ESSAYS,

POLITICAL, ECONOMICAL,

AND

PHILOSOPHICAL.

VOL. III.


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পুস্তক কালেজ ফোর্টউলিয়ম

ESSAYS,

[redacted]LITICAL, ECONOMICAL,

AND

PHILOSOPHICAL.

By BENJAMIN COUNT OF RUMFORD,

[redacted]OF THE ORDERS OF THE WHITE EAGLE, AND ST. STANISLAUS;
Chamberlain, Privy Counſellor of State, and Lieutenant-General in the Service
of his Moſt Serene Highneſs the ELECTOR PALATINE *Reigning* DUKE
of BAVARIA; *Colonel of his Regiment of Artillery, and Commander in*
Chief of the General Staff of his Army; F. R. S. Acad. R.
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ALMOST four years have elapſed ſince this Eſſay was announced to the Public, and although a conſiderable part of the Manuſcript was then ready, yet, from a variety of conſiderations, I have been induced to defer ſending it to the preſs; and even now the Firſt Part only of the Eſſay is laid before the Public.

Among the motives which have operated moſt powerfully to induce me to poſtpone the publication of this work was a deſire to make it as free of faults as poſſible, and to accommodate it as much as poſſible to the actual ſtate of opinions and practices in this country.

In proportion as my exertions to promote uſeful improvements have been favourably received by the Public, and my writings have obtained an extenſive circulation, my anxiety has been increaſed to deſerve that confidence which is eſſential to my ſucceſs. I feel it to be more and more my duty to proceed ſlowly, and to uſe every precaution in inveſtigating the ſubjects I have undertaken to treat, and in explaining what I recommend, in order that others may not be led into errors, either by miſtakes in principle, or inaccuracy in deſcription.

I have, indeed, of late ſeen but too many proofs of the neceſſity of adopting this cautious method of proceeding.

On my return to England from Bavaria laſt autumn (1798), after an abſence of two years, I was not a little gratified to learn, that ſeveral improvements recommended in my Eſſays, and particularly the alterations in the conſtruction of Chimney Fire-places, that were propoſed in my Fourth Eſſay, had been adopted in many places; and that they had in general been found to anſwer very well; but the ſatisfaction which this information naturally afforded me, has ſince been,—I believe I may ſay,—more than counterbalanced by the pain I have experienced on diſcovering, on a nearer examination, the numerous miſtakes that have been committed by thoſe who have undertaken to put my plans in execution:—not to mention the unjuſtifiable uſe that has in ſome inſtances been made of my name, in bringing forward for ſale inventions which I never recommended, and of which I never can approve without abandoning all the fundamental principles relative to the combuſtion of fuel, and the management and direction of heat, which, after a long and patient inveſtigation, I have been induced to adopt.

It would be fooliſh for me to imagine, and ridiculous to pretend, that the plans I have propoſed are ſo perfect as to be incapable of farther improvement. I am far, very far, from being of that opinion, and I can ſay with truth, that I ſhall at all

all times rejoice when farther improvements are made in them; but ſtill I may be permitted to add, that it would be a great ſatisfaction to me if thoſe, who, from an opinion of their utility, or from a deſire to give the experiment a fair trial, ſhould be diſpoſed to adopt any of the plans I have recommended, would take the trouble to examine whether the workmen they employ really underſtand, and are diſpoſed to follow the directions I have given,—or whether they are not, perhaps, prepoſſeſſed with ſome favourite contrivance and imaginary improvement of their own,—or whether there is no danger of their introducing alterations for the purpoſe of enhancing the price of their work,—or of the articles they furniſh.

Theſe are dangers of which thoſe who have the ſmalleſt acquaintance with mankind, muſt be perfectly ſenſible; and it would be unwiſe, and I had almoſt ſaid unjuſt, not to attend to them, at leaſt to a certain degree.

All I aſk is, that a *fair trial* may be given to the plans I propoſe, when *any* trial is given them; and this requeſt will not, I truſt, be thought unreaſonable: and as I never preſume to recommend to the Public any new invention or improvement that I have not previouſly and repeatedly tried, and found *by experience* to be uſeful, it would perhaps be thought excuſeable were I to expreſs a wiſh that my propoſals might not be condemned nor neglected merely in conſequence of the failure of contrivances announced as *improvements* of my Plans.

The reader will not be ſurprized at my extreme anxiety to remove thoſe obſtacles which appear to me moſt powerfully to obſtruct and retard the general introduction of the improvements I am labouring to introduce; for anxiety for the ſucceſs of an undertaking naturally flows from a conviction of its importance, and is always connected with that fervent zeal which important undertakings are ſo eminently calculated to inſpire.

To this Second Edition of the Firſt Part of my Tenth Eſſay, I beg leave to add a few words reſpecting the SOUP ESTABLISHMENTS that have lately been formed in London, and in other places, for feeding the Poor.

Many perſons in this country are of opinion that a great deal of meat is neceſſary in order to make a good and wholeſome ſoup; but this is far from being the caſe in fact. Some of the moſt ſavoury and moſt nouriſhing ſoups are made without any meat; and in providing food for the poor it is neceſſary, on many accounts, to be very ſparing in the uſe of it.

When the poor are fed from a Public Kitchen, care ſhould be taken to ſupply them with the cheapeſt kinds of food, and particularly with ſuch as they can afterwards provide for themſelves, at their own dwellings, at a ſmall expence; otherwiſe the temporary relief that is afforded them in times

of

of ſcarcity, by ſelling to them rich and expenſive meat ſoups at reduced prices, will operate as a great and permanent evil to themſelves and to ſociety.

The moſt palatable and the moſt nouriſhing ſoups may, with a little care and ingenuity, be compoſed with very cheap materials, as has been proved of late by a great number of deciſive experiments made upon a large ſcale in different countries. The Soup Eſtabliſhments that have been formed at Hamburgh,—at Geneva,—at Lauſanne, and other parts of Switzerland,—at Marſeilles, and lately at Paris, have all ſucceeded; and at moſt of theſe places the kind of ſoup that was provided for the poor at Munich has been adopted, with but little variation.—In ſome caſes a ſmall quantity of ſalt meat has been uſed, but this has been merely as a ſeaſoning: the baſis of theſe ſoups has uniformly been barley, potatoes, and peas or beans; and a ſmall quantity of bread has in all caſes been added to the ſoup when it has been ſerved out.

No ingredient, is, in my opinion, ſo indiſpenſably neceſſary in the ſoups that are furniſhed to the poor as *bread*; it ſhould never be omitted, and certainly not in times of ſcarcity; becauſe there is no way in which bread will go ſo far as when it is eaten in ſoups: for every ounce ſo uſed, I am confident that four ounces that would otherwiſe be eaten by the poor at their homes, would be ſaved. And to this we may add, that oaten cakes, and other bread of inferior quality, will anſwer very well in ſoups, particularly

ticularly if it be toaſted or fried, and broken or cut into ſmall pieces. If the ſoup be well ſeaſoned, its taſte will predominate, and the taſte peculiar to the bread will not be perceived.

A great variety of the moſt agreeable taſtes may be given to ſoups, at a very ſmall expence; and if bread be mixed with the ſoup, maſtication will be rendered neceſſary, and the pleaſure that is enjoyed in eating a good meal of it will be greatly prolonged and increaſed.

It is by no means ſurpriſing that prejudices ſhould be ſtrong againſt ſoups, in thoſe countries where ſoups and broths are conſidered as being merely thin waſh without taſte or ſubſtance, a pint of which might as eaſily be ſwallowed down at a breath as ſo much water; but theſe prejudices will vaniſh when the falſe impreſſions which gave riſe to them are removed.

Soups may, it is true, be made thick and ſubſtantial with meat; but when this is done, they are neither palatable nor wholeſome: they appal and load the ſtomach,—weaken the powers of digeſtion,—and inſtead of affording wholeſome nouriſhment, ſtrength, and refreſhment, are the cauſe of many diſorders; they are moreover very expenſive. But this is not the caſe with ſoups made thick and ſubſtantial with farinacious matter, and other vegetable ſubſtances, and ſeaſoned and rendered palatable with ſalt, pepper, onions, and a little ſalted herrings, hung beef, bacon, or cheeſe, and eaten with a due proportion of bread.

I am

I am the more anxious to recal the attention of the Public to this ſubject at the preſent time, as the utility of the Public Kitchens for feeding the Poor, which have lately been formed and are now forming in various parts of the kingdom, muſt depend very much on the choice of the ingredients uſed in preparing food, and the manner of combining them, which is adopted by thoſe who have the direction of theſe intereſting eſtabliſhments. The ſhare I have had in bringing theſe eſtabliſhments into uſe,—the opinion I entertain of their importance to ſociety,—and the anxiety I muſt naturally feel for their ſucceſs,—will, I flatter myſelf, be conſidered as a ſufficient excuſe for my ſolicitude in watching over their progreſs, and for the liberty I may take in pointing out any miſtakes in the management of them that might tend to bring them into diſrepute.

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MANY unſucceſsful attempts have been made, at different times, to heat liquids by means of ſteam—Reaſon why theſe attempts failed—When ſteam is uſed for heating a liquid, it muſt be introduced into it far below its ſurface, otherwiſe, as heat does not deſcend in fluids, the liquid cannot be uniformly heated—Detailed account of an apparatus, by means of which liquid may be heated, and made to boil, by ſteam coming from a boiler at a diſtance, and introduced into them—This plan has been adopted with the moſt complete ſucceſs—Deſcription of the DYING-HOUSE *of Meſſrs. Gott and Co. at Leeds, in which all the Coppers are heated by ſteam—Deſcription of the* CULINARY STEAM APPARATUS *in the kitchen at the houſe of the Royal Inſtitution—Propoſals for employing hot, or ſtrong ſteam, in* ALLUM WORKS, *and in* DISTILLERIES—*Of the uſe that may be made of ſteam in* DRYING-HOUSES - - - page 475

COUNT RUMFORD'S ESSAYS,

I. to XV.

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ESSAY X.

ON THE

CONSTRUCTION OF KITCHEN FIRE-PLACES

AND

KITCHEN UTENSILS,

TOGETHER WITH

REMARKS and OBSERVATIONS relating to the various *PROCESSES OF COOKERY*;

AND

PROPOSALS for improving that MOST USEFUL ART.

ESSAY X.

INTRODUCTION.

In contriving machinery for any purpoſe, it is indiſpenſably neceſſary to be acquainted with the nature of the mechanical operation to be performed; and though the Proceſſes of Cookery appear to be ſo ſimple and eaſy to be underſtood, that any attempt to explain and illuſtrate them might perhaps be thought not only ſuperfluous but even frivolous, yet when we examine the matter attentively, we ſhall find their inveſtigation to be of ſerious importance.—I ſay of *ſerious* importance, for ſurely thoſe inquiries which lead to improvements by which the providing of *food* may be facilitated, are matters of the higheſt concern to mankind, in every ſtate of ſociety.

The proceſs by which food is moſt commonly prepared for the table,—BOILING,—is ſo familiar to every one, and its effects are ſo uniform, and apparently ſo ſimple, that few, I believe, have taken the trouble to enquire *how*, or in *what manner*, thoſe effects are produced; and whether any, and what improvements in that branch of cookery are

poſſible. So little has this matter been an object of inquiry, that few, very few indeed, I believe, among the *millions of perſons* who for ſo many ages have been *daily* employed in this proceſs, have ever given themſelves the trouble to beſtow one ſerious thought on the ſubject.

The cook knows *from experience*, that if his joint of meat be kept a certain time immerſed in boiling water, it will be *done*, as it is called in the language of the kitchen; but if he be aſked *what* is done to it?—or *how*, or *by what agency* the change it has undergone has been effected?—if he underſtands the queſtion,—it is ten to one but he will be embarraſſed:—if he does not underſtand it, he will probably anſwer without heſitation, that "*the meat is* "*made tender and eatable by being boiled.*"—Aſk him if the boiling of the water be eſſential to the ſucceſs of the proceſs?—He will anſwer, "*without* "*doubt.*" Puſh him a little farther by aſking him, whether, *were it poſſible* to keep the water *equally hot* without boiling, the meat would not be cooked *as ſoon*, and *as well*, as if the water were made to boil? Here it is probable that he will make the firſt ſtep towards acquiring knowledge, *by learning to doubt.*

When you have brought him to ſee the matter in its true light, and to confeſs that *in this view of it* the ſubject is new to him, you may then venture to tell him, (and to prove to him, if you happen to have a thermometer at hand,) that water which *juſt boils* is as hot as it can poſſibly be made *in an open veſſel.*—That all the fuel which is uſed in making it

boil

boil with violence is waſted, without adding a ſingle degree to the heat of the water, or expediting or ſhortening the proceſs of cooking a ſingle inſtant.—That it is by *the heat*,—its *intenſity*, and *the time of its duration*, that the food is cooked,—and not by the *boiling* or *ebullition*,—or bubbling up of the water; which has *no part whatever* in that operation.

Should any doubts ſtill remain in his mind with reſpect to the inefficacy and inutility of boiling, in culinary proceſſes, where *the ſame degree of heat* may be had, and be *kept up* without it, let a piece of meat be cooked in a Papin's digeſter, which, as is well known, is a boiler whoſe cover (which is faſtened down with ſcrews) ſhuts with ſo much nicety that no ſteam can eſcape out of it. In ſuch a *cloſed* veſſel, boiling (which is nothing elſe but the eſcape of ſteam in bubbles from the hot liquid) is abſolutely impoſſible; yet, if the heat applied to the digeſter be ſuch as would cauſe an equal quantity of water in an open veſſel to boil, the meat will not only be *done*, but it will be found to be dreſſed in a ſhorter time, and to be much tenderer than if it had been boiled in an open boiler. By applying a ſtill greater degree of heat to the digeſter, the meat may be ſo much done in a very few minutes as actually to fall to pieces; and even the very bones may be made ſoft.

Were it a queſtion of mere idle curioſity, whether it be the *boiling* of water, or ſimply the *degree of heat* which exiſts in boiling water, by which

food is cooked, it would doubtleſs be folly to throw away time in its inveſtigation; but this is far from being the caſe, for *boiling* cannot be carried on without a very great expence of fuel; but any boiling hot liquid (by uſing proper means for confining the heat) may be kept *boiling hot* for any length of time almoſt without any expence of fuel at all.

The waſte of fuel in culinary proceſſes, which ariſes from making liquids boil *unneceſſarily*, or when nothing more would be neceſſary than to keep them *boiling-hot*, is enormous. I have not a doubt but that much more than half the fuel uſed in all the kitchens, public and private, in the whole world, is waſted preciſely in this manner.

But the evil does not ſtop here. This unſcientific and ſlovenly manner of cooking renders the proceſs much more laborious and troubleſome than otherwiſe it would be;—and, (what by many will be conſidered of more importance than either the waſte of fuel, or the increaſe of labour to the cook,)—the food is rendered leſs ſavoury, and very probably leſs nouriſhing and leſs wholeſome.

It is natural to ſuppoſe that many of the finer and more volatile parts of food (thoſe which are beſt calculated to act on the organs of taſte) muſt be carried off with the ſteam when the boiling is violent; but the fact does not reſt on theſe reaſonings;—it is *proved* to a demonſtration, not only by the agreeable fragrance of the ſteam which riſes from veſſels in which meat is boiled, but alſo from the

the ſtrong flavour and ſuperior quality of ſoups which are prepared by a long proceſs over a very gentle fire.

In many countries where ſoups conſtitute the principal part of the food of the inhabitants, the proceſs of cooking laſts from one meal-time to another, and is performed almoſt without either trouble or expence. As ſoon as the ſoup is ſerved up, the ingredients for the next meal are put into the pot, (which is never ſuffered to cool, and does not require ſcouring,) and this pot,—which is of caſt iron,—or of earthen ware,—being well cloſed with its thick wooden cover, is placed *by the ſide of the fire*, where its contents are kept ſimmering for many hours, but are ſeldom made to boil, and never but in the gentleſt manner poſſible.

Were the pot placed in a cloſed fire-place, (which might eaſily be conſtructed, even with the rudeſt materials, with a few bricks or ſtone, or even with ſods, like a camp-kitchen,) no arrangement for cooking could well be imagined more economical, or more convenient.

Soups prepared in this way are uncommonly ſavoury; and I am convinced that the true reaſon why nouriſhing ſoups, and broths, are not more in uſe among the common people in Great Britain and Ireland, is becauſe they do not know how good they really are, nor how to prepare them; in ſhort, becauſe they are not acquainted with them.

But to return from this digreſſion. It is moſt certain, not only that meat and vegetables of all kinds may be cooked in water which is kept *boiling hot*, without actually boiling, but alſo that they may even be cooked with a degree of heat *below* the boiling point.

It is well known that the heat of boiling water is not the ſame in all ſituations;—that it depends on the preſſure of the atmoſphere,—and conſequently is conſiderably greater at the level of the ſurface of the ſea than inland countries, and on the tops of high mountains; but I never heard that any difficulty was found to attend the proceſs of dreſſing food by boiling, even in the higheſt ſituations. Water boils at London, (and at all other places on the ſame level,) at the temperature of 212 degrees of Fahrenheit's thermometer; but it would be abſolutely impoſſible to communicate that degree of heat to water in an open boiler in Bavaria. The boiling point at Munich under the mean preſſure of the atmoſphere at that place is about 209½ degrees of Fahrenheit's thermometer; yet nobody, I believe, ever perceived that boiled meat was *leſs thoroughly done* at Munich than at London. But if meat may, without the leaſt difficulty, be cooked with the heat of 209½ degrees of Fahrenheit at Munich, why ſhould it not be poſſible to cook it with the ſame degree of heat in London?—If this can be done, (which I think can hardly admit of a doubt,) then it is evident that the proceſs of cookery,

cookery, which is called *boiling*, may be performed in water which is not boiling-hot.

I well know, from my own experience, how difficult it is to perſuade cooks of this truth, but it is ſo important, that no pains ſhould be ſpared in endeavouring to remove their prejudices and enlighten their underſtandings. This may be done moſt effectually in the caſe before us by a method I have ſeveral times put in practice with complete ſucceſs.—It is as follows:—Take two equal boilers, containing equal quantities of *boiling-hot water*, and put into them two equal pieces of meat taken from the ſame carcaſe,—two legs of mutton, for inſtance—and boil them during the ſame time. Under one of the boilers make a *ſmall fire*, juſt barely ſufficient to keep the water *boiling-hot*, or rather juſt *beginning to boil*:—under the other make *as vehement a fire as poſſible*, and keep the water boiling the whole time with the utmoſt violence.

The meat in the boiler in which the water has been kept *only juſt boiling-hot*, will be found to be quite as well done as that in the other*, under which ſo much fuel has been waſted in making the water boil violently to no uſeful purpoſe.—It will even be more done; for as a great deal of water will be boiled away, (evaporated,) during the proceſs, in the boiler under which a great fire is kept up, this boiler muſt often be filled up; and if the

* It will even be found to be much better cooked,—that is to ſay, tenderer, more juicy, and much higher flavoured.

water with which it is from time to time replenished be cold, this will of courſe retard the proceſs of cooking the meat.

To form a juſt idea of the enormous waſte of fuel that ariſes from making water boil, and *evaporate* unneceſſary in culinary proceſſes, we have only to conſider how much heat is expended in the formation of ſteam. Now it has been proved by the moſt deciſive and unexceptionable experiments that have ever been made by experimental philoſophers, that if it were poſſible that the heat which actually combines with water, in forming ſteam, (and which gives it wings to fly up into the atmoſphere,)—could exiſt in the water, without changing it from a denſe liquid to a rare elaſtic vapour, this water would be heated by it to the temperature of red-hot iron.

From the ſame *data* it is eaſy to ſhew, by computation, that if any given quantity of ice-cold water can be made to boil with the heat generated in the combuſtion of a certain quantity of any given kind of fuel, it will require more than *five times* that quantity of fuel to reduce that ſame quantity of water,—already boiling hot,—to ſteam.

Hence it appears, that in the formation of ſteam there is a great and unavoidable *expence* of heat; but it does not ſeem probable that heat is *expended* or *combined*, in any of thoſe proceſſes by which food is prepared for the table,—except it be perhaps in baking;—and as heat is *immortal*,—that is to ſay,—as it never dies, or ceaſes to exiſt; and

as

as its diſperſion may be prevented, or at leaſt greatly *retarded*, by various ſimple contrivances, it is not ſurpiſing, when we conſider the matter attentively, that moſt of thoſe proceſſes (in which nothing more ſeems to be neceſſary than that the food to be cooked ſhould be expoſed a certain time in a medium at a certain temperature) ſhould be capable of being performed with *a very ſmall expence of fuel.*

The quantity of heat, or rather the quantity of fuel by which any given culinary proceſs may be performed, may be determined with much certainty and preciſion from the reſults of experiments which have already been made.

Suppoſe, for inſtance, it were required to compute the quantity of dry pine-wood (what in England is called deal) uſed as fuel, and burned in a cloſed fire-place, conſtructed on the moſt approved principles, to boil 100 lbs. of beef. And firſt we will ſuppoſe this beef to be in ſuch large pieces, that 3 hours of boiling, after it has been made boiling hot, are neceſſary to make it ſufficiently tender to be fit for the table: and we will ſuppoſe farther, that 3 lbs. of water are neceſſary to each pound of beef; and that both the water and the beef are at the temperature of 55° of Fahrenheit's thermometer (the mean temperature of the atmoſphere in England) at the beginning of the experiment.

The firſt thing to be aſcertained is how much fuel would be required to heat the water and the beef *boiling-hot*; and then to ſee how much more would

would be required to *keep them boiling-hot* three hours.

And firſt for *heating the water*;—it has been ſhewn by one of my Experiments (N° 20, Eſſay VI.), that $20\frac{1}{10}$ lbs. of water may be heated 180 degrees of Fahrenheit's thermometer with the heat generated in the combuſtion of 1 lb. of dry pine-wood.

But it is required to heat the water in queſtion only 157 degrees; for its temperature being that of 55°, and the boiling point 212°, it is 212°—55°=157°: and if 1 lb. of the fuel be ſufficient for heating $20\frac{1}{10}$ lbs. of water 180 degrees, it muſt be ſufficient for heating 23 lbs. of water 157 degrees —for 157° is to 180° as $20\frac{1}{10}$ lbs. to 23 lbs.

But if 23 lbs. of water, at the temperature of 55°, require 1 lb. of dry pine-wood, as fuel, to make it boil, then 300 lbs. of water (the quantity required in the proceſs in queſtion) would require $12\frac{6}{10}$ lbs. of the wood to heat it boiling-hot.

To this quantity of fuel muſt be added that which would be required to heat the meat (100 lbs. weight) boiling-hot. Now it has been found by actual experiment by the late ingenious Doctor Crawford, (ſee his Treatiſe on Animal Heat, ſecond edition, page 490,)—that the fleſh of an ox requires leſs heat to heat it than water, in the proportion of 74 to 100; conſequently the quantity of beef in queſtion (100 lbs.) might be made boiling-hot with preciſely the ſame quantity of fuel as would be required to heat 74 lbs. of water at the ſame temperature to the boiling point.—And this

quantity

quantity in the caſe in queſtion would amount to $3\frac{1}{4}$ lbs. as will be found on making the computation.

This quantity ($3\frac{1}{4}$ lbs.) added to that before found, which would be required to heat the water alone, (= 23 lbs.) gives $26\frac{1}{4}$ lbs. of dry pine-wood for the quantity required to heat 300 lbs. of water and 100 lbs. beef (both at the temperature of 55°) boiling-hot.

To eſtimate the quantity of fuel which would be neceſſary to keep this water and beef boiling-hot 3 hours, we may have recourſe to the reſults of my experiments. In the Experiment, N° 25, (ſee Eſſay VI.) 508 lbs. of boiling-hot water were kept actually boiling—not merely kept boiling hot)—3 hours with the heat generated in the combuſtion of $4\frac{1}{2}$ lbs. of dry pine-wood,—this gives $338\frac{2}{3}$ lbs. of boiling-hot water kept boiling 1 hour with 1 lb. of the fuel; and computing from theſe data.—And ſuppoſing farther that a pound of beef requires as much heat to keep it boiling-hot any given time as a pound of water, it appears that $3\frac{1}{4}$ lbs. of pine wood, uſed as fuel, would be ſufficient to keep the 300 lbs. of water, with the 100 lbs. of beef in it, boiling 3 hours. This quantity of fuel ($=3\frac{1}{4}$ lbs.), added to that required to heat the water and the meat boiling-hot ($=26\frac{1}{4}$ lbs.), gives $29\frac{1}{4}$ lbs. of pine wood, for the quantity of fuel required to cook 100 lbs. of boiled beef.

This quantity of fuel, which is juſt about equal in effect to 16 lbs.—or $\frac{1}{4}$ of a peck of pit-coal, will doubt-

doubtleſs be thought a ſmall allowance for boiling 100 lbs. of beef; but it is in fact much more than would be neceſſary *merely for that purpoſe* could all the heat generated in the combuſtion of the fuel be applied *immediately* to the cooking of the meat, and *to that purpoſe alone*. Much the greateſt part of that which is generated is expended in heating the water in which the meat is boiled, and as it remains in the water after the proceſs is ended it muſt be conſidered as loſt.

This loſs may, however, be prevented in a great meaſure; and when that is done, the expence of fuel in boiling meat will be reduced almoſt to nothing. We have juſt ſeen that 100 lbs. of meat, at the mean temperature of the atmoſphere in England, (55°,) may be made boiling-hot with the heat generated in the combuſtion of $3\frac{1}{4}$ lbs. of pine-wood; and there is no doubt but with the uſe of proper means for confining the heat, this meat might be kept boiling-hot 3 hours, and conſequently be thoroughly done, with the addition of $\frac{1}{4}$ of a pound of the fuel, making in all 4 lbs. of pine-wood, equal in effect to about $2\frac{1}{4}$ lbs. of pit-coal; which, according to this eſtimate, is all the fuel that would be *abſolutely neceſſary* for cooking 100 lbs. of beef.

This quantity of fuel would coſt in London leſs than *one farthing and a half*, when the chaldron of coals weighing 28 cwt. is ſold at 40 ſhillings. This, however, is the *extreme* or *utmoſt limit* of the economy of fuel, beyond which it is abſolutely impoſſible

ſible to go. It is even impoſſible in practice, to arrive at this limit, for the containing veſſel muſt be heated, and kept hot, as well as the meat;—but very conſiderable advances may be made towards it, as I ſhall ſhew hereafter.

If we ſuppoſe the meat to be boiled in the uſual manner, and that 300 lbs. of cold water are heated expreſsly for that purpoſe, in that caſe the fuel required, amounting to 16 lbs. of coal, would coſt in London—(the chaldron reckoned as above)—juſt 2 *pence* 1¾ *farthings*. But all this expence ought not to be placed to the account of the cooking of the meat; by adding a few pounds of barley-meal, ſome greens, roots, and ſeaſoning, to the water, it may be changed into a good and wholeſome ſoup, at the ſame time that the meat is boiled; and the expence for fuel (2 pence 1¾ farthings) may be divided between the meat boiled, (100 lbs.) and 300 lbs. or 37½ gallons of ſoup.

I am aware of the danger to which I expoſe myſelf by entertaining the public with accounts of facts, and of deductions from them which are certainly much too new and extraordinary to be credited, but on the ſtrongeſt proofs, while many of the arguments and computations I offer in their ſupport, however concluſive they may, and certainly *muſt*, appear to natural philoſophers and mathematicians,—are ſuch as the generality of readers will be tempted to paſs over without examination; but deeply impreſſed with the importance of the

the object I have in view, I am determined to purſue it at all hazards.

My principal deſign in publiſhing theſe computations is to *awaken the curioſity of my readers*, and fix their attention on a ſubject, which however low and vulgar it has hitherto generally been thought to be, is, in fact, highly intereſting, and deſerving of the moſt ſerious conſideration. I wiſh they may ſerve to inſpire cooks with a juſt idea of the importance of their art,—and of the intimate connection there is between the various proceſſes in which they are daily concerned, and many of the moſt beautiful diſcoveries that have been made by experimental philoſophers in the preſent age.

The advantage that would reſult from an application of the late brilliant diſcoveries in Philoſophical Chemiſtry, and other branches of Natural Philoſophy and Mechanics, to the improvement of the Art of Cookery, are ſo evident, and ſo very important, that I cannot help flattering myſelf that we ſhall ſoon ſee ſome enlightened and liberal-minded perſon of the profeſſion take up the matter in earneſt, and give it a thoroughly *ſcientific* inveſtigation.

In what art or ſcience could improvements be made that would more powerfully contribute to increaſe the comforts and enjoyments of mankind?

And it muſt not be imagined that the ſaving of fuel is the only or even the moſt important advantage

vantage that would reſult from theſe inquiries:—others, of ſtill greater magnitude, reſpecting the *manner* of preparing food for the table, would probably be derived from them.

The heat of boiling water, continued for a ſhorter or a longer time, having been found by experience to be ſufficient for cooking all thoſe kinds of animal and vegetable ſubſtances that are commonly uſed as food; and *that degree* of heat being eaſily procured, and eaſily kept up, in all places and in all ſeaſons; and as all the utenſils uſed in cookery are contrived for that kind of heat, few experiments have been made to determine the effects of uſing *other degrees of heat*, and *other mediums* for conveying it to the ſubſtance to be acted upon in culinary proceſſes. The effects of different degrees of heat in the ſame body are however ſometimes very ſtriking, and the taſte of the ſame kind of food is often ſo much altered by a trifling difference in the manner of cooking it, that it would no longer be taken for the ſame thing. What a ſurpriſing difference, for inſtance, does the manner of performing that moſt ſimple of all culinary proceſſes, *boiling in water*, make on potatoes!—Thoſe who have never taſted potatoes *boiled in Ireland*, or cooked according to the Iriſh method, can have no idea what delicious food theſe roots afford when they are properly prepared. But it is not merely the *taſte* of food that depends on the manner of cooking it; its nutri-

tiouſneſs alſo, and its wholeſomeneſs, qualities ſtill more eſſential if poſſible than taſte, are no doubt very nearly connected with it.

Many kinds of food are known to be moſt delicate and ſavoury when cooked in a degree of heat conſiderably below that of boiling water; and it is more than probable that there are others which would be improved by being expoſed in a heat greater than that of boiling water.

In the ſea-port towns of the New England States in North America it has been a cuſtom, time immemorial, among people of faſhion, to dine one day in the week (Saturday) on *ſalt-fiſh*, and a long habit of preparing the ſame diſh has, as might have been expected, led to very conſiderable improvements in the art of cooking it. I have often heard foreigners who have aſſiſted at theſe dinners, declare that they never taſted ſalt-fiſh dreſſed in ſuch perfection; and I well remember that the ſecret of cooking it is to keep it a great many hours in water that is *juſt ſcalding hot*, but which is never made actually to boil.

I had long ſuſpected that it could hardly be poſſible that *preciſely* the temperature of 212 degrees of Fahrenheit's thermometer (that of boiling water) ſhould be that which is beſt adapted for cooking *all ſorts of food*; but it was the unexpected reſult of an experiment that I made with another view, which made me particularly attentive to this ſubject. Deſirous of finding out whether it would be

be poſſible to roaſt meat in a machine I had contrived for drying potatoes, and fitted up in the kitchen of the Houſe of Induſtry at Munich, I put a ſhoulder of mutton into it, and after attending to the experiment three hours, and finding it ſhewed no ſigns of being done, I concluded that the heat was not ſufficiently intenſe; and deſpairing of ſucceſs, I went home, rather out of humour at my ill ſucceſs, and abandoned my ſhoulder of mutton to the cook maids.

It being late in the evening, and the cook maids thinking perhaps that the meat would be as ſafe in the drying machine as anywhere elſe, left it there all night. When they came in the morning to take it away, intending to cook it for their dinner, they were much ſurpriſed to find it *already cooked*, and not merely eatable, but perfectly done, and moſt ſingularly well-taſted. This appeared to them the more miraculous, as the fire under the machine was gone quite out before they left the kitchen in the evening to go to bed, and as they had locked up the kitchen when they left it, and taken away the key.

This wonderful ſhoulder of mutton was immediately brought to me in triumph, and though I was at no great loſs to account for what had happened, yet it certainly was quite unexpected; and when I taſted the meat I was very much ſurpriſed indeed to find it very different, both in taſte and flavour, from any I had ever taſted. It was perfectly

tender; but though it was ſo much done, it did not appear to be in the leaſt ſodden or inſipid; on the contrary, it was uncommonly ſavoury and high flavoured. It was neither boiled, nor roaſted, nor baked. Its taſte ſeemed to indicate the manner in which it had been prepared: that the gentle heat to which it had for ſo long a time been expoſed, had by degrees looſened the coheſion of its fibres, and concocted its juices, without driving off their fine and more volatile parts, and without waſhing away or burning and rendering rancid and empyrumatic its oils.

Thoſe who are moſt likely to give their attention to this little hiſtory will perceive what a wide field it opens for ſpeculation and curious experiment. The circumſtances I have related, however trifling and unintereſting they may appear to many, ſtruck me very forcibly, and recalled to my mind ſeveral things of a ſimilar nature which had almoſt eſcaped my memory. They recalled to my recollection the manner juſt deſcribed in which ſalt-fiſh is cooked in America; and alſo the manner in which *ſamp* is prepared in the ſame country. (See my Eſſay on Food.) This ſubſtance, which is exceedingly palateable and nouriſhing food when properly cooked, *is not eatable* when ſimply boiled. How many cheap articles may there be of which the moſt delicate and wholeſome food might be prepared, were the art and the *ſcience* of cooking them better underſtood?

—But

—But I beg my reader's pardon for detaining him ſo long with ſpeculations which he may perhaps conſider as foreign to the ſubject I promiſed to treat in this Eſſay.—To proceed therefore to thoſe inveſtigations which are more immediately connected with the conſtruction of Kitchen Fire-places.—

CHAP. I.

Of the imperfections of the Kitchen Fire-places now in common uſe.—Objects particularly to be had in view in attempts to improve them.—Of the diſtribution of the various parts of the machinery of a Kitchen.—Of the method to be obſerved in forming the plan of a Kitchen that is to be fitted up, and in laying out the work.

As the principal object of this publication is to convey ſuch plain and ſimple directions for conſtructing Kitchen Fire-places and Kitchen Utenſils as may eaſily be underſtood, even by thoſe who are not verſed in philoſophical inquiries, and who have not had leiſure to examine ſcientifically the principles on which the propoſed improvements are founded, I ſhall endeavour, in treating the ſubject, to make uſe of the plaineſt language, and to avoid as much as poſſible, all obſtruſe and difficult inveſtigation.

It will be proper to begin by taking a curſory view of Kitchen Fire-places, as they are now commonly conſtructed, and to point out their defects; and ſhew what the objects are which ought principally to be had in view in attempts to improve them.

Of the imperfections of the Kitchen Fire-places now in common uſe.

THE great fault in the conſtruction and arrangement of the Kitchens of private families now in common uſe in moſt countries, and particularly in Great Britain and Ireland, (a fault from which all their other imperfections ariſe,) is, that they are not *cloſed*. The fuel is burnt in a long open grate called a *kitchen-range*; over which the pots and kettles are freely ſuſpended, or placed on ſtands; or fires are made with charcoal in ſquare holes, called *ſtoves*, in a ſolid maſs of brick-work, and connected with no flue to carry off the ſmoke, over which holes ſtewpans or ſaucepans are placed on tripods, or on bars of iron, expoſed on every ſide to the cold air of the atmoſphere.

The loſs of heat and waſte of fuel in theſe Kitchens is altogether incredible; but there are other evils attending them, which are perhaps ſtill more important. All the various proceſſes in which fire is uſed in preparing food for the table are extremely unpleaſant and troubleſome in theſe Kitchens, not only on account of the exceſſive heat to which thoſe are expoſed who are employed in them, but alſo and more eſpecially on account of the *noxious exhalations* from the burning charcoal; and the *currents of cold air* in the Kitchen, which are occaſioned by the ſtrong draft up the chimney.

It

It is ſufficient to have once been in a kitchen when dinner was preparing for a large company,—or even merely to have met the cook coming ſweltering out of it, to be convinced that the buſineſs of cooking, as it is now performed, is both diſagreeable and unwholeſome: and it appears to me, that it would be no ſmall addition to the enjoyments of thoſe who are fond of the pleaſures of the table, to know that they were procured with leſs trouble and with leſs injury to the health of thoſe who are employed in preparing them.

Another inconvenience attending open chimney Fire-places as they are now conſtructed, is the great difficulty of preventing their ſmoking. In order that there may be room for all the pots and kettles which are placed over the fire, the grate, or *kitchen-range*, as it is called, muſt be very long,—and in order that the cook may be able to approach theſe pots, &c. the mantle of the chimney is made very high; conſequently the throat of the chimney is not only enormouſly large, but it is ſituated very high above the burning fuel; both of which circumſtances tend very much to make a chimney ſmoke, as I have ſhown in my Eſſay on Open Chimney Fire-places; and there does not appear to be any effectual remedy for the evil, without altering entirely the conſtruction of ſuch Fire-places.

Of the objects particularly to be had in view in attempts to improve Kitchen Fire-places.

THE objects which ought principally to be attended to in the arrangement of a kitchen, are the following:

1ſt, Each boiler, kettle, and ſtewpan, ſhould have its ſeparate cloſed Fire-place.

2dly, Each Fire-place ſhould have its grate, on which the fuel muſt be placed, and its ſeparate aſh-pit, which muſt be cloſed by a door well-fitted to its frame, and furniſhed with a regiſter for regulating the quantity of air admitted into the Fire-place through the grate. It ſhould alſo have its ſeparate canal for carrying off the ſmoke into the chimney; which canal ſhould be furniſhed with a damper. By means of this damper and of the aſh-pit door regiſter, the rapidity of the combuſtion of the fuel in the Fire-place, and conſequently the rapidity of the generation of the heat, may be regulated at pleaſure. The economy of fuel will depend principally on the proper management of theſe two regiſters.

3dly, In the Fire-places for all boilers and ſtewpans which are more than eight or ten inches in diameter, or which are too large to be eaſily removed with their contents *with the ſtrength of one hand*, an horizontal opening juſt above the level of the

the grate muſt be made for introducing the fuel into the Fire-place; which opening muſt be nicely cloſed by a fit ſtopper, or by a double door. In the Fire-places which are conſtructed for ſmaller ſtewpans this opening may be omitted, and the fuel may be introduced through the ſame opening into which the ſtewpan is fitted by removing the ſtewpan occaſionally for a moment for that purpoſe.

4*thly*, All portable boilers and ſtewpans, and eſpecially ſuch as muſt often be removed from their Fire-places, ſhould be *circular*, and they ſhould be ſuſpended in their Fire-places by their circular rims; but the beſt form for all fixed boilers, and eſpecially ſuch as are very large, is that of an oblong ſquare, and all boilers, great and ſmall, ſhould rather be *broad* and *ſhallow* than narrow and deep.

A circular form is beſt for portable boilers, on account of the facility of fitting them to their Fire-places; and an oblong ſquare form is beſt for large fixed boilers, on account of the facility of conſtructing and repairing the ſtrait horizontal flues under them and round them, in which the flame and ſmoke by which they are heated is made to circulate.

When large boilers are ſhallow, and when their bottoms are ſupported on the tops of narrow flues, the preſſure or weight of their contents being ſupported by the walls of the flues, the metal of which the boiler is conſtructed may be *very thin*, which will not only diminiſh very much the firſt coſt of the boiler,

boiler, but will alſo greatly contribute to its *durability*; for the thinner the bottom of a boiler is, the leſs it is *fatigued* and *injured* by the action of the fire, and the longer of courſe it will laſt; which is a curious fact, that has hitherto been too little known, or not enough attended to in the conſtruction of large boilers.

5thly, All boilers, great and ſmall, ſhould be furniſhed with covers, which covers ſhould be conſtructed in ſuch a manner, and of ſuch materials as to render them well adapted for confining heat. Thoſe who have never examined the matter with attention would be aſtoniſhed on making the experiment to find how much heat is carried off by the cold air of the atmoſphere from the ſurface of hot liquids, when they are expoſed naked to it, in boilers without covers: but in culinary proceſſes it is not merely the loſs of heat which is to be conſidered;—a great proportion of the finer and more rich and ſavoury particles of the food are alſo carried off at the ſame time, and loſt, which renders it an object of ſerious importance to apply an effectual remedy to this evil.

As heat makes its way through wood with great difficulty, and very ſlowly, there would perhaps be no ſubſtance better adapted for conſtructing covers for boilers than it, were it not for the perpetual changes in its form and dimenſions which are occaſioned by alternate changes of dryneſs and moiſture, but theſe alterations are ſo conſiderable, and their effects ſo difficult to be counteracted, eſpecially

cially when the form of the cover is circular, that for portable boilers, and for ſtewpans and ſaucepans, I ſhould prefer covers made of thin ſheets of tinned iron, or of *tin*, as it is commonly called. Theſe covers (which muſt always be made *double*) have already been particularly deſcribed in my *Sixth* Eſſay.

Though boilers and ſtewpans ſhould never be uſed naked over an open fire, or otherwiſe than in cloſed Fire-places, yet it is not neceſſary in fitting up a kitchen to build as many ſeparate Fire-places as it may be proper to have boilers, ſtewpans, and ſaucepans; for the ſame Fire-place may be made to ſerve occaſionally for ſeveral boilers or ſtewpans. Thoſe however that are uſed in the ſame cloſed Fire-place muſt be all of the ſame diameter; and in order that their capacities may be different, they may be made of different depths.

As in the hurry of buſineſs in the kitchen, one ſtewpan or boiler might eaſily be taken for another, were their diameters to vary by only a ſmall difference, and were they not diſtinguiſhed by marks or numbers; to prevent theſe miſtakes their diameters, expreſſed in inches, ſhould be marked on ſome conſpicuous part; on their handles for inſtance, or on their brims, and alſo on their covers; and their Fire-places ſhould be marked with the ſame number.

To guard ſtill more effectually againſt all miſtakes reſpecting the ſizes of theſe utenſils, and the Fire-places to which they belong, the difference

ference of the diameters of two boilers or ſtewpans ſhould never be leſs than *one whole inch.* In ſeveral private kitchens that have been conſtructed on my principles, their diameters have been made to vary by *two inches,* that is to ſay, they have been made of 6, 8, 10, 12, and 14 inches in diameter; and in order that thoſe of the ſame diameter might be of different capacities, they were made of three different depths, namely $\frac{1}{3}$, $\frac{1}{2}$, and $\frac{2}{3}$ their diameter in depth. Not only the numbers which ſhew their diameters, but the fractions alſo which expreſs their depths are marked on their handles, or on their brims.

The ſize of a private kitchen, or the number and ſize of its ſeparate cloſed Fire-places, and of its boilers and ſtewpans, muſt be regulated by the ſize of the family, or rather by the ſtyle of living; for where ſumptuous entertainments are occaſionally provided for large companies, the kitchen muſt be ſpacious, and its arrangement complete, however ſmall the family may be, or however moderate the expences of their table may be in their ordinary courſe of living in private.

Yet when kitchens are fitted up on the principles I am deſirous of recommending, neither the ſize of the kitchen, nor the number or dimenſions of its utenſils, will occaſion any addition to the table expences of the family in their ordinary courſe of living when they have no company, which is an important advantage that theſe kitchens have over thoſe on the common conſtruction.

In large kitchens with open Fire-places, the kitchen range being wide and very roomy, an enormous quantity of fuel is ſwallowed up by it, even when only a very ſmall quantity of food is provided; but this unneceſſary waſte is completely prevented by cooking in boilers and ſtewpans properly fitted into ſeparate cloſed Fire-places.

More fuel is frequently conſumed in a kitchen range to boil a tea-kettle, than, with proper management, would be ſufficient to cook a dinner for fifty men.

Of the diſtribution of the various parts of the machinery of a kitchen.

THOUGH the internal conſtruction of the Fire-places, and the means employed for confining and directing the heat generated in the combuſtion of the fuel, (ſubjects which have been thoroughly inveſtigated in my Sixth Eſſay,)—are matters of the firſt concern in the fitting up of a kitchen, yet theſe are not all that require attention; the diſtribution of the various parts of the machinery is a matter of conſiderable importance, for a good arrangement of the different inſtruments and utenſils; —of the boilers—ovens—roaſters, &c.—will tend very much to facilitate the buſineſs of cooking, and conſequently *to put the cook in good humour*; which is certainly a matter of ſerious importance.

Cooks

Cooks in general are averſe to all new inventions, and this is not ſurpriſing and ought by no means to be imputed to them as a fault. Accuſtomed *to work with their own tools*, they naturally feel awkward and embarraſſed when others are put into their hands; and to this we may add, that there is always a degree of humiliation felt by thoſe who, after having been accuſtomed to conſider themſelves, and to be conſidered by others, as maſters of their profeſſion, are required to learn any thing new, or to do any thing in any other manner than that in which they have always been accuſtomed to do it, and in the performance of which they have always acquired praiſe. It will not however be difficult to convince thoſe of the profeſſion who are poſſeſſed of a good underſtanding, and are above low and vulgar prejudices, that the alterations propoſed will moſt certainly meet with their approbation, *when they become better acquainted with them.*

The diſtribution of the parts of a kitchen muſt always depend ſo much on local circumſtances, that general rules can hardly be given reſpecting it; the principles, however, on which this diſtribution ought in all caſes to be made, *viz.* convenience to the cook, — cleanlineſs, — and ſymmetry, — are ſimple, and eaſy to be underſtood; and in the application of them, the architect will have a good opportunity of diſplaying his ingenuity, and ſhowing his taſte.

Should

Should he condeſcend to conſult the cook in making theſe arrangements he will do wiſely, on more accounts than one.

Though the ſmoke from the Fire-places of the boilers may be conveyed almoſt to any diſtance in horizontal canals, yet it will in moſt caſes be adviſable to place the boilers near the chimney;—and it will in general, though not always, be beſt to place them all in one range, or rather in one maſs of brick-work.

Of the method of forming a plan of a Kitchen that is to be fitted up; and of laying out the work.

Before the plan of a kitchen which it is intended to fit up is made, an exact plan muſt be procured of the room in which it is to be conſtructed, in which plan all the doors and windows muſt be diſtinctly marked, and alſo the Fire-place, if there be one in the room, and the chimney. The number and the dimenſions muſt likewiſe be known of all the boilers and ſaucepans which are to be fitted up in the brick-work.

The readieſt way of proceeding in making a plan or drawing of the machinery of a kitchen is to form it on the plan of the room; and in doing this the work will be much facilitated by the following very ſimple contrivance,

Cut out of thick paſteboard, detached pieces to repreſent the boilers, — ſaucepans, — roaſters,— ovens, &c. which are to be fitted up in the brick-work, and placing theſe in different ways on the plan of the room, ſee in what manner they can beſt be diſpoſed, or arranged. As theſe models (which muſt be drawn to the ſame ſcale as that uſed in drawing the plan of the room) may be moved about at pleaſure, and placed in an infinite variety of different poſitions in regard to each other, and to the different parts of the room; the effect of any propoſed arrangement may be tried in a few moments, in a very ſatisfactory manner, without expence, and almoſt without any trouble.

To facilitate ſtill more theſe preliminary trials with theſe models of the boilers, &c. ſeveral ſlips of paſteboard, equal in width to the diſtance at which one boiler ought to be placed from the other in the brick-work, meaſured on the ſcale of the plan, ſhould be provided and uſed in placing the models of the boilers at proper diſtances from each other. This diſtance in fitting up or ſetting kitchen boilers and ſaucepans I have commonly taken at the width of a brick, or $4\frac{1}{2}$ inches, and I have allowed the ſame ſpace—($4\frac{1}{2}$ inches)—for the diſtance of the ſide of the boiler from the outſide or front of the maſs of the brick-work in which it is ſet. When this point is ſettled, (that reſpecting the diſtance which ſhould be left between the boilers,) the arranging

arranging of the paſteboard models of the boilers on the plan will be perfectly eaſy.

As ſoon as the diſtribution of the various boilers, &c. is finally ſettled, a ground plan of the whole of the machinery ſhould be traced on the plan of the room; and a ſufficient number of ſections and elevations ſhould be drawn to ſhow the ſituations, forms, and dimenſions of the Fire-places, and of all the other parts of the apparatus.

When this is done,—and when the boilers and the materials for building are provided, and every thing elſe that can be wanted in fitting up the kitchen is in readineſs, the architect or *amateur* may proceed to the laying out of the work.

As this will not be found to be difficult, and as it is really a moſt amuſing occupation, I cannot help recommending it very earneſtly to gentlemen, and even to ladies,—to ſuperintend and direct theſe works.

I don't know what opinion others may entertain of theſe amuſements, but with regard to myſelf I own that I know of nothing more intereſting than the planning and executing of machinery, by which the powers of Nature are made ſubſervient to my views;—by which the very elements are bound as it were in chains, and made to obey my deſpotic commands.—And not my commands alone, but thoſe of all the human race to whoſe neceſſities and comforts they are made the faithful and obedient miniſters!

The firſt thing to be done in laying out the work when a kitchen is to be fitted up, is to draw with red or white chalk, or with a coal, a ground plan of the brick-work, of the full ſize, on the floor or pavement of the room. When the kitchen is neither paved nor floored, this drawing muſt of courſe be made on the ground. In this drawing, the aſh-pits, and the paſſages leading to them muſt be marked, and when the aſh-pit is to be ſunk into the ground, that is the firſt thing that muſt be executed.

As ſoon as this ground plan is ſketched out, the aſh-pit doors ſhould all be placed, and the foundations of the brick-work laid.

To aſſiſt the bricklayer, and prevent his making miſtakes, ſeveral ſections of the brick-work of the full ſize, and particularly ſections of all the boilers, repreſented as fixed in their Fire-places, ſhould be drawn on wide boards, or on very large ſheets of paper,—or they may be drawn with charcoal or red chalk on the ſides of the room. Theſe ſections of the full ſize, where the bricklayer can readily take meaſure of the various parts of the work to be performed, will be found very uſeful.

Before I proceed to give a more particular and minute deſcription of the various Kitchen Utenſils and other machinery which will be recommended, I ſhall lay before my reader an account, illuſtrated by drawings, of ſeveral complete kitchens that have already been conſtructed under my direction. I have been induced to adopt this method in treating

my ſubject, from an opinion that the directions which ſtill remain to be given reſpecting the conſtruction of Kitchen Fire-places, and of Kitchen Utenſils, will more eaſily be underſtood when a general idea ſhall have been formed of ſome of thoſe kitchens which have already been conſtructed on the principles recommended.

CHAP. II.

Detailed accounts, illuſtrated by correct plans, of various Kitchens, public and private, that have already been conſtructed on the Author's principles, and under his immediate direction.

ONE of the moſt complete kitchens I have ever yet cauſed to be conſtructed is, in my opinion, that belonging to Baron de Lerchenfeld at Munich, and although its general form and the diſtribution of the machinery are very different from any thing that has been ſeen in this country;—ſo different that I ſhould, perhaps, doubt whether it would be prudent at the firſt outſet to recommend their adoption and exact imitation; yet, as this kitchen has been found to anſwer remarkably well; even to the entire ſatisfaction of the cook, who began however by entering his formal proteſt againſt it, I have thought it right to lay the following deſcription of it before my readers. Thoſe who are alarmed at the novelty of its appearance will be ſo good as to recollect that much may be done, as will hereafter be ſhown, by way of accommodating the plan to the idea of thoſe to whom it is too new not to appear extraordinary and uncouth.

Deſcription

Deſcription of a Kitchen in the Houſe of BARON DE LERCHENFELD *at* MUNICH.

PLATE I.

Fig. 1. This plate ſhows a perſpective view of the Kitchen Fire-place ſeen nearly in front. The maſs of brick-work in which the boilers and ſauce-pans are ſet, projects out into the room, and the ſmoke is carried off by flues that are concealed in this maſs of brick work, and in the thick walls of an open chimney Fire-place which, ſtanding on it, on the farther ſide of it, where it joins to the ſide of the room, is built up perpendicularly to the ceiling of the room. At the height of about twelve or fifteen inches above the level of the mantle of this open chimney Fire-place, the ſeparate canals for the ſmoke concealed in its walls end in the larger canal of this Fire-place, which laſt-mentioned larger canal ſloping backwards, ends in a neighbouring chimney which carries off the ſmoke through the roof of the houſe into the atmoſphere.

An horizontal ſection of this open chimney Fire-place, at the level of the upper ſurface of the maſs of brick-work on which it ſtands, may be ſeen Plate III. fig. 5. In this ſection the vertical canals are diſtinctly marked, which carry off the ſmoke from the boilers into the chimney, as alſo the ſtoppers which are occaſionally taken away to

remove the ſoot, when theſe canals are cleaned. Theſe ſtoppers, which are made of earthen ware burnt like a brick or tile, are eight inches long, ſix inches wide, and three inches thick, and on their outſides they have two deep grooves that form a kind of handle for taking hold of them. When they are fixed in their places, their joinings with the door-way into which they are fitted are made tight by filling up the crevices with moiſt clay. The canals are cleaned by means of a ſtrong cylindrical bruſh, made of hogs' briſtles fixed to a long flexible handle of twiſted iron wire.

The open chimney Fire-place was conſtructed in order that an open fire might be made on its hearth, (which, as appears by the plan, is on a level with, or is a continuation of the top or upper ſurface of the maſs of brick-work in which the boilers are ſet,) ſhould any ſuch fire be wanted; but the fact is, that although this kitchen has been in daily uſe more than five years, it has not yet been found neceſſary to light a fire in this place. When any thing is to be fried or broiled, the cook finds it very convenient to perform theſe proceſſes of cookery over the two large ſtoves that are placed in the front of this open Fire-place; as the diſagreeable vapour that riſes from the frying-pan or from the gridiron, goes off immediately by the open chimney: and theſe ſtoves ſerve likewiſe occaſionally for warming heaters for ironing, and alſo for burning wood to obtain live coals for warming beds, or for keeping up a ſmall fire for boiling

boiling a tea-kettle, or for warming any thing that is wanted in the family. When this fire is not wanted, the regiſter in the aſh-pit door is nearly cloſed, and the top of the ſtove is covered with a fit cover of earthen-ware, by which means the fire is kept alive for a great length of time, almoſt without any conſumption of fuel; and may at any time be revived and made to burn briſkly in leſs than half a minute, merely by admitting a larger current of freſh air.

The convenience in a family of being able to have a briſk fire in the kitchen in a moment, when wanted, and to check the combuſtion in an inſtant, without extinguiſhing the fire, and without even cooling the Fire-place, when the fire is no longer wanted, can hardly be conceived by thoſe who have not been uſed to any other methods of making and keeping up kitchen fires than thoſe commonly uſed in the kitchens in Great Britain.

It will certainly be confeſſed that neither ſcience nor art has done much either for ſaving labour or for ſaving expence,—either for convenience, comfort, cleanlineſs, or economy in the invention and management of a *kitchen range*.

Before I proceed to explain more minutely the different parts of this kitchen, it may be uſeful to give a general idea of the whole of it, taken together.

PLATE II.

Fig. 2. This figure ſhows a front view, or, more ſtrictly ſpeaking, an elevation of this kitchen. In this plan the aſh-pit doors with their regiſters are diſtinctly ſeen; and alſo the ends of the earthen ſtoppers which cloſe the openings into the Fire-places * of four of the principal boilers. The covers of the principal boilers †, as alſo of ſeveral of the ſtewpans, are ſeen above the level of the upper ſurface of the maſs of brick-work.

The height of this maſs of brick-work *a b*, meaſured from the floor or pavement of the kitchen, is juſt three feet.

Fig. 3. This figure ſhews an horizontal ſection of the maſs of brick-work in which the boilers, &c. are ſet, taken at the level of the horizontal flues, that carry off the ſmoke from the boilers, ſtewpans, and ſaucepans, into the vertical canals which convey it into the chimney.

The ſmoke from three of the principal boilers, ſituated on the left hand, is carried by ſeparate canals to a circular cavity, over which a large ſhallow boiler is placed, in which water is heated

* For a particular account of theſe ſtoppers, ſee p. 30—188, and Plate I. figures 6, 7, and 8, Eſſay VI.

† For an account of theſe covers, ſee p. 18—187. and Plate I. figures 1 and 2, Eſſay VI.

(by

(by this ſmoke) for the uſe of the kitchen, and more eſpecially for waſhing the plates and diſhes. This boiler is diſtinctly ſeen with its wooden cover, (conſiſting of three pieces of deal united by two pairs of hinges) in the figure 5, Plate III.

The five Fire-places on the left-hand ſide of the maſs of brick-work are repreſented without their circular grates, and the eight Fire-places that are ſituated on the right hand, are ſhown with their circular grates in their places*.

The Fire-places of the four largeſt boilers, which are ſituated in front of the brick-work, have doors or openings, cloſed with ſtoppers, for introducing fuel into theſe Fire-places, and three of theſe openings are repreſented in the plan as being cloſed by their ſtoppers; while the fourth (that ſituated on the right hand) is ſhown open, or without its ſtopper.

As all the reſt of the Fire-places (or ſtoves as they would be called in this country) are without any lateral opening for introducing the fuel, when any fuel is to be introduced into one of theſe Fire-places the ſtewpan or ſaucepan muſt be removed for a moment for that purpoſe.

It will be obſerved that ſeveral of the horizontal canals that carry off the ſmoke from the boilers are divided into two branches, which unite at a little

* For a particular account of theſe circular grates, ſee p. 41—187. and Plate I. figure 3 and 4. In Great Britain theſe grates may be made very cheap of caſt iron.

diſtance

diſtance from their Fire-places;—this contrivance is very uſeful, eſpecially for cloſed Fire-places that are without flues under the boilers, as it occaſions the flame to divide under the bottom of the boiler, and to play over every part of it in a thin ſheet.

The reaſon why flues were not made under theſe boilers was to render it poſſible to uſe occaſionally ſeveral boilers of different depths in the ſame Fire-place; a convenience of no ſmall importance in the kitchen of a private gentleman, who occaſionally gives dinners to large companies.

It will be perceived, that in the Fire-places of all the ſtewpans and ſaucepans there are circular flues which oblige the flame to make one complete turn round the ſides of the veſſel, before it goes off into the horizontal canal; but I am far from being ſure that the ſaving of fuel, ariſing from this peculiar arrangement, is ſufficient to counterbalance the loſs of that great convenience that reſults from being able to uſe indifferently ſtewpans and ſaucepans of different depths in the ſame ſtove, which cannot be obtained while theſe circular flues remain.

They will indeed be rendered unneceſſary, provided that the flame be made to divide under the bottom of the veſſel, (which may be done by cauſing it to enter the horizontal canal by two oppoſite openings,) and provided that this canal be furniſhed with a good damper,—WHICH OUGHT NEVER TO BE OMITTED. Although, to avoid the confuſion that is apt to reſult from the delineation of

of a multitude of different objects in the ſame drawing, the dampers to the canals are all omitted in theſe plans, they muſt on no account be left out in practice; for they are of ſuch importance that there is no poſſibility of managing fires properly without them: and as it is of very little importance whether they be placed near the fire or far from it, or what is their form, provided they be ſo conſtructed as to diminiſh at pleaſure, and occaſionally to cloſe entirely the canal by which the ſmoke makes its eſcape, it is not neceſſary for me to give any particular directions how they are to be made: indeed their conſtruction is ſo very ſimple, and ſo generally known, that it would be quite ſuperfluous for me to enlarge on that ſubject.

The dotted lines leading from the front of the brick-work to the Fire-places ſhow the poſition and dimenſions of the aſh-pits.

The whole length of the maſs of brick-work from A to B is eleven feet, and its width from A to C is ſeven feet four inches. The ſpace it occupies on the ground may be conceived to conſiſt of ſix equal ſquares of forty-four inches each, placed in two rows of three ſquares each; theſe two rows being joined to each other by their ſides, and forming together a parallelogram. And in laying out the work when a kitchen is to be fitted up on the plan here deſcribed, it will always be beſt to begin by actually drawing theſe ſix ſquares on the

the floor of the kitchen. Nearly the whole of the middle ſquare of the back row is occupied by the open chimney Fire-place, and by its thick hollow walls; and the greater part of the middle ſquare of the front row is left as a paſſage for the cook to come to the open chimney Fire-place, or rather to the ſtoves that are ſituated near it.

PLATE III.

Fig. 4. This figure, which repreſents a vertical ſection of the maſs of brick-work through the centres of the Fire-places of the four principal boilers, is chiefly deſigned to ſhow the conſtruction of thoſe Fire-places, and alſo that of the boilers. Sections of the circular grates on which the fires are made to burn under the boilers are here repreſented, and alſo ſections of the aſh-pits, and of the contractions of the Fire-places immediately below the grates *; and in one of the Fire-places, which is ſhown without its boiler, the openings of the branched canal by which the ſmoke goes off horizontally towards the chimney, are alſo marked.

Fig. 5. This figure ſhows a bird's eye view of the upper ſurface of the brick-work, with all the boilers and ſaucepans in their places, except one;

* For an account the utility of theſe contractions, ſee Eſſay VI. page 43.

three

three of the principal boilers and one ſaucepan with their covers on; and the reſt of them without their covers. It likewiſe repreſents an horizontal ſection of the open chimney Fire-place, four inches above the level of the top of the maſs of brick-work in which the boilers and ſaucepans are ſet.

It is to be obſerved, that all the boilers, ſtewpans, and ſaucepans, are fitted into circular rings of iron, which are firmly fixed to the brick-work; and that they are ſuſpended in their Fire-places by their circular rims. All the ſtewpans and ſaucepans, that are not too large to be lifted with their contents in and out of their Fire-places with the ſtrength of one hand, have iron handles attached to their circular rims; but the four principal boilers, which are too large to be managed with one hand, have each two rings fitted to their rims. Theſe handles and rings are ſo conſtructed, that they do not prevent the ſaucepans and boilers from fitting the circular openings of their Fire-places; neither do they prevent their being fitted by their own circular covers.

It will doubtleſs be obſerved, that the four principal boilers ſhown in fig. 4. belonging to the kitchen I am now deſcribing, differ but very little in form from the boilers in common uſe, and conſequently that they are conſiderably deeper in proportion to their width than they ought to be, in order that the heat generated in the combuſtion of the fuel might act upon them to the greateſt advantage; but it is to be remembered that to each of theſe Fire-places there are other ſhallower boilers

that

that are uſed occaſionally, which do not appear in theſe plans. There is however one advantage attending deep boilers, to which it may in ſome caſes be uſeful to pay attention, and that is, that they economize *ſpace* in a kitchen; and when their Fire-places are properly conſtructed, and above all when they are furniſhed with good regiſters and dampers, the additional quantity of fuel they will require will be too trifling to be conſidered. The walls of their Fire-places will abſorb more heat in the beginning, but who knows but that the greater part of this heat may not afterwards be emitted in rays, and at laſt find its way into the boiler? I could mention ſeveral facts that have lately fallen under my obſervation, which ſeem to render this ſuppoſition extremely probable.—This however is not the proper place to give an account of them.

As I have ſaid that no fire has yet been made in the open chimney Fire-place of the kitchen I am deſcribing, it may perhaps be aſked how this kitchen is warmed in cold weather. To this I anſwer, that it has been found that the maſs of brick-work is made ſufficiently hot by the fires that are kept up in it when cooking is going on every day, to keep the room comfortably warm in the coldeſt weather.

This anſwer will probably give riſe to another queſtion, which is;—how we contrive to prevent the room from being much too warm in ſummer? By opening one of the windows a very little, and by opening at the ſame time the regiſter of a wooden

wooden tube or ſteam-chimney, which, riſing from the ceiling of the room, ends in the open air; and which is always opened to clear the room of vapour when it is found neceſſary, and eſpecially when the victuals are taken out of the boilers, or when any other operation is going on that occaſions the diffuſion of a conſiderable quantity of ſteam. The oblong opening of this ſteam-chimney may be ſeen Plate I. Fig. 1. in the ceiling, at the right hand corner of the room.

Near this corner of the room may likewiſe be ſeen a front view of the hither end of one large roaſter, and part of the front view of a ſmaller one ſituated by the ſide of it; both with their ſeparate Fire-place doors.

The Fire-place door of the larger roaſter, as alſo both its blow-pipes, are repreſented as being open; but the aſh-pit door of this roaſter is hid by the maſs of brick-work in which the boilers are ſet. A particular account of theſe roaſters will be given hereafter.

The dimenſions of the boilers in this kitchen are as follows:

	Wide at the brim. Inches.	Deep. Inches.
One large boiler heated by ſmoke -	20	8
Two large boilers - - - - - -	16	16
Two ditto uſed occaſionally in the Fire-places of the two boilers laſt mentioned - - - - - - -	16	8
Two ſmaller boilers - - - - -	12	12
Two ditto fitted to the ſame Fire-places	12	6

The diameters of the ſtewpans and ſaucepans are 12, 10, and 8 inches; and their depth is made equal to half their diameters.

The fuel burnt in this kitchen is wood; and the billets uſed are cut into lengths of about ſix inches.

Common bricks were uſed in the conſtruction of the Fire-places, but care was taken to lay them in mortar compoſed of clay and brickduſt, without any ſand, with only a very ſmall proportion of lime.

In this kitchen, as alſo in that which I am now about to deſcribe, the maſs of brick-work in which the boilers are ſet projects into the room from the middle of one ſide of it.

Deſcription of the KITCHEN *of the Hoſpital of* LA PIETA *at* VERONA.

PLATE IV. Fig. 6. This figure repreſents the ground plan of the maſs of brick-work in which the boilers are fixed, and the canals by which the ſmoke is carried off from the Fire-places into the Chimney. The ground covered by this maſs of brick-work, and by the area (*y*) between the boilers, may be conceived to be divided into ſix equal ſquares, of 43 inches, placed in two rows of three ſquares each. In the centres of four of theſe ſquares, namely, of thoſe which are ſituated at the ends of the rows, are placed four large circular boilers.—The middle ſquare of the front row is chiefly occupied by the area

area which is left between the two front boilers; and one half of the middle ſquare of the back row is occupied by an open Chimney Fire-place, in the thick walls of which no leſs than ſix vertical flues are concealed, which carry off the ſmoke from the boilers and ſtewpans into the Chimney.

The ſmoke from the fire which heats the large boiler P, (which boiler is $32\frac{1}{2}$ inches in diameter,) on quitting its Fire-place, goes off in four ſeparate branches, which ſoon unite, and forming one canal, riſes up under the middle of the bottom of the neighbouring large boiler Q—makes one complete turn under that boiler, and, paſſing from thence towards the centre of the maſs of brick-work, circulates in canals divided into ſeveral branches under an iron plate that forms the bottom of an oven, which is ſituated under the hearth of the open chimney Fire-place. From under the bottom of this oven this ſmoke goes off obliquely, and, entering the bottom of the vertical canal p, goes off into the Chimney. The principal uſe of this oven is to dry the wood that is uſed as fuel in the Kitchen. The large boiler Q, that is heated by this ſmoke, is deſigned for warming water for the uſe of the Kitchen, and for various other purpoſes for which hot water is occaſionally uſed in the Hoſpital.

The boiler P is principally uſed in preparing food for the children in the Hoſpital.

The ſmoke from the fire which heats the boiler R, paſſing off in a canal which leads to the boiler S, there ſeparates, and paſſing round the ſides of the boiler S, and under a ſmall part of its bottom, unites again, and paſſes off into the chimney by the vertical canal r. The heat in this ſmoke, though it is ſufficient to *warm* the water in the boiler S, is not ſufficient to make it boil. In order that the contents of this boiler may occaſionally be made boiling hot, the boiler has a ſmall Fire-place of its own, ſituated immediately under the middle of its bottom; and when the water in the boiler has been previouſly made warm by the ſmoke from the boiler R, a very ſmall fire made under it, in its own ſeparate Fire-place, will make it boil. The ſmoke from this Fire-place goes off by its own ſeparate canal into the vertical canal s, ſo that it does not interfere at all with the ſmoke from the Fire-place of the boiler R; and in conſequence of this arrangement, the heating of the boiler S, by the ſmoke from this neighbouring Fire-place and by its own fire, may be going on at the ſame time.

The ſmoke from the ſmall boiler T, and from the ſtewpans U and W, goes off immediately by ſeparate horizontal canals into their ſeparate vertical canals (*t u* and *w*) that open into the chimney at the height of about 15 inches above the mantle of the open chimney Fire-place; and all the vertical canals, by which the ſmoke goes into the chimney, are furniſhed with dampers.

The

The ſide *b c* of the maſs of brick-work is placed againſt the middle of one ſide of the Kitchen, which is a large room; and the walls of the open chimney Fire-place *g h i k* are carried up perpendicularly to the ceiling of the room. The hearth *l m n o* is on a level with the top of the brick-work in which the boilers are ſet.

As the principal boilers are deep, in order to provide ſufficient room for them, and a ſufficient depth for their aſh-pits, the foundation of the quadrangular maſs of brick-work *a b c d* was raiſed 16 inches above the pavement of the Kitchen, and on the three ſides of the maſs of brick-work *a b*, *a d*, and *d c*, which project into the room, there are two ſteps, 8 inches in height each, which extend the whole length of each of thoſe ſides; and for greater convenience in approaching the boilers. the uppermoſt ſtep is made two feet wide, and the area *y* is on a level with the top of this wide ſtep. The aſh-pit doors of the principal boilers are placed in the front of this ſtep, and the bottoms of the paſſages or door-ways into their Fire-places by which the fuel is introduced, are ſituated juſt on a level with its upper ſurface.

The maſs of brick-work in which the boilers are placed, is 10 feet 9 inches long, and 8 feet 2 inches wide; and it is elevated to the height of about 3 feet 2 inches above the top of the upper broad ſtep, by which it is ſurrounded on three ſides, and on which it appears to ſtand.

Deſcription of the Kitchen of the HOUSE OF CORRECTION *at* MUNICH.

PLATE IV. Fig. 7, and PLATE V. Fig, 8 and 9, repreſent the plans and ſections of this Kitchen.

Fig. 7. repreſents the ground plan of the brick-work in which the boilers, &c. are ſet, or rather an horizontal ſection of the brick-work at the level of the Fire-places, and of the canals for carrying off the ſmoke. In this Kitchen the fires are not made on circular iron grates, as in that juſt deſcribed, but the fuel is burnt on grates or bars compoſed of bricks ſet edgewiſe, as may be ſeen by the plans. (See *b b b*, &c. Fig. 7.)

The two principal boilers (*l l*, Fig. 9.) are quadrangular, each being 3 feet long, 2 feet wide, and fifteen inches deep, furniſhed with wooden covers moveable on hinges; and they are both heated by one fire. That which is ſituated in the front of the brick-work, and immediately over the fire, is uſed for making ſoup; while the other which is placed very near it, and on the ſame level, is uſed for boiling meat, potatoes, greens, &c. in ſteam. A ſmall quantity of water (about an inch in depth) being put into the ſecond boiler, the ſmoke from the firſt, which paſſes in flues under the ſecond, ſoon cauſes this water to boil, and fills the boiler with hot ſteam. The ſteam from the firſt boiler is alſo carried into the ſecond by means of a

tube about $\frac{3}{4}$ of an inch in diameter, furniſhed with a cock, which forms a communication between the two boilers juſt below the level of their brims. This tube of communication is not expreſſed in the Plates.

The ſmoke having quitted the ſecond boiler, riſes up obliquely to the level of the top of the maſs of brick-work in which the before-mentioned boilers are ſet, and then circulates under a quadrangular copper veſſel, (expreſſed by dotted lines at A, Fig. 8,) 27 inches long, 19 inches wide, and 20 inches deep, deſtined for containing warm water for the uſe of the Kitchen. As this veſſel ſtands higher than the tops of the boilers, it is found to be very convenient for filling them with water; and as this water is kept warm by the ſmoke, this arrangement produces a conſiderable economy of fuel as well as of time. The water is drawn off from this veſſel, for uſe, by means of a braſs cock, which is not expreſſed in the drawing; and it is ſupplied with water from a neighbouring reſervoir, the entrance of the water being regulated by a regulating cock, or valve, furniſhed with a ſwimming ball.

The ſmoke, after it has circulated in flues under this veſſel, goes off into a vertical canal which conducts it into the chimney. This vertical canal, together with three others deſigned for a ſimilar uſe, (ſee *d d d d*, Fig. 7, and Fig. 9,) are ſituated in the thick walls of an open chimney Fire-place, (*n*, Fig. 8,) the hearth of which is on a level with the top of the maſs of brick-work in which the boilers

are ſet. An horizontal ſection of theſe four vertical flues, taken at the height of 3 inches above the level of the hearth; and alſo an horizontal ſection of the brick-work of a roaſting machine, (B. Fig. 8 and 9,) ſituated on the left of this open chimney Fire-place, are diſtinctly repreſented in the Figure 9.

Under the hearth of the Fire-place there is an open vault which ſerves as a magazine for fuel; and in the front wall of the Fire-place, above the mantle, juſt under the ceiling of the room, there are two openings into the chimney, by which the ſteam that riſes from the boilers eſcapes into the chimney, and goes off with the ſmoke.

The manner in which the flues are conſtructed under the different boilers, and the horizontal canal for carrying off the ſmoke from the round boilers into the chimney, are ſhewn in the fig. 7. The aſh-pit doors to the two principal round boilers, which are expreſſed by dotted lines, are oppoſite to E and F, Fig. 7.

The aſh-pit door belonging to the Fire-place of the large quadrangular boilers is ſituated oppoſite to G, Fig. 7. The reaſon why theſe aſh-pit doors were not placed immediately under their Fire-place doors is becauſe there was not room for them in that ſituation, owing to the pavement of the area between the boilers being raiſed one ſtep higher than the floor of the kitchen, which was done for the convenience of the Cook.

The openings for introducing the fuel into the Fire-places are conical holes in ſquare tiles, cloſed with earthen ſtoppers, (ſee page 30, Eſſay VI.)

Though

Though theſe tiles are not particularly diſtinguiſhed in theſe plates, the ſtoppers which cloſe their conical openings are ſhewn. As theſe tiles are ſo worked into the maſs of the brick-work as to make a part of it, and as they are plaiſtered and white-waſhed in front, it is not eaſy to diſtinguiſh them from the bricks when the work is finiſhed. Their joinings with the bricks in front could not therefore with propriety be marked in any of theſe plans.

Although the roaſter belonging to the kitchen we are deſcribing is not ſeen, yet the maſs of brick-work in which it is fitted up appears on the left hand ſide of the open chimney Fire-place in Fig. 8; and a bird's eye view of its Fire-place, and of the projecting edges of the bricks on which it reſts, are ſeen in the figure 9.

Deſcription of the new Kitchen in the MILITARY HOSPITAL *at* MUNICH.

PLATE VI. Fig. 10 and 11, and PLATE VII. Fig. 12.

The maſs of brick-work in which the boilers, the roaſter, the ſtewpans, &c. are ſet, occupies one corner of the Kitchen, extending 11½ feet on one ſide of the room, and 13 feet 7 inches on the other. The greateſt width of the maſs of brick-work (from A to B, or from C to D) is 50½ inches, and its height from the floor 36 inches. The circular area (E, Figures 9 and 10) in the angle of the maſs of brick-work is 6 feet 8½ inches

inches in diameter; and it is raiſed one eaſy ſtep, or about 5 inches above the level of the floor of the room. There is an open chimney Fire-place of a peculiar form (F, Fig. 10) in the corner of this Kitchen, the hearth of which is on a level with, or rather makes a part of the upper ſurface of the maſs of brick-work. The ſide-walls of this open chimney Fire-place are hollow, (ſee G and H, Fig. 10,) and ſerve as canals for carrying off the ſmoke from the boilers into a chimney, which is ſituated quite in the corner of the room. Theſe canals open into the Chimney about 15 inches above the level of the mantle.

The ſmoke goes of from each Fire-place by two ſeparate and very narrow horizontal canals into larger common canals, (ſee I and K, fig. 9,) which conducts it to the Chimney; and the openings of theſe narrow canals are occaſionally cloſed more or leſs by means of ſmall pieces of brick or of earthen-ware, which ſerve inſtead of dampers, but which are not expreſſed in the Plates. The fires all burn on flat grates, compoſed of bricks, or thin tiles ſet edge-wiſe. To ſave expence the covers of the boilers and ſtewpans were all made of wood. The oblong quadrangular veſſel, (ſee L, Figures 10 and 11,) which is made of copper, and has a door above moveable on hinges, is deſtined for containing warm water for the uſe of the Kitchen, and is heated by the ſmoke from all the neighbouring cloſed Fire-places.

The Fire-place of the roaſter is ſeen in Figure 9 (M); a bird's-eye view of the top of the roaſter appears

appears in Figure 10, and a vertical ſection of it and of its flues are faintly marked by dotted lines in Fig. 11.

The two large ſhallow ſtewpans, (N, O, Fig. 10,) vertical ſections of which, and of their Fire-places, are faintly marked by dotted lines in Fig. 11, are conſtructed of hammered iron, and are uſed principally for cooking ſteam dumplins, (dampf-nudels,) a kind of food in great repute in Bavaria.

When any thing is to be fried or broiled, a fire is made on the hearth of the open chimney Fire-place. Under this hearth there is a ſmall vault which ſerves for holding the wood that is wanted for fuel; but it would have been much better if that ſpace had been occupied by two circular cloſed Fire-places, ſo conſtructed as to be uſed occaſionally for a frying-pan or a gridiron.

Deſcription of a detached Part of the Kitchen of the Military Academy at Munich.

PLATE VII. Fig. 13. This figure is the ground plan of a maſs of brick-work occupying a ſpace about 6 feet 9 inches ſquare, meaſured on the floor, in one corner of the room, in which two of the principal boilers belonging to the kitchen, and three large ſtewpans, are fixed.

A and B are two ſteps, each 8 inches high, and the upper (flat) ſurface of the maſs of brick-work, in which the boilers are ſet, and which is 45 inches

inches wide, is juſt 30 inches above the level of the upper ſurface of the ſtep B.

Neither the boilers nor ſtewpans are ſhewn in this plan, but their circular Fire-places are repreſented; as alſo their circular diſhing iron grates, on which the fuel is burnt, and the horizontal canals by which the ſmoke paſſes off into the chimney.

The ſmoke divides under each of the two principal boilers, and paſſes off in two canals ſituated on oppoſite ſides of the Fire-place; which canals, however, unite and form one ſingle canal at a ſmall diſtance from the boiler. In the Fire-places of the ſtewpans the ſmoke does not divide in this manner; but the Fire-place is ſo conſtructed, that the flame makes one complete turn round the ſtewpan before it goes off into the horizontal canal leading to the chimney.

The opening by which the fuel is introduced into the Fire-place of each of the two large boilers is cloſed by a conical ſtopper, (conſtructed of fire-ſtone,) repreſented in the figure, immediately under which ſtopper the (regiſter) door of the aſh-pot is ſituated.

The aſh-pit of each of the Fire-places of the ſtewpans is furniſhed with a regiſter door. The paſſages into theſe aſh-pits are expreſſed in the figure by dotted lines. The fuel, (which is ſmall pieces of wood about 5 inches in length) is introduced into the Fire-place from above, by removing the ſtewpan for a moment for that purpoſe.

The

The chimney C, by which the ſmoke goes off, is ſituated in a corner of the room, and when it is ſwept, the chimney-ſweeper enters it by a door-way, which is ſituated in front, juſt above the level of the upper ſurface of the maſs of brick-work, and which is cloſed by an iron door.

Each of the horizontal canals by which the ſmoke is carried off from the Fire-places of the two large boilers into the chimney, is furniſhed with a damper, which is faintly marked in the figure. Each of the horizontal canals, which carry off the ſmoke from the Fire-places of the ſtewpans, is likewiſe furniſhed with a damper, but, to avoid confuſion, they are not expreſſed in the engraving.

The bottoms of the aſh-pit doors of the Fire-places of the three ſtewpans, are on a level with the upper ſurface of the ſtep B; but the bottoms of the aſh-pit doors of the Fire-places of the two large boilers are on a level with the pavement of the kitchen.

The two large boilers (which are conſtructed of ſheet copper, tinned,) are 22 Rhinland inches in diameter above,—19¼ inches in diameter below,—and 24 inches deep. They weigh each 62 lbs. Avoirdupois, and contain 28 wine gallons. The circular diſhing grates belonging to their Fire-places are each 10 inches in diameter, meaſured externally, and the Fire-place, properly ſo called, or the cavity in which the burning fuel is confined, is 10 inches in diameter below, 18 inches in diameter above, and 8½ inches deep.

The largeſt ſtewpan is 12 inches in diameter, and 4 inches deep; and the two others are each 11 inches in diameter, and 4 inches deep.

The Fire-places belonging to the ſtewpans are cylindrical,—5 inches deep, and 6 inches in diameter, and are furniſhed with circular diſhing grates.

Each of the large boilers is furniſhed with a circular wooden rim, 2 inches wide, and 2 inches thick, which is accurately fitted to the brim of the boiler; and a circular wooden cover, conſiſting of three pieces of deal board attached to each other by two pairs of hinges, cloſes the boiler by being fitted accurately to the upper ſurface of its circular wooden rim.

One of the three pieces of board, which together form the flat circular cover of the boiler, is firmly faſtened down to the wooden rim of the boiler, by means of two ſmall hooks of iron; and from the middle of this part of the cover, ſo faſtened down, a long tin tube, about $1\frac{1}{4}$ inches in diameter, riſes up perpendicularly to the ceiling of the room, and carries off the ſteam from the boiler out of the kitchen.

As the cover of the boiler is compoſed of three flat pieces of board united by hinges, and as the cover, ſo formed, is merely laid down on the flat ſurface of the wooden rim which is connected with the brim of the boiler, it might very naturally be expected that ſome of the ſteam would be forced through between the joinings of the cover, or between

tween the cover and the wooden rim; but this is what never happens:—So far from it, ſteam ſeldom comes into the room even when the cover of the boiler is in part removed, by laying back the firſt diviſion of it upon the ſecond—ſo ſtrong is the draught of the ſteam tube.

This phenomenon, which rather ſurpriſed me when I firſt obſerved it, was of conſiderable uſe to me; for it led me to diſcover the utility of dampers in the tubes, or chimnies, that are deſtined for carrying off the ſteam from boilers, and more eſpecially from ſuch boilers whoſe covers are not perfectly air-tight. If theſe ſteam chimnies are of any conſiderable length, they cannot fail to occaſion a ſtrong draught through them, which will have a tendency to cauſe the cold air of the atmoſphere to preſs in by every crevice between the brim of the boiler and its cover; which ſtreams of cold air being precipitated upon the ſurface of the boiling liquid, will be there warmed; and then paſſing off rapidly by the ſteam-chimney, will occaſion a very conſiderable loſs of heat.

The rule for regulating the damper of the ſteam-chimney of a boiler, whoſe cover is not ſteam tight, is this;—cloſe the damper juſt ſo much, that cloſing it any more would cauſe ſome ſteam to be driven out between the joinings of the brim of the boiler and its cover. When this is done, it is evident that little or no cold air can enter the boiler by any ſmall crevices in its cover that may remain open, conſequently little or no heat

heat will be carried off by the air of the atmoſphere from the ſurface of the hot liquid.

I have been the more particular in explaining this matter, as I am perſuaded that a great deal of heat is frequently loſt in boiling and evaporating liquids, by cauſing or permitting the cold air of the atmoſphere to come into contact with the ſurface of the hot liquid.

Some, I know, are of opinion, that a ſtream of freſh air, or a wind, which is made to paſs over the ſurface of a liquid that is evaporated by boiling, tends rather to increaſe the evaporation than to diminiſh it; but it appears to me that there are ſtrong reaſons to conclude that this opinion is erroneous. A very ſimple experiment which I propoſe to make, and which others may perhaps be induced to make before I can find leiſure to attend to it, will determine the fact.

The large boiler belonging to the Fire-place, which is ſituated on the left hand in the maſs of brick-work above deſcribed, is that which was uſed in the Experiment mentioned in the ninth page of my Sixth Eſſay.

It was once my intention to have publiſhed drawings and deſcriptions of every part and detail of the kitchen of the Military Academy at Munich, and alſo that of the Houſe of Induſtry in that city; but as enough has already been ſaid in this and in my Sixth Eſſay to give clear and diſtinct ideas of the fundamental principles on which all the eſſential parts of the machinery in thoſe kitchens

kitchens were conſtructed; and as the peculiar arrangement of a kitchen muſt ever depend much on its ſize, and on the variety and kinds of food that are to be cooked in it, to avoid being tedious and tireſome to my readers, I have, after mature deliberation, concluded that it will be beſt to ſuppreſs theſe details.

Having now finiſhed all the deſcriptions which I think it uſeful to publiſh of the various public and private kitchens that have been conſtructed under my direction in foreign countries, and having explained in the moſt ample manner in this Eſſay, and in my other writings on the Management of Fire, all the leading principles according to which, in my opinion, kitchens and fire-places of all kinds ſhould be conſtructed, I ſhall in the next place proceed to ſhow in what manner my plans may be ſo modified and accommodated to the opinions and practices in this country as to remove the objections that will probably be made to them, and facilitate their gradual introduction into general uſe.

I am well aware that it is by no means enough for thoſe who propoſe improvements to the public to be in the right in regard to the intrinſic merit of their plans: much muſt be done to prepare the way for, and to facilitate their introduction, or all their labours will be in vain.

CHAP. III.

Of the alterations and improvements that may be made in the Kitchen Fire-places now in common uſe in Great Britain.—All improvement in Kitchen Fire-places impoſſible, as long as they continue to be encumbered with ſmoke-jacks.—They occaſion an enormous waſte of fuel—Common jacks, that go with a weight, are much better.—Ovens and boilers that are connected with a kitchen range ſhould be detached from it, and heated each by its own ſeparate fire.—The cloſed Fire-places for iron ovens and roaſters can hardly be made too ſmall.—Of the various means that may be uſed for improving the large open fire-places of kitchens.—Of the cottage Fire-places now in common uſe, and of the means of improving them.—Of the very great uſe that ſmall ovens conſtructed of thin ſheet iron would be of to cottagers.—Of the great importance of improving the implements and utenſils uſed by the poor in cooking their food.—No improvement in their method of preparing their food poſſible without it.—Deſcription of an oven ſuitable for a poor family, with an eſtimate of the coſt of it.—Of neſts of three or four ſmall ovens heated by one fire.—Of the utility of theſe neſts of ovens in the

kitchens of private families.—They may be fitted up at a very ſmall expence.—Occaſional remarks reſpecting the materials proper to be uſed in conſtructing the ſides and backs of open chimney Fire-places.

THE Kitchen Fire-place of a family in eaſy circumſtances in this country conſiſts almoſt univerſally of a long grate, called a Kitchen-Range, for burning coals, placed in a wide and deep open chimney with a very high mantle. The front and bottom bars of the grate are commonly made of hammered iron, and the back of the grate (which uſually ſlopes backwards) of a plate of caſt iron; and ſometimes there is a vertical plate of iron, moveable by means of a rack in the cavity of the grate, by means of which plate the capacity, or rather the length of that part of the grate that is occupied by the burning fuel, may occaſionally be diminiſhed. At one end of the grate there is commonly an iron oven, which is heated by the fire in the grate; and ſometimes there is a boiler ſituated in a ſimilar manner at the other end of it. To complete the machinery, (which in every part and detail of it ſeems to have been calculated for the expreſs purpoſe of *devouring fuel,*) a ſmoke-jack is placed in the Chimney!

I ſhall begin my obſervations on the ſmoke-jack.

No human invention that ever came to my knowledge appears to me to be ſo abſurd as this. A wind-will is certainly a very uſeful contrivance,

but were it propoſed to turn a wind-mill by an artificial current of air, how ridiculous would the ſcheme appear! What an enormous force would neceſſarily be waſted in giving velocity to a ſtream of air ſufficient to cauſe the mill to work with effect! A ſmoke-jack is, however, neither more nor leſs than a wind-mill, carried round by an artificial current of air: and to this we may add, that the current of air which goes up a chimney, in conſequence of the combuſtion of fuel in an open Chimney Fire-place, is produced in the moſt expenſive and diſadvantageous manner that can well be imagined. It would not be difficult to prove, that much leſs than *one thouſandth* part of the fuel that is neceſſary to be burnt in an open Chimney Fire-place, in order to cauſe a ſmoke-jack to turn a loaded ſpit, would anſwer to make the ſpit go round, were the force evolved in the combuſtion of the fuel properly directed; through the medium of a ſteam-engine, for inſtance.

But it is not merely the waſte of power, or of mechanical force, that unavoidably attends the uſe of ſmoke jacks, that may be objected to them; they are very inconvenient in many reſpects: they frequently render it neceſſary to make a great fire in the kitchen, when otherwiſe a great fire would not be wanted: they very frequently cauſe chimnies to ſmoke, and always render a ſtronger current of air up the chimney neceſſary, than would be ſo merely for the combuſtion of the fuel wanted for the purpoſes of cooking; conſequently they increaſe

creaſe the currents of cold air from the doors and windows to the Fire-place: and laſtly, they are troubleſome, noiſy, expenſive, frequently out of order, and never do the work they are meant to perform with half ſo much certainty and preciſion as it would be done by a common jack, moved by a weight or a ſpring.

There is, I know, an objection to common jacks that is well founded, which is, that they require frequent winding up; but for this there is an eaſy remedy. A jack may without any difficulty (merely by uſing a greater weight, and a greater combination of pullies) be made to run almoſt any length of time;—a whole day, for inſtance, or even longer; and if it ſhould be neceſſary, the weight may be at a conſiderable diſtance from the kitchen. It may indifferently be raiſed up into the air,—deſcend into a well,—or may be made to deſcend along an inclined plane; and but little ingenuity will be required to contrive and diſpoſe of the machinery in ſuch a manner as to keep it out of the way, and if it ſhould be required, completely out of ſight: and with regard to the winding up of ſuch a jack as I here recommend, (that is, to go a whole day,) it may eaſily be done by any ſervant of the houſe, in leſs than five minutes.

Incomparably leſs labour will be required to wind up the weight of a common jack than to bring coals to feed the fire that is requiſite to make a ſmoke-jack go.

I know that it is ſaid in favour of ſmoke-jacks, that all the fire that is required to make them perform would be neceſſary in the kitchen for other purpoſes, and conſequently that they occaſion no additional expence of fuel; but that this ſtatement is very far indeed from being accurate will be evident to any perſon who will take the trouble to examine the matter with care. That the ſails of a ſmoke-jack will turn round with the application of a very ſmall force, when the pivots, on which its axle-tree reſts, are well conſtructed, and when its motion is not impeded by any load, is very true; but it requires a very different degree of force to move it, when it is obliged to carry round one, or perhaps two or three loaded ſpits. Even the heat given off to the air by the kitchen range in cooking, after the fire is gone out, will ſometimes keep up the motion of the ſails of the ſmoke-jack for many hours. But what a ſtriking proof is this of the enormous waſte of fuel in kitchens in this country!

Would to God that I could contrive to fix the public attention on this ſubject.

Nothing ſurely is ſo diſgraceful to ſociety, and to individuals, as unmeaning waſtefulneſs.

But to return to the attack of my ſmoke-jack;—which (although it be a *wind-mill*) is certainly not a *giant*, and cannot be perſonally formidable, however it may expoſe me to another ſpecies of danger.

There

There is one objection to ſmoke-jacks that muſt be quite concluſive wherever the improvements I have recommended, and ſhall recommend, in Kitchen Fire-places, are to be introduced. Where ſmoke-jacks exiſt, theſe improvements cannot be introduced, it being quite impracticable to unite them.

On a ſuppoſition that I have gained my point, and that the ſmoke-jack is to be removed, I ſhall now proceed to propoſe ſeveral alterations and improvements that may be made in the Kitchen Range.

And, firſt, all ovens, boilers, ſteam-boilers, &c. which are connected with the back and ends of the range, and heated by the fire made in the grate, ſhould be detached from it, and for each of the ovens, boilers, &c. a ſmall, ſeparate, cloſed Fire-place muſt be conſtructed, ſituated *directly under* the oven or boiler, and furniſhed with a ſeparate canal for carrying its ſmoke into the Kitchen Chimney, which ſeparate canal may open into the Chimney about a foot above the level of the mantle.

There is nothing ſo waſteful as the attempt to heat ovens and boilers by heat drawn off laterally from a fire in an open grate. The conſumption of fuel is enormous, to ſay nothing of the expence of the machinery, and the inconvenience that muſt frequently ariſe from the heat being forcibly drawn away ſidewiſe under an oven or boiler, when it is wanted elſewhere.

The ſeparate cloſed Fire-place under iron ovens and roaſters muſt be made *very ſmall*, otherwiſe the cook or his aſſiſtants will ſometimes, in the hurry of buſineſs, make too large a fire; the conſequences of which will be the ſpoiling of the food, and the burning and deſtroying of the oven or roaſter.

Almoſt all the roaſters that have been put up in England have been ſpoiled in conſequence of their Fire-places being made too large; and not one has ever received the ſlighteſt accident or injury, or failed to perform to entire ſatisfaction, that has been heated by a very ſmall fire, and never overheated.

The Fire-place for an oven or roaſter of ſheet-iron, from 18 to 20 inches wide, and from 24 to 30 inches long, ſhould never be more than 6 inches wide,—6 inches deep,—and about 9 or at moſt 10 inches long; and this Fire-place ſhould ſeldom be half-filled with coals. If the oven or roaſter be ſet in ſuch a manner that the flame or ſmoke from the fire muſt neceſſarily ſpread round it and embrace it on every ſide, there will be no want of heat for any of the common purpoſes of cookery, and its intenſity may at all times be regulated by means of the damper in the Chimney, and the Regiſter in the aſh-pit door.

It is not eaſy to imagine how much the buſineſs of cooking is facilitated by making the machinery ſo perfect, that the quantity of heat may at any time be regulated with certainty merely by regiſters

ters and dampers, and without adding to or diminiſhing the quantity of fuel in the Fire-place. It is on theſe advantages and the numerous other conveniences that will reſult from them, that my hopes are principally founded of gaining over the cooks, and engaging their cordial aſſiſtance in bringing forward into general uſe the improvements I recommend. I am well aware of their influence, and of the importance of their co-operation.

When all the ovens and fixed boilers are detached from the Kitchen-range, then, and not before, meaſures may be taken with ſome proſpect of ſucceſs for improving the Kitchen Fire-place, ſo as to economiſe fuel, and prevent the Kitchen Chimney from ſmoking, if it has that fault; and the meaſures proper to be adopted for obtaining thoſe ends muſt depend principally on the ſize, or rather on the width of the open fire that will be wanted in the Kitchen. Where the family is ſmall, and where great dinners are ſeldom or never given, and eſpecially where cloſed roaſters are introduced, a ſmall Fire-place, and conſequently a narrow grate, will anſwer every purpoſe that can be wanted; and the Fire-place of the Kitchen may be fitted up nearly upon the principles laid down in my Fourth Eſſay, on the Conſtruction of open Chimney Fire-places.

The Kitchen of Mr. Summers, Ironmonger, of New Bond Street, (No. 98,) has been fitted up in this

this manner, and has been found to anſwer perfectly well.

But if it be neceſſary to leave the grate of the Kitchen Range with its width undiminiſhed, in order that a wide fire may occaſionally be lighted in it, this can beſt be done in the manner that was lately adopted in altering and fitting up the Kitchen in the houſe of the Counteſs of Morton in Park Street. The range being ſuffered to remain (or rather the front and bottom bars of the grate only, for the iron plate that formed the back of the range was taken away); — the range, which is about five feet long, was divided into three unequal parts, which parts were built up with hard fire-bricks in ſuch a manner as to form three diſtinct Fire-places, the one contiguous to the other, and ſeparated from each other by diviſions ſo thin in front, that when fires are burning in them all it appears like one fire, and has all the effect of one fire in roaſting meat that is put before it. Each Fire-place is, however, perfectly diſtinct from the others, and has its own diſtinct coverings, (which are oblique,) — back, throat, &c. though the ſame front bars, which are of hammered iron, and made very ſtrong, run through them all.

When a very ſmall fire is wanted, (merely for boiling a tea-kettle, for inſtance,) it is kindled in the *firſt* or ſmalleſt Fire-place: when a little larger fire is neceſſary, it is made in the *ſecond* Fire-place, which

which is at the oppoſite end of the range: when a ſtill larger fire is required, it is made in the *third* Fire-place, which occupies the middle of the range. If a large fire in the fourth degree is wanted, two neighbouring fires are kindled in the *firſt* and *third* Fire-places: if in the fifth degree, the two contiguous fires are lighted in the ſecond and third Fire-places; and when the greateſt fire that can be made is wanted, all the three Fire-places are at the ſame time filled with burning fuel.

In caſes where a ſingle open Chimney Fire-place of a moderate ſize, that is to ſay, from 18 to 20 inches in width, might ſometimes be too ſmall, and a very wide fire, like that juſt deſcribed, would never be wanted, I would adviſe the conſtruction of two ſeparate but adjoining Fire-places, the one about 12 inches, and the other about 18 or 20 inches in width. Theſe would, I imagine, anſwer every purpoſe for which an open Fire in the kitchen could be wanted by a large family, even though they ſhould (contrary to all my recommendations) continue to roaſt their meat upon a ſpit.

That I am not unreaſonable enough to expect that all my recommendations will immediately be attended to, is evident from the pains I take to improve machinery now in uſe, of which I do not approve, and which is perfectly different from that I am deſirous to ſee introduced.

When my roaſters ſhall become more generally known, and the management of them better underſtood,

ſtood, I have no doubt but that open Chimney Fire-places, and open fires of all deſcriptions, will be found to be much leſs neceſſary in kitchens than they now are.

I am even ſanguine enough to expect that the time will come when open fires will diſappear, even in our dwelling rooms and moſt elegant apartments. Genial warmth can certainly be kept up, and perfect ventilation effected much better without them than with them; and though I am myſelf ſtill child enough to be pleaſed with the brilliant appearance of burning fuel, yet I cannot help thinking that ſomething elſe might be invented equally attractive to draw my attention and amuſe my ſight, that would be leſs injurious to my eyes,—leſs expenſive,—and leſs connected with dirt, aſhes, and other unwholeſome and diſagreeable objects.

It is very natural to ſuppoſe that thoſe nations who inhabit countries where the winter is moſt ſevere, muſt have made the greateſt progreſs in contriving means for making their dwellings warm and comfortable in cold weather; and when, in milder climates, the growing ſcarcity of fuel has rendered the ſaving of that article an object of rational economy, it appears to me to be wiſe to ſearch *there* for the means of doing it, where neceſſity has long ſince rendered the uſe and higheſt poſſible improvement of thoſe means indiſpenſable. And the truly liberal,—that is to ſay, the enlightened, juſt, and generous,—feel no difficulty in acknowledg-

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ing the ingenuity and induſtry of their neighbours, and no humiliation in adopting their uſeful inventions and improvements.

BEFORE I finiſh this publication I muſt ſay a few words on the conſtruction of *Cottage Fire-places*. It is, I am ſenſible, a long time ſince I promiſed to publiſh an Eſſay on that ſubject, and ſtill mean to do ſo; but a variety of weighty conſiderations have engaged me to poſtpone the putting of that Eſſay out of my hands. I conceived the ſubject to be of very great importance, and wiſhed to have time to make myſelf fully acquainted with the preſent ſtate of cottages, and of the different kinds of fuel uſed in them in different parts of theſe kingdoms.—I had with pain obſerved the numerous miſtakes that have been made in altering Chimney Fire-places on the principles recommended in my Fourth Eſſay, and on that account I was very deſirous of deferring the publication of my directions for conſtructing Cottage Fire-places, till I could inform the public where Cottage Fire-places, conſtructed on the principles recommended, might be ſeen.

I hope and truſt that in the arrangement of the repoſitory of the Royal Inſtitution, now fitting up in this metropolis, an opportunity will be found for exhibiting Cottage Fire-places on the moſt perfect plans, as alſo of ſhowing many other mechanical contrivances that may be of general utility.

Cottage

Cottage Chimnies, as they are now commonly conſtructed in moſt parts of Great Britain, have a very wide open Fire-place, with a high mantle, and large chimney corners, in which the children frequently ſit on little ſtools, when in cold weather they hover round the fire. Theſe chimney corners are very comfortable; and except the whole room could be made equally ſo, it would certainly be a pity to deſtroy them; but this, I am perſuaded, may eaſily be done: in the mean time, much may be done to make cottages warm and comfortable, merely by a few ſimple alterations in their preſent Fire-places.

As the principal fault of theſe Fire-places is the enormous width of the throats of their chimnies, which frequently occaſions their ſmoking, and always gives too free a paſſage for the warm air of the room to eſcape up the chimney, a ſmaller Fire-place may be conſtructed in the midſt of the larger one, and the little chimney of this ſmall Fire-place being carried up perpendicularly in the middle of the large Fire-place, the large chimney corners, without being deſtroyed, may be arched over and cloſed in above, ſo as to leave no paſſage in thoſe parts for the eſcape of the warm air of the room into the chimney, and from thence into the atmoſphere.

The back of the old chimney may ſerve for a back to the new Fire-place, and the jambs of the new chimney need not project forward beyond the back more than 12 or 15 inches; ſo that the new chimney,

chimney, and every part of it, may be completely included within the opening of the old Fire-place. This is to be done in order to preſerve the old chimney corners; but in caſes where the opening of the old Fire place is not ſufficiently wide, high, and deep, to permit of the leaving of chimney corners ſufficiently ſpacious to be uſeful, it will be beſt to ſacrifice theſe corners, and to proceed in a different manner in conſtructing the new Fire-place.

In this laſt caſe the back of the new Fire-place ſhould be brought forward, and the new work ſhould be executed agreeably to the directions contained in my Fourth Eſſay for the conſtruction of open Chimney Fire-places. If void ſpaces ſhould remain on the right and left of the new jambs, they will be found uſeful for various purpoſes.

It is of ſo much importance to facilitate the means of cooking to the poor, and enabling them to prepare food in different ways, that I think it extremely deſirable that each cottager ſhould have an *iron pot* or *digeſter*, ſo contrived as to be uſed occaſionally over his open fire, or, what will be much more economical, in a ſmall cloſed Fire-place, which may be made with a few bricks on one ſide of his open Fire-place.

But what would be of more uſe, if poſſible, to a poor family, even than a good boiler, would be a *ſmall oven* of ſheet iron, well put up in brick-work. Such an oven would not coſt more than a

few

few ſhillings; and if properly ſet, would laſt for many years without needing any repairs. It would anſwer not only for baking houſehold bread and cakes, but might likewiſe be uſed with great advantage in cooking rice puddings, potatoe pies, and many other kinds of nouriſhing food of the moſt exquiſite taſte, that might be prepared at a very trifling expence.

It is in vain to expect that the poor ſhould adopt better methods of chuſing and preparing their food, till they are furniſhed with better implements and utenſils for cooking.

I put up an oven like that I now recommend laſt winter in my lodgings at Brompton, and have made a great number of experiments with it, from the reſults of which I am fully perſuaded of its utility. I pulled it down on removing into the houſe I now occupy, but mean to put it up again as ſoon as my kitchen ſhall be ready to receive it. As I put up this oven merely as an experiment, in order to aſcertain by actual trials how far it might be uſeful to poor families, the oven was made ſmall, and it was ſet in the cheapeſt manner, merely with common bricks and mortar, without any iron or other coſtly material. The grate of the cloſed Fire-place (which was 5 inches wide and about 8 inches long) was conſtructed of three common bricks placed edgewiſe, and a ſliding brick was uſed for cloſing the door of the Fire-place, and another for a regiſter to the aſh-pit door-way. The oven, which

which is of thin ſheet iron, is 18½ inches long, 12 inches wide, and 12 inches high,—and it weighs juſt 10½ lb. excluſive of its front frame and front door, which together weigh 6¼ lb.

For a ſmall family the oven might be made of a ſmaller ſize,—11 inches wide for inſtance, 10 inches high, and 15 inches long; and it is not indiſpenſably neceſſary that it ſhould have either a front frame or a front door of iron. It might be ſet in the brick-work without a frame, perfectly well; and a flat twelve-inch tile, or a flat piece of ſtone, or even a piece of wood, placed againſt its mouth, might be made to anſwer inſtead of an iron door.

The only danger of injury to theſe ovens from accident to which they are liable, is that ariſing from careleſneſs in making too large a fire under them. They require but a very ſmall fire indeed, and a large one is not only quite unneceſſary, but detrimental on ſeveral accounts. For greater ſecurity againſt accidents from too ſtrong fires, I would adviſe the Fire-place to be made extremely—I had almoſt ſaid—ridiculouſly ſmall; not more than from 4 to 5 inches wide, from 6 to 8 inches long, and about 5 inches deep; and I would place the bottom or grating of the Fire-place 11 or 12 inches below the bottom of the oven. For ſtill greater ſecurity, the bottom of the oven, immediately over the fire might, if it ſhould be found neceſſary, be defended by a thin plate of caſt, hammered, or ſheet iron, full of ſmall holes (as large as peas), placed about half an inch from the bottom

of the oven, and directly below it: but if any common degree of attention be uſed in the management of the fire, this precaution will not, I am perſuaded, be neceſſary.

In ſetting theſe ovens, care muſt be taken that room be left for the flame and ſmoke to come into contact with the oven, and ſurround it on every ſide; and it can hardly be neceſſary to add, that a canal muſt be made by which the ſmoke can afterwards paſs off into the chimney.

I once imagined that ſmall ovens for poor cottagers might be made very cheap indeed, by making only the bottom of the oven of iron, and building up the reſt with bricks; but on making the experiment, it was not found to anſwer. I cauſed ſeveral ovens on this principle to be conſtructed in my kitchen, and made many attempts to correct their faults; but I found it impoſſible to heat them equally and ſufficiently. I then altered my plan, by making both the bottom and the top of ſheet iron. But this even did not anſwer. It might anſwer, and certainly would anſwer, for a perpetual oven, like that which I cauſed to be made in the Houſe of Induſtry at Dublin; but if an oven of this kind is ever ſuffered to become cold, it will require a long time to heat it again, which is a circumſtance that renders it very unfit for the uſe of a poor family. The ovens I have recommended, conſtructed entirely of thin ſheet iron, have the advantage of being heated almoſt in an inſtant, and the heat which penetrates the walls of their cloſed

Fire-

Fire-places being gradually given off after all the fuel is burnt out, keeps them hot for a long time. Care ſhould, however, always be taken to keep theſe ovens well cloſed when they are uſed, and to leave only a very ſmall hole, when neceſſary, for the eſcape of the generated ſteam or vapour.

For larger families the oven may be made larger in proportion; or, what will be ſtill more convenient, a neſt of two, three, or four ſmall ovens, placed near to each other, may be ſo ſet in brick-work as to be heated by one and the ſame fire.

A neſt of four ſmall ovens, ſet in this manner, was fitted up in the kitchen of the Military Academy at Munich, and found very uſeful: they were rectangular, each being 10 inches wide, 10 inches high, and 16 inches long; and they were placed two a-breaſt in two rows, one immediately above the other, the ſides and bottoms of neighbouring ovens being at the diſtance of about $1\frac{1}{4}$ inch, that the flame and ſmoke which ſurrounded them on every ſide, might have room to paſs between them. The Fire-place was ſituated immediately below the interval that ſeparated the two lowermoſt ovens, at the diſtance of about 10 inches below the level of their bottoms; and by means of dampers the flame could be ſo turned and directed as to increaſe or diminiſh the heat in any one or more of the ovens at pleaſure.

Theſe four ovens were furniſhed with iron doors, moveable on hinges, which, in order that they

might not be in the way of each other, opened two to the right, and two to the left.

In a large kitchen, where a variety of different kinds of food are baked at the ſame time, or on the ſame day, it is eaſy to perceive, that a neſt of ſmall ovens muſt be very uſeful, much more ſo than one large oven equal in capacity to them all; for beſides the inconvenience in cooking a variety of different things in the ſame oven, that ariſes from the promiſcuous mixture of various exhalations and ſmells, the proceſs going on in one diſh muſt often be diſturbed by opening the oven to put in, or take out another, and the heat can never be ſo regulated as to ſuit them all.

But the cook of the Military Academy at Munich finds the neſt of ovens uſeful, not merely for baking: he uſes them alſo for ſtewing and for boiling, with great ſucceſs. A large quantity of cold liquid cannot, it is true, be heated and made to boil in a very ſhort time in one of theſe ovens, but a ſaucepan or boiler, whoſe contents are already boiling-hot, being placed in one of them, a gentle boiling may be kept up for a great length of time, with the conſumption of an exceedingly ſmall quantity of fuel.

With regard to the expence or coſt of ſuch a neſt of ovens, it could not, or at leaſt ought not to be conſiderable. If they were each 12 inches wide, 12 inches high, and 16 inches long, they would not weigh more than 15 lb. each, their doors included;

cluded; and this would make but 60 lb. for the weight of the whole neſt, ſuppoſing it to conſiſt of four ovens. I do not know what price might be demanded by the artificers in this country, or by the trade, for work of this kind, but I ſhould think they might well afford to ſell theſe ovens, properly made, and ready for ſetting, at leſs than 6d. the pound, avoirdupois weight. The ſheet iron would coſt them in the market, at the firſt hand, not more than about $3\frac{1}{2}$ d. *per* pound. The expence of ſetting the ovens would not be conſiderable, eſpecially as only one ſmall Fire-place would be neceſſary.

In ſome future publication, or in a ſubſequent part of this Eſſay, I ſhall give a deſign of one of theſe neſts of ovens, with an exact eſtimate of the expence of it; in the mean time I will endeavour to get one of them put up for the public inſpection at the Royal Inſtitution.

I cannot cloſe this Chapter without once more calling the attention of my reader to the neceſſity of furniſhing the canal that carries away the ſmoke into the chimney with a damper. If this is not done in ſetting the ovens I have juſt been deſcribing, it will be quite impoſſible to manage the heat properly. For the Fire-place of a ſmall oven for the family of a cottager, a common brick may be made to anſwer very well as a damper; and, indeed, a very good damper for any ſmall Fire-place may be made with a brick, or a tile, or a piece of ſtone.

If, in addition to the introduction of a good damper, care be taken to cauſe the ſmoke to *deſcend* about 12 or 15 inches juſt after it has quitted the oven (or the boiler), and before it is permitted to riſe up and go off into the chimney, this will greatly contribute to the economy of fuel.

It is ſurely not neceſſary that I ſhould again obſerve how very eſſential it is in altering open Chimney Fire-places,—whether they belong to kitchens,—to the dwelling rooms of the opulent,—or to cottages, to build up their backs and ſides,—in that part eſpecially which contains and is occupied by the burning fuel,—with fire-bricks or with ſtone; and never in any caſe to kindle a fire againſt a plate of iron.

If all the metal in a regiſter ſtove, except the front, and the front and bottom bars, were removed, and the back and ſides built up properly with fire bricks, or partly with fire-bricks and partly with fire-ſtone, it would make a moſt excellent Fire-place.

This laſt obſervation is, I acknowledge, in ſome degree foreign to my preſent ſubject; but as it is well meant, I hope it will be well received.

In a Supplementary Eſſay now preparing for the preſs, in which will be publiſhed ſuch additional remarks and obſervations to all my former Eſſays as may be neceſſary to their complete explanation and elucidation, I ſhall take occaſion to enter fully into the ſubject of Chimney Fire-places, and ſhall endeavour to ſhow, at ſome length, why it is improper and

and ill-judged to conſtruct the ſides and backs of their grates of iron, or of any other metallic ſubſtance.

In a Second Part which will be added to this (Tenth) Eſſay, particular directions will be given for conſtructing boilers, ſteam diſhes, ovens, roaſters, and various other implements and utenſils uſed in cookery; and a detailed plan will be laid before the public for improving the kitchen utenſils of cottagers and other poor families.

I have been induced to reſerve theſe various matters for a ſeparate publication, in order to accommodate my writings as much as is poſſible to the convenience of the various claſſes of readers into whoſe hands they are likely to come. The Plates, which were indiſpenſably neceſſary to elucidate the deſcriptions contained in the preceding Chapters, (which have been admirably executed by that excellent artiſt Lowry,) could not fail to enhance very conſiderably the price of this publication, and on that account I was deſirous to detach and publiſh ſeparately all ſuch popular parts of the ſubjects I have undertaken to treat in this Eſſay, as appeared to me to bid fair to be moſt read, and to be of moſt general utility.

Whether the reader agrees with me or not in reſpect to the validity of the reaſons which have determined my judgment on this occaſion, I hope and truſt that he will do me the juſtice to believe, that I have no wiſh ſo much at my heart as to

render my labours of ſome real and laſting utility to mankind. How happy ſhall I be when I come to die, if I can *then* think that I have lived to ſome uſeful purpoſe!

The End of the FIRST PART of the TENTH ESSAY.

APPENDIX

TO THE

FIRST PART OF THE TENTH ESSAY.

An account of the expence of fitting up a ſmall Oven.

SINCE the foregoing ſheets were printed off, I have cauſed a ſmall oven of ſheet iron to be made, and ſet in brick-work, for the expreſs purpoſe of aſcertaining the coſt of it. This oven, which is ſuch as would be proper for the uſe of a ſmall poor family, is 11 inches wide, 11 inches high, and 15½ inches long; and it weighs 6 lb. 2 oz. At its mouth or opening, the ſheet iron is turned back in ſuch a manner as to form a rim, half an inch wide, projecting outwards; which rim ſerves to ſtrengthen the oven, and is likewiſe uſeful in fixing it in the brick-work.

The whole oven is conſtructed of two pieces of ſheet-iron, of unequal dimenſions, the largeſt piece (which is about 16½ inches wide by 45 inches long) forming the top, bottom, and two ſides; and the ſmalleſt (which is about 12 inches ſquare) forming the end. Theſe ſheets of iron are united by ſeams without rivets. One ſeam only runs through the oven

oven in the direction of its length, and that is ſituated in the middle of the upper part of it.

A good workman was employed juſt two hours in making this oven, but there is no doubt but the work might be done in a ſhorter time by a man accuſtomed to that kind of manufacture, eſpecially if the proper means were uſed for facilitating and expediting the labour.

The ſheet-iron uſed in the conſtruction of this oven,—which was of the very beſt quality,—coſt 34 s. *per* groſs hundred of 112 lb. which is at the rate of $3\frac{1}{2}$ d. and $\frac{3}{4}$ of a farthing *per* lb.—The quantity uſed—6 lb. 2 oz. muſt therefore have coſt 1 s. $10\frac{1}{2}$ d. and $\frac{1}{112}$ part of a farthing.

If now we allow two ounces for waſtage, this will bring the quantity neceſſary for conſtructing one of theſe ovens to $6\frac{1}{4}$ lb. which quantity, at the rate above mentioned, would coſt ſomething leſs than 1 s. 11 d.; and if to this ſum we add 1 s. for the making, this will bring the prime coſt of the oven to 2 s. 11 d.

Let us allow 20 *per cent.* for the profit of the manufacturer, and ſtill the price of the oven to buyers will be only 3s. 6 d.*

In order to aſcertain the expence of ſetting one of theſe ovens in brick-work, I cauſed that above

* The oven I have here deſcribed was made by Mr. Summers, ironmonger, of New Bond ſtreet, who, before I acquainted him with the above computations, offered to furniſh theſe ovens in any quantities at 4s. a-piece. This, for the offer of a manufacturer, I thought not unreaſonable.

deſcribed

deſcribed to be put up in the middle of a wide chimney Fire-place in my houſe in Brompton-Row; and the work was executed with as much care and attention as was neceſſary, in order to render it ſtrong and durable. In doing this 114 bricks were uſed, and ſomething leſs than 3 hods of mortar; and the bricklayer performed the job in 3 hours and 10 minutes.

Three bricks ſet edgewiſe formed the grate or bottom of the Fire-place; the middle brick being placed vertically, and thoſe on each ſide of it inclining a little inwards above, to give a more free paſſage to the falling aſhes.

The entrance into the Fire-place was cloſed with a ſliding brick, and another brick ſerved as a regiſter to the aſh-pit door-way; a third ſerved as a damper to the canal that carried off the ſmoke into the chimney; and the oven itſelf was cloſed with a twelve-inch tile.

The expence of ſetting this oven was eſtimated as follows:

		s.	d.
114 bricks, at 3 s. *per* hundred	-	3	4
3 hods of mortar, at 4 d. -	-	1	0
1 twelve-inch tile, at 4 d. -	-	0	4
Bricklayer's labour - -	-	1	6
	Total	6	2
If to this ſum we add the amount of the ironmonger's bill for the oven	-	3	6
The whole expence will turn out	-	9	8

The

The maſs of brick-work in which this oven is ſet is juſt 2 feet wide, 19½ inches deep, meaſured from front to back,—and 3 feet 3½ inches high. The chimney Fire-place in which it is placed is 3 feet wide, 3 feet 3½ inches high, and 20 inches deep.

If the oven had been ſet in one corner of this Fire-place, inſtead of occupying the middle of it, near one quarter of the bricks that were uſed might have been ſaved; but if in building a new chimney a convenient place were choſen and prepared for it, an oven of this kind might be put up at a very ſmall expence indeed; perhaps for 3 s. or 3 s. 6 d., which would reduce the coſt of the oven, when ſet, to about 7 s. or 7 s. 6 d.

Though the bricklayer was above 3 hours putting up this oven, yet, as it was the firſt he ever ſet, there is no doubt but that he was conſiderably longer in doing the work on that account. He thinks he could put up another in two hours, and I am of the ſame opinion.

I think it would be adviſeable, in order to facilitate ſtowage and carriage of theſe ſmall ovens, always to manufacture them in neſts of four, one within the other, even when they are deſigned to be ſold, and to be put up ſingly; for it can be of no great importance whether they be a quarter of an inch or half an inch wider, or narrower; and it will often be a great convenience to be able to pack them one within the other, eſpecially when they are to be ſent to any conſiderable diſtance.

If

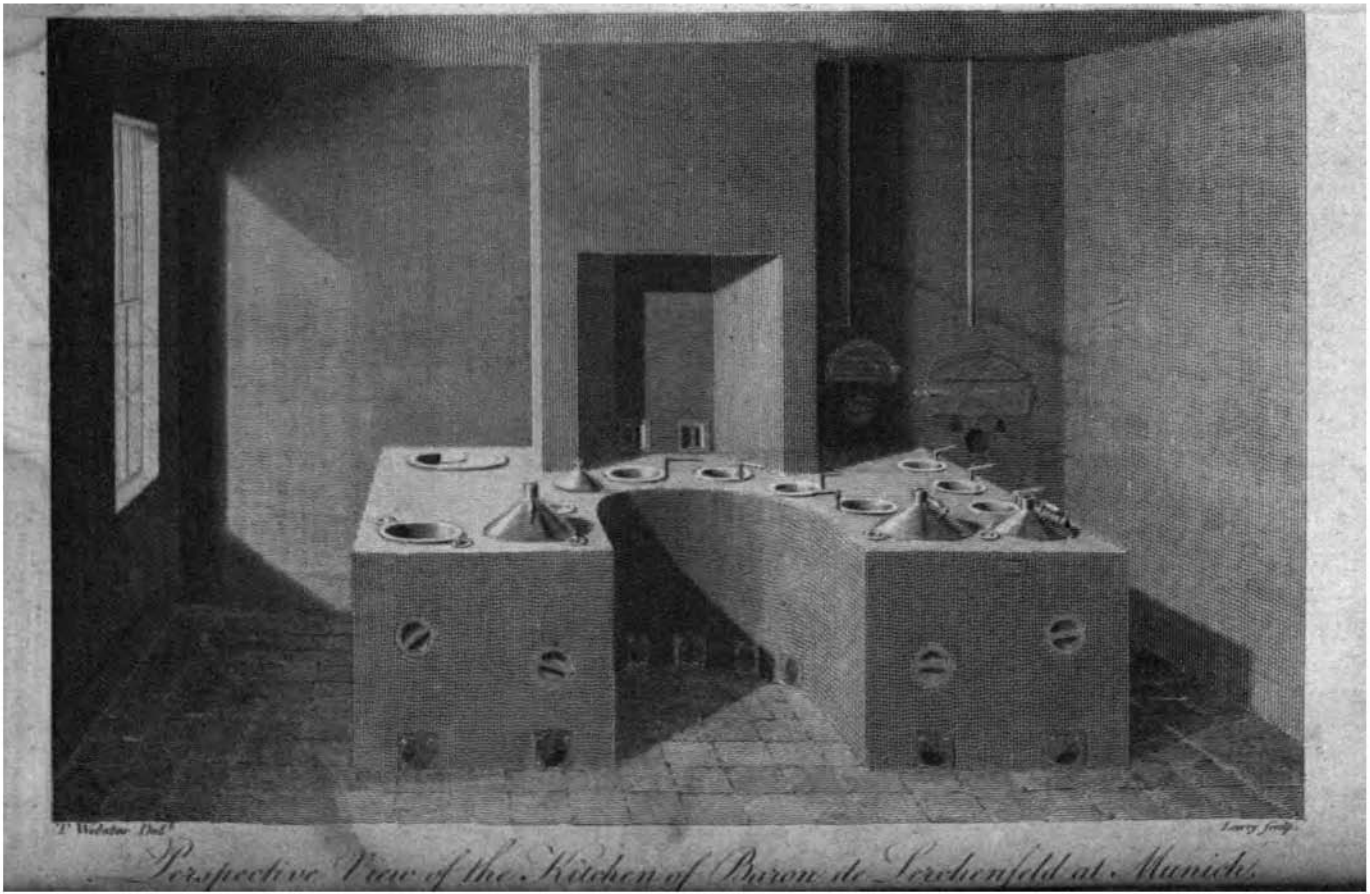
If care be taken in making them, to preſerve their forms and dimenſions, and if the ſeams of the metal be properly beaten down, the difference in the ſizes of two ovens that will fit one within the other need not be very conſiderable.—But I forget that I am writing for the cleverest and moſt experienced workmen upon the face of the earth, to whom the utility of theſe contrivances is perfectly familiar, and who, without waiting for my ſuggeſtions, will not fail to put them all in practice.

Though there is nothing I am more anxious to avoid than tiring my reader with uſeleſs repetitions, yet I cannot help mentioning once more the great importance of cauſing the ſmoke that heats one of the ovens I have been deſcribing, to deſcend at leaſt as low as the level of the bottom of the oven, after it has paſſed round and over it, before it is permitted to riſe up freely and eſcape by the chimney into the atmoſphere. In ſetting the oven, and forming the canal for carrying off the ſmoke from the oven into the chimney, this may eaſily be effected; and if it be done, the oven will retain its heat for a great length of time even after the fire is gone out;—but if it be not done, the fire muſt conſtantly be kept up, or the oven will ſoon be cooled by the cold air that will not fail to force its way through the Fire-place and up the chimney.

From the reſult of this experiment it appears, that an oven of the kind recommended is very far from

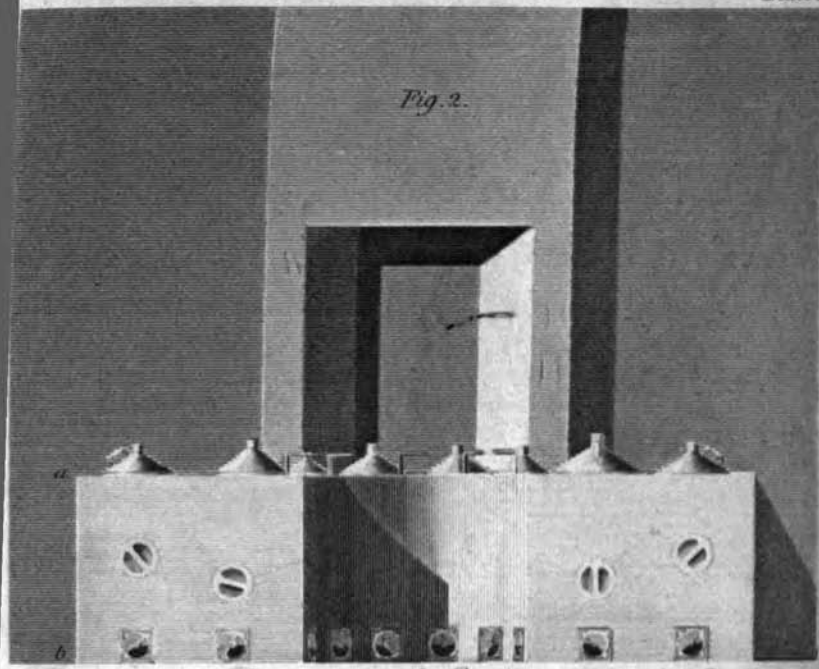
from being an expenſive article; and there is no doubt but that with a little care in the management of the fire, an oven of this ſort would laſt many years without wanting any repairs. It is hardly neceſſary for me to add, that a neſt of theſe ſmall ovens, conſiſting of three or four, put up together, and heated by a ſingle fire, would be very uſeful in the kitchen of a private gentleman, and indeed of every large family.

If neſts of ſmall ovens ſhould come into uſe, (which I cannot help thinking will be the caſe,) it would be beſt, as well for convenience in carriage as for other reaſons, to make thoſe which belong to the ſame neſt, not preciſely of the ſame dimenſions, but varying in ſize juſt ſo much as ſhall be neceſſary, in order that they may be packed one within the other.



Perspective View of the Kitchen of Baron de Lerchenfeld at Munich.

Fig. 2.



Plans of Baron de Lerchenfeld's Kitchen?

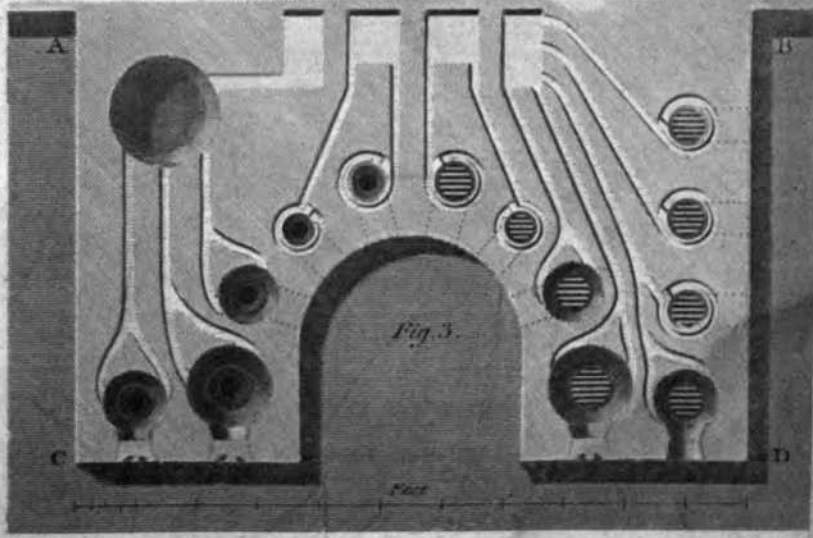


Fig. 3.

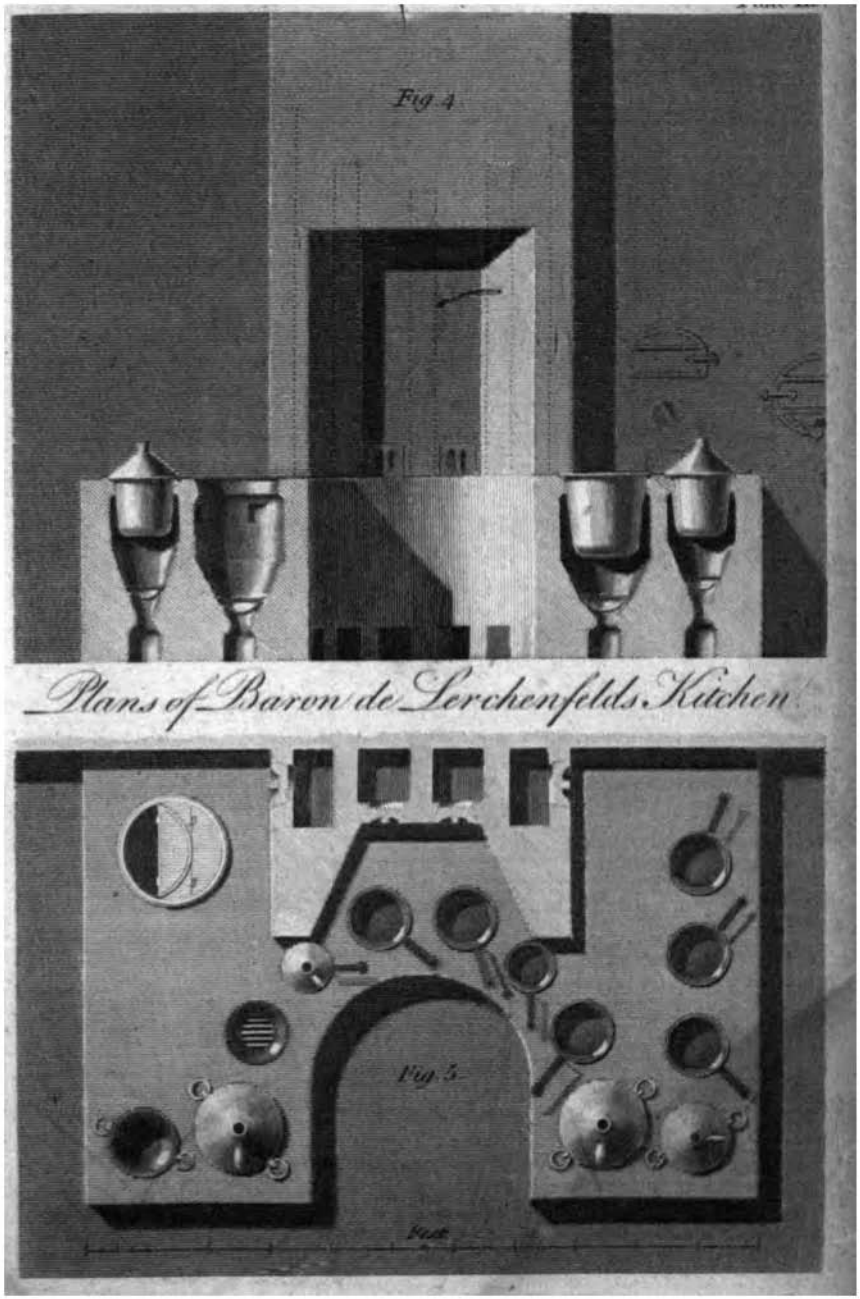
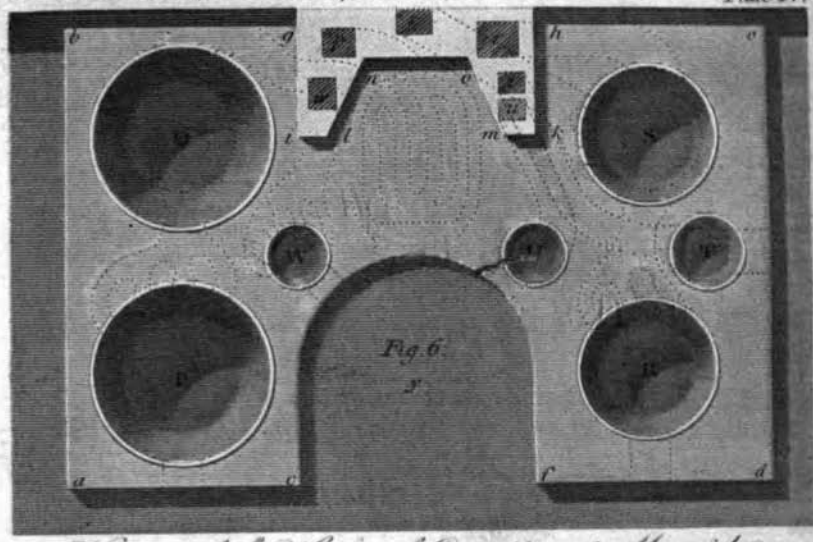


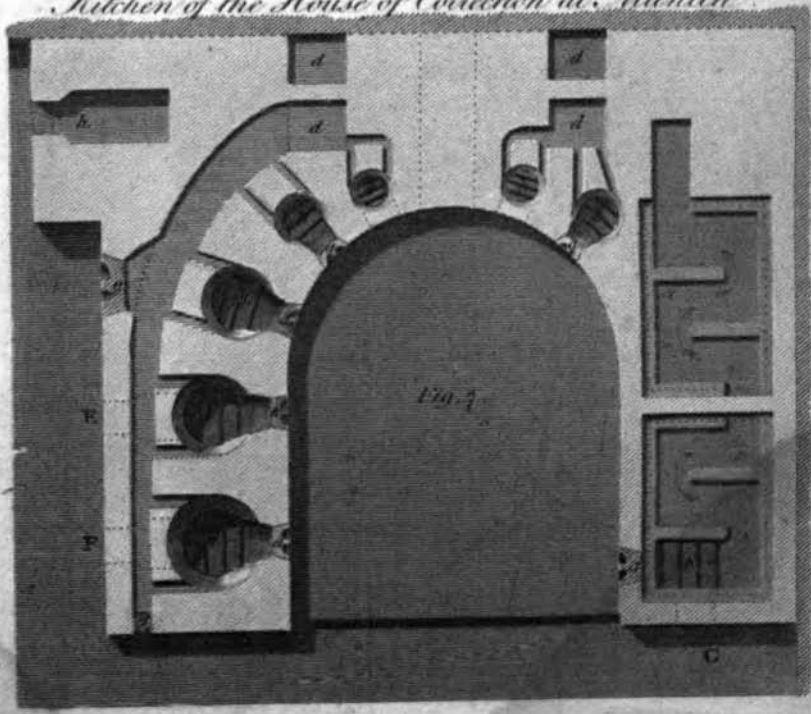
Fig 4
Plans of Baron de Lerchenfelds Kitchen
Fig 3

Kitchen of the Hospital of La Pieta at Verona.

Plate IV.



Kitchen of the House of Correction at Munich.



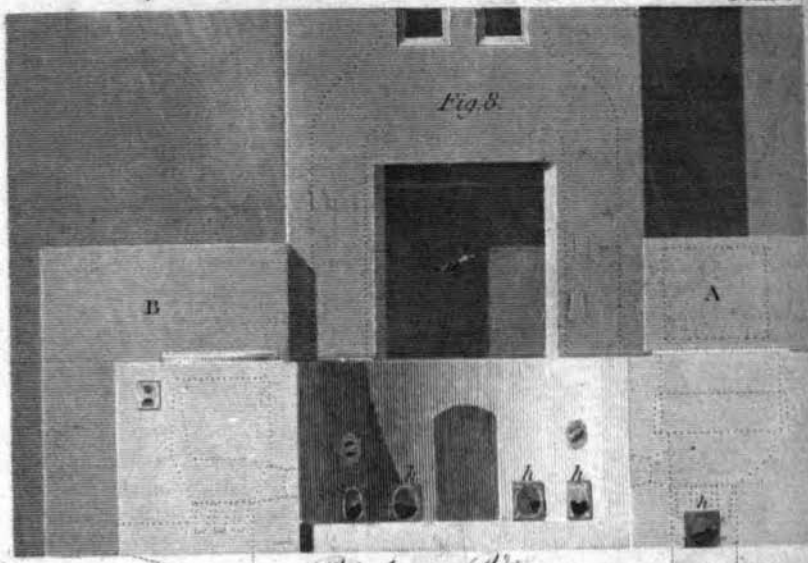
Scale 40 Inches to the Inch.

Lowry sculp.

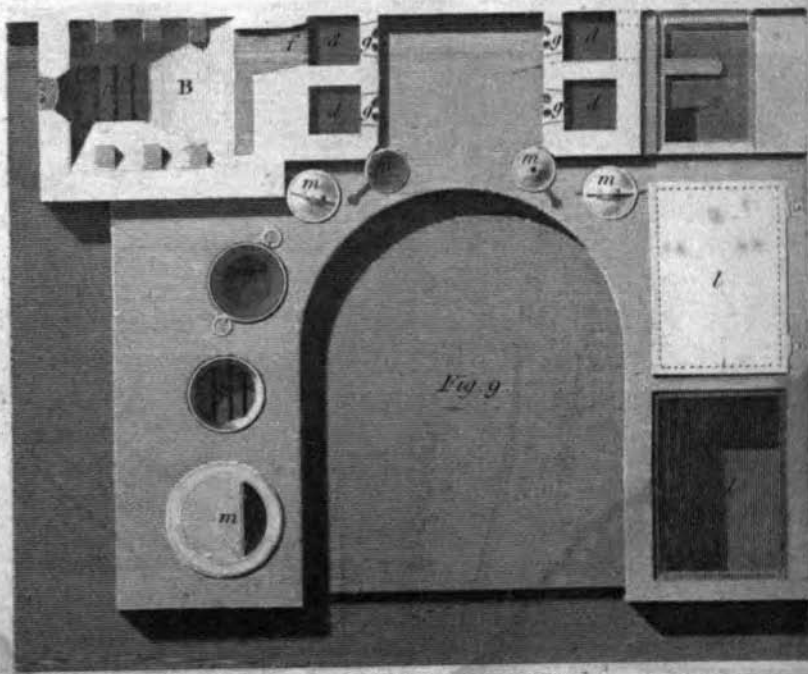
Front View of the Kitchen of the House of Correction at Munich

Plate V.

Fig. 8.

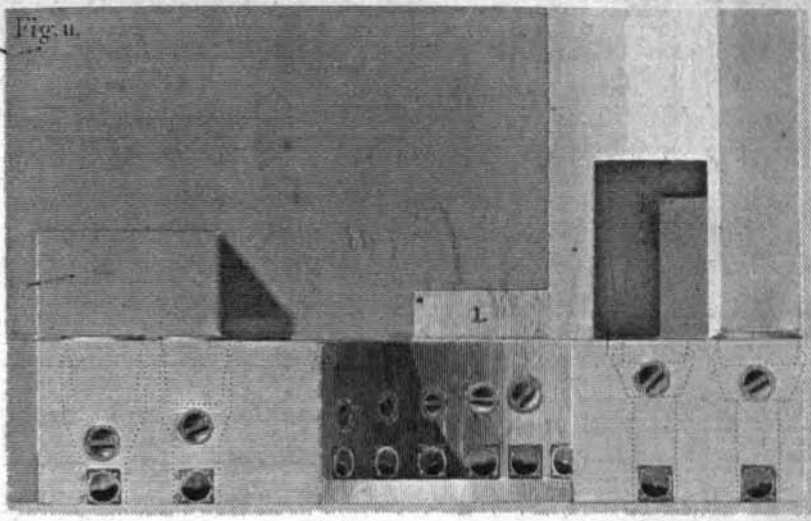


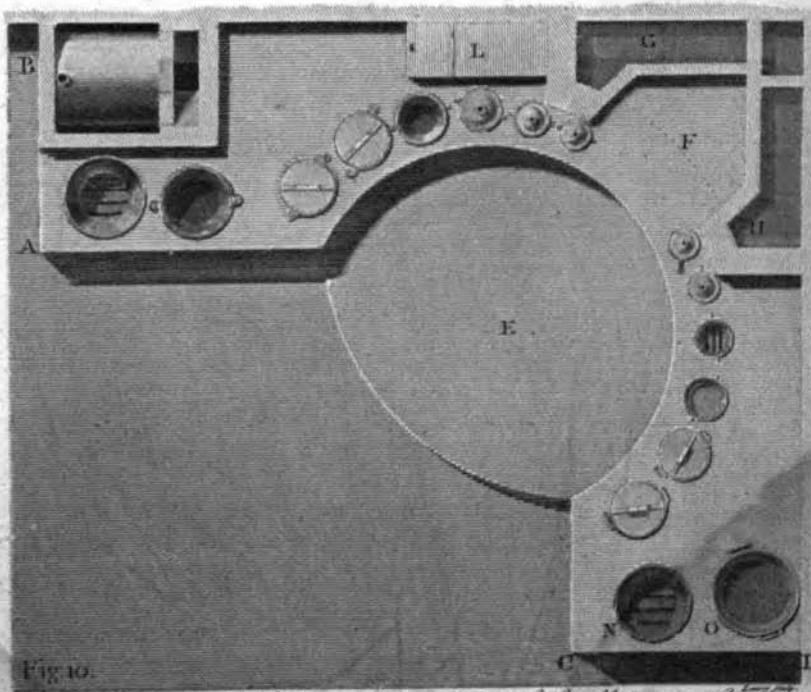
Birds-eye View.



Scale 40 Inches to the Inch.

Lowry sculp.





Plan & Elevation of the new Kitchen of the Military Hospital at Munich.

Plan of a Part of the Kitchen of the Military Academy.

PL VII.

Fig. 13.

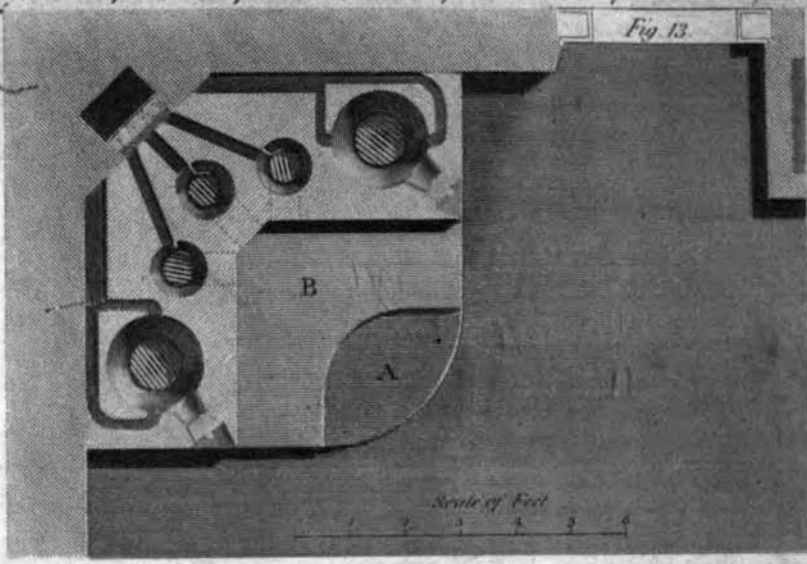
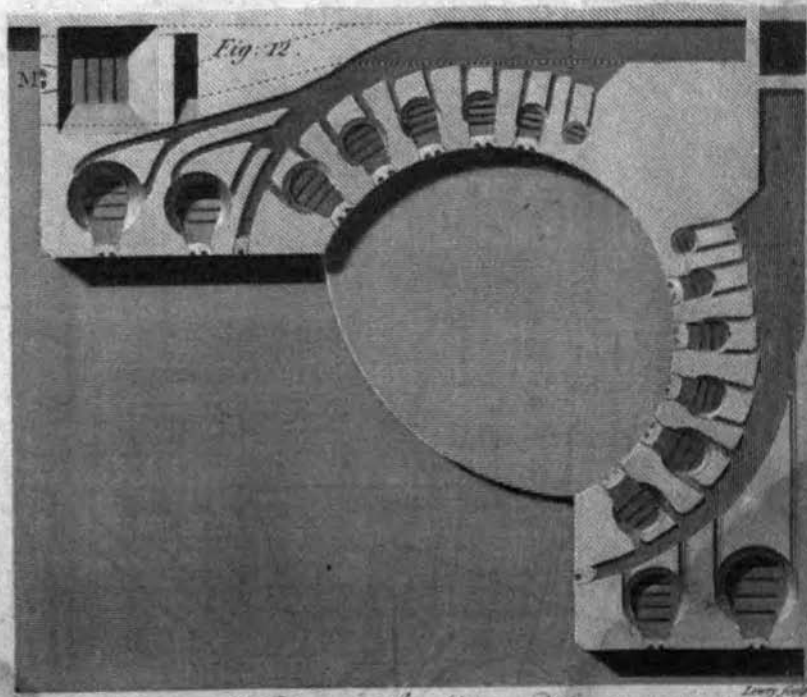


Fig. 12.



Plan of the New Kitchen of the Military Hospital at Munich.

ESSAY X.

PART II.

ON THE

CONSTRUCTION OF KITCHEN FIRE-PLACES

AND

KITCHEN UTENSILS;

TOGETHER WITH

REMARKS AND OBSERVATIONS

RELATING TO THE VARIOUS

PROCESSES OF COOKERY;

AND

PROPOSALS FOR IMPROVING

THAT MOST USEFUL ART.

PREFACE.

I too often find myſelf in ſituations, in which I feel it to be neceſſary to make apologies for delays and irregularities in the publication of my writings. This Second Part of my Tenth Eſſay was announced in the beginning of the year 1800; and it ought certainly to have made its appearance long ago; but a variety of circumſtances have conſpired to retard its publication.

During ſeveral months, almoſt the whole of my time was taken up with the buſineſs of the ROYAL INSTITUTION; and thoſe who are acquainted with the nature and objects of that noble eſtabliſhment, will, no doubt, think that I judged wiſely, in preferring its intereſts to every other concern. For my own part, I certainly conſider it as being by far the moſt uſeful, and conſequently the moſt important undertaking in which I was ever engaged, and of courſe I feel deeply intereſted in its ſucceſs. The diſtinguiſhed patronage, and liberal ſupport, it has already received, afford good

ground to hope that it will continue to proſper, and be a laſting monument of the liberality and enterprizing ſpirit of an enlightened nation.

It is certainly a proud circumſtance for this country, that, in times, like the preſent, and under the accumulated preſſure of a long and expenſive war, individuals generouſly came forward, and ſubſcribed, in a very ſhort time, no leſs a ſum than *thirty thouſand pounds ſterling*, for the noble purpoſe of "DIFFUSING THE KNOWLEDGE AND "FACILITATING THE GENERAL INTRODUC-"TION OF NEW AND USEFUL INVENTIONS "AND IMPROVEMENTS."

In the *repoſitory* of this new eſtabliſhment, will be found, Specimens of all the Mechanical Improvements which I have ventured to recommend to the Public in my Eſſays.

ESSAY X.—PART II.

CHAP. IV.

An Account of a new Contrivance for roaſting meat.—Circumſtance which gave riſe to this invention.—Means uſed for introducing it into common uſe.—Liſt of tradeſmen who manufacture Roaſters.—Number of them that have already been ſold.—Deſcription of the Roaſter.—Explanation of its action.—Reaſons why meat roaſted in this machine is better taſted and more wholeſome than when roaſted on a ſpit.—It is not only better taſted, but alſo more in quantity when cooked.—Directions for ſetting Roaſters in brick-work.—Directions for the management of a Roaſter.—Miſcellaneous obſervations reſpecting Roaſters and ovens.

THERE is no proceſs of cookery more troubleſome to the cook, or attended with a greater waſte of fuel, than roaſting meat before an open fire.

Having had occaſion, ſeveral years ago, to fit up a large kitchen (that belonging to the Military Academy at Munich) in which it was neceſſary to make arrangements for roaſting meat every day for near 200 perſons, I was led to conſider this ſubject with ſome attention; and I availed my-

ſelf of the opportunity which then offered, to make a number of intereſting experiments; from the reſults of which, I was enabled to conſtruct a machine for Roaſting, which upon trial was found to anſwer ſo well, that I thought it deſerving of being made known to the Public: accordingly, during the viſit I made to this country in the years 1795 and 1796, I cauſed two of theſe Roaſters to be conſtructed in London—one, at the houſe then occupied by the BOARD OF AGRICULTURE, and the other, at the FOUNDLING HOSPITAL; and a third was put up, under my direction, in Dublin, at the houſe of the DUBLIN SOCIETY.

All theſe were found to anſwer very well, and they were often imitated; but I had the mortification to find, on my return to England in the year 1798, that ſome miſtakes had been made in the conſtruction, and many in the management of them. Their fire-places had almoſt univerſally been made three or four times as large as they ought to have been; as, neither the cooks, nor the bricklayers who were employed in ſetting them, could be perſuaded that it was poſſible that any thing could be ſufficiently roaſted with a fire, which to them appeared to be *ridiculouſly ſmall*; and the large quantities of fuel which was introduced into theſe capacious fire-places, not only deſtroyed the machinery very ſoon, but, what was ſtill more fatal to the reputation of the contrivance, rendered it impoſſible for the meat to be well roaſted.

When meat, ſurrounded by air, is expoſed to the

the action of very intenſe heat, its ſurface is ſoon ſcorched and dried; which, preventing the meat from penetrating freely to the center of the piece, the meat cannot poſſibly be equally roaſted throughout.

Theſe miſtakes could not fail to diſcredit the invention, and retard its introduction into general uſe; but, being convinced, by long experience, of the utility of the contrivance, as well as by the unanimous opinion, in its favour, of all thoſe who had given it a fair trial, I was reſolved to perſiſt in my endeavours to make it known, and, if poſſible, to bring it into uſe in this country. The Roaſter, in the kitchen of the Military Academy at Munich, had been in daily uſe more than eight years; and many others in imitation of it, which had been put up in private families in Bavaria, and other parts of Germany, and in Switzerland, had been found to anſwer perfectly well; and as that in the kitchen of the Foundling Hoſpital, in London, had likewiſe, during the experience of two years, been found to perform, to the entire ſatisfaction of thoſe who have the direction of that noble Inſtitution, I was juſtified in concluding, that, wherever the experiment had failed, it muſt have been owing to miſmanagement. And I was the more anxious to get this contrivance brought into general uſe, as I was perfectly convinced, that meat roaſted by this new proceſs, is not merely as good, but *decidedly better*, that is to ſay, more delicate, more juicy, more ſavory, and higher flavoured, than

when roaſted in the common way—on a ſpit, before an open fire.

A real improvement in the art of cookery, which unites the advantage of economy with wholeſomeneſs, and an increaſe of enjoyment in eating, appeared to me to be very intereſting; and I attended to the ſubject with all that zeal and perſeverance which a conviction of its importance naturally inſpired.

On my return to this country, in the autumn of the year 1798, one of the firſt things I undertook in the proſecution of my favourite purſuit, was to engage an ingenious tradeſman, who lives in a part of the town which is much frequented (Mr. Summers, ironmonger, of New Bond-ſtreet) to put up a Roaſter in his own kitchen;—to inſtruct his cook in the management of it;—to make daily uſe of it; to ſhew it in actual uſe to his cuſtomers, and others who might deſire to ſee it; and alſo to allow other cooks to be preſent, and aſſiſt when meat was roaſted in it, in order to their being convinced of its utility, and taught how to manage it. I likewiſe prevailed on him to engage an intelligent bricklayer in his ſervice, who would ſubmit to be taught to ſet Roaſters properly; and who would follow, *without deviation*, the directions he ſhould receive. All theſe arrangements were carried into execution in the beginning of the year 1799; and ſince that time Mr. Summers has ſold, and put up, no leſs than 260 Roaſters, all of which have been found to anſwer perfectly well; and although he employs

employs a great many hands in the manufacture of this new article, he is not able to ſatisfy all the demands of his numerous cuſtomers.

Many of theſe Roaſters have been put up in the houſes of perſons of the higheſt rank and diſtinction; others in the kitchens of artificers and tradeſmen; and others, again, in ſchools, taverns, and other houſes of public reſort; and in all theſe different ſituations, the uſe of them has been found to be economical, and advantageous in all reſpects.

Several other tradeſmen in London have alſo been engaged in the manufacture of Roaſters. Mr. Hopkins, of Greek-ſtreet, Soho, ironmonger to the King, made that which is at the Foundling hoſpital, likewiſe that which was put up in the houſe formerly occupied by the Board of Agriculture;—and he informs me, that he has ſold above 200 others, which have been put up in the kitchens of various hoſpitals and private families, in the capital, and in different parts of the country.

Meſſrs. Moffat and Co. of Great Queen-ſtreet, Lincoln's-Inn Fields, and Mr. Feetham, of Oxford-ſtreet; as alſo Mr. Gregory, Mr. Spotſwood, Mr. Hanan, and Mr. Briadwood, in Edinburgh; have engaged in the manufacture of them. Other tradeſmen, no doubt, with whoſe names I am not acquainted, have manufactured them; and as there is no difficulty whatever in their conſtruction, and as all perſons are at full liberty to manufacture and ſell them, I hope ſoon to ſee theſe Roaſters become a common article of trade.

I have

I have done all that was in my power to improve and to bring them forward into notice; and all my wiſhes reſpecting them will be accompliſhed, if they ſhould be found to be uſeful; and if the public is furniſhed with them at reaſonable prices.

Several Roaſters, conſtructed by different workmen, may be ſeen, ſome of them ſet in brick-work, and others not, at the Repoſitory of the Royal Inſtitution.

I have delayed thus long to publiſh a deſcription of this contrivance, in order that its uſefulneſs might previouſly be eſtabliſhed by experience; and alſo, that I might be able, with the deſcription, to give notice to the public where the thing deſcribed might be ſeen. I was likewiſe deſirous of being able at the ſame time, to point out *ſeveral places* where the article might be had.

Theſe objects having been fully accompliſhed, I ſhall now proceed by giving

An Account of the ROASTER, *and of the Principles on which it is conſtructed.*

WHEN I firſt ſet about to contrive this machine, meditating on the nature of the mechanical and chemical operations that take place in the culinary proceſs in queſtion, it appeared to me that there could not poſſibly be any thing more neceſſary to the roaſting of meat than *heat*, in certain degrees of intenſity, accompanied by certain degrees of *dryneſs*;

dryneſs; and I thought, if matters could be ſo arranged, by means of ſimple mechanical contrivances, that the cook ſhould be enabled, not only to regulate the degrees of heat at pleaſure, but alſo *to combine* any given degree of *heat* with any degree of *moiſture*, or of *dryneſs* required; this would unqueſtionably put it in his power to perform every proceſs of *roaſting* in the higheſt poſſible perfection.

The means I uſed for attaining theſe ends, will appear by the following deſcription of the machinery I cauſed to be conſtructed for that purpoſe.

The moſt eſſential part of this machinery which I ſhall call the *body* of the Roaſter (ſee fig. 14.) is an hollow cylinder of ſheet-iron, which, for a Roaſter of a moderate ſize, may be made about 18 inches in diameter, and 24 inches long; cloſed at one end, and ſet in an horizontal poſition in a maſs of brick-work, in ſuch a manner that the flame of a ſmall fire, which is made in a cloſed fire-place directly under it, may play all round it, and heat it equally and expeditiouſly. The open end of this cylinder, which ſhould be even with the front of the brick-work in which it is ſet, is cloſed either with a double door of ſheet-iron, or with a ſingle door of ſheet-iron covered on the outſide with a pannel of wood; and in the cylinder there is an horizontal ſhelf, made of a flat plate of ſheet-iron, which is ſupported on ledges rivetted to the inſide of the cylinder, on each ſide

of

of it. This ſhelf is ſituated about three inches below the center or level of the axis of the body of the Roaſter, and it ſerves as a ſupport for a dripping-pan, in which, or rather *over which* the meat to be roaſted is placed.

This dripping-pan, which is made of ſheet-iron, is about two inches deep, 16 inches wide above, 15¼ inches in width below, and 22 inches long; and it is placed on four ſhort feet; or what is better, on two long ſliders, bent upwards at their two extremities, and faſtened to the ends of the dripping-pan, forming, together with the dripping-pan, a kind of ſledge; the bottom of the dripping-pan being raiſed by theſe means about an inch above the horizontal ſhelf on which it is ſupported.

In order that the dripping-pan on being puſhed into or drawn out of the Roaſter may be made to preſerve its direction, two ſtrait grooves are made in the ſhelf on which it is ſupported, which, receiving the ſliders of the dripping-pan, prevent it from ſlipping about from ſide to ſide, and ſtriking againſt the ſides of the Roaſter. The front ends of theſe grooves are ſeen in figure 14, as are alſo the front ends of the ſliders of the dripping-pan, and one of its handles.

In the dripping-pan, a gridiron (ſeen in fig. 14.) is placed, the horizontal bars of which are on a level with the ſides or brim of the dripping-pan, and on this gridiron the meat to be roaſted is laid; care being taken that there be always a ſufficient quantity

quantity of water in the dripping-pan to cover the whole of its bottom to the height of at leaſt half or three quarters of an inch.

This water is eſſential to the ſucceſs of the proceſs of roaſting: it is deſigned for receiving the drippings from the meat, and preventing their falling on the heated bottom of the dripping-pan, where they would be evaporated, and their oily parts burnt or volatilized, filling the Roaſter with ill-ſcented vapours which would ſpoil the meat, by giving it a diſagreeable taſte and ſmell.

It was with a view more effectually to defend the bottom of the dripping-pan from the fire, and prevent as much as poſſible the evaporation of the water it contains, that the dripping-pan was raiſed on feet or ſliders, inſtead of being merely ſet down on its bottom on the ſhelf which ſupports it in the Roaſter.

A late improvement has been made in the arrangement of the dripping-pan, by an ingenious workman at Norwich, Mr. Froſt, who has been employed in putting up Roaſters in that part of the country; an invention which I think will, in many caſes, if not in all, be found very uſeful. Having put a certain quantity of water into the principal dripping-pan, which is conſtructed of ſheet-iron, he places a ſecond, ſhallower, made of tin, and ſtanding on four ſhort feet, into the firſt, and then places the gridiron which is to ſupport the meat in this ſecond dripping pan. As the water in the firſt keeps the ſecond cool, there is no neceſſity for

for putting water into this; and the drippings of the meat may, without danger, be ſuffered to fall into it, and to remain there unmixed with water. When Yorkſhire puddings, or potatoes, are cooked under roaſting meat, this arrangement will be found very convenient.

In conſtructing the dripping-pans, and fitting them to each other, care muſt be taken that the ſecond do not touch the firſt, except by the ends of its feet; and eſpecially that the bottom of the ſecond (which may be made diſhing) do not touch the bottom of the firſt. The lengths and widths of the two dripping-pans above, or at their brims, may be equal, and the brim of the ſecond may ſtand about half an inch above the level of the brim of the firſt. The horizontal level of the upper ſurface of the gridiron ſhould not be lower than the level of the brim of the ſecond dripping-pan; and the meat ſhould be ſo placed on the gridiron that the drippings from it cannot fail to fall into the dripping-pan, and never upon the hot bottom or ſides of the Roaſter.

To carry off the ſteam which ariſes from the water in the dripping-pan, and that which eſcapes from the meat in roaſting, there is a ſteam-tube belonging to the Roaſter, which is ſituated at the upper part of the Roaſter, commonly a little on one ſide, and near the front of it, to which tube there is a damper, which is ſo contrived as to be eaſily regulated without opening the door of the

Roaſter. This ſteam-tube is diſtinctly ſeen in figure 14; and the end of the handle by which its damper is moved, may be ſeen in figure 15.

The heat of the Roaſter is regulated at pleaſure, and to the greateſt nicety, by means of the regiſter in the aſh-pit door of its fire-place (repreſented in figure 15.) and by the damper in the canal, by which the ſmoke goes off into the chimney; which damper is not repreſented in any of the figures.

The *dryneſs* in the Roaſter is regulated by the damper of the ſteam-tube, and alſo by means of a very eſſential part of the apparatus—the *blow pipes*—which ſtill remain to be deſcribed. They are diſtinctly repreſented in the figures 14, 15, and 16.

Theſe blow-pipes, which lie immediately under the Roaſter, are two tubes of iron, about 2½ inches in diameter, and 23 inches long, or about one inch ſhorter than the Roaſter; which tubes, by means of elbows at their farther ends, are firmly fixed to the bottom of the Roaſter, and communicate with the inſide of it. The hither ends of theſe tubes come through the brick-work, and are ſeen in front of the Roaſter, being even with its face.

Theſe blow-pipes have ſtoppers, by which they are accurately cloſed; but when the meat is to be *browned*, theſe ſtoppers are removed, or drawn out a little, and the damper in the ſteam-tube of the Roaſter being at the ſame time opened, a ſtrong current

current of hot air preſſes in through the tubes into the Roaſter, and through the Roaſter into and through the ſteam-tube, carrying and driving away all the moiſt air and vapour out of the Roaſter.

As theſe blow-pipes are ſituated immediately below the Roaſter, and juſt over the fire, and are ſurrounded on every ſide by the flame of the burning fuel (ſee figure 16.) they are much expoſed to the heat; and when the fire is made to burn briſkly, which ſhould always be done when the meat is to be browned, they will be heated red-hot, conſequently the air which paſſes through them into the Roaſter will be much heated; and this *hot wind* which blows over the meat, will ſuddenly heat and dry its ſurface in every part, and give it that appearance and taſte which are peculiar to meat that is well roaſted.

When theſe Roaſters were firſt propoſed, and before their merit was eſtabliſhed, many doubts were entertained reſpecting the taſte of the food prepared in them. As the meat was ſhut up in a confined ſpace, which has much the appearance of an oven, it was natural enough to ſuſpect that it would be rather *baked* than *roaſted*; but all thoſe who have tried the experiment have found that this is by no means the caſe. The meat is *roaſted*, and not *baked*; and however bold the aſſertion may appear, I will venture to affirm, that meat of every kind, without any exception, roaſted in a roaſter, is *better taſted—higher flavoured—and much*

more

more juicy and delicate, than when roaſted on a ſpit before an open fire.

I ſhould not have dared to have publiſhed this opinion four years ago; but I can with ſafety do it now, for I can appeal for a confirmation of the fact to the reſults of a number of deciſive experiments, lately made in this metropolis, and by the moſt *competent judges*.

Among many others who, during the laſt year, have cauſed Roaſters to be put up in their kitchens, I could mention one perſon in particular, a nobleman, diſtinguiſhed as much by his ingenuity and indefatigable zeal in promoting uſeful improvements, as by his urbanity and his knowledge in the art of refined cookery; who had *two Roaſters* put in his houſe in town, and who informs me, that he has frequently invited company to dine with him ſince his Roaſters have been in uſe, and that the diſhes prepared in them have never failed to meet with marked approbation.

In enumerating the excellencies of this new implement of cookery, there is one of indiſputable importance, which ought not to be omitted. When meat is roaſted in this machine, its *quantity*, determined by weight, is conſiderably greater than if it were roaſted upon a ſpit before a fire. To aſcertain this fact, two legs of mutton, taken from the ſame carcaſe, and made perfectly equal in weight before they were cooked, were roaſted on the ſame day, the one in a Roaſter, the other on a ſpit before the fire; and to prevent all deception,

the perſons employed in roaſting them were not informed of the principal deſign of the experiment. When theſe pieces of roaſted meat came from the fire, they were carefully weighed; when it appeared, that the piece which had been roaſted in the Roaſter was heavier than the other, by a difference which was equal to ſix *per Cent.* or ſix pounds in an hundred. But this even is not all; nor is it indeed the moſt important reſult of the experiment. Theſe two legs of mutton were brought upon table at the ſame time, and a large and perfectly unprejudiced company was aſſembled to eat them. They were both declared to be very good; but a decided preference was unanimouſly given to that which had been roaſted in the Roaſter, it was much more juicy, and was thought better taſted. They were both fairly eaten up; nothing remaining of either of them that was eatable. Their fragments, which had been carefully preſerved, being now collected and placed in their ſeparate diſhes; it was *a compariſon of theſe fragments* which afforded the moſt ſtriking proof of the relative merit of theſe two methods of roaſting meat, in reſpect to the economy of food. Of the leg of mutton which had been roaſted in the Roaſter, hardly any thing viſible remained except the bare bone; while a conſiderable heap was formed of ſcraps not eatable, which remained of that roaſted on a ſpit.

I believe I may venture to ſay, that the reſult of this experiment is deſerving of the moſt ſerious attention,

ttention, eſpecially in this country, where ſo much
oaſted meat is eaten, and where the economy of
ood is every day growing to be more and more an
bject of public concern.

I could mention ſeveral other experiments ſimilar
o that juſt deſcribed, which have been made, and
ith ſimilar reſults; but it would be ſuperfluous
o bring many examples to aſcertain a fact, which
ſo well eſtabliſhed by one.

There is one peculiarity more, reſpecting meat roaſted in a Roaſter, which I muſt mention; that is, the uncommon delicacy of the taſte of the fat of the meat ſo roaſted, eſpecially when it has been done by *a very ſlow fire*. When good mutton is roaſted in this manner, its fat is exquiſitely ſweet and well taſted; and when eaten with currant jelly, can hardly be diſtinguiſhed from the fat of the very beſt veniſon. The fat parts of other kinds of meat are alſo uncommonly delicate when prepared in this manner; and there is reaſon to think that they are much leſs unwholeſome than when they are roaſted before an open fire.

The heat which is generated by the rays which proceed from burning fuel, is frequently moſt intenſe; and hence it is that the ſurface of a piece of meat that is roaſted on a ſpit, is often quite burnt, and rendered not only hard and ill-taſted, but very unwholeſome. The fat of veniſon is not thought to be unwholeſome; but in roaſting veniſon, care is taken by covering it, to prevent the rays from the fire from burning it. In the Roaſt-

ing machine, the bad effects of theſe direct rays are always prevented by the ſides of the Roaſter, which intercepts them, and protects the ſurface of the meat from the exceſſive violence of their action; and even, when at the end of the proceſs of roaſting, the intenſity of the heat in the Roaſter is ſo far increaſed as to brown the ſurface of the meat, yet this heat being communicated through the medium of a heated fluid (air) is much more moderate and uniform and certain in its effects, than direct rays which proceed from burning fuel, or from bodies heated to a ſtate of incandeſcence.

Directions for SETTING *Roaſters.*

THERE are two points, to which attention muſt be paid by bricklayers in SETTING theſe Roaſters; otherwiſe they will not be found to anſwer. Their fire-places muſt be made extremely ſmall; and proviſion muſt be made for cleaning out their flues from time to time when they become obſtructed with ſoot.

When I firſt introduced theſe Roaſters into this country five years ago, I was not fully aware of the irreſiſtible propenſity to make too great fires on all occaſions, which thoſe people have who inhabit kitchens; but ſad experience has ſince taught me, that nothing ſhort of rendering it abſolutely impoſſible to deſtroy my Roaſters by fire, will prevent their being ſo deſtroyed. The knowledge of this fact

fact has put me on my guard, and I now take effectual meaſures for preventing this evil. I cauſe the fire-places of Roaſters to be made *very ſmall*, and direct them to be ſituated at a conſiderable diſtance below the bottom of the Roaſter.

For a Roaſter which is 18 inches wide, and 24 inches long, the fire-place ſhould not be more than ſeven inches wide and nine inches long; and the ſide walls of the fire-place ſhould be quite vertical to the height of ſix or ſeven inches. Small as this fire-place may appear to be, it will contain quite coals enough to heat the Roaſter, and many more than will be found neceſſary for keeping it hot when heated. The fact is, that the quantity of fuel required to roaſt meat in this way, is almoſt incredibly ſmall. By experiments, made with great care at the Foundling Hoſpital, it appeared to be only about *one ſixteenth* part of the quantity which would be required to roaſt the ſame quantity of meat in the common way before an open fire. But it is not merely to ſave fuel that I recommend the fire-places to be made very ſmall;—it is to prevent the Roaſters from being wantonly deſtroyed, the meat ſpoiled, and a uſeful invention diſcredited.

With regard to the proviſion which ought to be made, in the ſetting of a Roaſter, for occaſionally cleaning out its flues, this muſt be done by leaving proper openings (about four or five inches ſquare for inſtance) in the brick-work, to introduce a bruſh, like a bottle-bruſh, with a long handle; which openings may be cloſed with ſtoppers or fit

pieces of brick, or of ſtone, and the joinings made good with a little moiſt clay. To render theſe ſtoppers more conſpicuous, they may each be furniſhed with a ſmall iron ring or knob, which will likewiſe be uſeful as an handle in removing them, and replacing them.

In the figures of 15 and 16, a ſimple contrivance may be ſeen, repreſented, by means of which the ſoot which is apt to collect about the top of a Roaſter, may be removed with very little trouble as often as it ſhall be found neceſſary, without injuring the brick-work, or deranging any part of the machinery. By means of an oblong ſquare frame, conſtructed of ſheet iron, and faſtened to the top of the Roaſter by rivets, a door-way is opened into the void ſpace left for the flame and ſmoke between the outſide of the Roaſter, and the hollow arch or vault in which it is placed; and by introducing a bruſh with a flexible handle through this door-way, the ſoot adhering to the outſide of the top of the Roaſter, and to the ſurface of the brick-work ſurrounding it, may be detached and made to fall back into the fire-place, from whence it may be removed with a ſhovel. The ſides of the Roaſter may be cleaned by introducing a bruſh through the door-way of the fire-place.

The door-way at the top of the Roaſter may be cloſed either by a ſtopper made of ſheet iron, or by a fit piece of ſtone or brick, furniſhed with a ring or knob, to ſerve as a handle to it.

If coke be burnt under theſe Roaſters, inſtead of

of coal (which, as they will not be more expenſive fuel, and as they burn longer, and give a more equal heat, I would ſtrongly recommend) the flues will ſeldom if ever require to be cleaned out. I burn nothing but coke and a few pieces of wood, in the cloſed fire-places of my own kitchen; and for my open chimney fires, I uſe a mixture of coke and coals, which makes a very pleaſant fire, and is, I believe, leſs expenſive than coals. It appears to me that there is no ſubject which offers ſo promiſing a field for experimental inveſtigation, and where uſeful improvements would be ſo likely to be made, as in the *combination and preparation of fuel.*— But to return from this digreſſion.

In conſtructing the fire-place of a Roaſter (and all other cloſed fire-places) care muſt be taken to place the iron-bars on which the fuel burns, at a conſiderable diſtance from the door of the fire-place; otherwiſe this door being near the fire, its handle will become very hot, and it will burn the hand of a perſon that takes hold of it. I have more than once ſeen Roaſters and ovens condemned, diſgraced, and totally neglected, merely from an accident of this kind. And yet how eaſy would it have been to have corrected this fault! —If the door of the fire-place is formed to become too hot, ſend for the bricklayer, and let him put the fire-place farther backward.

There ſhould always be a paſſage, or throat, of a certain length, between the mouth or door of a cloſed fire-place, and the fire-place properly ſo

called, or the cavity occupied by the burning fuel. Where fire-places are of large dimenſions, it is very uſeful (as indeed it is cuſtomary) to keep this throat conſtantly filled and choaked up with coal. This coal, which, as there is no ſupply of air in the paſſage, does not burn, ſerves to defend the fire-place door from the heat of the fire. It ſerves another uſeful purpoſe; it gets well warmed, and even heated very hot before it is puſhed forward into the fire-place, which diſpoſes it to take fire inſtantaneouſly, and without cooling the fire-place and depreſſing the fire when it is introduced. If any part of it takes fire while it occupies the throat or paſſage of the fire-place, it is that part only which is in immediate contact with the burning fuel; and what is ſo burnt, is conſumed under the moſt advantageous circumſtances; for the thick vapour which riſes from this coal, as it grows very hot, and which, under other leſs favourable circumſtances, would not fail to go off in ſmoke, takes fire in paſſing over the burning fuel, and burns with a clear bright flame. I have had frequent opportunities of verifying this intereſting fact; and I mention it now, in order, if poſſible, to fix the attention of thoſe who have the management of large fires, to an object which perhaps is of greater importance than they are aware of.

When good reaſons can be aſſigned for the advantages which reſult from any common practice, this not only tends to ſatisfy the mind, and make people careful, cheerful, and attentive in the proſecutio

ſecution of their buſineſs, but it has alſo a very ſalutary influence, by preventing thoſe perpetual variations and idle attempts at improvement, *undirected by ſcience*, which are the conſequence of the inconſtancy, curioſity, and reſtleſsneſs of man.

Diſcoveries are always accidental; and the great uſe of *ſcience* is by inveſtigating the nature of the effects produced by any proceſs or contrivance, and of the cauſes by which they are brought about, to explain the operation, and determine the preciſe value of every new invention. This fixes as it were the *latitude* and *longitude* of each diſcovery, and enables us to place it in that part of the map of human knowledge which it ought to occupy It likewiſe enables us to uſe it in taking *bearings* and *diſtances*, and in ſhaping our courſe when we go in ſearch of new diſcoveries.—But I am again ſtraying very far from my humble ſubject.

In conſtructing cloſed fire-places for Roaſters, Boilers, Ovens, &c. for kitchens, I have found it to be a good general rule to make the diſtance between the fire-place door and the hither end of the bars of the grate, juſt equal to the width of the fire-place, meaſured juſt above the bars. In fire-places of a moderate ſize, where double doors are uſed, it will ſuffice, if the diſtance from the hinder ſide of the inner door, to the hither end of the bars, be made equal to the width of a brick, or 4½ inches; but if the door be not double, it is neceſſary that the length of the paſſage from the

the door, into the place occupied by the burning fuel, ſhould be at leaſt ſix or ſeven inches.

In ſetting the iron frame of the door of a cloſed fire-place, care ſhould be taken to maſk the metal by ſetting the bricks before it in ſuch a manner that no part of the frame *may be ſeen* (if I may uſe that expreſſion) by the fire. This precaution ſhould be uſed in conſtructing fire-places of all ſizes, otherwiſe the frame of the fire-place door will be heated very hot by the rays from the burning fuel, eſpecially when the fire-place is large, and its form will ſoon be deſtroyed by the frequent expanſion and contraction of the metal. The conſequences of this change of form will be, the looſening of the frame in the brick-work, and the admiſſion of air into the fire-place over the fire, between the ſides of the frame and the brick-work, and likewiſe between the frame and its door, which will no longer fit each other.

The expence of keeping large fire-places in repair is very conſiderable, as I have learnt from ſome of the London brewers. More than *nine-tenths* of that expence might eaſily be ſaved, by conſtructing the machinery more ſcientifically, and uſing it with care.

Fig. 15, is a front view; and fig. 16, repreſents a vertical ſection of a Roaſter, ſet in brick-work. The hollow ſpaces repreſented in fig. 16. are expreſſed by ſtrong vertical lines, namely, the aſh-pit, A. the fire-place, B. The ſpace between the outſide of the Roaſter, and the arch of brick-work which

which ſurrounds it, C.—the broad canal at the farther end of the Roaſter, by which the ſmoke deſcends, D.—and the place E, where it turns, in order to paſs upwards into the chimney by the perpendicular canal, F.—The brick-work is expreſſed by fainter lines drawn in the ſame direction.

The farther end of the Roaſter muſt be ſo fixed in the brick-work, that no part of the ſmoke can find its way from the fire-place B, directly into the canal D, otherwiſe it will not paſs up by the ſides of the Roaſter to the top of it. At the top of the Roaſter, at its farther end, an opening muſt of courſe be left for the ſmoke to paſs into the deſcending canal D.

As I have already mentioned the neceſſity of cauſing the ſmoke, which is uſed for heating an iron oven or a Roaſter, *to deſcend* before it is permitted to paſs off into the chimney, I ſhall inſiſt no farther on that important point in this place. It may, however, be uſeful to obſerve, that if the place where a Roaſter is ſet is not deep enough to allow of the deſcending canal, D, and the canal F, by which the ſmoke aſcends and paſſes into the chimney, to be ſituated at the farther end of the Roaſter, both theſe canals may, without the ſmalleſt inconvenience, be placed on one ſide of the Roaſter: indeed, as houſes are now built, it will commonly be moſt convenient to place them on one ſide, and not at the end of the Roaſter. When this is done, the ſmoke muſt be permitted to paſs up behind the

the farther end of the Roaſter, as well as by the ſides of it.

By taking away a large flat ſtone, or a twelve-inch tile, placed edgeways, a paſſage from A to E may be opened occaſionally, in order to clean out the canals D and F, and remove the ſoot. Theſe paſſages may be cleaned out either from above or from below, by means of a bruſh, with a long flexible handle.

The ſteam tube (which is ſeen in this figure) muſt open into a ſeparate canal (not expreſſed in the figure) which muſt be conſtructed for the ſole purpoſe of carrying off the ſteam into the chimney, or into the open air. If this ſteam tube were to open into either of the cavities or canals C, D, E, or F, in which the ſmoke from the fire which heats the Roaſter circulates, this ſmoke might, on ſome occaſions, be driven back into the Roaſter, which could not fail to give a bad taſte to the meat. The ſteam tube muſt be laid on a *deſcent*, otherwiſe the water generated in it, in conſequence of the condenſation of the ſteam, might run back into the Roaſter.

Some care will be neceſſary in forming the vault which is to cover the Roaſter above. Its form ſhould be regular, in order that it may be every where at the ſame diſtance from the Roaſter; and its concave ſurface ſhould be as even and ſmooth as poſſible, in order that there may be the fewer cavities for the lodgment of ſoot. The diſtance between the outſide of the Roaſter and the con-

cave

cave ſurface of this vault, may be about two inches; and the ſame diſtance may be preſerved below, between the brick-work and the ſides of the Roaſter. In the figure 15, the outline of the fire-place and of the cavity in which the Roaſter is ſet, is indicated by a dotted line.

Directions for the Management of Roaſter.

CARE muſt be taken to keep the Roaſter very clean, and above all, to prevent the meat from touching the ſides of it, and the gravy from being ſpilt on its bottom. If by any means it becomes greaſy in any part that is expoſed to the action of the fire, as the metal becomes hot, this greaſe will be evaporated, as has already been obſerved, and will fill the Roaſter with the moſt offenſive vapour. When greaſe ſpots appear, the inſide of the Roaſter muſt be waſhed, firſt with ſoap and water, to take away the greaſe, and then with pure water, to take away the ſoap, and it muſt then be wiped with a cloth till it be quite dry.

The fire muſt be moderate, and time muſt be allowed for the meat to be roaſted *by the moſt gentle heat*. About one-third more time ſhould in general be employed in roaſting meat in a Roaſter, than would be neceſſary to roaſt it in the uſual way, on a ſpit before a fire.

The blow-pipes ſhould be kept conſtantly cloſed from the time the meat goes into the Roaſter, till within 12 or 15 minutes of its being ſufficiently done

done to be ſent to the table, that is to ſay, till it is fit *to be browned.*

The meat is browned in the following manner: the fire is made to burn bright and clear for a few minutes, till the blow-pipes begin to be red-hot (which may be ſeen by withdrawing their ſtoppers for a moment, and looking into them;) when the damper of the ſteam-tube of the Roaſter being opened, and the ſtoppers of the blow-pipes drawn out, a certain quantity of air is permitted to paſs through the heated blow-pipes, into and through the Roaſter.

I ſay, *a certain quantity* of air is allowed to paſs through the blow-pipes into the Roaſter. If the ſteam-tube and the blow-pipes were ſet *wide open*, it is very poſſible, that too much might be admitted, and that the inſide of the Roaſter and its contents might be cooled by it, inſtead of being raiſed to a higher temperature. As the velocity with which the cold air of the atmoſphere will ruſh into and through the blow-pipes of a Roaſter will depend on a variety of circumſtances, and may be very different even in Roaſters of the ſame ſize and conſtruction, no general rules can be given in browning the meat for the regulation of the ſtoppers of the blow-pipes, and of the damper in the ſteam tube; theſe muſt depend on what may be called *the Trim of the Roaſter*, which will ſoon be diſcovered by the cook.

There is an infallible rule for the regulation of the damper of the ſteam tube, *during the time the meat is roaſting by a gentle heat.* It muſt then be kept

kept juſt ſo much opened, that the ſteam which ariſes from the meat, and from the evaporation of the water in the dripping-pan, may not be ſeen coming out of the Roaſter through the crevices of its door; for if it be more opened, the cold air of the atmoſphere will ruſh into the Roaſter through thoſe crevices, and by partially cooling it, will derange the proceſs that is going on; and if it be leſs opened, the room will be filled with ſteam.

In brightening the fire, preparatory to the browning of the meat, the regiſter in the aſh-pit door, and the damper in the canal by which the ſmoke paſſes off into the chimney, ſhould both be opened, and it may be uſeful to ſtir up the fire with a poker, but this would be a very improper time for throwing a quantity of freſh coals into the fire-place, for that would cool the fire-place, and damp the fire for a conſiderable time. By far the beſt method of brightening the fire for this purpoſe, would be to throw a ſmall faggot into the fire, or a little bundle of dry wood of any kind, ſplit into ſmall pieces about ſix or ſeven inches in length. This would afford a clear bright flame, which would heat the blow-pipes quickly, and without injuring them. Indeed wood ought always to be uſed for heating Roaſters, in preference to coal, where it can be had, and the quantity of it required is ſo extremely ſmall, that the difference in the expence would be very trifling, even here in London, where the price of fire-wood is ſo high. And if the durability of the machinery be taken

taken into the account, which is but juſt, I am confident, that for heating Roaſters and Ovens conſtructed of ſheet iron, coals would turn out to be dearer fuel than wood.

I have already inſiſted ſo much on the neceſſity of keeping a quantity of water under meat that is roaſting, in order to prevent the drippings from the meat from falling on any very hot metal, that I ſhall not now enlarge farther on the ſubject, except by ſaying, once more, that it is a circumſtance, to which it is indiſpenſably neceſſary to pay attention.

When meat is roaſted by a very moderate heat, it will ſeldom or never require being either turned or baſted, but when the heat in the Roaſter is more intenſe, it will be found uſeful both to turn it, and to baſte it three or four times during the proceſs. The reaſon of this difference in the manner of proceeding, will be evident to thoſe who conſider the matter with attention.

When Roaſters are conſtructed of large dimenſions, ſeveral kinds of meat may be roaſted in them at the ſame time. If care be taken to preſerve their drippings ſeparate, which may eaſily be done by placing under each a ſeparate diſh, or dripping-pan, ſtanding in water contained in a larger dripping-pan, there will be no mixture of taſtes; and, what no doubt will appear ſtill more extraordinary, a whole dinner, conſiſting of various diſhes, roaſted, ſtewed, baked, and boiled, may be prepared at the ſame time in the ſame Roaſter, without

out any mixture whatever of taſtes. A reſpectable friend of mine, who firſt made the experiment, and who has ſince repeated it ſeveral times, has aſſured me of this curious fact. It may perhaps, in time, turn out to be an important diſcovery. A ſimple and economical contrivance, by means of which all the different proceſſes of cookery could be carried on at the ſame time, and by one ſmall fire, would, no doubt, be a valuable acquiſition.

It is very certain that Roaſters will either bake or roaſt, ſeparately, in the higheſt poſſible perfection; and it is not improbable that, with certain precautions in the management of them, they may be made to perform thoſe two proceſſes at the ſame time, in ſuch a manner as to give general ſatisfaction. When Roaſters are deſigned for roaſting and baking at the ſame time, they ſhould be made ſufficiently large to admit of a ſhelf above the meat, on which the things to be baked ſhould be placed. I am told, that above half the Roaſters lately put up in London, are ſo conſtructed, and that they are frequently made to roaſt and bake at the ſame time. I ſhall take another opportunity of enlarging on the utility of this contrivance.

There is a precaution to be taken in opening the door of a Roaſter, when meat is roaſting in it, which ought never to be neglected; that is, to open the ſteam-tube and both the blow-pipes, for about a quarter of a minute, or while a perſon can count fifteen or twenty, before the door of the Roaſter be thrown open. This will drive away the

ſteam and vapour out of the Roaſter, which otherwiſe would not fail to come into the room as often as the door of the Roaſter is opened.

As it will frequently happen that the meat will be done before it will be time to ſend it up to table; when this is the caſe, it may either be taken out of the Roaſter and put into a hot cloſet, which may very conveniently be ſituated immediately over the Roaſter, or it may remain in the Roaſter till it is wanted. If this laſt mentioned method of keeping it warm be adopted, the following precautions will be neceſſary for cooling the Roaſter, otherwiſe the proceſs of roaſting will ſtill go on, and the meat, inſtead of being merely kept warm, will be over done: The regiſter in the aſh-pit door ſhould be cloſed; the fire-place door, and the damper in the chimney, ſhould be ſet wide open; the fire ſhould either be taken out of the fire-place, or it ſhould be covered with cold aſhes; and laſtly, the damper in the ſteam-tube and both the blow-pipes ſhould be opened. By theſe means the heat will very ſoon be driven away up the chimney, and as ſoon as it is ſo far moderated as to be no longer dangerous, the blow-pipes and the damper in the ſteam-tube may be nearly cloſed; and if there ſhould be danger of the cooling being carried too far, the fire-place door may be ſhut. By theſe means the heat of the Roaſter, and of the brick-work which ſurrounds it, may be moderated and regulated at pleaſure, and meat already roaſted may be kept warm, for almoſt any length of time, without any danger of its being ſpoiled.

Miſcellaneous

Miſcellaneous Obſervations reſpecting Roaſters and Ovens.

I SHALL, no doubt, be criticiſed by many, for dwelling ſo long on a ſubject, which to them will appear low, vulgar, and trifling; but I muſt not be deterred by faſtidious criticiſms from doing all I can do, to ſucceed in what I have undertaken. Were I to treat my ſubject ſuperficially, my writings would be of no uſe to any body, and my labour would be loſt; but by inveſtigating it thoroughly, I may perhaps engage others to pay that attention to it, which, from its importance to ſociety, it certainly deſerves. If improvements in articles of elegant luxury, which not one perſon in ten thouſand is rich enough to purchaſe, are conſidered as matters of public concern, how much more intereſting to a benevolent mind muſt thoſe improvements be, which contribute to the comfort and convenience of every claſs of ſociety, rich and poor.

But the ſubject now under conſideration is very far from being unintereſting, even if we conſider it merely as it is connected with *ſcience*, without any immediate view to its utility; for in it are involved ſeveral of the moſt abſtruſe queſtions relative to the doctrine of heat.

Many have objected to the Roaſter, on a ſuppoſition that meat cooked in it muſt neceſſarily partake more of the nature of *baked* meat than of

roaſted meat. The general appearance of the machinery is certainly calculated to give riſe to that idea, and when it is known that all kinds of baking may be performed in great perfection in the Roaſter, that circumſtance no doubt tended very much to confirm the ſuſpicion: but when we examine the matter attentively, I think we ſhall find that this objection is not well founded.

When any thing is baked in an oven, (on the common conſtruction) the heat is gradually *diminiſhing* during the whole time the proceſs is going on.—In the Roaſter, the heat is regulated at pleaſure, and can be ſuddenly increaſed towards the end of the proceſs; by which means the diſtinguiſhing and moſt delicate operation, *the browning of the ſurface* of the meat, can be effected in a few minutes, which prevents the drying up of the meat, and the loſs of its beſt juices.

In an oven, the exhalations being confined, the meat ſeldom fails to acquire a peculiar and very diſagreeable ſmell and taſte, which, no doubt, is occaſioned ſolely by thoſe confined vapours. The ſteam tube of a Roaſter being always ſet open, when, in browning the meat, the heat is ſufficiently raiſed to evaporate the oily particles at its ſurface, the noxious vapours unavoidably generated in that proceſs are immediately driven away out of the Roaſter, by the current of hot and pure air from the blow-pipes. This leaves the meat perfectly free, both from the taſte and the ſmell peculiar to baked meat.

Some

Some have objected to Roaſters, on an idea that as the water which is placed under the meat, is (in part at leaſt) evaporated during the proceſs, this muſt make the meat *ſodden*, or give it the appearance and taſte of meat boiled in ſteam; but this objection has no better foundation, than that we have juſt examined. As ſteam is much lighter than air, that generated from the water in the dripping-pan, will immediately riſe up to the top of the Roaſter, and paſs off by the ſteam-tube, and the meat will remain ſurrounded by air, and not by ſteam. But were the Roaſter to be conſtantly full of ſteam, to the perfect excluſion of all air, which however is impoſſible, this would have no tendency whatever to make the meat *ſodden*. It is a curious fact, that ſteam, ſo far from being a moiſt fluid, is perfectly *dry*, as long as it retains its elaſtic form; and that it is of ſo drying a nature, that it cannot be contained in wooden veſſels, (however well ſeaſoned they may be) without drying them and making them ſhrink till they crack and fall to pieces.

Steam is never moiſt. When it is condenſed with cold it becomes *water*, which is moiſture itſelf; but the ſteam in a Roaſter, which ſurrounds meat that is roaſting, cannot be condenſed upon it; for the ſurface of the meat, being heated by the calorific rays from the top and ſides of the Roaſter, is even hotter than the ſteam.

If ſteam were a moiſt fluid, it would be found

very difficult to bake bread, or any thing elſe, in a common oven.

Meat which is *boiled* or *ſodden* in ſteam, is put cold into the containing veſſel, and the hot ſteam which is admitted, is inſtantly condenſed on its ſurface, and the water reſulting from this condenſation of ſteam, dilutes the juices of the meat, and waſhes them away, leaving the meat taſteleſs and inſipid at its ſurface: but when meat is put cold into a Roaſter, the water in the dripping-pan being cold likewiſe, long before it can acquire heat ſufficient to make it boil, the ſurface of the meat will become too hot for ſteam to be condenſed upon it; and were it not to be browned at all, it could not poſſibly taſte *ſodden*.

It appears to me, that theſe illucidations are ſufficient to remove the two objections which are moſt commonly made to the Roaſter, by thoſe who are not well acquainted with its mechaniſm, and manner of acting.

In my account of the blow-pipes, I have ſaid that the current of air which comes into the Roaſter through them, when they are opened to brown the meat, "drives away all the moiſt air and vapour "out of the Roaſter." This I well know is not an accurate account of what really happens; but it may ſerve, perhaps better than a more ſcientific explanation, to give the generality of readers diſtinct ideas of the nature of the effects that are produced by them. The noxious vapour generated from

from the oily particles that are evaporated by the ſtrong heat, are moſt certainly driven away, preciſely in the manner deſcribed; and we have juſt ſeen how very eſſential it is that theſe vapours ſhould not be permitted to remain in the Roaſter;—and whether the ſurface of the meat be in fact dried by the immediate contact of a current of hot and dry air, or whether this effect is produced in conſequence of an increaſe of calorific rays from the top and ſides of the Roaſter, occaſioned by the additional heat communicated to the internal ſurface of the Roaſter by this hot wind, the utility of the blow-pipes is equally evident in both caſes.

CHAPTER V.

More particular deſcriptions of the ſeveral parts of the Roaſter, deſigned for the information of workmen —Of the body of the Roaſter—Of the advantages which reſult from its peculiar form—Of the beſt method of proceeding in covering the iron doors of Roaſters, and Ovens, with pannels of wood, for confining the heat—Method of conſtructing double doors of ſheet iron, and of caſt iron—Of the blow-pipes—Of the ſteam tube—Of the dripping-pan—Precautions to be uſed for preventing the too rapid evaporation of the water in the dripping-pan—Of large Roaſters that may be uſed for roaſting and baking at the ſame time—Precautions which become neceſſary when Roaſters are made very large—Of various alterations that may be made in the forms of Roaſters, and of the advantages and diſadvantages of each of them—Account of ſome attempts to ſimplify the conſtruction of Roaſters—Of a Roaſting-oven—Of the difference between a Roaſting-oven, and a Roaſter.

ALTHOUGH it will be eaſy for perſons acquainted with the mechanic arts, and accuſtomed to examine drawings and deſcriptions of machines, to form a perfect idea of the invention in queſtion, from what has already been ſaid, yet ſomething more will be neceſſary for the inſtruction of artificers, who may be employed in executing

ing the work, and more eſpecially for ſuch as may from theſe deſcriptions undertake to conſtruct Roaſters, without ever having ſeen one. By going into theſe details, I ſhall no doubt find opportunities for introducing occaſional remarks on the uſes and management of the various parts of the machinery; which will tend not a little to illuſtrate the foregoing deſcriptions, and enable the reader to form a more preciſe and ſatisfactory opinion reſpecting the merit of the contrivance.

Of the BODY *of the Roaſter.*

Although I have directed the Body of the Roaſter to be made cylindrical, it may, without any conſiderable inconvenience, be conſtructed of other forms. The reaſons why I preferred the cylindrical form to all others, were, becauſe I was told by workmen, that it was the form of eaſieſt conſtruction; and becauſe I knew it to be the form beſt adapted for ſtrength and durability.

There is another reaſon, which I did not dare to communicate to the workmen (iron-plate workers) whom I was obliged to employ, in order to introduce this contrivance into common uſe in this country: when Roaſters are of this form, it will be eaſy to make them of *caſt-iron*, which will render the article not only cheaper to the purchaſer, but alſo much more durable, and better on many accounts.

As

As there is a certain proportion of ſulphur in the coal commonly uſed in this country, I was always perfectly aware of the conſequences of burning it *under* Roaſters conſtructed of ſheet-iron. I knew that the ſulphureous vapour from ſuch fuel would be much more injurious to the Roaſter, and eſpecially to its blow-pipes (which are much expoſed) than the clear flame of a wood fire; but I truſted to the remedy, which I knew might eaſily be provided for this defect. I thought that *caſt-iron*, which is much leſs liable to be injured by a coal fire, than wrought iron, would ſoon be ſubſtituted in lieu of it, firſt for the blow-pipes, and then for the body of the Roaſter. In this expectation I have not been diſappointed, for the blow-pipes of Roaſters are now commonly made of caſt-iron by the London workmen; and where ſea-coal is uſed as fuel, they never ſhould be made of any other material.

The firſt Roaſters I cauſed to be made, had all flat bottoms, and their ſides were vertical, and their tops were arched over in the form of a trunk; but ſeveral inconveniencies were found to reſult from this ſhape. Their bottoms were too much expoſed to the heat, and this exceſſive heat in that part heated the bottom of the dripping-pan too much, and cauſed the water in it to be ſoon evaporated; it likewiſe cauſed them to warp, and ſometimes prevented their doors from cloſing them with that preciſion which is neceſſary.

If the hot air in a Roaſter be permitted to eſcape by

by the crevices of its door, or what is ſtill worſe and more likely to happen, if cold air be permitted to enter the Roaſter by thoſe openings, it is quite impoſſible that the proceſs of roaſting can go on well.

As cold air will always tend to preſs into the body of the Roaſter by every paſſage that is left open, whenever, the Roaſter being hot, the damper of its ſteam-tube is open; this ſhows how neceſſary it is, in roaſting meat, not to leave that damper open at any time when it ought to be kept cloſed.

As iron doors, for confining heat, are very liable to be warped by the expanſion of the metal, they ſhould never be made to ſhut into grooves, but they ſhould be made to cloſe tight by cauſing the flat ſurface of the inſide of the door to lie againſt, and touch in all parts, the front edge of the door frame; which front edge muſt of courſe be made to be perfectly level, and as ſmooth as poſſible.

When the body of the Roaſter is made cylindrical, it will be eaſier to make the front of it, againſt which its door cloſes, level, than if it were of any other form; and when the door is circular, by making it a little diſhing, it will not be liable to be warped; eſpecially when it is made double.

If the front end of the cylinder of ſheet-iron which forms the body of the Roaſter, be turned outwards over a very ſtout iron wire, (about one-third of an inch in diameter for inſtance,) this will ſtrengthen the Roaſter very much, and will render it eaſier to make the end of the Roaſter level, to receive

receive the flat ſurface of its door: it can moſt eaſily be made level by placing the cylinder in a vertical or upright poſition, with its open end downwards, on a flat anvil, and hammering the wire above mentioned, till its front edge, which repoſes on the anvil, is quite level.

In order that the door of the Roaſter may cloſe well, its hinges ſhould be made to project outwards two or three inches beyond the ſides of the Roaſter; and it ſhould be faſtened, not by a common latch, but by two turn-buckles, ſituated juſt oppoſite to the two hinges. The diſtance at which the two hinges (and conſequently the two turn-buckles) ſhould be placed from each other, ſhould be equal to half the diameter of the Roaſter.

The hooks for the hinges, and alſo the ſupport for the turn-buckles, ſhould be ſituated at the projecting ends of ſtrong iron ſtraps, faſtened at one of their ends to the outſide of the Roaſter, by means of rivetting-nails. The manner in which theſe turn-buckles are conſtructed, and the manner in which they are faſtened to the Roaſter, may be ſeen by examining figure 17, where they are repreſented on a large ſcale.

The firſt Roaſters that were made were furniſhed with two ſeparate doors, the one placed about four inches within the body of the Roaſter, the other even with its front. As the inſide door had no hinges, but, like a common oven door, was taken quite away when the Roaſter was opened; there was ſome trouble in the management of it; and it was found that the cooks, to avoid that trouble,

trouble, frequently threw it away, and uſed the roaſter without it. This contrivance of the cooks to ſave trouble, came very near to diſcredit the Roaſters altogether, and to put a final ſtop to their introduction in this country. The circumſtance upon which the principal merit of the Roaſter depends, and on which the excellence of the food cooked in it depends entirely, is the *equality of the heat.* When the heat is equal on every ſide, it may be more *moderate* than when it is unequal; and the more moderate and equal the heat is by which meat can be properly roaſted, the better taſted and more wholeſome will it be. Now it is quite impoſſible to keep up an *equal* heat in a Roaſter which is cloſed only by a ſingle door of ſheet-iron; for ſo much heat will paſs off *through* ſuch a thin metallic door, and be carried away by the cold air of the atmoſphere which is lying againſt the outſide of it, that the degrees of heat in different parts of the Roaſter muſt neceſſarily be very different; and the conſequence of this inequality will be, either that the meat will not be ſufficiently done in ſome parts, or that the heat muſt be ſo much increaſed as to prevent its being well done in any part.

In order to induce perſons to be careful in the management of machinery of any kind which is new to them, it is neceſſary to point out the bad conſequences which will reſult from ſuch neglects and inattentions as they are moſt liable to fall into in the uſe of it; for, however particular inſtructions may be, ſtrict attention to them cannot be

expected from thoſe who are not aware of the bad effects that may reſult, from what may appear to them very trifling deviations or neglects.

Thoſe who make Roaſters muſt take the greateſt care to conſtruct them in ſuch a manner that they may be accurately cloſed, and that the heat may not be able to make its way *through* their doors;—and thoſe who uſe them, muſt be careful to manage them properly.

There are two ways in which the door of a Roaſter may be conſtructed, ſo as to confine the heat perfectly well, without giving any additional trouble to the cook in the management of it. It may be made of a ſingle ſheet of iron, and covered on the outſide with a pannel of wood:—or it may be conſtructed of two ſheets of iron, placed parallel to each other, at the diſtance of about an inch, and ſo faſtened together that the air between them may be confined.

When a door of ſingle ſheet iron is made to confine the heat by means of an outſide covering of wood, care muſt be taken to make ſuch outſide wooden covering in the form of a *pannel*, otherwiſe it will not anſwer. If a *board* be uſed inſtead of a framed pannel it will moſt certainly warp with the heat, and will either detach itſelf from the iron door to which it is faſtened, or will cauſe the door to bend, and prevent its cloſing the Roaſter with ſufficient accuracy. I have ſeen ſeveral attempts made to uſe boards, inſtead of panſels, in covering the outſides of the iron doors of Roaſters, and iron ovens; but they were all unſucceſsful. It is quite impoſſible

impoſſible that they ever ſhould anſwer, as will be evident to thoſe who will take the trouble to conſider the matter with attention.

As Doors of ſheet iron, covered with wood on the outſide, when they are properly conſtructed, are admirably calculated for confining heat; I think it worth while to give a detailed account of the precautions that are neceſſary in the conſtruction of them.

Of the beſt Method of covering the Iron Doors of Roaſters and Ovens, &c. with Wooden Pannels, for confining the Heat.

The object principally to be attended to in this buſineſs, is to contrive matters ſo that the ſhrinking and ſwelling of the wood by alternate heat and moiſture, ſhall have no tendency either to detach the wood from the iron-door, or to change its form; or to cauſe openings in the wood by which the air confined between the wood and the iron can make its eſcape.

The manner in which this may, in all caſes, be done, will be evident from an examination of the figure 18, which repreſents a front view of the door of a cylindrical Roaſter, 18 inches in diameter, covered with a ſquare wooden pannel.

It will be obſerved, that this pannel conſiſts of ſquare frame tenanted, and faſtened together at each of its four corners with a ſingle pin; and filled up in the middle with a ſquare board or pannel, which is confined in its place, by being made to enter into

into deep grooves or channels, made to receive it, in the inſides of the pieces which form the frame. The circular iron door to which this pannel is fixed, cannot be ſeen in the figure, being covered and concealed from view by the wood, but its ſize and poſition are marked out by a dotted circle; and the heads of ten rivets are ſeen, by which the wooden pannel is faſtened to the iron door. Theſe rivets are made to hold the wood faſt to the iron by means of ſmall circular plates of ſheet iron, which are diſtinctly repreſented in the figure *.

If the poſitions of the pins by which the wooden frame is faſtened together, and of the rivets which faſten the pannel to the iron door, are conſidered, it will be evident, that all bad effects of the ſhrinking of the wood by the heat are prevented by the propoſed conſtruction. The four pieces of wood, which conſtitute the frame of the pannel (which may be of common deal, and about four inches wide, and one inch thick), being faſtened with one pin only at each of their joinings at the corners, and theſe pins being ſituated in the center of thoſe joinings, if upon the frame, in the middle of each of the four pieces which compoſe it, a ſquare be drawn in ſuch a manner that the corners of this ſquare may coincide with the centers of the four

* Inſtead of theſe rivets, ſhort wood ſcrews may be uſed for faſtening the wooden pannel to the iron door; but care muſt be taken to place theſe ſcrews in the ſame places which are pointed out for the rivets. The heads of the wood ſcrews muſt of courſe be on the inſide of the iron door.

pins

pins which hold the frame together, as neither heat nor dryneſs makes any conſiderable alteration in the length of the fibres of wood, it is evident that the ſhrinking of the four pieces which compoſe this frame, cannot alter the dimenſions of this ſquare, or in any way change its poſition. If, therefore, care be taken in faſtening the pannel to the iron door to place the rivetting-nails *in the lines which form the four ſides of this ſquare*, the ſhrinking of the wood will occaſion no ſtrain on the iron door, nor have any tendency whatever to change its form; and with regard to the center piece of the pannel, if it be faſtened to the iron door by two rivets, ſituated *in the direction of the fibres of the wood*, in a line dividing this piece into two equal parts, its ſhrinking will be attended with no kind of inconvenience. Care ſhould however be taken to make this pannel enter ſo deeply into the grooves in its frame, that when it has ſhrunk as much as poſſible, its width ſhall not be ſo much reduced as to cauſe it to come quite out of the grooves. This piece may be made about one-third of an inch thick; and the grooves which receive it may be made of the ſame width, and about three quarters of an inch deep.

When wooden covers of this kind are made for iron doors of large dimenſions, they ſhould be divided into a number of compartments, otherwiſe the center pieces, or the pannels, properly ſo called, being very large, the ſhrinking of the wood

with heat will be apt to make them quit the grooves of their frames, which would open a paſſage for the cold air to approach the ſurface of the iron door.

In faſtening the wooden pannel to its iron door, it will be beſt that the wood ſhould not come into immediate contact with the iron. Two or three ſheets of cartridge paper placed one upon the other, may be interpoſed between them; and to prevent the poſſibility of this paper taking fire it may previouſly be rendered incombuſtible by ſoaking it in a ſtrong ſolution of alum, mixed with a little armenian bole, or common clay. This paper will not only aſſiſt very much in confining the heat, but will alſo effectually prevent the wood from being ſet on fire by heat communicated through the iron door of the Roaſter. It is indeed highly improbable that the Roaſter ſhould ever be ſo intenſely heated as to produce this effect; but as the ſtrangeſt accidents ſometimes do happen, it is always wiſe to be prepared for the worſt that can happen.

As the center piece of wood, or pannel properly ſo called, which fills up the wooden frame, is only one-third of an inch in thickneſs, while the frame is one inch in thickneſs, it is evident that if the face of the frame be made to apply every where to the flat ſurface of the iron door, the center piece will not touch it. This circumſtance will be rather advantageous than otherwiſe, in confining the heat; but ſtill it will require ſome attention in faſtening the wood to the iron. Each

of

of the two rivets which paſs through this center piece, muſt alſo be made to paſs through a ſmall block of wood, about an inch ſquare for inſtance, and one-third of an inch thick, which will give theſe rivets a proper bearing, without any ſtrain on the iron door which can tend to alter its form.

When the wood and the iron are firmly rivetted together, the ſuperfluous paper may be taken away with a knife.

The hinges of the door, which in the figure 18 are ſeen projecting outwards on the right hand, are to be rivetted to the outſide ſurface of the circular iron door; and in order that they may not prevent the pannel from applying properly to the door, they are to be let into the wood. The turn-buckles, by which the door is faſtened, muſt be made to preſs againſt the outſide or front of the wooden frame.

No inconvenience of any importance will ariſe from leaving the wooden pannel ſquare, while the door itſelf is circular; but if it ſhould be thought better, the corners of the pannels may be taken off, or the wooden pannel may be made circular; this ſhould not however be done till after the pannel has been fixed to the door. After this has been done, as the rivets will be ſufficient to hold the ſides of the frame in their places, the cutting off of the corners of the frame will produce no bad conſequences.

I have been the more particular in my account of the manner of covering iron doors with wooden

pannels, for the purpoſe of confining heat; as this contrivance may be uſed with great advantage, not only for Roaſters and Ovens, but alſo for a variety of other purpoſes; for the covers of large boilers for inſtance, for the doors of hot cloſets, ſteam cloſets, &c.

Of Double Doors for Roaſters, conſtructed of two circular pieces of Sheet-Iron ſeamed together.

No difficulty will be found in the conſtruction of theſe doors; and though they may not perhaps confine the heat quite ſo perfectly as the doors we have juſt deſcribed, they anſwer very well; and when the outſide of the door is japanned, they have a very handſome and cleanly appearance.

There are two ways of conſtructing them, either of which may be adopted; the circular ſheet of iron which forms the inſide of the door, may be flat, and the outſide ſheet diſhing; or the outſide ſheet may be flat, and the inſide ſheet diſhing; but whichſoever of theſe methods is adopted, the hinges muſt be attached to the outſide of the door; and care muſt be taken to make that part of the inſide of the door quite flat which lies againſt the end of the Roaſter, and cloſes it. The diſtance of the inſide ſheet of iron and the outſide ſheet, is not very eſſential; it ſhould not however be leſs than one inch in the center of the door; and theſe two ſheets ſhould not touch each other any where, except

cept it be at their circumference, where they are faſtened together. In the center of the outſide ſheet there ſhould be fixed a knob of iron, or of braſs, to ſerve as a handle for opening and ſhutting the door.

Double doors of this kind might eaſily be conſtructed of two circular pieces of caſt iron, faſtened together by rivets, or of one piece of caſt iron, caſt diſhing, and a flat piece of ſheet iron turned over it. When the latter conſtruction is adopted, the caſt iron muſt form the inſide of the door, and its convex ſide muſt project into the Roaſter. It ſhould be quite flat near its circumference, in order that it may cloſe the Roaſter with accuracy, and it ſhould be at leaſt three quarters of an inch larger in diameter than the Roaſter, in order that no part of the circular plate of ſheet iron, which ſhould be faſtened to it by being turned over its edge, may get between it and the end of the Roaſter.

Of the Blow Pipes.

THERE are various ways in which the Blow-Pipes may be faſtened to the Roaſter. The common method, when they are made of ſheet iron, is to faſten them with rivets; but as blow-pipes of ſheet-iron are liable to be burnt out in a few years, if much uſed, it is better to procure them of caſt-iron from an iron-founder, in which caſe they ſhould

be caſt with flanches, and ſhould be keyed on the inſide of the Roaſter; and their joinings with the bottom of the Roaſter muſt be made tight with ſome good cement that will ſtand fire, and is proper for that uſe.

The effect of the blow-pipes will be conſiderably increaſed, if a certain quantity of iron wire, in looſe coils, or of iron turnings, be put into them. Theſe being heated by the fire, the air which paſſes through the tubes, coming into contact with them, will be more heated than it would be if the tubes were empty; but care muſt be taken that the quantities of theſe ſubſtances uſed, be not ſo great as to choke up the tube and obſtruct too much the paſſage of the air.

The ſtoppers of the blow-pipes muſt be made to cloſe them well, otherwiſe air will find its way through the blow-pipes into the Roaſter at times when it ought not to be admitted. One of theſe ſtoppers, repreſented on a large ſcale, is ſeen drawn a little way out of its blow-pipe, in the figure 17; and in that figure, part of the iron ſtrap is ſeen which ſupports the front ends of the two blow-pipes, and confines them in their places. This ſtrap will not appear when the Roaſter is ſet, for it will then be entirely covered and concealed by the brick-work.

Where blow-pipes are made of ſheet iron, they ſhould be ſo conſtructed and ſo faſtened to the Roaſter, that they may at any time be removed and replaced without taking the Roaſter out of the brick-work. This is neceſſary, in order that they

may be taken away to be repaired or replaced with new ones, when by long uſe they become burnt out and unfit for ſervice. If they be made with flanches, and keyed on the inſide, and if they be ſupported in front on an iron ſtrap of the form repreſented in figure 14, they may at any time be removed with little trouble, by unkeying them, and removing a few bricks. When the bricks in front, which it will be neceſſary to take away, are removed, this will open a paſſage into the fire-place ſufficiently large to come at the wall at the farther end of the fire-place, which muſt come away in order to diſengage the farther ends of the blow-pipes, which are fixed in it. This wall muſt be carefully built up again, after the new blow-pipes have been introduced and faſtened to the Roaſter.

Of the Steam Tube.

THIS is an eſſential part of the machinery of a Roaſter, and muſt never be omitted. It ſhould be ſituated ſomewhere in the upper part of the Roaſter, but it is not neceſſary that it ſhould be placed exactly at the top of it. It might perhaps be thought that a hole in the upper part of the door would ſerve the purpoſe of a ſteam-tube; but this contrivance would not be found to anſwer. A ſteam-tube, properly conſtructed, will have what is called *a draft* through it, which on ſome occaſions will be found to be very uſeful,

but an hole in the door, unconnected with a tube could have no draft. It is abſolutely neceſſary that there ſhould be a damper in the ſteam-tube. The ſimpleſt damper is a circular plate of iron, a very little leſs in diameter than the tube, which, being placed in it, is moveable about an axis, which is perpendicular to the axis of the tube. This circular plate being turned about, and placed in different poſitions in the tube, by means of its axis, which, being prolonged, comes forward through the brick-work, the paſſage of the ſteam through the tube is more or leſs obſtructed by it. This prolonged axis, which may be called the projecting handle of this damper, is repreſented in the figures 14, 15, and 17. This appears to me to be one of the ſimpleſt kind of dampers I am acquainted with; and it has this in particular to recommend it, that it may be regulated without opening any paſſage into the ſteam-tube, or into the Roaſter, by which the air could force its way.

Of the Dripping Pan.

As the principal dripping-pan of a Roaſter is deſtined for holding water, and as it is of much importance that it ſhould not leak, it ſhould be hammered out of one piece of ſheet-iron, in the ſame manner as a frying-pan is formed; or if the metal be turned up at the corners, it ſhould be lapped over, but not cut, and all rivetting-nails ſhould be avoided, except ſuch as can be placed very

very near the edge of the pan, and above the common level of the water that is put into it. To avoid the neceſſity of placing any rivetting-nail at the bottom of the pan, or near it, in faſtening the ſliders on which the pan runs, theſe ſliders ſhould be made to paſs upwards, by the ends of the pan, in order to their being faſtened to it near its brim.

The dripping pan ſhould not be made quite ſo long as the Roaſter, for room muſt be left between the farther end of it and the farther end of the Roaſter, for the hot air from the blow-pipes to paſs up into the upper part of the Roaſter. In order to ſtop the dripping-pan in its proper place, when it is puſhed into the Roaſter, the farther end of the ſhelf on which it ſlides, may be turned upwards, and the brim of the dripping-pan made to ſtrike againſt this projecting part of the ſhelf. The opening between this projecting part of the ſhelf, and the farther end of the Roaſter, ſhould be about one inch, or 1 ¼ inches wide, and it may be juſt as long as the dripping-pan is wide at the brim. This part of the ſhelf which projects upwards, ſhould be half an inch higher than the brim of the dripping-pan, in order to prevent the current of hot air from the blow-pipes from ſtriking againſt the end of the dripping-pan, and heating it too much. The ſhelf may be ſtopped in its proper place, by means of two horizontal projecting ſlips of iron, about one inch, or 1 ¼ inches long, each, at its farther end, which, ſtriking againſt the end of the Roaſter, will prevent the ſhelf from being puſhed

puſhed too far into it. The dripping-pan ſhould have two falling handles, one at each end of it, which handles ſhould have ſtops to hold them faſt when they are raiſed into an horizontal poſition. As theſe handles will neceſſarily project a little beyond the ends of the pan, even when they are not raiſed up, the handle at the farther end of the pan will prevent the brim of the pan from actually touching the projecting end of the ſhelf; which circumſtance will be advantageous, as it will ſerve to defend the end of the pan, and prevent its being ſo much heated as otherwiſe it would be by the hot air from below.

I find, on enquiry from ſeveral perſons who have lately made the experiment, that it is by far the beſt method to uſe two dripping-pans, one within the other, with water between them. As the upper pan is very thin, being made of tin * (tinned ſheet iron) it is kept as cool as is neceſſary by the water; and the ſurface of the water being covered and protected, it does not evaporate ſo faſt as when it is left expoſed to the hot air in the Roaſter.

Of the Precautions that may be uſed to prevent the Dripping Pan from being too much heated.

THIS is a very important matter, and too much attention cannot be paid to it by thoſe who con-

* Some perſons have uſed a ſhallow earthen diſh, inſtead of this ſecond dripping-pan; but earthen ware does not anſwer ſo well for this uſe as tin, as it is more liable to be heated too much by the radiant heat from above.

ſtruct

ſtruct Roaſters. From what has been ſaid, it is evident, that if, in roaſting meat, the water in the dripping-pan ever happens to be all evaporated, the drippings from the meat which fall on it cannot fail to fill the Roaſter with noxious fumes. It is certainly not ſurprizing that thoſe who, in roaſting in a Roaſter, neglected to put water into the dripping-pan, ſhould not much like the flavour of their roaſted meat.

There is a method of defending the dripping-pan from heat, which many have put in practice with ſucceſs; but although it effectually anſwers the purpoſe, yet it is attended with a ſerious inconvenience, which, as it is not very obvious, ought to be mentioned. When the bottoms of Roaſters were made flat, their dripping-pans were much more liable to be too much heated than they are when the body of the Roaſter being made cylindrical, the dripping-pan is placed on a ſhelf in the manner I have here recommended. And ſeveral perſons finding the water in the dripping-pans of their Roaſters to boil away very faſt, covered the (flat) bottoms of their Roaſters with ſand, or with a paving of thin tiles, or bricks. This produced the deſired effect; but this contrivance occaſions the bottom of a Roaſter to be very ſoon burnt out and deſtroyed. The heat from the fire communicated to the under ſide of the bottom of the Roaſter not being able to make its way upwards into the body of the Roaſter, through the ſtratum of ſand or bricks (which ſubſtances are non-conductors of heat) it is accumulated in the bottom of

the

the Roaſter, and becomes there ſo intenſe as to deſtroy the iron in a ſhort time.

The beſt method that can be adopted for preventing the dripping-pan from being too much heated, is to defend the bottom of the Roaſter from the direct action of the fire, by interpoſing a ſcreen of ſome kind or other between it and the burning fuel. This ſcreen may be a plate of caſt iron, about one third of an inch thick, with a number of ſmall holes through it, ſupported upon iron bars at the diſtance of about an inch below the bottom of the Roaſter;—or it may be formed of a row of thin flat tiles laid upon the blow-pipes, and ſupported by them.

Roaſters which are made of a cylindrical form, will hardly ſtand in need of any thing to ſcreen them from the fire; eſpecially if their fire-places are ſituated at a proper diſtance below them, and if the ſize of the fire is kept within due bounds. But after all, if the perſon to whom the management of a Roaſter is committed is determined to deſtroy it, no precautions can prevent it; and hence it appears how very neceſſary it is to ſecure the good will of the cooks. They ought certainly to wiſh well to the ſucceſs of theſe inventions; for the introduction of them cannot fail to diminiſh their labour, and increaſe their comforts very much.

Of large *Roaſters, that will ſerve to* ROAST *and* BAKE *at the ſame Time.*

It has been found by experience that any Roaſter may be made to roaſt and bake at the ſame time, in great perfection, when the proper precautions are taken; but this can beſt be done when the Roaſter is of a large ſize, from 20 inches to 24 inches in diameter, for inſtance; for in this caſe there will be room above the meat for a ſhelf on which the things to be baked can be placed. And even when there is no roaſting going on below it, any thing to be baked ſhould be placed on this ſhelf, in order to its being nearer to the top of the Roaſter, where the proceſs of baking goes on better than any where elſe. In baking bread, pyes, cakes, &c. it ſeems to be neceſſary that the heat ſhould *deſcend* in rays from the top of the oven, and as the intenſity of the effects produced by the calorific rays which proceed from a heated body, is much greater near the hot body than at a greater diſtance from it, (being moſt probably as the ſquares of the diſtances inverſely) it is evident why the proceſs of baking ſhould go on beſt in a low oven, or when the thing to be baked is placed near the top of the oven, or of the Roaſter, when it is baked in a Roaſter.

The ſhelf in the upper part of a Roaſter for baking, may be made of a ſingle piece of ſheet-iron.

iron, but it will be much better to make it double, that is to ſay, of two pieces of ſheet-iron, placed at a ſmall diſtance from each other, and turned inwards, and faſtened together at their edges in the manner which will preſently be more particularly deſcribed. This ſhelf, whether it be made ſingle or double, ſhould be placed upon ledges, rivetted to the ſides of the Roaſters; and to prevent the hot air from the blow-pipes from paſſing up between the farther end of this ſhelf and the farther end of the Roaſter, the ſhelf ſhould be puſhed quite back againſt the end of the Roaſter. It ſhould be made ſhorter than the Roaſter by about two inches, in order that there may be ſufficient room between the hither end of the ſhelf and the inſide of the door of the Roaſter, for the vapour that ought to be driven out of the Roaſter to paſs upwards to the opening of the ſteam-tube. This ſhelf ſhould not be faſtened in its place, for it may ſometimes, when very large pieces of meat are roaſted, be found neceſſary to remove it.

As it ſeems probable that *radiant heat* from the top and ſides of the Roaſter, acts an important part, even in the proceſs of roaſting, if a Roaſter of very large dimenſions were to be conſtructed, I think it would be adviſeable not to make its tranſverſe ſection circular, but elyptical, the longeſt axis of the elypſe being in an horizontal poſition. This form would bring the top of the Roaſter to be nearer to the meat than it would be if its form were cylindrical; its capacity remaining the ſame.

How far an horizontal ſhelf of ſheet iron, placed immediately over the meat, and *very near it*, would anſwer as a remedy for the defect of a Roaſter, the top of which, on account of its great ſize, ſhould be found to be too far from the ſurface of the meat, I cannot pretend to determine, as I never have made the experiment; but I think it well deſerving of a trial. If the farther end of this ſhelf were made to touch the farther end of the Roaſter, ſo as to prevent the current of air from the blow-pipes from getting up between them, it is very certain that this hot air would be forced to impinge againſt the ſhelf, and run along the under ſide of it, to the hither end of the Roaſter. The only queſtion remaining, and which can only be determined by experiment, is, whether this hot air would heat the ſhelf *ſufficiently*, or to that temperature which is neceſſary, in order that the iron may throw off thoſe calorific rays which are wanted.

If this ſhelf were covered above with a pavement of tiles, or if it were conſtructed of two ſheets of iron placed parallel to each other, at the diſtance of about one inch, turned in, or made diſhing at their edges, and ſeamed together at their ends and ſides in ſuch a manner as to confine the air ſhut up between them, either of theſe contrivances, by obſtructing the heat in its paſſage *through* the ſhelf, would promote its accumulation at its under ſurface, which would not only increaſe the intenſity of the radiant heat where it is wanted,

ed, but, by diminiſhing the quantity of heat which paſſes *through* the ſhelf, would be very uſeful when any thing is placed on it in order to be baked.

Whenever a ſhelf is made in a Roaſter, whether it be ſituated above the dripping-pan or below it, I think it would always be found advantageous to conſtruct it in the manner here deſcribed, viz. of two ſheets of iron, with confined air between them; or perhaps it may be ſtill better to fill this cavity with finely pulverized charcoal. The additional expence of conſtructing the ſhelves of Roaſters in this manner would be but trifling; and the paſſage of the heat *through them*, which it is always deſirable to prevent as much as poſſible, will, by this ſimple contrivance, be greatly obſtructed. If the lower ſhelf be ſo conſtructed, it will no doubt be found very uſeful in preventing the too quick evaporation of the water in the dripping-pan.

Of various alterations that have been made in the forms of Roaſters, and of the advantages and diſadvantages of each of them.

The blow-pipes of all the Roaſters that were conſtructed, till very lately, were made to paſs round to the farther end of the Roaſter; and after forming two right angles each, they entered the Roaſter, in an horizontal direction, juſt above the level of the brim of the dripping-pan, in the manner repreſented in the figure 19.

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The figure 20 ſhows the manner in which the blow-pipes have been conſtructed of late.

The advantages of the former conſtruction were, a great length of tube, and conſequently a greater effect on that account; and a good direction to the current of hot air: the diſadvantages were, the difficulty of removing the tubes to repair them, without unſetting the Roaſter; and the difficulty of procuring blow-pipes of this form, of caſt iron; and laſtly, the great depth of ſpace that was required for ſetting the Roaſter.

The advantages of the blow-pipe, repreſented in figure 20, have already been noticed. The diſadvantage from want of length, is compenſated by a ſmall increaſe of diameter. When this blow-pipe is faſtened to the Roaſter, its flanch is covered with a cement, and the vertical end of the pipe being introduced into the Roaſter, through the circular hole in the bottom of it, which is made to receive it, a flat iron ring, covered with cement on its under ſide, is then ſlipt over the end of the tube within the Roaſter, and a key of iron, in the form of a wedge, being paſſed through both ſides of the tube, in holes prepared to receive it, by driving this wedgelike key with a hammer, the ring is forced downwards, and at the ſame time the flanch of the blow-pipe is forced upwards againſt the bottom of the Roaſter, by which means the blow-pipe is firmly fixed in its place, and the cement makes the joinings air-tight. By removing this key, the pipe may at any time be removed without deranging the Roaſter.

The figure 19 repreſents the ſection of a flat-bottomed Roaſter. In this there is a ſhelf on which two pies are ſeen baking, and a piece of meat is repreſented lying on the gridiron.

In the figures 14 and 15, the front of hither end of the Roaſter is repreſented as being turned over a ſtout iron wire. The firſt Roaſters that were conſtructed were all made in a different manner. The hither end of the Roaſter was rivetted to a broad flat frame, conſtructed of ſtout plate iron; and to this frame, or flat front, which projected before the brick-work, the hinges and turn-buckles of the door were faſtened. An idea of this manner of conſtructing the front of a Roaſter may be formed from the figure 21, although this figure does not repreſent the front of a Roaſter, but that of an oven, which will be deſcribed preſently.

There is no objection to this method of conſtructing Roaſters, but the expence of it.

Of ſome attempts to ſimplify the Conſtruction of the Roaſter.

FINDING that much more heat was always communicated to the under ſides of Roaſters, eſpecially as they were firſt conſtructed (with flat bottoms) than was there wanted, meditating on the means I could employ to defend the bottom of the dripping-pan from this exceſſive heat, without, at the

the ſame time, expoſing the bottom of the Roaſter to the danger of being ſoon deſtroyed, in conſequence of the accumulation of it, on its paſſage upwards being prevented; it occurred to me, that if the bottom of the Roaſter were covered with a ſhallow iron pan turned upſide down, with a row of holes from ſide to ſide at the farther end of it, and if a certain quantity of freſh air could occaſionally be admitted under this inverted pan; this cold air, on coming into contact with the bottom of the Roaſter would take off the heat, and becoming ſpecifically lighter on being heated, would paſs upwards through the holes at the farther end of this pan into the Roaſter, ſerving at the ſame time three uſeful purpoſes, namely, to defend the dripping-pan;—to cool the bottom of the Roaſter;—and to aſſiſt in heating the inſide of the Roaſter, above, where heat is moſt wanted. This invention was put in practice, and was found to anſwer very well all the purpoſes for which it was contrived. It was likewiſe found, that with proper management the current of heated air from below the inverted pan might be ſo regulated, as to roaſt meat very well without making any uſe of the blow-pipes; and conſequently that Roaſters might be conſtructed without blow-pipes.

As the ſubſtitution of the contrivance above deſcribed in lieu of the blow-pipes would ſimplify the conſtruction of the Roaſter very much, and enable tradeſmen to afford the article at a much lower price, I took a great deal of pains to find out

whether a Roaſter on this ſimple conſtruction could be made to perform as well as thoſe which are made with blow-pipes. I cauſed one of them to be put up in my own houſe, and tried it frequently; and I engaged ſeveral of my friends to try them; and they were found to anſwer ſo well, that I ventured at length to recommend it to manufacturers to make them for ſale. As they were called Roaſters, and as they coſt little more than half what thoſe with blow-pipes were ſold for, many perſons preferred them on account of their cheapneſs, and more than two hundred of them have already been put up in different parts of the country, and I am informed that they have anſwered to the entire ſatisfaction of thoſe who have tried them.

Although they are undoubtedly inferior in ſome reſpects to Roaſters which are furniſhed with blow-pipes, meat may, with a little care and attention, be roaſted in them in very high perfection; and as nothing can poſſibly anſwer better than they do for all kinds of baking, they will, I am perſuaded, find their way in due time into common uſe.

Roaſters on this ſimple conſtruction (without blow-pipes) which I ſhall call *Roaſting Ovens*, were at firſt made with flat bottoms, but of late they have been made cylindrical; and as I think the cylindrical form much the beſt in many reſpects, I ſhall give a deſcription of one of them.

Figure 21 repreſents a front view of a cylindrical Roaſting-Oven with its door ſhut. The front end

end of the large cylinder, which conſtitutes the body of this oven, inſtead of being turned over a ſtout wire, is turned outwards, and rivetted to a flat piece of thick ſheet iron, which in this figure is diſtinguiſhed by vertical lines, and which I ſhall call *the front* of the oven.

The door of the oven is diſtinguiſhed by horizontal lines. The general form of the front of the oven is circular; but it has two projections on oppoſite ſides of it, to one of which the hinges of the door, and to the other the turnbuckles for faſtening it when it is cloſed, are faſtened. It has another projection above, which ſerves as a frame to the doorway, through which a bruſh is occaſionally introduced for the purpoſe of cleaning the flues. On one ſide of this projection there is a ſmall hole, which is diſtinguiſhed by the letter *a*, through which the handle or projecting axis of the circular regiſter of the vent-tube (which is not ſeen) paſſes.

In the body of the oven, at the diſtance of half its ſemi-diameter below its center or axis, there is an horizontal ſhelf, which is fixed in its place, not by reſting on ledges, or by being rivetted to the ſides of the oven, but by its hither end being turned down, and firmly rivetted to the vertical plate of iron, which I have called the front of the oven. This ſhelf, which ſhould be made *double* to prevent the heat from paſſing through it from below, muſt not reach quite to the farther end of the oven: there muſt be an opening left, about one inch in width, between the end of it and the

farther end of the oven, through which opening the air heated below the ſhelf will make its way upwards into the upper part of the oven.

From what has been ſaid, it will be evident that the hollow ſpace below the ſhelf we have juſt been deſcribing, which I ſhall call the *air-chamber*, is intended to ſerve in lieu of the blow-pipes of a Roaſter; and this office it will perform tolerably well, provided means are uſed for admitting cold air into it, from without, occaſionally. This is done by means of a regiſter, which is ſituated at the lower part of the vertical front of the Roaſter, a little below the bottom of the door. This regiſter is diſtinctly repreſented in the figure 21.

Figure 22, which repreſents a vertical ſection of the oven through its axis, ſhows the (double) door of the Roaſter ſhut, and the two dripping-pans, one within the other, ſtanding on the ſhelf we have juſt been deſcribing, and a piece of meat above them, which is ſuppoſed to be laying on a gridiron placed in the ſecond dripping-pan. The regiſter of the air-chamber, below the ſhelf, which ſupplies the place of the blow-pipes, is repreſented as being open; and a part of the ſteam-tube is ſhown, through which the ſteam and vapour are driven out of the oven, by the blaſt of hot air from the air-chamber.

The cylinder which conſtitutes the body of the oven, is two feet long, and is ſuppoſed to be of caſt iron. It is caſt with a flanch, which projects outwards about one inch at the opening of the cylinder,

linder, by means of which flanch it is attached, by rivets, to the front of the oven, which, as I have already obſerved, muſt be made of ſtrong ſheet iron, which may be near one-eighth of an inch in thickneſs.

As the ſhelf is not attached to the ſides of the oven, but to its *front*, the body of the oven need not be perforated, except in one place, namely, where the ſteam goes off; and as the bottom, or farther end of the cylinder, and the flanch at its hither end, and the cylinder itſelf, are all caſt at the ſame time, and as the form of the oven is ſuch as will deliver well from the mould, it appears to me that the article might be afforded at a low price, eſpecially in this country, where the art of caſting in iron is carried to ſo high a pitch of perfection.

The ſhelf might eaſily be made of caſt iron, as might alſo the dripping-pans and the double door of the oven; and I ſhould not be ſurprized if Engliſh workmen ſhould ſucceed in making even the front of the oven, and the regiſter of the air-chamber, and every other part of the machinery, of that cheap and moſt uſeful metal.

If the ſhelf be made of caſt iron, to ſave the trouble of rivetting in making it double, it may be covered by an inverted ſhallow pan of caſt iron, and in the bottom of this pan, which will be uppermoſt when it is inverted, there may be caſt two ſhallow grooves, both in the direction of the length of the pan, and conſequently parallel to

each other, in which grooves (which may be ſituated about an inch from the ſides of the inverted pan) two parallel projections at a proper diſtance from each other, caſt at the bottom of the lower dripping-pan, may paſs. Theſe projections paſſing freely in the grooves which receive them, will ſerve to keep the dripping-pan ſteady in its proper direction when it is puſhed into or drawn out of the oven.

To increaſe the effect of the air-chamber when this oven is uſed for roaſting meat, a certain quantity of iron wire, in looſe coils, or of iron turnings, may be put into the air-chamber.

The door of the oven, which is very diſtinctly repreſented in the figure 21, ſhould be about 19 inches in diameter, if the oven is 18 inches in diameter within, or in the clear. In this figure the internal edge or corner of the hither end of the body of the oven is indicated by a dotted circle, and the poſition of the ſhelf is pointed out by an horizontal dotted line.

In faſtening the vertical plate, which forms the front of the oven, to the projecting flanch at the hither end of the cylindrical body of the oven, care muſt be taken to beat down the heads of the rivetting nails in front, otherwiſe they will prevent the door of the oven from cloſing it with that nicety which is requiſite.

In ſetting this *Roaſting-Oven*, the whole of the thickneſs of the vertical front of it ſhould be made to project forward before the brick-work.

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The fire-place doors, aſh-pit, regiſter-door, damper in the chimney, &c. ſhould be ſimilar in all reſpects to thoſe uſed for Roaſters; and the flues ſhould likewiſe be conſtructed in the ſame manner.

I have been the more particular in my deſcription of this *Roaſting-Oven*, becauſe I think it bids fair to become a moſt uſeful implement of cookery. As an oven it certainly has one advantage over all ovens conſtructed on the common principles, which muſt give it a decided ſuperiority; by means of the air-chamber and the ſteam-tube it may be kept clear of all ill-ſcented and noxious fumes, without the admiſſion of cold air.

Of the Difference between a Roaſting-Oven and a Roaſter.

FROM the account of the Roaſting-Oven that has juſt been given, it might be imagined that it poſſeſſes all the properties of the Roaſter, and in the ſame degree; but this is not the caſe. The eſſential difference between them is this; the blow-pipes of the Roaſter being ſurrounded by the flame on all ſides, they are heated *about* as well as below, and the air in paſſing through them is much more expoſed to the heat than it is in paſſing through the air-chamber of the Roaſting-Oven. The particles of air which happen to come into contact with the bottom of the oven will of courſe be heated; but if, in conſequence of their acquired lightneſs on being heated, they riſe upwards

wards to the top of the air-chamber, they will there come in contact with the bottom of the ſhelf, which, inſtead of communicating more heat to them, will deprive them of a part of that which they bring with them from below; but circumſtances are very different in the blow-pipes of a Roaſter; in them, the particles of air require continually additional heat from every part of the ſurface with which they come into contact in their paſſage through the tube.

From this view of the ſubject, we ſee how very eſſential it is that the ſhelf of a Roaſting-Oven ſhould be ſo compoſed or conſtructed, that heat may not readily find its way *through it*; and we ſee likewiſe how neceſſary it is to manage the regiſters of blow-pipes and of air-chambers with proper care.