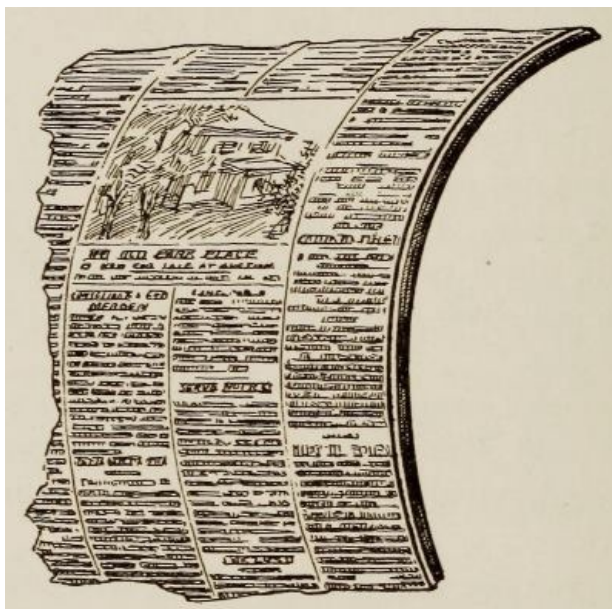
"Those small rollers you are watching are inking cylinders," answered her brother. "They are very important in the printing. See them keep inking the type cylinder, rolling against the part which has just done some printing as it turns around to print again. I don't believe you can see the ink fountain which covers them with ink so that they in turn can cover the type, but it is there, working all the time."

"It is easy enough to see why it is called a rotary press," said Mrs. Granger. "Cylinders and cylinders and cylinders rolling round and round and round."

"Do you see why it is called a perfecting press, Jimmie?" asked Uncle Francis.

"No, I don't believe I do. Do you, mother?" he asked.

"Why, yes, I think so. Look at the other end of the press and see those newspapers fairly pouring out all cut from the web, folded, and even counted. If they are completed in every respect so that there is nothing for anybody to do but sell them, I should think the press might be called a perfecting press."



CURVED STEREOTYPE PLATE

"Shall we go back to the office now where there is less noise and see what to-day's paper says?" asked Uncle Francis after giving Jimmie a good long time to watch the press. "There is one thing more I should like to have you see, but it is too late for you to do so to-day. Give one look at the type cylinder before you leave. Can you see that the type is not in little pieces of one letter each, but is in solid pieces of metal curved to fit the cylinder?" On the way back to the office Uncle Francis showed Jimmie a stereotype plate which he could study at close range.

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"These plates are what you saw on the type cylinder," explained Uncle Francis. "You shall see one made sometime. In these days in the big offices after the real type is set letter by letter it isn't used for the printing at all. It wears it out too fast to print 50,000 newspapers from it each day, and besides it takes too much type. Instead of using the movable type for the printing, we cover the type with a soft substance like soaked up pasteboard, press it hard on the type, dry it, and have a perfect copy of the type except that the letters are little hollows instead of raised pieces.

"This copy, or model, is used for a mold into which we pour liquid metal. When this cools we have, you see, another copy of the type and in this the letters are all raised. The mold is curved to fit the cylinders before the molten metal is poured in, so that the stereotype plate, as the page of fixed type is called, can be clamped tight on the big cylinder. It is these big plates that you have seen used for type on the press cylinders."

"Jingles! but it is some work to print a newspaper!" exclaimed Jimmie.

"Yes, it is, and it is a very wonderful process, too, more wonderful every year. You and your mother will be interested in this paragraph in to-day's paper," said his uncle, passing Mrs. Granger one of the freshly printed papers. "In that article about the new press are some striking comparisons you will enjoy."

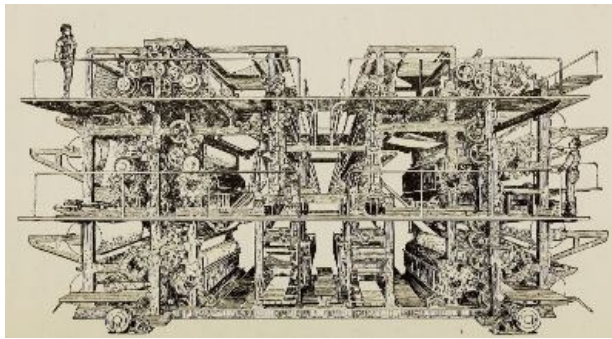
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"What a change in printing!" said Mrs. Granger. "Just listen, Jimmie! 'The old flat screw press of the colonial period could print fifty small papers on one side in an hour; the Washington compound lever hand press in 1829—the best hand press ever made—brought the number up to 250; the revolving cylinder press made it possible to print about 1000 an hour; then in 1847 the Hoe lightning press printed 30,000; and now the Hoe rotary perfecting press prints on both sides,—not a little four-page paper, but a large-sized eight-page paper—at the rate of 24,000 an hour!'"

"Jingles!" said Jimmie again, for what can a boy say to such figures as those.

When Jimmie reached home that night he announced to his father that he was going to be a newspaper man.

"I'm willing," replied his father. "The printing press has done more for the progress of civilization than anything else, and the modern newspaper is one of the greatest factors in the world's advancement. Go ahead. You'll live to see the printing press reach even more people than it does now."



SEXTUPLE PERFECTING PRESS

Mr. Granger was right. When Jimmie was no older than his uncle had been on the day that Jimmie first saw a big press, Jimmie did indeed see another wonder. It was a Hoe Double Octuple Press—the biggest press in the world in 1912—which, with others built on the same principle even if they were smaller, made newspaper printing cheap enough so that a sixteen-page paper could be sold for one cent.

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The grown-up Jimmie felt as he stood by the new press very much as he felt years before. Could there be a more wonderful machine? Eight rolls of paper were feeding the monster; eighteen plate cylinders were revolving, each carrying type enough for eight pages of a large newspaper; the cylinders, turning at a speed of three hundred revolutions a minute, were consuming paper at the rate of 108 miles of paper six feet wide in an hour. Jimmie, then an experienced newspaper man, watched the four sets of folders pouring out thirty-two-page papers at the rate of 75,000 an hour, until he turned away, saying, "Can it be possible that printing will ever be easier? How I wish Benjamin Franklin could see this press! How he would glory in its possibilities! It is perfectly true that the printing press is to literature what the steam engine is to the industries, and what the locomotive is to traffic."

ANNA HOLMAN'S DAGUERRETYPE

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When Anna Holman was twelve years old she had to sit perfectly still for one hundred twenty seconds—think of it! two whole minutes!—to have her picture taken. Now she could have it taken in one hundredth of the time at one hundredth of the cost.

The only likenesses of people which Anna knew about before she was twelve were the pictures in the parlor of her home. Two of these were pictures of her Grandfather and Grandmother Holman, whom she had never seen. These pictures always interested her, though for a certain reason she did not like them.

Anna had been told that her grandmother was a great beauty in her day, and she often tried to see if she could tell how her grandmother had looked. This she never felt sure she knew, as the picture was only a silhouette. Of all the different kinds of pictures that people have had made, the silhouette, surely, is the most unsatisfactory.

These were not uncommon in the days before photography was known. They were made by using a strong light to obtain a clear, black shadow of the profile of the sitter, and then cutting from plain black paper as perfect a copy as possible of the shadow head. Of course, the sitter was always posed for a direct side view in order to get an outline of the features; and, of course, in such a picture the expression of the face was wholly lacking.

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SILHOUETTES OF GRANDFATHER AND GRANDMOTHER

When Grandmother Holman sat for her silhouette and the picture maker had cut out the little black shadow which her beautiful head had made, Grandfather Holman said, "It is perfect, Rebecca"; and then when Grandfather Holman, in turn, had sat for his picture and the picture maker had cut a silhouette which showed very little but his straight nose and strong chin, Grandmother Holman said: "It is just like you, James."

They knew each other well enough to supply the expression which the pictures lacked. In fact they were so well pleased with the little black paper heads that they had them mounted on white cards and framed for the parlor, never dreaming how these same silhouettes would some day

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disappoint a little granddaughter who wanted to know how her grandparents had really looked.

In the same room was a life-size oil portrait of Anna's great grandfather. This she liked, and she felt that she knew just how he had looked.

"Why didn't Grandmother Holman have some artist paint a picture of her?" Anna asked her mother one day.

"It cost too much," her mother answered. "She wanted a portrait of your grandfather and he wanted a portrait of her; and I think there never was money enough to have a good artist paint them both. I wish we were rich enough to have a miniature of you painted, Anna. Perhaps we shall be sometime. Your Aunt Anna in her last letter says she wishes we would send her a daguerreotype of you for her Christmas present.

"I know very little about these new pictures, but they are a wonderful kind which the sun makes. I have heard that they are not very expensive, and I think that if there were only a chance here in town to have the daguerreotype taken we might do what she suggests. These pictures, as I understand it, are entirely different from anything you and I have ever seen: they show the face, the eyes, the smile—everything, like a portrait—but there are no colors; the pictures are all in black and white."

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Anna had really been wondering, ever since she heard of her aunt's wish, why anybody should care to have a picture of a girl who had freckles and straight yellow hair and blue eyes, instead of curly black hair and black eyes. When she heard her mother's last words she laughed merrily.

"Would my hair be black in the picture? And my eyes, too?" she exclaimed.

"Yes, I think so," answered her mother with a smile.

"How lovely! How I hope I can have my picture taken!"

Later that very day when Anna went down town on an errand she saw this notice:

COMING AUGUST 20

Prof. Aaron B. Coleman, Artist,

will open a daguerreotype gallery and furnish perfect likenesses of his patrons for \$2.00 a picture.

Abigail Silsbee joined Anna while she was still studying the notice.

"I'm going to have my picture taken!" exclaimed Abigail joyfully. "Mrs. Follen saw some daguerreotypes in Boston when she was there, and she says they are splendid. She told mother about them yesterday, and mother says I may have one taken. Why don't you have your picture taken?"

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"Perhaps I shall," answered Anna. "I'll tell my father and mother about the notice."

At supper time when Anna brought up the matter of having her picture taken, her father did not approve.

"I do not believe there are any satisfactory pictures except oil portraits," he said. "I think it would be just a waste of money."

By that time, however, Anna had become quite enthusiastic over daguerreotypes. She had learned during the afternoon of three of her friends who were going to have their pictures taken.

"May I have mine taken if I earn the money myself?" she asked.

"Oh, yes, indeed," her father replied, and then dismissed the matter, feeling that when she had seen a daguerreotype she would have no further interest in them.

It was then two weeks before the artist, as he called himself, would come to town. Anna went to work at once picking blueberries. The berries were plentiful, and Anna's purse held enough money for the picture before the two weeks had passed. Anna, however, did not go to the picture gallery the first day it was opened. She waited to see Abigail's picture. When Abigail fairly danced into the house the second afternoon after the artist's arrival, Anna was much disappointed at first, because she thought Abigail had left the picture at home.

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"See!" cried Abigail, holding up something that looked like a little black wooden book. It was about four inches by three and a half and not more than half an inch thick.



Abigail unfastened the two tiny brass hooks which held the two covers together, and displayed the picture inside. Fitted into one of the covers and framed by a mat of red velvet was a likeness of Abigail which made Anna gasp with surprise. There was Abigail's face, Abigail's smile, even the sprigs of roses on Abigail's new delaine dress. It was not a colored picture, to be sure, but otherwise it was just as good a picture as an oil painting, so Anna thought.

Such daguerreotypes as that of Abigail, and the ambrotypes and the ferrotypes which were advertised at almost the same time—so quickly were new kinds of pictures invented when once the process of photography was discovered—were the first portraits made by the camera. Compared with the beautiful photographs of to-day, these pictures taken during the ten years preceding the Civil War seem very poor and unsatisfactory; but to those who had never seen any likenesses except either the oil portraits or the silhouettes, these likenesses made by the camera were very wonderful. [Pg 117]

It is rather surprising that the pictures taken when Anna was a child were as good as those still in existence show them to have been. It had been little more than ten years since Monsieur Daguerre had announced to the French Academy his invention of photography. Unlike most other inventors he actually wished all his discoveries to be made public, and as a result, the further discoveries of other men greatly hastened the development of the art.

In 1839, when Daguerre announced his discovery, he exposed his picture one hour and twelve minutes. This, of course, meant that it could not be used for portraits until the exposure could be reduced to a reasonable length. The use of different chemicals from those Daguerre used soon brought the time of exposure to thirty minutes; but one of the newspapers of the day says that the portraits taken then were "terrific likenesses of the human visage." [Pg 118]

By 1850 such improvements had been made that one writer says that in the large cities cameras were as common as hand organs, and that the pictures were no longer "terrific." The credit for all this surely belongs to the far-seeing inventor who asked that he might give to the public all that he had found out, in order that other men might build on his discoveries.

After seeing three of these new pictures, it was no wonder that Anna could hardly wait until the next day to go to the photographer's herself. That night at bedtime she said to her mother, "I suppose, if my hair is going to look black in the picture, I could have black curls if you were willing to do up my hair on rags."

"Do you really want me to?" asked her mother, hoping Anna would decide against the curls.

"Of course I don't. I was just joking. I want Aunt Anna to have a real picture of me," replied Anna.

The first thing the next morning Anna wanted to know when they should go to the photographer's.

"Right away after dinner I think will be the best time," her mother answered.

Accordingly, as early in the afternoon as possible, Anna dressed to have her picture taken. As this was back in 1853, Anna wore, although she was only twelve years old, a full, ruffled skirt which came almost to the tops of her brown gaiter boots. The boots were her special pride, and as they were the very first she had ever owned with kid vamps and cloth tops, she did hope they would show in the picture. She wore her best white guimpe, which was cut in what was called a half-low neck; her sprigged muslin, which had very large, flowing sleeves; and her new white muslin undersleeves, which had been a present from Aunt Anna. Her hair was parted in the middle and held in place on the sides by a round comb. [Pg 119]

"Do I look all right?" Anna asked, turning slowly for her mother to inspect her.

"Yes, I think so, and to me you look very nice," her mother answered. "Don't you think you'll need your galoshes? The showers last night have left the streets very muddy."

"I'll wear them, for I'm sure I don't want anything to happen to my beautiful boots," said Anna, and so she buckled on a pair of the clumsy rubber overshoes which they wore in those days.

Anna wanted a full length picture; her mother said little, but preferred the head and shoulders only, as the face then would be so much larger and plainer. Finally it was decided to have the little girl seated in a quaintly carved high-backed chair. In those early days of photography Anna must keep still two minutes—one hundred and twenty seconds—instead of one second, and so it was really better to sit than to stand. [Pg 120]

When Anna was seated, she folded her hands, and held her head very high. The photographer said her position seemed a little stiff, and so he turned her head slightly to one side and gave her the choice of a stuffed bird or a paper rose to hold in her hands. Anna chose the rose because it was pink and matched the roses in her new sprigged muslin dress. She forgot that the picture would be all black and white anyway. She felt more at ease when she had something to hold and was sure she could sit as still as a stone for one hundred twenty seconds or even twice that.

The photographer went behind the great, awkward machine which he called a camera and covered up his head and part of the camera, with what looked to Anna like a tablecloth. She almost laughed, and the photographer, who was looking through the camera, told her almost sharply not to smile so much because it made her open her mouth.

"Say 'Flip' to make your mouth small and get it into shape again," he directed.

Anna said "Flip," anxious at the same time to try "Flop" to see if it would make a large mouth. It [Pg 121]

was just as well she did not delay matters just then by trying, for only a very little later she actually read in the Boston *Transcript*: "For a small mouth 'Flip,' for a large mouth 'Cabbage.'"

"All ready," said the man at last, after he had taken his head from under the shawl several times to arrange the folds of Anna's skirt, to turn her head a little more, or to straighten her shoulders. Then he slipped the plate for the picture into place in the camera and said, "Now look pleasant."

Anna did her best to do so, but her mouth felt stiff, and she wanted both to wink and to swallow, and, worst of all, her nose itched. It seemed one hundred twenty minutes instead of one hundred twenty seconds to the little girl, but at last the photographer said, "All done."

In those early days of photography the completed picture was the very plate which had been placed in the camera. They did not know then how to print from the plate as photographers do now, and so the plate on which the image was made was developed and "fixed" and then mounted under glass in such little cases as Abigail's. Only one picture could be made at a time, and pictures were consequently expensive.

It did not take long, however, to develop a daguerreotype and mount it. Soon Anna was looking at her own picture. She thought it very good indeed and secretly felt it more elegant than Abigail's, because she was seated and showed the whole figure, and Abigail's was only of head and shoulders. [Pg 122]

"Good!" said Anna's father when he saw it. "I didn't believe there was much in this new process of photography, but there is. Monsieur Daguerre and all those who have made improvements on his discovery certainly deserve great honor. This is really a picture of my little girl. If this is Aunt Anna's, then I must have another to keep myself."

"It really is a good picture of Anna, isn't it?" said Mrs. Holman as her husband passed it back to her. Then, as she looked again at the picture, she laughed merrily. "It is a very good picture of the galoshes, too."

"The galoshes!" exclaimed Anna.

"The galoshes!" said her father.

"Didn't I take them off?" asked Anna.

"It must be that you didn't," replied her mother. "Never mind; it must be a very fine picture of you yourself or we should have seen the galoshes sooner."

Anna wondered if her Aunt Anna would notice the overshoes. The present reached her aunt in her far-off western home on Christmas day.

"I am delighted with the picture," she wrote. "It is like having a visit from my dear little niece. It seems as if she could speak to me if she wished. What a lovely dress, and what a lovely guimpe! Really, I am so pleased with the picture that I even admire the *galoshes*." [Pg 123]

Anna had many other pictures taken before she was grown up, but she said she always felt the marvel of sitting before a camera for the sun to reflect and imprint her features on a plate which she could not see. Indeed, the faithfulness and the certainty of the result always made her declare that she could never have her picture taken without recalling the lines which Lucy Larcom wrote after her first daguerreotype was made:

"Oh, what if thus our evil deeds
Are mirrored on the sky,
And every line of our wild lives
Daguerreotyped on high."

THE STORY OF THE REAPER

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"What if Cyrus McCormick should be able to make his reaper really work and we could cut all that wheat by machinery! No more dreadful backaches then in harvest time!" said Ezra Harding, as he stood looking out of the back door of a Virginia farmhouse one bright morning in June in the year 1832.

He saw nothing of the beauty all around him; all he saw was acre upon acre of yellow wheat ready to be harvested. How he dreaded the harvesting! It meant the hardest work his father ever asked him to do. Help was so scarce that even Ezra, the youngest of the five Harding boys, though he was only fifteen, had to do a man's work. It made Ezra feel almost eighty to think about the back-breaking work that was to begin the next morning.

At that time all the wheat in the world was cut by hand, and on that account there was not enough raised so that everybody could have white bread. In the old world the peasants used chiefly the sickle to cut the wheat; in the new world the farmers preferred the scythe and cradle. To harvest wheat means both to cut it and to tie the long stalks into bundles, or sheaves, for the drying which is necessary before the wheat kernels are threshed out. Hay can be pitched about hit-or-miss, but not so the wheat. It must be tied up in an orderly fashion so that as it dries it can be gathered into the barns without shaking out and losing too many of the wheat kernels. [Pg 125]



THE OLD WAY OF REAPING

Ezra knew his part would be to swing a cradle scythe. This was a rather broad scythe with a wooden frame attached which was called a cradle. This cradle was nothing more than a set of wooden fingers parallel with the scythe, which helped to lay the cut grain straight in the rows because they collected the grain and carried it to the end of the stroke. The straighter it fell, the easier it was to bundle it. The contrivance was clumsy and Ezra disliked it very much. However, he was thankful he did not have to follow the men who mowed the grain and do the bundling and tying. That work he knew was the most back-breaking of all.

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Ezra was feeling anything but cheerful when he saw his father come out of the barn with a smile on his face.

"What do you think I heard last night at Lexington Court House?" his father asked, coming up the path. "Cyrus McCormick is going to try his new reaping machine here in Lexington in Farmer Ruff's wheat field to-day. I want to see the trial. We'll all go over, if you boys like."

Like to go? Indeed they would, and they thought of nothing but the possibility of a successful reaping machine all through breakfast time.

Late in the season the preceding year Cyrus McCormick had created a sensation by cutting six acres of oats in an afternoon at Steele's Tavern near his home eighteen miles north of the Hardings' farm. None of the Hardings had seen that event, but they had been deeply interested not only because they would welcome a successful reaping machine, but also because the young man's father, Robert McCormick, was a friend of Mr. Harding, and they knew of the repeated trials and failures of the father's reaping machine. In fact, Robert McCormick had worked for fifteen years on a reaper which he had tried for the last time in that same season of 1831 and then had reluctantly put away forever as a failure.

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"I still believe a successful reaping machine is possible, but somebody else will have to make it," he had said sadly.

The Hardings knew that the son Cyrus, who had worked for years with his father, had not given up even then, and, begging his father to leave one small patch of grain for him to use for trial, had started a new machine on a different principle, and late in the season had tried it at home with only his own family to watch its working.

"It is a success!" they had said one to another, but they dared say very little outside because it was still far from satisfactory.

Mr. Harding had learned from the older McCormick that it had not run smoothly, but that it had cut the grain without tangling it and had left it on a platform from which the raker could take it off in good order for the bundling. To the McCormicks, however, it had been a proof that the machine could be made a success, and a few days later, after making some changes, Cyrus McCormick had cut the six acres of oats at Steele's Tavern in one afternoon. It was then too late in the season for other demonstrations, and the Hardings had heard nothing more about the invention until the day before the trial at Lexington in Farmer Ruff's field.

An hour before the time set for the trial of the reaper Ezra Harding and his brothers were at the appointed place. They watched the crowd gather. There were Negroes, and farm laborers, and some owners of farms. Most of the people around Ezra, to his surprise, not only seemed to expect the machine to fail, but actually hoped it would. He could not understand why until he heard two rough, ignorant fellows talk about losing their chance to earn their bread if machines could be made to do the work of men.

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THE FIRST TYPE OF MCCORMICK REAPER

"We'll smash the things," they said, "before we'll have the bread taken out of our mouths by any such contraptions."

Ezra thought it strange they should oppose the invention for he knew how anxious his father was that it should be a success. His father said machinery meant the possibility of larger crops, and therefore not less work, but more work and more wealth for all. Ezra was puzzling over the strange stupidity of these men who could not see what larger crops would mean, and who seemed to want to go on in their old back-breaking toil, at the same pitifully small wages,—for the pay of these days was actually less than a nickel an hour,—when the machine came in view drawn by two horses. Two Negroes were leading the horses because the machine made such a clattering noise that it frightened them. About a hundred spectators had gathered by that time. The crowd jeered at the sight of the strange machine.

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"It's drunk," they said, and laughed uproariously at their own wit.

On it came, turned into the field, and began in a short time to cut the wheat. It did not work well. The field was rough and hilly, and the heavy, cumbersome machine careened like a ship in a gale. The crowd ran up and down the field alongside the machine, hooting at the top of their voices and calling the reaper all kinds of names. The Negroes were doubled up with laughter at the slewing of the unwieldy machine. One man said to another with decision, "Give me the old cradle yet."

Another said scornfully, "It's a humbug!"

Farmer Ruff, rough by nature as well as by name, ran, too, shouting, "Stop! Stop! your machine is rattling the heads off my wheat!"

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It did look as if the trial would end in complete failure. Much as Ezra wished the machine to succeed he had no confidence that it was going to, and he turned to see if he could read his father's thoughts. Just as he turned he saw a fine-looking man on horseback ride up to the jeering crowd. It was Hon. William Taylor. Taking in the situation at a glance he changed everything instantly.

"Pull down the fence," he ordered, pointing to the division fence between his field and that of Farmer Ruff, "and cross over into my wheat field. I'll give you a fair chance to try your machine!"

This opportunity was eagerly seized by the young inventor, and soon he was ready to begin again the trial of his precious machine. Mr. Taylor's field was smoother and less hilly than that of Farmer Ruff. The machine began to cut the grain successfully. Once around! Ezra could scarcely credit his eyes. Round and round the machine went—cutting, cutting, cutting. The heavy clack-clack of the machine was sweet music to the little group of those who were eager for its success.

The crowd became quieter as the grain continued to fall, and many after an hour or two lost all interest in watching and went home. For nearly five hours the reaper was driven around Mr. Taylor's field, and the six acres of wheat were cut in that time—the first wheat in the United States to be cut by machinery. No wonder the young inventor was proud of the accomplishment. His machine had done in less than half a day what he knew would have required, according to the method generally used in Europe, twenty-four peasants with sickles.

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After the trial was over, Mr. Harding and Ezra joined the excited little group around the inventor.

"Your reaper is a success," Ezra heard Robert McCormick say to his son, "and it makes me proud to have a son do what I could not do!" Ezra felt like throwing his cap and cheering. What a joy to have a machine which could do that back-breaking work he had had to do in harvesting the grain!

That night the machine was hauled to the court house square in Lexington. There it was examined by a crowd of curious people who had heard of the successful trial in the afternoon. One of the men who was specially interested in the machine was Professor Bradshaw of the Female Academy of Lexington, a thoughtful man whose judgment was greatly respected in the community. In his usual impressive manner he fairly astounded the bystanders by the wholly improbable statement, "That machine is worth—a—hundred—thousand—dollars!"

"A hundred thousand dollars!" repeated Mr. Harding when the remark was told him the next day. "I think this time Professor Bradshaw is wrong. Cyrus McCormick will be disappointed, surely, if he expects any such large returns from his invention. The great inventors have not become very rich men even when the invention, like the cotton gin, has caused a revolution in a whole industry."

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This was when Cyrus McCormick was twenty-three years old. Before he was an old man the reaper had proved itself worth more millions than the predicted thousands, and Ezra and his father had many a laugh over Mr. Harding's criticism of Professor Bradshaw. However, at the time the astounding remark was made, not even the inventor himself dreamed of the complete change in methods of farming which the reaper would make all over the country. Nobody, indeed, could realize that within the life time of the inventor it would be possible for the farmers of the United States to raise enough wheat to feed the whole world. Most people, naturally enough, perhaps, felt as did Miss Polly Carson when she saw the reaper dragged along the road on the way to Farmer Ruff's field. Years later when she told the story of that day she said:

"I thought it a right smart curious sort of thing, but that it wouldn't amount to much."

The successful trial of the reaper was in 1832, when the United States was about fifty years old. For the next ten years Cyrus McCormick was preaching reapers but he did not succeed in selling them. They seemed very costly to the farmer; and, moreover, they were not the perfect machines we know to-day, machines which work as if they had brains of their own. Not until 1840 was

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Cyrus McCormick successful in selling the reapers, which he made himself at his home. Then he sold two machines for fifty dollars each. Two years later he sold seven for one hundred dollars each. Soon he could sell hundreds.

The West Virginia home was not a good location for making the reapers as it was both difficult and expensive, with the poor railroad facilities of the day, to ship the machines to the great West where it was already plain that the largest number would be used. Accordingly Cyrus McCormick moved nearer his best market, establishing himself first in Cincinnati, but two years later, in 1847, choosing the very new, very muddy, very unattractive little town which has since become the immense city of Chicago. History has shown the wisdom of his choice. Chicago soon became the greatest distributing center of the West, and as the reaper was necessary to work successfully the big wheat fields, it was no uncommon sight as early as the sixties to see, moving out from Chicago, a whole train loaded with nothing but showy bright-red reapers.

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McCORMICK'S REAPING MACHINE

As advertised in *The Working Farmer*, 1852. Notice that a man rides on the machine to rake off the grain.

During the ten years while Cyrus McCormick was struggling to introduce his reaper, Ezra Harding grew to admire more and more the tall, handsome, powerful man who never lost his courage. Ezra believed in reapers almost as fully as did Mr. McCormick himself; and when Mr. McCormick moved to Chicago, Ezra followed him to help make the wonderful machines.

In the years between the first successful trial and the time when Ezra went to Chicago so many changes had been made in the reaper that Miss Polly Carson would hardly have recognized it, had she seen it coming down the road. When the machine was tried in Farmer Ruff's field the grain was cut by a cutting bar similar to that on a mowing machine, then it was caught by a reel and carried to a platform from which it was raked to be tied in bundles. Two men were needed with each machine; one walked beside the horses to drive them, the other walked beside the platform to rake off the wheat for the bundling. Not very long afterward Mr. McCormick added seats for both driver and raker. One of the next big changes was to take off the raker and his seat and put in their place an "iron man." This was really a long iron finger moved by the turning wheels, which did the work of the raker, and automatically pushed off the cut grain in untied bundles.

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Tying, or binding, the bundles remained for years the hardest part of the harvesting. It was the custom to tie the sheaves with a crude rope made of the grain. This hard, back-breaking work required both strength and skill and could be endured only by the strongest men. Even Ezra Harding said:

"No genius will ever live who can make a machine throw a cord around a bundle of wheat and knot that cord securely."

In this, however, Ezra was wrong, for within twenty-five years from the time when the first reapers were sold Ezra saw added to the machine two steel arms which, driven by the revolution of the wheels, caught each bundle of grain before it left the platform on which it was collected, whirled a wire tight around it, fastened the two ends together with a twist, cut it loose, and tossed it on the ground.

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There was then only one complaint made by the farmers. When the grain was fed to cattle they were often injured by pieces of wire. This trouble was remedied later by substituting twine for wire, adding a very ingenious contrivance for knotting the twine, and then the McCormick Reaper and Self-Binder might be said to be perfected.

One man alone, to drive the reaper, could then do what, only twenty years before, had required twenty men. Moreover, the harvesting of a bushel of wheat which required under the slow snip, snip of a sickle three hours could be done in ten minutes! Long before Ezra Harding was an old man he saw moving out of the Chicago freight yards a train loaded with nothing but reapers, carrying these machines not only over the United States but even to Russia and China. He saw the wheat crop of this country doubled and trebled and quadrupled; he saw the time when even a poor man could have white bread to eat, because the cost of a loaf had been cut in two; he saw the reaper bring millions and millions of dollars to its inventor; and he saw not only this great wealth come to the man he himself had long admired, but also, while Cyrus McCormick was still in the prime of life, the honor and fame which have been denied many of the great inventors until after death.

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In 1891 when Harriet Lewis wrote just before her grandmother's annual visit:

"We have something in Portland this year that really will surprise you, Grandma," all the family laughed over her grandmother's answer.

"If you mean the electric cars which I have been reading about in the *Press*," so her grandmother's letter ran, "remember that I have already seen street cars running up and down hill in San Francisco without any horses to draw them, and that it won't be any more surprising to see them running all alone in Portland, even if it is electricity this time which makes them go."

"Can't astonish Grandma, can we?" said Harriet's father, smiling.

It certainly was hard to do so. Grandma had always been a traveler. She was born in Bath, Maine, in the days when Maine was famous for its ship building, and Maine sailing vessels went all around the world. Her father had been a sea captain and Grandma had been to China with him before she was eighteen; her husband also had been a sea captain and she had been around the world twice with him. Grandma had seen so much and was always so interested in what was going on in the world that when she went to Portland to visit her oldest son the family there used to say jokingly:

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"We must find something new to show Grandma or she won't feel that she has been anywhere."

They had all expected Grandma to think it as wonderful as they did that electricity could take the place of horses, and had expected her to be very anxious to see the new cars of which so much had been written. Evidently she did not think them very much ahead of the cable cars.

"Don't be disappointed, Harriet," said Mr. Lewis to his little ten-year old daughter, who was Grandma's namesake. "Wait until Grandma has seen the new cars; perhaps then she will think it as marvelous as we do that electricity can be harnessed to make these cars slide along the rails. She never has believed that electric cars would be a success."

"I remember last year when she was here," said Harriet's mother, turning to the little girl's father, "how she used to say, 'I don't like horse cars on these Maine hills. You ought to have cable cars. They are the only proper things for hills!' and how you used to say, 'Wait until next year, Mother, and you shall see something better than cable cars.'"

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"She always answered, I recall," added Mr. Lewis, "John, never in my lifetime or yours will electricity be anything but a mystery and a danger. It may be used to some extent for lighting, but, mark my words, it can never be made to run heavily loaded cars. It is too absurd to consider."

When Grandma reached Portland, Harriet and her father met her at the station, and drove her home behind steady old Prince, who had drawn the family carriage for years. As they jogged along on the way to the house they met an electric car.

"I really don't see why it should go, but it is plain that it does go. If they keep on going for another twenty-four hours, I am going to have a ride in one to-morrow morning," said Grandma.

"Oh Mother, Mother!" exclaimed the son. "You do like to try new things, don't you? Here I drove Prince to the station just so that you wouldn't have to ride in one of these cars until you became used to seeing them slide along driven by what you call that dangerous fluid."

"Well, I'm going to ride once anyway. I've always tried all the different ways of getting about that I could. Why, I was the very first person from our town to ride in a street car in Boston. That was way back in 1856 in a little bobbing horse car drawn by two horses harnessed tandem. Lots of people then made fun of the little cars, I remember. They said the omnibus was better. They used to have races between car and omnibus sometimes to prove which was better. How the passengers on the one ahead would cheer! In the spring, when the snow was going off, the omnibus, which would still be on runners, would get stuck in the mud and the car would win; in the winter, if there was drifting snow, the car would get stuck and the omnibus would go gliding by with sleigh bells ringing and passengers waving their hands. Oh, it was quite exciting, but the omnibuses were not used a great while after the cars were introduced, as the cars were really more comfortable, more convenient, and could make better time."

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Several times during the first day of her visit Grandma exclaimed, "I am thankful not to see any poor horses straining to draw those cars!"

Pity for the horses had always interfered with Grandma's enjoyment in riding on the horse cars. When she and Harriet had been on their accustomed rides, Harriet always had taken pains to tell when a third horse was added to the usual pair to help draw a car up a hill.

"Now he's on, Grandma," she would say when the car stopped at the foot of a hard hill and a boy brought up the horse which had been waiting there and hooked the heavy tugs to the whiffletree bar so that the third horse could run along beside the others, although just outside the rails. "It's a big horse," she would often add.

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But even this had not satisfied Grandma. She had been in San Francisco when the cable cars were first put in use and she believed them the only car suitable for a hilly city.

"You ought to have the cable cars," she had said many a time. However, before she had watched the electric cars a half day Grandma went so far as to say, "If you could be sure there would be no danger from electricity and be sure of power enough I don't know why these wouldn't do just as well as the cable cars."

"Tell me about the cable cars, won't you, Grandma? What makes them go?" asked Harriet, now

old enough to be interested in the difference between the systems.

"The cable makes them go," answered her grandmother. "It is an endless iron chain which the engine at the central station keeps running all the time. It travels between the rails in an open channel or groove just below ground. The car is carried along by being fastened to this cable. What is it you call the driver of your new cars—a motorman? The man who drives a cable car is called a gripman. It is his business to work the 'grip,' a stout iron contrivance which must catch hold of the cable when the car is to be carried along and must be loosened when the car is to be stopped."

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"Is San Francisco the only city where they have those cars?" asked Harriet.

"Oh, no," answered Grandma. "They have them now in several of the other large cities. San Francisco was the first city to have them. The hills there are so steep that it was out of the question to use horses. Something had to be invented, and Andrew S. Hallidie planned this system which has been used successfully ever since 1873."

"Weren't there any people in those days who thought the cable cars were dangerous, Mother?" asked Harriet's father slyly.

"Oh, dear me, yes," replied his mother. "The gripman himself lost his courage, I remember, on one of the very first trips and stopped his car at the top of his first steep hill. He got off the car and said that, as he had a wife and children, he did not think it would be right for him to take the car down such a hill. The passengers said it was not a case of right or wrong but a case of being scared, and they insisted upon his getting on again and taking them to their journey's end."

"There goes another electric car, Grandma!" said Harriet who was looking out the window. "It goes a good deal faster than a horse car, doesn't it?"

"I should think it did," answered Grandma, "In contrast with travel on horse cars, going as fast as that must seem like flying. How can it be possible to get power enough to drive a big car like that!"

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"It comes right along that overhead wire," answered Harriet's father.

"Oh, yes, I know that from what I have read," continued Grandma. "And it is conducted to the car along that long iron rod which runs from the overhead wire to the car. What is it you call that?"

"The trolley," said Mr. Lewis.

"Then what really happens after the electricity has reached the car?"

"This current of electricity runs to those cylinders in front of the motorman. Then it is where it can be controlled. By the turning of a crank the motorman can turn on the power to start the motor and drive the car ahead, or he can shut it off and make the car stand still. Just as steam power turns the wheels of the locomotive, so electric power turns the wheels of these cars."

"It is very mysterious after all," said Grandma.

"It certainly is," assented her son. "Oliver Wendell Holmes says it is like witchcraft. Have you read his poem which says:

'Since then on many a car you'll see
A broomstick, plain as plain can be;
On every stick there's a witch astride—
The string, you see, to her leg is tied!'"

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Grandma and Harriet laughed.

"How fast are these cars going?" asked Grandma.

"About ten miles an hour including the stops. Probably the rate without stops is about fifteen miles," answered Mr. Lewis.

"There never could be power enough in electricity to drive the car much faster than that, I suppose?" said Grandma.

"Yes, they have already gone considerably faster," replied her son. "I was reading only last night that back in 1880 when Thomas Edison first began his experiments with electricity as a motive power on his own private track at Menlo Park, he drove his little electric train more than twice as fast. In June 1880, Grosvenor Lowry wrote, 'Have spent part of a day at Menlo, and all is glorious. I have ridden at forty miles an hour on Mr. Edison's electric railway—and we ran off the track.'"

"It is dangerous after all, isn't it?" commented Grandma.

"Most people do not think so. That was when they were experimenting and of course accidents were bound to happen. In the three years since Richmond introduced the system of electric cars more than a hundred other cities have introduced it; and a hundred more are putting it in, I suppose, at this present moment."

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"We'll ride to-morrow in one of the new cars, Harriet," said Grandma.

"Goody," said Harriet, "I love to ride in them. I'd like to ride on Mr. Edison's own electric railway, and go forty miles an hour."

"I don't doubt you would, puss," said her father, "but I think he is not using that at all now. He considers the electric railway a success and he is working now on something which his friends say will make it possible to run a horseless carriage without the help of either rails or a trolley."

"Oh, surely that never can be, John," said Grandma.

"I don't know. I should have said the same thing ten years ago about a horseless street car, I think. Edison's friends remind us that first it was the horse without the carriage, then it was the horse and the carriage, and now they say it is surely going to be the carriage without the horse. Wonders do not seem to cease; it may come true."

That night about midnight there was a splintering crash which Grandma thought was only a short distance from her window. Something had certainly happened in the street, but there was no outcry and all was still again in a few minutes after the crash. Grandma could not explain it, but it did not worry her and she went to sleep again. [Pg 147]

Very early in the morning she was wakened again by unusual noises on her side of the house. Going to the window she was surprised to see an electric car across the gutter, stopped apparently in its course by a broken telegraph pole. How had it come there? It seemed to have come down the track on the hill opposite, and then to have come without any track at all straight across the street at the foot of the hill until it crashed into the pole. The front of the car was considerably broken. It had evidently run into the pole with force enough to snap that off short and spoil the front of the car.

Grandma watched with interest the crew which had been sent out to get the injured car back again on the track and take it to the car barn before most people were stirring. They had a smaller car to which they securely fastened the runaway car. Then the little service car pulled the runaway out of the gutter, across the street, and on to the track once more. The last Grandma saw of the wrecked car it was at the top of the hill still being pulled along by the other car.

"There's no question of power," said Grandma to herself. "One small car can run along with a big car trailing after it as easily as if it were alone. There is only one question left in my mind, and that is the question of control of the power. To see a big car right across the gutter surely does not look as if the power were under control." [Pg 148]

At breakfast Grandma told what she had heard and seen.

"Do you know what made the car run away?" she asked her son.

"Yes, I went out to the street last night after the crash and found out. There was just one man out there and he didn't feel very much like talking, but he did finally tell me what had happened. The man I found was the conductor."

"What had become of the motorman? Was he hurt?" asked Mrs. Lewis quickly.

"Nobody was hurt, and nothing was injured except the pole, and the front of the car, and the conductor's feelings. It seems that on the last trip last evening there was nobody on the car except the conductor and the motorman, and so, though it is against the rules, the conductor offered to let the motorman get off when they reached his home, and to take the car himself up to the end of the line and then back a little way to the car barn. His own home is close by the barn. All went well until the new driver was reaching the end of the line just opposite us. Then the trolley slipped off and the car came to a standstill. The conductor stepped off to put the trolley back in place, and he easily and quickly swung it back where it belonged, when—Great Scott!—the car sailed off and left him! Went to the end of the rails and then had momentum enough to roll straight across the street plump into the pole." [Pg 149]

"What made it go?" asked Harriet, completely mystified.

Harriet was not the only one of those present who was puzzled, and they all listened very carefully when Mr. Lewis said, "Because the conductor forgot to shut off the motor when he left the car. As there wasn't any power on when he stepped off, naturally he felt no need of shutting it off, but, unfortunately for him, there was plenty of power as soon as the trolley was on again."

Harriet began to laugh.

"I see! I see! How easy it was to start a real runaway! Nothing to do but to put the trolley on when everything was right for the car to go ahead."

"Exactly," said her father.

"How surprised that poor conductor must have felt," said Grandma.

"How mortified he must have felt," said Mamma.

"He must have felt the way I did when I left the water running and flooded the bathroom," said Harriet sadly.

"I think he had all those feelings," said Mr. Lewis, "judging from what he said last night."

"Well, it proves there's power enough to run a car even without smooth rails," said Grandma. "And perhaps it proves it is well controlled if it runs the car straight ahead even when there is nobody aboard to drive it." [Pg 150]

"I hope this strange introduction to electric cars won't make any difference about your enjoying your ride to-day, Mother," said Mr. Lewis.

"Difference? Why should it? There won't be any more conductors taking the place of motormen to-day, I know," said Grandma.

"Probably not," replied Mr. Lewis, laughing.

"I'm perfectly satisfied with the way the car behaved," said Grandma. "We'll ride and ride to-day,

Harriet."

And ride and ride they surely did. Grandma liked the motion and she was interested in all the details of running the car, even in how the whistle was operated, and how the end of the trolley was connected to the car.

"My introduction to electric cars may have been peculiar," said Grandma that night, "but my acquaintance thus far is entirely satisfactory. I really think I know how they are run and I shouldn't wonder if I could run one as well as the conductor on the car last night."

"If you let the motorman get off and you run the car for him, you won't get off to put the trolley on unless you have shut off the motor, will you, Grandma?" asked Harriet.

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Everybody laughed to think how the car had run away and left the astonished conductor in the road unable to stop it; but Grandma said, "Runaways or no runaways, the electric car is the marvel of the age. It does not seem as if the mind of man could devise anything more wonderful than this harnessing of electricity; but yet it may be that Harriet will sometime ride in one of the horseless carriages her father spoke of yesterday. If they ever do have such things of course they'll be very, very dangerous, but I do wish"—and everybody knew what Grandma was going to wish—"that I could have just one ride in one myself."

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