The American Woman's Home

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AMERICAN WOMAN'S HOME: OR, PRINCIPLES OF DOMESTIC SCIENCE;

BEING A GUIDE TO THE FORMATION AND MAINTENANCE OF ECONOMICAL, HEALTHFUL, BEAUTIFUL, AND CHRISTIAN HOMES.

BY CATHERINE E. BEECHER AND HARRIET BEECHER STOWE

TO THE WOMEN OF AMERICA, IN WHOSE HANDS REST THE REAL DESTINIES OF THE REPUBLIC, AS MOULDED BY THE EARLY TRAINING AND PRESERVED AMID THE MATURER INFLUENCES OF HOME, THIS VOLUME IS AFFECTIONATELY INSCRIBED.

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XXXV.

INTRODUCTION.

The authors of this volume, while they sympathize with every honest effort to relieve the disabilities and sufferings of their sex, are confident that the chief cause of these evils is the fact that the honor and duties of the family state are not duly appreciated, that women are not trained for these duties as men are trained for their trades and professions, and that, as the consequence, family labor is poorly done, poorly paid, and regarded as menial and disgraceful.

To be the nurse of young children, a cook, or a housemaid, is regarded as the lowest and last resort of poverty, and one which no woman of culture and position can assume without loss of caste and

respectability.

It is the aim of this volume to elevate both the honor and the remuneration of all the employments that sustain the many difficult and sacred duties of the family state, and thus to render each department of woman's true profession as much desired and respected as are the most honored professions of men.

When the other sex are to be instructed in law, medicine, or divinity, they are favored with numerous institutions richly endowed, with teachers of the highest talents and acquirements, with extensive libraries, and abundant and costly apparatus. With such advantages they devote nearly ten of the best years of life to preparing themselves for their profession; and to secure the public from unqualified members of these professions, none can enter them until examined by a competent body, who certify to their due preparation for their duties.

Woman's profession embraces the care and nursing of the body in the critical periods of infancy and sickness, the training of the human mind in the most impressible period of childhood, the instruction and control of servants, and most of the government and economies of the family state. These duties of woman are as sacred and important as any ordained to man; and yet no such advantages for preparation have been accorded to her, nor is there any qualified body to certify the public that a woman is duly prepared to give proper instruction in her profession.

This unfortunate want, and also the questions frequently asked concerning the domestic qualifications of both the authors of this work, who have formerly written upon such topics, make it needful to give some account of the advantages they have enjoyed in preparation for the important office assumed as teachers of woman's domestic duties.

The sister whose name is subscribed is the eldest of nine children by her own mother, and of four by her step-mother; and having a natural love for children, she found it a pleasure as well as a duty to aid in the care of infancy and childhood. At sixteen, she was deprived of a mother, who was remarkable not only for intelligence and culture, but for a natural taste and skill in domestic handicraft. Her place was awhile filled by an aunt remarkable for her habits of neatness and order, and especially for her economy. She was, in the course of time, replaced by a stepmother, who had been accustomed to a superior style of housekeeping, and was an expert in all departments of domestic administration.

Under these successive housekeepers, the writer learned not only to perform in the most approved manner all the manual employments of domestic life, but to honor and enjoy these duties.

At twenty-three, she commenced the institution which ever since has flourished as "The Hartford Female Seminary," where, at the age of twelve, the sister now united with her in the authorship of this work became her pupil, and, after a few years, her associate. The removal of the family to the West, and failure of health, ended a connection with the Hartford Seminary, and originated a similar one in Cincinnati, of which the younger authoress of this work was associate principal till her marriage.

At this time, the work on _Domestic Economy_, of which this volume may be called an enlarged edition, although a great portion of it is entirely new, embodying the latest results of science, was prepared by the writer as a part of the _Massachusetts School Library_, and has since been extensively introduced as a text-book into public schools and higher female seminaries. It was followed by its sequel, _The Domestic Receipt-Book_, widely circulated by the Harpers in every State of the Union.

These two works have been entirely remodeled, former topics rewritten, and many new ones introduced, so as to include all that is properly embraced in a complete Encyclopedia of Domestic Economy.

In addition to the opportunities mentioned, the elder sister, for many years, has been studying the causes and the remedies for the decay of constitution and loss of health so increasingly prevalent among American women, aiming to promote the establishment of _endowed_ institutions, in which women shall be properly trained for their profession, as both housekeepers and health-keepers. What advantages have thus been received and the results thus obtained will appear in succeeding pages.

During the upward progress of the age, and the advance of a more enlightened Christianity, the writers of this volume have gained more elevated views of the true mission of woman--of the dignity and importance of her distinctive duties, and of the true happiness which will be the reward of a right appreciation of this mission, and a proper performance of these duties.

There is at the present time an increasing agitation of the public mind, evolving many theories and some crude speculations as to woman's rights and duties. That there is a great social and moral power in her keeping, which is now seeking expression by organization, is manifest, and that resulting plans and efforts will involve some mistakes, some collisions, and some failures, all must expect.

But to intelligent, reflecting, and benevolent women--whose faith rests on the character and teachings of Jesus Christ--there are great principles revealed by Him, which in the end will secure the grand result which He taught and suffered to achieve. It is hoped that in the following pages these principles will be so exhibited and illustrated as to aid in securing those rights and advantages which Christ's religion aims to provide for all, and especially for the most weak and defenseless of His children.

CATHARINE E. BEECHER.

[Illustration]

CHAPTER I.

THE CHRISTIAN FAMILY.

It is the aim of this volume to elevate both the honor and the remuneration of all employments that sustain the many difficult and varied duties of the family state, and thus to render each department of woman's profession as much desired and respected as are the most honored professions of men.

What, then, is the end designed by the family state which Jesus Christ came into this world to secure?

It is to provide for the training of our race to the highest possible intelligence, virtue, and happiness, by means of the self-sacrificing labors of the wise and good, and this with chief reference to a future immortal existence. The distinctive feature of the family is self-sacrificing labor of the stronger and wiser members to raise the weaker and more ignorant to equal advantages. The father undergoes toil and self-denial to provide a home, and then the mother becomes a self-sacrificing laborer to train its inmates. The useless, troublesome infant is served in the humblest offices; while both parents unite in training it to an equality with themselves in every advantage. Soon the older children become helpers to raise the younger to a level with their own. When any are sick, those who are well become self-sacrificing ministers. When the parents are old and useless, the children become their self-sacrificing servants.

Thus the discipline of the family state is one of daily self-devotion of the stronger and wiser to elevate and support the weaker members. Nothing could be more contrary to its first principles than for the older and more capable children to combine to secure to themselves the highest advantages, enforcing the drudgeries on the younger, at the sacrifice of their equal culture.

Jesus Christ came to teach the fatherhood of God and consequent brotherhood of man. He came as the "first-born Son" of God and the Elder Brother of man, to teach by example the self-sacrifice by which the great family of man is to be raised to equality of advantages as children of God. For this end, he "humbled himself" from the highest to the lowest place. He chose for his birthplace the most despised village; for his parents the lowest in rank; for his trade, to labor with his hands as a carpenter, being "subject to his parents" thirty years. And, what is very significant, his trade was that which prepares the family home, as if he would teach that the great duty of man is labor--to provide for and train weak and ignorant creatures. Jesus Christ worked with his hands nearly thirty years, and preached less than three. And he taught that his kingdom is exactly opposite to that of the world, where all are striving for the highest positions. "Whoso will be great shall be your minister, and whoso will be chiefest shall be servant of all."

The family state then, is the aptest earthly illustration of the heavenly kingdom, and in it woman is its chief minister. Her great mission is self-denial, in training its members to self-sacrificing labors for the ignorant and weak: if not her own children, then the neglected children of her Father in heaven. She is to rear all under her care to lay up treasures, not on earth, but in heaven. All the pleasures of this life end here; but those who train immortal minds are to reap the fruit of their labor through eternal ages.

To man is appointed the out-door labor--to till the earth, dig the mines, toil in the foundries, traverse the ocean, transport merchandise, labor in manufactories, construct houses, conduct civil, municipal, and state affairs, and all the heavy work, which, most of the day, excludes him from the comforts of a home. But the great stimulus to all these toils, implanted in the heart of every true man, is the desire for a home of his own, and the hopes of paternity. Every man who truly lives for immortality responds to the beatitude, "Children are a heritage from the Lord: blessed is the man that hath his quiver full of them!" The more a father and mother live under the influence of that "immortality which Christ hath brought to light," the more is the blessedness of rearing a family understood and appreciated. Every child trained aright is to dwell forever in exalted bliss with those that gave it life and trained it for heaven.

The blessed privileges of the family state are not confined to those who rear children of their own. Any woman who can earn a livelihood, as every woman should be trained to do, can take a properly qualified female associate, and institute a family of her own, receiving to its heavenly influences the orphan, the sick, the homeless, and the sinful, and by motherly devotion train them to follow the self-denying example of Christ, in educating his earthly children for true happiness in this life and for his eternal home.

And such is the blessedness of aiding to sustain a truly Christian home, that no one comes so near the pattern of the All-perfect One as those who might hold what men call a higher place, and yet humble themselves to the lowest in order to aid in training the young, "not as men-pleasers, but as servants to Christ, with good-will doing service as to the Lord, and not to men." Such are preparing for high places in the kingdom of heaven. "Whosoever will be chiefest among you, let him be your servant."

It is often the case that the true humility of Christ is not understood. It was not in having a low opinion of his own character and claims, but it was in taking a low place in order to raise others to a higher. The worldling seeks to raise himself and family to an equality with others, or, if possible, a superiority to them. The true follower of Christ comes down in order to elevate others.

The maxims and institutions of this world have ever been antagonistic to the teachings and example of Jesus Christ. Men toil for wealth, honor, and power, not as means for raising others to an equality with themselves, but mainly for earthly, selfish advantages. Although the experience of this life shows that children brought up to labor have the fairest chance for a virtuous and prosperous life, and for hope of future eternal blessedness, yet it is the aim of most parents who can do so, to lay up wealth that their children need not labor with the hands as Christ did. And although exhorted by our Lord not to lay up treasure on earth, but rather the imperishable riches which are

gained in toiling to train the ignorant and reform the sinful, as yet a large portion of the professed followers of Christ, like his first disciples, are "slow of heart to believe."

Not less have the sacred ministries of the family state been undervalued and warred upon in other directions; for example, the Romish Church has made celibacy a prime virtue, and given its highest honors to those who forsake the family state as ordained by God. Thus came great communities of monks and nuns, shut out from the love and labors of a Christian home; thus, also, came the monkish systems of education, collecting the young in great establishments away from the watch and care of parents, and the healthful and self-sacrificing labors of a home. Thus both religion and education have conspired to degrade the family state.

Still more have civil laws and social customs been opposed to the principles of Jesus Christ. It has ever been assumed that the learned, the rich, and the powerful are not to labor with the hands, as Christ did, and as Paul did when he would "not eat any man's bread for naught, but wrought with labor, not because we have not power "[to live without hand-work,]" but to make ourselves an example."(2 Thess. 3.)

Instead of this, manual labor has been made dishonorable and unrefined by being forced on the ignorant and poor. Especially has the most important of all hand-labor, that which sustains the family, been thus disgraced; so that to nurse young children, and provide the food of a family by labor, is deemed the lowest of all positions in honor and profit, and the last resort of poverty. And so our Lord, who himself took the form of a servant, teaches, "How hardly shall they that have riches enter the kingdom of heaven!"--that kingdom in which all are toiling to raise the weak, ignorant, and sinful to such equality with themselves as the children of a loving family enjoy. One mode in which riches have led to antagonism with the true end of the family state is in the style of living, by which the hand-labor, most important to health, comfort, and beauty, is confined to the most ignorant and neglected members of society, without any effort being made to raise them to equal advantages with the wise and cultivated.

And, the higher civilization has advanced, the more have children been trained to feel that to labor, as did Christ and Paul, is disgraceful, and to be made the portion of a degraded class. Children, of the rich grow up with the feeling that servants are to work for them, and they themselves are not to work. To the minds of most children and servants, "to be a lady," is almost synonymous with "to be waited on, and do no work," It is the earnest desire of the authors of this volume to make plain the falsity of this growing popular feeling, and to show how much happier and more efficient family life will become when it is strengthened, sustained, and adorned by family work.

II.

A CHRISTIAN HOUSE.

In the Divine Word it is written, "The wise woman buildeth her house." To be "wise," is "to choose the best means for accomplishing the best

end." It has been shown that the best end for a woman to seek is the training of God's children for their eternal home, by guiding them to intelligence, virtue, and true happiness. When, therefore, the wise woman seeks a home in which to exercise this ministry, she will aim to secure a house so planned that it will provide in the best manner for health, industry, and economy, those cardinal requisites of domestic enjoyment and success. To aid in this, is the object of the following drawings and descriptions, which will illustrate a style of living more conformed to the great design for which the family is instituted than that which ordinarily prevails among those classes which take the lead in forming the customs of society. The aim will be to exhibit modes of economizing labor, time, and expenses, so as to secure health, thrift, and domestic happiness to persons of limited means, in a measure rarely attained even by those who possess wealth.

At the head of this chapter is a sketch of what may be properly called a Christian house; that is, a house contrived for the express purpose of enabling every member of a family to labor with the hands for the common good, and by modes at once healthful, economical, and tasteful. Of course, much of the instruction conveyed in the following pages is chiefly applicable to the wants and habits of those living either in the country or in such suburban vicinities as give space of ground for healthful outdoor occupation in the family service, although the general principles of house-building and house-keeping are of necessity universal in their application--as true in the busy confines of the city as in the freer and purer quietude of the country. So far as circumstances can be made to yield the opportunity, it will be assumed that the family state demands some outdoor labor for all. The cultivation of flowers to ornament the table and house, of fruits and vegetables for food, of silk and cotton for clothing, and the care of horse, cow, and dairy, can be so divided that each and all of the family, some part of the day, can take exercise in the pure air, under the magnetic and healthful rays of the sun. Every head of a family should seek a soil and climate which will afford such opportunities. Railroads, enabling men toiling in cities to rear families in the country, are on this account a special blessing. So, also, is the opening of the South to free labor, where, in the pure and mild climate of the uplands, open-air labor can proceed most of the year, and women and children labor out of doors as well as within.

In the following drawings are presented modes of economizing time, labor, and expense by the close packing of conveniences. By such methods, small and economical houses can be made to secure most of the comforts and many of the refinements of large and expensive ones. The cottage at the head of this chapter is projected on a plan which can be adapted to a warm or cold climate with little change. By adding another story, it would serve a large family.

[Illustration: Fig. 1.]

Fig. 1 shows the ground-plan of the first floor. On the inside it is forty-three feet long and twenty-five wide, excluding conservatories and front and back projections. Its inside height from floor to ceiling is ten feet. The piazzas each side of the front projection have sliding-windows to the floor, and can, by glazed sashes, be made green-houses in winter. In a warm climate, piazzas can be made at the back side also.

In the description and arrangement, the leading aim is to show how

time, labor, and expense are saved, not only in the building but in furniture and its arrangement. With this aim, the ground-floor and its furniture will first be shown, then the second story and its furniture, and then the basement and its conveniences. The conservatories are appendages not necessary to housekeeping, but useful in many ways pointed out more at large in other chapters.

[Illustration: Fig. 2]

The entry has arched recesses behind the front doors, (Fig. 2,) furnished with hooks for over-clothes in both--a box for over-shoes in one, and a stand for umbrellas in the other. The roof of the recess is for statuettes, busts, or flowers. The stairs turn twice with broad steps, making a recess at the lower landing, whore a table is set with a vase of flowers, (Fig. 3.) On one side of the recess is a closet, arched to correspond with the arch over the stairs. A bracket over the first broad stair, with flowers or statuettes, is visible from the entrance, and pictures can be hung as in the illustration.

The large room on the left can be made to serve the purpose of several rooms by means of a _movable screen_. By shifting this rolling screen from one part of the room to another, two apartments are always available, of any desired size within the limits of the large room. One side of the screen fronts what may be used as the parlor or sitting-room; the other side is arranged for bedroom conveniences. Of this, Fig. 4 shows the front side;--covered first with strong canvas, stretched and nailed on. Over this is pasted panel-paper, and the upper part is made to resemble an ornamental cornice by fresco-paper. Pictures can be hung in the panels, or be pasted on and varnished with white varnish. To prevent the absorption of the varnish, a wash of gum isinglass (fish-glue) must be applied twice.

[Illustration: Fig. 4. CLOSET, RECESS, STAIR LANDING.]

[Illustration: Fig 5.]

Fig. 5 shows the back or inside of the movable screen toward the part of the room used as the bedroom. On one side, and at the top and bottom, it has shelves with _shelf-boxes_, which are cheaper and better than drawers, and much preferred by those using them. Handles are cut in the front and back side, as seen in Fig. 6. Half an inch space must be between the box and the shelf over it, and as much each side, so that it can be taken out and put in easily. The central part of the screen's interior is a wardrobe.

[Image: Panel screens]

This screen must be so high as nearly to reach the ceiling, in order to prevent it from overturning. It is to fill the width of the room, except two feet on each side. A projecting cleat or strip, reaching nearly to the top of the screen, three inches wide, is to be screwed to the front sides, on which light frame doors are to be hung, covered with canvas and panel-paper like the front of the screen. The inside of these doors is furnished with hooks for clothing, for which the projection makes room. The whole screen is to be eighteen inches deep at the top and two feet deep at the base, giving a solid foundation. It is moved on four wooden rollers, one foot long and four inches in diameter. The pivots of the rollers and the parts where there is friction must be rubbed with hard soap, and then a child can move the

whole easily.

A curtain is to be hung across the whole interior of the screen by rings, on a strong wire. The curtain should be in three parts, with lead or large nails in the hems to keep it in place. The wood-work must be put together with screws, as the screen is too large to pass through a, door.

[Illustration: Fig. 6.]
[Illustration: Fig. 7.]
[Illustration: Fig. 8.]

At the end of the room, behind the screen, are two couches, to be run one under the other, as in Fig. 7. The upper one is made with four posts, each three feet high and three inches square, set on casters two inches high. The frame is to be fourteen inches from the floor, seven feet long, two feet four inches wide, and three inches in thickness. At the head, and at the foot, is to be screwed a notched two-inch board, three inches wide, as in Fig. 8. The mortises are to be one inch wide and deep, and one inch apart, to revive slats made of ash, oak, or spruce, one inch square, placed lengthwise of the couch. The slats being small, and so near together, and running lengthwise, make a better spring frame than wire coils. If they warp, they can be turned. They must not be fastened at the ends, except by insertion in the notches. Across the posts, and of equal height with them, are to be screwed head and foot-boards.

The under couch is like the upper, except these dimensions: posts, nine inches high, including castors; frame, six feet two inches long, two feet four inches wide. The frame should be as near the floor as possible, resting on the casters.

[Illustration: Fig. 9.]

The most healthful and comfortable mattress is made by a case, open in the centre and fastened together with buttons, as in Fig. 9; to be filled with oat straw, which is softer than wheat or rye. This can be adjusted to the figure, and often renewed.

Fig. 10 represents the upper couch when covered, with the under couch put beneath it. The coverlid should match the curtain of the screen; and the pillows, by day, should have a case of the same.

[Illustration: Fig. 10.]
[Illustration: Fig. 11.]

Fig. 11 is an ottoman, made as a box, with a lid on hinges. A cushion is fastened to this lid by strings at each corner, passing through holes in the box lid and tied inside. The cushion to be cut square, with side pieces; stuffed with hair, and stitched through like a mattress. Side handles are made by cords fastened inside with knots. The box must be two inches larger at the bottom than at the top, and the lid and cushion the same size as the bottom, to give it a tasteful shape. This ottoman is set on casters, and is a great convenience for holding articles, while serving also as a seat.

The expense of the screen, where lumber averages $4 a hundred, and carpenter labor $3 a day, would be about $30, and the two couches about $6. The material for covering might be cheap and yet pretty. A woman

with these directions, and a son or husband who would use plane and saw, could thus secure much additional room, and also what amounts to two bureaus, two large trunks, one large wardrobe, and a wash-stand, for less than $20--the mere cost of materials. The screen and couches can be so arranged as to have one room serve first as a large and airy sleeping-room; then, in the morning, it may be used as sitting-room one side of the screen, and breakfast-room the other; and lastly, through the day it can be made a large parlor on the front side, and a sewing or retiring-room the other side. The needless spaces usually devoted to kitchen, entries, halls, back-stairs, pantries, store-rooms, and closets, by this method would be used in adding to the size of the large room, so variously used by day and by night.

[Illustration: Fig. 12.]

Fig. 12 is an enlarged plan of the kitchen and stove-room. The chimney and stove-room are contrived to ventilate the whole house, by a mode exhibited in another chapter.

Between the two rooms glazed sliding-doors, passing each other, serve to shut out heat and smells from the kitchen. The sides of the stove-room must be lined with shelves; those on the side by the cellar stairs, to be one foot wide, and eighteen inches apart; on the other side, shelves may be narrower, eight inches wide and nine inches apart. Boxes with lids, to receive stove utensils, must be placed near the stove.

On these shelves, and in the closet and boxes, can be placed every material used for cooking, all the table and cooking utensils, and all the articles used in house work, and yet much spare room will be left. The cook's galley in a steamship has every article and utensil used in cooking for two hundred persons, in a space not larger than this stove-room, and so arranged that with one or two steps the cook can reach all he uses.

In contrast to this, in most large houses, the table furniture, the cooking materials and utensils, the sink, and the eating-room, are at such distances apart, that half the time and strength is employed in walking back and forth to collect and return the articles used.

[Illustration: Fig. 13.]

Fig. 13 is an enlarged plan of the sink and cooking-form. Two windows make a better circulation of air in warm weather, by having one open at top and the other at the bottom, while the light is better adjusted for working, in case of weak eyes.

The flour-barrel just fills the closet, which has a door for admission, and a lid to raise when used. Beside it, is the form for cooking, with a moulding-board laid on it; one side used for preparing vegetables and meat, and the other for moulding bread. The sink has two pumps, for well and for rain-water--one having a forcing power to throw water into the reservoir in the garret, which supplies the water-closet and bath-room. On the other side of the sink is the dish-drainer, with a ledge on the edge next the sink, to hold the dishes, and grooves cut to let the water drain into the sink. It has hinges, so that it can either rest on the cook-form or be turned over and cover the sink. Under the sink are shelf-boxes placed on two shelves run into grooves, with other grooves above and below, so that one may move the shelves

and increase or diminish the spaces between. The shelf-boxes can be used for scouring-materials, dish-towels, and dish-cloths; also to hold bowls for bits of butter, fats, etc. Under these two shelves is room for two pails, and a jar for soap-grease.

Under the cook-form are shelves and shelf-boxes for unbolted wheat, corn-meal, rye, etc. Beneath these, for white and brown sugar, are wooden can-pails, which are the best articles in which to keep these constant necessities. Beside them is the tin molasses-can with a tight, movable cover, and a cork in the spout. This is much better than a jug for molasses, and also for vinegar and oil, being easier to clean and to handle. Other articles and implements for cooking can be arranged on or under the shelves at the side and front. A small cooking-tray, holding pepper, salt, dredging-box, knife and spoon, should stand close at hand by the stove, (Fig. 14.)

[Illustration: Fig. 14.]
[Illustration: Fig. 15.]

The articles used for setting tables are to be placed on the shelves at the front and side of the sink. Two tumbler-trays, made of pasteboard, covered with varnished fancy papers and divided by wires, (as shown in Fig. 15,) save many steps in setting and clearing table. Similar trays, (Fig. 16,) for knives and forks and spoons, serve the same purpose.

[Illustration: Fig. 16.]

The sink should be three feet long and three inches deep, its width matching the cook-form.

[Illustration: Fig. 18.]

Fig. 17 is the second or attic story. The main objection to attic rooms is their warmth in summer, owing to the heated roof. This is prevented by so enlarging the closets each side that their walls meet the ceiling under the garret floor, thus excluding all the roof. In the bed-chambers, corner dressing-tables, as Fig. 18, instead of projecting bureaus, save much space for use, and give a handsome form and finish to the room. In the bath-room must be the opening to the garret, and a step-ladder to reach it. A reservoir in the garret, supplied by a forcing-pump in the cellar or at the sink, must be well supported by timbers, and the plumbing must be well done, or much annoyance will ensue.

The large chambers are to be lighted by large windows or glazed sliding-doors, opening upon the balcony. A roof can be put over the balcony and its sides inclosed by windows, and the chamber extend into it, and be thus much enlarged.

The water-closets must have the latest improvements for safe discharge, and there will be no trouble. They cost no more than an out-door building, and save from the most disagreeable house-labor.
A great improvement, called _earth-closets_, will probably take the place of water-closets to some extent; though at present the water is the more convenient. A description of the earth-closet will be given in another chapter relating to tenement-houses for the poor in large cities.

The method of ventilating all the chambers, and also the cellar, will be described in another chapter.

[Illustration: Fig. 19.]

Fig. 19 represents a shoe-bag, that can be fastened to the side of a closet or closet-door.

[Illustration: Fig. 20.]

Fig. 20 represents a piece-bag, and is a very great labor and space-saving invention. It is made of calico, and fastened to the side of a closet or a door, to hold all the bundles that are usually stowed in trunks and drawers. India-rubber or elastic tape drawn into hems to hold the contents of the bag is better than tape-strings. Each bag should be labeled with the name of its contents, written with indelible ink on white tape sewed on to the bag. Such systematic arrangement saves much time and annoyance. Drawers or trunks to hold these articles can not be kept so easily in good order, and moreover, occupy spaces saved by this contrivance.

[Illustration: Fig. 21. Floor plan]

Fig. 21 is the basement. It has the floor and sides plastered, and is lighted with glazed doors. A form is raised close by the cellar stairs, for baskets, pails, and tubs. Here, also, the refrigerator can be placed, or, what is better, an ice-closet can be made, as designated in the illustration. The floor of the basement must be an inclined plane toward a drain, and be plastered with water-lime. The wash-tubs have plugs in the bottom to let off water, and cocks and pipes over them bringing cold water from the reservoir in the garret and hot water from the laundry stove. This saves much heavy labor of emptying tubs and carrying water.

The laundry closet has a stove for heating irons, and also a kettle on top for heating water. Slides or clothes-frames are made to draw out to receive wet clothes, and then run into the closet to dry. This saves health as well as time and money, and the clothes are as white as when dried outdoors.

The wood-work of the house, for doors, windows, etc., should be oiled chestnut, butternut, white-wood, and pine. This is cheaper, handsomer, and more easy to keep clean than painted wood.

In Fig. 21 are planned two conservatories, and few understand their value in the training of the young. They provide soil, in which children, through the winter months, can be starting seeds and plants for their gardens find raising valuable, tender plants. Every child should cultivate flowers and fruits to sell and to give away, and thus be taught to learn the value of money and to practice both economy and benevolence.

According to the calculation of a house-carpenter, in a place where the average price of lumber is $4 a hundred, and carpenter work $3 a day, such a house can be built for $1600. For those practicing the closest economy, two small families could occupy it, by dividing the kitchen, and yet have room enough. Or one large room and the chamber over it can be left till increase of family and means require enlargement.

A strong horse and carryall, with a cow, garden, vineyard, and orchard, on a few acres, would secure all the substantial comforts found in great establishments, without the trouble of ill-qualified servants.

And if the parents and children were united in the daily labors of the house, garden, and fruit culture; such thrift, health, and happiness would be secured as is but rarely found among the rich.

Let us suppose a colony of cultivated and Christian people, having abundant wealth, who now are living as the wealthy usually do, emigrating to some of the beautiful Southern uplands, where are rocks, hills, valleys, and mountains as picturesque as those of New England, where the thermometer but rarely reaches 90 degrees in summer, and in winter as rarely sinks below freezing-point, so that outdoor labor goes on all the year, where the fertile soil is easily worked, where rich tropical fruits and flowers abound, where cotton and silk can be raised by children around their home, where the produce of vineyards and orchards finds steady markets by railroads ready made; suppose such a colony, with a central church and school-room, library, hall for sports, and a common laundry, (taking the most trying part of domestic labor from each house,)--suppose each family to train the children to labor with the hands as a healthful and honorable duty; suppose all this, which is perfectly practicable, would not the enjoyment of this life be increased, and also abundant treasures be laid up in heaven, by using the wealth thus economized in diffusing similar enjoyments and culture among the poor, ignorant, and neglected ones in desolated sections where many now are perishing for want of such Christian example and influences?

III.

A HEALTHFUL HOME.

When "the wise woman buildeth her house," the first consideration will be the health of the inmates. The first and most indispensable requisite for health is pure air, both by day and night.

If the parents of a family should daily withhold from their children a large portion of food needful to growth and health, and every night should administer to each a small dose of poison, it would be called murder of the most hideous character. But it is probable that more than one half of this nation are doing that very thing. The murderous operation is perpetrated daily and nightly, in our parlors, our bed-rooms, our kitchens, our schoolrooms; and even our churches are no asylum from the barbarity. Nor can we escape by our railroads, for even there the same dreadful work is going on.

The only palliating circumstance is the ignorance of those who commit these wholesale murders. As saith the Scripture, "The people do perish for lack of knowledge." And it is this lack of knowledge which it is woman's special business to supply, in first training her household to intelligence as the indispensable road to virtue and happiness.

The above statements will be illustrated by some account of the manner

in which the body is supplied with healthful nutriment. There are two modes of nourishing the body, one is by food and the other by air. In the stomach the food is dissolved, and the nutritious portion is absorbed by the blood, and then is earned by blood-vessels to the lungs, where it receives oxygen from the air we breathe. This oxygen is as necessary to the nourishment of the body as the food for the stomach. In a full-grown man weighing one hundred and fifty-four pounds, one hundred and eleven pounds consists of oxygen, obtained chiefly from the air we breathe. Thus the lungs feed the body with oxygen, as really as the stomach supplies the other food required.

The lungs occupy the upper portion of the body from the collar-bone to the lower ribs, and between their two lobes is placed the heart.

[Illustration: Fig. 22.]
[Illustration: Fig. 23.]
[Illustration: Fig. 24.]
[Illustration: Fig. 25.]
[Illustration: Fig. 26.]

Fig. 22 shows the position of the lungs, though not the exact shape. On the right hand is the exterior of one of the lobes, and on the left hand are seen the branching tubes of the interior, through which the air we breathe passes to the exceedingly minute air-cells of which the lungs chiefly consist. Fig. 23 shows the outside of a cluster of these air-cells, and Fig. 24 is the inside view. The lining membrane of each air-cell is covered by a network of minute blood-vessels called _capillaries_ which, magnified several hundred times, appear in the microscope as at Fig. 25. Every air-cell has a blood-vessel that brings blood from the heart, which meanders through its capillaries till it reaches another blood-vessel that carries it back to the heart, as seen in Fig. 26. In this passage of the blood through these capillaries, the air in the air-cell imparts its oxygen to the blood, and receives in exchange carbonic acid and watery vapor. These latter are expired at every breath into the atmosphere.

By calculating the number of air cells in a small portion of the lungs, under a microscope, it is ascertained that there are no less than eighteen million of these wonderful little purifiers and feeders of the body. By their ceaseless ministries, every grown person receives, each day, thirty-three hogsheads of air into the lungs to nourish and vitalize every part of the body, and also to carry off its impurities.

But the heart has a most important agency in this operation. Fig. 27 is a diagram of the heart, which is placed between the two lobes of the lungs. The right side of the heart receives the dark and impure blood, which is loaded with carbonic acid. It is brought from every point of the body by branching veins that unite in the upper and the lower _vena cava_, which discharge into the right side of the heart. This impure blood passes to the capillaries of the air-cells in the lungs, where it gives off carbonic acid, and, taking oxygen from the air, then returns to the left side of the heart, from whence it is sent out through the _aorta_ and its myriad branching arteries to every part of the body. When the upper portion of the heart contracts, it forces both the pure blood from the lungs, and the impure blood from the body, through the valves marked V, V, into the lower part. When the lower portion contracts, it closes the valves and forces the impure blood into the lungs on one side, and also on the other side forces the purified blood through the aorta and arteries to all parts of the body.

As before stated, the lungs consist chiefly of air-cells, the walls of which are lined with minute blood-vessels; and we know that in every man these air-cells number _eighteen millions_.

Now every beat of the heart sends two ounces of blood into the minute, hair-like blood-vessels, called capillaries, that line these air-cells, where the air in the air-cells gives its oxygen to the blood, and in its place receives carbonic acid. This gas is then expired by the lungs into the surrounding atmosphere.

Thus, by this powerful little organ, the heart, no less than twenty-eight pounds of blood, in a common-sized man, is sent three times every hour through the lungs, giving out carbonic acid and watery vapor, and receiving the life-inspiring oxygen.

Whether all this blood shall convey the nourishing and invigorating oxygen to every part of the body, or return unrelieved of carbonic acid, depends entirely on the pureness of the atmosphere that is breathed.

Every time we think or feel, this mental action dissolves some particles of the brain and nerves, which pass into the blood to be thrown out of the body through the lungs and skin. In like manner, whenever we move any muscle, some of its particles decay and pass away. It is in the capillaries, which are all over the body, that this change takes place. The blood-vessels that convey the pure blood from the heart, divide into myriads of little branches that terminate in capillary vessels like those lining the air-cells of the lungs. The blood meanders through these minute capillaries, depositing the oxygen taken from the lungs and the food of the stomach, and receiving in return the decayed matter, which is chiefly carbonic acid.

This carbonic acid is formed by the union of oxygen with _carbon_ or _charcoal_, which forms a large portion of the body. Watery vapor is also formed in the capillaries by the union of oxygen with the hydrogen contained in the food and drink that nourish the body.

During this process in the capillaries, the bright red blood of the arteries changes to the purple blood of the veins, which is carried back to the heart, to be sent to the lungs as before described. A portion of the oxygen received in the lungs unites with the dissolved food sent from the stomach into the blood, and no food can nourish the body till it has received a proper supply of oxygen in the lungs. At every breath a half-pint of blood receives its needed oxygen in the lungs, and at the same time gives out an equal amount of carbonic acid and water.

Now, this carbonic acid, if received into the lungs, undiluted by sufficient air, is a fatal poison, causing certain death. When it is mixed with only a small portion of air, it is a slow poison, which imperceptibly undermines the constitution.

We now can understand how it is that all who live in houses where the breathing of inmates has deprived the air of oxygen, and loaded it with carbonic acid, may truly be said to be poisoned and starved; poisoned with carbonic acid, and starved for want of oxygen.

Whenever oxygen unites with carbon to form carbonic acid, or with

hydrogen to form water, heat is generated Thus it is that a land of combustion is constantly going on in the capillaries all over the body. It is this burning of the decaying portions of the body that causes animal heat. It is a process similar to that which takes place when lamps and candles are burning. The oil and tallows which are chiefly carbon and hydrogen, unite with the oxygen of the air and form carbonic acid and watery vapor, producing heat during the process. So in the capillaries all over the body, the carbon and hydrogen supplied to the blood by the stomach, unite with the oxygen gained in the lungs, and cause the heat which is diffused all over the body.

The skin also performs an office, similar to that of the lungs. In the skin of every adult there are no less than seven million minute perspirating tubes, each one fourth of an inch long. If all these were united in one length, they would extend twenty-eight miles. These minute tubes are lined with capillary blood-vessels, which are constantly sending out not only carbonic acid, but other gases and particles of decayed matter. The skin and lungs together, in one day and night, throw out three quarters of a pound of charcoal as carbonic acid, beside other gases and water.

While the bodies of men and animals are filling the air with the poisonous carbonic acid, and using up the life-giving oxygen, the trees and plants are performing an exactly contrary process; for they are absorbing carbonic acid and giving out oxygen. Thus, by a wonderful arrangement of the beneficent Creator, a constant equilibrium is preserved. What animals use is provided by vegetables, and what vegetables require is furnished by animals; and all goes on, day and night, without care or thought of man.

The human race in its infancy was placed in a mild and genial clime, where each separate family dwelt in tents, and breathed, both day and night, the pure air of heaven. And when they became scattered abroad to colder climes, the open fire-place secured a full supply of pure air. But civilization has increased economies and conveniences far ahead of the knowledge needed by the common people for their healthful use. Tight sleeping-rooms, and close, air-tight stoves, are now starving and poisoning more than one half of this nation. It seems impossible to make people know their danger. And the remedy for this is the light of knowledge and intelligence which it is woman's special mission to bestow, as she controls and regulates the ministries of a home.

The poisoning process is thus exhibited in Mrs. Stowe's "House and Home Papers," and can not be recalled too often:

"No other gift of God, so precious, so inspiring, is treated with such utter irreverence and contempt in the calculations of us mortals as this same air of heaven. A sermon on oxygen, if we had a preacher who understood the subject, might do more to repress sin than the most orthodox discourse to show when and how and why sin came. A minister gets up in a crowded lecture-room, where the mephitic air almost makes the candles burn blue, and bewails the deadness of the church--the church the while, drugged by the poisoned air, growing sleepier and sleepier, though they feel dreadfully wicked for being so.

"Little Jim, who, fresh from his afternoon's ramble in the fields, last evening said his prayers dutifully, and lay down to sleep in a most Christian frame, this morning sits up in bed with his hair bristling with crossness, strikes at his nurse, and declares he won't

say his prayers--that he don't want to be good. The simple difference is, that the child, having slept in a close box of a room, his brain all night fed by poison, is in a mild state of moral insanity. Delicate women remark that it takes them till eleven or twelve o'clock to get up their strength in the morning. Query, Do they sleep with closed windows and doors, and with heavy bed-curtains?

"The houses built by our ancestors were better ventilated in certain respects than modern ones, with all their improvements. The great central chimney, with its open fire-places in the different rooms, created a constant current which carried off foul and vitiated air. In these days, how common is it to provide rooms with only a flue for a stove! This flue is kept shut in summer, and in winter opened only to admit a close stove, which burns away the vital portion of the air quite as fast as the occupants breathe it away. The sealing up of fire-places and introduction of air-tight stoves may, doubtless, be a saving of fuel; it saves, too, more than that; in thousands and thousands of cases it has saved people from all further human wants, and put an end forever to any needs short of the six feet of narrow earth which are man's only inalienable property. In other words, since the invention of air-tight stoves, thousands have died of slow poison.

"It is a terrible thing to reflect upon, that our northern winters last from November to May, six long months, in which many families confine themselves to one room, of which every window-crack has been carefully calked to make it air-tight, where an air-tight stove keeps the atmosphere at a temperature between eighty and ninety; and the inmates, sitting there with all their winter clothes on, become enervated both by the heat and by the poisoned air, for which there is no escape but the occasional opening of a door.

"It is no wonder that the first result of all this is such a delicacy of skin and lungs that about half the inmates are obliged to give up going into the open air during the six cold months, because they invariably catch cold if they do so. It is no wonder that the cold caught about the first of December has by the first of March become a fixed consumption, and that the opening of the spring, which ought to bring life and health, in so many cases brings death.

"We hear of the lean condition in which the poor bears emerge from their six months' wintering, during which they subsist on the fat which they have acquired the previous summer. Even so, in our long winters, multitudes of delicate people subsist on the daily waning strength which they acquired in the season when windows and doors were open, and fresh air was a constant luxury. No wonder we hear of spring fever and spring biliousness, and have thousands of nostrums for clearing the blood in the spring. All these things are the pantings and palpitations of a system run down under slow poison, unable to get a step further.

"Better, far better, the old houses of the olden time, with their great roaring fires, and their bed-rooms where the snow came in and the wintry winds whistled. Then, to be sure, you froze your back while you burned your face, your water froze nightly in your pitcher, your breath congealed in ice-wreaths on the blankets, and you could write your name on the pretty snow-wreath that had sifted in through the window-cracks. But you woke full of life and vigor, you looked out into the whirling snow-storms without a shiver, and thought nothing of plunging through drifts as high as your head on your daily way to

school. You jingled in sleighs, you snow-balled, you lived in snow like a snow-bird, and your blood coursed and tingled, in full tide of good, merry, real life, through your veins--none of the slow-creeping, black blood which clogs the brain and lies like a weight on the vital wheels!"

To illustrate the effects of this poison, the horrors of "the Black Hole of Calcutta" are often referred to, where one hundred and forty-six men were crowded into a room only eighteen feet square with but two small windows, and in a hot climate. After a night of such horrible torments as chill the blood to read, the morning showed a pile of one hundred and twenty-three dead men and twenty-three half dead that were finally recovered only to a life of weakness and suffering.

In another case, a captain of the steamer Londonderry, in 1848, from sheer ignorance of the consequences, in a storm, shut up his passengers in a tight room without windows. The agonies, groans, curses, and shrieks that followed were horrible. The struggling mass finally burst the door, and the captain found seventy-two of the two hundred already dead; while others, with blood starting from their eyes and ears, and their bodies in convulsions, were restored, many only to a life of sickness and debility.

It is ascertained by experiments that breathing bad air tends so to reduce all the processes of the body, that less oxygen is demanded and less carbonic acid sent out. This, of course, lessens the vitality and weakens the constitution; and it accounts for the fact that a person of full health, accustomed to pure air, suffers from bad air far more than those who are accustomed to it. The body of strong and healthy persons demands more oxygen, and throws off more carbonic acid, and is distressed when the supply fails. But the one reduced by bad air feels little inconvenience, because all the functions of life are so slow that less oxygen is needed, and less carbonic acid thrown out. And the sensibilities being deadened, the evil is not felt. This provision of nature prolongs many lives, though it turns vigorous constitutions into feeble ones. Were it not for this change in the constitution, thousands in badly ventilated rooms and houses would come to a speedy death.

One of the results of unventilated rooms is _scrofula_, A distinguished French physician, M. Baudeloque, states that:

"The repeated respiration of the same atmosphere is _the_ cause of scrofula. If there be entirely pure air, there may be bad food, bad clothing, and want of personal cleanliness, but scrofulous disease can not exist. This disease _never_ attacks persons who pass their lives in the open air, and always manifests itself when they abide in air which is unrenewed. _Invariably_ it will be found that a truly scrofulous disease is caused by vitiated air; and it is not necessary that there should be a prolonged stay in such an atmosphere. Often, several hours each day is sufficient. Thus persons may live in the most healthy country, pass most of the day in the open air, and yet become scrofulous by sleeping in a close room where the air is not renewed. This is the case with many shepherds who pass their nights in small huts with no opening but a door closed tight at night."

The same writer illustrates this, by the history of a French village where the inhabitants all slept in close, unventilated houses. Nearly all were seized with scrofula, and many families became wholly extinct,

their last members dying "rotten with scrofula." A fire destroyed a large part of this village. Houses were then built to secure pure air, and scrofula disappeared from the part thus rebuilt.

We are informed by medical writers that defective ventilation is one great cause of diseased joints, as well as of diseases of the eyes, ears, and skin.

Foul air is the leading cause of tubercular and scrofulous consumption, so very common in our country. Dr, Guy, in his examination before public health commissioners in Great Britain, says: "Deficient ventilation I believe to be more fatal than _all other causes_ put together." He states that consumption is twice as common among tradesmen as among the gentry, owing to the bad ventilation of their stores and dwellings.

Dr. Griscom, in his work on Uses and Abuses of Air, says:

"Food carried from the stomach to the blood can not become _nutritive_ till it is properly oxygenated in the lungs; so that a small quantity of food, even if less wholesome, may be made nutritive by pure air as it passes through the lungs. But the best of food can not be changed into nutritive blood till it is vitalized by pure air in the lungs."

And again:

"To those who have the care and instruction of the rising generation--the future fathers and mothers of men--this subject of ventilation commends itself with an interest surpassing every other. Nothing can more convincingly establish the belief in the existence of something vitally wrong in the habits and circumstances of civilized life than the appalling fact that _one fourth_ of all who are born die before reaching the fifth year, and _one half_ the deaths of mankind occur under the twentieth year. Let those who have these things in charge answer to their own consciences how they discharge their duty in supplying to the young a _pure atmosphere_, which is the _first_ requisite for _healthy bodies_ and _sound minds_."

On the subject of infant mortality the experience of savages should teach the more civilized. Professor Brewer, who traveled extensively among the Indians of our western territories, states: "I have rarely seen a sick boy among the Indians." Catlin, the painter, who resided and traveled so much among these people, states that infant mortality is very small among them, the reason, of course, being abundant exercise and pure air.

Dr. Dio Lewis, whose labors in the cause of health are well known, in his very useful work, _Weak Lungs and How to Make them Strong_, says:

"As a medical man I have visited thousands of sickrooms, and have not found in _one in a hundred_ of them a pure atmosphere. I have often returned from church doubting whether I had not committed a sin in exposing myself so long to its poisonous air. There are in our great cities churches costing $50,000, in the construction of which, not fifty cents were expended in providing means for ventilation. Ten thousand dollars for ornament, but not ten cents for pure air!

"Unventilated parlors, with gas-burners, (each consuming as much oxygen as several men,) made as tight as possible, and a party of ladies and

gentlemen spending half the night in them! In 1861, I visited a legislative hall, the legislature being in session. I remained half an hour in the most impure air I ever breathed. Our school-houses are, some of them, so vile in this respect, that I would prefer to have my son remain in utter ignorance of books rather than to breathe, six hours every day, such a poisonous atmosphere. Theatres and concert-rooms are so foul that only reckless people continue to visit them. Twelve hours in a railway-car exhausts one, not by the journeying, but because of the devitalized air. While crossing the ocean in a Cunard steamer, I was amazed that men who knew enough to construct such ships did not know enough to furnish air to the passengers. The distress of sea-sickness is greatly intensified by the sickening air of the ship. Were carbonic acid _only black_, what a contrast there would be between our hotels in their elaborate ornament!"

"Some time since I visited an establishment where one hundred and fifty girls, in a single room, were engaged in needle-work. Pale-faced, and with low vitality and feeble circulation, they were unconscious that they were breathing air that at once produced in me dizziness and a sense of suffocation. If I had remained a week with, them, I should, by reduced vitality, have become unconscious of the vileness of the air!"

There is a prevailing prejudice against _night air_ as unhealthful to be admitted into sleeping-rooms, which is owing wholly to sheer ignorance. In the night every body necessarily breathes night air and no other. When admitted from without into a sleeping-room it is colder, and therefore heavier, than the air within, so it sinks to the bottom of the room and forces out an equal quantity of the impure air, warmed and vitiated by passing through the lungs of inmates. Thus the question is, Shall we shut up a chamber and breathe night air vitiated with carbonic acid or night air that is pure? The only real difficulty about night air is, that usually it is damper, and therefore colder and more likely to chill. This is easily prevented by sufficient bed-clothing.

One other very prevalent mistake is found even in books written by learned men. It is often thought that carbonic acid, being heavier than common air, sinks to the floor of sleeping-rooms, so that the low trundle-beds for children should not be used. This is all a mistake; for, as a fact, in close sleeping-rooms the purest air is below and the most impure above. It is true that carbonic acid is heavier than common air, when pure; but this it rarely is except in chemical experiments. It is the property of all gases, as well as of the two (oxygen and nitrogen) composing the atmosphere, that when brought together they always are entirely mixed, each being equally diffused exactly as it would be if alone. Thus the carbonic acid from the skin and lungs, being warmed in the body, rises as does the common air, with which it mixes, toward the top of a room; so that usually there is more carbonic acid at the top than at the bottom of a room. [Footnote: Prof. Brewer, of the Tale Scientific School, says: "As a fact, often demonstrated by analysis, there is generally more carbonic acid near the ceiling than near the floor."] Both common air and carbonic acid expand and become lighter in the same proportions; that is, for every degree of added heat they expand at the rate of 1/480 of their bulk.

Here, let it be remembered, that in ill-ventilated rooms the carbonic acid is not the only cause of disease. Experiments seem to prove that other matter thrown out of the body, through the lungs and skin, is

as truly excrement and in a state of decay as that ejected from the bowels, and as poisonous to the animal system. Carbonic acid has no odor; but we are warned by the disagreeable effluvia of close sleeping-rooms of the other poison thus thrown into the air from the skin and lungs. There is one provision of nature that is little understood, which saves the lives of thousands living in unventilated houses; and that is, the passage of pure air inward and impure air outward through the pores of bricks, wood, stone, and mortar. Were such dwellings changed to tin, which is not thus porous, in less than a week thousands and tens of thousands would be in danger of perishing by suffocation.

These statements give some idea of the evils to be remedied. But the most difficult point is _how_ to secure the remedy. For often the attempt to secure pure air by one class of persons brings chills, colds, and disease on another class, from mere ignorance or mismanagement.

To illustrate this, it must be borne in mind that those who live in warm, close, and unventilated rooms are much more liable to take cold from exposure to draughts and cold air than those of vigorous vitality accustomed to breathe pure air.

Thus the strong and healthy husband, feeling the want of pure air in the night, and knowing its importance, keeps windows open and makes such draughts that the wife, who lives all day in a close room and thus is low in vitality, can not bear the change, has colds, and sometimes perishes a victim to wrong modes of ventilation.

So, even in health-establishments, the patients will pass most of their days and nights in badly-ventilated rooms. But at times the physician, or some earnest patient, insists on a mode of ventilation that brings more evil than good to the delicate inmates.

The grand art of ventilating houses is by some method that will empty rooms of the vitiated air and bring in a supply of pure air _by small and imperceptible currents_.

But this important duty of a Christian woman is one that demands more science, care, and attention than almost any other; and yet, to prepare her for this duty has never been any part of female education. Young women are taught to draw mathematical diagrams and to solve astronomical problems; but few, if any, of them are taught to solve the problem of a house constructed to secure pure and moist air by day and night for all its inmates.

The heating and management of the air we breathe is one of the most complicated problems of domestic economy, as will be farther illustrated in the succeeding chapter; and yet it is one of which, most American women are profoundly ignorant.

IV.

SCIENTIFIC DOMESTIC VENTILATION.

We have seen in the preceding pages the process through which the air

is rendered unhealthful by close rooms and want of ventilation. Every person inspires air about twenty times each minute, using half a pint each time. At this rate, every pair of lungs vitiates one hogshead of air every hour. The membrane that lines the multitudinous air-cells of the lungs in which the capillaries are, should it be united in one sheet, would cover the floor of a room twelve feet square. Every breath brings a surface of air in contact with this extent of capillaries, by which the air inspired gives up most of its oxygen and receives carbonic acid in its stead. These facts furnish a guide for the proper ventilation of rooms. Just in proportion to the number of persons in a room or a house, should be the amount of air brought in and carried out by arrangements for ventilation. But how rarely is this rule regarded in building houses or in the care of families by housekeepers!

The evils resulting from the substitution of stoves instead of the open fireplace, have led scientific and benevolent men to contrive various modes of supplying pure air to both public and private houses. But as yet little has been accomplished, except for a few of the more intelligent and wealthy. The great majority of the American people, owing to sheer ignorance, are, for want of pure air, being poisoned and starved; the result being weakened constitutions, frequent disease, and shortened life.

Whenever a family-room is heated by an open fire, it is duly ventilated, as the impure air is constantly passing off through the chimney, while, to supply the vacated space, the pure air presses in through the cracks of doors, windows, and floors. No such supply is gained for rooms warmed by stoves. And yet, from mistaken motives of economy, as well as from ignorance of the resulting evils, multitudes of householders are thus destroying health and shortening life, especially in regard to women and children who spend most of their time within-doors.

The most successful modes of making "a healthful home" by a full supply of pure air to every inmate, will now be described and illustrated.

It is the common property of both air and water to expand, become lighter and rise, just in proportion as they are heated; and therefore it is the invariable law that cool air sinks, thus replacing the warmer air below. Thus, whenever cool air enters a warm room, it sinks downward and takes the place of an equal amount of the warmer air, which is constantly tending upward and outward. This principle of all fluids is illustrated by the following experiment:

Take a glass jar about a foot high and three inches in diameter, and with a wire to aid in placing it aright, sink a small bit of lighted candle so as to stand in the centre at the bottom. (Fig. 28.) The candle will heat the air of the jar, which will rise a little on one side, while the colder air without will begin falling on the other side. These two currents will so conflict as finally to cease, and then the candle, having no supply of oxygen from fresh air, will begin to go out. Insert a bit of stiff paper so as to divide the mouth of the jar, and instantly the cold and warm air are not in conflict as before, because a current is formed each side of the paper; the cold air descending on one aide and the warm air ascending the other side, as indicated by the arrows. As long as the paper remains, the candle will burn, and as soon as it is removed, it will begin to go out, and can be restored by again inserting the paper.

[Illustration: Fig. 28]

[Illustration: Fig. 29]

This illustrates the mode by which coal-mines are ventilated when filled with carbonic acid. A shaft divided into two passages, (Fig. 29,) is let down into the mine, where the air is warmer than the outside air. Immediately the colder air outside presses down into the mine, through the passage which is highest, being admitted by the escape of an equal quantity of the warmer air, which rises through the lower passage of the shaft, this being the first available opening for it to rise through. A current is thus created, which continues as long as the inside air is warmer than that without the mine, and no longer. Sometimes a fire is kindled in the mine, in order to continue or increase the warmth, and consequent upward current of its air.

This illustrates one of the cases where a "wise woman that buildeth her house" is greatly needed. For, owing to the ignorance of architects, house-builders, and men in general, they have been building school-houses, dwelling-houses, churches, and colleges, with the most absurd and senseless contrivances for ventilation, and all from not applying this simple principle of science. On this point, Prof. Brewer, of the Scientific School of Yale College, writes thus:

"I have been in public buildings, (I have one in mind now, filled with dormitories,) which cost half a million, where they attempted to ventilate every room by a flue, long and narrow, built into partition walls, and extending up into the capacious garret of the fifth story. Every room in the building had one such flue, with an opening into it at the floor and at the ceiling. It is needless to say that the whole concern was entirely useless. Had these flues been of proper proportions, and properly divided, the desired ventilation would have been secured."

And this piece of ignorant folly was perpetrated in the midst of learned professors, teaching the laws of fluids and the laws of health.

A learned physician also thus wrote to the author of this chapter: "The subject of the ventilation of our dwelling-houses is one of the most important questions of our times. How many thousands are victims to a slow suicide and murder, the chief instrument of which is want of ventilation! How few are aware of the fact that every person, every day, vitiates thirty-three hogsheads of the air, and that each inspiration takes one fifth of the oxygen, and returns as much carbonic acid, from every pair of lungs in a room! How few understand that after air has received ten per cent of this fatal gas, if drawn into the lungs, it can no longer take carbonic acid from the capillaries! No wonder there is so much impaired nervous and muscular energy, so much scrofula, tubercles, catarrhs, dyspepsia, and typhoid diseases. I hope you can do much to remedy the poisonous air of thousands and thousands of stove-heated rooms."

In a cold climate and wintry weather, the grand impediment to ventilating rooms by opening doors or windows is the dangerous currents thus produced, which are so injurious to the delicate ones that for their sake it can not be done. Then, also, as a matter of economy, the poor can not afford to practice a method which carries off the heat generated by their stinted store of fuel. Even in a warm season and climate, there are frequent periods when the air without is damp and chilly, and yet at nearly the same temperature as that in the house. At such times, the opening of windows often has little effect in

emptying a room of vitiated air. The ventilating-flues, such as are used in mines, have, in such cases, but little influence; for it is only when outside air is colder that a current can be produced within by this method.

The most successful mode of ventilating a house is by creating a current of warm air in a flue, into which an opening is made at both the top and the bottom of a room, while a similar opening for outside air is made at the opposite side of the room. This is the mode employed in chemical laboratories for removing smells and injurious gases.

The laboratory-closet is closed with glazed doors, and has an opening to receive pure air through a conductor from without. The stove or furnace within has a pipe which joins a larger cast-iron chimney-pipe, which is warmed by the smoke it receives from this and other fires. This cast-iron pipe is surrounded by a brick flue, through which air passes from below to be warmed by the pipe, and thus an upward current of warm air is created. Openings are then made at the top and bottom of the laboratory-closet into the warm-air flue, and the gases and smells are pressed by the colder air into this flue, and are carried off in the current of warm air.

The same method is employed in the dwelling-house shown in a preceding chapter. A cast-iron pipe is made in sections, which are to be united, and the whole fastened at top and bottom in the centre of the warm-air flue by ears extending to the bricks, and fastened when the flue is in process of building. Projecting openings to receive the pipes of the furnace, the laundry stove, and two stoves in each story, should be provided, which must be closed when not in use. A large opening is to be made into the warm-air fine, and through this the kitchen stove-pipe is to pass, and be joined to the cast-iron chimney-pipe. Thus the smoke of the kitchen stove will warm the iron chimney-pipe, and this will warm the air of the flue, causing a current upward, and this current will draw the heat and smells of cooking out of the kitchen into the opening of the warm-air flue. Every room surrounding the chimney has an opening at the top and bottom into the warm-air Hue for ventilation, as also have the bathroom and water-closets.

[Illustration: Fig. 30.]

The writer has examined the methods most employed at the present time, which are all modifications of the two modes here described. One is that of Robinson, patented by a Boston company, which is a modification of the mining mode. It consists of the two ventilating tubes, such as are employed in mines, united in one shaft with a roof to keep out rain, and a valve to regulate the entrance and exit of air, as illustrated in Fig. 30. This method works well in certain circumstances, but fails so often as to prove very unreliable. Another mode is that of Ruttan, which is effected by heating air. This also has certain advantages and disadvantages. But the mode adopted for the preceding cottage plan is free from the difficulties of both the above methods, while it will surely ventilate every room in the house, both by day and night, and at all seasons, without any risk to health, and requiring no attention or care from the family.

By means of a very small amount of fuel in the kitchen stove, to be described hereafter, the whole house can be ventilated, and all the cooking done both in warm and cold weather. This stove will also warm the whole house, in the Northern States, eight or nine months in the

year. Two Franklin stoves, in addition, will warm the whole house during the three or four remaining coldest months.

In a warm climate or season, by means of the non-conducting castings, the stove will ventilate the house and do all the cooking, without imparting heat or smells to any part of the house except the stove-closet.

At the close of this volume, drawings, prepared by Mr. Lewis Leeds, are given, more fully to illustrate this mode of warming and ventilation, and in so plain and simple a form that any intelligent woman who has read this work can see that the plan is properly executed, even with workmen so entirely ignorant on this important subject as are most house-builders, especially in the newer territories. In the same article, directions are given as to the best modes of ventilating houses that are already built without any arrangements for ventilation.

V.
THE CONSTRUCTION AND CARE OF STOVES, FURNACES, AND CHIMNEYS.

If all American housekeepers could be taught how to select and manage the most economical and convenient apparatus for cooking and for warming a house, many millions now wasted by ignorance and neglect would be saved. Every woman should be taught the scientific principles in regard to heat, and then their application to practical purposes, for her own benefit, and also to enable her to train her children and servants in this important duty of home life on which health and comfort so much depend.

The laws that regulate the generation, diffusion, and preservation of heat as yet are a sealed mystery to thousands of young women who imagine they are completing a suitable education in courses of instruction from which most that is practical in future domestic life is wholly excluded. We therefore give a brief outline of some of the leading scientific principles which every housekeeper should understand and employ, in order to perform successfully one of her most important duties.

Concerning the essential nature of heat, and its intimate relations with the other great natural forces, light, electricity, etc., we shall not attempt to treat, but shall, for practical purposes, assume it to be a separate and independent force. Heat or caloric, then, has certain powers or principles. Let us consider them:

First, we find _Conduction_, by which heat passes from one particle to another next to it; as when one end of a poker is warmed by placing the other end in the fire. The bodies which allow this power free course are called conductors, and those which do not are named non-conductors, Metals are good conductors; feathers, wool, and furs are poor conductors; and water, air, and gases are non-conductors.

Another principle of heat is _Convection_, by which water, air, and gases are warmed. This is, literally, the process of _conveying_ heat from one portion of a fluid body to another by currents resulting from changes of temperature. It is secured by bringing one portion of a

liquid or gas into contact with a heated surface, whereby it becomes lighter and expanded in volume. In consequence, the cooler and heavier particles above pressing downward, the lighter ones rise upward, when the former, being heated, rise in their turn, and give place to others again descending from above. Thus a constant motion of currents and interchange of particles is produced until, as in a vessel of water, the whole body comes to an equal temperature. Air is heated in the same way. In case of a hot stove, the air that touches it is heated, becomes lighter, and rises, giving place to cooler and heavier particles, which, when heated, also ascend. It is owing to this process that the air of a room is warmest at the top and coolest at the bottom. It is owing to this principle, also, that water and air can not be heated by fire from above. For the particles of these bodies, being non-conductors, do not impart heat to each other; and when the warmest are at the top, they can not take the place of cooler and heavier ones below.

Another principle of heat (which it shares with light) is _Radiation_, by which all things send out heat to surrounding cooler bodies. Some bodies will absorb radiated heat, others will reflect it, and others allow it to pass through them without either absorbing or reflecting Thus, black and rough substances absorb heat, (or light,) colored and smooth articles reflect it, while air allows it to pass through without either absorbing or reflecting. It is owing to this, that rough and black vessels boil water sooner than smooth and light-colored ones.

Another principle is _Reflection_, by which heat radiated to a surface is turned back from it when not absorbed or allowed to pass through; just as a ball rebounds from a wall; just as sound is thrown back from a hill, making echo; just as rays of light are reflected from a mirror. And, as with light, the rays of heat are always reflected from a surface in an angle exactly corresponding to the direction in which it strikes that surface. Thus, if heated are comes to an object perpendicularly--that is, at right angles, it will be reflected back in the same line. If it strikes obliquely, it is reflected obliquely, at an angle with the surface precisely the same as the angle with which it first struck. And, of course, if it moves toward the surface and comes upon it in a line having so small an angle with it as to be almost parallel with it, the heated air is spread wide and diffused through a larger space than when the angles are greater and the width of reflection less.

[Illustration: Fig. 31.]
[Illustration: Fig. 32.]
[Illustration: Fig. 33.]

The simplest mode of warming a house and cooking food is by radiated heat from fires; but this is the most wasteful method, as respects time, labor, and expense. The most convenient, economical, and labor-saving mode of employing heat is by convection, as applied in stoves and furnaces. But for want of proper care and scientific knowledge this method has proved very destructive to health. When warming and cooking were done by open fires, houses were well supplied with pure air, as is rarely the case in rooms heated by stoves. For such is the prevailing ignorance on this subject that, as long as stoves save labor and warm the air, the great majority of people, especially among the poor, will use them in ways that involve debilitated constitutions and frequent disease.

The most common modes of cooking, where open fires are relinquished,

are by the range and the cooking-stove. The range is inferior to the stove in these respects: it is less economical, demanding much more fuel; it endangers the dress of the cook while standing near for various operations; it requires more stooping than the stove while cooking; it will not keep a fire all night, as do the best stoves; it will not burn wood and coal equally well; and lastly, if it warms the kitchen sufficiently in winter, it is too warm for summer. Some prefer it because the fumes of cooking can be carried off; but stoves properly arranged accomplish this equally well.

After extensive inquiry and many personal experiments, the author has found a cooking-stove constructed on true scientific principles, which unites convenience, comfort, and economy in a remarkable manner. Of this stove, drawings and descriptions will now be given, as the best mode of illustrating the practical applications of these principles to the art of cooking, and to show how much American women have suffered and how much they have been imposed upon for want of proper knowledge in this branch of their profession. And every woman can understand what follows with much less effort than young girls at high-schools give to the first problems of Geometry--for which they will never have any practical use, while attention to this problem of home affairs will cultivate the intellect quite as much as the abstract reasonings of Algebra and Geometry.,

[Illustration: Fig. 34.]

Fig. 34 represents a portion of the interior of this cooking-stove. First, notice the fire-box, which has corrugated (literally, wrinkled) sides, by which space is economized, so that as much heating surface is secured as if they were one third larger; as the heat radiates from every part of the undulating surface, which is one third greater in superficial extent than if it were plane. The shape of the fire-box also secures more heat by having oblique sides--which radiate more effectively into the oven beneath than if they were perpendicular, as illustrated below--while also it is sunk into the oven, so as to radiate from three instead of from two sides, as in most other stoves, the front of whose fire-boxes with their grates are built so as to be the front of the stove itself.

[Illustration: Fig 35. Model Stove]
[Illustration: Fig 36. Ordinary Stove]

The oven is the space under and around the back and front sides of the fire-box. The oven-bottom is not introduced in the diagram, but it is a horizontal plate between the fire-box and what is represented as the "flue-plate," which separates the oven from the bottom of the stove. The top of the oven is the horizontal corrugated plate passing from the rear edge of the fire-box to the back flues. These are three in number--the back centre-flue, which is closed to the heat and smoke coming over the oven from the fire-box by a damper--and the two back corner-flues. Down these two corner-flues passes the current of hot air and smoke, having first drawn across the corrugated oven-top. The arrows show its descent through these flues, from which it obliquely strikes and passes over the flue-plate, then under it, and then out through the centre back-flue, which is open at the bottom, up into the smoke-pipe.

The flue-plate is placed obliquely, to accumulate heat by forcing and compression; for the back space where the smoke enters from the

corner-flues is largest, and decreases toward the front, so that the hot current is compressed in a narrow space, between the oven-bottom and the flue-plate at the place where the bent arrows are seen. Here again it enters a wider space, under the flue-plate, and proceeds to another narrow one, between the flue-plate and the bottom of the stove, and thus is compressed and retained longer than if not impeded by these various contrivances. The heat and smoke also strike the plate obliquely, and thus, by reflection from its surface, impart more heat than if the passage was a horizontal one.

The external radiation is regulated by the use of nonconducting plaster

applied to the flue-plate and to the sides of the corner-flues, so that the heat is prevented from radiating in any direction except toward the oven. The doors, sides, and bottom of the stove are lined with tin casings, which hold a stratum of air, also a non-conductor. These are so arranged as to be removed whenever the weather becomes cold, so that the heat may then radiate into the kitchen. The outer edges of the oven are also similarly protected from loss of heat by tin casings and air-spaces, and the oven-doors opening at the front of the store are provided with the same economical savers of heat. High tin covers placed on the top prevent the heat from radiating above the stove. These are exceedingly useful, as the space under them is well heated and arranged for baking, for heating irons, and many other incidental necessities. Cake and pies can be baked on the top, while the oven is used for bread or for meats. When all the casings and covers are on, almost all the heat is confined within the stove, and whenever heat for the room is wanted, opening the front oven-doors turns it out into the kitchen.

Another contrivance is that of ventilating-holes in the front doors, through which fresh air is brought into the oven. This secures several purposes: it carries off the fumes of cooking meats, and prevents the mixing of flavors when different articles are cooked in the oven; it drives the heat that accumulates between the fire-box and front doors down around the oven, and equalizes its heat, so that articles need not be moved while baking; and lastly, as the air passes through the holes of the fire-box, it causes the burning of gases in the smoke, and thus increases heat. When wood or bituminous coal is used, perforated metal linings are put in the fire-box, and the result is the burning of smoke and gases that otherwise would pass into the chimney. This is a great discovery in the economy of fuel, which can be applied in many ways.

Heretofore, most cooking-stoves have had dumping-grates, which are inconvenient from the dust produced, are uneconomical in the use of fuel, and disadvantageous from too many or too loose joints. But recently this stove has been provided with a dumping-grate which also will sift ashes, and can be cleaned without dust and the other objectionable features of dumping-grates. A further account of this stove, and the mode of purchasing and using it, will be given at the close of the book.

Those who are taught to manage the stove properly keep the fire going all night, and equally well with wood or coal, thus saving the expense of kindling and the trouble of starting a new fire. When the fuel is of good quality, all that is needed in the morning is to draw the back-damper, snake the grate, and add more fuel.

Another remarkable feature of this store is the extension-top, on which is placed a w

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