THE KITCHEN FIRE
AND
HOW TO RUN IT

BY
SAMUEL SEWARD WRIGHT

"No Item in the Housekeepers' Domain is more recklessly mismanaged than the Coal Range."

—Good Housekeeping Magazine.

THE KITCHEN FIRE

AND

HOW TO RUN IT.

A Manual for the Housewife showing how
to save Coal, Gas, Labor and Health

BY

SAMUEL SEWARD WRIGHT

FEATURES

ECONOMY OF FUEL
EFFICIENCY OF STOVE
CONVENIENCE OF OPERATION
SAFETY AND SANITATION

PART I.

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ILLUSTRATIONS.

PREFACE

The Author's conception in presenting in readable form the facts gathered from a decade's experience with questions of Fuel Economy has not been to offer the public a scientific treatise or dissertation, but to present in simple every day terms a book which all housekeepers can read and understand.

The Greatest of all Waste in the World Occurs in the Cooking of Food in the Nation's Kitchen. Economists assert that as a nation we are far more extravagant and wasteful in our use of the necessaries of life than the people of any other nation. Fuel, like food, is a necessity of life, and our profligacy in the consumption of fuel is even more marked and more to be deplored than our wastefulness in the preparation and consumption of food.

The aggregate value of food consumed by ninety-three millions of people for three hundred and sixty-five days, computed at twenty-five cents per day only for each individual, amounts to the enormous sum of eight billions of dollars. The fact has been deduced after most careful and painstaking research that there is a spoilage or waste of ten per cent. in the cooking of food for the family consumption. Ten per cent. of the total value of the annual food consumption is eight hundred millions of dollars, which represents spoilage or waste.

Cooking is the most general manufacturing business in our country. The money value of the output of the product is far greater than in any other industry. The loss in the value of the food spoiled or wasted is not the only loss,—great as it is in the aggregate.

This food in the eighteen millions of homes and in the hotels, clubs, restaurants, etc., is cooked in stoves or ranges where wood, coal, gas or oil is consumed as fuel. It can be demonstrated that the waste of fuel is far greater than the ten per cent. of food waste, that is approximately forty or fifty per cent.

Our annual fuel bill, shown by United States Government statistics, is nearly five hundred millions of dollars. Forty per cent. of this amount is two hundred millions of dollars, which represents fuel loss or waste in the nation's cooking stoves.

It is possible, therefore, to save one billion of dollars in each five years in fuel value by adopting and practicing correct methods of operating and maintaining the kitchen fire. The Author has demonstrated and observed demonstrations in thousands of homes, North, South, East and West, where, by practicing improved methods of maintaining fires, approximately one-half the usual amount of fuel consumed has been saved with more and better sustained heat, and greater efficiency from the stove has been secured.

The kitchen stove or range is the machine used to produce the manufactured product, the fuel is necessary to supply the motive power, while the cook is the engineer or skilled mechanic who operates the machine. Upon him or her rests the responsibility for the success of the manufacturing process.

A single quotation from a letter received by the Author from a far-off Northwestern state, being only one of hundreds received, follows:

"If I could have had the lesson thirty-five years ago that I have had this week, in using and controlling the heat problem in the cookstove, I honestly believe that I could have saved in the neighborhood of one thousand dollars in fuel since we went to housekeeping. **I am astonished** to think that I have lived to be over sixty years old and to find that I knew so little about so simple and yet so important a matter as the control of the kitchen fire." The writer of the letter is a gentleman above the average in experience and intelligence, being an architect and builder who is successful in his vocation.

Having made the diagnosis, located the trouble, and prescribed the remedy, the Author submits this production to the consideration of an interested public with the hope that the information furnished between the covers of this small volume may be put to the practical test in order to secure the comforts and conveniences certain to follow.

SAMUEL SEWARD WRIGHT.

INTRODUCTION

FLAME.

In modern civilization, after Air, Water and Food, nothing is more important than Fire, to the happiness and prosperity of the human race. If all present knowledge of artificial means of producing fire were obliterated and not rediscovered, civilization would relapse into barbarism. Business could not be transacted, railroads and steamboat lines could not be operated, manufactories would close, our homes would become desolate without heat and light, and chaos would reign supreme.

Those heroes of invention, whoever they were, who first kindled flame, did more for human welfare than any who have succeeded them, for it was their success that has made all progress possible.

WHAT IS FLAME?

The flame of a fire is really nothing at all. It is not what ancient Greeks thought, an element like air, water or earth. But the early Greeks did not understand that air, water and earth were not in themselves elements, but a mixture or compound of elements, for air is now known to be composed of a mixture of two elements—two gases—known as Oxygen and Nitrogen; that water is a compound of two gases known as Oxygen and Hydrogen, and that earth is a mixture of many gases and solids—all being simple elements.

All the gaseous and solid elements are known as matter-substance—something that can be weighed, measured, seen, felt or tasted, and which may be utilized in some form for human needs.

The flame is not an element of different kind or nature. It is simply what the elements—the gases look like when they are burning and glowing under the influence of heat.

WHY IS FIRE HOT?

Heat comes from Carbon, which is mostly the solid part of Coal, Wood or other fuels, and the Oxygen of the air. A wonderful amount of power and energy is stored lying dormant in Carbon and Oxygen.

When flame—fire—is applied to a union of Carbon and Oxygen the wonderful energy locked up in both is released, becomes active, shows itself in rapid motion, communicates itself to the surrounding air, making it hot, and continues to move, producing radiant heat.

WHAT IS CARBON?

Carbon is a solid lying in mass in the earth, being stored there for ages for the use of mankind in the form of mineral like coal, or in liquid form like petroleum, or as the so-called natural gas. All vegetation springing from the earth is composed largely of carbonaceous matter. Nature has stored immense quantities of carbon in our forests, upon which our ancestors have drawn for their fuel necessities until our nation's wood supply has become seriously depleted.

FUEL AND ITS KINDS.

Fuel is the name give to any material which may be burned for domestic purposes, or in the arts or sciences. It appears in many different forms and under many different names, and for convenience will be classified as follows:

First—Solid fuels, including wood, charcoal, peat, coal and coke.

Second—Liquid fuels, including petroleum, tar, etc.

Third—Gaseous fuels, including coal gas, oil gas, producer gas and water gas.

The value of any of the fuels named depends upon the amount of Carbon stored in the substance and the quantity of heat that may be generated when it is subjected to the high temperature of flame or fire.

The nature and composition of the more prevalent fuels will be treated in following chapters.

BURNING FUEL IN STOVES AND RANGES.

There is a right way and a wrong way of burning fuel in stoves and ranges. The right way is to burn it with as little consumption of fuel as possible, to secure the desired volume of heat, and to burn it in a sanitary and healthful way, which is, or should be, the first consideration. Also, it should be burned in a manner conducive to the safety of the home and the lives of its inmates. The right way to burn fuel is to burn as little Carbon, which costs dollars, and as much Oxygen as possible, which is free, and can be had without expense.

The wrong way is the common or ordinary manner in which stoves are operated in nearly all families. The most simple principles of correct burning, proper operation of the stove and management of the fire are generally disregarded. This condition is well nigh universal, and as a result nearly twice as many dollars are expended in the average family for fuel as is necessary.

This book is written with the purpose of supplying correct and needed information on the care and maintenance of the kitchen fire, and a consecutive reading of its several chapters will furnish such information.

WHERE THE WASTE GOES.

Fuel is wasted or lost in two ways. Its burning is often so incomplete and imperfect that large quantities of Carbon are found in the ash box in the form of cinders and clinkers, which are sometimes reclaimed by sifting of the ashes. A great loss occurs through the smoke pipe and chimney as, if the fire be not properly controlled. many of the gases after being generated in the fire are allowed to escape through the smoke pipe and chimney before the process of burning has been completed. Losses in both directions—the ash box and the chimney—may be almost wholly obviated or reduced to a minimum by acquiring correct information concerning the use of drafts and dampers, which will also be discussed in other parts of this book.

SMOKE PIPE AND CHIMNEY.

The smoke pipe which connects the stove or range to the chimney flue is a very important feature of the kitchen heating system, but its importance is frequently overlooked, and stoves and fire troubles are endured which might be readily obviated. The proper flue connection is very important, and the course the smoke pipe must take from the stove to the chimney is often susceptible to change with most beneficial results. The chimney and its flues are a study in themselves and their correct understanding and care of much consequence.

HOW TO BURN FUEL PROPERLY.

The proper manipulation of a stove or range is not at all difficult or irksome where conditions are favorable for satisfactory fuel burning. The practical management of the stove and fire will be discussed in all its detail, and any reader who has unusual or peculiar problems to be solved is invited to communicate with the Author by letter.

NEW ACCESSORIES TO STOVES.

Since the great coal strike in 1902 more attention has been paid by writers and inventors to Fuel Saving Problems. Many devices have been invented to be used as accessories to coal and gas ranges and heating stoves. Some have actual merit—others are worthless. A brief description of some of them and the principles involved will appear at the end of Part Second, which is devoted to practical application of the information herein submitted.

CHAPTER I.

WATER—AIR—FIRE.

Well informed people frequently express their surprise that the general public remains so illy informed concerning the important yet very simple matters of everyday life. How few can explain that the most prevalent liquid known—Water—is a combination in certain exact proportions of two most prevalent gases, viz., Oxygen and Hydrogen, or that the atmospheric air which we must continue to breathe in order to exist is a mixture in other certain fixed proportions of Oxygen and Nitrogen. All know that water and air are superabundant—co-existing in all regions of the earth, and that both are essential to human and animal existence.

The air we breathe being all prevalent, provided for all His creatures—human and animal—by an All-Wise Creator, costs not a penny. Water being a liquid instead of a gas like air, is more controllable, more easily mobilized, and in densely populated communities is controlled by a few individuals, and through artificial means is made a commodity and sold for money to the general public.

The housekeeper who pays his dollars for the water his family must consume, provides ways and means for **controlling and conserving its waste** by using meters, faucets and other necessary devices so that fewer of his dollars shall find their way into the coffers of the municipality or company who has the water to sell.

By similar means the supply and waste of light, either gas, oil or electricity are controlled, for light, like water, has become a commodity and must be purchased, and is therefore a fixed charge upon the income of every family.

FIRE.

Likewise all know that heat is produced by fire, that coal, wood and other fuel when ignited will burn and generate heat, and that draft so-called—air—is necessary to cause a fire to burn before heat can be evolved or produced. All are familiar with the phenomena of fire—its uses and purposes—but what the actual process is in transforming wood or coal into heat remains to them in the category of the unknown.

Nothing is commoner, nothing is more necessary to civilization than Fire, which was to prehistoric man a luxury both costly and precarious. Before man knew how to produce fire he observed fire coming from natural sources, like volcanoes, oil wells burning like those on the shores of the Caspian Sea, which have flamed or smouldered for centuries. He must have observed a tree set afire by the lightning stroke, a meteorite setting fire to leaves and underbrush, a storm driving the stems of a bamboo groove against each other until friction excited flame. He, no doubt, saw fire from such causes sweep through forests, burning animals and birds, and his first knowledge of cooking might have been gained from a feast of the flesh of such primitive cooking.

ARTIFICIAL FIRE.

How and when man first produced flame and fire by artificial agencies will never be revealed. The rubbing of sticks of wood together until flame was produced is probably the oldest known method. Then pieces of stone or other mineral were doubtless employed. Centuries passed before man knew how to strike the cheap phosphorous match which was perfected as recently as

1840. In fact, not until the principles of chemistry became understood was man able to produce and control flame at will.

The actual process of burning or combustion was not known until the latter part of the Eighteenth Century. It was then discovered that atmospheric air is composed of two gases instead of one—Oxygen and Nitrogen—the proportion being one-fifth Oxygen and four-fifths Nitrogen. It was also discovered that Nitrogen is an inert gas without definite quality, that Oxygen is essential to the existence of all humans and animals, and that **without a sufficient supply of Oxygen a fire cannot burn.**

Therefore a fire is primarily a union of two elements, Oxygen and the substance to be burned, which may be either solid, liquid or gaseous, and is called Carbon. The Oxygen and Carbon must be brought together in proper proportion and placed under ignition before a fire, which produces light and heat, can burn. By ignition we mean producing a flame, and the flame is gas in process of burning.

As pure water is composed in certain exact proportion of Oxygen and Hydrogen, and pure air is composed of Oxygen and Nitrogen in exact proportion, so in order to effect in a fire proper or economical combustion or burning of the substance to be burned, there must be preserved the necessary proportion of Oxygen and Carbon.

It is because of the lamentable general lack of knowledge by men and women of the principles and facts before stated, that such great trouble and annoyance is so often experienced in maintaining the kitchen and other fires, and which results in the enormous waste of expensive fuel.

Fire—combustion—is a simple chemical process. Certain elements must be combined in certain quantities under certain conditions—the Oxygen of the air and the Carbon of the fuel—before a satisfactory or economical fire can be maintained. The druggist, in compounding prescriptions, must mix the several ingredients in proper proportion and under certain conditions, else the mixture will be useless and fail of its purpose. The housewife, in mixing bread or cake for baking, must combine in certain proportion, by weight or measure, the flour, water, salt, sugar, butter and other ingredients, for if not properly mixed or combined—no matter how well baked—the food will be neither palatable nor wholesome.

Every kitchen is a laboratory, and every cook, unconsciously though it may be, practices or uses the arts or knowledge of the chemist in her daily avocation. Even the wash woman in her use of water, in the use of soda, bluing, and in the preparation of starch and in other ways, makes use of the principles of chemistry.

If the housewife, cook or maid, exercised the same diligence and painstaking care in the operation or control of the kitchen fire that must be given to successful cooking and baking and other kitchen work, fire and stove troubles would largely vanish, economy in the use of fuel would take the place of extravagance and waste, and the labor involved be greatly diminished.

While economy is very important in our domestic affairs, sanitary conditions and practice are of greater importance. The kitchen fire uncontrolled and mismanaged too often is a menace to the health and lives of our families. This feature will be treated in a plain, thorough and practical manner in the other portions of this book.

CHAPTER II

FUEL.

The more important fuels burned for domestic purposes in kitchens and homes include wood, peat, lignite, coal and gas. All are stored in greater or lesser quantities with Carbon, which is the combustible material. Combustible means that which will burn when flame is applied. The higher the proportion of Carbon in the fuel, the greater its heat-giving quality, and therefore the greater its money value.

WOOD.

Hard woods include heavy, compact woods like oak, hickory, beech, birch, elm, ash, maple and walnut.

Soft woods include pine, hemlock, poplar, willow, and many others.

Freshly chopped green wood, either hard or soft, contains about forty-five per cent. of moisture, often more, and sometimes less. Even dry wood contains moisture of about twenty per cent. It is plain, therefore, that dry wood will burn more readily than green wood, for the great amount of moisture in green wood must be expelled before the carbon in the wood can be burned, and it requires a great deal of heat to first expel the moisture. For this reason it is not economical to burn wood until it has become well seasoned.

Wood contains only fifty per cent. or less of Carbon, while the best of anthracite coal contains as much as ninety-eight per cent. The residue or ash from wood is less than two per cent., while the ash or earthy matter of anthracite coal varies from three to four per cent.

WOOD BECOMING SCARCE.

When the Government of the United States was established about one hundred and twenty-five years ago, no coal had been discovered, and the forest seemed destined to provide wood fuel sufficient for the nation's need for centuries, but the wonderful increase and activity of our population and the wanton destruction and waste of the forests long since greatly depleted this source of our fuel supply, and to such an extent that the more populous Eastern Section and many portions of the Middle West and South no longer consume wood for domestic purposes because of its scarcity and consequent high price, except it may be in certain localities where the agricultural population prevails.

Notwithstanding the serious depletion of our forest lands, our wood fuel consumed for domestic purposes annually reaches in value the great sum of two hundred and fifty millions of dollars, as shown by the Bureau of Statistics of the United States Government.

At the present rate of increase of population and the present rate of wood consumption per capita, only a few decades will suffice to exhaust the present supply, and wood as fuel will no longer be available in any section of our country.

PEAT.

Immense deposits of peat exist in the United States and in other parts of the world. It is called turf in Ireland and has been burned for fuel in that and other countries for a long period. It consists of vegetable matter deposited in swampy ground, and important geological changes in its formation are still progressing. Very little use has been made of peat in this country yet, owing to the abundance, cheapness and superior heating quality of coal. In European countries it is used for other than domestic purposes also.

LIGNITE.

This is classed among mineral coals being inferior to bituminous coal, yielding only moderate heat. Extensive deposits exist in the territory west of the Mississippi river and its use thus far has been limited, but as that territory becomes developed it will become of greater importance as a fuel for domestic consumption. Lignite can be coked, though the product is not of good quality. It is lower in its carbon than most of the soft coals, but contains more water and gaseous matter. It crumbles rapidly when exposed to the weather, and as a fuel must be used in its natural state and near where it is mined to obtain the best results.

COAL.

Coal is classified as Anthracite, or hard coal, and Bituminous, or soft coal. The anthracite varies in degrees of hardness, and hard coal that contains as much as seven or eight per cent. of volatile or gaseous matter is known as semi-anthracite. Because of this gaseous matter the semi-anthracite kindles more quickly and burns more rapidly than the hard anthracite.

When coal contains as much as eighteen or twenty per cent. of volatile matter that is changed into gas when flame or fire is applied, it is called bituminous or soft coal. Other coals of the soft kinds are known as coking coals, from which coke is produced. The process is to drive off the volatile or gaseous portion of the coal, leaving the solid carbon, which is called coke. It is used largely for melting iron in furnaces, for it yields intense heat and burns freely under a strong blast of air.

Bituminous coal, under another process, furnishes illuminating gas, and coke is also the residue of the solid carbon, but it is not so hard and more easily ignited than the preceding coke. This coke is largely used in some sections for domestic fuel with excellent results. It burns freely and with intense heat.

Bituminous coal is more generally used in manufacturing and transportation enterprises because it is more free burning than anthracite, and steam can be produced more quickly than by using the slower burning anthracite. It is used, however, in a large section of the country for domestic purposes in kitchens and homes. It is not as convenient to handle as the solid anthracite, and having a much larger proportion of volatile or gaseous matter, burns with more smoke and is not, therefore, so desirable for domestic use.

Bituminous coal analysis is as follows:

Solid Carbon from fifty to eighty-four per cent.

Volatile matter—gaseous—from twelve to forty-eight per cent.

Earthy matter—ash—from two to twenty per cent.

Sulphur from one to three per cent.

The deposits of bituminous coal in the region west of the Allegheny Mountains and extending to some distance west of the Mississippi River and in Southern and Southwestern states seem almost inexhaustible.

ANTHRACITE COAL

Being richer in carbon, more compact than all others, and almost free from the light, volatile gas, and having so little earthy matter, anthracite is the ideal coal for kitchen use.

It frequently contains as much as ninety-five per cent. of carbon. Being so free from volatile gas, it is also more sanitary to burn, and although kindling slowly it can be burned slowly and a fire retained much longer than with the other coal fuels or wood. It also burns to a fine ash and without smoke.

BRIQUETTES.

This is a new fuel to the American public, although briquettes have been made, sold and consumed both for manufacturing and domestic use in the principal European countries for seventy years. Germany alone produced in 1908 more than eighteen million tons.

Briquettes are made by a patented process from the fine particles of anthracite coal known as culm, which is practically solid carbon, all slate or bony matter so often found in the prepared domestic sizes of anthracite being removed. It is carefully washed to remove dirt and other foreign matter and dried, after which it is mixed in order to hold the fine particles together with a binder of coal tar or pitch, which is distilled as one of the by-products of bituminous or soft coal in the manufacture of coke. It is then subjected to extreme heat and severe pressure and formed into sizes corresponding to either chestnut or the larger sizes of anthracite coal, and when cooled they result in a hard product which can be transported without breakage.

The pitch used consists of fifty-seven per cent. of carbon (pure coal) and forty-three per cent. of volatile or gaseous matter.

As a fuel it ignites more quickly, burns with greater freedom and gives more heat than anthracite coal, from which it is made. It also burns to a fine ash and without clinkers, and is, therefore an economical fuel.

The Scranton Anthracite Briquette Company has already manufactured and sold more than 500,000 tons of briquettes. Possessing so many of the qualities of an ideal fuel, anthracite briquettes seem destined to become one of the leading fuels in the future.

FUEL WASTE.

The deposit of hard, or anthracite coal, which is far more desirable than soft coal for domestic use, exists only in a few counties in Eastern Pennsylvania, and so rapidly has this most valuable fuel been mined and wasted in mining and consumed, that its supply, like that of wood, is already seriously depleted. Because of the increasing difficulty and expense of mining, and the certain ultimate exhaustion of the product, the tendency of the price of anthracite per ton is and will continue upward as the price of wood per cord is already in most sections prohibitive.

As the two fuels named cannot now be purchased for a less price per ton or cord, and in all probability they will ultimately be doubled in cost, it certainly behooves the prudent consumer to learn how to utilize all the heat units in the fuel to the end that the annual fuel expense may be greatly reduced.

Concerning economy in the use of the three necessities of life—Food, Clothing and Fuel—there is a notable difference or distinction. An individual or a family cannot economize or lessen food cost or expense except by eating less food or food of a cheaper price or poorer quality.

Likewise with clothing expense, less clothing must be purchased or clothing of a cheaper price. A family may, however, greatly decrease fuel expense without sacrificing any of the volume of heat or any of the comforts and conveniences at present enjoyed.

Another reason other than saving fuel—which costs money—for the welfare of the present generation, should prompt all to practice fuel conservation. It is for the welfare of those who will follow us—our children and childrens' children—our posterity. When food is purchased it is consumed, of course, but more food is produced—grown—each and every year. The fields bring forth their annual crops of divers kinds. The animals are fattened on the herbage of the fields and nature perennially provides subsistence for mankind. The cotton plant, and skins and wools of animals, and other provisions of nature supply our needs for clothing.

But when a ton of coal is mined and burned it is totally lost—destroyed—and cannot be replaced from year to year by the chemical action induced by the copious rain of Heaven filtering through the fertile soil of Mother Earth.

For this reason the wanton waste of fuel is more deplorable—a waste that will not be restored by natural forces—than the waste of the other necessities of life or of any luxury.

It is easy of demonstration that from one-third to one-half—frequently a greater quantity—of coal consumed is needlessly burned, and if that one-half or one-third has a money value of one dollar per week, it would be no more reckless, foolish or extravagant to throw the dollar in the fire at the beginning or end of every week than to throw its value from the coal pail into the fire day by day. The loss, measured in dollars, is the same in either event, but when one-third of the fuel is needlessly thrown into the fire the time and effort spent in handling that one-third unnecessarily is also lost.

It follows, therefore, that a housekeeper who would burn the money weekly, and learn to save one-third or more of fuel, would actually practice economy of time and labor and secure other benefits which can readily be named.

How to burn fuel economically and in a healthful manner will be presented in Part Two.

CHAPTER III.

OXYGEN THE FRIEND OF CARBON

It has already been shown that fire is the result of a union of the elements of Oxygen and Carbon exposed to the heat of flame. Each is as important as the other, and without both the Oxygen Gas and the solid Carbon no fire could be produced. Oxygen is just as essential in producing and maintaining fire as it is to the existence of all plant and animal life. The source of Oxygen is the atmosphere. One-fifth part of the air is Oxygen. Eight-ninths of water is Oxygen, and it is found in lesser quantity in the earth. It also exists in all the fuels, particularly wood, in greater or less degree. Oxygen, when pure, is colorless, tasteless and without odor. Oxygen has weight, and is about one-tenth heavier than atmospheric air, of which it is a part. It is the most abundant of all the elements.

Oxygen in science is called a supporter of combustion, which means it is necessary in order to burn carbon—fuel—to have present a constant supply of Oxygen. Oxygen can be separated from air. The remaining four-fifths of air is called Nitrogen. If pure Oxygen is confined in a jar and a piece of burning iron is placed in it, the iron will be entirely consumed. If pure Oxygen without its companion, Nitrogen, were supplied to a fire of any of the ordinary solid fuels, the grate itself would be burned, because it would be more combustible than either coal or wood.

Man himself could not exist very long if he were compelled to breathe only pure Oxygen, for he would be so stimulated that he would lose control of all his vital organs and senses.

It is well known that Oxygen is often administered to very sick people, but only temporarily with beneficial results.

It will be readily understood, then, how very valuable and important a factor Oxygen is in the process of producing heat from burning any of the carbon fuels, either coal, wood or gas.

NITROGEN.

Both in volume occupying space and by weight, Nitrogen is the principal constituent of the air. It is without color, taste or smell in its natural state, and is slightly less in weight than air. It does not support combustion of fuel like Oxygen. It will not burn, no matter to what extreme heat it may be subjected. It simply occupies space and does not change in form. If Nitrogen only is supplied to burning fuel without its companion, Oxygen, the fire will immediately die, just as all animals and humans would die if they only inhaled Nitrogen. It does not dissolve in water. In the atmosphere it is like a diluent. It dilutes air, lowers it down, and makes it moderate and useful for us.

Nitrogen is an active element, but a very safe one. It carries away and dispenses poisonous fumes of any kind through the atmosphere until they find place where they are needed to perform some important purpose for the good of mankind.

Nitrogen performs the important function in the process of burning fuel in stoves, of carrying away through the smoke pipe and chimney the fuel gases, which will not burn at the rate of from three feet to ten feet per second. It thus assists to produce draft so necessary to proper fuel burning.

HYDROGEN.

This gas is the lightest substance known, but performs an important part in fuel burning in stoves and ranges. Like Oxygen and Nitrogen, it is also, when pure, colorless, tasteless and without odor. It is not found in a free state, and although it is one-ninth part of pure water, it may be separated from the Oxygen, but not without much trouble and effort. Pure Hydrogen burns with a faint blue light, but gives off intense heat. In fact, Hydrogen is the best fuel known. It gives off more heat than by burning any other substance. Hydrogen is found in varying quantities in all the fuels—the greatest in the oils and gases.

The three gases, Oxygen, Nitrogen and Hydrogen, are most important elements in the phenomena of fire as well as in human existence. All are colorless, tasteless and odorless in their natural state. We are continually inhaling and swallowing them with benefit instead of injury. Unlike some of the fuel gases, they have no dangerous quality. Their practical use in burning fuel will be described in the following pages.

CHAPTER IV.

STOVES—WOOD—COAL—GAS.

It would require a volume of hundreds of pages to describe the immense number and variety of stoves the ingenuity of man has constructed during the past five centuries in Europe and the United States. It requires but little speculation and imagination on the part of the reader to conclude that stoves were designed to supersede fireplaces because less fuel is required where it is ignited and burned when inclosed than when it is burned in the open atmosphere, and less air is required in the process of burning. The first stoves used in Europe were made in France about the time that Columbus discovered America, and in Holland later. The Holland stove came much later and was small and of the box shape, and being used only in the milder climates, was designed for wood fuel and moderate fires. In the colder countries of Russia and Sweden larger stoves and greater heat were required, and they were constructed of iron and brick. Neither of the patterns mentioned became popular in England because of the prejudice of the people in favor of open fires, which also furnished light as well as heat. The first receptacle for fire known to have been made in America was cast in Lynn, Mass., soon after the Pilgrims landed at Plymouth Rock. The exact date is said to be 1642. It is not a stove, but a small round bottomed kettle with a cover.

It was a little more than one hundred years thereafter that Benjamin Franklin, in 1745, invented what he called the Franklin Stove, or Pennsylvania Fire Place, which was more of a fireplace or a hot air furnace than a stove. It was not designed for cooking but for heating purposes and for the consumption of wood as fuel, no coal having then been discovered in America.

The Franklin Stove was a great improvement in heating devices, and the Governor of the State of Pennsylvania offered Franklin a patent for the control of the manufacture and sale of his invention. This Franklin refused on the ground that the improvement being for the public benefit it would not be right to deprive the public of any of the benefits of the invention.

Franklin understood how necessary it is to control the amount of air to be supplied to the burning wood and he also knew the necessity of controlling the exit of the smoke and the other waste products of combustion through the chimney. He provided ways and means of ingress and egress of air with the purpose of saving fuel. He provided what he called a Register, but which was a flue or pipe damper and which he directed should be used to control the draft so that so much heat should not be lost through the chimney. He was thus able to demonstrate that large quantities of wood could be saved and more and better sustained heat had by properly controlling the ingress and egress of air.

At that time Priestly had not discovered that air was composed of two gases—Oxygen and Nitrogen—and Franklin did not understand the composition of fuels, but he early recognized that the quantity of air necessary to a proper and economical burning of the fuel is limited and therefore should be controlled.

In 1771, and later, Franklin invented other stoves—one for burning bituminous coal which would consume its own smoke and had a downward draft, and another intended for the same purpose having a basket grate with movable bars at the top and bottom. After being filled and kindled at the top, it could be inverted and made to burn from the base. Franklin was one of the first manufacturers of stoves in America, and he wrote an elaborate treatise for public use, which was widely distributed, teaching housekeepers the general principles of fire control and the consequent fuel saving. He tried to educate those who purchased his stove how to get the full benefit from their money investment.

In 1786 heating stoves of box shape were made in Philadelphia and were shipped to Providence, R. I., and Troy, N. Y., where they were put together and sold in the trade.

From 1795 to 1825 no material progress was made in the construction of stoves. Wood was universally used for fuel till about 1830. Anthracite coal created a great revolution in stove construction. In 1833 Mott demonstrated that anthracite fire could be maintained in stoves with nut and pea sizes of coal, and a little later President Nott, of Union College, burned anthracite in heating stoves.

STOVE CONSTRUCTION

"There have been no important changes in cook stove construction," says Jeremiah Dwyer, President of the Michigan Stove Company, Detroit, Mich., "since that date (1850). Minor changes have been made to increase sales, such as Filley's Gauge Door, his return flue construction, the various arrangements of reservoirs and grates, the methods of oven ventilation and Buck's Stove Company's brilliant glass and enameled oven doors. Ranges as they are now called are each year more generally made with one door and the pipe on the side where the other door was formerly. The only change in ten years has been in ornamentation, the substitution of aluminum for tin in the lining of the oven door and there has been a general reduction in price, while the cost of manufacturing has increased."

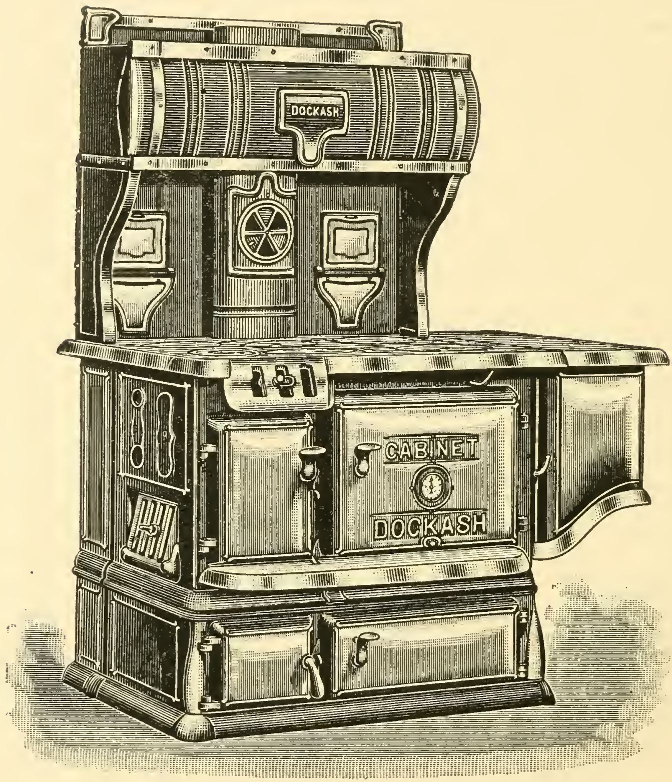
It will be observed that the eminent authority makes no claim that the modern cooking stove or range is more economical in its consumption of fuel than was the old-time cooking stove used in our grandfather's day. The same general method of producing heat in stoves continues as it was fifty or sixty years ago.

At the present time there are two general classes of stoves manufactured and sold for domestic purposes, viz., cooking stoves and heating stoves, in which charcoal, coal, wood or coke, oil or gas are consumed as fuel.

According to the particular kind of fuel to be burned they are known as wood stoves, coal stoves, gas stoves or oil stoves. The wood stove has been supplanted very largely in the large cities by the coal stove or range, whereas at the present time the oil or gas stoves principally used for cooking purposes are coming into more popular use at the expense of the coal range. This condition exists very largely for the reason that manufacturers of coal and wood stoves and producers of the coal fuel are allowing themselves to be outstripped by their more enterprising competitors for public patronage—the manufacturers and distributors of the gas fuel. The manufacturer of gas teaches housekeepers how to burn gas cheaply by properly operating the gas stove. He shows its convenience and apparent cheapness, etc., by circulating printed matter and giving free public and even private demonstrations. This is in striking contrast to the supine indifference of the stove manufacturer, the stove dealer and the coal operator or dealer who could demonstrate that coal is a cheaper fuel when properly burned than gas or oil, that death or sickness always lurks in the shadow of the gas range because one-third of the gas is composed of the deadly Carbonic Oxide.

Cooking stoves and ranges consuming coal, wood or coke as fuel are constructed along the same general lines, although they may be different in shape, size weight of casting and in features of general convenience and comfort. All have grates, fire box linings of brick or metal, ash pit or receiver of ashes, lids and center pieces, the supporters of lids, ovens, doors, slide drafts, dampers and other parts, yet all may vary in construction and still perform the general purpose for which they are constructed. Some ranges have reservoirs for containing and heating water, which is accomplished by the heat which is diverted around the oven. In other cases ranges are equipped with the accessory of what is known as the Water Back, which is attached to the fire box, pipes being connected with an upright boiler standing near the stove and the water circulating through the pipes in the fire box is heated to the boiling point. Many other features could be mentioned, but the public has general knowledge concerning them. It is for the housekeeper to understand the advantages and disadvantages of the respective fuels it is within her convenience to use— which machines are better suited to her kitchen conditions and how to operate such machines at least expense consistent with the needed requirements and in a safe and sanitary manner, thereby being certain to conserve the life and health of herself and those entrusted to her care and protection.

THE CABINET DOCKASH RANGE.



The above is an excellent type of the modern coal or wood kitchen range. The Dockash grate is easily operated and the fire box is constructed on scientific principles, has large capacity and is cemented tightly so that **no cold air** enters the fire box. The fuel can be changed from coal to wood instantly. It is supplied with the Hypocaust Oven, which is ventilated, and food roasted or baked in this oven loses but little in shrinkage, has better quality, while less time is required for the baking. It is also furnished with gas attachments. It is manufactured by The Scranton Stove Works, Scranton, Pa.

CHAPTER V.

CHIMNEYS—DAMPERS—DRAFTS.

A chimney is a vertical structure of stone, brick or metal containing an internal passageway or flue through which smoke and the waste gases of combustion are carried off from a stove, fireplace or furnace. It may be built inside or outside of a dwelling, and it also performs the very important function of supplying draft for the fire from which it receives the smoke and waste gases.

The action of a chimney is based upon the simple principle that a column of heated air is lighter than a column of cooler air of the same height, and as heated air rises when unconfined, the greater weight of the cooler air at the bottom forces the warm air upwards and thus air ascending current is produced. This is called draft.

The chimney extending from the hearth or fireplace to the roof of the house is a modern invention, and was unknown to the ancients. The Greeks had no chimneys and the smoke of the fires escaped through a hole in the roof. The first form of a chimney was a short funnel through the wall of the house. Chimneys were common in Venice in the fourteenth century, a number being overthrown in the earthquake of January 25, 1347.

No traces of chimneys were found in Pompeii or Herculaneum. Persians still retain the ancient custom of making fires in holes in earthen floors in an iron vessel, a low table placed directly over, covered to the floor with a curtain and no means provided for the escape of smoke and gases. Chimneys were unknown in England earlier than the twelfth century, and for centuries after remained as luxuries for the houses of the great. Even at the beginning of the sixteenth century they were almost unknown.

In our time there is no detail in house construction so important to the comfort of its occupants as the chimney which furnishes draft to the heating devices in their home.

CHIMNEY CONSTRUCTION.

As a good draft is indispensable if the best service and efficiency is to be realized from the stove machine, particular attention must be given to the proper construction of the chimney and its flue. The chimney flue should never be less than 8x8 or 8x12 inches, and in large houses not less than 12x16 inches, especially if furnaces or boilers are used as part of heating system, not because such size is absolutely necessary, but to overcome roughness and cleaning of the flue. The straighter and more true the flues the more powerful will be the draft.

If slight bends occur, the inside should not be drawn in, as that would lessen the capacity and tend to intercept the smoke and gases in their exit to the atmosphere. A round flue is more desirable also, because there will be less friction for the escape of the gases in their travel upward.

If brick is the material used in construction, the hardest only should be used next to the flue, for the coal gases greatly affect the brick and mortar, while wood fuel gases do not. The mortar should not extend beyond the surface of the brick inside the flue, and it would be better still to use tile flue lining, for it does not absorb heat, and the inside of the flue would be tight and smooth and thus greatly facilitate the exit of the gases. Another important point to consider in the construction of the chimney is the top and that part which extends above the roof. The top of the chimney should not be drawn in or the exit of the flue made smaller, as there would be a liability to impede the draft. It would be better to increase rather than diminish the area at the top of the flue.

DRAFTS.

The chimney should be built high enough above the roof to obviate any down draft that might result from wind eddies or whirls of air that frequently occur where there are surrounding higher objects like other buildings, trees, hills, etc. Usually the addition of a few feet to the height will obviate a difficulty of such character. Smoky stoves and fireplaces are due to impeded drafts and if proper chimney diagnosis is made the cause should be quickly discovered and remedied.

In some countries it is the custom to cover the top of the chimney with some sort of a roof which may be arched or extend to a point. Openings must be left for the quick and easy exit of the smoke and gases. A slab of stone or iron is also frequently used as a covering. Down drafts in this manner are prevented and rain and moisture precluded from falling into the chimney.

A mechanical contrivance called a cowl, attached to the chimney top, is now used with great success for the purpose of increasing the chimney draft and thereby preventing smoke. It consists of a hood in which is a fan, it being so constructed that the fan faces the wind, changing with it, and by its revolution produces an upward suction of the air, which greatly increases the draft.

One cause for a defective or weak draft is a poorly ventilated kitchen or room in which the stove or furnace is located. Doors and windows when provided with weather strips are nearly air tight and thus prevent a constant and fresh supply of air. Such inlets of air should be allowed if it is desirable to have the draft unimpeded.

Still another cause for weak drafts is a sooty or dirty chimney. This condition prevents the smoke and waste gases from quickly passing up the chimney, thereby decreasing its natural draft. Great danger of chimney fires exist from such causes, and a sooty chimney also attracts lightning.

With chimney conditions favorable, the best results from present stove construction are secured when all the air that passes up the flue enters at the bottom of the fire. It is thus heated to its highest temperature by passing through all the fire, and the fire is stimulated to increased combustion by the blast thus obtained.

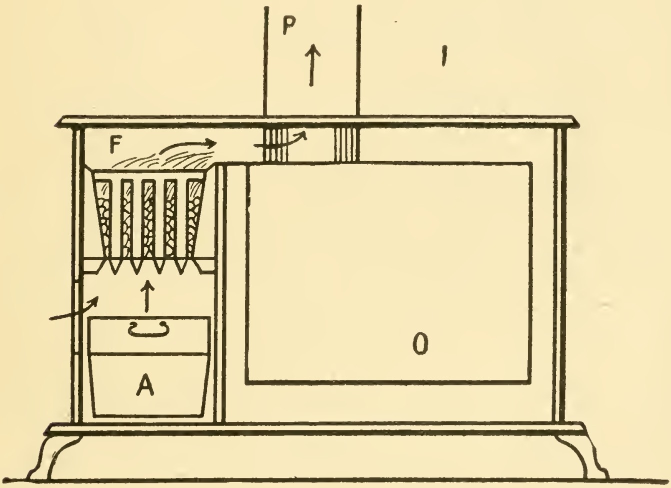
DAMPERS.

A damper is an obstruction used to either prevent air from entering into a stove below the fire or to allow it to enter in large or small volume as needed to increase or diminish draft. Dampers are also used to prevent the waste and other gases from passing too quickly from the firebox of the stove through the smoke pipe flue and into the chimney from whence these escaping products of combustion pass upward into the general atmosphere. Stoves are usually provided with one or more doors which open into the ash pan, which is below the grate, and therefore under the fire. Such doors usually contain slide drafts, so called, but which are properly slide dampers. These dampers are intended to regulate the amount of air or draft to the bed of the burning fuel. It is, however, the tendency of every cook, fireman or stoker, to allow too much air, far more than necessary, to pass through this open damper into the fire. Except when starting a new fire, it is seldom necessary to allow this slide damper to stand wide open for more than a few minutes unless the stove or chimney is defective in draft or in bad condition.

Also many stoves have slide check dampers over and above the fire box, which, when open, either wholly or partially allow air to pass directly upon the burning fuel. This is designed to check or diminish the rapidity of the combustion or burning of the fuel, and is directly opposite to the first named process. Air admitted under the grate and through the fire increases the draft, thereby causing the fuel to burn more quickly, while air admitted above the fire and upon its top surface causes the fire to burn more slowly. The reason is that the air or atmosphere of the room is much cooler than are the gases as they arise from the burning fuel. The gases thus become chilled, and as their temperature is then many degrees below the point at which they can ignite and burn, their combustion or burning is effectually prevented.

Cooking and heating stoves also are usually supplied with internal dampers, sometimes called oven dampers or smoke dampers, and which are designed to prevent the heat (waste gases) from passing directly from the fire to the smoke pipe flue and from thence into the chimney. Such dampers close the opening into the base of the pipe and the heat and gases must then pass over and around the oven and find their way into the smoke pipe flue after their tortuous journey at the back of the stove.

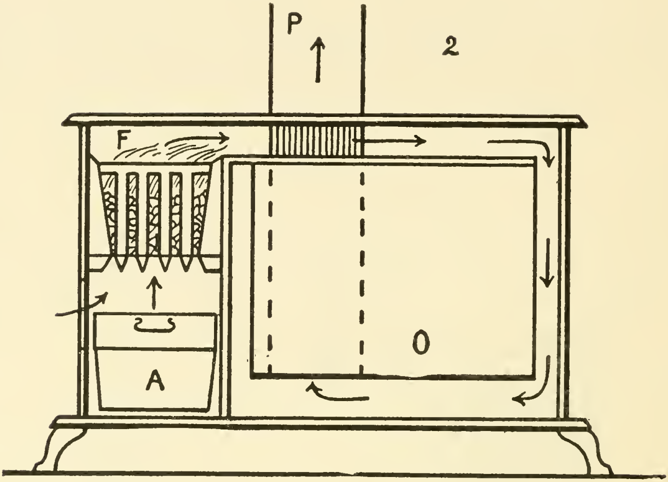
ILLUSTRATION No 1



The oven or smoke damper in the illustration is open and the heat and gases pass directly into the smoke pipe and chimney where they are lost.

Still another form of a damper is frequently installed in the face of the first length of smoke pipe, which is usually oblong in shape, a short distance above the top of the stove. These dampers, or check drafts, may be either rectangular slides or circular in form, and are

ILLUSTRATION No. 2



In this illustration the oven or smoke damper is closed and the heat and gases pass around the oven before going into the chimney. They are thus utilized to better heat the oven.

designed to intercept or extinguish the draft from the fire to the chimney.

The oldest, best and most efficient damper to be used above the upper surface of the fire, is the damper installed inside of the smoke pipe flue. This damper gives better control of the fire and should be installed whenever possible. Every cook, fireman and stoker should thoroughly master the subjects of drafts and dampers by experimenting with the several kinds, thereby learning their uses and benefits under varying conditions. Large quantities of fuel would be saved and the labor would be greatly reduced, while the elimination of poisonous coal gas would be complete.

CHAPTER VI.

FUEL GASES AND SMOKE.

The subject of Fuel Gases is not generally understood by housekeepers. The proper manipulation of the fire has a most important effect upon the lives and health of all members of the family. Many women are disinclined to learn of the nature of the gases that are generated by fire, and thus remain uninformed, whereas, by investigating the subject, they would quickly learn how to always insure themselves against the pernicious and sometimes deadly effect of poisonous Coal Gas.

A modern stove has already been stated to be a machine for converting fuel of some nature or kind into heat. When a coal fire is started or fresh coal added to a fire, the first step or stage in the process of burning is that the heat releases the several gases, of which all fuel in some measure is composed. Being so released it is most desirable that the process of combustion should be completed.* Complete combustion means burning all the gases and all the carbon or solid portion of the fuel that it is possible to burn under the ordinary stove and chimney conditions prevailing in our homes.

It is better, so far as possible, to cause these gases to be burned inside the stove, and thus destroyed, than to run the risk of the unburnt poisonous gases escaping from the stove through holes, through open doors of the stove or where, by the most reprehensible practice of wholly or partially removing one or more of the stove lids for the purpose of checking the fire, the gases are invited to enter the atmosphere of the kitchen. If there is fire in the stove, gases are generated, and if they are not burned they must escape through the smoke pipe to the chimney or enter the atmosphere of the living rooms.

Where wood is the fuel the gases are not so deleterious to life and health. The volume of poisonous gases generated from anthracite coal is far less than from any of the soft coals, while the volume of deadly gases generated by burning the so-called Water Gas, commonly known as Illuminating Gas or Manufactured Gas, is several times that derived from burning the other fuels.

The most poisonous and therefore the most deadly, gas produced from burning coal is known as carbon monoxide, or carbonic oxide, both terms referring to the same gas. One portion of oxygen and one like portion of carbon unite to form carbon monoxide. This gas will not burn until it takes on another like portion of oxygen, when it will burn to what is called carbon dioxide, or carbonic acid gas, which will not burn. Carbonic oxide has no color, taste or smell, and is, therefore, most insidious and dangerous to human life. When breathed pure it produces almost instant coma—unconsciousness. Carbon dioxide or carbonic acid gas is always present in the atmosphere in small quantities and supplies vegetable life with its necessary carbon. The carbon monoxide is the gas which is the product of imperfect combustion. All stoves in poor condition and those where lids are partially removed at night to check the fire can hardly fail to emit poisonous gas in some quantity.

Other gases in small quantities are produced in the process of burning, some of which are combustible and others incombustible. Some are deleterious and others harmless, but the carbon monoxide is the great menace to life and health, which, however, may be utilized to our benefit if we will but exercise our privilege to become acquainted with its properties—both beneficial and life destroying—and utilize our information to the end that it be compelled to be our agent for good instead of our mortal enemy.

SMOKE.

When smoke issues from a chimney or from a stove, it is evidence that imperfect combustion is in progress and that there is marked waste of fuel. Probably there is not great waste of fuel in the smoke itself, but the real waste arises from the non-combustion of the impurities that escape with the smoke. These impurities consist of unconsumed carbon known as soot and of various poisonous gases, chiefly Carbon Monoxide, which will burn if the proper amount of oxygen is furnished to support its combustion, and also ammonia and sulphurous and nitrous acids escape. The soot, which, with condensed water vapor, constitute the visible or darkened portion of smoke, clogs the lungs when inhaled, the poisonous gases act chemically on the blood, injure the nerves and irritate the delicate mucous membranes of the air passages and unfit them for their most important duty—the protection of the body against the germs of tuberculosis and other diseases.

The injuries inflicted on animal organisms by smoke and soot do not, as a rule, become well marked until the injurious influences have acted for a considerable time.

In vegetation the effect appears more rapidly. Foliage becomes coated with the soot, which hinders transpiration (breathing) and suffocates the plants. The coniferous trees, such as pine, fir and spruce, whose leaf surface is increased by sub-division into myriads of slender points like needles, have a hard and doubtful struggle for existence in the soot-laden air of our cities. The injury is increased by acrid and poisonous substances deposited with the soot or acting in gaseous forms.

By proper construction of grates, air passages and other parts of stoves and furnaces, careful selection of fuel with rational methods of stoking or firing and the employment of suitable apparatus for the absorption and consumption of smoke it is quite possible to effect a considerable abatement of smoke nuisance with a corresponding economy in fuel.

Both on economical and humanitarian grounds, smoke should be prohibited in cities where hundreds of thousands of chimneys of dwellings and power plants daily emit in the aggregate hundreds of tons of soot which pollute the atmosphere and tend to breed disease and cause the death of the inhabitants.

It is estimated that nearly one hundred and fifty thousand tons of soot are deposited annually from the chimneys of the City of New York, and that in ten cities of the United States more than four hundred thousand tons of soot fall yearly on those cities. As this soot contains thousands of tons of ammonia, chloride, carbon and tar, it is necessarily inhaled by the people, and is a direct cause of the frequency of catarrhal and lung troubles.

The shopkeepers of the City of London suffered a loss of twenty-six millions of dollars ($26,000,000) in a two days' fog from the smoke and soot nuisance. It was described as the blackest in ten years, and caused influenza to become epidemic and deaths to be increased.

Great financial loss is sustained in our cities by shopmen, buildings are damaged, and the property loss is hardly computable because no legislation has been enacted by municipal legislative bodies to prohibit the smoke nuisance. A Public Health Act in operation in the City of London comprising money fines of twenty-five dollars for the first offense of smoke emission from furnace chimneys, fifty dollars for second offense, and so on in progression, has resulted in a great diminution of the nuisance.

The municipal authorities in American cities, awakened to the danger to life and property from poisonous fuel gases, are passing ordinances for smoke suppression.

There is reason to hope that the nuisance will ultimately be suppressed and that our chimneys will discharge only the final products of complete combustion, viz.: Carbon Dioxide and Water Vapor.

Meanwhile devices for minimizing the injurious action of smoke, furnishing means for producing better and more complete burning of fuel, possess great interest.

As very little volatile or gaseous matter is stored in anthracite coal, its smoke is hardly perceptible. Wood is not burned in our cities to an appreciable extent, and if so burned, its smoke not containing the poisonous gases of coal, would not be a menace to life and property.

The softer, or bituminous coals are the principal offenders.

CHAPTER VII.

SAFETY AND SANITATION.

It has been stated in a preceding chapter that the lives and health of a family are often seriously affected by the imperfect or careless manner in which coal or gas is burned in stoves and ranges. Safety follows sanitation. If the fire is properly confined in the stove and the proper quantity of air admitted to the fire in the proper place and at the proper time, the fuel will be properly burned; in other words, perfect combustion will be nearly realized. In such case the unsanitary condition of poisonous coal gas will be eliminated.

The elimination of coal gas—the deadly carbonic oxide—is and always has been since coal has been burned for fuel in the home, a more difficult problem to solve, and its elimination is only possible by providing means for the complete burning of the fuel gases. Good, tight plumbing will obviate the disagreeable odor which follows the intrusion of sewer gas into the atmosphere of the home. The coal gas is far more frequent a visitor in the homes of the rich and poor than the obnoxious smelling sewer gas. As soon as the presence of sewer gas is realized prompt measures are taken to remove the nuisance. The plumber is called and disinfectants are liberally used to purify the atmosphere of the home. No expense is considered to be too great, if only the foul intruder can be expelled.

The deadly coal gas, Carbon Monoxide, however, does not herald or give premonition of its coming. It is colorless, tasteless and without odor, and is, therefore, extremely dangerous. Chemists assert that carbonic oxide gas is the most dangerous and deadly blood poison known to science.

Physicians who have made extensive and protracted investigation and are familiar with the symptoms of carbon monoxide blood poisoning attribute many of the physical ills, more particularly of women and small children who remain much indoors, to the baleful effects of the constant yet unrealized inhalation of coal gas. The sufferers usually attribute their ailment to other causes, not realizing the presence of the deadly gas.

Some of the typical symptoms of this blood poisoning are headache, dizziness, shortness of breath, palpitation, drowsiness, impaired energy and strength.

When carbon monoxide is inhaled, as it is very often daily, the supply of oxygen inhaled is, of course, less, and serious changes are made in the heart, brain and other organs, and lesions are to be expected.

When coal was first introduced in France from England, one serious objection to its use was that the complexion of women was injured by the inhalation of the smoke and gases. At that time it seemed a trivial objection, but who can now doubt that as the inhalation of coal gas is known to deplete and shrivel the corpuscles of the blood, that the complexion and countenance of those inhaling it constantly would fail to betray its poisonous presence?

It has been stated that wood fires are more healthful because of the comparatively slight presence of carbon monoxide in that fuel, and that coal gas, is and has always been, a menace to life and health since it came into general use for fuel. Also that anthracite coal contains a smaller proportion of carbon monoxide in its composition than any of the soft coals. More gases and smoke are generated from their burning because they contain a large proportion of the volatile gases. It necessarily follows that the housekeeper must contend against more deadly carbon monoxide and smoke when burning the bituminous coal.

While the coal range frequently proves to be a factor in coal gas poisoning, the danger is not always in the fact that the stove is defective or illy constructed for its purpose. Frequently it has been mismanaged by the cook or housewife. If out of repair, exposed fire box, or if its flues are choked with soot or ashes so that its ordinary draft is impeded, the unburned coal gas will generally find its escape to the kitchen atmosphere. A foul chimney or an accumulation of soot or ashes in the smoke pipe, more liable to occur in the elbows or where the pipe enters the chimney flue, may produce similar results. The danger is greatly increased where both conditions exist.

WHEN GAS IS BURNED?

While the province of this small volume does not quite cover the problem of burning gas as fuel, yet many have gas ranges also, or combination gas and coal ranges, and it may be desirable for such to understand the greater danger from carbon monoxide in operating the gas range.

An eminent authority has written as follows: "There is no industry connected with the production and sale of a deadly poison so little subject to control and regulation as the gas industry."

Illuminating gas was formerly distilled from suitable bituminous coal and contained less than seven per cent. of carbon monoxide. As stated, if inhaled in sufficient quantity, it will destroy life, but such inhalation could scarcely occur without the knowledge of the affected party. The deaths from accidental poisoning due to gas leakage were quite infrequent. The present system of manufacturing illuminating gas is less expensive than the old. Water gas, as it is now known, is not distilled, but made from forcing steam on hot coal, anthracite or coke, which is partial burning or combustion. The steam changes the coal to carbon monoxide, and instead of being less than seven per cent of the volume, it is nearly thirty-one per cent. or five times the former percentage. Measured by deaths from gas poisoning, the difference is much greater where illuminating gas as now manufactured is used.

The economic feature has controlled the sanitary feature. While the cost of gas fuel has been reduced, the liability to death from gas poisoning has increased nearly five fold.

Most of the apparatus furnished for heating and cooking purposes has been constructed with but little attention to the sanitary or health preserving feature. It is used about as ignorantly as our barbarous ancestors used their tent fires, except that the hole in the roof does not appear in our habitations.

Any device, plate or burner, designed for burning gas, either for lighting, cooking or heating purposes in the open atmosphere of the room without being enclosed or confined, is a menace to life and health. The combustion of the gas is very liable to be incomplete, and if the carbon monoxide is not wholly consumed it is certain to vitiate and poison the atmosphere of the room in which it is burned.

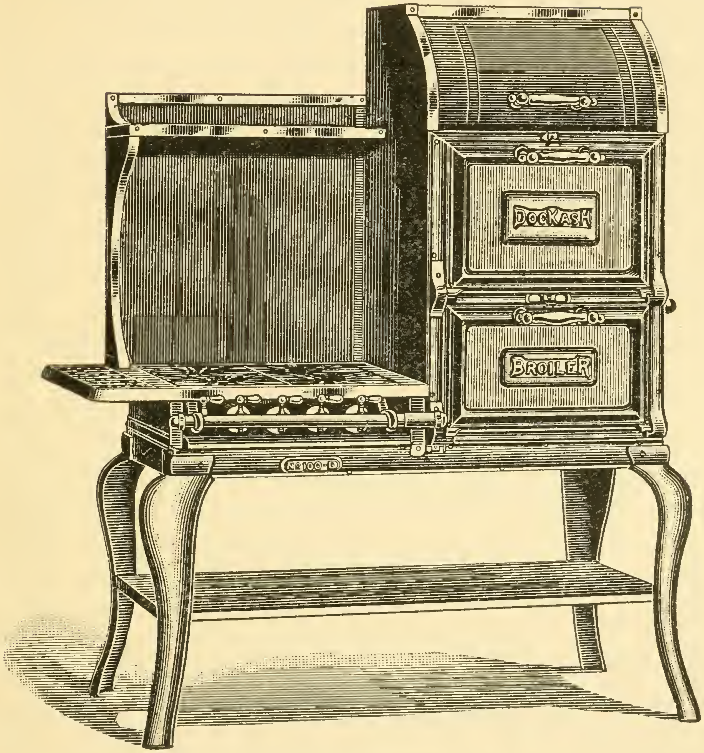
The gas tubing used to connect the plate or burner or flatiron with the gas pipe is often cheaply constructed, soon becomes leaky, and a lighted match held at the connections will often light a flame an inch long. The gas range requires constant attention and care, else instead of being an economical heat producing machine, it often becomes an instrument of death and disaster.

Not only do many deaths result from carbon monoxide poisoning as a result from leaky and defective pipes and fixtures, but that fact is really unimportant compared with the effect upon health of gas leakage in less than immediately fatal quantities. Air containing only four-tenths of one per cent. of carbon monoxide would, after a sufficient time, cause death in man, and even one-half that quantity would in many cases prove fatal.

It follows, therefore, that either a coal range or a gas range is a most important factor in the life and health of any family. It may be made an almost perfectly working machine, both economical and sanitary in its operation, a device of great comfort and convenience; or by indifferent or careless atention it may prove not only extravagant and unsanitary, but destructive of human life.

Too careful attention cannot be given to the following chapter on combustion or burning fuel in stoves.

THE DOCKASH GAS RANGE.



The Dockash Gas Range, as shown above, possesses the desirable features which all efficient gas ranges must possess if the best cooking can be done and the fuel gas burned in a sanitary and economical manner. It can be furnished to burn gasoline, but has been constructed to burn artificial or natural gas. It is manufactured by The Scranton Stove Works, Scranton, Pa.

CHAPTER VIII.

FUEL BURNING AND FUEL SAVING.

The following is quoted from an editorial in The Nation: "When hard coal is ten dollars a ton many will study the mysteries of their furnaces and kitchen range and it will be found that with careful husbanding of heating and cooking fires, from **one-quarter to one-half of the fuel formerly consumed can be saved.** It will not be many generations before able-bodied Americans will be seen picking up dead leaves and dried pods along the road to cook their dinners."

It is true that the last named condition already exists in European countries, and that every twig of wood that can be utilized as fuel is carefully preserved for use when needed.

Anthracite coal is on its way to ten dollars a ton, and soft coal is advancing toward the same excessive price.

A large saving can be made in any home by simply controlling the fire. Fuel is wasted because the fire is not controlled, but is usually allowed to shirk for itself. It either is allowed to burn too fast, thereby forcing the largest volume of heat through the smoke pipe and chimney into the air where its only purpose is to warm the atmosphere, or it is allowed to smoulder and die out, making it necessary to rekindle or light afresh, both of which conditions result in a wasteful expenditure of fuel.

The great volume of heat lost because of its escape through the smoke pipe and chimney is not realized by the housewife. No thermometer used in the home for measuring the temperature is graduated or marked in degrees nearly high enough to register or measure the degrees of heat inside the smoke pipe. When the temperature of a kitchen is at eighty or ninety degrees only, and a brisk fire burning in the range with an oven hot enough for baking and roasting, the temperature **inside** the smoke pipe frequently registers five hundred or more degrees. This escaping heat is a total loss so far as its usefulness for cooking and baking is concerned. A greater volume of heat exists inside the smoke pipe, where it is not needed, than in the oven, where it is needed. The heat radiated from smoke pipe and chimney may serve to partially warm other rooms through which either or both may chance to pass, but aside from this benefit no useful purpose is served in allowing such large volumes of heat to escape without any attempt to control its exit.

If it were possible to confine all the heat which escapes from the top of the chimneys of an ordinary dwelling into one room covering the area of the top of the dwelling, that room would, even in zero weather, be warmer than any room in the house. It would be a summer garden in which tropical fruits and plants would grow and thrive. The remedy for such gross waste of heat lies in its control after it has been generated in the stove machine by preventing its free exit from the stove. This is done by a properly constructed and properly installed damper **inside** the smoke pipe flue.

It has already been shown that in order to burn fuel properly, and, therefore, economically and with the best practical results, a certain proportion of air must be furnished to the burning fuel, which is, under perfect stove, chimney and fuel conditions, with proper attention to fire control, twelve pounds of air (one-fifth part of which is oxygen) to each pound of carbon, let us say, to each pound of best anthracite coal. In our domestic affairs, however, those **perfect** conditions never exist, and consequently a considerably larger quantity of air or draft, so called, is necessary.

It is not anticipated nor expected that any housewife or cook could, or would if she could, measure or weigh the air or the fuel consumed in maintaining the fire. It is, however, necessary to forcibly impress upon all the fact that far better fire and stove service may be secured from a less consumption of expensive fuel by exercising a better control of the stove machine. Better control of air admitted to the fire and better control of the heat products of combustion after the same have been generated. This means more careful attention to drafts and dampers.

The prevailing practice is to allow far too much air to enter the fire. The more air admitted to the fire under the grate by allowing the lower slide dampers to remain long wide open, the greater will be the intensity of the fire, but also the faster will the heat be driven to escape through the smoke pipe and chimney flue, so that only a small proportion of the desired heat is utilized. If this heat be prevented from escaping so rapidly by a proper use of the smoke pipe damper, it will be retained in the stove and utilized to better heat the oven and combustion chamber of the stove for all heating, cooking and baking purposes. **It will be found that less fire is needed because the chimney waste is largely reduced and less air or draft is necessary under the grate.**

It has been stated that fuel is carbon and that the larger the quantity of carbon in the fuel the more valuable it is as fuel. Also, that the carbon is of two kinds, viz., solid carbon or coke, and free carbon or gas, both of which may be burned in order to produce heat. Neither, however, can be entirely consumed, for there will be a small residue or remainder of the solid carbon in the form of ash, and a portion of the gas is also incombustible—will not burn—and must be allowed to escape through the smoke pipe and chimney flue. The nitrogen of the air which enters the fire with the oxygen does not burn and escapes with the waste gases. Nitrogen is the largest quantity of the gases escaping through the chimney, but it is not poisonous. It, however, is often so large in quantity that it absorbs much heat in its passage through the fire, so that if two or three times as much air as is necessary is admitted to the fire, the extra amount of nitrogen takes up a great deal of heat and carries off just so much of the heat with it in its journey through the chimney.

The solid carbon and the free carbon burn separately and distinct, there being two separate processes in the burning. When coal is added to a fire the heat causes the free carbon, the gas, to separate from the solid carbon in the form of water, vapor, steam, in small quantity only, which is mostly consumed. Directly the carbon gases are also released, and if proper quantity of oxygen is supplied so that every atom of the fuel is exposed to the action of the heated oxygen, the carbon gas mixes in even quantity with oxygen, thus producing carbon monoxide gas which will burn to carbon dioxide gas if another even quantity of oxygen has been supplied, thus producing heat. This is at the bottom of the layer of fuel directly at the seat or place of live coals. As these gases are working upward through the fire there is less oxygen than nearer the grate, and as the fire increases there is more gas produced from the upper layer of the fuel and consequently more free carbon. There is not then enough oxygen to mix with the carbon monoxide, which, as has been stated, will burn. This gas finds its way through the bed of fuel unconsumed, because it has not found another equal quantity of the needed oxygen to support or help it to burn. It then must find its affinity—oxygen—above the fire or it will escape either into the kitchen or into the atmosphere through the chimney. In either case, it is waste, and it is also a menace to health and life.

In order to be certain to burn this combustible gas known as carbon monoxide, it is necessary then to furnish oxygen at or near the top surface of the fire, so that the burning of all the combustible gas may be complete. The right quantity of oxygen must be supplied at the right time and right place. More still is necessary. Cold oxygen will not unite with hot carbon gas, so the oxygen should be heated to a high degree of temperature before it is allowed to enter upon the fire. Oxygen could be readily furnished by removing wholly or partially one of the stove lids, but the quantity admitted not only would be excessive, but its temperature would be so much cooler that the union would not take place.

It will therefore be understood that the proper manner to burn fuel is to furnish air under the grate in regulated quantity, and to furnish **heated** air to the upper surface of the fire in order to completely burn the combustible gas which is always seeking to escape.

The burning of the coke or solid carbon proceeds regularly in a more simple manner and requires but little additional air.

It is not the great intensity of the fire in the range, but its proper control, which affords the most satisfactory volume of heat. A moderate, uniform fire is usually sufficient for all practical purposes, and if under good control it can be increased or diminished almost as desired.

CHAPTER IX.

SUPER-HEATED OXYGEN AND FUEL SAVING.

The principle long since established of materially aiding the perfect combustion of fuel gases by projecting freshly heated air upon the top of fire has for a few years received marked attention by heating engineers in the United States and Europe. Heating engineers employed by railroad companies and large manufacturing corporations have made numerous experiments with many mechanical devices designed to furnish a blast of hot air upon the top surface of the burning fuel in the fire box of stationary and locomotive engines. Also many locomotive engines have been equipped with accessories to super-heat the steam in order to create greater expansive power, and in both instances to primarily save fuel by utilizing all of the heat units instead of allowing the imperfect combustion of the fuel to continue. Many manufacturers of stoves have constructed their ranges so that the air can be heated before it reaches the fire. Also manufacturers of hot air furnaces, steam and hot water boilers are adopting this principle by supplying means to super-heat the air before it reaches the fire box.

Mr. John Livingstone, a heating engineer, read before the St. Louis Railway Club a paper on "How to Save Fifty Per Cent. Now Spent on Coal." His remarks were as follows:

COMBUSTION OF FUEL.

"Each locomotive will consume about five thousand dollars worth of coal each year on the average.

If the union of the oxygen with the carbon of the combustible is perfect the result is Carbonic Acid.

In the union, oxygen burns as well as the carbon of the fuel.

When a ton of coal is said to be burned it means that if the combustion has been perfect every pound of the hydrogen (of the combustible) has entered into a union of eight pounds of oxygen producing 62,032 units of heat; that every pound of the carbon (of the combustible) has entered into a union with 2.66 pounds of oxygen and produced 14,500 units of heat; that every pound of carburetted hydrogen (of the combustible) has entered into union with four pounds of oxygen and produced 23,313 units of heat; that every pound of bicarburetted hydrogen (of the combustible) has entered into union with 3.43 pounds of oxygen and produced 21,343 units of heat; that every pound of sulphur (of the combustible) has entered into union with one pound of oxygen producing 4,032 units of heat. And that to obtain those units of heat, the oxygen of the air was burned as well as the combustibles of the fuel. Those would be the resulting units of heat in perfect burning and about seven hundred and thirty thousand cubic feet of air would be required per ton of coal to deliver those combining portions of oxygen in the fire box.

In the act of burning, an excess of air will lower the temperature below that at which carbon and oxygen will unite, and if an insufficiency of air for that union, Carbonic Oxide instead of the Carbonic Acid which results from perfect union, will be evolved.

In the act of burning on the grate by the union of the combustible with the oxygen coming in air up through the grate, Carbonic Acid is formed, but that in coming through the bed of fuel to the surface is robbed of one and one-third (1 1-3) part of its oxygen and the Carbonic Acid is resolved into Carbonic Oxide; in effect the 14,500 units of heat from the perfect union of the carbon and oxygen are reduced to 4,452 units of heat by the formation of the Carbonic Oxide. But the Carbonic Oxide is a combustible Gas, and if there be oxygen with the temperature over the bed equal to the igniting temperature for carbon, when the Carbonic Oxide emerges through the fuel bed, the oxygen will unite with the Carbonic Oxide, reconvert it into Carbonic Acid with recovery of the lost 10,000 units of heat; the problem at that stage for the steam maker is how to get the required oxygen into the fire box without lowering the temperature.

As the fire burns it tends to create a vacuum.

The air rushes in to fill the vacuum."

The principles governing the complete and therefore economical burning of fuel in all heating systems is the same. The solid carbon and the free carbon—gas—burn in the same manner **in the stove** as in the locomotive. Different devices only are required to put the principle in practical operation where fuel is burned for domestic purposes. Such devices are successful in their operation and are valuable accessories to the range or stove. The saving of fuel is large, while the labor of maintaining the fire is greatly reduced. An illustration of a device made in circular form, to be used without alteration to the stove, simply occupying the place of one of the lids, appears on another page.

PART II.

"Few people appreciate the fact that there can be a real saving of fuel with a coal range."—Good Housekeeping Magazine.

CONTENTS.

ILLUSTRATIONS.

NECESSARY CONDITIONS FOR FUEL SAVING.

First—A good stove in good repair with proper chimney connections.

Second—Good fuel.

Third—Proper attention by the cook or person who operates the fire.

A GOOD STOVE.

A good stove is one suited to burn either wood, coal or coke. A change in grate may be necessary according to the kind of fuel to be burned. It should have a fire box of sufficient capacity to hold, when three-fourths full, enough fuel to properly heat the oven for baking and roasting. Also, if water reservoir is attached or hot water boiler to heat the water satisfactorily. Usually the oven test is sufficient, for any cooking stove or range which furnishes sufficient heat for baking and roasting performs all other functions satisfactorily. It should be equipped with free acting grate, proper fire brick lining of fire box and all its parts should be tightly fitted and assembled so that outside air can be excluded at will from the ash pit, fire box, oven and general combustion chamber of the stove. All draft and damper slides should be closely fitted and work easily when manipulated. The stove pipe should fit closely upon the collar of the stove or range, and it should be connected with the chimney flue with as few elbows and angles as possible. The general draft is better sustained by direct connections than when the pipe must follow a tortuous course to the chimney flue. Where the pipe enters the chimney it should be made tight and close by surrounding the pipe with a thimble so that no air can enter the chimney flue around the pipe. The pipe should not extend into the chimney flue, but should only meet it unless the chimney draft should be very strong, when the pipe could enter the flue and its end could be closed and the upper side of the pipe cut off slantingly, which would tend to decrease the strong draft. If another pipe connection with the same flue exists, either opposite or below, and which interferes with the draft of the stove in question, the same application could be made with beneficial results.

SMOKE PIPE AND DAMPER.

A cut-off damper, either round or oblong, should be installed inside the smoke pipe at as high a point above the stove as it could be conveniently reached by the operator standing upon the kitchen floor. No stove damper quite equals in efficiency the smoke pipe damper. It can be used wholly or partially closed, or open. Under certain conditions it can be used to prevent a down draft of air from the chimney and upon the other hand it can be used to moderate a strong draft when needed. The ordinary smoke pipe damper is perforated, having a hole in the center an inch or two in diameter, which is supposed, when closed, to allow the exit of nitrogen and other escaping products of combustion.

This construction, although long used, is unscientific, for the nitrogen and other gases do not ascend perpendicularly, but spirally, and at the rate of from three to ten feet per second. The damper should not be perforated, but it should be installed with a less diameter than the inside of the smoke pipe so that the incombustible gases which must be allowed to escape can pass when the damper is closed between the outer edge of the damper and the inside of the smoke pipe. An opening all around the damper, when the same is closed, of three-sixteenths of an inch is usually sufficient to allow the incombustible gases to escape.

GOOD FUEL.

The best fuel cannot always be obtained, but only the best obtainable should be purchased.

WOOD.

If wood must be burned it should be cut in lengths only an inch or two shorter than the inside length of the fire box in which it is to be burned. It should also be well seasoned, containing as little moisture as possible and preferably of the hard varieties like oak, beech, birch, maple, etc., and if split finely it will be consumed more rapidly than when in larger pieces, and round wood will not be burned so quickly as when split.

COAL.

The most satisfactory coal to purchase, and which is burned with less waste, less labor, and furnishing more units of heat, is hard anthracite. It is not accessible in all parts of the country owing to its production in a limited field and the consequent excessive transportation expense to remote distances. Its cleanliness and the limited quantity of gaseous matter it contains are additional reasons why it is considered the most desirable fuel for domestic consumption.

ANTHRACITE.

The amount of carbon in anthracite coal varies from eighty-five per cent. to ninety-eight per cent.; the volatile gases varying from one to eight per cent., while ash varies from one to seven per cent. Only that anthracite should be purchased which has the largest proportion of carbon. It should be practicable for the housekeeper to demand from the dealer an analysis of the composition of the coal he offers to sell, and its price should be based upon the heat giving qualities of the product. The sale of coal should be regulated by law in the same manner as the sale of milk and food products are regulated. This is a reform which in due time will be inaugurated, and the subject no doubt will be taken up by the organizations of women who are seeking to discover methods by which the high cost of living may be reduced.

SEMI-ANTHRACITE.

This follows closely hard anthracite in all its desirable features. It contains more volatile matter and is rather freer burning.

SEMI-BITUMINOUS.

It is a very close second to semi-anthracite, burning still more freely and contains a still larger proportion of volatile gas. It is, nevertheless, a desirable fuel, and can be burned practically under the same conditions as anthracite.

BITUMINOUS.

Ordinary bituminous or soft coal is very plentiful, immense deposits existing in nearly all of the states in the South, West, and Central West. Its price is much less than that of anthracite owing to its abundance and to the fact that it is more gaseous, not so clean to handle, and having less carbon in its analysis. A very large proportion of the population in the United States burn soft coal for domestic purposes for the reasons given and because of its being so accessible. Its carbon varies from fifty-two to eighty-four per cent., its volatile matter from twelve to forty-eight per cent., ash and earthy matter from two to ten per cent., and it also contains from one to three per cent. of sulphur. As sulphur will burn, its low percentage is not objectionable.

PROPER ATTENTION TO THE FIRE.

Modern stoves are machines used to convert any of the fuels named into heat. The stove being a machine must be operated by an engineer, who may be man or woman, housekeeper, cook, maid, or servant. If this engineer understands the nature of fuels and their gases, the elements Oxygen, Nitrogen and Hydrogen and the use of drafts and dampers incident to the machine we call the stove, the labor of operating it will be reduced very greatly, and a very large reduction made in fuel consumption.

It should be remembered that when coal is burned gas is first produced, then this gas that is combustible should be burned **inside the stove** and the heat utilized instead of being allowed to escape through the smoke pipe and chimney unconsumed. The machine is intended to be used first to convert the fuel into gas, and second, to provide means to burn the gas.

Specific directions follow:

OF FIRST IMPORTANCE.

First—The stove and the pipe and where the pipe enters the chimney flue must be kept clean. Ashes and soot must not be allowed to accumulate in any part of the stove or pipe at the connection of the pipe with chimney flue. Such accumulation impedes draft, and without good draft the complete efficiency of the stove will not be realized.

Second—Do not add large quantities of coal at any time. A larger quantity may be necessary to carry a fire over night, but not nearly so much is necessary as is commonly believed.

Third—Do not allow lower slide drafts to remain open long at any one time, nor should the pipe dampers remain open indefinitely. Try to operate the stove with the smoke pipe damper closed as much as possible. The cut-off smoke pipe damper can be opened or closed one-fourth, one-half, three-fourths, or opened or closed completely. It can be adjusted at any angle. The oven damper, however, is not adjustable to stop at any angle. Generally it is so constructed that it must be entirely open or entirely closed. The lower slide draft is adjustable. It can be opened only one-eighth of an inch, or entirely opened, or stopped at any intermediate point. Do not allow too much air to enter below the grate. Limit the quantity by using the slide draft in the door below the grate.

Fourth—Operate the fire by keeping it as low as possible in the fire box. Never permit the fuel to be above the top of the fire bricks.

Fifth—Shake grate lightly to dispose of loose ashes. There will be no clinkers unless the fire has been allowed to burn too fiercely and then suddenly cooled.

Sixth—If the chimney draft is weak or medium, open the oven damper and operate the stove with the aid of the smoke pipe damper and the lower slide draft. When baking is necessary, follow the directions given elsewhere.

EXPERIMENTS WITH DRAFTS AND DAMPERS.

First—Open the lower slide drafts and oven damper and wholly close the smoke pipe damper. Watch the action of the fire long enough to determine the result.

Second—Then also close the oven damper, leaving the lower slide draft open. Again carefully observe results.

Third—Now close the lower slide drafts also and observe as before.

Fourth—After that experiment, open the oven damper, leaving the smoke pipe damper and the lower slide drafts closed. This should hold a good fire a long time with but little fuel consumption. If more heat is needed, allow more air by opening the lower slide drafts as little or as much as the occasion may require.

Fifth—It will be seen that the lower drafts being adjustable and the smoke pipe damper being also adjustable, the fire may be controlled at will. It is only in those extreme cases of very strong draft that it will be found necessary to also close the oven damper (baking excepted).

STARTING A WOOD FIRE.

Remove all the dust and ashes from the grate and also from the top of the oven and brush them into the ash pan. Ashes should be removed daily and not allowed to accumulate, because they absorb heat, and if left, might choke the draft. Also, ashes should be frequently removed from under the oven. The cleaner the stove can be kept in all its chambers of soot and ashes, the better. The draft will then remain normal.

Either shavings or paper should be placed in the bottom of the grate loosely,—not packed,—so the air can pass freely through them. Upon this lay small kindling of light wood, the pieces crossing each other, and then use larger pieces of wood crosswise as much as possible. The air can then pass freely through the fuel after it is lighted, and now light with match or paper or wood taper from below after having the stove lids in place. The smoke pipe and the oven dampers must be wide open—also the lower slide drafts below the grate. After the fire has been well started and the fuel settled, add more wood and close the oven damper and partially close the lower slide. If the chimney draft is strong, the lower drafts may be entirely closed. If there is installed a cut-off damper in the smoke pipe above the stove, it should be also closed. It is better to control the fire by opening or closing that damper in connection with the lower draft. At times either may be wholly or partially opened or closed independently of the other.

STARTING A COAL FIRE.

The same process should be followed as with the wood fire except to place a shovel or two of fine coal on top of the wood. When the fire is nicely started add two or three shovels of coal, and when the coal is burning red fill the fire box three-fourths full, but never to the top or above the fire bricks. If the coal reaches above the top of the fire brick the lids and top of the stove will become red hot and be warped or broken, the draft will be impeded and fuel wasted. Damage will be done and no benefit realized.

When the blue flame appears on top of the fire, close the drafts and dampers wholly or partially as before. Add small quantities of coal as needed and be certain to have it sprinkled over all the top of the fire. The top of the fire should always be kept level, for if fuel is placed only at one end the fire will not be uniform and one end of the fire will be burned out when the other end is burning briskly.

Do not remove covers to dampen the fire, but control it by using a smoke pipe damper. In case the chimney draft is very strong, the fire can be further checked by partially opening the slide draft directly over the fire.

Always seek to check the fire by other means than forcing air upon the top of the fire by removing lids. By such means fuel is wasted and coal gas allowed to escape in the room.

COKE FIRES.

A coke fire is operated in the same manner, but requires less air for draft than coal. It produces more heat and burns out grates and fixtures more than other fuels if not properly controlled. Coke absorbs moisture readily and should be stored in a dry place.

SOFT COAL FIRES.

This fuel is burned in a similar manner and does not require so much draft as hard coal. Sometimes soft coal fires become caked on top and need to be stirred or broken with a poker before fresh fuel is added. If small quantities only of soft coal are added to the fire, it may be burned with much less smoke.

FIXING THE FIRE FOR THE NIGHT.

First—If the chimney draft is very strong, don't shake out all the loose ashes in the bottom of the grate, for a new and clean fire will burn out too quickly. If some ashes remain in the bottom of the grate it will cause the fire to burn more slowly.

Second—Put on the fire only one-half the usual quantity of fuel supposed to be necessary to carry the fire till morning. Do not remove the stove lids to dampen the fire, for when cold air is admitted to the top of the fire, combustion of the coal is imperfect and the sulphurous and poisonous gases will escape into the room, but in cases of very strong draft the slide check draft above the fire box may be partially opened. Leave the damper in the smoke pipe closed or partially closed according to the strength of the chimney draft. With strong chimney draft, the smoke pipe damper may be closed, and with a weak or medium chimney draft it may be left entirely or partially open. Another method of retarding a strong draft is to pack the fuel tightly so that the air cannot circulate freely through it. Only in extreme cases is such action necessary.

IN THE MORNING.

If the fire is out in the morning, it has had either too much or too little draft. If the coal is all burned to ashes there has been too much draft—too much air supplied. In such case the smoke pipe damper must be entirely closed, and some of the expedients before mentioned used also. If the coal has not been burned, but the fire has smothered out, there has been too little draft, and the pipe damper should be left entirely open. When a fire is found to be low in the morning, open all drafts, oven and pipe dampers, and sprinkle a little coal over the fire and be careful about shaking the grate too much for that might disarrange the fire so rebuilding would become necessary. Shaking out the loose ashes gently or raking them from the bottom of the grate with a poker is the proper treatment.

BAKING AND ROASTING.

All stoves and ranges not known as "good bakers" require special preparation of the fire previous to using the oven for that important purpose.

The fire, therefore, must be prepared by vigorous shaking of the grate to remove loose ashes. A moderate quantity of fuel—coal when that is the fuel—or wood, should be covered upon the fire and the oven or smoke damper opened. Also the cut-off damper inside the pipe should be opened (we insist that a cut-off damper inside the pipe is an indispensable accessory to any stove or range). The lower drafts must be wide open, which will cause the fuel to be burned rapidly. When the coal is incandescent—red—close the smoke pipe damper, and the heat, instead of passing up the smoke pipe and chimney, will be retained in the stove and the oven quickly heated. If then it seems desirable to have more heat in the oven, close the oven or smoke damper, which will send the heat over and around the oven, and partially open the cut-off damper in the smoke pipe, **leaving the lower drafts open.** If the oven gets too hot, close the lower drafts and open wide the cut-off damper in pipe. It is desirable to retain all the heat possible in the stove and therefore the smoke pipe damper should be kept closed as much as possible and the lower drafts kept open as necessary. By this process the heat, instead of escaping through the pipe and chimney is utilized in the stove. The result is less consumption of fuel.

CLINKERS.

Occasionally housekeepers are annoyed by the collection or fusing of the fuel into rough, irregular bodies usually known as clinkers. They occupy space to the extent of reducing the volume of the fire and often seriously impede the draft. They are commonly supposed to consist of poor coal, which, in some instances, may be true. Generally they are the product of poor combustion occasioned by the mismanagement of the fire. The drafts have been allowed to remain open too long, resulting in a very high temperature of the burning coal. This condition being observed by the person who maintains the fire, drafts are closed and lids removed to dampen the fire. The cooler air in the room quickly lowers the temperature of the fire, stopping combustion, and as a result the unconsumed parts of the fuel fuse—collect in a mass, which are called clinkers. The difficulty may generally be obviated by maintaining better control of the fire and not allowing it to burn to white heat.

WHY A DAMPER SHOULD BE INSTALLED IN THE SMOKE PIPE ABOVE THE STOVE.

First—Because by using a smoke pipe damper in conjunction with the lower slide drafts the fire can be better regulated and controlled than by relying upon the oven or smoke damper which is located at the base of the pipe inside the stove. The principal benefit derived from the oven damper is in its use in sending heat around the oven. Nine-tenths of the time it would be better to have the oven damper open and rely on the smoke pipe damper for control. In baking, the oven damper may be used if thought necessary.

Second—It is desirable to allow nitrogen and other incombustible gases to pass away from the burning fuel as quickly as possible, for they are in the way and retard complete combustion. If the pipe is open at the base the nitrogen will pass quickly up the pipe through the smoke pipe damper into the chimney at the rate of three feet or more per second and into the atmosphere. If, however, the oven damper closes the pipe at the base the nitrogen is retained too long in the stove and must pursue a tortuous journey across, up and down several feet in distance before it can resume its direct journey to the atmosphere. Its presence is deleterious to good combustion.

Third—It better prevents waste through the chimney.

Fourth—It greatly assists in producing slower yet better combustion of the fuel, thereby burning the fuel to fine ashes, which renders sifting unnecessary.

Fifth—It assists in securing better control of the fire and prevents the stove top from being overheated and injured.

Sixth—It helps to prevent down draft in the chimney and stove from smoking.

Seventh—it will prevent chimney fires where wood is burned as fuel.

Eighth—It greatly assists in controlling strong draft.

Ninth—it greatly assists in securing a hot oven for baking and a hot fire for ironing by keeping the heat in the stove, thereby saving large quantities of fuel.

Tenth—By better fire control the stove will last longer, will not need frequent repairs, permits maintaining a low fire in hot weather, with a warm kitchen even in zero weather and a plentiful supply of hot water at all times.

HOW MUCH COAL IN TWENTY-FOUR HOURS?

When the heat which in the ordinary processes of burning coal in stoves and ranges is allowed to escape up the smoke pipe and chimney is utilized in the stove, the saving of coal is enormous. Many families of only ordinary size—six persons—consume as much as one ton of two thousand pounds in a single month, or sixty-six and two-thirds pounds each twenty-four hours as an average. This amount, large though it may be, is often exceeded—as much as seventy-five pounds per day, or the equivalent of three large coal hods, is frequently consumed.

When stove conditions are favorable and good fuel had with the proper smoke pipe damper installed, not more than thirty-three pounds of anthracite coal should be consumed in a family of six or seven persons. The assumption is that the fire has intelligent attention.

One ton of coal at the rate of thirty-three pounds daily will be burned in sixty days. At the rate of $6.00 per ton for coal the cost of fuel will be ten cents per day, or $3.00 per month, which is not an excessive fuel expense, although so much would not be burned in all the months of the year. The Author has frequently observed instances where ten pounds less per day are consumed, and the more careful and painstaking cooks demonstrate they can operate their range with twenty pounds of coal daily unless some extra demand has been made for more heat. At this rate of coal consumption the cost would be but six cents daily, or one dollar and eighty cents per month.

THE BURNING OF ILLUMINATING GAS.

Gas as Fuel. The illuminating gas manufactured by distillation from coal and called Coal Gas was first used in the United States for lighting and not for cooking purposes. It contained only about seven per cent. or one-fourteenth part of Carbon Monoxide Gas, which is a deadly blood poison.

As the public demand for gas both for illuminating and cooking purposes increased, gas manufacturers learned to manufacture what is called Water Gas and which contains from thirty to forty per cent. of the deadly Carbon Monoxide. This Water Gas is manufactured more cheaply than the former gas, so while the consumer may gain in economy of dollars (which is not at all certain), and convenience, for gas is a convenient fuel to burn, it is at the risk of the health of the family.

The following is quoted from a bulletin by Dr. Bensel, Chief of the Sanitary Bureau of the Health Department, New York City: "Gas stoves are by all odds the most detrimental of the heating apparatus inasmuch as the products of combustion in themselves include gases that are detrimental to health and at times even dangerous to life. In the case of gas stoves not only is oxygen removed from the air and Carbon Dioxide and water added to it, but a certain quantity of Carbon Monoxide, an extremely deadly gas, is also added. The case of oil stoves is a little different inasumch as the products of combustion are simply Carbon Dioxide and water, none of the dangerous Carbon Monoxide being added.

In both instances, however, as the products of combustion are given directly into the atmosphere they must be considered as decidedly detrimental to health unless extreme provision is made for ventilation. It may be added that extreme ventilation is such a rarity as to be unusual."

Carbon Dioxide is the gas which is a product of **complete** combustion. It will not burn, but is the product left after all other gases have been consumed. Plants breathe and must have it to prolong their life. It exists constantly in the atmosphere in the proportion of four parts in ten thousand. When air is inhaled by humans containing six parts in ten thousand, the sanitary limit has been reached.

Carbon Monoxide is the gas which is a product of **incomplete** combustion, and as complete combustion in stoves is seldom realized, the danger of Carbonic Monoxide poisoning is always imminent.

The toxic—the poisoning—power of Carbon Monoxide is sixty times that of Carbon Dioxide. It is absorbed in appreciable quantities by the blood from an atmosphere containing in it one part in five thousand. When air containing one part of Carbon Monoxide in two thousand is inhaled, the blood absorbs as much Carbon Monoxide as oxygen, and death ensues.

Prolonged exposure to an atmosphere containing even one part of Carbon Monoxide in twenty thousand is extremely dangerous to health.

THE GAS STOVE.

When gas is used continuously through the year for cooking purposes, some provision should be made to carry off the products of combustion, as they are of a poisonous nature and the conditions under which they are produced being different from gas lighting.

It cannot be insisted on too strongly that the idea that some forms of gas stoves or burners can be used without being attached to a proper flue is not only dangerous to health, but also militates against the use of gas for fuel. A gas fire, whether used for heating or cooking, must be connected with a flue, as the products of combustion are just as deleterious, if not so dirty, as those thrown off by the combustion of solid fuel.

Theoretically, complete and therefore both economical and hygienic combustion is possible in the operation of the Gas Range notwithstanding more than one-third of the gas fuel is a deadly poison. When all conditions are perfect the results cannot fail to be satisfactory, and all gases will be consumed except a small residue of harmless Carbon Dioxide and water vapor, even if there be no connection between the Gas Range and chimney flue.

It is probable, however, that more than ninety per cent. of gas stoves have at least one if not more burners out of adjustment. This condition is due to several causes, such as clogged burners, burners not in proper condition, insufficient supply of gas and the wrong proportion of air caused by inexperienced hands changing the position of the air shutter, any of which will produce incomplete combustion, the products of which, if not properly carried off, will condense on the doors, windows and walls. Therefore, when equipping a kitchen with gas appliances to be used throughout the whole year, ample provision should be made for either direct or indirect flue connections.

But little danger exists in summer months when doors are open and the kitchen well ventilated, but in the winter danger is extreme, as windows and doors will be kept closed and some means must be provided for the escape of the poisonous fumes. When oven burners only are connected with a flue, the waste gases from the top burners are not provided for and the direct flue connection with the oven burners sets up a draft that draws heat from the oven that otherwise would be utilized. This condition makes a greater expenditure of the fuel gas necessary. A direct flue connection with the oven burner might, too, result in a down draft, which has been known to extinguish the flame, and serious accidents have been the result.

A hood placed about three feet above the top of the stove and connected either with the chimney, the attic or the outside of the dwelling ofttimes provides the best and most practicable method of ventilation for gas ranges, as the fumes from the oven as well as from the top burners will rise directly to the hood and be carried out of the room by the heated current of air set in motion by burning gas.

Carbon Monoxide is often formed when the flames from a top burner strike the cool bottom of a vessel because of an improperly adjusted burner or one that is too near the racks. In this condition we have the gas burning in an insufficient supply of oxygen the same as when a burner back fires. The flames should not touch the bottom of the vessel placed on the burner. The burner should be placed low enough so that when properly adjusted the flames cannot come in contact with the vessel. If the flame is of sufficient length to touch the vessel it may be observed that there is a space directly underneath the vessel where there is no combustion taking place or no flame is burning, and as the vessel becomes heated this space decreases the temperature and extinguishes the flame, thereby giving incomplete combustion. This is not only a waste of gas, but an unsanitary condition, and the waste products should have convenient access to the outside atmosphere.

For sanitary reasons only, no gas stove or burner of any description should be allowed in use where proper flue conditions have not been provided. The laws of the state or municipality permit gas fuel composed of at least a one-third deadly poison to be sold without any restriction whatsoever. The mortality statistics of New York and Philadelphia show strikingly the increase in the poisonous qualities of the gas fuel since the introduction of Water Gas. The fatalities resulting from the accidental or other inhalation of Carbon Monoxide are but as a single grain of sand upon the seashore compared to the myriads of people who constantly suffer from continued inhalation of the deadly poison.

A Remedy. It has been proposed to restrict by law the amount of Carbon Monoxide in gas and to prohibit the distribution of any gas containing more than a stated quantity of the poisonous ingredient. This plan would prove effective but nothing short of a general uprising of the public in a demand for such legislation will avail. A system of weekly or monthly inspection of all installations where gas is used for fuel by properly constituted authority, while expensive, would greatly conduce to the health, safety and economy of the entire public.

The Gas Water Heater. When a Gas Water Heater is installed in a bath room a flue should always be provided for the exit of the waste gases. The burner in such a heater is necessarily large, and even if properly adjusted to give a correct mixture of gas and air, the flame is certain to come into contact with the cold coils, which reduces the temperature of the gas quickly and Carbon Monoxide and Acetylene will be given off, the result of imperfect combustion. It is very necessary to have flue conditions to dispose of these poisonous products.

Bath rooms are generally of small area and are usually not ventilated, and when the Gas Heater is in action, especially in cold weather, no ventilation is tolerated. The poisonous products must, under such conditions, remain to be inhaled, and this is often followed by serious results.

When a flue connection is made great care must be taken to prevent back drafts from the outside atmosphere as a back draft often smothers the flame. This can be prevented by placing a hood or cap at the outer end of the flue pipe. Ofttimes it is possible to have a connection exhausting in the attic. Back drafts are thereby almost completely obviated.

Another method of preventing back drafts is by installing a damper in the flue. While this method is effective, there is always present the danger that the damper may be accidentally closed or forgotten, and if the pipe has been neglected and becomes dirty and clogged with soot, the small openings in the damper will be obstructed, giving no ventilation whatsoever. Serious accidents have resulted under similar conditions. Such accidents may be avoided by keeping the Gas Range and flue clean so that the proper combustion of the gas can always take place.

The instantaneous water heater, though consuming more gas, is more hygienic than the circulating. The heated products of combustion coming in contact with the water destroys all germs therein, giving a pure bath water.

Keeping the Gas Range Clean. The necessity of keeping a gas range clean, especially the connecting flues and burners, is even a more important detail than a like supervision of the coal range. The gas fuel is more dangerous to handle than the coal fuel. When the flues and burners become clogged in a gas range the combustion is certain to be imperfect, and this condition positively results in great waste of gas and extreme danger to health and life. The holes in the burner must be kept open so there can be a steady, full egress of gas from the burner. Under the most careful usage and perfect conditions surrounding the gas range, the atmosphere of the kitchen is polluted to some extent with the poisonous products of combustion. All gas pipes, rubber hose and all their connections with stoves, flues, light burners and fixtures should be frequently tested to determine if leakage occurs in any quantity whatever. A small leakage here and there may appear unimportant, but in the aggregate its volume greatly pollutes the atmosphere of the kitchen.

Test for Leaky Pipes. Apply soap suds by means of a brush to the fittings and joints suspected of being leaky. Whenever there is a leak the escaping air will cause soap bubbles to form and will in this way show its location. The housekeeper should insist on tests by the Gas Company at stated intervals.

To Clean a Gas Stove. Every housewife or maid is more or less annoyed by the top of the gas stove becoming soiled, if not clogged, with spatterings of grease. All the parts of the stove that can be removed should for several hours be immersed in a warm lye containing one part of caustic soda to twenty parts of water. The fixed parts of the stove may be well brushed in this lye and afterwards all rinsed in clear warm water, wiped dry and a fire started in the stove for a few minutes to completely remove all moisture so that no parts will rust.

ACCESSORIES FOR COAL AND GAS RANGES.

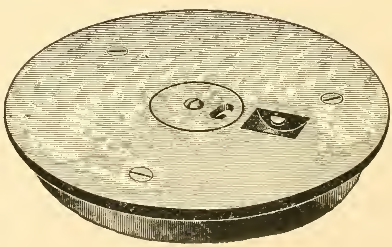
In recent years a very large number of devices have been invented and manufactured designed to save fuel, to give greater efficiency to stoves and to render kitchen labor less disagreeable and irksome. Many such devices possess great merit and are marvels of convenience, their use affording comforts not hitherto enjoyed by the housewife or cook.

The articles herein illustrated have been subjected to both practical and scientific test in the Experiment Station of the Good Housekeeping Institute conducted by the Good Housekeeping Magazine in the interest of its readers and may be accepted, therefore, by housekeepers as devices possessing absolute merit.

COAL RANGE ACCESSORIES.

The Wonder Disc is a very simple yet very practicable stove accessory, designed to save wood, coal or coke, and to burn it in a sanitary manner. It furnishes heated air—oxygen—to the upper surface of the fire where it mixes or commingles with the gases and causes all that are combustible to burn. The saving of fuel is large, varying under conditions from one-third to one-half.

The indorsement of the Wonder Disc follows the illustration.

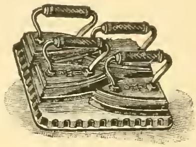


THE "WONDER" DISC TAKEN APART, SHOWING HOW THE OXYGEN IS HEATED AND SPREAD OVER THE FIRE SURFACE

Approved by Good Housekeeping Institute as follows: "An iron lid for use on range using anthracite coal so constructed as to consume the gases, thereby increasing heat and saving fuel. This is an excellent device when properly used."

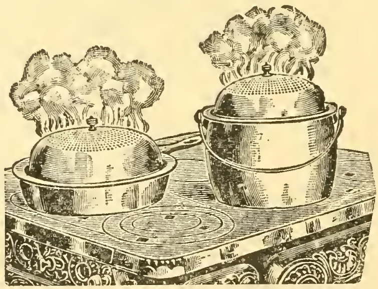
VULCAN IRON HEATER.

This simple device may be used with either a coal or gas range. It heats four flat irons at once, keeps the irons clean and smooth, and helps to make ironing easy. The irons never come in contact with the flame when used on a gas range. It reduces gas bills.



Good Housekeeping Institute approves as follows: "The Vulcan Square Iron Heater is a flat iron plate with polished surface made to hold four ordinary sized flat irons. To be used on coal or gas stoves for heating flat irons or as a griddle or hot plate. Made by William H. Crane Company, New York City."

THE DOME SHAPED PERFORATED FRYING PAN AND POT COVER.

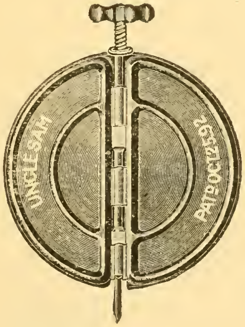


The dome shaped cover placed on a boiler will give far better satisfaction than a flat cover. It prevents boiling over when cooking, and the spattering of grease on the stove. It is a most meritorious device, convenient, sanitary and economical, and has been approved by the Good Housekeeping Institute.

SMOKE PIPE DAMPERS.

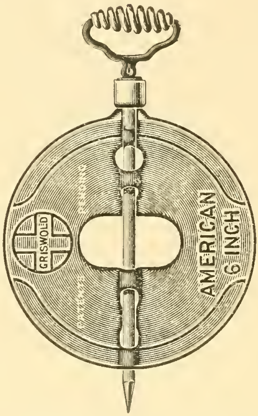
The principal use of a smoke pipe damper is to retard the exit of the products of combustion. It is an exceedingly valuable stove adjunct accessory, and should be installed in every smoke pipe when practicable.

UNCLE SAM DAMPER.



When the chimney draft is strong or very strong the Uncle Sam Damper should be installed inside the smoke pipe as high above the stove as it is convenient and practicable to operate it. It should be installed so that it may be easily operated without friction with the inside of the smoke pipe.

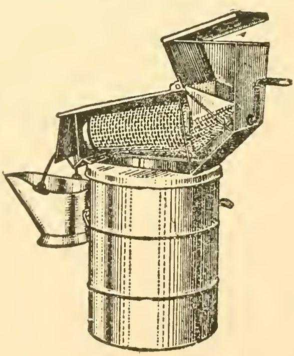
The above damper is manufactured by the Sayre Stamping Company, Sayre, Pa.



THE AMERICAN DAMPER.

This damper is not a solid plate, but is perforated, is very strongly made, and easily operated. It is of special use in cases of medium or weak chimney draft and is manufactured by Griswold & Co., Erie, Pa.

PERFECTION ASH SIFTER.



By Good Housekeeping Institute:

"The Perfection Ash Sifter is made entirely of galvanized iron and consists of a case which fits closely over the top of an ash can, a hopper and cinder chute. The ashes being placed in the hopper are fed through a stationary screen into a cone-shaped screen in the chute, which revolves. The hopper and cinder chutes are made in one piece, but so arranged as to separate ashes and cinders, the ashes into the barrel, the cinders passing on to a coal hod hung on a hook. The screen cannot become clogged and a removable top cover over the the rotary screen gives access to all parts. A dust damper in the under chute prevents escape of dust in sifting and the action of the sifter is easy. Manufactured by Success Manufacturing Company, Gloucester, Mass."

GAS STOVE ACCESSORIES.

Burning gas in an open flame is extravagant and unsanitary, whether it is done either with a gas range or a gas plate. Where gas is burned for illuminating purposes, globes, chimneys and mantles are provided not only for radiating or diffusing the light, but to conserve the gas by burning it economically. It is just as necessary to regulate the amount of air—oxygen—furnished to the burning gas as it is when coal or wood is burned in the kitchen range. Too much air allowed to come into contact with the burning gas, either when used for cooking or lighting purposes, produces incomplete and, therefore, improper combustion or burning, and is wasteful in the extreme.

When wood or fuel is burned in a bonfire in the outside air, the heat is wasted—dissipated—because it is unconfined and the quantity of air uncontrolled. In a less degree when wood, coal, natural gas or other fuel is burned in an open fireplace, the heat is mostly wasted because it is unconfined and the supply of air not regulated. If the wick of a kerosene lamp be ignited and allowed to burn without a globe or chimney the light is unsatisfactory, smoke is produced, and the air in the room is soon polluted with the waste products of its burning, all because too much air is brought into contact with the burning oil. Several devices have come into public use whose purpose it is to prevent an unlimited quantity of air from coming into contact with the gas burner in a range and also to concentrate the heat so it may be utilized instead of being allowed to escape by diffusion through the atmosphere of the kitchen. These devices are scientifically constructed and fit over and around the gas burners of the range. Their effect is to promote better burning of the gas fuel and to so concentrate the heat that a much smaller quantity of gas is necessary for cooking purposes.

THE ECONOMIC TOP.

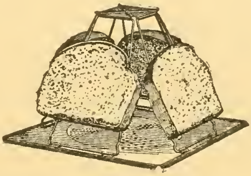
This top placed over the burners of a gas range makes it possible to use four kettles at one time if two burners are used, while with one burner three kettles may be used. Cooking and ironing may be done at the same time. It saves largely in gas consumption, burns it in a sanitary manner and gives greater general efficiency to the gas range.

It is approved by Good Housekeeping Institute as follows:

"A solid iron top made to fit over the entire top of the ordinary open gas stove. There are four lids and a damper in the back for creating draft. This makes it possible for heat to be distributed as in the ordinary coal range, so that slow cooking may be accomplished and dishes kept warm. Cooking is done with less expenditure of gas. Made by the Gas Stove Improvement Company, Boston, Mass."

THE VULCAN TOASTER.

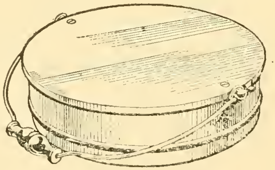
This excellent device can be used on any stove and toasts four slices of bread at one time in two minutes. The gas flame cannot come in contact with the bread, and the toasting is therefore hygienic. Bread is toasted evenly without burning.



Good Housekeeping Institute says "The Vulcan Toaster is designed to use on a gas stove and consists of a flat piece of sheet iron which rests on the stove. The toaster is made double, having an inner perforated cone within a square perforated heat radiator. This inner cone being directly over the flame becomes red hot and toasting is done with rapidity. Manufactured by Wm. H. Crane Company, New York City."

THE VULCAN CAKE GRIDDLE.

Another very satisfactory device is the Vulcan Cake Griddle on which four cakes may be cooked at one time. The heat deflector in the griddle distributes the gas flames so that the cakes are cooked equally as well at the extreme edge of the griddle as at the center. This is a device both economical and hygienic.

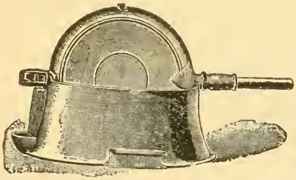


By Good Housekeeping Institute:

"This is a griddle designed for use on a gas stove. The griddle is round, having a sheet iron side and steel top which is eleven and one-half inches in diameter. Underneath this top is a perforated inverted cone which distributes the gas evenly over the entire cooking top. Manufactured by William H. Crane Company, New York City."

VULCAN WAFFLE IRON.

The ordinary Waffle Iron used on a coal range cannot be used successfully on a gas range. The Vulcan Waffle Iron has been constructed for that purpose and fully meets over the top burners of the gas range in such a manner that the heat is centered on the soft iron within which the waffle lies. It can be turned without being removed from the stove and the heat is so evenly distributed that the edges of the waffle brown as quickly as the middle.



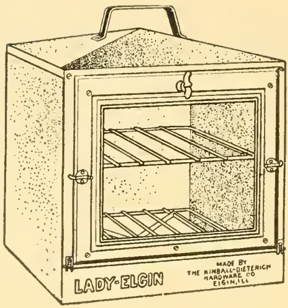
Gas is saved because the heat is properly concentrated and it is most convenient to operate because of the simplicity of its construction.

The improved cooking which results is the best evidence that the article meets the requirements of the most exacting cook.

Made by William H. Crane Company, New York City.

THE LADY ELGIN OVEN.

This is a very valuable accessory to any gas plate or gas range, both for its convenience and its gas saving quality. It is quite possible to save one-half the gas used for baking, and it is entirely hygienic.

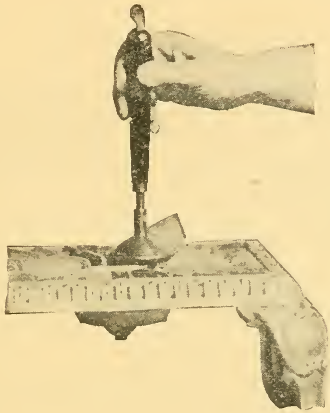


By Good Housekeeping Institute:

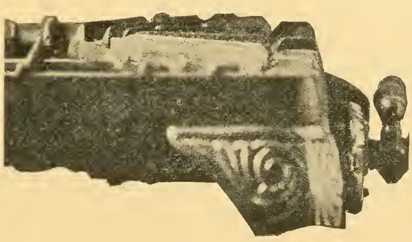
"The Lady Elgin Oven, which has a glass door, is twelve and one-half inches square and made of highly polished blue steel. It is lined throughout, back, ends top, and has a V-shaped flame spreader, asbestos lined. The door, which is supported by rods when open is eleven and a quarter inches wide and nine and a quarter inches high. The glass drop door permits the food to be seen in the process of cooking without opening the door. The oven is especially designed for use on the top burner of a gas stove and is suitable for baking bread, puddings, cakes, pies, biscuits, potatoes, or for roasting of poultry and meats. It is well adapted for paper bag cooking. Manufactured by Kimball-Dietrich Hardware Company, Elgin, Ill."

SAFETY GAS STOVE LIGHTER.

This device is a great convenience for lighting gas in stoves, for it avoids the danger of setting fire to women's clothing, the unsightly scratch marks from striking matches, the disagreeable and unhealthful odor of burning sulphur and the nuisance of burnt matches. It is also made in different forms for the convenient lighting of gas ovens, store window lights and other general uses.



THE SAFETY LIGHTER.

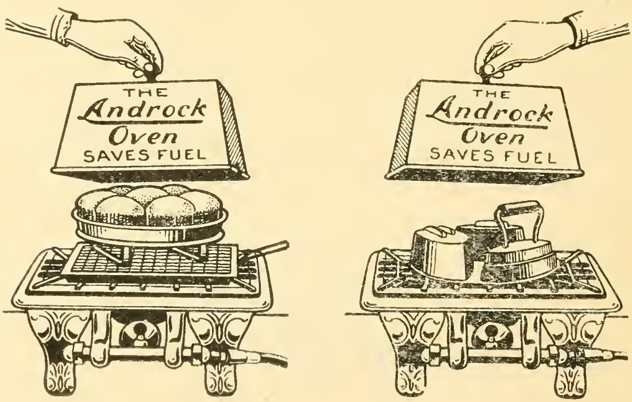


ROUND FILE POPULAR.

Good Housekeeping Institute approves in the following description:

"This is operated by turning on the gas, placing the lighter over the burner and pressing down on the handle quickly. The spark is produced on the principle of the old-fashioned flint and the device is simple and easily manipulated. An inverted cone prevents gas from burning hands or fingers. Made by the Gas Safety Lighter Company, Haverhill, Mass."

THE ANDROCK OVEN.



The Androck Oven is designed for use on top of all kinds of stoves, but is especially recommended when used with gas, gasoline or kerosene stoves.

When the cover is lifted the baking is in plain sight.

It is also used to concentrate the heat on three sad irons so that the flame can be turned low and the room will be cool. The Androck Oven is a very useful article and its use results in a large saving of gas. It is manufactured by The Andrew Wire and Iron Works, Rockford, Ill.

COKE BURNER

The Coke Burner can be used separately or in connection with any gas range, and is made to burn coke, wood, coal, rubbish and garbage. It can be used for heating water in the kitchen boiler and to heat the room.

The illustration shows the Coke Burner in connection with Gas Range and is manufactured by American Stove Company, Cleveland, Ohio.

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