CHAPTER VI.

Of the uſefulneſs of ſmall Iron Ovens, and of the beſt methods of conſtructing them, and managing them—Reaſons why they have not ſucceeded in many caſes where they have been tried—Ovens may be uſed for other proceſſes of cookery beſides baking—Curious reſults of ſome attempts to boil meat in an oven—Explanation of theſe appearances—Conjectures reſpecting the origin of ſome national cuſtoms.

IN the Firſt Part of this Tenth Eſſay, I recommended ſmall iron ovens for cottagers, and neſts of ſmall ovens for the kitchens of large families; and I have had occaſion to know ſince, that ſeveral perſons have adopted them. I have likewiſe been made acquainted with the reſults of many of the trials that have been made of them, and with the complaints that have been brought againſt them. As I am more than ever of opinion that iron ovens will always be found uſeful when they are properly conſtructed and properly managed, I ſhall in this place add a few obſervations to what I have already publiſhed concerning them.

And in the firſt place I muſt obſerve, that a *ſmall* iron oven ſtands in need of a good door; that is to ſay, of a door well contrived for confining heat; and the ſmaller the oven is, ſo much the

the more neceſſary is it that the door ſhould be good.

The door muſt not only fit againſt the mouth of the oven with accuracy, but it muſt be compoſed of materials through which heat does not eaſily make its way.

An oven door conſtructed of a ſingle ſheet of plate iron, will not anſwer, however accurately it may be made to fit the oven, for the heat will find its way *through it*, and it will be carried off by the cold air of the atmoſphere, which comes into contact with the outſide of it. The bottom of the oven may be made hot by the fire under it; but the top and ſides of it cannot be properly heated, while there is a continual and great loſs of heat through its door. But an oven, to perform well, muſt be very equally heated in every part of it.

If the flame and ſmoke of the fire be made to ſurround an oven on every ſide, and if the fire be properly managed, there can be no difficulty in heating an iron oven equally, and of keeping it at an equal temperature, provided the loſs of heat by and *through* the door be prevented.

If the door be conſtructed of ſheet iron, it muſt either be made *double*, or it muſt be covered on the outſide with a pannel of wood. By a *double door*, I do not here mean *two doors*, but one door conſtructed of two ſheets or plates of iron, placed parallel to and at a certain diſtance from each other; and ſo conſtructed, that the air which is between the two plates may be ſhut up and confined. The two plates or ſheets

of iron, of which the double door of an oven is made, muſt not touch each other, except at their edges (where they muſt join in order to their being faſtened together) for were they to lie one flat upon the other, the heat would paſs too rapidly through them, notwithſtanding there being two of them; but it is not neceſſary that they ſhould be farther aſunder than an inch, or an inch and an half. One of the plates may be quite flat, and the other a little convex. The end of the oven muſt be made quite flat, or level, ſo as to be perfectly cloſed by a flat ſurface placed *againſt* it. The door is that flat ſurface; and the greateſt care muſt be taken that it apply with accuracy, or touch the end of the oven in every part, when it is preſſed againſt it; for if any opening be left, eſpecially if it be near the top of the oven, the hot air in the oven will not fail to make its eſcape out of it.

It never ſhould be attempted to make the door of an oven or of a cloſed fire place fit, by cauſing it to *ſhut into a rabbet.* That is a very bad method; for beſides the difficulty of executing the work with any kind of accuracy, the expanſion of the metal with heat is very apt to derange the machinery, when the door is ſo conſtructed.

From what has been ſaid of the neceſſity of cauſing the door of an oven to fit with accuracy, it is evident that care muſt be uſed to place its hinges properly; and I have found, by experience, that ſuch a door is cloſed more accurately by two turn-buckles, placed at a proper diſtance from each other, than by a ſingle latch. I beg pardon for repeating what has already been ſaid elſewhere.

Of the Management of the Fire in heating an Iron Oven.

In a certain degree of attention is always neceſſary in the management of fire, there is certainly nothing on which we can beſtow our care that repays us ſo amply; and with regard to the trouble of managing a fire in a cloſed fire-place, it is really too inconſiderable to deſerve being mentioned.

Whenever a fire is made under an iron oven, in a cloſed fire-place, conſtructed on good principles, there is always *a very ſtrong draft* or preſſure of air into the fire place; and this circumſtance, which is unavoidable, renders it neceſſary to keep the fire-place door conſtantly cloſed, and to leave but a ſmall opening for the paſſage of the air through the aſh-pit regiſter. The fire-place too ſhould be made very ſmall, and particularly the bottom of it, or the grate on which the fuel burns.

If any of theſe precautions are neglected, the conſequences will be,—the rapid conſumption of the fuel,—the ſudden heating and burning of the bottom of the oven,—and the ſudden cooling of the oven as ſoon as the fire-place ceaſes to be filled with burning fuel.

It is a fact which ought never to be forgotten, "that of the air that forces its way into a cloſed "fire-place, that part only which comes into "actual contact with the burning fuel, and is de-"compoſed by it in the proceſs of combuſtion,

" contributes

" contributes any thing to the heat generated; " and that all the reſt of the air that finds its way " into and *through* a fire-place, is a thief, that ſteals " heat, and flies away with it up the chimney."

The draft occaſioned by a fire in a cloſed fire-place being INTO THE CHIMNEY and not into the fire, cold air is as much diſpoſed to ruſh in *over* the fire, as through it, and it violently forces its way into the hot fire-place by every aperture, even after all the fuel is conſumed, carrying the heat away with it up the chimney and into the atmoſphere. It even makes its way between the bars of the grate whenever they are not quite covered with burning fuel: hence it appears how neceſſary it is to make the grate of a cloſed fire-place ſmall, and to give to that part of the fire-place which is deſtined for holding the fuel, the form of an inverted truncated cone or pyramid, or elſe to make it very deep in proportion to its length and width.

But the prevention of the air from finding its way through the fire-place without coming into contact with the burning fuel, is not the only advantage that is derived from conſtructing cloſed fire-places in the manner here recommended; it ſerves alſo to increaſe the intenſity of the heat in that part of the fire-place which contains the fuel, which tends very powerfully to render the combuſtion of the fuel complete, and conſquently to augment the quantity of heat generated in that proceſs.

To prevent the bottom of the oven (or boiler) from

from being too much affected by this intenſe heat, nothing more is neceſſary than to make the fire-place *ſufficiently ſmall*, and to place it at a ſufficient diſtance below the bottom of the oven. It will be indiſpenſably neceſſary however with ſuch a (ſmall) fire-place, ſituated far below the bottom of an oven, to keep the fire-place door *well cloſed*, otherwiſe ſo much cold air will ruſh in *over the fire*, that it will be quite impoſſible to make the oven hot.

I have found by recent experiments, that a fire-place in the form of an oblong ſquare or priſm, ſix inches wide, nine inches long, and ſix inches deep, is ſufficient to heat an iron oven 18 inches wide, 24 inches long, and from 12 to 15 inches in height; and that the grate of this fire-place ſhould be placed about 12 inches below the bottom of the oven. More effectually to prevent the fire from operating with too much violence upon any one part of the bottom of the oven, the brick-work may be ſo ſloped outwards and upwards on every ſide from the top of the burning fuel to the extreme parts of the ſides and ends of the bottom of the oven, that the whole of the bottom of the oven may be expoſed to the direct rays from the fire.

In ſome caſes I have ſuffered the flame to paſs freely up both ſides of the oven to the top of it, and then cauſed it to deſcend by the end of the oven to the level of its bottom, or rather below it, and from thence to paſs off by an horizontal canal into the chimney; and in other caſes I have cauſed it to paſs backwards and forwards in horizontal

canals

canals by the ſides of the oven, before I permitted it to go off into the chimney. Either of theſe methods will do very well, provided the ſmoke be made to *deſcend* after it has left the top of the oven, till it reaches below the level of the bottom of it, before it is permitted to paſs off into the chimney; and provided the canal by which the ſmoke paſſes off be furniſhed with a damper.

In ſetting an oven proviſion ſhould be made, by leaving holes, to be ſtopped up with ſtoppers, for occaſionally cleaning out all the canals in which the ſmoke is made to circulate; and in order that theſe canals may not too often be choaked up with ſoot, they ſhould never be made leſs than two inches wide, even where they are very deep or broad; and where they are not more than four or five inches deep, they ſhould be from three to four inches wide, otherwiſe they will be very often choaked up with ſoot.

To clean out the flues of an Oven, Roaſter, or large fixed boiler, a ſtrong cylindrical bruſh may be uſed, which may have a flexible handle made of three or more iron wires, about $\frac{1}{8}$ or $\frac{1}{16}$ of an inch in diameter, twiſted together.

Holes cloſed with fit ſtoppers muſt of courſe be left in the brick-work for occaſionally cleaning out theſe flues.

If the iron door of an oven be made double, the outſide of it may with ſafety be japanned black or white, which will prevent its ruſting, and add much to the cleanlineſs and neatneſs of the appearance of the kitchen.

Theſe details may by ſome be thought unimportant and tireſome; but thoſe who know how much depends on minute details in the introduction of new mechanical improvements, will be diſpoſed to excuſe the prolixity of theſe deſcriptions. I wiſh I could make my writings palatable to the generality of readers, but that I fear is quite impoſſible. My ſubjects are too common and too humble to excite their curioſity, and will not bear the high ſeaſoning to which modern palates are accuſtomed.

A great diſadvantage under which I labour is, that of thoſe who *might* profit moſt from my writings, many *will not read*, and others *cannot*.

But to return to my ſubject. To ſave expence, ſmall ovens for poor families may be cloſed with flat ſtones, or with tiles; and the fire-place door for ſuch an oven, and its aſh-pit regiſter, may be made of common bricks placed edgewiſe, and made to ſlide againſt thoſe openings.

There is a circumſtance reſpecting the iron ovens I am deſcribing, which is both curious and important. The fire-place for an oven of the ſmalleſt ſize ſhould be nearly as capacious as one which is deſtined for heating a much larger oven; and I have found by repeated experiments, that a neſt of four ſmall ovens, ſet together, and heated by the ſame fire, will require but very little more fuel to heat them than would be neceſſary to heat one of them, were it ſet alone. An attentive conſideration of the manner in which the heat is applied—of the ſmallneſs of the quantity, in all caſes, that is applied to the heating of the contents of the oven—

and

and the much greater quantity that is expended in heating the fire-place and the flues, will enable us to account for this curious fact, in a manner that is perfectly philoſophical and ſatisfactory.

A cottage oven, 11 inches wide, 10 inches high, and 16 inches long, will require a fire-place five inches wide, five inches high, and ſeven inches long; and for *four* of theſe ovens, ſet together in a neſt, the fire-place need not be more than ſix inches wide, ſix inches high, and eight inches long.

I have in my houſe at Brompton two iron ovens, each 18 inches wide, 14 inches high, and 24 inches long, ſet one over the other, and heated by the ſame fire; and their fire-place is only ſix inches wide, ſix inches high, and nine inches long.

If the fire-place of an iron oven be properly conſtructed, and if the fire be properly managed, it is almoſt incredible how ſmall a quantity of fuel will anſwer for heating the oven, and for keeping it hot. But if the fire-place door be allowed to ſtand open, and a torrent of cold air be permitted to ruſh into the fire-place and through the flues, it will be found quite impoſſible to heat the oven properly, whatever may be the quantity of fuel conſumed under it; and neither the baking of bread, nor of pies, nor any other proceſs of cookery, can be performed in it in a ſuitable manner.

A very moderate ſhare indeed of ingenuity is required in the proper management of a fire in a cloſed fire-place, and very little attention; and as it requires no bodily exertion, but ſaves labour, and

expence, and anxiety; and as moreover it is an intereſting and amuſing occupation, attended by no diſguſting circumſtance, and productive of none but pleaſing, agreeable, and uſeful conſequences; we may, I think, venture to hope, that thoſe prejudices which prevent the introduction of theſe improvements, will in time be removed.

It is not obſtinacy, it is that *apathy* which follows a total corruption of taſte and morals, that is an *incurable* evil;—for that, alas! there is no remedy, but calamity and extermination.

Ovens may be uſed in boiling and ſtewing, and alſo in warming rooms.

THERE are ſo many different ways in which the heat neceſſary in preparing food may be applied, that it would not be ſurpriſing if one ſhould ſometimes be embarraſſed in the choice of them; and I am not without apprehenſion, that I may embarraſs my readers by deſcribing and recommending ſo many of them. The fact is, they all have their different kinds of merit, and in the choice of them regard muſt always be had to the exiſting circumſtances.

Deſirous of contriving a fire-place on as ſimple a conſtruction as poſſible, that ſhould ſerve at the ſame time for heating a room, and for the performance of all the common proceſſes of cookery for a ſmall family, and which moreover ſhould

not

not be expenſive, nor require much attendance, I cauſed four ſmall iron ovens to be ſet in the opening of a common chimney fire-place. Thoſe ovens, which were conſtructed of ſheet iron, and were furniſhed with doors of the ſame ſheet iron, each covered with a pannel of wood to confine the heat, were 16 inches long, 11 inches wide, and 10 inches high each; and they were ſet in brick-work in ſuch a manner, that the fronts of the doors of the ovens being even with the ſide of the room, the original opening of the chimney fire-place, which was large, was completely filled up. Theſe ovens were all heated by one ſmall fire, the cloſed fire-place being ſituated about 12 inches below the level of the bottoms of the two lowermoſt ovens, and perpendicularly under the diviſion between them, and the paſſage into the fire-place was cloſed by a fit ſtopper.

From this deſcription, it will not be difficult for any perſon who has peruſed the preceding chapters of this eſſay, to form a perfect idea of this arrangement; and it is equally eaſy to perceive, that had not the open chimney fire-place, in which theſe four ovens were ſet, been very large, I ſhould have been under the neceſſity of enlarging it, or at leaſt of raiſing its mantle, in order to have been able to introduce theſe ovens, and ſet them at proper diſtances from each other.

I ſhall now proceed to give an account of the experiments that were made with this fire-place.

My firſt attempt was to warm the room by

means of it. A ſmall fire being made in its cloſed fire-place, its oven doors were all ſet wide open, and the room, though by no means ſmall, ſoon became very warm. This warming apparatus was now, to all intents and purpoſes, a German ſtove. By ſhutting two of the oven doors, the heat of the room was ſenſibly diminiſhed; and by leaving only one of them open, it was found that a moderate degree of warmth might be kept up, even in cold weather.

As no perſon in this country would be ſatisfied with any fire-place, if in its arrangement proviſion were not made for boiling a tea-kettle, I cauſed a very broad ſhallow tea-kettle, with a bottom perfectly flat, to be conſtructed of common tin, and filling it with cold water, placed it in one of the two lower ovens, and ſhut the oven door. Although the fire under the ovens was but ſmall, it burnt very bright, and the water in the tea-kettle was ſoon made to boil.

I was not ſurprized that the water boiled in a ſhort time, for it was what I expected; but on removing the tea-kettle I obſerved an appearance which did ſurprize me, and which indicated a degree of heat in the oven which I had no idea of finding there. The handle of the tea-kettle reſembled very much, in form, the handle of a common tea-kettle, but, like the reſt of the kettle, was conſtructed of tin, or, to ſpeak more properly, of tinned ſheet iron.

On removing the kettle from the oven I found

that the tin on its handle had been melted, and had fallen down in drops, which reſted on the body of the kettle below, where they had congealed, having been cooled by the water in the kettle.

This diſcovery convinced me that I ſhould not fail of obtaining in theſe ovens any degree of heat that could poſſibly be wanted in any culinary proceſs whatever: it ſhowed me likewiſe that degrees of temperature, much higher than that of boiling water, may exiſt in a cloſed oven in which water is boiling; and it ſeemed to indicate, that all the different culinary proceſſes of boiling, ſtewing, roaſting, and baking, might be carried on at the ſame time in one and the ſame oven. Subſequent experiments have ſince confirmed all theſe indications, and have put the facts beyond all doubt. Theſe facts are certainly curious, and the knowledge of them may lead to uſeful improvements; for they may enable us to ſimplify very much the implements uſed in cookery.

Having found that I could boil water in my ſmall ovens, my next attempt was to boil meat in them. I put about three pounds of beef, in one compact lump, into an earthen pot, and filling the pot to within about two inches of its brim with cold water, I ſet it in one of the lower ovens, ſhutting the door of the oven, and keeping up a ſmall ſteady fire in the fire-place. In about two hours and three-quarters the meat was found to be ſufficiently boiled; and all thoſe who partook of it (and they were not fewer than nine or ten perſons) agreed in

thinking it perfectly good and uncommonly ſavory. On my guard againſt the illuſions which frequently are produced by novelty, I ſhould have had doubts reſpecting the reality of thoſe *ſuperior qualities* aſcribed to this boiled beef, had not an uncommon appearance in the water in which it had been boiled attracted my attention. This water, after the meat had been boiled in it, appeared to be nearly as tranſparent and as colourleſs as when it was brought from the pump. It immediately occurred to me, that this effect could be owing to nothing elſe but to the ſtate of perfect quiet in which the water muſt neceſſarily have been during the greater part of the time it remained in the oven; and to determine whether this was really the caſe, or not, I made the following deciſive experiment:

Having provided two equal pieces of beef from the ſame carcaſe, I put them into two ſtew-pans of nearly the ſame form and dimenſions; one of them which had a cover, being conſtructed of earthen ware, while the other, which had no cover, was made of copper.

Into theſe ſtew-pans I now put equal quantities of water, with this difference however, that while the water put into the copper ſtew-pan was cold, that put into the other was boiling hot. A ſmall fire being now made in the fire-place, theſe two ſtew-pans, with their contents, were introduced into the two lower ovens. The earthen ſtew-pan was ſet down upon a ten-inch tile, which had previously been placed in the oven, to ſerve as a

ſupport

ſupport for it, in order to prevent the bottom of the ſtew-pan from coming into immediate contact with the bottom of the oven, and the door of that oven was ſhut; but the copper ſtew-pan was ſet down immediately on the bottom of its oven, and the door of that oven was left open during the whole time the experiment laſted.

At the end of three hours, the ſtew-pans were taken out of the ovens, and their contents were examined. The appearances were juſt what I expected to find them. The meat in each of the ſtew-pans was ſufficiently boiled, but there was certainly a very ſtriking difference in the appearance of the liquor remaining in the two utenſils; and if I was not much miſtaken, there was a ſenſible difference in the taſte of the two pieces of meat; that boiled in the earthen ſtew-pan being the moſt juicy and *moſt* ſavory. The water *remaining in* this veſſel—and little of it had evaporated—was ſtill very tranſparent and colourleſs, and nearly taſteleſs, while the liquor in the copper ſtew-pan was found to be a rich meat-broth.

The reſult of this experiment recalled very forceably to my recollection a diſpute I had had ſeveral years before, in Germany, with the cook of a friend of mine, who, at my recommendation, had altered his kitchen fire-place; in which diſpute I now ſaw I was in the wrong, and ſeeing it, felt a deſire more eaſy to be conceived than to be deſcribed, to make an apology to an innocent perſon whom I had unjuſtly ſuſpected of wilful miſrepreſentation.

repreſentation. This woman (for it was a female cook) on being repeatedly reprimanded for ſending to table a kind of ſoup of inferior quality, which, before the kitchen was altered, ſhe had always been famous for making in the higheſt perfection, perſiſted in declaring that ſhe could not make the ſame good rich ſoup in the new faſhioned boilers (fitted up in cloſed fire-places, and heated by ſmall fires) as ſhe uſed to make in the old boilers, ſet down upon the hearth before a great roaring wood fire.

The woman was perfectly in the right. To make a rich meat ſoup, the juices muſt be waſhed out of the meat, and intimately mixed with the water; and this waſhing out in boiling muſt be greatly facilitated and expedited by the continual and rapid motion into which the contents of a boiler are neceſſarily thrown when heat is applied to one ſide of it only, eſpecially when that heat is ſufficiently intenſe to keep the liquid continually boiling with vehemence. I ought, no doubt, to have foreſeen this; but how difficult is it to foreſee any thing!—It is much eaſier to explain than to predict.

If it be admitted that fluids in receiving and giving of heat are neceſſarily thrown into internal motions, in conſequence of the changes of ſpecific gravity in the particles of the fluid, occaſioned by the alteration of their temperatures, we ſhall be able to account, in a manner perfectly ſatisfactory, not only for the appearances obſerved in the experiments

riments above mentioned, and for the ſuperior richneſs of the ſoup made by the Bavarian cook in her boiler, but alſo for ſeveral other curious facts.

When the copper ſtew-pan, containing cold water and a piece of meat, was put into an iron oven, heated by a fire ſituated below it, as the bottom of the oven on which the ſtew-pan was placed was very hot, the heat paſſing rapidly through the flat bottom of this metallic utenſil, communicated heat to the lower ſtratum of the water, which, becoming ſpecifically lighter on being thus heated was crouded out of its place, and forced upwards, by the ſuperincumbent colder and conſequently heavier liquid:—This neceſſarily occacaſioned a motion in every part of the fluid, and this motion muſt have been rapid in proportion as the communication of heat was rapid; and it is evident that it could never ceaſe, unleſs all the water in the ſtew-pan could have acquired and preſerved an equal and a permanent temperature, which, under the exiſting circumſtances, was impoſſible; for as the door of the oven was left open, the upper ſurface of the water was continually cooled by giving of heat to the cold atmoſphere, which, ruſhing into the oven, came into contact with it; and as ſoon as the water was made boiling hot, an internal motion of another kind was produced in it, in conſequence of the formation and eſcape of the ſteam; which laſt motion was likewiſe rapid, and violent in proportion to the rapidity

pidity of the communication of heat. Hence we ſee that the water in the copper ſtew-pan muſt have been in a ſtate of continual agitation from the time it went into the oven till it came out of it; and the ſtate in which this liquid was found at the end of the experiment, was preciſely that which might have been expected, on a ſuppoſition that theſe motions would take place. Let us now ſee what, agreeably to our aſſumed principles, ought to have taken place in the other ſtew-pan.

In this caſe its contents having been nearly boiling hot when the ſtew-pan was put into the oven, and the door of the oven having been kept cloſed, and the ſtew-pan covered with its earthen cover, and the ſtew-pan being moreover earthenware, which ſubſtance is a very bad conductor of heat, and being placed, not immediately on the bottom of the oven, but on a thick tile, every circumſtance was highly favourable, not only for keeping up the equal heat of the water, but alſo for preventing it from receiving additional heat ſo rapidly as to agitate it by boiling. There is therefore every reaſon to think that the water remained at reſt, or nearly ſo, during the whole time it was in the oven: and the tranſparency of this fluid, at the end of the experiment, indicated that little or none of the juices of the meat had been mixed with it.

When the Bavarian cook made ſoup in her own way, the materials (the meat and water) were put into a tall cylindrical boiler, and this boiler was ſet down upon the hearth *againſt* a wood fire, in

ſuch a manner that the heat was applied to *one ſide only* of the boiler, while the other ſides of it were expoſed to the cold air of the atmoſphere; conſequently the communication of the heat to the water produced in it a rapid circulatory motion; and when the water boiled, this motion became ſtill more violent. And this proceſs being carried on for a conſiderable length of time, the juices of the meat were ſo completely waſhed out of it, that what remained of it were merely taſteleſs fibres: but when the ingredients for this meat ſoup, taken in the ſame proportions, were cooked during the ſame length of time in a boiler ſet in a cloſed fire-place, and heated by a ſmall equal fire; this moderate heat being applied to the boiler on every ſide at the ſame time, while the loſs of heat at the ſurface of the liquid was effectually prevented by the double cover of the boiler, the internal motions in the water, occaſioned by its receiving heat, were not only very gentle, but they were ſo divided into a vaſt number of ſeparate aſcending and deſcending ſmall currents, that the mechanical effects of their impulſe on the meat could hardly be ſenſible; and as the fire was ſo regulated that the boiling was never allowed to be at all vehement (the liquid being merely kept gently ſimmering) after the contents of the boiler were once brought to the temperature of boiling, the currents occaſioned by the heating ceaſed of courſe, and the liquid remained nearly in a ſtate of reſt during the remainder of the time that the proceſs

proceſs of cooking was continued; the ſoup was found to be of a very inferior quality, but on the other hand the meat was uncommonly juicy and ſavory.

Theſe minute inveſtigations may perhaps be tireſome to ſome readers; but thoſe who feel the importance of the ſubject, and perceive the infinite advantages to the human ſpecies that might be derived from a more intimate knowledge of the *ſcience* of preparing food, will be diſpoſed to engage with cheerfulneſs in theſe truly intereſting and entertaining reſearches: and ſuch readers, and ſuch only, will perceive that it has not been without deſign, that in chapters devoted to the explanation of ſubjects the moſt humble, I have frequently introduced obſtruſe philoſophical reſearches, and the reſults of profound meditation.

I am not unacquainted with the manners of the age. I have lived much in the world, and have ſtudied mankind attentively; and am fully aware of all the difficulties I have to encounter in the purſuit of the great object to which I have devoted myſelf. I am even ſenſible, fully ſenſible, of the dangers to which I expoſe myſelf.—In this ſelfiſh and ſuſpicious age it is hardly poſſible that juſtice ſhould be done to the purity of my motives; and in the preſent ſtate of ſociety, when ſo few who have leiſure can bring themſelves to take the trouble to read any thing except it be for mere amuſement, I can hardly expect to engage attention.

tion. I may write; but what will writing avail if nobody will read. My bookſeller, indeed, will not be ruined, as long as it ſhall continue to be *faſhionable* to have *fine libraries*. But my object will not be attained, unleſs my writings are read; and the importance of the ſubjects of my inveſtigations are felt.

Perſons who have been ſatiated with indulgences and luxuries of every kind, are ſometimes tempted by the novelty of an untried purſuit. My beſt endeavours ſhall not be wanting to give to the objects I recommend, not only all the alluring charms of novelty, but alſo the power of procuring a pleaſure as new, perhaps, as it is pure and laſting.

How might I exult, could I but ſucceed ſo far as to make it *faſhionable* for the rich to take the trouble to *chuſe for themſelves* thoſe enjoyments which their money can command, inſtead of being the dupes of thoſe tyrants, who, in the garb of ſubmiſſive fawning ſlaves, not only plunder them in the moſt diſgraceful manner, but render them at the ſame time perfectly ridiculous, and fit for that deſtruction which is always near at hand, when good taſte has been driven quite off the ſtage.

When I ſee, in the capital of a great country, in the midſt of ſummer, a coachman ſitting on a coach-box, dreſſed in a thick heavy great coat with ſixteen capes, I am not ſurprized to find the coach door ſurrounded by a groupe of naked beggars.

We

We ſhould tremble at ſuch appearances, did not the ſhortneſs of life, and the extreme levity of the human character, render us inſenſible to dangers while at any diſtance; however great, and impending, and inevitable they may be.

But to return from this digreſſion.

It is frequently uſeful, and is always amuſing, to trace the differences in the cuſtoms and uſages of different countries to their cauſes. The French have for ages been remarkable for their fondneſs for ſoups, and for their ſkill in preparing them: now as national habits of this kind muſt neceſſarily originate at a very early period of ſociety, and muſt depend on peculiar local circumſtances, may not the prevalence of the cuſtom of eating ſoup in France be aſcribed to the open chimney fire-places and wood-fires, which have ever been common in that country?

It is certain that in the infancy of ſociety, before the arts had made any conſiderable progreſs, families cooked their victuals by the ſame fire which warmed them. Kitchens then were not known; and the utenſils uſed in cooking were extremely ſimple, an earthen pot perhaps ſet down before the fire. We have juſt ſeen, that with ſuch an apparatus, ſoups of the very beſt qualities would naturally be produced; and it is not ſurprizing, that a whole nation ſhould acquire a fondneſs for a ſpecies of food, not only excellent in its kind, but cheap, nutritious, and wholeſome, and eaſily prepared.

Had

Had coals been the fuel uſed in France, it is not likely that ſoups would have been ſo generally adopted in that country; for a common coal fire is not favourable for making good ſoups; although with a little management the very beſt ſoups may be made, and every other proceſs of cookery be performed, *in the higheſt perfection*, with any kind of fuel.

When the *ſcience* of cookery is once well underſtood, or an intimate knowledge is acquired of the preciſe nature of thoſe chemical and mechanical changes which are produced in the various culinary proceſſes, we may then, and not till then, take meaſures with certainty for improving the *art* of preparing food. Experience, unaſſiſted by ſcience, may lead, and frequently does lead to uſeful improvements; but the progreſs of ſuch improvement is not only ſlow, but vaciliating, uncertain, and very unſatisfactory. On that account no doubt, it is, that men of ſcience have in all ages been reſpected as valuable members of ſociety.

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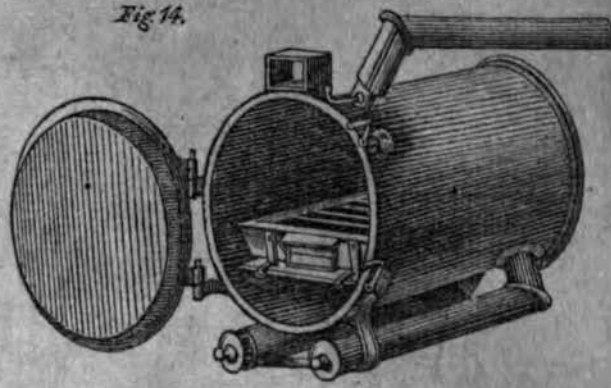
Fig. 14.



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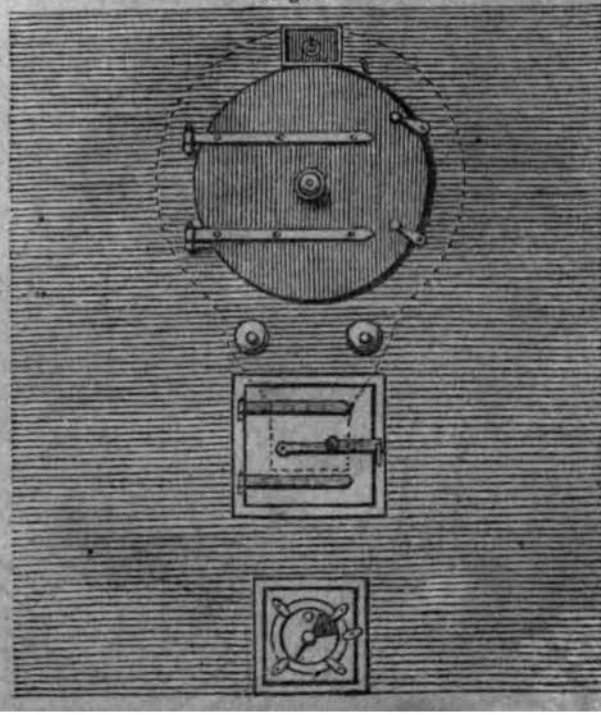

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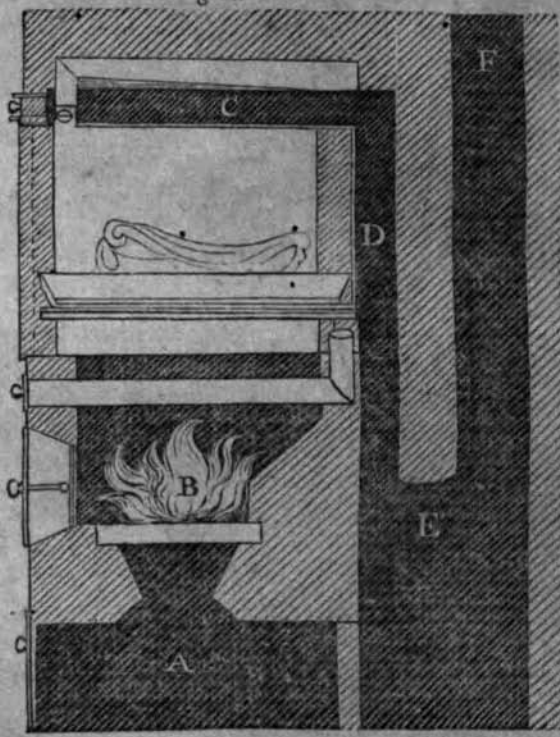

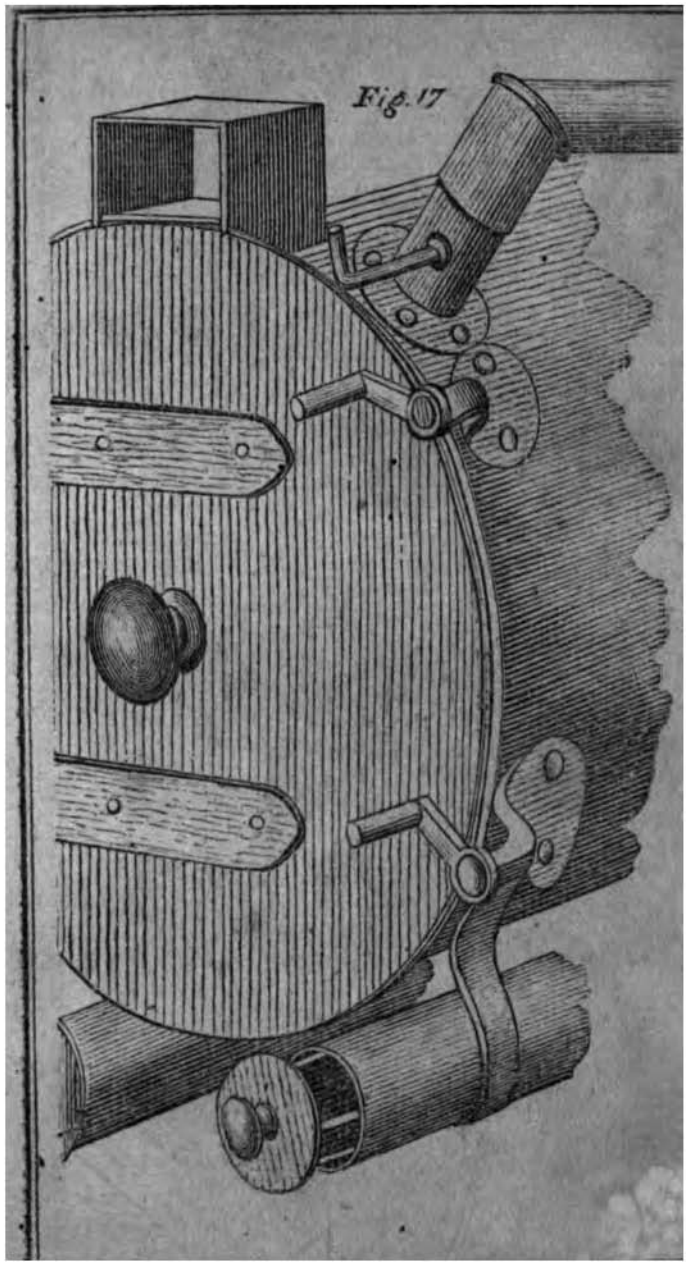
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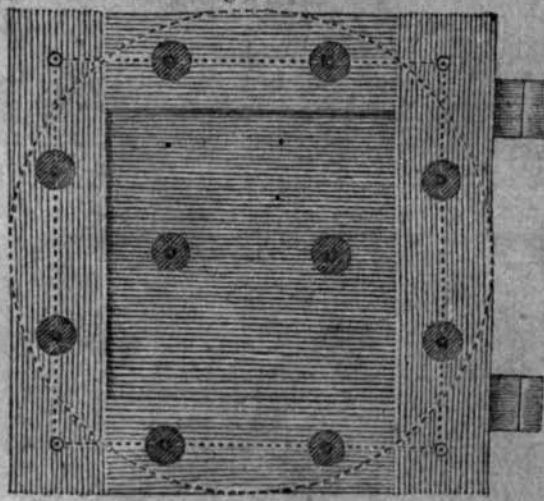
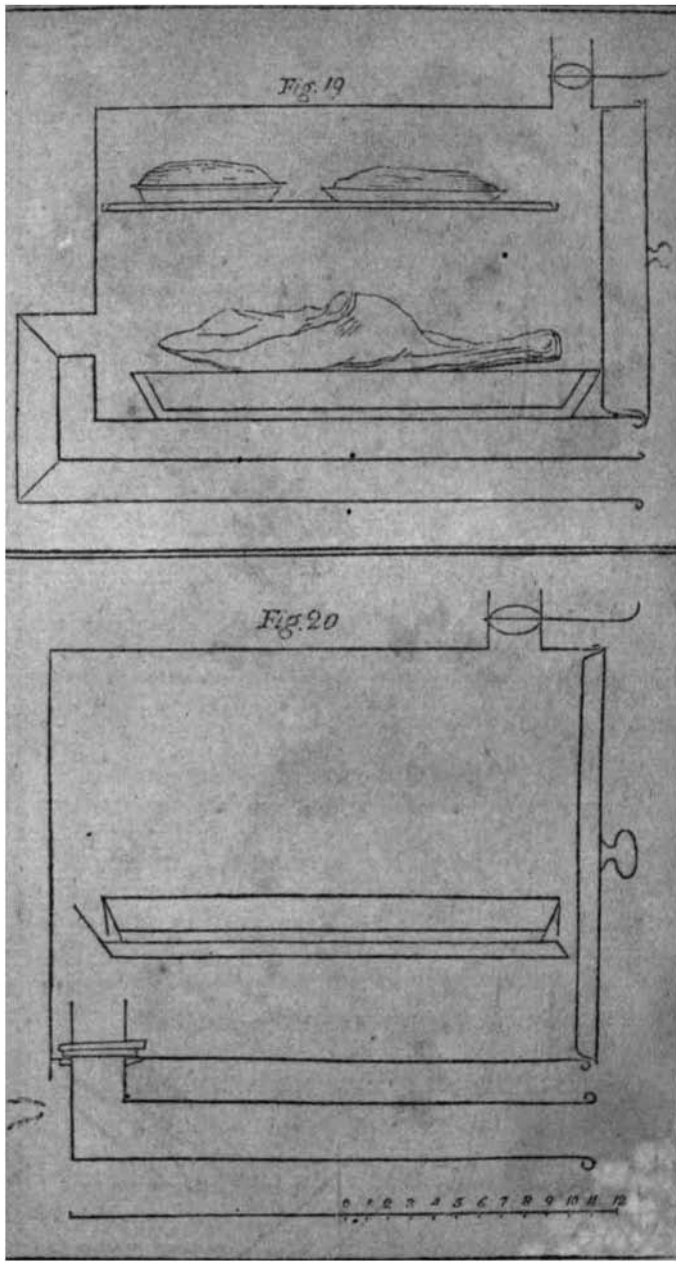
Fig. 18.

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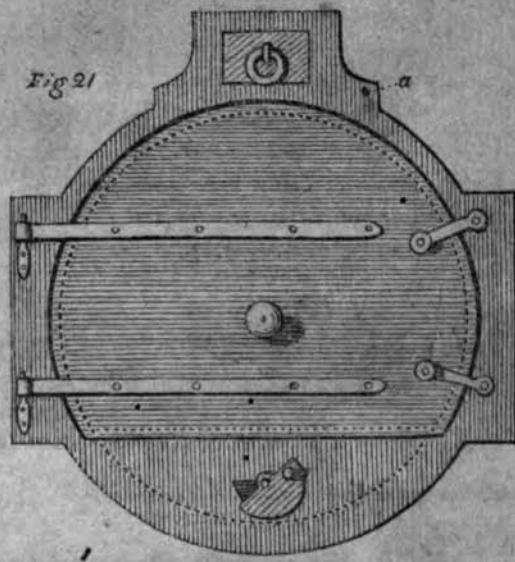
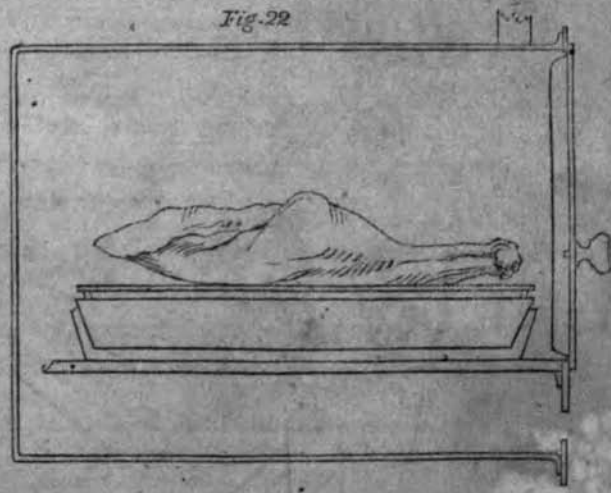


Fig. 22



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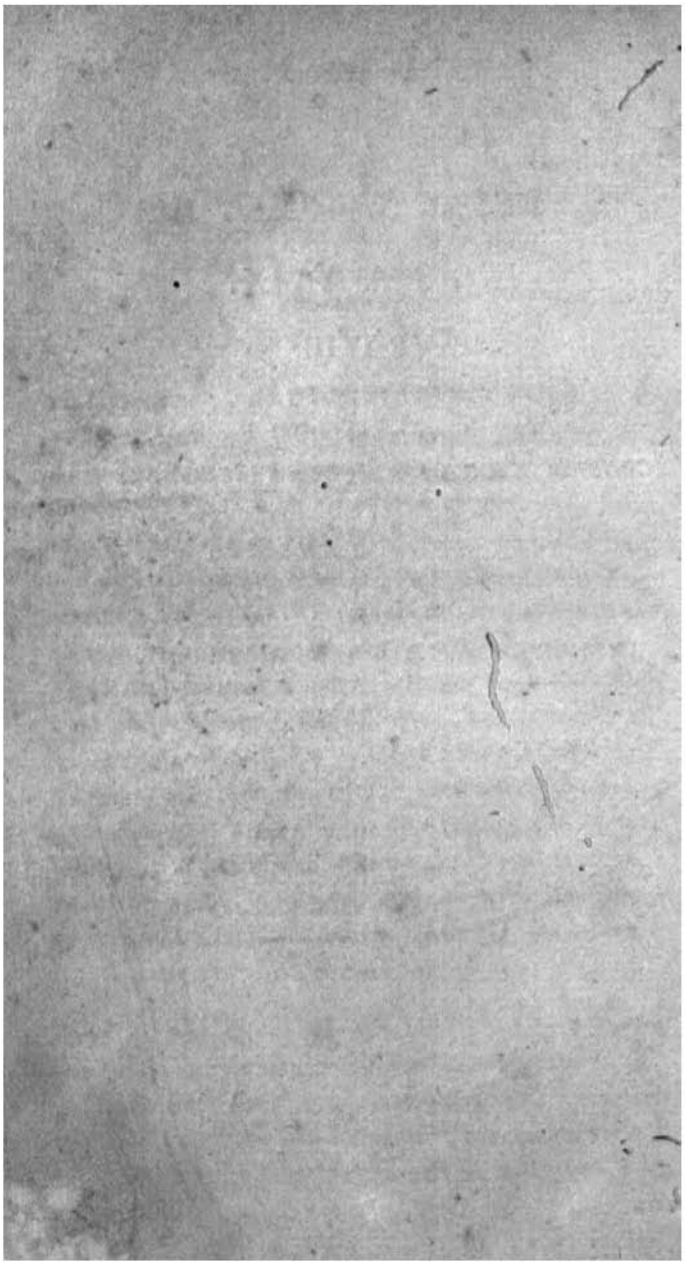


ESSAY X.—PART III.

CHAP. VII.

Of the Conſtruction of Boilers, Stew-pans, &c.—Choice of the Material for Conſtructing Kitchen Utenſils—Objections to copper—Iron much leſs unwholeſome—Of the attempts that have been made in different countries to cover the ſurface of iron boilers with an enamel—Of earthen ware glazed with ſalt—Stew-pans and ſauce-pans of that ſubſtance recommended—Kitchen utenſils of earthen ware may be covered and protected by an armour of ſheet-copper—Wedgewood's ware, unglazed, would anſwer very well for kitchen utenſils—Directions for conſtructing ſtew-pans and ſauce-pans of copper in ſuch a manner as to make them more durable, and more eaſy to be kept clean—Theſe utenſils are frequently corroded and deſtroyed by the operation of what has been called the Galvanic influence—Of the Conſtruction of Covers for kitchen boilers, ſtew-pans, &c.

THE *choice of the material* to be uſed in conſtructing kitchen boilers, ſtew-pans, &c. is a matter of ſo much importance, that I cannot paſs it over in ſilence; though I am very ſenſible that all I can offer on the ſubject will not be ſufficient

to remove entirely the various difficulties I ſhall be obliged to point out.

The objects principally to be had in view, in the choice of materials to be uſed in the conſtruction of kitchen utenſils are, wholeſomeneſs—cheapneſs—and durability. The material moſt commonly uſed for conſtructing kitchen boilers and ſauce-pans is *copper*; but the poiſonous qualities of that metal, and the facility with which it is corroded and diſſolved by the acids which abound in thoſe ſubſtances that are uſed as food, has long been known and lamented; and numerous attempts have been made to prevent its deleterious effects, by covering its ſurface with tin and with other metallic ſubſtances, and with various kinds of varniſh and enamel; but none of theſe contrivances have completely anſwered the purpoſe for which they were deſigned.

The method which has been found to be moſt effectual is, to keep the copper utenſils well tinned, or to tin them afreſh as often as the copper begins to appear, and this is what is now commonly practiſed; but ſtill it were to be wiſhed that ſome good ſubſtitute might be found for that unwholeſome metal.

Iron has often been propoſed; and though it is more liable to be corroded even than copper, yet as the ruſt (oxide) of iron is not poiſonous, though it changes the colour of ſome kinds of food that are cooked in it, and in ſome caſes communicates an

an aſtringent taſte to them, it is not thought to make food unwholeſome.

There is, however, one precaution, by means of which the diſagreeable effects produced by this metal on food, that is prepared in utenſils conſtructed of it, may be very much diminiſhed, and indeed in moſt caſes almoſt entirely prevented, eſpecially when the utenſil is made of *caſt iron*. If, inſtead of ſcouring the inſide of iron boilers and ſtew-pans with ſand, and keeping them bright, which notable houſewives are apt to do, in order that their kitchen furniture may appear neat and clean, they be ſimply waſhed and rinſed out with warm water, and wiped with a ſoft diſh-cloth or towel, the ſurface of the metal will ſoon become covered with a thin cruſt or coating of a dark brown colour, reſembling enamel; which covering, if it be ſuffered to remain, and to conſolidate, will at laſt become ſo hard as to take a very good poliſh, and will ſerve very efficaciouſly to defend the ſurface of the metal from farther corroſion, and conſequently to prevent the food from acquiring that taſte and colour which iron is apt to impart to it.

The proceſs by which this covering is gradually formed, is ſimilar to that by which ſome gunſmiths brown the barrels of fowling-pieces, and could no doubt be greatly expedited by the ſame means which they employ for that purpoſe: the object had in view is likewiſe the ſame in both caſes, namely, by cauſing a hard and impenetrable

covering of ruſt to be formed on the ſurface of the iron, to defend it from a contact with thoſe ſubſtances which are capable of diſſolving or corroding it, or in other words, to prevent the farther progreſs of the ruſt.

For iron utenſils deſigned merely for *frying*, or cooking in fat, there is an eaſy and a very effectual precaution that may be taken for preventing ruſt. It is to avoid putting hot-water into them, and above all to avoid boiling, or even heating water in them. They may occaſionally be waſhed out with warm water; but as often as this is done, great care muſt be taken to wipe them perfectly dry with a dry cloth before they are put away.

The effects produced by this management may be explained in a ſatisfactory manner. As fatty or oily ſubſtances cannot communicate oxigen to iron, (with which that metal muſt unite in order that ruſt may be formed,) and as they prevent the approach of other ſubſtances which could furniſh it (air, water, acids, &c.) as long as the ſurface of the iron is completely covered by them, it is evident that no ruſt can be formed. But boiling hot-water, and more eſpecially water heated and actually made to boil in ſuch a veſſel, could not fail to diſlodge the fat from the ſurface of the metal, and leave it naked and expoſed to every thing that is capable of corroding it.

Kitchen utenſils made of iron may be tinned on the inſide to preſerve them from ruſt; and this is frequently done.—But even tin, though it be much

leſs

leſs liable to be diſſolved by thoſe ſubſtances which are uſed in cookery than iron or copper, yet it is ſometimes ſenſibly corroded by them, and conſequently is taken into the ſtomach with our food.

What its effects may be on the human body, when taken in very ſmall quantities, I cannot pretend to determine.—In large doſes it is well known to be a fatal poiſon.

That the tin with which the inſides of kitchen-boilers and ſtew-pans are covered, is actually corroded in many of the proceſſes of cookery, is rendered highly probable by the very ſhort time that ſuch a coating laſts, when the utenſil is in daily uſe; but I had, not long ſince, a ſtill more ſtriking proof of that fact. Learning by accident from my cook, that a diſh of which I am very fond, *(ſtewed pears*, which I frequently eat with bread and milk for my ſupper,) require three hours boiling, it occurred to me, that as this proceſs was performed in a copper ſtew-pan, tinned, and as it laſted ſo long a time, the tin might perhaps be attacked, and ſome part of it diſſolved by the acid of the pears, or by that of the ſugar which was mixed with them. In order that I might be able to enjoy my favourite diſh, free from all apprehenſions of being poiſoned, I ordered it to be always prepared in future in a ſtew-pan of porcelain: but ſeveral of theſe veſſels having been deſtroyed in a ſhort time by the fire, in this proceſs, I found myſelf obliged to abandon this ſcheme on account of theſe fre-

quent accidents: and I now had recourſe to my Roaſter.

The pears, being previouſly cut in quarters, and freed from their ſkins, ſeeds, and cores, were put with a ſufficient quantity of water and ſugar, into a ſhallow glaſs baſin fitted with a glaſs cover, and this baſin being placed upon a brick, was put into the Roaſter, and a ſmall fire being made under it, the water in the baſin was ſoon brought to boil, and in leſs than three hours the pears were found to be ſufficiently done.

When they were ſerved up, I obſerved that their colour was different from what it had always been before; and enquiring into the cauſe of it, I was let into a ſecret which explained the matter completely. The cook informed me, that it was abſolutely impoſſible to give *a beautiful red colour* to ſtewed pears without ſome metal, and that their colour would not have been ſo fine as it was when they were cooked in porcelain, had not the precaution been taken *to boil a pewter ſpoon with them.* The Reader can eaſily imagine how much I was ſurprized at receiving this unexpected information.

This ingenious contrivance is ſimilar to one ſometimes uſed in this country—that of boiling *half-pence* with greens to give them a fine colour.

Several years ago a variety of attempts were made in Sweden to improve cooking utenſils made of iron, by covering them on the inſide with a kind of enamel, to protect them from ruſt; and ſince

ſince that time a conſiderable manufacture of caſt-iron boilers and ſtew-pans, covered within with white enamel, was eſtabliſhed by Count Heinitz, on his eſtate in Sileſia; but this ſcheme has not ſucceeded intirely, owing to the difficulty of finding an enamel capable of uniting with iron, the expanſion of which with heat ſhall be ſo nearly equal to the expanſion of iron, as not be liable to crack and fly off upon being ſuddenly expoſed to heat and to cold; and even were it poſſible to compoſe an enamel that would withſtand the effects of the heat and the cold, and the blows to which it would be expoſed in the buſineſs of the kitchen, there would ſtill remain a very important point to be aſcertained, which is, whether the matter of which the enamel is compoſed *is not itſelf of a poiſonous nature*, and whether there is not reaſon to apprehend that it might communicate its deleterious qualities to the food?

Lead is an eſſential ingredient in moſt, if not all enamels, and as its effects are known to be extremely pernicious to health, under all its various forms, when taken internally, it would be highly neceſſary to aſcertain, by the moſt rigid experimental inveſtigation, whether the enamel of kitchen utenſils contains any lead, or other noxious metals or unwholeſome ſubſtance; and if this be the caſe, whether ſuch poiſonous ſubſtance be liable to be corroded and diſſolved, or mixed in any other manner with the food.

It

It is poſſible that a poiſonous ſubſtance may be ſo fixed, on being mixed and united with other ſubſtances, as to render it perfectly inſoluble, and conſequently perfectly inert and harmleſs; but ſtill the fact ought to be well aſcertained before it is admitted.

A large proportion of the calx of lead enters into the compoſition of flint glaſs, yet it is not probable that flint glaſs ever communicates any thing poiſonous to food or drink that is kept in it. But on the other hand there is reaſon to conclude, that the glazing of common pottery, which is likewiſe compoſed in part of calx of lead, is not equally ſafe, when earthen veſſels covered with it are uſed as implements of cookery.—In ſome countries the uſe of ſuch veſſels in the proceſſes of boiling and ſtewing is forbidden by the laws, under ſevere penalties; and in this country it is not cuſtomary to uſe earthen veſſels, ſo glazed, for preſerving pickles, and other ſubſtances deſigned for the uſe of the table, which contain ſtrong acids.

The beſt glazing for earthen veſſels that are to be uſed in preparing or preſerving food, is moſt undoubtedly made with common ſalt; as this glazing (which appears to be merely the beginning of a vitrification of the earth at the ſurface of the veſſel) is not only very hard and durable, but it is alſo perfectly inſoluble in all the acids and other ſubſtances in common uſe in kitchens; and contains nothing poiſonous or unwholeſome.

A large proportion of lead enters into the compoſition of pewter; but it has lately been proved by many ingenious experiments made to aſcertain the fact, that the lead, united to tin, and the other metallic ſubſtances that are uſed in compoſing pewter, is incomparably leſs liable to be diſſolved by acids, and conſequently much leſs unwholeſome, than when it is pure or unmixed with other metals. This fact is very important, as it tends to remove all apprehenſion reſpecting the unwholeſomeneſs of a very uſeful compound metal, which from its cheapneſs, as well as on account of its durability, renders it peculiarly well adapted for many domeſtic uſes. It would not however be adviſeable to boil or ſtew any kind of food, eſpecially ſuch as contain acids, in pewter veſſels; nor ſhould acid ſubſtances ever be ſuffered to remain long in them.

The beſt, or at leaſt the moſt wholeſome material for ſtew-pans and ſauce-pans is, undoubtedly, earthen ware, glazed with ſalt*. Several manufactories

* Nothing is more pernicious than the glazing of common coarſe earthen ware. There is no objection to *unglazed* earthen ware, but its being apt to imbibe moiſture, which renders it difficult to be kept clean. I have lately ſeen ſome kitchen utenſils of very fine, compact, unglazed earthen ware, bought at Mr. Wedgewood's manufactory, which I thought very good. They were made thin, and ſeemed to ſtand the fire very well; and as their ſurface was very ſmooth, they were eaſily kept clean. I wiſh that the intelligent gentlemen, who direct that noble manufactory, would turn their attention to the improvement

factories of this kind of pottery have lately been eſtabliſhed in this country, and one in particular in the King's Road, at Chelſea, which belonged to the late Mrs. Hempel, which is, I believe, now carried on by her ſons. The principal reaſon why this article has not long ſince found its way into common uſe, is, no doubt, the brittleneſs of earthen ware, and its being ſo liable to crack on being ſuddenly expoſed to heat, or to cold; for, excepting this imperfection, it has every thing to recommend it. It is perfectly wholeſome (when glazed with ſalt); and is kept clean with little trouble; and things cooked in it are much leſs liable to be burnt to the ſides of the veſſel, and ſpoilt, than when the utenſil is formed of a metallic ſubſtance.

There is a very great difference in earthen ware, in reſpect to its power of withſtanding the heat, without injury, on being ſuddenly expoſed to the action of a fire; ſome kinds of it being much leſs liable to crack, and fly, when ſo expoſed, than others; and in order to take meaſures with certainty for diminiſhing this imperfection, we have only to conſider the cauſes from which it proceeds. Now, it is quite certain, that the cracking of an earthen veſſel on its being put over a fire, is owing to *two* circumſtances—the brittleneſs of the ſubſtance

ment of an article ſo nearly connected with the health, comfort, and peace of mind, of a great portion of ſociety. Stew-pans of this material, ſuſpended in a cylindrical armour of ſheet iron, would be admirably calculated for the regiſter ſtoves I ſhall recommend. Some of theſe ſtoves may be ſeen in the Great Kitchen of the Royal Inſtitution.

ſtance—and the difficulty or ſlowneſs with which heat paſſes through it; for it is evident, that neither of theſe circumſtances, alone, or acting ſingly, would be capable of producing the effect.

As heat expands all ſolid bodies, if one ſide of a veſſel, compoſed of a brittle ſubſtance, be ſuddenly heated, and *expanded*, it muſt crack, or rather, it muſt cauſe the other ſurface to crack, unleſs the heat can make its way through the ſolid ſubſtance of the veſſel, and heat and expand that other ſurface ſo expeditiouſly as to prevent that accident. Now as heat paſſes *through* a veſſel which is thin, ſooner than through one (compoſed of the ſame material) which is thicker, it is evident that the *thinner* an earthen veſſel for cooking is made, the leſs liable will it be to receive injury on being expoſed to ſudden heat or cold.

I mention ſudden *cold* as being dangerous, and it is eaſy to ſee why it muſt be equally ſo with ſudden heat. If a brittle veſſel be (by ſlow degrees) made very hot, if the heat be equally diſtributed throughout the whole of its ſubſtance, this heat, however intenſe it may be, will have no tendency whatever to cauſe the veſſel to crack; for the expanſion being equal at the two oppoſite ſurfaces, the *tenſion* at thoſe ſurfaces will be equal alſo; but if cold water be ſuddenly poured into a veſſel ſo heated, its internal ſurface will be ſuddenly cooled, and as ſuddenly *contracted*; and as the external ſurface cannot contract, being forceably kept in a ſtate of expanſion by the heat, the

the inſide ſurface muſt neceſſarily crack, in conſequence of its contraction, and this fracture will make its way immediately through the whole ſolid ſubſtance of the veſſel from the inſide to the outſide ſurface.

Sudden HEAT applied to one ſide, or ſurface, of a brittle veſſel cauſes the *oppoſite* ſide of it to crack; but ſudden COLD *cauſes the ſide to crack to which the cold is applied.*

By forming diſtinct ideas of what happens in theſe two caſes, every thing relative to the ſubject under conſideration will be rendered perfectly clear and intelligible.

The *form* of a veſſel has a conſiderable effect in rendering it more or leſs liable to be cracked and deſtroyed by ſudden heat or cold. All flat ſurfaces, ſharp corners, and inequalities of thickneſs, ſhould, as much as poſſible, be avoided. The globular form is the beſt of all, and next to it are thoſe forms which approach neareſt to it; and the thinner the utenſil is made, conſiſtent with the requiſite ſtrength to reſiſt occaſional blows, the better it will be in all reſpects.

The beſt compoſition for earthen ware for culinary purpoſes is, I am told, pounded Heſſian cruſibles, or any kind of broken earthen ware of that kind, reduced to powder, and mixed with a very ſmall proportion of Stourbridge clay.

The method of glazing this ware with ſalt is by throwing decripitated common ſalt into the top of the kiln, with an iron ladle, through ſix or eight holes

holes made for that purpoſe in different parts of the top of the kiln. Theſe holes, which need not be more than four inches in diameter, each, may be kept covered with common bricks laid over them.

The ſalt ſhould not be thrown in till the ware is ſufficiently burnt, and till it has acquired the moſt intenſe heat that can be given it; and the holes ſhould be immediately cloſed as ſoon as the ſalt is thrown in. If as much as a large handful of ſalt be thrown into each hole, that will be ſufficient, unleſs the kiln be very large.

The ſalt is immediately reduced to vapour by the intenſe heat, and this vapour expands itſelf, and fills every part of the kiln, and diſpoſes the ware to vitrify at its ſurface.

I have made ſeveral attempts to protect ſtew-pans and ſauce-pans of earthen ware from danger from ſudden heat, and from accidental blows, by covering them on the outſide with ſheet-copper, and with ſheet-iron, and in theſe attempts I have ſucceeded tolerably well. Several ſtew-pans covered in this manner may be ſeen in the kitchen, and in the repoſitory of the Royal Inſtitution. As the ſubject is of infinite importance to the health and comfort of mankind, I wiſh that ſome ingenious and enterprizing tradeſman would turn his attention to it.

As cooking utenſils of tinned iron are incomparably leſs dangerous to health than thoſe which are made of copper, I have taken conſiderable pains

to

to get ſerviceable ſtew-pans and ſauce-pans made of that material. The great difficulty was to unite durability with cheapneſs and cleanlineſs. How far I have ſucceeded in this attempt will be ſeen hereafter.

As it is probable the copper ſtew-pans and ſauce-pans will continue to be uſed, at leaſt for a conſiderable time to come, notwithſtanding the objections which have ſo often been made to that poiſonous metal; I ſhall proceed to an inveſtigation of the beſt *forms* for thoſe utenſils.

Before I proceed to a conſideration of the improvements that may be made in the forms of kitchen utenſils, I muſt beſpeak the patience of the reader. It is quite impoſſible to make the ſubject intereſting to thoſe who read merely for amuſement; and ſuch would do well to paſs over the remainder of this chapter without giving it a peruſal; but I dare not treat any part of a ſubject lightly, which I have promiſed to inveſtigate. Beſides this, I really think the details, in which I am now about to engage, of no inconſiderable degree of importance; and many other perſons will, no doubt, be of the ſame opinion reſpecting them. The ſmalleſt real improvement of any utenſil in general and daily uſe, muſt be productive of advantages that are incalculable. It is probable that more than a million of kitchen-boilers and ſtew-pans are in uſe every day, in the United Kingdom of Great Britain and Ireland; and the providing and keeping kitchen furniture in repair is a heavy article of expence in

houſekeeping. I am certain that this expence may be conſiderably leſſened; and in doing this, that kitchen utenſils may be made much more convenient, neat, and elegant, than they now are.

As it is indiſpenſably neceſſary, in recommending new mechanical improvements, not only to point out what alterations ought to be made, but alſo to ſhow diſtinctly *how the work to be done, can be executed in the eaſieſt, and beſt manner*; the fear of being by ſome thought prolix and tireſome, muſt not deter me from being very particular and minute in my deſcriptions and inſtructions.

In juſtice it ought always to be remembered, that my object in writing is, profeſſedly to be uſeful; and that I lay no claim to the applauſe of thoſe delicate and ſevere judges of literary compoſition, who read more with a view to being pleaſed by fine writing, than to acquire information. If thoſe who are quick of apprehenſion are ſometimes tempted to find fault with me for being too particular, they muſt remember, that it is not given to all to be quick of apprehenſion;—and that it is amiable to have patience, and to be indulgent.—But to proceed.

As the fire employed in heating ſtew-pans, ſauce-pans, &c. may be applied in a variety of different ways; and as the form of the utenſil ought in all caſes to be adapted to the form of the fire-place, and to the mode of applying the heat, it is neceſſary, in laying down rules for the conſtruction of ſtew-pans and kitchen boilers, to take into conſidera-

tion the conſtruction of the fire-places, in which they are to be uſed. But kitchen fire-places, conſtructed on the beſt principles, are ſuſceptible of a variety of different forms,

In the ſpacious dwellings of the rich, where large rooms are ſet apart for the ſole purpoſe of cooking, a number of ſeparate fire-places, in large maſſes of brick-work, conſtructed on the principles adopted in the kitchen of Baron de Lerchenfeld, at Munich, will be found moſt convenient; (ſee page 39, Part I. of this Eſſay*); but for perſons of moderate fortunes, to whom the economy of houſe-room is an object of importance, a leſs expenſive arrangement may be choſen.

It is very eaſy (as will be ſhewn hereafter) ſo to arrange the implements neceſſary in cooking for a moderate family, as to leave the kitchen, not merely an habitable, but alſo a perfectly comfortable, and even an elegant room. All thoſe who have ſeen the kitchen in my houſe, at Brompton,

* For all ſuch fire-places, at leaſt for all ſuch as are deſtined for heating ſtew-pans and ſauce-pans, I am quite ſure that *wood* is the cheapeſt fuel that can be uſed, even here in London, where it bears ſo high a price. It is certainly the moſt cleanly, and moſt convenient, and makes the moſt manageable fire. I found by an experiment, made on purpoſe to aſcertain the fact, that any given quantity of wood, burnt in a cloſed fire-place, gives very near *three times* as much heat as it would give if it were firſt reduced to charcoal, and then burnt in the ſame fire-place. But the great advantage of uſing wood as fuel in the ſmall fire-places of ſtew-pans and ſauce-pans, is, the facility with which it may be kindled, and the facility and quickneſs with which the fire may be put out (by ſhutting the dampers) when it is no longer wanted.

ton, (which was fitted up principally with a view to exemplify that important fact) will not doubt the truth of this aſſertion.

In treating the ſubject I have propoſed to inveſtigate in this chapter, I ſhall firſt conſider what forms will be beſt for ſauce-pans and ſtew-pans that are deſigned to be uſed in fixed fire-places; and ſhall then ſhew how thoſe ſhould be conſtructed, which are deſigned to be heated in a different manner.

Of the Conſtruction of Sauce-pans and Stew-pans for fixed Fire-places.

The reaſons have already been given why ſtew-pans and ſauce-pans ought always to be circular. They are indeed always made in that form; but ſtill, as they are commonly conſtructed, they have a fault which renders them but ill adapted for the cloſed fire-places I have recommended. Their handles being faſtened to them on their outſides (by rivets) the regularity of their form is deſtroyed, and they cannot be made to fit well to the circular openings in their fire-places, which they ought to occupy, and to fill.

There are two ways in which this imperfection may be remedied; the firſt, which is the leaſt expenſive, but which is alſo at the ſame time the leaſt perfect, is to rivet the handle to the *inſide* of the ſauce-pan. This leaves the *outſide* of the ſauce-pan circular, or cylindrical, that is to ſay, if care is taken to beat down the heads of the rivetting nails,

and

and to make them flat and even with the outſide ſurface of the veſſel; but the regularity of the form of the inſide of the ſauce-pan will in this caſe be ſpoiled by that part of the handle that enters the ſauce-pan; which circumſtance will not only render it more difficult to keep the ſauce-pan clean; but will alſo make it impoſſible to cloſe it well with a circular cover. The cover may indeed be ſo contrived as to fit the opening of the ſauce-pan, by making a notch in one ſide of it to receive that part of the handle which is in the way; and in this manner I have ſometimes cauſed kitchen utenſils already on hand to be altered and made to ſerve very well for cloſed fire-places. The Figures 23 and 24 will give a perfect idea of the manner in which theſe alterations were executed.

Fig. 23.

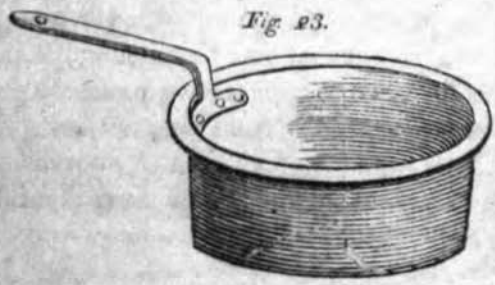
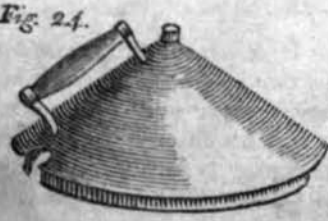


Fig. 24.



But

But, when new ſauce-pans and ſtew-pans are conſtructed, I would ſtrongly recommend the following more ſimple and more advantageous contrivance:

A circular rim of iron ſhould be provided for each ſauce-pan, with a handle belonging to it, of the form here repreſented:

Fig. 25.

and by forming the ſauce-pan to this rim, its form at its brim will be circular *within* and *without*; and conſequently the ſauce-pan will exactly fit the circular opening of its fire-place, and will at the ſame time be exactly fitted by its *circular cover*. No attention will in that caſe be neceſſary, in putting on the cover, to place it in any particular manner or ſituation,—and the ſauce-pan, not being pierced with holes for rivets, will, on that account, be leſs liable to leak, and will alſo be more durable, and more eaſily kept clean*.

The

* One reaſon is obvious why ſtew-pans without rivets ſhould be more durable than thoſe which have their handles rivetted to them; but there is another reaſon more occult, which requires the knowledge of a late diſcovery in chemiſtry, to underſtand. When iron and copper, in contact with each other, are placed in a ſituation in which they are expoſed to be frequently wetted, they act on each other, very powerfully, and one of the metals

The circular iron rim above recommended ſhould be broad and flat; from $\frac{2}{10}$ to $\frac{3}{10}$ of an inch in thickneſs, and from $\frac{1}{2}$ an inch to $\frac{3}{4}$ of an inch in width. Its handle, which muſt be welded faſt to it, and muſt project from one ſide of it, may be from $1\frac{1}{4}$ inch to $1\frac{3}{4}$ in width, from 6 to 8 or 10 inches long, and of the ſame thickneſs as the circular rim, where it joins it.

The under ſide of this flat iron rim ſhould be made perfectly flat, in order that the ſauce-pan,

metals will ſoon be deſtroyed by ruſt. When ſhips firſt began to be covered with copper this fact was not known, and great inconvenience was found to ariſe from the rapid decay of the iron bolts in the veſſels ſo covered. As there appeared to be no remedy for this evil, it was found neceſſary to ſubſtitute copper bolts for iron bolts, in conſtructing ſhips intended to be coppered. Theſe effects are now known to depend on what (from the name of its diſcoverer) has been called the *Galvanic influence*.

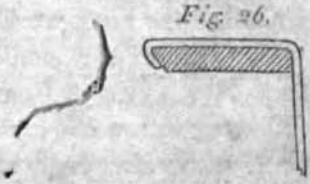
It appears to me to be highly probable that ſtew-pans and ſauce-pans, conſtructed in the manner above deſcribed, would laſt more than twice as long as thoſe made in the uſual manner. Frequent attempts have been made to line copper boilers and ſauce-pans with tinned iron (commonly called ſheet-tin) in order to guard againſt the poiſonous qualities of the copper; but none of theſe have ſucceeded ſo well as was expected: the tin being found to be deſtroyed by ruſt with uncommon rapidity. This, no doubt, was owing to the influence of the ſame cauſe by which the iron bolts of coppered ſhips were ſo ſuddenly deſtroyed.

If handles muſt be riveted to the ſides of copper ſauce-pans or boilers, ſuch handles ſhould be made of copper, and not of iron; and the nails by which they are faſtened, ſhould likewiſe be copper. They would coſt ſomething more, at firſt, but the utenſils would laſt ſo much longer, that they would turn out to be much the cheapeſt in the end.

by being ſuſpended by it in its fire-place, may ſo completely cloſe the circular opening of the fire-place, as to prevent the ſmoke from coming into the room; and alſo to prevent (what would be much more likely to happen)—the cold air of the room from deſcending into the fire-place, and mixing *there* with the flame and ſmoke, and afterwards going off, thus heated, through the chimney, into the atmoſphere.

The copper ſauce-pan or ſtew-pan is to be faſtened to its iron rim by being turned over its outward edge; and in order that the copper, thus turned over the outward edge of the iron rim, may hold faſt without projecting below the level of the lower flat ſurface of the ring (which would be attended with inconvenience), the lower part of the outward edge of the ring muſt be chamfered away, in the manner repreſented in the following figure (26), which ſhews a vertical ſection of the ring, of the full ſize, with the copper turned over it.

Fig. 26.



The upper inſide edge of this iron ring may be rounded off, as it is repreſented to be in the above figure. In this figure the ſection of the ring is diſtinguiſhed by diagonal lines; and that of the

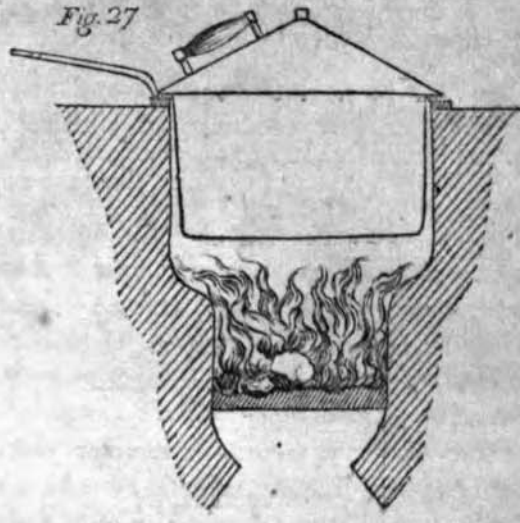
copper, (which is turned over it), by two parallel crooked lines.

When ſtew-pans and ſauce-pans are conſtructed on the principles here recommended (with flat circular iron rings), an advantage will be attained, which in many caſes will be found to be of no ſmall importance: they will be well adapted for being uſed in ſmall portable fire-places, heated by charcoal; or in portable ſtoves, heated (or rather kept hot) by heaters. Deſcriptions of theſe portable fire-places and heater-ſtoves will be given in the ſequel of this work.

As the upper part of the circular opening of the fire-place (Fig. 27.) on the top of which the lower part of the circular rim of the ſauce-pan repoſes, is nearly on a level with the top of the ſolid maſs of the brick-work, it is neceſſary that the handle of the ſauce-pan ſhould be bended upwards, ſo as to be above the level of the brim of the ſauce-pan; otherwiſe, when the ſauce-pan is in its place, there would not be room between the handle and the ſurface of the brick-work for the fingers to paſs in taking hold of the handle to remove the ſauce-pan. This is evident from a bare inſpection of the following figure (27); which repreſents the ſection of a ſauce-pan conſtructed on the plan here propoſed, fitted into its fire-place.

There

Fig. 27



There ſhould be a round hole, about a ¼ of an inch in diameter, near the end of the handle, by which the ſauce-pan may occaſionally be hung up on a nail, or peg, when it is not in uſe. The cover belonging to the ſauce-pan may be hung up on the ſame nail, or peg, by means of the projection of its rim.

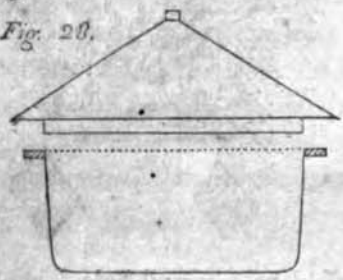
Theſe will be thought trifling matters; but it muſt not be forgotten that convenience, and the economy of time, are often the reſult of attention to the arrangement of things apparently of little importance.

In conſtructing *the cover of a ſauce-pan*, care muſt be taken to avoid a fault, into which it is eaſy to fall, and which, as I have found by experience, will be attended with diſagreeable conſequences.

ſequences. The circular plate of tin, or of thin ſheet-copper tinned, which forms the bottom of the cover, ſhould be of the ſame diameter *preciſely* as the outſide of the brim of the ſauce-pan.

I once thought it would be better to make the bottom of the cover rather *larger* than the top of the brim of the ſauce-pan, as it is repreſented in the following ſection.

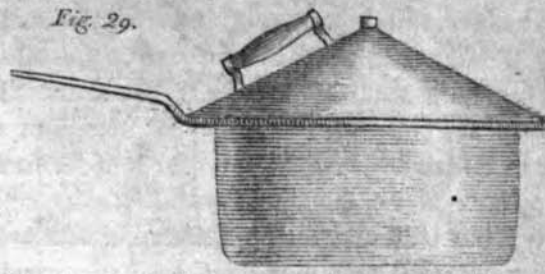
Fig. 28.



I imagined that it would prevent any thing that happened by accident to be ſpilled on the cover, from finding its way into the ſauce-pan, and ſpoiling the victuals; and this indeed it would do moſt effectually; but it often occaſioned another accident not leſs diſagreeable in its effects; it drew the ſmoke into the ſauce-pan, which happened to eſcape by the ſides of the circular opening of the fire-place.

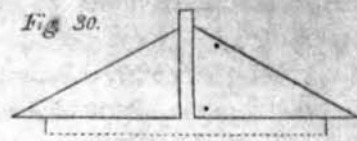
When the cover is preciſely of the ſame diameter as the brim of the ſauce-pan, there is little danger of any thing entering the ſauce-pan in this manner, as will be evident from an inſpection of the following figure.

Fig. 29.



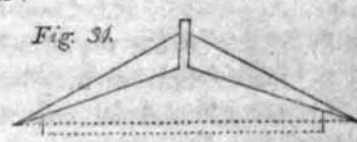
The bottom of the cover may either be made quite flat, as in this ſection:

Fig. 30.



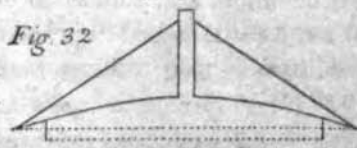
Or it may be made concave, and of a conical form, thus:

Fig. 31.



Or concave, and of a ſpherical figure, as is repreſented in the following figure:

Fig. 32



The only utility derived from making the bottom of the cover hollow, inſtead of flat, is, that a little more room is left for the boiling up, or ſwelling of the contents of the ſauce-pan. Cooks will be beſt able to judge how far this is an object of importance.

In

In each of the three laſt figures, a ſection of the tube which carries off the ſteam is ſhewn, as alſo a ſection of the rim of the cover that enters the ſauce-pan. This rim, which may be from ¼ of an inch to 1 inch in breadth, ſhould be made to fit the opening of the ſauce-pan with ſome degree of nicety; but it ſhould not be fitted ſo cloſely as to require any effort in removing it, or ſo as to render it neceſſary to uſe both hands in doing it—one to hold the ſauce-pan faſt in its place, and the other to take off its cover.

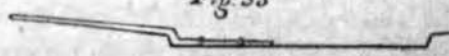
The ſteam tube of the cover, which may be ½ an inch or ⅓ of an inch in diameter, and ſhould project about ½ an inch above the top of the cover, muſt paſs through both the top and the bottom of the cover, and muſt be well fitted and ſoldered in both, in order that the air between the top of the cover and its bottom may be confined and completely cut off from all communication with the ſteam, and alſo with the external air. This ſteam tube ſhould have a fit ſtopple, which may be made of wood, and which, to prevent its being loſt, ſhould be attached to the top of the cover, by a ſmall wire chain, about 2 or 3 inches long.

In reſpect to the handles of theſe covers, the choice of the form to be adopted may be left to the workman who is employed to make the cover; for, excepting in certain caſes, which will be particularly noticed hereafter, it is a point of little importance.

It is right that I ſhould obſerve here, that though the covers I have here deſcribed are ſuch as I have generally recommended, yet others of different forms may be conſtructed on the ſame principles that very poſſibly may anſwer quite as well as theſe, and coſt leſs. The ſteam tube, for inſtance, for ſmall ſauce-pans, may with ſafety be omitted, and the ſteam be left to make its way between the rim of the cover and the ſauce-pan; and ſhould it be thought an improvement, the upper part of the cover, inſtead of being a cone, may be a ſegment of a ſphere.

The following figure is the ſection of the cover of a ſauce-pan, now in general uſe in this country.

Fig. 33



It is made of a circular piece of ſheet copper, and its handle, which is of iron, is faſtened to it by rivets; and it is tinned on the under ſide. Its form is ſuch that it fits without a rim into the ſauce-pan to which it belongs.

This cover might be greatly improved, and perhaps rendered as well adapted for confining heat as any metal cover whatever, merely by covering it above with a thin circular plate of tinned iron, or of copper, either quite flat, or convex, like that repreſented by this figure.

Fig. 34.

It

It can hardly be neceſſary for me to obſerve, that this thin circular plate muſt be well ſoldered to the cover, all round its circumference, in order to confine the air that is intercepted between the upper ſurface of the cover and the lower ſurface of this plate.

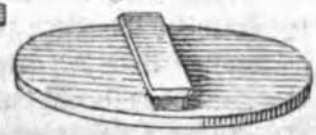
For the mere purpoſe of confining the heat in a ſtew-pan or ſmall boiler—were ſuperior neatneſs and cleanlineſs not objects of particular attention—one of the very beſt covers that could be uſed would be a common ſauce-pan cover, defended above from the cold air of the atmoſphere by a circular cover of wood, firmly fixed to it by means of a ſcrew, or a rivet.

The following Figures

Fig. 35.

Fig. 36.

Fig. 37.



repreſent covers ſo defended; and were the circular piece of wood, to prevent its warping, to be compoſed of two or three very thin boards, glued faſt to each other, and nailed or rivetted together, to unite them more ſtrongly, I am inclined to think that this would be one of the beſt covers for common uſe, eſpecially for large ſtew-pans, that could be made. Its handle might be made of wood, and of either of the forms repreſented in theſe figures, or of any other ſimple form.

The

The covers for large ſtew-pans ſhould always be furniſhed with ſteam tubes, in order that the ſteam, when it becomes too ſtrong to be confined, may eſcape without deranging or lifting up the cover.

A cover made entirely of wood might anſwer very well for confining heat, eſpecially if care were taken to conſtruct it in ſuch a manner as to prevent its being liable to be warped by the heat, and by the moiſture, to which it is continually expoſed; but the wooden covers of boilers, ſauce-pans, and ſtew-pans, require much attention to keep them clean, unleſs they be lined with tin, or with ſheet-copper.

Having now finiſhed my obſervations on the covers of ſmall boilers and ſauce-pans, *in their moſt ſimple ſtate*; when they are deſigned merely for confining heat; it remains to conſider of the means that may be put in practice to render them uſeful in *directing* the heat that eſcapes in the ſteam, which is formed when liquids are boiled, in the various proceſſes of cookery, and *employing this heat to uſeful purpoſes*.

As the quantity of heat that exiſts in ſteam is very conſiderable (as has been elſewhere obſerved) the recovery of this heat is frequently an object deſerving of attention; but before we proceed in this enquiry, it will be neceſſary to ſay ſomething reſpecting the method of *Cooking in Steam*. This ſubject will be treated in the following chapter.

CHAPTER VIII.

Of Cooking in Steam—Objections to the ſteam-kitchens now in uſe—Principles on which a ſteam apparatus for cooking ſhould be conſtructed—Deſcriptions of fixed boilers for cooking with ſteam—A particular deſcription of a STEAM-RIM *for boilers, by means of which their covers may be made ſteam-tight—Deſcription of a* STEAM-DISH, *to be uſed occaſionally for cooking with ſteam over a kitchen boiler—Account of what has been called a* FAMILY-BOILER; *many of them have already been ſold, and have been found very uſeful—Hints to Cooks, concerning the means that may be uſed for improving ſome popular diſhes.*

AS the art of cooking with ſteam is well known, and has long been ſucceſsfully practiſed in this country, it would be a waſte of time to attempt to prove, what is univerſally acknowledged, namely, that almoſt every kind of food uſually prepared for the table in boiling water, may be as well cooked, and in many caſes better, by means of boiling-hot ſteam. I ſhall therefore confine my preſent enquiries to the inveſtigation of the beſt methods of confining and directing ſteam, and employing it uſefully with the moſt ſimple and leaſt expenſive apparatus.

Steam-kitchens, as they are called, conſiſt of very expenſive machinery, and I have been informed

formed by ſeveral perſons who have uſed them, that they do not produce any conſiderable ſaving of fuel. Bare inſpection is indeed ſufficient to ſhew that they cannot be economical in that reſpect; for the ſurface of the tin ſteam-veſſel filled with hot ſteam, that is expoſed quite naked to the cold air of the atmoſphere, is ſo great, that it muſt neceſſarily occaſion a very conſiderable loſs of heat.

A primary object in contriving a ſteam apparatus for cooking, ſhould be to prevent the loſs of heat *through the ſides of the containing veſſels*; and this is to be done, firſt, by expoſing as ſmall a ſurface as poſſible to the atmoſphere; and ſecondly, by covering up that ſurface with the warmeſt covering that can conveniently be uſed, to defend it from the cold air.

The ſteam-veſſel in the kitchen of the Foundling Hoſpital, is a large wooden box, lined with tin, capable of containing a large quantity of potatoes; and the ſteam comes through a ſmall tin tube, from an oblong quadrangular iron boiler, which is uſed daily for boiling meat, &c. for the Hoſpital. As this boiler is furniſhed with what I have called a *ſteam-rim* (which will preſently be deſcribed) when the (wooden) cover of the boiler is down, all the ſteam that is generated in the boiler is forced to paſs through the ſteam-box, and the potatoes, greens, &c. that are in the box are cooked, without any additional expence of fuel.

The ſteam-box has a ſteam-rim, and alſo a wooden cover, which, when it is down, cloſes the box, and makes it perfectly ſteam-tight.

When ſteam is generated faſter than it can be condenſed in the ſteam-box, that which is redundant paſſes off by a waſte tube, which conducts it into a neighbouring chimney.

The apparatus for cooking with ſteam in the kitchen of the Houſe of Correction, at Munich, is ſtill more ſimple. Here, two equal quadrangular boilers are ſet, one at the end of the other, at the ſame level, in the ſame maſs of brick-work, and the flame and ſmoke from the ſame fire paſs under them both; (ſee Eſſay X. Part I. plate iv. fig. 7, and plate v. fig. 9.) Both boilers being incloſed in brick-work, and being covered with wooden covers, it is evident that no part of the apparatus is expoſed to the cold air.—I ſay *no part* of it; for the covers of the boilers being of wood, which is one of the worſt conductors of heat, very little heat can make its way through them; and to prevent even this loſs, inconſiderable as it is, theſe wooden covers may, if it ſhould be thought neceſſary, be defended from the cold air, by warm rugs thrown over them.

The ſmoke which paſſes under the ſecond boiler, not only prevents the approach of the cold air to the under ſurface of its bottom, but, acting on the ſmall quantity of water that is contained in it, actually aſſiſts in the generation of ſteam. It even happens

happens ſometimes, (namely, when there is but a ſmall quantity of water in the ſecond boiler, and the firſt is nearly filled with cold water) that the water in the ſecond boiler actually boils, and fills the boiler with ſteam, before the water in the firſt boiler is heated boiling hot.

This appears to me to be one of the moſt economical methods that can be uſed for cooking, and that it is well adapted for hoſpitals, and alſo for large private families. If it ſhould be neceſſary to make proviſion for cooking a great number of different diſhes in ſteam at the ſame time, either the ſteam-boiler may be made ſufficiently large to receive them; or, inſtead of it, two or more ſteam-boilers, of a moderate ſize, may be put up; and if the different kinds of food that are cooked at the ſame time in the ſame ſteam-boiler, be placed each in a ſeparate diſh, and covered over with ſome proper veſſel in the form of a bell (a common earthen pot, for inſtance, turned upſide down) the exhalations from the different kinds of food will be prevented from ſo mixing together as to give an improper taſte or flavour to any of the victuals.

Theſe covers to the different diſhes will likewiſe be uſeful on another account; when the cover of the ſteam-boiler is opened, for the purpoſe of examining, or of introducing or removing any diſh, the proceſs of cooking going on in the other diſhes will not be interrupted: for their bell-like covers remaining filled with ſteam, will prevent the cold air from coming into contact with the victuals. It

is true, that the cover, or lid, of the ſteam-boiler muſt not be kept open too long, otherwiſe the ſteam confined under the covers of the diſhes will be condenſed, and the cold air will find its way under them.

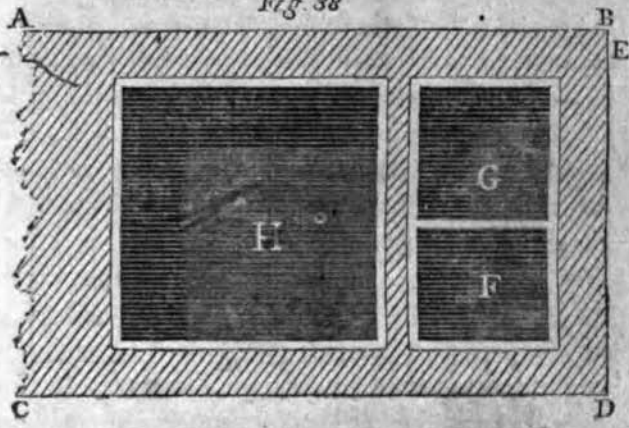
In order that theſe boilers may be perfectly ſteam-tight when their lids are down, they muſt all be furniſhed with *ſteam-rims*; and there muſt be a tube of communication between them for the paſſage of the ſteam; and another tube to carry off the redundant ſteam from the boiler which is ſituated fartheſt from the fire.

If it ſhould be neceſſary, the principal boiler may, without any difficulty or inconvenience, be divided into two compartments, ſo as to render it poſſible to prepare two different kinds of ſoup, or to boil two different things ſeparately, at the ſame time. Suppoſe, for inſtance, that the apparatus is deſigned for the kitchen of a large family, and that the principal boiler is 12 inches wide, 24 inches long, and 12 inches deep; this may be ſo divided by a vertical partition, as to form two compartments; the one—that immediately over the fire, for inſtance, 12 inches by 10; and the other 12 inches by 14. In this caſe I ſhould make the ſecond, or *ſteam-boiler*, 24 inches ſquare by 12 inches deep, and ſhould cauſe the ſmoke to circulate in three flues, parallel to each other; the firſt (in the hither end of which the fire-place ſhould be ſituated) ſhould be immediately under the firſt boiler; and the ſecond and third ſhould be under the ſecond boiler.

The

The following figure ſhews the manner in which theſe boilers ſhould be ſet:

Fig. 38



A, B, is the ſide of the room. A, C, D, E, the maſs of brick-work in which the boilers are ſet.

F, and G, are the two compaartments of the firſt boiler, which is ſhewn with its ſteam-rim.

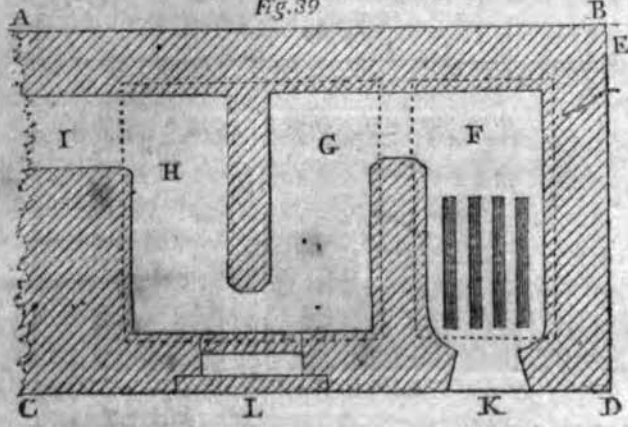
H. is the larger boiler, which is alſo repreſented with its ſteam-rim.

The covers of theſe boilers (which do not appear in the figure) ſhould be ſo attached to the boilers by hinges, as to be laid back when the boilers are opened, and reſted againſt the ſide of the room; and theſe covers ſhould be lined with tin, or with thin ſheet copper, tinned.

The following figure repreſents an horizontal

ſection of the brick-work in which theſe boilers are to be ſet, taken at the level of the tops of the flues:

Fig.39



A, B, is the ſide of the room, and A, C, D, E, the maſs of brick-work, which is placed againſt it. F, G, and H, are the three parallel flues, and I. is the canal that carries off the ſmoke from the ſecond boiler to the chimney. K. is the opening into the fire-place by which the fuel is introduced; and L. is a paſſage, cloſed up with a tile or with looſe bricks, which is occaſionally opened to clean the flues G, and H.

The damper in the canal I, may be placed near the left-hand ſide of the ſecond boiler.

The ſituations of the boilers are indicated by dotted lines.

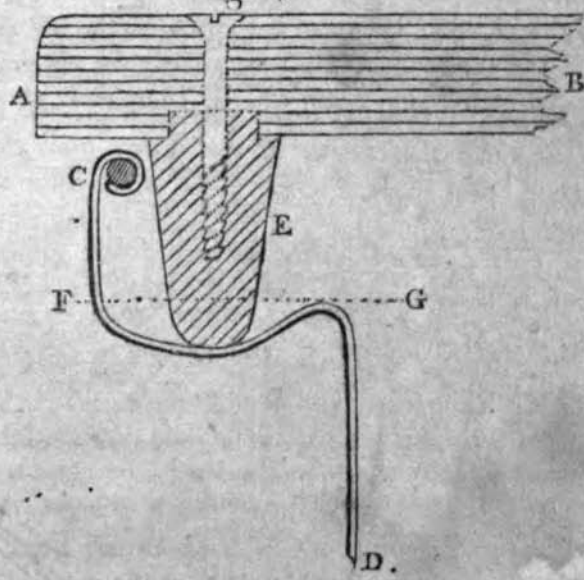
As it is not neceſſary that I ſhould repeat in this place the directions which have already been ſo amply explained concerning the proper method of

proceeding in ſetting boilers, I ſhall not enlarge farther on that ſubject, but ſhall proceed to give an account of a very eſſential part, not yet deſcribed, of the apparatus neceſſary for cooking with ſteam, in the ſimple way I have here recommended: the part I mean is the *ſteam-rim* of the boiler:

Deſcription of a Steam-rim for a Boiler, by means of which its Cover may eaſily be made ſteam-tight.

To give a more complete idea of this contrivance I have, in the following figure, repreſented a vertical ſection of a ſmall part of one ſide of a boiler, and its ſteam-rim, with its (wooden) cover in its place, both of the full ſize:

Fig. 40



A. B. is a ſection of part of the flat wooden cover;

the crooked line C. D. is a ſection of the ſteam-rim, and part of the ſide of a boiler. E. is a ſection of a deſcending rim of wood belonging to, and making an eſſential part of the cover; which rim, when the cover is down, enters the ſteam-rim of the boiler, and repoſes on the bottom of it. In the figure it is repreſented in this ſituation: the wooden rim of the cover is faſtened to the flat part of it by means of wood-ſcrews, one of which is repreſented in the figure *.

Now it is evident, from an inſpection of the figure, that a ſmall quantity of water will lodge in the ſteam-rim, and will ſtand at the level of the dotted line F. G; and as the rim of the cover will enter this water when the cover is ſhut down, all communication between the ſteam in the boiler, and the external air, muſt neceſſarily be cut off, and of courſe the ſteam will be completely confined.

It is true that if, in conſequence of the increaſe of its temperature, above the heat of water boiling in the open air, the elaſticity of the ſteam ſhould become ſufficient to overcome the preſſure of the atmoſphere, it will force the water in the ſteam-rim to aſcend toward C. and getting under the rim E. of the cover of the boiler, it will make its

* The cover itſelf is ſuppoſed to be framed and pannelled in the manner deſcribed in the 5th chapter of this Eſſay (part II.) and it ſhould be lined with tin, or with thin ſheet copper, tinned, in order to prevent the wood from being cracked and deſtroyed by the ſteam.

eſcape,

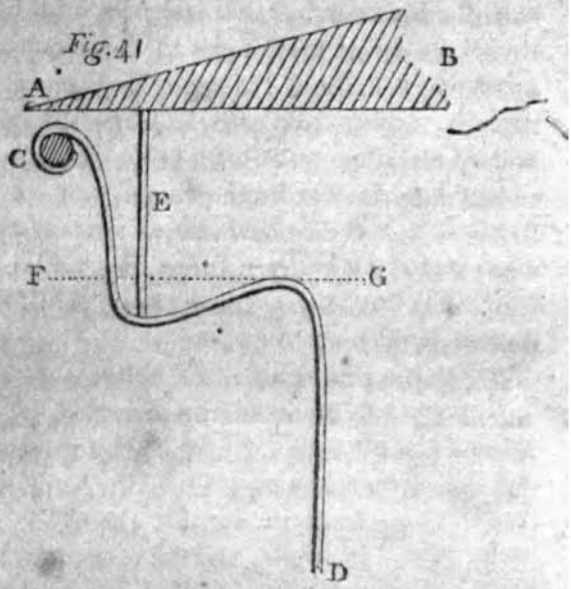
eſcape, but no bad conſequences will reſult from this loſs; on the contrary, the ſteam-rim will, in this caſe, ſerve inſtead of a *ſafety valve*; and although this contrivance may not be adequate to the confining of *ſtrong* ſteam, it certainly anſwers perfectly well for confining that kind of ſteam which is moſt proper to be uſed for cooking. It will likewiſe be found uſeful in many caſes for covering boilers, where the principal object in view is to prevent the contact of the cold air with the contents of the boiler. It will be uſeful for the boilers of bleachers, as alſo for laundry boilers, for brewers boilers, and for all boilers deſtined for the evaporation of liquids under a boiling heat.

It appears to me that this contrivance might, with a little alteration, be uſed with great advantage for covering the boilers uſed by diſtillers. By making the ſteam-rim deeper, the cover of the boiler would be tight, under a conſiderable preſſure; and by making the boiler broad and ſhallow, with ſeveral ſeparate fire-places under it (the flat bottom of the boiler being ſupported on the tops of the flues of theſe fire-places) a variety of important advantages would be gained; and theſe would not be compenſated by any diſadvantages that I can foreſee. The boiler might be conſtructed of very thin ſheet copper, which would not only render it leſs expenſive, but would alſo make it more durable.

When ſteam-rims were firſt introduced, they were made of the form repreſented in the following figure,

figure, which repreſents a vertical ſection of part of one ſide of a boiler with a ſteam-rim, covered with a conical double cover, made of tin:

Fig. 41



In this and the following figures, A, B, repreſents a ſection of part of one ſide of the (double) cover of the boiler.

C. D. The ſteam-rim and part of one ſide of the boiler.

E. The deſcending rim of the cover: and,

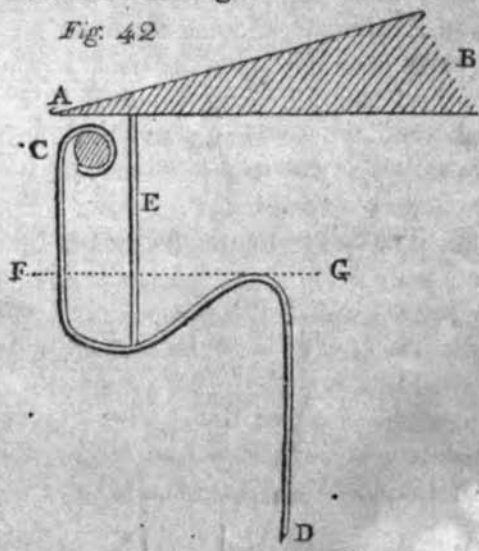
F. G. The level of the water in the ſteam-rim—all of the full ſize.

This conſtruction was found to be attended with an inconvenience, which, indeed, might eaſily have been foreſeen. When the ſteam, on being confined,

fined, became ſtrong enough to force its way under the deſcending rim E. of the cover of the boiler, the water in the ſteam-rim was frequently blown out of it with conſiderable violence, and diſperſed about the room. To prevent theſe diſagreeable accidents, the form of the upper part of the ſteam-rim was altered. To make a proper finiſh to the boiler, the edge of its brim (which forms the top of its ſteam-rim) had been turned *outwards* over a ſtrong wire. It was now turned *inwards* over the wire; and the outſide, or riſing part of the ſteam-rim, inſtead of being made *ſloping outwards*, was now made *vertical*.

A complete idea of theſe different alterations, and of the effects neceſſarily produced by them, may be formed by comparing the foregoing figure (41) with the following:

Fig. 42



It

It is evident that in this caſe, as there is ſufficient room between the outſide of the deſcending rim of the cover, and the vertical ſide of the ſteam-rim, to contain all the water that can be forced upwards between them by the ſteam, there is little danger of any part of this water being blown out of the ſteam-rim by the ſteam, when it makes its eſcape under the rim of the cover.

Of the Manner in which Kitchen Boilers and Stew-pans may be conſtructed, ſo as to be rendered uſeful in cooking with Steam.

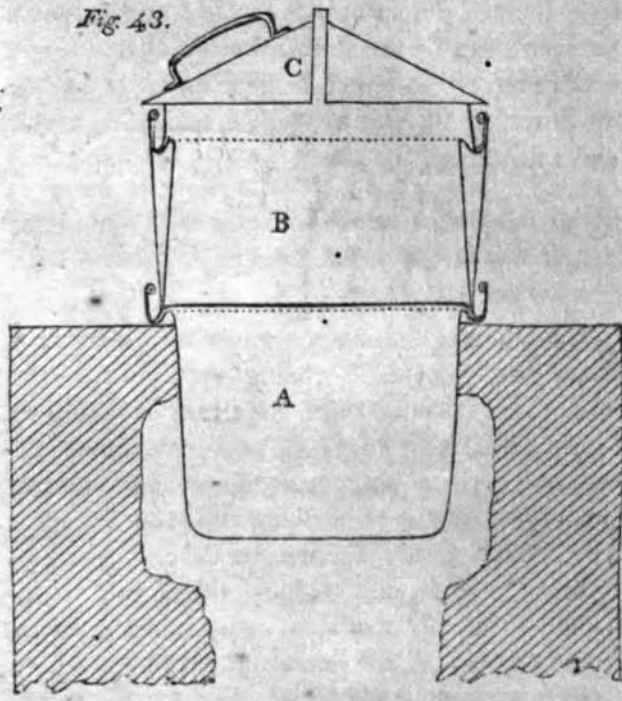
If a common kitchen boiler be furniſhed with a ſteam rim, and the deſcending rim of its cover be made to ſhut down into it, the ſteam in the boiler will be effectually confined, and may, in various ways, be uſefully employed in cooking. One of the ſimpleſt methods of doing this is to ſet what I ſhall call a *ſteam-diſh* upon the boiler. The bottom of this ſteam-diſh being furniſhed with a deſcending rim, or projection, fitting into the ſteam-rim of the boiler, the ſteam-diſh may be made to ſerve as a cover to the boiler; and if a number of ſmall holes be made in the bottom of this diſh near its circumference, the ſteam will paſs up into it from below; and if it be properly cloſed above, any victuals placed in it will be cooked in ſteam.

If this diſh be furniſhed with a ſteam-rim, of the ſame form and ſize with that of the boiler, the cover of the boiler will then ſerve for covering the ſteam-diſh, whenever that diſh is in uſe.

The

The following figure, which repreſents a vertical ſection of the apparatus, will ſhow this contrivance in a clear and diſtinct manner:

Fig. 43.



A. is the boiler, which is ſeen ſet in brick-work.

B. is the ſteam-diſh; and

C. is the cover of the boiler, which is here made to ſerve as a cover for the ſteam-diſh.

The ſides of the ſteam-diſh (which is made of tin) are double, for the purpoſe of confining the heat more effectually.

If

If it be required to cook ſeveral kinds of food at the ſame time, a ſteam-diſh may be uſed that is divided into ſeveral compartments; or two or more ſteam-diſhes may be placed one above another, over the ſame boiler, that which is uppermoſt being covered with the cover of the boiler.

A very complete apparatus of this kind may be ſeen in the kitchen of Mr. Summers, of New Bond-ſtreet, ironmonger, who makes and ſells theſe articles, and who has ſold no leſs than 225 ſets of theſe FAMILY BOILERS, as they are called, ſince he firſt began to manufacture them; and Mr. Feetham, of Oxford-ſtreet, has ſold 110 ſets of them. A cooking apparatus of this kind may likewiſe be ſeen at the Royal Inſtitution; and at Herriot's Hoſpital, at Edinburgh; and in the houſes of many private families, in England and Scotland. There are ſeveral tradeſmen who now manufacture them, and all perſons deſirous of making and ſelling them are at full liberty to do ſo.

When different kinds of food, placed one above the other, are cooked in ſteam, the drippings of thoſe above might, in ſome caſes, be apt to ſpoil thoſe below, if means were not uſed to prevent it: This inconvenience may be avoided in the apparatus I am deſcribing, by introducing the food into the ſteam-diſhes, placed in deep plates or in ſhallow baſons, ſufficiently capacious, however, to contain as much water as will be generated in conſequence of the condenſion of the ſteam on the ſurface of the food in heating it boiling hot. I

ſay,

ſay, "in heating it boiling hot," for after it is once heated to that temperature, no more ſteam will be condenſed upon it, however long the proceſs of cooking may be continued*.

This

* It is not difficult to determine with great preciſion, what the ſize or contents of the diſh muſt be, in order that it may contain all the water that can poſſibly be produced by the condenſation of the ſteam, in heating the victuals that are cooked in it, to the temparature of boiling water. Suppoſe, for inſtance, that a piece of beef, weighing ſix pounds, is to be cooked in the ſteam-diſh, and that this meat, when it is put into the diſh, is at the temperature of 55° of Fahrenheit's Thermometer, which is the mean annual temperature of the atmoſphere at London. Now as this piece of meat is to be made boiling hot, its temperature muſt be raiſed 157 degrees, namely from 55° to 212°. But we have ſeen that any given quantity, by weight, of beef, requires leſs heat to heat it any given number of degrees, than an equal weight of water, in the proportion of 74 to 100; (ſee the introduction to this Eſſay, page 12) conſequently theſe 6lb. of beef will be heated 157 degrees, or from 55° to the boiling point, with a quantity of heat which would be required to heat 4lb. 7 oz. of water 157 degrees.

Now if we ſuppoſe, with Mr. Watt, that the ſteam which produces, in its condenſation, 1lb. of water, gives off as much heat as would raiſe the temperature of 5½lb. of water 180 degrees, namely, from the point of freezing to that of boiling water, the ſame quantity of heat muſt be ſufficient to raiſe the temperature of 6lb. 5 oz. of water 157 degrees, or from 55° to 212°.

And if 6lb. 5 oz. of water require 1lb. of condenſed ſteam to heat it 157 degrees, 4lb. 7 oz. of water, or 6lb. of beef, will require only 11¼ oz. of condenſed ſteam to raiſe its temperature the ſame number of degrees, for it is 6lb. 5 oz. is to 1lb. as 4lb. 7 oz. to 11¼ oz.

Conſequently if 6lb. of beef at the temperature of 55° were placed in a ſteam apparatus, in a ſhallow diſh, capable of containing

This is a curious circumſtance, and the knowledge of the fact may be turned to a good account. If, for inſtance, it were required to make the ſtrongeſt extract of the pure juices of any kind of meat, unmixed with water; this may be done by heating the meat nearly boiling hot, either in boiling water, or in ſteam, and then putting it, placed in a ſhallow diſh, into a ſteam-diſh, or into any cloſed veſſel filled with hot ſteam, and leaving it in this ſituation two or three hours, or for a longer time: Whatever liquid is found collected in the diſh at the end of the proceſs, muſt neceſſarily be the pureſt juices of the meat. In this manner the richeſt gravies may no doubt be prepared.

Thick ſteaks or cutlets of beef, boiled in this manner, and made perfectly tender throughout, and then broiled on a gridiron, and ſerved up in their own gravy, with or without additions, would, I imagine, be an excellent diſh, and very wholeſome: But it muſt be left to cooks, and to profeſſed judges of good eating to determine, whether theſe hints, (which are thrown out with all becoming humility and deference) are deſerving of attention: For although I have written a whole chapter on the pleaſure of eating, I muſt acknowledge, what

taining 11½oz. or a little leſs than *three quarters of a pint*, this diſh would contain all the water that could poſſibly reſult from the condenſation of ſteam on the ſurface of the meat, in heating it boiling hot.

This computation may be of ſome uſe in determing the dimenſions of the veſſels proper to be uſed for holding the victuals that are cooked in the ſteam-diſhes above deſcribed.

all

all my acquaintances will certify—that few perſons are leſs attached to the pleaſures of the table, than myſelf. If, in treating the ſubject, I ſometimes appear to do it *con amore*, this warmth of expreſſion ought, in juſtice, to be aſcribed ſolely to the ſenſe I entertain of its infinite importance to the health, happineſs and innocent enjoyments of mankind.

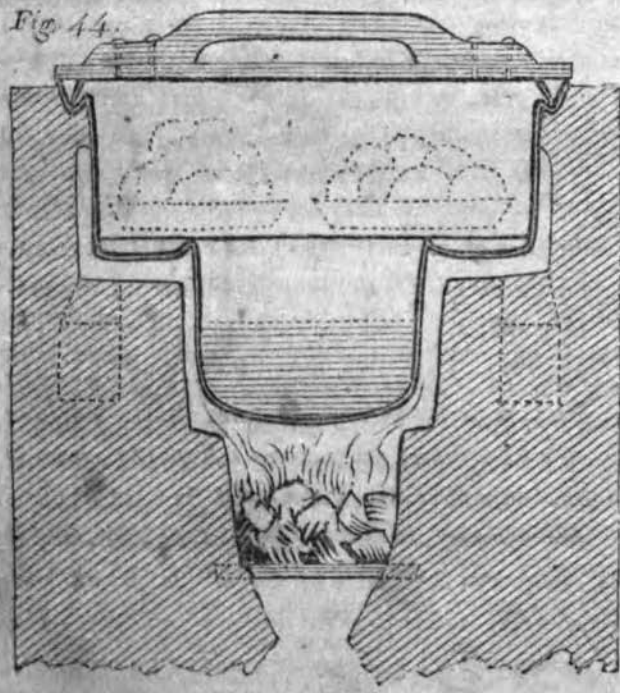
CHAP. IX.

Deſcription of an UNIVERSAL KITCHEN BOILER, *for the uſe of a ſmall family, to anſwer all the purpoſes of cookery; and alſo for boiling water for waſhing, &c.—Deſcription of a* PORTABLE FIRE-PLACE *for an univerſal Kitchen Boiler.—Account of a Contrivance for warming a Room by means of this Fire-place and Boiler.—Of* STEAM STOVES *for warming Rooms.—They are probably the beſt contrivance for that purpoſe that can be made uſe of—they warm the air without ſpoiling it—they economiſe Fuel, and may be made very ornamental.*

Deſcription of an UNIVERSAL KITCHEN BOILER *for the uſe of ſmall Families, to anſwer all the purpoſes of cookery; and alſo for boiling water for waſhing, &c.*

THE following figure repreſents a vertical ſection of this boiler, and alſo of its fire-place and cover.

Fig. 44.



This boiler is ſuppoſed to be made of caſt-iron, and its ſection is repreſented by a double line.

The lower part of it, which is repreſented as being filled about half full with water, is 12 inches in diameter above, about 11 inches in diameter below, and 9 ½ inches deep. The upper part of it, which is furniſhed with a ſteam-rim, is 24 inches in diameter above—where its ſteam-rim begins—and 23 inches in diameter below—where it joins the flat part which unites it to the lower part of the boiler.

The lower part of this boiler (which might, without any impropriety, be called the *lower boiler*) is deſtined for containing the ſoup, or the water that is made to boil, while the upper and broader part is uſed for boiling with ſteam. The brim of the lower boiler projects upward, about an inch above the level of the flat bottom of the upper boiler. This projection prevents the water reſulting from the condenſation of ſteam againſt the ſides of the upper boiler from deſcending into the lower boiler. The upper boiler is 8 ½ inches deep, from the top of the inſide of its ſteam-rim to the flat part of its bottom. The whole depth of both boilers is 18 inches, from the top of the ſteam-rim to the lower boiler.

A circular piece of tin, about 22 inches in diameter, with many holes through it, to give a free paſſage to the ſteam, being laid down, in an horizontal poſition, upon the top, or projecting brim of the lower boiler. Upon this circular plate the ſhallow diſhes are placed, which contain the victuals that are to be cooked in ſteam. Two ſuch diſhes are faintly repreſented in the foregoing figure by dotted lines.

The cover of this univerſal boiler is a ſhallow circular diſh, 26 inches in diameter at its brim, and about 1 ½ inches deep, turned upſide down, and covered above with a circular covering of wood, to confine the heat. The handle to this cover is a ſtrong cleat of wood, faſtened to the circular wooden cover by means of four wood ſcrews. This handle is diſtinctly repreſented in the figure.

The circular wooden cover for confining the heat muſt be conſtructed in pannels, and muſt be faſtened to the ſhallow metallic diſh by means of rivets, or wood ſcrews. In doing this, all the precautions muſt be taken that are pointed out in the 5th chapter of this Eſſay, page 141; otherwiſe the wood and the metal will be ſeparated from each other, in conſequence of the ſhrinking of the wood, on its being expoſed to heat.

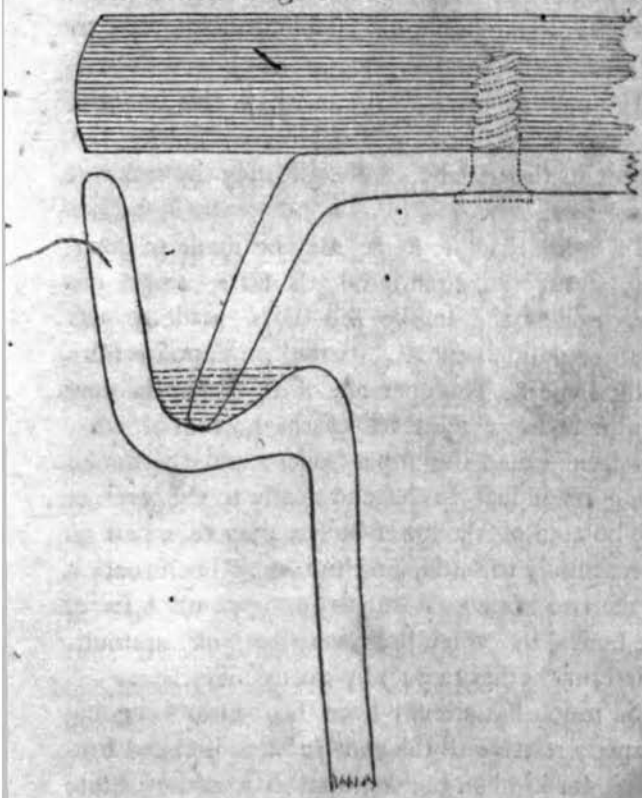
The inverted ſhallow diſh, which, properly ſpeaking, conſtitutes the cover of this boiler, may be made either of tin, or of ſheet-iron, or of ſheet-copper; or it may be made of caſt-iron. Whatever the material is of which it is conſtructed, care muſt be taken to make it of ſuch dimenſions preciſely, that its brim may enter the ſteam-rim, and occupy the lower or deepeſt part of it, otherwiſe the ſteam will not be properly confined in the boiler.

The following figure repreſents a vertical ſection, *of the full ſize*, of the ſteam-rim of one of theſe boilers (of caſt iron) together with a ſection of a part of an inverted ſhallow caſt-iron pan, which ſerves

as

as a cover to the boiler, and alſo of the circular covering of wood which is attached to the pan, and defends it from the cold air of the atmoſphere.

Fig. 45



In this figure the ſteam-rim is repreſented as being full of water; and one of the ſcrews is ſeen, which faſten the circular wooden cover to the inverted

verted ſhallow pan, which confines the ſteam in the boiler.

On examining the two preceding figures, it will be found that both the boiler and its cover are of forms that will readily deliver from their moulds; and that circumſtance will enable iron-founders to ſell theſe articles at low prices.

The maſs of brick-work, in which this boiler is ſet, may be a cube of 3 feet; or, by ſinking the aſh-pit in the ground, its height may be reduced to 2 ½ feet.

In order that the flame may be made to ſeparate, and ſpread equally on all ſides, under the lower boiler, the ſmoke ſhould be made to paſs off in two ſmall canals, ſituated on oppoſite ſides of the boiler. The openings of theſe canals may be a little below the level of the bottom of what has been called the upper boiler; and the ſmoke being made firſt to deſcend nearly to the level of the bottom of the lower boiler, may then paſs off horizontally towards the chimney. The ſituation of the two horizontal canals (on oppoſite ſides of the boiler) by which the ſmoke goes off, are indicated (in the figure 44.) by dotted lines.

So much has already been ſaid in the foregoing chapters relative to the conſtruction of cloſed fire-places for kitchen boilers, that it would be quite ſuperfluous to give any particular directions reſpecting the conſtruction of the fire-place for this boiler. The manner in which the boiler is ſet in

brick-work, and the means that are uſed for cauſing the ſmoke to ſurround it on every ſide, are diſtinctly ſhewn in the figure.

In order more effectually to confine the heat, the boiler ſhould be entirely incloſed in the brick-work on every ſide, in ſuch a manner that the brim of its ſteam-rim ſhould not project above it more than half an inch. To preſerve the brick-work from being wetted, the top of it may be covered with ſheet-lead, which may be made to turn over the top of the brim of the ſteam-rim of the boiler.

There may either be a ſteam-tube in the cover of the boiler, or the ſteam may be permitted to force its way under the deſcending rim of the inverted ſhallow pan, which conſtitutes the cover. If there be a ſteam-tube, it ſhould be half an inch in diameter, and about one inch in length; and it ſhould be made very ſmooth on the inſide, in order that another tube of tin, or of tinned copper, about 10 inches in length, may paſs freely in it. The uſe of this moveable tube is to cauſe the air to be expelled from the upper boiler, while it is uſed for cooking with ſteam. This will be done, if, while the water below is boiling, the long tube be thruſt down into the boiler through the ſteam-tube, till its lower end comes to the level of the brim of the lower boiler. For, as ſteam is conſiderably lighter than common air, it will of courſe riſe up and occupy the upper part of the upper boiler, and the air below it being compreſſed, will eſcape through the tube we have juſt deſcribed; and, although

that tube ſhould remain open, the upper boiler will, nevertheleſs, remain filled with ſteam, to the total excluſion of atmoſpheric air. The inſide of the ſteam-tube, and the outſide of the moveable tube ſhould be made to fit each other with accuracy, in order that no ſteam may eſcape between them. The neceſſity of this precaution is too evident to require any illucidation.

It will be beſt to place the ſteam-tube within about an inch of the ſide of the cover, in which caſe it will be eaſy, by turning the cover about, to place it in ſuch a poſition that the moveable tube may deſcend into the upper boiler, without being ſtopped by meeting with any of the diſhes that are placed in it.

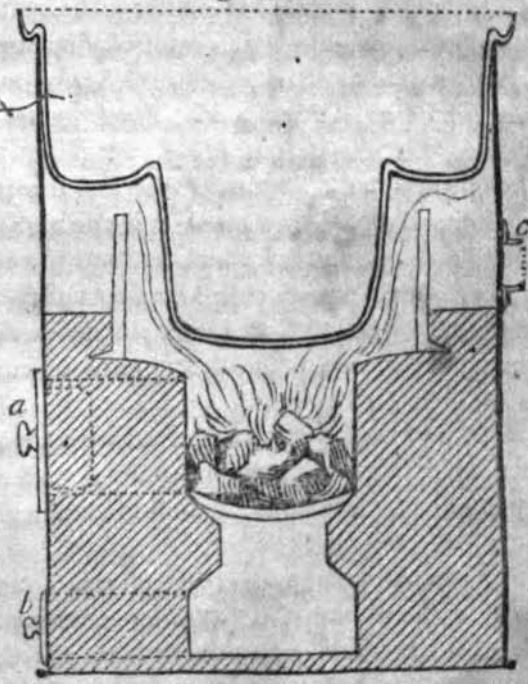
It is hardly neceſſary that I ſhould obſerve here, that boilers on the principles above deſcribed may b c onſtructed of ſheet-iron, or ſheet-copper, as well as of caſt-iron, and that they may be made of any dimenſions. That which is repreſented in the foregoing figure (44.) is of a moderate ſize, and would, I ſhould imagine, be ſuitable for the family of a labourer, conſiſting of eight or ten perſons. The lower part of the boiler would hold about $3\frac{3}{16}$ gallons; but the whole boiler, filled up to within an inch of the level of the inſide of the ſteam-rim, would hold $14\frac{1}{4}$ gallons. When ſo filled up, I ſhould ſuppoſe the boiler to be ſufficiently capacious to heat water for waſhing, or for any other purpoſe that could be wanted by an induſtrious

family, conſiſting of the number of perſons above-mentioned.

Deſcription of a PORTABLE FIRE-PLACE *for an* UNIVERSAL KITCHEN BOILER.

The following figure repreſents a vertical ſection of the fire-place, with its boiler in its place.

Fig. 46.



This figure is drawn to a ſcale of 10 inches to the inch.

The

The boiler is ſuppoſed to be of caſt-iron, and the ſection of it is repreſented by a double line. To render its form more conſpicuous, its cover is omitted.

The portable fire-place is a cylinder of ſheet-iron, 24 ½ inches in diameter, and 34 ¼ in height, open above, and cloſed below. The ſections of this cylinder, and of its bottom, are marked by ſtrong black lines.

The fire-place, properly ſo called, is the center, or axis of this cylinder: it is built of fire-bricks and ſturbridge clay; and the fire burns on a circular caſt-iron diſhing grate, eight inches in diameter.

The opening (at *a*.) by which the fuel is introduced, is marked by dotted lines; as is alſo another opening below it (at *b*.) which leads to the aſh-pit. Theſe openings are cloſed by doors of ſheet-iron, which are attached by hinges to the outſide of the cylinder, and faſtened by means of turn-buckles.

The door of the aſh-pit is furniſhed with a regiſter for regulating the admiſſion of air.

The ſmoke is carried off by an horizontal tube, a part of which is ſeen at C.

There is a particular and very ſimple contrivance for cauſing the ſmoke to come into contact with the ſides of the lower boiler, and with the flat bottom of the upper boiler, and then to *deſcend* before it is permitted to paſs off. This is a cylinder of caſt-iron or of earthen-ware, which is 6 inches in diameter

diameter within, or in the clear, and 8 inches high, with a thin ſlanch about an inch wide, at its lower extremity. This ſlanch ſerves as a foot for keeping it ſteady in its vertical poſition, and alſo for faſtening it in its place, by laying the ends of a circular row of ſhort pieces of brick upon it. The lower end of this cylinder being ſet down at the level of the bottom of the lower boiler, upon the top of the hollow cylindrical maſs of brick-work which conſtitutes the fire-place, the ſmoke is obliged to paſs up between the inſide of this cylinder and the outſide of the lower boiler, and to ſtrike againſt the flat bottom of the upper boiler. It then paſſes horizontally over the top of this cylinder, and turning downwards into the ſpace which is left for it, between the outſide of this ſhort cylinder and the great cylinder of ſheet-iron in which the boiler is ſuſpended, it paſſes off by the ſmall horizontal tube which carries it to the chimney.

This ſhort cylinder is ſo diſtinctly repreſented in the figure, that letters of reference are quite unneceſſary.

A piece of brick, or of fire-ſtone, about 2½ inches thick, is ſuppoſed to be attached to the inſide of the fire-place door, to prevent its being too much heated by the fire; and this is repreſented in the figure by dotted lines. The knobs in the fire-place door, and in the door of the aſh-pit, are deſigned to be uſed as an handle in opening them.

This

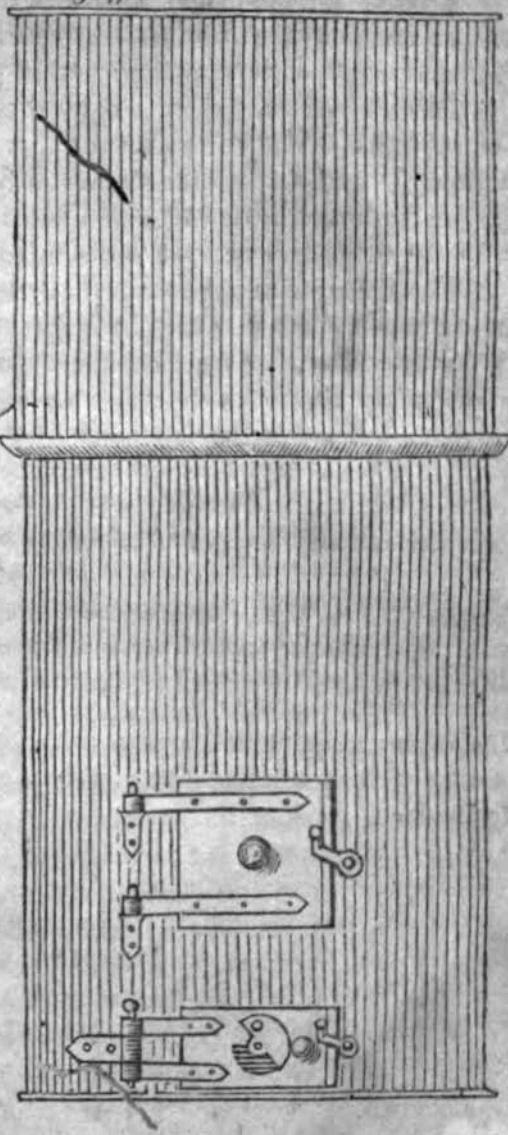
This portable fire-place may have two ſtrong handles for tranſporting it from place to place; and as the boiler may be removed, and carried ſeparately, the fire-place will not be too heavy to be carried very conveniently by two men.

Without ſtopping to expatiate on the uſefulneſs of this new implement of cookery, I ſhall proceed to ſhew how its utility may be made ſtill more extenſive. With a trifling additional expence, it may be changed into one of the very beſt ſtoves for warming a room in cold weather that can be contrived.—I ſay one of the *very beſt*, for it will warm the air of the room, without its being poſſible for it ever to heat it ſo much as to make it unwholeſome; and it will do it with the leaſt trouble, and at the expence of the leaſt poſſible quantity of fuel.

Deſcription of a contrivance for warming a room, by means of a PORTABLE UNIVERSAL KITCHEN BOILER.

The following figure repreſents an elevation, or front view of the machinery that may be uſed for this purpoſe.

Fig. 47



This machinery is very ſimple : It conſiſts of the

portable boiler and fire-place repreſented in the preceding figure (46.) with an inverted cylindrical veſſel, conſtructed of tin, or of very thin ſheet-copper, placed over the boiler. This cylindrical veſſel, which I ſhall call a STEAM-STOVE, muſt be juſt equal in diameter, to the ſteam-rim of the boiler, at the loweſt or deepeſt part of that rim; and it may be made higher, or lower, according to the ſize of the room that is to be heated by it. That repreſented in the foregoing figure is 26 inches in diameter, and 24 inches high; which gives 17 ſquare feet of ſurface for heating the room.

This *ſteam-ſtove* may be made of common ſheet-iron; but in that caſe it ſhould be japanned within and without, to prevent its ruſting. In japanning it, it might be painted, or gilded, and rendered very ornamental. The portable fire-place might likewiſe be japanned and ornamented; but in that caſe it would be neceſſary to line that part of it with clay or cement, with which the ſmoke comes into contact, otherwiſe the heat, in that part, might injure the japan.

There muſt be a ſmall tube, about ¼ of an inch in diameter, in one ſide of the ſteam-ſtove, juſt above the top of the ſteam-rim of the boiler. This tube ſhould be about two inches in length, and it ſhould project inwards, horizontally, into the cavity of the ſteam-ſtove. Into this tube, one end of another longer tube ſhould be introduced, which

is

is deſigned to carry off the redundant ſteam into the chimney.

The reaſon why this tube ſhould be placed near the bottom of the ſteam-ſtove, will be evident to thoſe who recollect that ſteam is lighter than air. Were it placed at the top of it, no ſteam would remain in the ſtove, and the object of the contrivance would be defeated.

This ſmall ſteam-tube at the lower part of the ſtove may, with ſafety, be kept quite open; for unleſs the water in the boiler be made to boil with vehemence, little or no ſteam will iſſue out of it; for the greater part, if not the whole of it, will be condenſed againſt the top and ſides of the ſteam-ſtove.

As the water which reſults from this condenſation of ſteam, will all return into the boiler, it will ſeldom be neceſſary to repleniſh the boiler with water.

When cooking is going on in the boiler in cold weather, the ſteam-ſtove will ſupply the place of a cover for the boiler; but when the weather is warm, the cover of the boiler may be uſed inſtead of it, and the air of the room will be very little heated.

Steam-ſtoves on theſe principles would be found very uſeful in heating halls and paſſages, and I think

think they might be uſed with advantage for heating elegant apartments. They are ſuſceptible of a variety of beautiful forms, and are not liable to any objections that I am aware of. A moſt elegant ſteam-ſtove might be made in the form of a doric temple, of eight or ten columns, ſtanding on a pedeſtal. The fire-place might be ſituated in the pedeſtal, and the columns and dome of the temple might be of braſs or bronze, and made hollow to admit the ſteam. In the center of the temple a ſmall ſtatue might be placed, as an ornamental decoration—or an argands lamp might be placed there to light the room. In caſe a lamp ſhould be placed in the center of the temple, there ſhould be a circular opening left in the top of the dome for the paſſage of the ſmoke of the lamp.

The fire under the boiler may be lighted and fed without the room, or within it; or the ſteam may be brought from a diſtance in a leaden pipe or copper tube. If the boiler that ſupplies the ſteam is ſituated in the pedeſtal of the temple, and if the fire is lighted from within the room, the fire-place and aſh-pit doors may be maſked by tablets and inſcriptions.

But I need not enlarge on the means that may be uſed for rendering an uſeful mechanical contrivance ornamental and expenſive; for many perſons will be ready to lend their aſſiſtance in that undertaking.

Thoſe

Thoſe who wiſh to ſee one of theſe univerſal kitchen boilers, will find one ſet in brick-work, in the kitchen of the Royal Inſtitution. It is conſtructed of copper, and tinned on the inſide; and it is conſiderably larger than that I have here deſcribed. The method uſed for confining the ſteam in this boiler is different from that here recommended; and there is a contrivance for heating the contents of the boiler occaſionally by means of ſteam, which is brought from another boiler; but this contrivance has no particular connection with the invention in queſtion, and is introduced here merely to ſhow how ſteam may be employed for making liquids boil.

In order that theſe univerſal kitchen-boilers, with ſteam-ſtoves, may the more eaſily find their way into common uſe in this country, ſome method ſhould be contrived for making tea in them. Now I think this might be done by putting the tea, with cold water, into a ſhallow tin tea-pot, or rather kettle, and placing it in the upper boiler, directly over the lower boiler. I once made an experiment of this kind; and if I was not much miſtaken, the tea that was ſo made was uncommonly good, and high flavoured. It certainly appeared to be conſiderably ſtronger than it would have been, if, with the ſame quantities of tea and of water, it had been made in the common way.

Boiling water poured upon a vegetable ſubſtance does not always extract from it all that might be extracted, by putting the ſubſtance to cold water, and heating them together. This fact is well known; and it renders it probable that the method here propoſed, of making tea, would be advantageous. If this ſhould be the caſe, no implement could be better contrived for that purpoſe than our univerſal kitchen boiler.

CHAP.

CHAP. X.

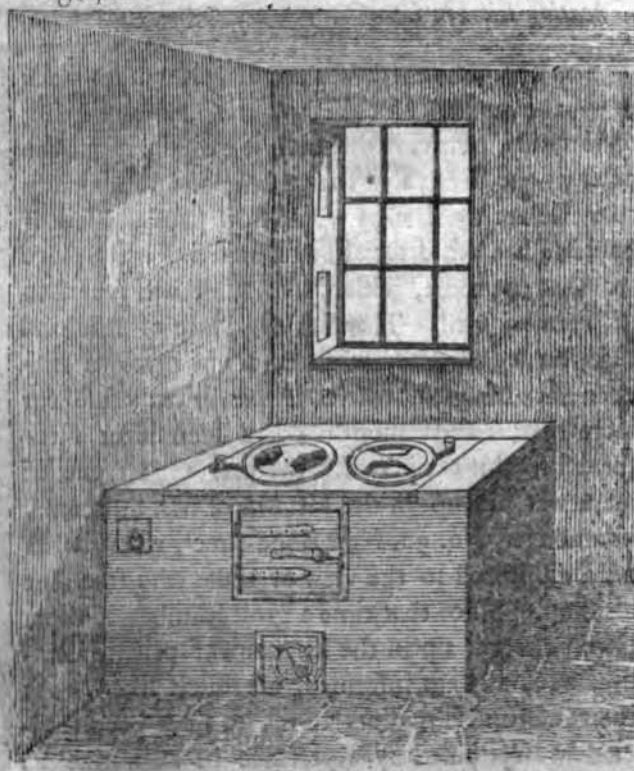
Deſcription of a new-invented REGISTER-STOVE *or* FURNACE, *for heating Kitchen Boilers, Stew-pans, &c.—Of the conſtruction of Boilers and Stew-pans, peculiarly adapted to thoſe Stoves.—Particular method of conſtructing Stew-pans and Sauce-pans of Tin, by which they may be rendered very durable.—Deſcription of a ſmall* PORTABLE FIRE-PLACE *for Stew-pans and Sauce-pans.—Of caſt-iron* HEATERS *for heating Kitchen Utenſils.*

HAVING learnt, by frequenting Kitchens while the various proceſſes of cookery were going on in them, how very deſirable it would be that the cook might be enabled to regulate, and occaſionally to moderate the fires by which ſtew-pans and ſauce-pans are heated, I ſet about contriving a fire-place for that purpoſe, which, on trial, was found to anſwer very well. The firſt fire-place of this kind that was conſtructed was put up in my own kitchen, at Munich, where it was in daily uſe for more than twelve months; and ſoon after I returned to this country (in the year 1798.) one of them was put up in the kitchen of Mr. Summers, ironmonger, No. 98, New Bond-ſtreet, where it has been exhibited to the view of thoſe who frequent his ſhop. Since that time a great number of them have been put up in the kitchens of private families, and, as I am informed, are much liked. As their uſefulneſs appears to me to have been ſufficiently aſcertained by experience to authorize me

to recommend them to the public, I ſhall now lay before the reader the moſt exact and particular deſcription of them that I can give; premiſing however, that it will be difficult to give ſo clear an account of this contrivance as to enable a perſon to form a perfect idea of it without having ſeen it.

I ſhall perhaps be moſt likely to ſucceed in this attempt, if I begin by exhibiting a view of the thing to be deſcribed.

Fig. 48



This plate repreſents a view of a regiſter-ſtove fire-

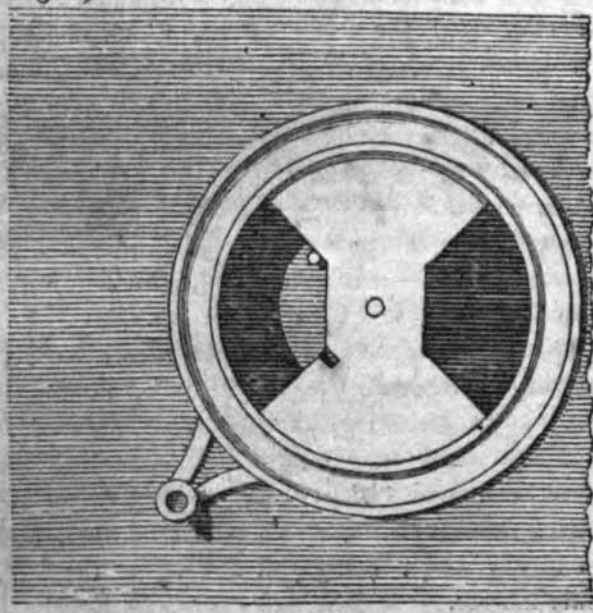
fire-place for two ſtew-pans, actually exiſting in Heriot's Hoſpital at Edinburgh. It is placed in a maſs of brick-work, two feet ſix inches high, four feet ſix inches long, and two feet wide, from front to back, ſituated in a corner of the room, on the right hand ſide of the fire-place. In the middle of the front of this maſs of brick-work are ſeen, the front of the fire-place door (which is double) —and the aſh-pit regiſter-door;—and near the end of it, on the left, in the upper front corner, may be diſcovered the ſtone ſtopper, which cloſes a canal, which is occaſionally opened for cleaning out the ſoot from the flues in the interior parts of the maſs of brick-work. A like ſtopper, and which ſerves for a like purpoſe, may be ſeen at the end of the maſs of brick-work, near the right hand corner above. Each of theſe ſtoppers is furniſhed with an iron ring, faſtened by a ſtaple, which ſerves as a handle in removing and replacing it.

On the top of this maſs of brick-work there is laid an horizontal plate of caſt-iron, 18 inches wide, three feet long, and about $\frac{1}{4}$ of an inch in thickneſs; and on the right and left of this iron plate, and level with its upper ſurface, there are placed two flat ſtones, each nine inches wide, and 18 inches long; being juſt as long as the iron plate is wide.

At the back of this iron plate runs a flue, four inches wide and five inches deep, which is covered above, at the level of the upper ſurface of the iron plate, with a flat ſtone, ſix inches wide.

One of the moſt eſſential parts of this contrivance is the iron plate, with its circular regiſter; both which are repreſented by the following figure. In order to give this figure upon the largeſt ſcale the ſpace which it muſt occupy will admit of, only one half of the plate is repreſented, being ſhewn broken off in the middle.

Fig. 49



In

In this figure the circular moveable regiſter (which is diſtinguiſhed from the oblong plate to which it belongs, by marking the latter by fine horizontal lines) is ſhewn in its place; and the projecting piece of metal is alſo ſeen, which ſerves as a handle to turn it about on its centre. This circular regiſter has a ſhallow circular groove, near its circumference, about $\frac{1}{4}$ an inch deep and $1\frac{1}{4}$ inches wide; and between the inſide of this groove and the centre of the regiſter there are two holes, or openings, on oppoſite ſides of the centre, which anſwer to two other openings of like form and dimenſions, which are in each half of the oblong plate to which the regiſters belong. By one of theſe openings (that next the middle of the oblong plate) flame riſes from a fire ſituated below, and ſpreads under the bottom of a boiler, which is ſuſpended over the circular regiſter; and by the other it deſcends, and again entering the maſs of brick-work, it goes off by an horizontal canal which communicates with the chimney.

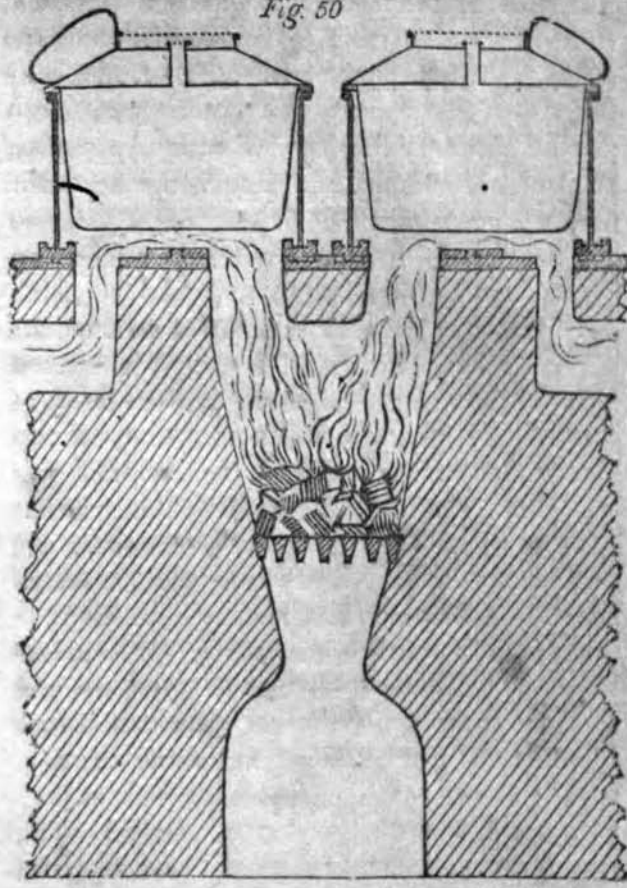
The boiler, or ſtew-pan is ſuſpended over the circular regiſter-plate, and the heat is confined about it by means of an hollow cylinder of ſheet-iron, or of earthen ware (about one inch longer, or higher than the boiler is deep) and open at both ends; the lower end of which entering the ſhallow groove of the regiſter, repoſes on it, while its upper end is cloſed by the boiler, which, reſting on it by its brim, is ſuſpended in it, and conſequently is ſurrounded by the flame.

This cylinder muſt be made quite flat, or even at its two ends, by grinding it on a flat ſtone; and the boiler muſt be made to fit it accurately, not however by fitting too nicely into its opening (which method would not be adviſeable)—but by making the under part of the iron ring, which forms the projecting brim of the boiler, perfectly flat, and cauſing the boiler to be ſuſpended by that ring on the flat end of the cylinder.

To prevent the eſcape of the flame under the bottom of the cylinder, or between its lower end and the circular regiſter-plate on which it ſtands, a ſmall quantity of ſand, or (what will be ſtill better) of fine filings of iron or braſs, may be put into the groove in which the cylinder is placed: and the ſame means may be uſed for making the joinings tight between the circular regiſters and the flat plate to which they belong.

The following figure, which ſhews a vertical ſection of this regiſter-ſtove, with its fire-place and its two boilers, or rather ſtew-pans, will give a clear idea of the arrangement of the machinery.

Fig. 50



Theſe ſtew-pans, which are 10½ inches in diameter above, and 6 inches deep, each, are conſtructed according to the directions given in the ſeventh chapter of this Eſſay. They are of copper, tinned, and are turned over flat iron rings at their brims.

Their

Their handles are not ſeen in this figure, having been omitted for want of room. Their covers, which are of tin, and made double, are on a peculiar conſtruction. They are ſo contrived that a ſmall ſauce-pan for melting butter, or warming gravy, may be placed upon them, and heated by the ſteam from their ſtew-pans.

From a careful inſpection of the three foregoing figures, and a compariſon of them with the ſhort deſcription that has been given of the various parts of this machinery, it will, I fancy, be poſſible to form ſo diſtinct an idea of this contrivance as to enable any perſon, conyerſant in matters of this kind, to imitate the invention, even without ever having ſeen the work executed. The principles, at leaſt, on which this contrivance is founded, will be perfectly evident; and when they are underſtood, ingenious men will find little difficulty in the application of them to practice. It is indeed highly probable that ſimpler and better means of applying them will be found, than thoſe I have adopted, when the uſe of the contrivance ſhall become more general. I am indeed aware of ſeveral alterations of the machinery, which I think would be improvements: but as I have not tried them, I dare not recommend them, as I recommend things which I know from experience to be uſeful.

I ſhall now proceed to give an account of ſeveral precautions in the conſtruction and uſe of theſe regiſter-

regiſter-ſtoves for boilers, which have been found to be neceſſary and uſeful.

The circular regiſters are ſo conſtructed, that by turning them round, they may be ſo placed as either to cloſe entirely the holes in the flat plate on which they lie, or to leave them open more or leſs. Now as there is no paſſage, by which the ſmoke can go off from the fire-place into the chimney, but through theſe holes, care muſt be taken never to attempt to kindle the fire when both theſe regiſters are cloſed;—and never to open one of them without having firſt placed an hollow cylinder on it, and a fit ſauce-pan or boiler in the cylinder, to cloſe it above. It can hardly be neceſſary that I ſhould add, that care muſt always be taken to put water, or ſome other liquid, into the boiler, to prevent its being burnt and ſpoiled by the heat.

The ſtate of the regiſter—in regard to its being more or leſs open—cannot be ſeen when the boiler is in its place, as the openings of the regiſter are concealed by it, and by the cylinder in which it is ſuſpended. But although the ſtate of the regiſter under theſe circumſtances, is not *ſeen*, it is nevertheleſs *known*; and the heat which depends on the dimenſions of the opening left for the paſſage of the flame, may, at any time, be regulated with the utmoſt certainty. By means of a projecting pin, or ſhort ſtub, repreſented in the figure 49, belonging to the lower (fixed) plate—and which is caſt with it—the moveable circular regiſter is ſtopped in two different poſitions; in one of which the openings

openings for the flame are as wide as poſſible, and in the other they are quite cloſed. When the handle, by which the circular plate is turned round, is pulled as far forward as poſſible towards the front of the brick-work, the regiſter is wide open. In this ſituation it is repreſented in the figure 49. When it is puſhed as far backwards as poſſible, the regiſter is cloſed; and its ſituation at any intermediate ſtation of the handle, between theſe two limits of its motion, will at any time ſhew the exact ſtate of the regiſter.

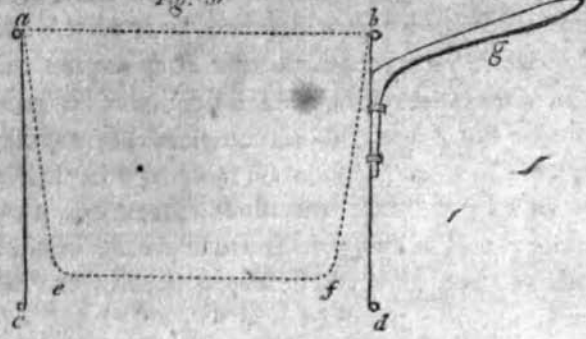
That the handles of the regiſter plates may not interfere with each other, they are placed on the ſides of their plates, which are fartheſt from the fire; conſequently they are as far from each other as poſſible. The form of theſe handles is ſuch that they never become very hot, although they are of iron, and of a piece with their plates, being caſt together. The cold air of the atmoſphere paſſing freely upward through a conical hole (left in caſting) in the center of the knob of the handle, the heat is carried off by this current of air, almoſt as faſt as it arrives from the circular plate.

There is a circumſtance to which it is abſolutely neceſſary to pay attention in ſetting the large flat iron plate in the brick-work, otherwiſe the machinery will be liable to be ſoon deranged, by the effects of the expanſion of the metal by heat:— The bottom, or under ſide of this plate muſt be every where completely covered and defended from the action of the flame by bricks or tiles. This is very

very eaſy to be done, but, at the ſame time, as it requires ſome care and attention, it is what workmen are very apt to neglect, if they are not well looked after.—As this plate is very large, if great care be not taken to prevent its being expoſed to the flame, it will ſoon be warped and thrown out of its place. If, inſtead of caſting this plate in one piece, it be formed of two pieces, each 18 inches ſquare, the bad effects produced by the expanſion of the metal by heat will be greatly leſſened; and this precaution has been taken in moſt of the regiſter-ſtoves on theſe principles that have been put up in London; but by an experiment lately made at Heriot's hoſpital at Edinburgh, I have been convinced that the large plates may be depended on, if they are properly ſet.

I have deſcribed the cylinder in which the ſtew-pan or boiler is ſuſpended, as being a ſeparate thing:—it is right, however, that I ſhould inform the reader, that in almoſt all caſes where regiſter fire-places of this kind have hitherto been put up, this cylinder has been firmly and inſeparably united to the ſtew-pan, ſo much ſo as to make a part of it, the handle even being attached to this cylinder, inſtead of being joined immediately to the ſtew-pan. The following figure, which repreſents a vertical ſection of one of theſe ſtew-pans, and its cylinder, will ſhew how they have hitherto generally been conſtructed.

Fig. 51



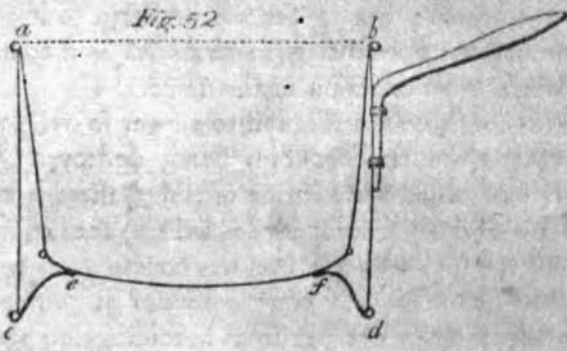
a, *b*, *c*, *a*, repreſents a vertical ſection of the cylinder, which is 11 ½ inches in diameter, and 8 inches high. Into this cylinder, which is open at both ends, the boiler or ſtew-pan, *a*, *e*, *f*, *d*, (which is diſtinguiſhed by dotted lines) is made to paſs with ſo much difficulty, as to require a conſiderable force to bring it into its place, and not to be in danger of being ſeparated from it by any accidental blow. The handle *g*, is rivetted to the cylinder previouſly to its being united to its ſtew-pan.

It having been found that this cylinder was liable to become very hot, and even to be deſtroyed by the heat in a ſhort time, if care was not taken to keep the fire low; and it having likewiſe been found that the heat that made its way upwards, between the outſide of the ſtew-pan and the inſide of the cylinder, frequently heated the upper part of the ſtew-pan ſo intenſely hot, as to cauſe the victuals cooked in it to be burnt to the ſides of the

ſtew-

ſtew-pan, eſpecially when the ſtew-pan was almoſt empty. With a view to remedy both theſe evils, and at the ſame time to conſtruct ſtew-pans and ſauce-pans of large dimenſions of common ſheet-tin (tinned iron) which ſhould be more durable, and ſuperior in many reſpects to thoſe of that material now in common uſe, ſome alterations were made in this utenſil, which will be eaſily underſtood by the help of the following figure.

Fig. 52



In order to prevent the flame from paſſing upwards between the ſauce-pan and its cylinder, and occupying the vacant ſpace, *c*, *a*, *e*, this ſpace was incloſed by means of a circular piece of ſheet-copper, *c*, *e*, *f*, *d*, with a large circular opening in its center, of the diameter, *e f*. This copper being a little larger in diameter than the cylinder, was firmly attached to it all round, by being turned over the ſame wire which ſtrengthened and made a finiſh to the bottom of the cylinder; while the inſide edge,

e,

e, *f*, of this circular perforated ſheet of copper being raiſed upwards, with the hammer, about an inch, as it is repreſented in the figure, the ſauce-pan is made of ſuch a form, that, on being brought into its place, its bottom is forced down upon the upper edge of this copper; by which means the empty ſpace between the ſauce-pan and its cylinder is cloſed up below by the copper, and the flame prevented from entering it. Sheet-iron might have been uſed inſtead of ſheet-copper, for cloſing up this ſpace; but copper was preferred to it on account of its not being ſo liable as iron to be deſtroyed by the action of the flame.

This contrivance was found to anſwer ſo well for preventing the cylinder from being deſtroyed by heat, that, when it was made of tinned ſheet-iron, (commonly, but improperly, called tin) the tin, by which the ſurface of the iron was covered, was not melted by it: and ſo completely did it prevent the ſides of the ſauce-pan from becoming too hot, that a quantity of fluid, of any kind, ſo ſmall as barely to cover the bottom of the veſſel, might be boiled in it, without the ſmalleſt danger of its being burnt to its ſides.

Having found that the ſides of the ſauce-pan were ſo effectually defended by this contrivance from intenſe heat, it occurred to me that a ſauce-pan of common tin might perhaps be ſo conſtructed, as, with this precaution for the preſervation of its ſides, it might be made to laſt a great while; which would not only ſave a conſiderable

expence for kitchen utenſils—tin being much cheaper than copper—but would alſo remove the apprehenſion of being poiſoned by any thing injurious to health, communicated to the food by the veſſel in which it is prepared; which thoſe cannot help feeling, who eat victuals cooked in copper utenſils, and who know the deleterious qualities of that metal.

Concluding that if I could contrive to prevent the ſeams or joinings of the tin, in a ſauce-pan or boiler, from ever coming into contact with the flame of the fire, it could not fail to contribute greatly to the durability of the utenſil; I cauſed the ſauce-pan, repreſented in the foregoing figure, to be made of that material. The bottom of this ſauce-pan, *e, f*, was made diſhing (inſtead of being flat, as the bottoms of tin ſauce-pans are commonly made) and being joined to the body of the ſauce-pan by a ſtrong double ſeam, the vacuities of the ſeam, both within and without, were well filled up with ſolder.

Now as care was taken in adjuſting the conical band of copper *c, e, f, d*, to the bottom of the ſauce-pan, to make its circular opening above, at *e, f*, ſomething leſs in diameter than the bottom of the ſauce-pan at its extreme breadth, or where it joins the ſides or body of the utenſil; and alſo to cauſe the upper edge of this copper actually to touch the bottom of the ſauce-pan, and even to preſs againſt it in every part of its circumference, it is evident that the ſeam, by which the body of the ſauce-pan and its diſhing bottom were united, was completely covered by the copper, and de-

fended from the intermediate action of the fire: it is likewiſe evident, that the ſide-ſeams in the body of the ſauce-pan, were likewiſe protected moſt effectually from all the deſtructive effects of intenſe heat: and if care were taken to cover the outſide of the body of the ſauce-pan with a good thick coating of japan, to prevent its being injured by ruſt, there is little doubt but that ſauce-pans ſo conſtructed would laſt a long time indeed.

The cylinder in which the ſauce-pan is ſuſpended might likewiſe be japanned—both within and without—which would not only preſerve it from ruſt, but would alſo give it a very neat appearance. All theſe improvements have been made, and a variety of ſauce-pans conſtructed on the principles here recommended may be ſeen in the Repoſitory of the Royal Inſtitution.

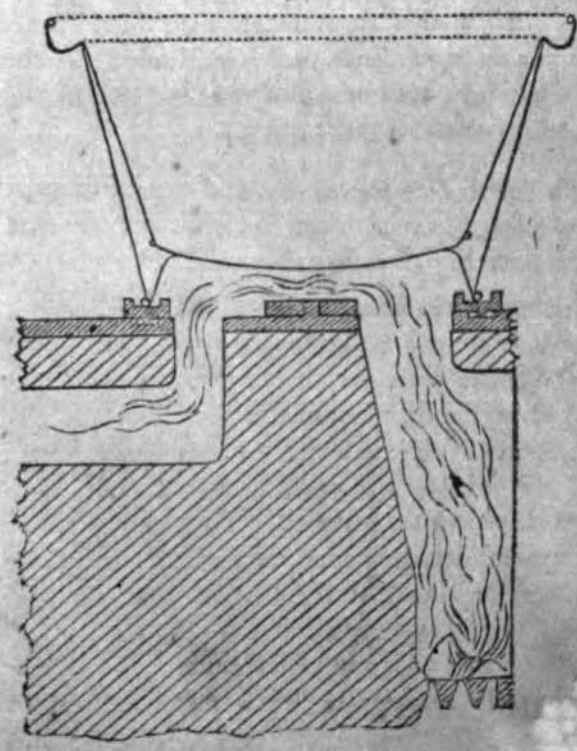
Of the means that may be employed for uſing indifferently Sauce-pans and Boilers of different ſizes, with the ſame Regiſter-Stove Fire-place.

Although the diameter, below, of the cylinder or cone (for it may be either the one or the other) in which the ſauce-pan or boiler is ſuſpended, is limited by the diameter of the groove of the circular regiſter-plate in which it ſtands over the fire; yet, the ſizes of the cooking utenſils uſed with them may be greatly varied. They may, without the ſmalleſt inconvenience, be made either broader or narrower above at their brims, than the bottom of the cylinder or cone in which they are ſuſpended; and, with any given breadth above, their depths (and conſequently their capacities) may be

varied almoſt at pleaſure. When, however, the diameter of one of theſe boilers, at its brim, is greater than the diameter of the groove of the regiſter-plate of the fire-place, it muſt be ſuſpended in an inverted hollow cone, and its body muſt neceſſarily be made conical.

The following figure ſhews how a boiler, 15 inches in diameter, with a ſteam-rim (with which the ſteam-diſhes of a 15 inch family boiler may occaſionally be uſed) may be adapted to a regiſter-ſtove fire-place of the uſual dimenſions.

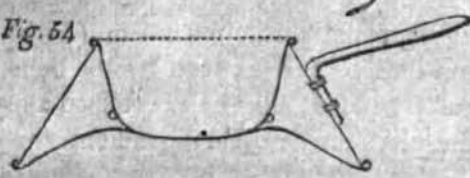
Fig. 53



This boiler requires no handle, as its ſteam-rim, may be uſed inſtead of a handle in moving it from place to place.

The following figure ſhews how very ſmall ſauce-pans are to be fitted up, in order to their being uſed with theſe regiſter-ſtove fire-places.

Fig. 54



This ſauce-pan is only ſix inches in diameter, at its brim, and three inches deep. The hollow cone in which it is ſuſpended is about ſix inches in diameter above—10½ inches in diameter below—and four inches in height.

In kitchens of a moderate ſize it will ſeldom be convenient to devote more ſpace for ſtoves for ſtew-pans and ſauce-pans than would be neceſſary for erecting one regiſter ſtewing-ſtove fire-place, which, if the fire-place has only two regiſters, will heat only two ſtew-pans or boilers at the ſame time; but in cooking for a large family it will frequently be neceſſary to have culinary proceſſes going on at the ſame time in ſeveral ſtew-pans and ſauce-pans; it remains therefore to ſhew how this may be done, with the apparatus and utenſils juſt deſcribed: and it is certain that this object is ſo important, that any arrangement of culinary apparatus would be eſſentially deficient and imperfect, which did not afford the means of attaining it completely, and without

without any kind of difficulty. There are two ways in which it may be done with the utenſils above deſcribed: A ſtew-pan or ſauce-pan having been placed upon one of the regiſter-plates of the ſtove till its contents are boiling hot, it may be removed, and placed over a very ſmall fire made with charcoal in a ſmall portable furnace reſembling a common chafing diſh;—or it may be ſet down upon a circular iron heater, made red hot, and placed in a bed of dry aſhes, in a ſhallow earthen pan. By either of theſe methods a boiling heat may be *kept up* for a long time in the ſtew-pan; and any common proceſs of boiling or ſtewing carried on in a very neat and cleanly manner. It muſt however be remembered, that it is only with ſtew-pans and boilers conſtructed on the principles here recommended, and conſtantly kept well covered, with double covers, to prevent the loſs of the heat, that the proceſſes of boiling and ſtewing can be carried on with very ſmall portable furnaces, and with heaters; but with theſe utenſils, which are ſo well calculated to confine the heat, it is almoſt incredible how ſmall a ſupply of heat will be ſufficient, when the contents of the veſſel have previouſly been made boiling hot, to keep up that temperature, and carry on any of the common proceſſes of cookery.

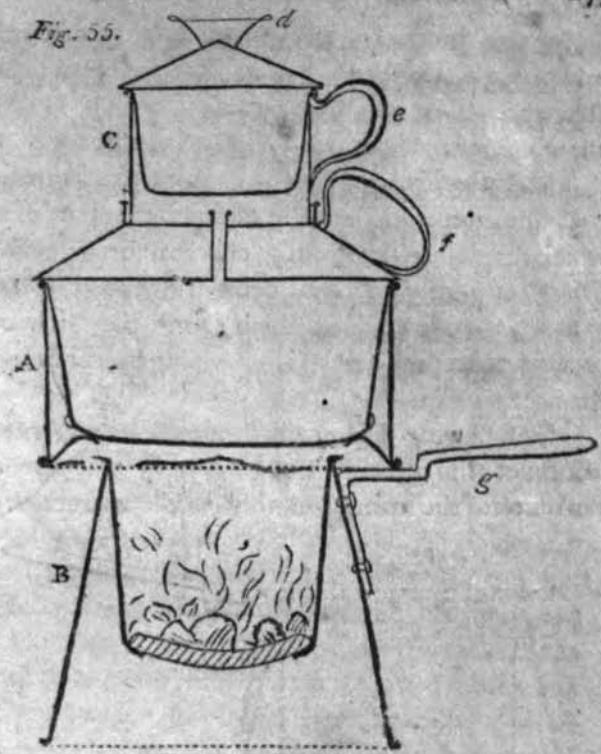
In the following figure (55.) A, repreſents a vertical ſection of a ſtew-pan, 11 inches wide at its brim, and 6 inches deep, ſuſpended in its cylinder,

and placed upon a *portable furnace*, B, which is 7 inches in diameter at its opening above, 11 inches in diameter below, and 9 inches high. A ſmall ſauce-pan, C, for melting butter, is placed on the cover of the ſtew-pan, and is heated by the ſteam from the ſtew-pan.

This ſmall ſauce-pan is ſuſpended in a cylinder, which ſerves for confining the ſteam about it, which riſes from the ſtewing ſtove.

The cover of this ſmall ſauce-pan is double, and, inſtead of an handle, it is furniſhed with a kind of a knob *(d)* formed of an hollow inverted cone of tin, which occaſionally ſerves as a foot for ſupporting the cover, when it is taken off from the ſauce-pan, and laid down in an inverted poſition. This contrivance is deſigned to prevent the inſide of the cover from being expoſed to dirt, when it is occaſionally taken off, and laid down. The ſauce-pan is furniſhed with a handle of the common form *(e)* which is repreſented in the figure.—The handle *(f)* of the ſtew-pan is alſo ſhewn; and that *(g)* of the portable fire-place.

Fig. 55.



The following figure is a perſpective view of the portable furnace, without the ſtew-pan:

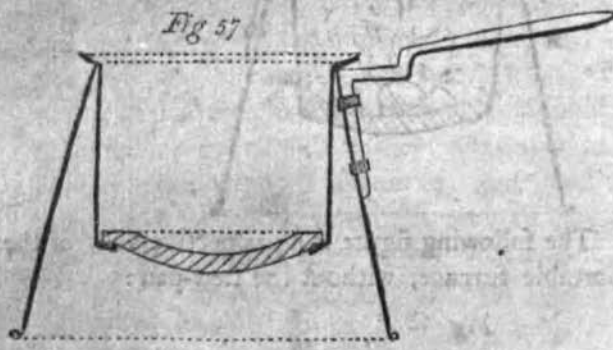
Fig. 56.

In this figure the three horizontal projecting arms are diſtinctly ſeen, which ſerve to ſupport the ſtew-pan. One of theſe arms, which is longer than the reſt, ſerves as an handle to the furnace.

This little furnace, which is conſtructed principally of ſheet-iron, is made double, that part of it which contains the burning charcoal being cylindrical, or nearly ſo, and being ſuſpended in the axis of an hollow cone, which forms the body of of the furnace, and ſerves as a covering for confining the heat.

The following figure, which repreſents a vertical ſection of this furnace through its axis, will give a clear idea of the manner in which it is conſtructed.

Fig 57



The air is introduced into the fire-place, firſt through a circular hole (repreſented in the figure 56.) about $1\frac{1}{2}$ inches in diameter, ſituated in the ſide of the hollow cone near its bottom; and from thence it paſſes up through a ſmall diſhing grate of caſt-iron, which lies at the bottom of the hollow cylinder which contains the burning fuel. At the upper

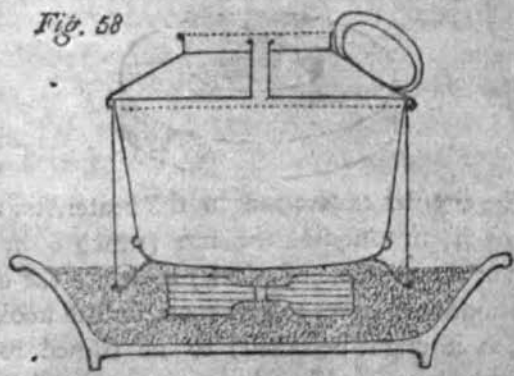
upper end of this cylinder there is a narrow rim, about half an inch wide, turned outwards, by which the cylinder is ſuſpended in its place; and a ſimilar rim being turned inwards below, ſerves as a ſupport for the diſhing grate.

When this fire-place is uſed, it will be proper to place it on a flat ſtone, or on a tile; or, what will be ſtill better, to ſet it in a thin earthen diſh.

The ſame earthen diſhes which would be proper for holding theſe portable fire-places, would alſo anſwer perfectly well for holding the caſt-iron heaters that may occaſionally be uſed for finiſhing the proceſſes of cooking that have been begun in ſtew-pans and ſauce-pans, heated over the fire of a regiſter-ſtove, or otherwiſe made boiling hot.

The following figure, which repreſents a vertical ſection of a ſtew-pan, placed over a heater of the kind here recommended, will give a perfect idea of this arrangement.

Fig. 58



The heater is here repreſented as lying in a bed of aſhes, and there is likewiſe a thin layer of aſhes