into the dining-hall; but I do not know that any advantages were derived from that practice; the ſoup being, to all appearance, quite as good ſince the barley and the peas have been cooked together as before.

As ſoon as the ſoup is done, and the boilers are emptied, they are immediately refilled with water, and the barley for the ſoup for the next day is put into it, and left to ſteep over-night; and at ſix o'clock the next morning the fires are lighted under the boilers *.

The peas, however, are never ſuffered to remain in the water over-night; as we have found, by repeated trials, that they never boil ſoft if the water in which they are boiled is not boiling hot when they are put into it.—Whether this is peculiar to the peas which grow in Bavaria, I know not.

When I began to feed the Poor of Munich, there was alſo a quantity of meat boiled in their ſoup; but as the quantity was ſmall, and the quality of it but very indifferent, I never thought it contributed much to rendering the victuals more

* By ſome experiments lately made, it has been found that the ſoup will be much improved if a ſmall fire is made under the boiler, juſt ſufficient to make its contents boil up once, when the barley and water are put into it, and then cloſing up immediately the aſh hole regiſter, and the damper in the chimney, and throwing a thick blanket, or a warm coverlid over the cover of the boiler, the whole be kept hot till the next morning. This heat ſo long continued, acts very powerfully on the barley, and cauſes it to thicken the water in a very ſurpriſing manner. Perhaps the *oat meal* uſed for making water gruel might be improved in its effects by the ſame means. The experiment is certainly worth trying.

nouriſhing:

nouriſhing: but as ſoon as means were found for rendering the ſoup palatable without meat, the quantity of it uſed was gradually diminiſhed, and it was at length entirely omitted. I never heard that the Poor complained of the want of it; and much doubt whether they took notice of it.

The management of the fire in cooking is, in all caſes, a matter of great importance; but in no caſe is it ſo neceſſary to be attended to as in preparing the cheap and nutritive ſoups here recommended.—Not only the palatableneſs, but even the ſtrength or richneſs of the ſoup, ſeems to depend very much upon the management of the heat employed in cooking it.

From the beginning of the proceſs to the end of it, the boiling ſhould be as gentle as poſſible;—and if it were poſſible to keep the ſoup always *juſt boiling hot* without actually boiling, it would be ſo much the better.

Cauſing any thing to boil violently in any culinary proceſs is very ill judged; for it not only does not expedite, even in the ſmalleſt degree, the proceſs of cooking, but it occaſions a moſt enormous waſte of fuel; and by driving away with the ſteam many of the more volatile and more ſavoury particles of the ingredients, renders the victuals leſs good and leſs palatable.—To thoſe who are acquainted with the experimental philoſophy of heat, and who know that water once brought to be *boiling hot*, however gently it may boil in fact, *cannot be made any hotter*, however large and intenſe the fire under it may be made, and who know that it is by the *heat*—that

is

is to ſay, *the degree* or intenſity of it, and the *time* of its being continued, and not by the bubbling up, or *boiling*, (as it is called,) of the water that culinary operations are performed—this will be evident, and thoſe who know that more than *five times* as much heat is required to *ſend off in ſteam* any given quantity of water *already boiling hot* as would be neceſſary to heat the ſame quantity of *ice-cold* water *to the boiling point*—will ſee the enormous waſte of heat, and conſequently of fuel, which, in all caſes, muſt reſult from violent boiling in culinary proceſſes.

To prevent the ſoup from burning to the boiler, the bottom of the boiler ſhould be made *double*; the falſe bottom (which may be very thin) being fixed on the inſide of the boiler, the two ſheets of copper being every where in contact with each other; but they ought not to be attached to each other with ſolder, except only at the edge of the falſe bottom where it is joined to the ſides of the boiler.—The falſe bottom ſhould have a rim about an inch and an half wide, projecting upwards, by which it ſhould be riveted to the ſides of the boiler; but only few rivets, or nails, ſhould be uſed for fixing the two bottoms together below, and thoſe uſed ſhould be very ſmall; otherwiſe, where large nails are employed at the bottom of the boiler, where the fire is moſt intenſe, the ſoup will be apt to *burn-to*; at leaſt on the heads of thoſe large nails.

The two ſheets of metal may be made to touch each other every where, by hammering them together

gether after the falſe bottom is fixed in its place; and they may be tacked together by a few ſmall rivets placed here and there, at conſiderable diſtances from each other; and after this is done, the boiler may be tinned.

In tinning the boiler, if proper care be taken, the edge of the falſe bottom may be ſoldered by the tin to the ſides of the boiler, and this will prevent the water or other liquids put into the boiler from getting between the two bottoms.

In this manner double bottoms may be made to ſauce-pans and kettles of all kinds uſed in cooking; and this contrivance will, in all caſes, moſt effectually prevent what is called by the cooks *burning to* *.

* This invention of double bottoms might be uſed with great ſucceſs by diſtillers, to prevent their liquor, when it is thick, from burning to the bottoms of their ſtills. But there is another hint, which I have long wiſhed to give diſtillers, from which, I am perſuaded, they might derive very eſſential advantages.—It is to recommend to them to make up warm clothing of thick blanketting for covering up their ſtill head, and defending them from the cold air of the atmoſphere, and for covering in the ſame manner all that part of the copper or boiler which riſes above the brick-work in which it is fixed. The great quantity of heat which is conſtantly given off to the cold air of the atmoſphere in contact with it by this naked copper, not only occaſions a very great loſs of heat, and of fuel, but tends likewiſe very much to *embarraſs* and to *prolong* the proceſs of diſtillation, for all the heat communicated by the naked ſtill-head to the atmoſphere is taken from the ſpirituous vapour which riſes from the liquor in the ſtill; and as this vapour cannot fail to be condenſed into ſpirits whenever and *wherever* it loſes *any part* of its heat,—is the ſpirits generated in the ſtill head in conſequence of this communication of heat to the atmoſphere do not find their way into the worm, but trickle down and mix again with the liquor in the ſtill,—the bad effects of leaving the ſtill-head expoſed naked to the cold air is quite evident. The remedy for this evil is as cheap and as effectual as it is ſimple and obvious.

The Heat is ſo much obſtructed in its paſſage through the thin ſheet of air, which, notwithſtanding all the care that is taken to bring the two bottoms into actual contact, will ſtill remain between them, the ſecond has time to give its heat as faſt as it receives it, to the Fluid in the boiler; and conſequently never acquires a degree of Heat ſufficient for burning any thing that may be upon it.

Perhaps it would be beſt to double copper ſauce-pans and ſmall kettles throughout; and as this may and ought to be done with a very thin ſheet of metal, it could not coſt much, even if this lining were to be made of ſilver.

But I muſt not enlarge here upon a ſubject I ſhall have occaſion to treat more fully in another place.—To return, therefore, to the ſubject more immediately under conſideration, Food.

CHAP. IV.

Of the ſmall Expence at which the Bavarian Soldiers are fed.—Details of their Houſekeeping, founded on actual Experiment.—An Account of the Fuel expended by them in Cooking.

IT has often been matter of ſurpriſe to many, and even to thoſe who are moſt converſant in military affairs, that ſoldiers can find means to live upon the very ſmall allowances granted them for their ſubſiſtence; and I have often wondered that nobody has undertaken to inveſtigate that matter, and to explain a myſtery at the ſame time curious and intereſting in a high degree.

The pay of a private ſoldier is in all countries very ſmall, much leſs than the wages of a day-labourer; and in ſome countries it is ſo mere a pittance, that it is quite aſtoniſhing how it can be made to ſupport life.

The pay of a private foot-ſoldier in the ſervice of His Moſt Serene Highneſs the Elector Palatine, (and it is the ſame for a private grenadier in the regiment of guards,) is *five creutzers* a-day, and no more.—Formerly the pay of a private foot-ſoldier was only four creutzers and a half a-day, but, lately, upon the introduction of the new military arrangements in the country, his pay has been raiſed to five creutzers;—and with this he receives

one pound thirteen ounces and a half, Avoirdupois weight, of rye-bread, which, at the medium price of grain in Bavaria and the Palatinate, coſts ſomething leſs than three creutzers, or juſt about *one-penny* ſterling.

The pay which the ſoldier receives in money,—(five creutzers a-day,) equal to one penny three farthings ſterling, added to his daily allowance of bread, valued at one penny, make *two pence three farthings* a-day, for the ſum total of his allowance.

That it is poſſible, in any country, to procure Food ſufficient to ſupport life with ſo ſmall a ſum, will doubtleſs appear extraordinary to an Engliſh reader;—but what would be his ſurpriſe upon ſeeing a whole army, compoſed of the fineſt, ſtouteſt, and ſtrongeſt men in the world, who are fed upon that allowance, and whoſe countenances ſhow the moſt evident marks of ruddy health, and perfect contentment?

I have already obſerved, how much I was ſtruck with the domeſtic economy of the Bavarian ſoldiers. I think the ſubject much too intereſting, not to be laid before the Public, even in all its details; and as I think it will be more ſatisfactory to hear from their own mouths an account of the manner in which theſe ſoldiers live, I ſhall tranſcribe the reports of two ſenſible non-commiſſioned officers, whom I employed to give me the information I wanted.

Theſe non-commiſſioned officers, who belong to two different regiments of grenadiers in garriſon at Munich, were recommended to me by their

colonels as being very ſteady, careful men, are each at the head of a meſs conſiſting of twelve ſoldiers, themſelves reckoned in the number. The following accounts, which they gave me of their houſekeeping, and of the expences of their tables, were all the genuine reſults of actual Experiments made at my particular deſire, and at my coſt.

I do not believe that uſeful information was ever purchaſed cheaper than upon this occaſion; and I fancy my reader will be of the ſame opinion when he has peruſed the following reports, which are literally tranſlated from the original German.

"In obedience to the orders of Lieut. General "Count Rumford, the following Experiments "were made by Serjeant Wickenhof's meſs, in the "firſt company of the firſt (or Elector's own) re-"giment of grenadiers, at Munich, on the 10th "and 11th of June 1795.

"June 10th, 1795.

"*Bill of Fare.*

"Boiled beef, with ſoup and bread dumplins.

"Details of the expence, &c.

"*For the boiled beef and the ſoup.*

lb	loths			Creutzers
2	0	beef *	— —	16
0	1	ſweet herbs	— —	1
0	$0\frac{1}{2}$	pepper	— —	$0\frac{1}{2}$
0	6	ſalt	— — —	$0\frac{1}{2}$
1	$14\frac{1}{2}$	ammunition bread, cut fine		2
9	20	water	— —	0
Total 13	10			Coſt 20

* The Bavarian pound (equal to $1\frac{738}{1000}$, or near one pound and a quarter Avoirdupois) is divided into 32 loths.

" All theſe articles were put together into an " earthen pot, and boiled two hours and a quar- " ter. The meat was then taken out of the ſoup " and weighed, and found to weigh 1 lb. 30 loths; " which, divided into twelve equal portions, gave " *five loths* for the weight of each.

" The ſoup, with the bread, &c. weighed 9 lb. " 30 ½ loths; which, divided into twelve equal " portions, gave for each 26 $\frac{7}{12}$ loths.

" The coſt of the meat and ſoup together, " 20 $\frac{7}{8}$ creutzers, divided by twelve, gives 1 $\frac{3}{4}$ creut- " zers, very nearly, for the coſt of each portion.

" *For the bread dumplins.*

lb.	loths		Creutzers.
1	13	of fine ſemel bread —	10
1	0	of fine flour — —	4 $\frac{1}{2}$
0	6	ſalt — — —	0 $\frac{1}{2}$
3	0	of water — —	0
Total 5	19	Coſt	15

" This maſs was made into dumplins, and theſe " dumplins were boiled half an hour in clear wa- " ter. Upon taking them out of the water, they " were found to weigh 5 lb. 24 loths; and divid- " ing them into twelve equal portions, each por- " tion weighed 15 $\frac{1}{2}$ loths, and the coſt of the " whole (15 creutzers), divided by twelve, gives " 1 $\frac{1}{4}$ creutzers for the coſt of each portion.

" The meat, ſoup, and dumplins were ſerved " all at once in the ſame diſh, and were all eaten " together; and with this meal, (which was their

" dinner, and was eat at twelve o'clock,) each " perſon belonging to the meſs was furniſhed with " a piece of rye-bread, weighing ten loths, and " which coſt $\frac{5}{16}$ of a creutzer.—Each perſon was " likewiſe furniſhed with a piece of this bread, " weighing ten loths, for his breakfaſt;—another " piece, of equal weight, in the afternoon at four " o'clock; and another in the evening."

Analyſis of this Day's Fare.

	Each perſon received in the courſe of the day,				Amount of coſt in Bavarian money.
	In ſolids.		In fluids.		
	lb.	loths.	lb.	loths.	Creutzers.
Boiled beef	0	5	—	—	$1\frac{5}{6}$
In the ſoup. Rye-bread	0	$3\frac{7}{8}$	—	—	
In the ſoup. Sweet herbs	0	$0\frac{1}{2}$	—	—	
In the ſoup. Salt	0	$0\frac{1}{4}$	—	—	
In the ſoup. Pepper	0	$0\frac{1}{24}$	—	—	$0,8$
In the ſoup. Water	-	-	0	$23\frac{1}{4}$	
In the ſoup. Total	0	$4\frac{7}{24}$	0	$23\frac{1}{4}$	
In dumplings. Wheaten bread	0	$3\frac{1}{4}$			
In dumplings. Ditto flour	0	$2\frac{3}{4}$			
In dumplings. Salt	0	$0\frac{1}{24}$			
In dumplings. Water	-	-	0	$7\frac{1}{12}$	$1\frac{1}{4}$
In dumplings. Total	0	$6\frac{11}{24}$	0	$7\frac{1}{12}$	
Dry bread. For breakfaſt	0	10	—	—	
Dry bread. At dinner	0	10	—	—	
Dry bread. In the afternoon	0	10	—	—	
Dry bread. At ſupper	0	10	—	—	$2\frac{1}{2}$
Dry bread. Total	1	8			
General Total	2	$24\frac{13}{24}$	0	$31\frac{1}{3}$	which coſt $5\frac{17}{18}$

The ammunition bread is reckoned in this eſtimate at two creutzers the Bavarian pound, which is about what it coſts at a medium; and as the daily allowance of the ſoldiers is $1\frac{1}{2}$ Bavarian pounds of this bread, this reckoned in money amounts to three *creutzers a-day;* and this added to his pay at *five creutzers a-day*, makes *eight creutzers a-day*, which is the whole of his allowance from the ſovereign for his ſubſiſtence.

But it appears from the foregoing account, that he expends for Food no more than $5\frac{17}{48}$ creutzers a-day, there is therefore a ſurplus amounting to $2\frac{31}{48}$ creutzers a-day, or very near *one third of his whole allowance*, which remains; and which he can diſpoſe of juſt as he thinks proper.

This ſurplus is commonly employed in purchaſing beer, brandy, tobacco, &c. Beer in Bavaria coſts two creutzers a pint; brandy, or rather malt-ſpirits, from fifteen to eighteen creutzers; and tobacco is very cheap.

To enable the Engliſh reader to form, without the trouble of computation, a complete and ſatisfactory idea of the manner in which theſe Bavarian ſoldiers are fed, I have added the following Analyſis of their fare; in which the quantity of each article is expreſſed in *Avoirdupois weight*, and its coſt in *Engliſh money.*

Analyſis.

Analyſis.

Each perſon belonging to the meſs received in the courſe of the day June 11th, 1795,	lb	oz.		Coſt in Engliſh money. s.	d.
Dry ammunition bread -	1	$8\frac{76}{100}$	——	0	$0\frac{10}{12}$
Ammunition bread cooked in the ſoup - -	0	$2\frac{4}{10}$	——	0	$0\frac{77}{164}$
Fine wheaten *(ſemel)* bread in the dumplins -	0	$2\frac{1}{10}$	——	0	$0\frac{10}{33}$
Total bread	1	$13\frac{46}{100}$			
Fine flour in the dumplins	0	$1\frac{66}{100}$	——	0	$0\frac{18}{33}$
Boiled beef - - - -	0	$3\frac{1}{10}$	——	0	$0\frac{72}{132}$
In ſeaſoning; fine herbs, ſalt, and pepper - -	0	$0\frac{11}{16}$	——	0	$0\frac{7}{11}$
Total ſolids	2	$2\frac{11}{100}$			
Water prepared by cooking.					
In the ſoup - -	0	$14\frac{57}{100}$			
In the dumplins -	0	$4\frac{32}{100}$			
Total prepared water	1	$2\frac{89}{100}$			
Total ſolids and fluids	3	$5\frac{16}{100}$			

Total expence for each perſon $5\frac{17}{44}$ creutzers, equal to *two pence* ſterling, very nearly.

But as the Bavarian ſoldiers have not the ſame fare every day, the expences of their tables cannot be aſcertained from one ſingle experiment. I ſhall therefore return to Serjeant Wickenhof's report.

" 11th of June 1795.

" *Bill of Fare.*

" Bread dumplins, and ſoup.

" Details of expences, &c.

" *For the dumplins.*

lb.	loths.				Creutzers.
2	13	wheaten bread		—	14
0	16	butter	—	—	9
1	0	fine flour	—	—	4½
0	11	eggs	—	—	3
0	6	ſalt	—	—	0½
0	0½	pepper	—	—	0½
3	16	water	—	—	—
7	30½			Coſt	31½ creutzers.

" This made into dumplins;—the dumplins, " after being boiled, were found to weigh eight " pounds eight loths, which, divided among twelve " perſons, gave for each twenty-two loths.—And " the coſt of the whole (31½ creutzers), divided " by 12, gives 2½ creutzers for each portion.

" *For the ſoup.*

lb.	loths.				Creutzers.
1	14½	ammunition bread		—	2½
0	6	ſalt	—	—	0½
0	1	ſweet herbs	—	—	1
12	0	water	—	—	—
13	21½			Coſt	4½ creutzers.

" This ſoup, when cooked, weighed 11 lb. 26 " loths; which, divided among the twelve per- " ſons belonging to the meſs, gave for each

" 31½

" 31½ loths; and the coſt (4⅓ creutzers), divided " by twelve, gives nearly *three ninths* of a creutzer " for each portion.

" *For bread.*

" Four pieces of ammunition bread, weighing " each ten loths, for each perſon,—namely, one " piece for breakfaſt—one at dinner—one in the " afternoon,—and one at ſupper; in all, 40 loths, " or one pound and a quarter, coſts two creutzers " and a half."

Details of expences, &c. for each perſon.

	lb.	loths.			Creutzers.
For	1	8	dry bread	—	2½
For	0	22	bread dumplins	—	2$\frac{17}{24}$
For	0	31½	bread ſoup	—	0$\frac{7}{8}$
	2	30½	of Food	Coſt	5$\frac{1}{2}$ creutzers.

The ſame details expreſſed in Avoirdupois weight, and Engliſh money:

For each perſon

lb.	oz.				Pence.
1	8$\frac{76}{128}$	dry ammunition bread	—	—	0$\frac{10}{11}$
0	13$\frac{6}{10}$	bread dumplins	—	—	0$\frac{693}{700}$
1	3½	bread ſoup	—	—	0$\frac{36}{164}$
3	9$\frac{86}{128}$	of Food	—	Coſt	2 pence.

" June

" June 20th, 1795.

" Serjeant Kein's meſs, ſecond regiment of grenadiers.

" *Bill of Fare.*

" Boiled beef—bread ſoup—and liver dumplins.

" Details of expences, &c.

" For the boiled beef and ſoup.

lb.	loths.				Creutzers.
2	0	beef	—	—	15
0	$6\frac{1}{2}$	ſalt	—	—	$0\frac{1}{2}$
0	$0\frac{1}{2}$	pepper	—	—	$0\frac{1}{2}$
0	2	ſweet herbs	—	—	$0\frac{1}{2}$
2	24	ammunition bread		—	$3\frac{1}{2}$
17	0	water	—	—	—
22	1			Coſt	$19\frac{1}{2}$ creutzers.

" Theſe ingredients were all boiled together " two hours and five minutes; after which the " beef was taken out of the ſoup and weighed, " and was found to weigh 1 lb. 22 loths; the " ſoup weighed 15 lb.; and theſe divided equally " among the twelve perſons belonging to the meſs, " gave for each portion $4\frac{1}{2}$ loths of beef, and 1 lb. " 8 loths of ſoup; and the coſt of the whole ($19\frac{3}{4}$ " creutzers), divided by 18, gives $1\frac{3}{4\,8}$ creutzers " for the coſt of each portion.

" Details

" Details of expences, &c. for the *liver dumplins*.

lb.	loths.			Creutzers.
2	28	of fine *semel* bread	—	15
1	0	of beef liver	—	5
0	18	of fine flour	—	$2\frac{1}{2}$
0	6	of falt —	—	$0\frac{1}{2}$
2	24	of water —	—	—
Total 7	12		Coft	23 creutzers.

" Thefe ingredients being made into dumplins, " the dumplins after being properly boiled were " found to weigh 8 lb.—This gave for each por- " tion $21\frac{1}{3}$ loths; and the amount of the coft " (23 creutzers), divided by 12, the number of " the portions, gives for each $1\frac{1}{12}$ creutzers.

" The quantity of dry ammunition bread fur- " nifhed to each perfon was 1 lb. 8 loths; and " this, at two creutzers a pound, amounts to $2\frac{1}{2}$ " creutzers."

Recapitulation.

For each perfon

lb.	loths.		Creutzers.
0	$4\frac{1}{2}$	of boiled beef, and	— $1\frac{11}{48}$
1	8	of bread foup	
0	$21\frac{1}{3}$	of liver dumplins	— $1\frac{11}{12}$
1	8	of dry bread	— $2\frac{1}{2}$
3	$9\frac{5}{8}$	of Food	Coft $6\frac{35}{48}$ creutzers.

In Avoirdupois weight, and Engliſh money, it is,—for each perſon:

lb.	oz.		Pence.
0	$2\frac{78}{100}$	of boiled beef, and	— $0\frac{948}{1584}$
1	$8\frac{91}{100}$	of bread foup	
0	$13\frac{19}{100}$	of liver dumplins	— $0\frac{276}{1056}$
1	$8\frac{76}{100}$	of dry bread	— $0\frac{10}{11}$
4	$1\frac{14}{100}$	of Food	Coft $2\frac{1}{3}$ pence.

" June

" June 21ſt, 1795.

" *Bill of Fare.*

" **B**oiled beef, and bread ſoup, with bread
" dumplins.

" **D**etails of expences, &c. for the *boiled beef*
" and *bread ſoup.*

" The ſame as yeſterday.

" For the *dumplins.*

lb.	loths.			Creutzers.
2	30	ſemel bread	—	$15\frac{1}{2}$
0	18	fine flour	—	3
0	6	ſalt —	—	$0\frac{1}{2}$
3	0	water —	—	—
6	22		Coſt	19 creutzers

" Theſe dumplins being boiled, were found to " weigh 7 lb. which gave for each perſon $18\frac{2}{7}$ loths; " and each portion coſt $1\frac{7}{2}$ creutzers.

" Dry ammunition bread furniſhed to each per- " ſon 1 lb. 8 loths, which coſt $2\frac{1}{4}$ creutzers.

Recapitulation.

" Each perſon belonging to the meſs received " this day:

lb.	loths.			Creutzers.
0	$4\frac{1}{2}$	of boiled beef, and		$1\frac{3}{8}$
1	8	of bread ſoup		
0	$18\frac{2}{3}$	of bread dumplins	—	$1\frac{5}{12}$
1	8	of dry bread	—	$2\frac{1}{4}$
3	$7\frac{1}{6}$	of Food	Coſt	$5\frac{5}{24}$ creutzers.

" In

" In *Avoirdupois weight*, and *Engliſh money*, it is,

lb.	oz.			Pence.
0	$2\frac{38}{100}$	of boiled beef, and	}	$0\frac{948}{1584}$
1	$8\frac{7}{16}$	of bread ſoup	}	
0	$11\frac{54}{100}$	of bread dumplins		$0\frac{228}{400}$
1	$8\frac{72}{100}$	of dry bread	—	$0\frac{10}{11}$
4	0	of Food	Coſt	$2\frac{1}{12}$ pence.

" June 22d, 1795.

" *Bill of Fare.*

" *Bread ſoup* and *meat dumplins.*

" Details of expences, &c.

lb.	loths.			Creutzers.
2	0	of beef	—	15
2	30	of ſemel bread	—	$15\frac{1}{2}$
0	18	of fine flour	—	3
0	1	of pepper	—	1
0	12	of ſalt	—	1
0	2	of ſweet herbs	—	$0\frac{1}{2}$
2	24	of ammunition bread		$3\frac{1}{2}$
2	16	of water to the dumplins		
			Coſt	$39\frac{1}{2}$ creutzers.

" The meat being cut fine, or minced, was " mixed with the ſemel or wheaten bread; and " theſe with the flour, and a due proportion of " ſalt, were made into dumplins, and boiled in the " ſoup.—Theſe dumplins, when boiled, weighed " 10 lb. which, divided into 12 equal portions, " gave $20\frac{3}{4}$ loths for each.

" The ſoup weighed 15 lb. which gave 1 lb. " 8 loths for each portion.—Of dry ammunition " bread, each perſon received 1 lb. 8 loths, which " coſt $2\frac{1}{2}$ creutzers.

Recipi-

Recapitulation.

" Each perſon received this day

lb.	loths.		Creutzers.
0	$20\frac{2}{3}$ of meat dumplins, and	}	$3\frac{13}{18}$
1	8 of bread ſoup	}	
1	8 of ammunition bread		$2\frac{1}{2}$
3	$4\frac{2}{3}$ of Food	Coſt	$5\frac{1}{18}$ creutzers.

" In *Avoirdupois weight*, and *Engliſh money*, it is,

lb.	oz.		Pence.
0	$12\frac{77}{100}$ of meat dumplins, and	}	$1\frac{1}{57}$
1	$8\frac{1}{10}$ of bread ſoup	}	
1	$8\frac{1}{10}$ of ammunition bread		$0\frac{1}{11}$
3	$14\frac{29}{100}$ of Food	Coſt	$2\frac{1}{18}$ pence.

The reſults of all theſe Experiments, (and of many more which I could add,) ſhow that the Bavarian ſoldier can live,—and the fact is that he actually does live,—upon a little more than *two-thirds* of his allowance.—Of the *five creutzers* a-day which he receives in money, he ſeldom puts more than *two creutzers and an half*, and never more than *three creutzers* into the meſs; ſo that at leaſt *two-fifths* of his pay remains, after he has defrayed all the expences of his ſubſiſtence; and as he is furniſhed with every article of his clothing by the ſovereign, and no ſtoppage is ever permitted to be made of any part of his pay, on any pretence whatever, *there is no ſoldier in Europe whoſe ſituation is more comfortable.*

Though

Though the ammunition bread with which he is furniſhed is rather coarſe and brown, being made of rye-meal, with only a ſmall quantity of the coarſer part of the bran ſeparated from it, yet it is not only wholeſome, but very nouriſhing; and for making ſoup it is even more palatable than wheaten bread. Moſt of the ſoldiers, however, in the Elector's ſervice, and particularly thoſe belonging to the Bavarian regiments, make a practice of ſelling a great part of their allowance of ammunition bread, and with the money they get for it, buy the beſt wheaten bread that is to be had; and many of them never taſte brown bread but in their ſoup.

The ammunition bread is delivered to the ſoldiers every fourth day, in loaves, each loaf being equal to two rations; and it is a rule generally eſtabliſhed in the meſſes, for each ſoldier to furniſh one loaf for the uſe of the meſs every twelfth day, ſo that he has five-ſixths of his allowance of bread, which remains at his diſpoſal.

The foregoing account of the manner in which the Bavarian ſoldiers are fed, will, I think, ſhow moſt clearly the great importance of making ſoldiers live together in meſſes.—It may likewiſe furniſh ſome uſeful hints to thoſe who may be engaged in feeding the Poor; or in providing Food for ſhip's companies, or other bodies of men who are fed in common.

With regard to the expence of fuel in theſe experiments, as the victuals were cooked in earthen

pots, over an open fire, the conſumption of fire-wood was very great.

On the 10th of June, when 9 lb. 30½ loths of ſoup, 1 lb. 28 loths of meat, and 5 lb. 24 loths of bread dumplins, in all 17 lb. 18½ of Food were prepared, and the proceſs of cooking, from the time the fire was lighted till the victuals were done, laſted two hours and forty-five minutes, and twenty-nine pounds, Bavarian weight, of fire-wood were conſumed.

On the 11th of June, when 11 lb. 26 loths of bread ſoup, and 8 lb. 8 loths of bread dumplins, in all 20 lb. 2 loths of Food were prepared, the proceſs of cooking laſted one hour and thirty minutes;—and ſeventeen pounds of wood were conſumed.

On the 20th of June, in Serjeant's Kein's meſs, 15 lb. of ſoup, 1 lb. 22 loths of meat, and 8 lb. of liver dumplins, in all 24 lb. 22 loths of Food were prepared, and though the proceſs of cooking laſted two hours and forty-five minutes, only 27½ lb. of fire-wood were conſumed.

On the 21ſt of June, the ſame quantity of ſoup and meat, and 7 lb. of bread dumplins, in all 23 lb. 22 loths of Food were prepared in two hours and thirty minutes, with the conſumption of 18½ lb. of wood.

On the 22d of June, 15 lb. of ſoup, and 10 lb. of meat dumplins, in all 25 lb. of Food, were cooked in two hours and forty-five minutes, and the wood conſumed was 18 lb. 10 loths.

The following table will ſhow, in a ſtriking and ſatisfactory manner, the expence of fuel in theſe experiments:

Date of the Experiments.	Time employed in cooking.		Quantity of Food prepared.		Quantity of Wood conſumed.	Quantity of Wood to 1 lb. of Food.
June 1795.	Hours.	min.	lb.	loths.	lb.	
10th,	2	45	17	18½	29	
11th,	1	30	20	2	17	
20th,	2	45	24	22	17½	
21ſt,	2	30	23	22	18½	
22d,	2	45	25	0	18¼	
Sums 5	12	15	111	0½	100¼	
Means	2	23	22	0⅕	20 1/20	1 7/11 lb.

The mean quantity of Food prepared daily in five days being 22 lb. very nearly, and the mean quantity of fire-wood conſumed being 20 1/20 lb.; this gives 1 7/11 lb. of wood for each pound of Food.

But it has been found by actual experiment, made with the utmoſt care, in the new kitchen of the Houſe of Induſtry at Munich, and often repeated, that 600 lb. of Food, (of the Soup No. I. given to the Poor,) may be cooked with the conſumption of only 44 lb. of pine-wood. And hence it appears how very great the waſte of fuel muſt be in all culinary proceſſes, as they are commonly performed; for though the time taken up in cooking the ſoup for the Poor is, at a medium, more than *four hours and a half*, while that employed by the ſoldiers in their cooking is

leſs than *two hours and an half;* yet the quantity of fuel conſumed by the latter is near *thirteen times* greater than that employed in the public kitchen of the Houſe of Induſtry.

But I muſt not anticipate here a matter which is to be the ſubject of a ſeparate Eſſay; and which, from its great importance, certainly deſerves to be carefully and thoroughly inveſtigated.

CHAP. V.

Of the great Importance of making Soldiers eat together in regular Meſſes.—The Influence of ſuch economical Arrangements extends even to the moral Character of thoſe who are the Objects of them.—Of the Expence of feeding Soldiers in Meſſes.—Of the ſurpriſing Smallneſs of the Expence of feeding the Poor at Munich.—Specific Propoſals reſpecting the feeding of the Poor in Great Britain, with Calculations of the Expence, at the preſent Prices of Proviſions.

ALL thoſe who have been converſant in military affairs muſt have had frequent opportunities of obſerving the ſtriking difference there is, even in the appearance of the men, between regiments in which meſſes are eſtabliſhed, and Food is regularly provided under the care and inſpection of the officers; and others in which the ſoldiers are left individually to ſhift for themſelves. And the difference which may be obſerved between ſoldiers who live in meſſes, and are regularly fed, and others who are not, is not confined merely to their external appearance: the influence of theſe cauſes extends much farther, and even the *moral character* of the man is affected by them.

Peace of mind, which is as eſſential to contentment and happineſs as it is to virtue, depends much upon order and regularity in the common affairs of life; and in no caſe are order and method more neceſſary to happineſs, (and conſequently to virtue,) than in that, where the preſervation of health is connected with the ſatisfying of hunger; an appetite whoſe cravings are ſometimes as inordinate as they are inſatiable.

Peace of mind depends likewiſe much upon economy, or the means uſed for preventing pecuniary embarraſſments; and the ſavings to ſoldiers in providing Food, which ariſe from houſekeeping in meſſes of ten or twelve perſons who live together, is very great indeed.

But great as theſe ſavings now are, I think they might be made ſtill more conſiderable; and I ſhall give my reaſons for this opinion.

Though the Bavarian ſoldiers live at a very ſmall expence, little more than *two-pence* ſterling a-day, yet when I compare this ſum, ſmall as it is, with the expence of feeding the Poor in the Houſe of Induſtry at Munich, which does not amount to more than *two-farthings* a-day, even including the coſt of the piece of dry rye-bread, weighing ſeven ounces Avoirdupois *, which is given them in their hands,

* For each 100 lb. Bavarian weight, (equal to 123, $\frac{54}{100}$ lb. Avoirdupois,) of rye meal, which the baker receives from the magazine, he is obliged to deliver ſixty-four loaves of bread, each loaf weighing 2 lb. $5\frac{1}{2}$ loths; equal to 2 lb. 10 oz Avoirdupois; and as each loaf is divided into ſix portions, this gives ſeven ounces Avoirdupois for each portion. Hence it appears that 100 lb. of rye-meal give 149 lb.

hands, at dinner, but which they ſeldom eat at dinner, but commonly carry home in their pockets for their ſuppers;—when I compare, I ſay, this ſmall ſum, with the daily expence of the ſoldiers for their ſubſiſtence, I find reaſon to conclude, either that the ſoldiers might be fed cheaper, or that the Poor muſt be abſolutely ſtarved upon their allowance. That the latter is not the caſe, the healthy countenances of the Poor, and the air of placid contentment which always accompanies them, as well in the dining-hall as in their working-rooms, affords at the ſame time the moſt intereſting and moſt ſatisfactory proof poſſible.

Were they to go home in the courſe of the day, it might be ſuſpected that they got ſomething at home to eat, in addition to what they receive from the public kitchen of the Eſtabliſhment;—but this they ſeldom or ever do: and they come to the houſe ſo early in the morning, and leave it ſo late at night, that it does not ſeem probable that they could find time to cook any thing at their own lodgings.

Some of them, I know, make a conſtant practice of giving themſelves a treat of a pint of beer at night, after they have finiſhed their work; but I do not believe they have any thing elſe for their

149 lb. of bread, for ſixty-four loaves, at 2 lb. $5\frac{1}{2}$ loths each, weigh 149 lb.—When this bread is reckoned at two creutzers a Bavarian pound, (which is about what it coſts at a medium,) one portion coſts juſt $\frac{15}{16}$ of a creutzer, or $\frac{120}{176}$ of a penny ſterling, which is ſomething leſs than one farthing.

ſuppers, except it be the bread which they carry home from the Houſe of Induſtry.

I muſt confeſs, however, very fairly, that it always appeared to me quite ſurpriſing, and that it is ſtill a myſtery which I do not clearly underſtand, how it is poſſible for theſe poor people to be ſo comfortably fed upon the ſmall allowances which they receive.—The facts, however, are not only certain, but they are notorious. Many perſons of the moſt reſpectable character in this country, (Great Britain,) as well as upon the Continent, who have viſited the Houſe of Induſtry at Munich, can bear witneſs to their authenticity; and they are ſurely not the leſs intereſting for being extraordinary.

It muſt however be remembered, that what formerly coſt *two farthings* in Bavaria, at the mean price of proviſions in that country, coſts *three* farthings at this preſent moment; and would probably coſt *five* in London, and in moſt other parts of Great Britain: but ſtill, it will doubtleſs appear almoſt incredible, that a comfortable and nouriſhing meal, ſufficient for ſatisfying the hunger of a ſtrong man, may be furniſhed in London, and at this very moment, when proviſions of all kinds are ſo remarkably dear, at *leſs than three farthings*. The fact, however, is moſt certain, and may eaſily be demonſtrated by making the experiment.

Suppoſing that it ſhould be neceſſary, in feeding the Poor in this country, to furniſh them with three

three meals a-day, even that might be done at a very ſmall expence, were the ſyſtem of feeding them adopted, which is here propoſed. The amount of that expence would be as follows:

	Pence	Farths.
For breakfaſt, 20 ounces of the Soup No. II. compoſed of pearl barley, peas, potatoes, and fine wheaten bread (See page 210.)	0	2½
For dinner, 20 ounces of the ſame Soup, and 7 ounces of rye-bread — — —	1	2
For ſupper, 20 ounces of the ſame Soup —	0	2½
In all 4 lb. 3 oz. of Food*, which would coſt	2	3

Should it be thought neceſſary to give a little meat at dinner, this may beſt be done by mixing it, cut fine, or minced, in bread dumplins; or when bacon, or any kind of ſalted or ſmoaked meat is given, to cut it fine and mix it with the bread which is eaten in the ſoup. If the bread be fried, the Food will be much improved; but this will be attended with ſome additional expence.—Rye-bread is as good, if not better, for frying, than bread made of wheat flour; and it is commonly not half ſo dear.—Perhaps rye-bread fried might be furniſhed almoſt as cheap as wheaten bread not fried; and if this could be done, it would certainly be a very great improvement.

* This allowance is evidently much too large, but I was willing to ſhow what the expence of feeding the Poor would be at *the higheſt calculation*. I have eſtimated the 7 ounces of rye-bread, mentioned above, at what it ought to coſt when rye is 7*s.* 6*d.* the buſhel, its preſent price in London.

There

There is another way by which theſe cheap ſoups may be made exceedingly palatable and ſavoury;—which is by mixing with them a very ſmall quantity of *red herrings*, minced very fine, or pounded in a mortar.—There is no kind of cheap Food, I believe, that has ſo much taſte as red herrings, or that communicates its flavour with ſo much liberality to other eatables; and to moſt palates it is remarkably agreeable.

Cheeſe may likewiſe be made uſe of for giving an agreeable reliſh to theſe ſoups; and a very ſmall quantity of it will be ſufficient for that purpoſe, provided it has a ſtrong taſte, and is properly applied.—It ſhould be grated to a powder with a grater, and a ſmall quantity of this powder thrown over the ſoup, *after it is diſhed out*.—This is frequently done at the ſumptuous tables of the rich, and is thought a great delicacy; while the Poor, who have ſo few enjoyments, have not been taught to avail themſelves of this, which is ſo much within their reach.

Thoſe whoſe avocations call them to viſit diſtant countries, and thoſe whoſe fortune enables them to travel for their amuſement or improvement, have many opportunities of acquiring uſeful information; and in conſequence of this intercourſe with ſtrangers, many improvements, and more *refinements*, have been introduced into this country; but the moſt important advantages that *might* be derived from an intimate knowledge of the manners and cuſtoms of different nations,—the introduction of improvements tending to facilitate the means

means of ſubſiſtence, and to increaſe the comforts and conveniences of the moſt neceſſitous and moſt numerous claſſes of ſociety,—have been, alas! little attended to. Our extenſive commerce enables us to procure, and we do actually import moſt of the valuable commodities which are the produce either of the ſoil, of the ocean, or of the induſtry of man in all the various regions of the habitable globe;—*but the reſult of the* EXPERIENCE OF AGES *reſpecting the uſe that can be made of thoſe commodities* has ſeldom been thought worth importing! I never ſee *maccaroni* in England, or *polenta* in Germany, upon the tables of the rich, without lamenting that thoſe cheap and wholeſome luxuries ſhould be monopolized by thoſe who ſtand leaſt in need of them; while the Poor, who, one would think, ought to be conſidered as having almoſt an *excluſive* right to them, (as they were both invented by the Poor of a neighbouring nation,) are kept in perfect ignorance of them.

But theſe two kinds of Food are ſo palatable, wholeſome, and nouriſhing, and may be provided ſo eaſily, and at ſo very cheap a rate in all countries, and particularly in Great Britain, that I think I cannot do better than to devote a few pages to the examination of them;—and I ſhall begin with Polenta, or *Indian Corn*, as it is called in this country.

CHAP. VI.

Of INDIAN CORN.—*It affords the cheapeſt and moſt nouriſhing Food known.—Proofs that it is more nouriſhing than Rice.—Different Ways of preparing or cooking it.—Computation of the Expence of feeding a Perſon with it, founded on Experiment.—Approved Receipt for making an* INDIAN PUDDING.

I CANNOT help increaſing the length of this Eſſay much beyond the bounds I originally aſſigned to it, in order to have an opportunity of recommending a kind of Food which I believe to be beyond compariſon the moſt nouriſhing, cheapeſt, and moſt wholeſome that can be procured for feeding the Poor.—This is Indian Corn, a moſt valuable production; and which grows in almoſt all climates; and though it does not ſucceed remarkably well in Great Britain, and in ſome parts of Germany, yet it may eaſily be had in great abundance, from other countries; and commonly at a very low rate.

The common people in the northern parts of Italy live almoſt entirely upon it; and throughout the whole Continent of America, it makes a principal article of Food.—In Italy it is called *Polenta*, where it is prepared or cooked in a variety of ways, and forms the baſis of a number of very nouriſhing diſhes.—The moſt common way however of uſing it in that country is to grind it into

into meal, and with water to make it into a thick kind of pudding, like what in this country is called a haſty-pudding, which is eaten with various kinds of ſauce, and ſometimes without any ſauce.

In the northern parts of North America, the common houſehold bread throughout the country is compoſed of one part of Indian meal and one part of rye meal; and I much doubt whether a more wholeſome, or more nouriſhing kind of bread can be made.

Rice is univerſally allowed to be very nouriſhing,—much more ſo even than wheat; but there is a circumſtance well known to all thoſe who are acquainted with the details of feeding the negro ſlaves in the ſouthern ſtates of North America, and in the Weſt Indies, that would ſeem to prove, in a very deciſive and ſatisfactory manner, that *Indian Corn is even more nouriſhing than rice.*—In thoſe countries, where rice and Indian Corn are both produced in the greateſt abundance, the negroes have frequently had their option between theſe two kinds of Food; and have invariably preferred the latter.—The reaſons they give for this preference they expreſs in ſtrong, though not in very delicate terms.—They ſay that "*Rice turns to water in* "*their bellies*, and runs off;"—but "Indian Corn "*ſtays with them, and makes ſtrong to work.*"

This account of the preference which negroes give to Indian Corn for Food, and of their reaſons for this preference, was communicated to me by two gentlemen of moſt reſpectable character, well known in England, and now reſident in London, who

who were formerly planters; one in Georgia, and the other in Jamaica.

The nutritive quality which Indian Corn poſſeſſes in a moſt eminent degree, when employed for fattening hogs and poultry, and for giving ſtrength to working oxen, has long been univerſally known and acknowledged in every part of North America; and nobody in that country thinks of employing any other grain for thoſe purpoſes.

All theſe facts prove to a demonſtration that Indian Corn poſſeſſes very extraordinary nutritive powers; and it is well known that there is no ſpecies of grain that can be had ſo cheap, or in ſo great abundance;—it is therefore well worthy the attention of thoſe who are engaged in providing cheap and wholeſome Food for the Poor,—or in taking meaſures for warding off the evils which commonly attend a general ſcarcity of proviſions, to conſider in time, how this uſeful article of Food may be procured in large quantities, and how the introduction of it into common uſe can moſt eaſily be effected.

In regard to the manner of uſing Indian Corn, there are a vaſt variety of different ways in which it may be prepared, or cooked, in order to its being uſed as Food.—One ſimple and obvious way of uſing it, is to mix it with wheat, rye, or barley meal, in making bread; but when it is uſed for making bread, and particularly when it is mixed with wheat flour, it will greatly improve the quality of the bread if the Indian meal, (the coarſer part of the bran being firſt ſeparated from it by ſifting,) be previouſly mixed with water, and boiled for a conſi-

conſiderable length of time,—two or three hours for inſtance, over a ſlow fire, before the other meal or flour is added to it.—This boiling, which, if the proper quantity of water is employed, will bring the maſs to the conſiſtency of a thin pudding, will effectually remove a certain diſagreeable *raw taſte* in the Indian Corn, which ſimple baking will not entirely take away; and the wheat flour being mixed with this pudding after it has been taken from the fire and cooled, and the whole well kneaded together, may be made to riſe, and be formed into loaves, and baked into bread, with the ſame facility that bread is made of wheat flour alone, or of any mixtures of different kinds of meal.

When the Indian meal is previouſly prepared by boiling, in the manner here deſcribed, a moſt excellent, and very palatable kind of bread, not inferior to wheaten bread, may be made of equal parts of this meal and of common wheat flour.

But the moſt ſimple, and I believe the beſt, and moſt economical way of employing Indian Corn as Food, is to make it into puddings.—There is, as I have already obſerved, a certain rawneſs in the taſte of it, which nothing but long boiling can remove; but when that diſagreeable taſte is removed, it becomes extremely palatable; and that it is remarkably wholeſome, has been proved by ſo much experience that no doubts can poſſibly be entertained of that fact.

The culture of it requires more labour than moſt other kinds of grain; but, on the other hand, the produce is very abundant, and it is always much cheaper than either wheat or rye.—The price

price of it in the Carolinas, and in Georgia, has often been as low as eighteen pence, and ſometimes as *one ſhilling* ſterling *per* buſhel;—but the Indian Corn which is grown in thoſe ſouthern ſtates is much inferior, both in weight and in its qualities, to that which is the produce of colder climates.—Indian Corn of the growth of Canada, and the New England ſtates, which is generally thought to be worth twenty *per cent.* more *per* buſhel than that which is grown in the ſouthern ſtates, may commonly be bought for two and ſixpence, or three ſhillings a buſhel.

It is now three ſhillings and ſixpence a buſhel at Boſton; but the prices of proviſions of all kinds have been much raiſed of late in all parts of America, owing to the uncommonly high prices which are paid for them in the European markets ſince the commencement of the preſent war.

Indian Corn and rye are very nearly of the ſame weight, but the former gives rather more flour, when ground and ſifted, than the latter.—I find by a report of the Board of Agriculture, of the 10th of November 1795, that three buſhels of Indian Corn weighed 1 cwt. 1 qr. 18 lb. (or 53 lb. each buſhel), and gave 1 cwt. 20 lb. of flour and 26 lb. of bran; while three buſhels of rye, weighing 1 cwt. 1 qr. 22 lb. (or 54 lb. the buſhel), gave only 1 cwt. 17 lb. of flour and 28 lb. of bran.—But I much ſuſpect that the Indian Corn uſed in theſe experiments was not of the beſt quality *.

I ſaw ſome of it, and it appeared to me to be of that kind which is commonly grown in the

* Farther inquiries which have ſince been made, have proved that theſe ſuſpicions were not without foundation.

ſouthern

ſouthern ſtates of North America.—Indian Corn of the growth of colder climates is, probably, at leaſt as heavy as wheat, which weighs at a medium about 58 lb. *per* buſhel, and I imagine it will give nearly as much flour *.

In regard to the moſt advantageous method of uſing Indian Corn as Food, I would ſtrongly recommend, particularly when it is employed for feeding the Poor, a diſh made of it that is in the higheſt eſtimation throughout America, and which is really very good, and very nouriſhing. This is called *haſty-pudding;* and it is made in the following maner: A quantity of water, proportioned to the quantity of haſty-pudding intended to be made, is put over the fire in an open iron pot, or kettle, and a proper quantity of ſalt for ſeaſoning the pudding being previouſly diſſolved in the water, Indian meal is ſtirred into it, by little and little, with a wooden ſpoon with a long handle, while the water goes on to be heated and made to boil;—great care being taken to put in the meal by very ſmall quantities, and by ſifting it ſlowly through the fingers of the left hand, and ſtirring the water about very briſkly at the ſame time with the

* Since writing the above, I have had an opportunity of aſcertaining, in the moſt deciſive and ſatisfactory manner, the facts relative to the weight of Indian Corn of the growth of the northern ſtates of America. A friend of mine, an American gentleman, reſident in London, (George Erving, Eſq. of Great George-ſtreet, Hanover-ſquare,) who, in common with the reſt of his countrymen, ſtill retains a liking for Indian Corn, and imports it regularly every year from America, has juſt received a freſh ſupply of it, by one of the laſt ſhips which has arrived from Boſton in New England; and at my deſire he weighed a buſhel of it, and found it to weigh 61 lb.; It coſt him at Boſton three ſhillings and ſixpence ſterling the buſhel.

wooden ſpoon, with the right hand, to mix the meal with the water in ſuch a manner as to prevent lumps being formed.—The meal ſhould be added ſo ſlowly, that, when the water is brought to boil, the maſs ſhould not be thicker than water-gruel, and half an hour more, at leaſt, ſhould be employed to add the additional quantity of meal neceſſary for bringing the pudding to be of the proper conſiſtency; during which time it ſhould be ſtirred about continually, and kept conſtantly boiling.—The method of determining when the pudding has acquired the proper conſiſtency is this;—the wooden ſpoon uſed for ſtirring it being placed upright in the middle of the kettle, if it falls down, more meal muſt be added; but if the pudding is ſufficiently thick and adheſive to ſupport it in a vertical poſition, it is declared to be *proof;* and no more meal is added.—If the boiling, inſtead of being continued only half an hour, be prolonged to three quarters of an hour, or an hour, the pudding will be conſiderably improved by this prolongation.

This haſty-pudding, when done, may be eaten in various ways.—It may be put, while hot, by ſpoonfuls into a bowl of milk, and eaten with the milk with a ſpoon, in lieu of bread; and uſed in this way it is remarkably palatable.—It may likewiſe be eaten, while hot, with a ſauce compoſed of butter and brown ſugar, or butter and molaſſes, with or without a few drops of vinegar; and however people who have not been accuſtomed to this American cookery may be prejudiced againſt it, they will find upon trial that it makes a moſt excellent diſh, and one which never fails to be much liked

liked by thoſe who are accuſtomed to it.—The univerſal fondneſs of Americans for it proves that it muſt have ſome merit;—for in a country which produces all the delicacies of the table in the greateſt abundance, it is not to be ſuppoſed that a whole nation ſhould have a taſte ſo depraved as to give a decided preference to any particular ſpecies of Food which has not ſomething to recommend it.

The manner in which haſty-pudding is eaten with butter and ſugar, or butter and molaſſes, in America, is as follows: The haſty-pudding being ſpread out equally upon a plate, while hot, an excavation is made in the middle of it, with a ſpoon, into which excavation a piece of butter, as large as a nutmeg, is put; and upon it, a ſpoonful of brown ſugar, or more commonly of molaſſes.—The butter being ſoon melted by the heat of the pudding, mixes with the ſugar, or molaſſes, and forms a ſauce, which, being confined in the excavation made for it, occupies the middle of the plate.—The pudding is then eaten with a ſpoon, each ſpoonful of it being dipt into the ſauce before it is carried to the mouth; care being had in taking it up, to begin on the outſide, or near the brim of the plate, and to approach the centre by regular advances, in order not to demoliſh too ſoon the excavation which forms the reſervoir for the ſauce.

If I am prolix in theſe deſcriptions, my reader muſt excuſe me; for perſuaded as I am that the action of Food upon the palate, and conſequently the pleaſure of eating, depends very much indeed

upon the *manner* in which the Food is applied to the organs of taſte, I have thought it neceſſary to mention, and even to illuſtrate in the cleareſt manner, every circumſtance which appeared to me to have influence in producing thoſe important effects.

In the caſe in queſtion, as it is the ſauce alone which gives taſte and palatableneſs to the Food, and conſequently is the cauſe of the pleaſure enjoyed in eating it, the importance of applying, or uſing it, in ſuch a manner as to produce the greateſt and moſt durable effect poſſible on the organs of taſte, is quite evident; and in the manner of eating this Food which has here been deſcribed and recommended, the ſmall quantity of ſauce uſed, (and the quantity muſt be ſmall, as it is the expenſive article,) is certainly applied to the palate more immediately;—by a greater ſurface;—and in a ſtate of greater condenſation;—and conſequently acts upon it more powerfully; and continues to act upon it for a greater length of time, than it could well be made to do when uſed in any other way.—Were it more intimately mixed with the pudding, for inſtance, inſtead of being merely applied to its external ſurface, its action would certainly be much leſs powerful; and were it poured over the pudding, or was proper care not taken to keep it confined in the little excavation or reſervoir made in the midſt of the pudding to contain it, much of it would attach itſelf and adhere to the ſurface of the plate and be loſt.

Hafty-pudding has this in particular to recommend it,—and which renders it ſingularly uſeful

as

as Food for poor families,—that when more of it is made at once than is immediately wanted, what remains may be preſerved good for ſeveral days, and a number of very palatable diſhes may be made of it.—It may be cut in thin ſlices, and toaſted before the fire, or on a gridiron, and eaten inſtead of bread, either in milk, or in any kind of ſoup or pottage; or with any other kind of Food with which bread is commonly eaten; or it may be eaten cold, without any preparation, with a warm ſauce made of butter, molaſſes, or ſugar, and a little vinegar.—In this laſt-mentioned way of eating it, it is quite as palatable, and I believe more wholeſome, than when eaten warm; that is to ſay, when it is firſt made.—It may likewiſe be put cold, without any preparation, into hot milk; and this mixture is by no means unpalatable, particularly if it be ſuffered to remain in the milk till it is warmed throughout, or if it be boiled in the milk for a few moments.

A favourite diſh in America, and a very good one, is made of cold boiled cabbage chopped fine, with a ſmall quantity of cold boiled beef, and ſlices of cold haſty-pudding, all fried together in butter or hog's lard.

Though haſty-puddings are commonly made of Indian meal, yet it is by no means uncommon to make them of equal parts of Indian, and of rye meal;—and they are ſometimes made of rye meal alone; or of rye meal and wheat flour mixed.

To give a ſatisfactory idea of the expence of preparing haſty-puddings in this country, (Eng-

land,) and of feeding the Poor with them, I made the following experiment:—About 2 pints of water, which weighed juſt 2 lb. Avoirdupois, were put over the fire in a ſaucepan of a proper ſize, and 58 grains in weight or $\frac{1}{120}$ of a pound of ſalt being added, the water was made to boil.—During the time that it was heating, ſmall quantities of Indian meal were ſtirred into it, and care was taken, by moving the water briſkly about, with a wooden ſpoon, to prevent the meal from being formed into lumps; and as often as any lumps were obſerved, they were carefully broken with the ſpoon;—the boiling was then continued half an hour, and during this time the pudding was continually ſtirred about with the wooden ſpoon, and ſo much more meal was added as was found neceſſary to bring the pudding to be of the proper conſiſtency.

This being done, it was taken from the fire and weighed, and was found to weigh juſt 1 lb. 11½ oz. —Upon weighing the meal which remained, (the quantity firſt provided having been exactly determined by weight in the beginning of the experiment,) it was found that juſt *half a pound* of meal had been uſed.

From the reſult of this experiment it appears, that for each pound of Indian meal employed in making haſty-puddings, we may reckon 3 lb. 9 oz. of the pudding.—And the expence of providing this kind of Food, or the coſt of it by the pound, at the preſent high price of grain in this country, may be ſeen by the following computation:

Half

	£.	s.	d.
Half a pound of Indian meal, (the quantity uſed in the foregoing experiment,) at 2d. a pound or 7s. 6d. a buſhel for the corn, (the price ſtated in the report of the Board of Agriculture of the 10th of November 1795, ſo often referred to,) coſts	0	0	1
58 grains or $\frac{1}{210}$ of a pound of ſalt, at 2d. *per* pound	0	0	$0\frac{1}{84}$
Total,	0	0	$1\frac{1}{84}$

Now, as the quantity of pudding prepared with theſe ingredients was 1 lb. $11\frac{1}{2}$ oz. and the coſt of the ingredients amounted to *one penny and one ſixtieth of a penny*, this gives for the coſt of one pound of haſty-pudding $1\frac{7}{15}\frac{1}{0}$ of a penny, or $2\frac{1}{7}$ farthings, very nearly.—It muſt however be remembered that the Indian Corn is here reckoned at a very exorbitant price indeed *.

But before it can be determined what the expence will be of feeding the Poor with this kind of Food, it will be neceſſary to aſcertain how much of it will be required to give a comfortable meal to one perſon; and how much the expence will be of providing the ſauce for that quantity of pudding.—To determine theſe two points with ſome degree of preciſion, I made the following experiment.—Having taken my breakfaſt, conſiſting of two diſhes of coffee, with cream, and a dry toaſt,

* The price of Indian meal as it is here eſtimated,—(2d a pound,) is at leaſt twice as much as it would coſt in Great Britain in common years, if care was taken to import it at the cheapeſt rate.

at my uſual hour of breakfaſting, (nine o'clock in the morning,) and having faſted from that time till five o'clock in the afternoon, I then dined upon my haſty-pudding, with the American ſauce already deſcribed, and I found, after my appetite for Food was perfectly ſatisfied, and I felt that I had made a comfortable dinner, that I had eaten juſt 1 lb. 1½ oz. of the pudding; and the ingredients, of which the ſauce which was eaten with it was compoſed, were half an ounce of butter; three quarters of an ounce of molaſſes; and 21 grains or $\frac{1}{112}$ of a pint of vinegar.

The coſt of this dinner may be ſeen by the following computation:

For the Pudding.

	Farthings.
1 lb. 1½ oz. of haſty-pudding, at 2½ farthings a pound	2½

For the Sauce.

Half an ounce of butter, 10d. *per* pound	1¼
Three quarters of an ounce of molaſſes, at 6d. *per* pound	1
$\frac{1}{112}$ of a pint of vinegar, at 2 s. 8 d. the gallon	$0\frac{1}{16}$
Total for the Sauce,	$2\frac{5}{16}$ farthings.
Sum total of expences for this dinner, for the pudding and its ſauce	$4\frac{11}{16}$ farthings.

Or ſomething leſs than one penny farthing.

I believe it would not be eaſy to provide a dinner in London, at this time, when proviſions of all

all kinds are ſo dear, equally grateful to the palate and ſatisfying to the cravings of hunger, at a ſmaller expence.—And that this meal was ſufficient for all the purpoſes of nouriſhment appears from hence, that though I took my uſual exerciſe, and did not ſup after it, I neither felt any particular faintneſs, nor any unuſual degree of appetite for my breakfaſt next morning.

I have been the more particular in my account of this expriment, to ſhow in what manner experiments of this kind ought, in my opinion, to be conducted;—and alſo to induce others to engage in theſe moſt uſeful inveſtigations.

It will not eſcape the obſervation of the reader, that ſmall as the expence was of providing this dinner, yet very near one-half of that ſum was laid out in purchaſing the ingredients for the ſauce.—But it is probable that a conſiderable part of that expence might be ſaved.—In Italy, *polenta*, which is nothing more than haſty-pudding made with Indian meal and water, is very frequently, and I believe commonly eaten without any ſauce, and when on holidays or other extraordinary occaſions they indulge themſelves by adding a ſauce to it, this ſauce is far from expenſive.—It is commonly nothing more than a very ſmall quantity of butter ſpread over the flat ſurface of the hot polenta which is ſpread out thin in a large platter; with a little Parmezan or other ſtrong cheeſe, reduced to a coarſe powder by grating it with a grater, ſtrewed over it.

Perhaps this Italian ſauce might be more agreeable to an Engliſh palate than that commonly uſed

uſed in America. It would certainly be leſs expenſive, as much leſs butter would be required, and as cheeſe in this country is plenty and cheap. But whatever may be the ſauce uſed with Food prepared of Indian Corn, I cannot too ſtrongly recommend the uſe of that grain.

While I was employed in making my experiment upon haſty pudding, I learnt from my ſervant, (a Bavarian,) who aſſiſted me, a fact which gave me great pleaſure, as it ſerved to confirm me in the opinion I have long entertained of the great merit of Indian Corn.—He aſſured me that polenta is much eſteemed by the peaſantry in Bavaria, and that it makes a very conſiderable article of their Food; that it comes from Italy through the Tyrol; and that it is commonly ſold in Bavaria *at the ſame price as wheat flour!* Can there be ſtronger proofs of its merit?

The negroes in America prefer it to rice; and the Bavarian peaſants to wheat.—Why then ſhould not the inhabitants of this iſland like it? It will not, I hope, be pretended, that it is in this favoured ſoil alone that prejudices take ſuch deep root that they are never to be eradicated, or that there is any thing peculiar in the conſtruction of the palate of an Engliſhman.

The objection that may be made to Indian Corn, —that it does not thrive well in this country,—is of no weight. The ſame objection might, with equal reaſon, be made to rice, and twenty other articles of Food now in common uſe.

It has ever been conſidered, by thoſe verſed in the ſcience of political economy, as an object of the

firſt importance to keep down the prices of proviſions, particularly in manufacturing and commercial countries;—and if there be a country on earth where this ought to be done, it is ſurely Great Britain:—and there is certainly no country which has the means of doing it ſo much in its power.

But the progreſs of national improvements muſt be very ſlow, however favourable other circumſtances may be, where thoſe citizens, who, by their rank and ſituation in ſociety, are deſtined to direct the public opinion, *affect* to conſider the national prejudices as unconquerable *.—But to return to the ſubject immediately under conſideration.

Though haſty-pudding is, I believe, the cheapeſt Food that can be prepared with Indian Corn, yet ſeveral other very cheap diſhes may be made of it, which in general are conſidered as being more palatable, and which, moſt probably, would be preferred in this country; and among theſe, what in America is called a *plain Indian pudding* certainly holds the firſt place, and can hardly fail to be much liked by thoſe, who will be perſuaded to try it.—It is not only cheap and wholeſome, but a great delicacy; and it is principally on account of theſe puddings that the Americans, who reſide in this country, import annually for their own conſumption Indian Corn from the Continent of America.

* Thoſe who diſlike trouble, and feel themſelves called upon by duty and honour to take an active part in undertakings for the public good, are extremely apt to endeavour to excuſe,—to themſelves as well as to the world,—their inactivity and ſupineneſs, by repreſenting the undertaking in queſtion as being ſo very difficult as to make all hope of ſucceſs quite chimerical and ridiculous.

In

In order to be able to give the moſt particular and ſatisfactory information reſpecting the manner of preparing theſe Indian puddings, I cauſed one of them to be made here, (in London,) under my immediate direction, by a perſon born and brought up in North America, and who underſtands perfectly the American art of cookery in all its branches *. This pudding, which was allowed by competent judges who taſted it to be as good as they had ever eaten, was compoſed and prepared in the following manner:

Approved Receipt for making a plain Indian Pudding.

Three pounds of Indian meal (from which the bran had been ſeparated by ſifting it in a common hair ſieve) were put into a large bowl, and *five pints of boiling water* were put to it, and the whole well ſtirred together; *three quarters of a pound of molaſſes* and *one ounce of ſalt* were then added to it, and theſe being well mixed, by ſtirring them with the other ingredients, the pudding was poured into a fit bag; and the bag being tied up, (an empty ſpace being left in the bag in tying it, equal to about one-ſixth of its contents, for giving room for the pudding to ſwell,) this pudding was put into a kettle of *boiling water*, and was boiled *ſix hours* without intermiſſion; the loſs of the water in the kettle by evaporation during this time being frequently replaced with *boiling water* from another kettle.

* The houſekeeper of my friend and countryman, Sir William Pepperell, Bart. of Upper Seymour Street, Portman Square.

The

The pudding upon being taken out of the bag weighed *ten pounds* and *one ounce*; and it was found to be perfectly done, not having the ſmalleſt remains of that raw taſte ſo diſagreeable to all palates, and particularly to thoſe who are not uſed to it, which always predominates in diſhes prepared of Indian meal when they are not ſufficiently cooked.

As this raw taſte is the only well-founded objection that can be made to this moſt uſeful grain, and is, I am perſuaded, the only cauſe which makes it diſliked by thoſe who are not accuſtomed to it, I would adviſe thoſe who may attempt to introduce it into common uſe, where it is not known, to begin with Indian (bag) puddings, ſuch as I have here been deſcribing; and that this is a very cheap kind of Food will be evident from the following computation:

Expence of preparing the Indian Pudding above mentioned.

		Pence.		Pence.
3 lb. of Indian meal at	——	1½	——	4½
¾ lb. of molaſſes at	——	6	——	4½
1 oz. of ſalt at 2 d *per* lb.	——	—	——	0½
			Total for the ingredients	9½

As this pudding weighed $10\frac{1}{16}$ lbs. and the ingredients coſt *nine pence* and *half a farthing*, this gives *three farthings and a half* for each pound of pudding.

It will be obſerved, that in this computation I have reckoned the Indian meal at no more than 1½ d. *per* pound, whereas in the calculation which was given to determine the expence of preparing haſty-pudding

pudding it was taken at *two pence* a pound. I have here reckoned it at 1½ d. a pound, becauſe I am perſuaded it might be had here in London for that price, and even for leſs.—That which has lately been imported from Boſton has not coſt ſo much; and were it not for the preſent univerſal ſcarcity of proviſions in Europe, which has naturally raiſed the price of grain in North America, I have no doubt but Indian meal might be had in this country for leſs than *one penny farthing per* pound.

In compoſing the Indian pudding above mentioned, the molaſſes is charged at 6 d. the pound, but that price is very exorbitant. A gallon of molaſſes weighing about 10 lb. commonly coſts in the Weſt Indies from 7 d. to 9 d. ſterling; and allowing ſufficiently for the expences of freight, inſurance, and a fair profit for the merchant, it certainly ought not to coſt in London more than 1 s. 8 d. the gallon*; and this would bring it to 2 d. *per* pound.

If we take the prices of Indian meal and molaſſes as they are here aſcertained, and compute the expence of the ingredients for the pudding before mentioned, it will be as follows:—

		Pence		Pence.
3 lb. of Indian meal at	——	1½	——	3½
¾ lb. of molaſſes at	——	2	——	1½
1 oz. ſalt at 2 d. *per* lb.	——	—	——	0⅛
			Total,	5⅜

Now as the pudding weighed 10 7/8 lbs. this gives *two farthings*, very nearly, for each pound of pud-

* Molaſſes imported from the French Weſt India Iſlands into the American States is commonly ſold there from 12 d. to 14 d. the gallon.

ding;

ding; which is certainly very cheap indeed, particularly when the excellent qualities of the Food are conſidered.

This pudding, which ought to come out of the bag ſufficiently hard to retain its form, and even to be cut into ſlices, is ſo rich and palatable, that it may very well be eaten without any ſauce; but thoſe who can afford it commonly eat it with butter. A ſlice of the pudding, about half an inch, or three quarters of an inch in thickneſs, being laid hot upon a plate, an excavation is made in the middle of it, with the point of the knife, into which a ſmall piece of butter, as large perhaps as a nutmeg, is put, and where it ſoon melts. To expedite the melting of the butter, the ſmall piece of pudding which is cut out of the middle of the ſlice to form the excavation for receiving the butter, is frequently laid over the butter for a few moments, and is taken away (and eaten) as ſoon as the butter is melted. If the butter is not ſalt enough, a little ſalt is put into it after it is melted. The pudding is to be eaten with a knife and fork, beginning at the circumference of the ſlice, and approaching regularly towards the centre, each piece of pudding being taken up with the fork, and dipped into the butter, or dipped into it *in part only*, as is commonly the caſe, before it is carried to the mouth.

To thoſe who are accuſtomed to view objects upon a great ſcale, and who are too much employed in directing *what* ought to be done, to deſcend to thoſe humble inveſtigations which are neceſſary

neceſſary to ſhow *how* it is to be effected, theſe details will doubtleſs appear trifling and ridiculous; but as my mind is ſtrongly impreſſed with the importance of giving the moſt minute and circumſtantial information reſpecting the *manner of performing* any operation, however ſimple it may be, to which people have not been accuſtomed, I muſt beg the indulgence of thoſe who may not feel themſelves particularly intereſted in theſe deſcriptions.

In regard to the amount of the expence for ſauce for a *plain Indian (bag) pudding*,—I have found that when butter is uſed for that purpoſe, (and no other ſauce ought ever to be uſed with it,) *half an ounce* of butter will ſuffice for *one pound* of the pudding.—It is very poſſible to contrive matters ſo as to uſe much more;—perhaps twice, or three times as much;—but if the directions relative to the *manner* of eating this food, which have already been given, are ſtrictly followed, the allowance of butter here determined will be quite ſufficient for the purpoſe for which it is deſigned; that is to ſay, for giving an agreeable reliſh to the pudding.—Thoſe who are particularly fond of butter may uſe three quarters of an ounce of it with a pound of the pudding; but I am certain, that to uſe an ounce would be to waſte it to no purpoſe whatever.

If now we reckon Iriſh, or other firkin butter, (which, as it is ſalted, is the beſt that can be uſed,) at eight pence the pound, the ſauce for one pound of pudding, namely, half an ounce of butter, will coſt juſt *one farthing*; and this, added to the coſt of the pudding,

pudding, *two farthings* the pound, gives *three farthings* for the coſt by the pound of this kind of food, *with its ſauce;* and, as this food is not only very rich and nutritive, but ſatisfying at the ſame time in a very remarkable degree, it appears how well calculated it is for feeding the Poor.

It ſhould be remembered, that the molaſſes uſed as an ingredient in theſe Indian puddings, does not ſerve merely to give taſte to them;—it acts a ſtill more important part;—it gives what, in the language of the kitchen, is called *lightneſs.*—It is a ſubſtitute for eggs, and nothing but eggs can ſerve as a ſubſtitute for it, except it be treacle; which, in fact, is a kind of molaſſes; or perhaps coarſe brown ſugar, which has nearly the ſame properties.—It prevents the pudding from being heavy, and clammy; and without communicating to it any diſagreeable ſweet taſte, or any thing of that flavour peculiar to molaſſes, gives it a richneſs uncommonly pleaſing to the palate. And to this we may add, that it is nutritive in a very extraordinary degree.—This is a fact well known in all countries where ſugar is made.

How far the laws and regulations of trade exiſting in this country might render it difficult to procure molaſſes from thoſe places where it may be had at the cheapeſt rate, I know not; nor can I tell how far the free importation of it might be detrimental to our public finances;—I cannot, however, help thinking, that it is ſo great an object to this country to keep down the prices of proviſions, or rather to check the alarming celerity

with which they are riſing, that means ought to be found to facilitate the importation, and introduction into common uſe, of an article of Food of ſuch extenſive utility. It might ſerve to correct, in ſome meaſure, the baleful influence of another article of foreign produce, (tea,) which is doing infinite harm in this iſland.

A point of great importance in preparing an Indian pudding, is to boil it *properly* and *ſufficiently*. The water muſt be actually boiling when the pudding is put into it; and it never muſt be ſuffered to ceaſe boiling for a moment, till it is done; and if the pudding is not boiled full ſix hours, it will not be ſufficiently cooked:—Its hardneſs, when done, will depend on the ſpace left in the bag for its expanſion. The conſiſtency of the pudding ought to be ſuch, that it can be taken out of the bag without falling to pieces;—but it is always better, on many accounts, to make it too hard than too ſoft. The form of the pudding may be that of a cylinder; or rather of a truncated cone, the largeſt end being towards the mouth of the bag, in order that it may be got out of the bag with greater facility; or it may be made of a globular form, by tying it up in a napkin.—But whatever is the form of the pudding, the bag, or napkin in which it is to be boiled, muſt be wet in boiling water before the pudding (which is quite liquid before it is boiled) is poured into it; otherwiſe it will be apt to run through the cloth.

Though this pudding is ſo good, perfectly plain, when made according to the directions here given, that

that I do not think it capable of any real improvement; yet there are various additions that may be made to it, and that frequently are made to it, which may perhaps be thought by ſome to render it more palatable, or otherwiſe to improve it. *Suet* may, for inſtance, be added, and there is no ſuet pudding whatever ſuperior to it; and as no ſauce is neceſſary with a ſuet pudding, the expence for the ſuet will be nearly balanced by the ſaving of butter. To a pudding of the ſize of that juſt deſcribed, in the compoſition of which three pounds of Indian meal were uſed, one pound of ſuet will be ſufficient; and this, in general, will not coſt more than from five pence to ſix pence, even in London;—and the butter for ſauce to a plain pudding of the ſame ſize would coſt nearly as much. The ſuet pudding will indeed be rather the cheapeſt of the two, for the pound of ſuet will add a pound in weight to the pudding;—whereas the butter will only add five ounces.

As the pudding, made plain, weighing $10\frac{1}{16}$lb. coſt $5\frac{3}{8}$ pence, the ſame pudding, with the addition of one pound of ſuet, would weigh $11\frac{1}{16}$lb. and would coſt $11\frac{1}{8}$ pence,—reckoning the ſuet at ſixpence the pound.—Hence it appears that Indian ſuet pudding may be made in London for about *one penny* a pound.—Wheaten bread, which is by no means ſo palatable, and certainly not half ſo nutritive, now coſts ſomething more than three pence the pound: and to this may be added, that dry bread can hardly be eaten alone; but of ſuet pudding a very comfortable meal may be made without any thing elſe.

A pudding in great repute in all parts of North America, is what is called an *apple pudding*. This is an Indian pudding, ſometimes with, and ſometimes without ſuet, with dried cuttings of ſweet apples mixed with it; and when eaten with butter, it is moſt delicious Food. Theſe apples, which are pared as ſoon as they are gathered from the tree, and being cut into ſmall pieces, are freed from their cores, and thoroughly dried in the ſun, may be kept good for ſeveral years. The proportions of the ingredients uſed in making theſe apple puddings are various; but, in general, about one pound of dried apples is mixed with three pounds of meal,—three quarters of a pound of molaſſes,—half an ounce of ſalt, and five pints of boiling water.

In America, various kinds of berries, found wild in the woods, ſuch as huckle-berries, bel-berries, whortle-berries, &c. are gathered and dried, and afterwards uſed as ingredients in Indian puddings: and dried cherries and plums may be made uſe of in the ſame manner.

All theſe Indian puddings have this advantage in common, that they are very good *warmed up*.—They will all keep good ſeveral days; and when cut into thin ſlices and toaſted, are an excellent ſubſtitute for bread.

It will doubtleſs be remarked, that in computing the expence of providing theſe different kinds of puddings, I have taken no notice of the expence which will be neceſſary for fuel to cook them.—This is an article which ought undoubtedly to be taken into the account. The reaſon of my not doing

doing it here is this:—Having, in the courſe of my Experiments on Heat, found means to perform all the common operations of cookery with a ſurpriſingly ſmall expence of fuel, I find that the expence in queſtion, when the proper arrangements are made for ſaving fuel, will be very trifling. And farther, as I mean ſoon to publiſh my Treatiſe on the Management of Heat, in which I ſhall give the moſt ample directions relative to the mechanical arrangements of kitchen fire-places, and the beſt forms for all kinds of kitchen utenſils, I was deſirous not to anticipate a ſubject which will more naturally find its place in another Eſſay.—In the mean time I would obſerve for the ſatisfaction of thoſe who may have doubts reſpecting the ſmallneſs of the expence neceſſary for fuel in cooking for the Poor, that the reſult of many experiments, of which I ſhall hereafter publiſh a particular account, has proved in the moſt ſatisfactory manner, that when Food is prepared in large quantities, and cooked in kitchens properly arranged, the expence for fuel ought never to amount to more than *two per cent.* of the coſt of the Food, even where victuals of the cheapeſt kind are provided, ſuch as is commonly uſed in feeding the Poor. In the Public Kitchen of the Houſe of Induſtry at Munich the expence for fuel is leſs than *one per cent.* of the coſt of the Food, as may be ſeen in the computation, page 206, Chap. III. of this Eſſay: and it ought not to be greater in many parts of Great Britain.

With regard to the price at which Indian Corn can be imported into this country from North America in time of peace, the following information, which I procured through the medium of a friend, from Captain Scott, a moſt worthy man, who has been conſtantly employed above thirty years as maſter of a ſhip in the trade between London and Boſton in the State of Maſſachuſetts, will doubtleſs be conſidered as authentic*.

'The following are the queſtions which were put to him,—with his anſwers to them:

Q. What is the freight, *per ton*, of merchandiſe from Boſton in North America to London in time of peace?——*A.* Forty ſhillings (ſterling).

Q. What is the freight, *per* barrel, of Indian Corn?——*A.* Five ſhillings.

Q. How much *per cent.* is paid for *inſurance* from Boſton to London in time of peace?——*A.* Two *per cent.*

Q. What is the medium price of Indian Corn, *per* buſhel, in New England?——*A.* Two ſhillings and ſixpence.

* This gentleman, who is as remarkable for his good fortune at ſea, as he is reſpectable on account of his private character and profeſſional knowledge, has croſſed the Atlantic Ocean the almoſt incredible number of *one hundred and ten times!* and without meeting with the ſmalleſt accident. He is now on the ſeas in his way to North America; and this voyage, which is his *hundred and eleventh*, he intends ſhould be his laſt.—May he arrive ſafe,—and may he long enjoy in peace and quiet the well-earned fruits of his laborious life! Who can reflect on the innumerable ſtorms he muſt have experienced, and perils he has eſcaped, without feeling much intereſted in his preſervation and happineſs?

Q. What

Q. What is the price of it at this time?——*A.* Three ſhillings and ſixpence.

Q. How many buſhels of Indian Corn are reckoned to a barrel?——*A. Four.*

From this account it appears that Indian Corn might, in time of peace, be imported into this country and ſold here for leſs than *four ſhillings* the buſhel;—and that it ought not to coſt at this moment much more than *five ſhillings* a buſhel.

If it be imported in caſks, (which is certainly the beſt way of packing it,) as the freight of a barrel containing four buſhels is five ſhillings, this gives 1s. 3d. a buſhel for freight; and if we add *one penny* a buſhel for inſurance, this will make the amount of freight and inſurance 1s. 4d. which, added to the prime coſt of the Corn in America, (2s. 6d. *per* buſhel in the time of peace, and 3s. 6d. at this time,) will bring it to 3s. 10d. *per* buſhel in time of peace, and 4s. 10d. at this preſent moment.

A buſhel of Indian Corn of the growth of New England was found to weigh 61 lb.; but we will ſuppoſe it to weigh at a medium only 60 lb. *per* buſhel; and we will alſo ſuppoſe that to each buſhel of Corn when ground there is 9lb. of bran, which is ſurely a very large allowance, and 1lb. of waſte in grinding and ſifting;—this will leave 50lb. of flour for each buſhel of the Corn; and as it will coſt, in time of peace, only 3s. 10d. or 46 pence, this gives for each pound of flour $\frac{46}{50}$ of a penny, or $3\frac{1}{2}$ farthings very nearly.

If the price of the Indian Corn *per* buſhel be taken at 4s. 10d. what it ought to coſt at this

time in London, without any bounty on importation being brought into the account,—the price of the flour will be 4s. 10d. equal to 58 pence for 50 lb. in weight, or $1\frac{1}{7}$ penny the pound, which is leſs than one third of the preſent price of wheat flour. Rice, which is certainly not more nouriſhing than Indian Corn, coſts $4\frac{1}{2}$ pence the pound.

If $\frac{1}{15}$ of the value of Indian Corn be added to defray the expence of grinding it, the price of the flour will not even then be greater in London than *one penny* the pound in time of peace, and about *one penny farthing* at the preſent high price of that grain in North America. Hence it appears, that in ſtating the mean price in London of the flour of Indian Corn at *one penny farthing*, I have rather rated it too high than too low.

With regard to the expence of importing it, there may be, and doubtleſs there are frequently other expences beſides thoſe of freight and inſurance; but, on the other hand, a very conſiderable part of the expences attending the importation of it may be reimburſed by the profits ariſing from the ſale of the barrels in which it is imported, as I have been informed by a perſon who imports it every year, and always avails himſelf of that advantage.

One circumſtance much in favour of the introduction of Indian Corn into common uſe in this country is the facility with which it may be had in any quantity. It grows in all quarters of the globe, and almoſt in every climate; and in hot countries two or three crops of it may be raiſed from the ſame ground in the courſe of a year.—It ſucceeds equally well in the cold regions of Canada;—in the tem-

temperate climes of the United States of America;—and in the burning heats of the tropics; and it might be had from Africa and Aſia as well as from America. And were it even true,—what I never can be perſuaded to believe,—that it would be impoſſible to introduce it as an article of Food in this country, it might at leaſt be uſed as fodder for cattle, whoſe averſion to it, I will venture to ſay, would not be found to be *unconquerable*.

Oats now coſt near two pence the pound in this country. Indian Corn, which would coſt but a little more than half as much, would certainly be much more nouriſhing, even for horſes, as well as for horned cattle;—and as for hogs and poultry they ought never to be fed with any other grain. Thoſe who have taſted the pork and the poultry fatted on Indian Corn will readily give their aſſent to this opinion.

CHAP. VII.

Receipts for preparing various Kinds of Cheap Food.—Of MACCARONI.—*Of* POTATOES.—*Approved Receipts for boiling Potatoes.—Of Potatoe Puddings.—Of Potatoe Dumplins.—Of boiled Potatoes with a Sauce.—Of Potatoe Salad.—Of* BARLEY—*Is much more nutritious than Wheat.—Barley Meal, a good Subſtitute for Pearl Barley, for making Soups.—General Directions for preparing cheap Soups.—Receipt for the cheapeſt Soup that can be made.—Of* SAMP—*Method of preparing it—Is an excellent Subſtitute for Bread.—of burnt Soup.—Of* RYE BREAD.

WHEN I began writing the foregoing Chapter of this Eſſay, I had hopes of being able to procure ſatisfactory information reſpecting the manner in which the maccaroni eaten by the Poor in Italy, and particularly in the kingdom of Naples, is prepared;—but though I have taken much pains in making theſe inquiries, my ſucceſs in them has not been ſuch as I could have wiſhed:—The proceſs, I have often been told, is very ſimple; and from the very low price at which maccaroni is ſold ready cooked, to the *Lazzaroni* in the ſtreets of Naples, it cannot be expenſive.—There is a better kind of maccaroni which is prepared and ſold by the nuns in ſome of the convents in Italy.

Italy, which is much dearer; but this ſort would in any country be too expenſive to be uſed as Food for the Poor.—It is however not dearer than many kinds of Food uſed by the Poor in this country; and as it is very palatable and wholeſome, and may be uſed in a variety of ways, a receipt for preparing it may perhaps not be unacceptable to many of my readers.

A Receipt for making that Kind of Maccaroni called in Italy TAGLIATI.

Take any number of freſh laid eggs and break them into a bowl or tray, beat them up with a ſpoon, but not to a froth,—add of the fineſt wheat flour as much as is neceſſary to form a dough of the conſiſtence of paſte.—Work this paſte well with a rolling pin;—roll it out into very thin leaves, lay ten or twelve of theſe leaves one upon the other, and with a ſharp knife cut them into very fine threads.—Theſe threads (which, if the mals is of a proper conſiſtency, will not adhere to each other) are to be laid on a clean board, or on paper, and dried in the air.

This maccaroni, (or *cut paſte* as it is called in Germany, where it is in great repute,) may be eaten in various ways; but the moſt common way of uſing it is to eat it with milk inſtead of bread, and with chicken broth, and other broths and ſoups, with which it is boiled. With proper care it may be kept good for many months.

It is ſometimes fried in butter, and in this way of cooking it, it forms a moſt excellent diſh indeed; inferior, I believe, to no diſh of flour that can be made. It is not, however, a very cheap diſh, as eggs and butter are both expenſive articles in moſt countries.

An inferiour kind of *cut paſte* is ſometimes prepared by the Poor in Germany, which is made ſimply of water and wheat flour, and this has more reſemblance to common maccaroni than that juſt deſcribed; and might, in many caſes, be uſed inſtead of it. I do not think, however, that it can be kept long without ſpoiling; whereas maccaroni, as is well known, may be kept good for a great length of time.—Though I have not been able to get any ſatisfactory information relative to the proceſs of making maccaroni, yet I have made ſome experiments to aſcertain the expence of cooking it, and of the coſt of the cheeſe neceſſary for giving it a reliſh.

Half a pound of maccaroni, which was purchaſed at an Italian ſhop in London, and which coſt ten pence *, was boiled till it was ſufficiently done, namely, about one hour and an half, when, being taken out of the boiling water and weighed, it was found to weigh thirty-one ounces

* This maccaroni would not probably have coſt one quarter of that ſum at Naples.—Common maccaroni is frequently ſold there as low as fourteen grains, equal to five pence half-penny ſterling the rottolo, weighing twenty-eight ounces and three quarters Avoirdupois, which is three pence ſterling the pound Avoirdupois. An inferiour kind of maccaroni, ſuch as is commonly ſold at Naples to the Poor, coſts not more than two pence ſterling the pound Avoirdupois.

and

and an half, or one pound fifteen ounces and an half. The quantity of cheeſe employed to give a reliſh to this diſh of boiled maccaroni, (and which was grated over it after it was put into the diſh,) was one ounce, and coſt *two farthings*.

Maccaroni is conſidered as very cheap Food in thoſe countries where it is prepared in the greateſt perfection, and where it is in common uſe among the lower claſſes of ſociety; and as wheat, of which grain it is always made, is a ſtaple commodity in this country, it would certainly be worth while to take ſome trouble to introduce the manufacture of it, particularly as it is already become an article of luxury upon the tables of the rich, and as great quantities of it are annually imported and ſold here at a moſt exorbitant price *.—But maccaroni is by no means the cheapeſt Food that can be provided for feeding the Poor, in this iſland;—nor do I believe it is ſo in any country.—*Polenta*, or *Indian Corn*, of which ſo much has already been ſaid,—and *Potatoes*, of which too much cannot be ſaid,—are both much better adapted, in all reſpects, for that purpoſe.—Maccaroni would however, I am perſuaded, could it be prepared in this country, be much leſs expenſive than many kinds of Food now

* If maccaroni could be made in this country as cheap as it is made in Naples, that is to ſay, ſo as to be afforded for three pence ſterling the pound Avoirdupois, for the beſt ſort, (and I do not ſee why it ſhould not,) as half a pound of dry maccaroni weighs when boiled very nearly two pounds, each pound of boiled maccaroni would coſt only *three farthings*, and the cheeſe neceſſary for giving it a reliſh *one farthing* more, making together *one penny*, which is certainly a very moderate price for ſuch good and wholeſome Food.

commonly

commonly uſed by our Poor; and conſequently might be of conſiderable uſe to them.

With regard to *Potatoes*, they are now ſo generally known, and their uſefulneſs is ſo univerſally acknowledged, that it would be a waſte of time to attempt to recommend them.—I ſhall therefore content myſelf with merely giving receipts for a few cheap diſhes in which they are employed as a principal ingredient.

Though there is no article uſed as Food of which a greater variety of well-taſted and wholeſome diſhes may be prepared than of potatoes, yet it ſeems to be the unanimous opinion of thoſe who are moſt acquainted with theſe uſeful vegetables, that the beſt way of cooking them is to boil them ſimply, and with their ſkins on, in water.—But the manner of boiling them is by no means a matter of indifference. This proceſs is better underſtood in Ireland, where by much the greater part of the inhabitants live almoſt entirely on this Food, than any where elſe.

This is what might have been expected;—but thoſe who have never conſidered with attention the extreme ſlowneſs of the progreſs of national improvements, *where nobody takes pains to accelerate them*, will doubtleſs be ſurpriſed when they are told that in moſt parts of England, though the uſe of potatoes all over the country has for ſo many years been general, yet, to this hour, few, comparatively, who eat them, know how to dreſs them properly.—The inhabitants of thoſe countries which lie on the ſea-coaſt oppoſite to Ireland have adopted

adopted the Iriſh method of boiling potatoes; but it is more than probable that a century at leaſt would have been required for thoſe improvements to have made their way through the iſland, had not the preſent alarms on account of a ſcarcity of grain rouſed the public, and fixed their attention upon a ſubject too long neglected in this enlightened country.

The introduction of improvements tending to increaſe the comforts and innocent enjoyments of that numerous and uſeful claſs of mankind who earn their bread by the ſweat of their brow, is an object not more intereſting to a benevolent mind than it is important in the eyes of an enlightened ſtateſman.

There are, without doubt, *great men* who will ſmile at ſeeing theſe obſervations connected with a ſubject ſo humble and obſcure as the boiling of potatoes, but *good men* will feel that the ſubject is not unworthy of their attention.

The following directions for boiling potatoes, which I have copied from a late Report of the Board of Agriculture, I can recommend from my own experience:

"*On the boiling of Potatoes ſo as to be eat as "Bread.*

"There is nothing that would tend more to "promote the conſumption of potatoes than to "have the proper mode of preparing them as "Food generally known.—In London, this is "little

" little attended to; whereas in Lancaſhire and " Ireland the boiling of potatoes is brought to " very great perfection indeed. When prepared in " the following manner, if the quality of the root " is good, they may be eat as bread, a practice " not unuſual in Ireland.—The potatoes ſhould " be, as much as poſſible, of the ſame ſize, and " the large and ſmall ones boiled ſeparately.— " They muſt be waſhed clean, and, without paring " or ſcraping, put in a pot with cold water, not " ſufficient to cover them, as they will produce " themſelves, before they boil, a conſiderable quan- " tity of fluid.—They do not admit of being put " into a veſſel of boiling water like greens.—If " the potatoes are tolerably large, it will be ne- " ceſſary, as ſoon as they begin to boil, to throw in " ſome cold water, and occaſionally to repeat it, " till the potatoes are boiled to the heart, (which " will take from half an hour to an hour and a " quarter, according to their ſize,) they will other- " wiſe crack, and burſt to pieces on the outſide, " whilſt the inſide will be nearly in a crude ſtate, " and conſequently very unpalatable and unwhole- " ſome.—During the boiling, throwing in a little " ſalt occaſionally is found a great improvement, " and it is certain that the flower they are cooked " the better.—When boiled, pour off the water, and " evaporate the moiſture, by replacing the veſſel " in which the potatoes were boiled once more " over the fire.—This makes them remarkably " dry and mealy.—They ſhould be brought to " the table with the ſkins on, and eat with a little

" ſalt,

" ſalt, as bread.—Nothing but experience can " ſatisfy any one how ſuperior the potatoe is, " thus prepared, if the ſort is good and meally.— " Some prefer roaſting potatoes; but the mode " above detailed, extracted partly from the inte- " reſting paper of Samuel Hayes, Eſquire, of " Avondale, in Ireland, (Report on the Culture " of Potatoes, p. 103.) and partly from the Lanca- " ſhire reprinted Report (p. 63.), and other com- " munications to the Board, is at leaſt equal, if " not ſuperior.—Some have tried boiling pota- " toes in ſteam, thinking by that proceſs that " they muſt imbibe leſs water.—But immerſion in " water cauſes the diſcharge of a certain ſubſtance, " which the ſteam alone is incapable of doing, " and by retaining which, the flavour of the root " is injured, and they afterwards become dry by " being put over the fire a ſecond time without " water.—With a little butter, or milk, or fiſh, " they make an excellent meſs."

Theſe directions are ſo clear, that it is hardly poſſible to miſtake them; and thoſe who follow them exactly will find their potatoes ſurpriſingly improved, and will be convinced that the manner of boiling them is a matter of much greater importance than has hitherto been imagined.

Were this method of boiling potatoes generally known in countries where theſe vegetables are only beginning to make their way into common uſe,—as in Bavaria, for inſtance,—I have no doubt but it would contribute more than any thing elſe to their ſpeedy introduction.

The following account of an experiment, lately made in one of the pariſhes of this metropolis (London), was communicated to me by a friend, who has permitted me to publiſh it.—It will ſerve to ſhow,—what I am moſt anxious to make appear,—that the prejudices of the Poor in regard to their Food *are not unconquerable.*

"February 25th, 1796.

"The pariſh officers of Saint Olaves, Southwark, "deſirous of contributing their aid towards leſſening "the conſumption of wheat, reſolved on the follow- "ing ſuccedaneum for their cuſtomary ſuet pudding, "which they give to their Poor for dinner one day "in the week; which was ordered as follows:

	£.	s.	d.
200 lb. potatoes boiled, and ſkinned and maſhed	0	8	0
2 gallons of milk - -	0	2	4
12 lb. of ſuet, at 4½ -	0	4	6
1 peck of flour - -	0	4	0
Baking - - -	0	1	8
Expence	1	0	6

"Their ordinary ſuet-pudding had been made "thus:

	£.	s.	d.
2 buſhels of flour - -	1	12	0
12 lb. ſuet - - -	0	4	6
Baking - - -	0	1	8
Expence	1	18	2
Coſts of the ingredients for the potatoe ſuet-pudding	1	0	6
Difference	0	17	8"

This

This was the dinner provided for 200 perſons, who gave a decided preference to the cheapeſt of theſe preparations, and wiſh it to be continued.

The following baked potatoe-puddings were prepared in the hotel where I lodge, and were taſted by a number of perſons, who found them in general very palatable:

Baked Potatoe-puddings.

N° I.

12 ounces of potatoes, boiled, ſkinned, and maſhed;
1 ounce of ſuet;
1 ounce (or $\frac{1}{16}$ of a pint) of milk, and
1 ounce of Glouceſter cheeſe.

Total 15 ounces,—mixed with as much boiling water as was neceſſary to bring it to a due conſiſtence, and then baked in an earthen pan.

N° II.

12 ounces of maſhed potatoes as before;
1 ounce of milk, and
1 ounce of ſuet, with a ſufficient quantity of ſalt.—Mixed up with boiling water, and baked in a pan.

N° III.

12 ounces of maſhed potatoes;
1 ounce of ſuet;
1 ounce of red herrings pounded fine in a mortar.—Mixed—baked, &c. as before.

N° IV.

12 ounces of maſhed potatoes;
1 ounce of ſuet, and
1 ounce of hung beef grated fine with a grater.—Mixed and baked as before.

Theſe puddings when baked weighed from 11 to 12 ounces each.—They were all liked by thoſe who taſted them, but N° I. and N° III. ſeemed to meet with the moſt general approbation.

Receipt for a very cheap Potatoe-dumplin.

Take any quantity of potatoes, half boiled;—ſkin or pare them, and grate them to a coarſe powder with a grater; mix them up with a very ſmall quantity of flour, $\frac{1}{16}$, for inſtance, of the weight of the potatoes, or even leſs;—add a ſeaſoning of ſalt, pepper, and ſweet herbs;—mix up the whole with boiling water to a proper conſiſtency, and form the maſs into dumplins of the ſize of a large apple.—Roll the dumplins, when formed, in flour, to prevent the water from penetrating them, and put them into boiling water, and boil them till they riſe to the ſurface of the water, and ſwim, when they will be found to be ſufficiently done.

Theſe dumplins may be made very ſavoury by mixing with them a ſmall quantity of grated hung beef, or of pounded red herring.

Fried bread may likewiſe be mixed with them, and this without any other addition, except a ſeaſoning of ſalt, forms an excellent diſh.

Upon

Upon the ſame principles upon which theſe dumplins are prepared, large boiled bag-puddings may be made; and for feeding the Poor in a public eſtabliſhment, where great numbers are to be fed, puddings, as there is leſs trouble in preparing them, are always to be preferred to dumplins.

It would ſwell this Eſſay, (which has already exceeded the limits aſſigned to it,) to the ſize of a large volume, were I to give receipts for all the good diſhes that may be prepared with potatoes.—There is however one method of preparing potatoes much in uſe in many parts of Germany, which appears to me to deſerve being particularly mentioned and recommended;—it is as follows:

A Receipt for preparing boiled Potatoes with a Sauce.

The potatoes being properly boiled, and ſkinned, are cut into ſlices, and put into a diſh, and a ſauce, ſimilar to that commonly uſed with a fricaſeed chicken, is poured over them.

This makes an excellent and a very wholeſome diſh, but more calculated, it is true, for the tables of the opulent than for the Poor.—Good ſauces might however be compoſed for this diſh which would not be expenſive.—Common milk-porridge, made rather thicker than uſual, with wheat flour, and well ſalted, would not be a bad ſauce for it.

Potatoe Salad.

A diſh in high repute in ſome parts of Germany, and which deſerves to be particularly recommended, is a ſalad of potatoes. The potatoes being pro-

perly boiled and ſkinned, are cut into thin ſlices, and the ſame ſauce which is commonly uſed for ſalads of lettuce is poured over them; ſome mix anchovies with this ſauce, which gives it a very agreeable reliſh, and with potatoes it is remarkably palatable.

Boiled potatoes cut in ſlices and fried in butter, or in lard, and ſeaſoned with ſalt and pepper, is likewiſe a very palatable and wholeſome diſh.

Of Barley.

I have more than once mentioned the extraordinary nutritive powers of this grain, and the uſe of it in feeding the Poor cannot be too ſtrongly recommended.—It is now beginning to be much uſed in this country, mixed with wheat flour, for making bread; but it is not, I am perſuaded, in bread, but in *ſoups*, that barley can be employed to the greateſt advantage.—It is aſtoniſhing how much water a ſmall quantity of Barley-meal will thicken, and change to the conſiſtency of a jelly;—and, if my ſuſpicions with regard to the part which water acts in nutrition are founded, this will enable us to account, not only for the nutritive quality of Barley, but alſo for the ſame quality in a ſtill higher degree which ſago and ſalope are known to poſſeſs.—Sago and ſalope thicken, and change to the conſiſtency of a jelly, (and, as I ſuppoſe, prepare for decompoſition,) a greater quantity of water than Barley, and both ſago and ſalope are known to be nutritious in a very extraordinary degree.

Barley

Barley will thicken and change to a jelly much more water than any other grain with which we are acquainted, rice even not excepted;—and I have found reaſon to conclude from the reſult of innumerable experiments, which in the courſe of ſeveral years have been made under my direction in the public kitchen of the Houſe of Induſtry at Munich, that for making ſoups, Barley is by far the beſt grain that can be employed.

Were I called upon to give an opinion in regard to the comparative nutritiouſneſs of Barley-meal and wheat flour, *when uſed in ſoups*, I ſhould not heſitate to ſay that I think the former at leaſt three or four times as nutritious as the latter.

Scotch broth is known to be one of the moſt nouriſhing diſhes in common uſe; and there is no doubt but it owes its extraordinary nutritive quality to the Scotch (or Pearl) Barley, which is always uſed in preparing it.—If the Barley be omitted, the broth will be found to be poor and waſhy, and will afford little nouriſhment;—but any of the other ingredients may be retrenched;—even the meat;—without impairing very ſenſibly the nutritive quality of the Food.—Its flavour and palatableneſs may be impaired by ſuch retrenchments; but if the water be well thickened with the Barley, the Food will ſtill be very nouriſhing.

In preparing the ſoup uſed in feeding the Poor in the Houſe of Induſtry at Munich, Pearl Barley has hitherto been uſed; but I have found by ſome experiments I have lately made in London, that Pearl

Barley is by no means neceſſary, as common Barley-meal will anſwer, to all intents and purpoſes, juſt as well.—In one reſpect it anſwers better, for it does not require half ſo much boiling.

In comparing cheap ſoups for feeding the Poor, the following ſhort and plain directions will be found to be uſeful:

General Directions for preparing cheap Soup.

Firſt, Each portion of Soup ſhould conſiſt of *one pint* and a *quarter*, which, if the Soup be rich, will afford a good meal to a grown perſon.—Such a portion will in general weigh about *one pound* and a *quarter*, or *twenty ounces* Avoirdupois.

Secondly, the baſis of each portion of Soup ſhould conſiſt of *one ounce* and a *quarter* of Barley-meal, boiled with *one pint and a quarter of water* till the whole be reduced to the uniform conſiſtency of a thick jelly.—All other additions to the Soup do little elſe than ſerve to make it more palatable; or by rendering a long maſtication neceſſary, to increaſe and prolong the pleaſure of eating;—both theſe objects are however of very great importance, and too much attention cannot be paid to them; but both of them may, with proper management, be attained without much expence.

Were I aſked to give a Receipt for the cheapeſt Food which (in my opinion) it would be poſſible to provide in this country, it would be the following:

Receipt

Receipt for a very cheap Soup.

Take of water eight gallons, and mixing with it 5lb. of barley-meal, boil it to the conſiſtency of a thick jelly.—Seaſon it with ſalt, pepper, vinegar, ſweet herbs, and four red herrings, pounded in a mortar.—Inſtead of bread, add to it 5lb. of Indian Corn made into *Samp*, and ſtirring it together with a ladle, ſerve it up immediately in portions of 20 ounces.

Samp, which is here recommended, is a diſh ſaid to have been invented by the ſavages of North America, who have no Corn-mills.—It is Indian Corn deprived of its external coat by ſoaking it ten or twelve hours in a lixivium of water and wood-aſhes.—This coat, or huſk, being ſeparated from the kernel, riſes to the ſurface of the water, while the grain, which is ſpecifically heavier than water, remains at the bottom of the veſſel; which grain, thus deprived of its hard coat of armour, is boiled, or rather ſimmered for a great length of time, two days for inſtance, in a kettle of water placed near the fire. —When ſufficiently cooked, the kernels will be found to be ſwelled to a great ſize and burſt open, and this Food, which is uncommonly ſweet and nouriſhing, may be uſed in a great variety of ways; but the beſt way of uſing it is to mix it with milk, and with ſoups, and broths, as a ſubſtitute for bread. It is even better than bread for theſe purpoſes, for beſides being quite as palatable as the very beſt bread, as it is leſs liable than bread to grow too ſoft when mixed with theſe liquids, with-

out being diſagreeably hard, it requires more maſtication, and conſequently tends more to increaſe and prolong the pleaſure of eating.

The Soup which may be prepared with the quantities of ingredients mentioned in the foregoing Receipt will be ſufficient for 64 portions, and the coſt of theſe ingredients will be as follows:

	Pence.
For 5 lb. of Barley-meal, at 1½ pence, the Barley being reckoned at the preſent very high price of it in this country, *viz.* 5 s. 6 d. *per* buſhel	7½
5 lb. of Indian Corn at 1¼ pence the pound	6¼
4 red herrings	3
Vinegar	1
Salt	1
Pepper and ſweet herbs	2
Total	20¾

This ſum, (20¾ pence,) divided by 64, the number of portions of Soup, gives ſomething leſs than *one third of a penny* for the coſt of each portion.—But at the medium price of Barley in Great Britain, and of Indian Corn as it may be afforded here, I am perſuaded that this Soup may be provided at *one farthing* the portion of 20 ounces.

There is another kind of Soup in great repute among the poor people, and indeed among the opulent farmers, in Germany, which would not come much higher.—This is what is called *burnt Soup*, or as I ſhould rather call it, *brown Soup*, and it is prepared in the following manner:

Receipt

Receipt for making BROWN SOUP.

Take a ſmall piece of butter and put it over the fire in a clean frying-pan made of iron (not copper, for that metal uſed for this purpoſe would be poiſonous);—put to it a few ſpoonfuls of wheat or rye meal;—ſtir the whole about briſkly with a broad wooden ſpoon, or rather knife, with a broad and thin edge, till the butter has diſappeared, and the meal is uniformly of a deep brown colour; great care being taken, by ſtirring it continually, to prevent the meal from being burnt to the pan.

A very ſmall quantity of this roaſted meal, (perhaps half an ounce in weight would be ſufficient,) being put into a ſauce-pan and boiled with a pint and a quarter of water, forms a portion of Soup, which, when ſeaſoned with ſalt, pepper, and vinegar, and eaten with bread cut fine, and mixed with it at the moment when it is ſerved up, makes a kind of Food by no means unpalatable; and which is ſaid to be very wholeſome.

As this Soup may be prepared in a very ſhort time, an inſtant being ſufficient for boiling it; and as the ingredients for making it are very cheap, and may be eaſily tranſported, this Food is much uſed in Bavaria by our wood-cutters, who go into the mountains far from any habitations to fell wood.—Their proviſions for a week, (the time they commonly remain in the mountains,) conſiſt of a large loaf of rye bread (which, as it does not ſo ſoon grow dry and ſtale as wheaten bread, is always preferred to it); a linen bag containing a ſmall quantity of roaſted meal;—another ſmall bag of

of ſalt;—and a ſmall wooden box containing ſome pounded black-pepper;—with a ſmall frying-pan of hammered iron, about ten or eleven inches in diameter, which ſerves them both as an utenſil for cooking, and as a diſh for containing the victuals when cooked.—They ſometimes, but not often, take with them a ſmall bottle of vinegar;—but *black-pepper* is an ingredient in brown Soup, which is never omitted.—Two table ſpoonfuls of roaſted meal is quite enough to make a good portion of ſoup for one perſon; and the quantity of butter neceſſary to be uſed in roaſting this quantity of meal is very ſmall, and will coſt very little.—One ounce of butter would be ſufficient for roaſting eight ounces of meal; and if half an ounce of roaſted meal is ſufficient for making one portion of Soup, the *butter* will not amount to more than $\frac{1}{16}$ of an ounce; and, at eight pence the pound, will coſt only $\frac{1}{32}$ of a penny, or $\frac{1}{8}$ of a farthing.—The coſt of the meal for a portion of this Soup is not much more conſiderable. If it be rye meal, (which is ſaid to be quite as good for roaſting as the fineſt wheat flour,) it will not coſt, in this country, even now when grain is ſo dear, more than $1\frac{1}{2}$d. *per* pound;—$\frac{1}{8}$ an ounce, therefore, the quantity required for one portion of the Soup, would coſt only $\frac{6}{32}$ of a farthing;—and the meal and butter together no more than $(\frac{1}{8} + \frac{6}{32}) = \frac{10}{32}$, or ſomething leſs than $\frac{1}{3}$ of a farthing.—If to this ſum we add the coſt of the ingredients uſed to ſeaſon the Soup, namely, for *ſalt*, *pepper*, and *vinegar*, allowing for them as much as the amount of the coſt of the

the butter and the meal, or $\frac{1}{3}$ of a farthing, this will give $\frac{2}{3}$ of a farthing for the coſt of the ingredients uſed in preparing one portion of this Soup; but as the bread which is eaten with it is an expenſive article, this Food will not, upon the whole, be cheaper than the Soup juſt mentioned; and it is certainly neither ſo nouriſhing nor ſo wholeſome.

Brown Soup might, however, on certain occaſions, be found to be uſeful. As it is ſo ſoon cooked, and as the ingredients for making it are ſo eaſily prepared, preſerved, and tranſported from place to place; it might be uſeful to travellers, and to ſoldiers on a march. And though it can hardly be ſuppoſed to be of itſelf very nouriſhing, yet it is poſſible it may render the bread eaten with it not only more nutritive, but alſo more wholeſome;—and it certainly renders it more ſavoury and palatable.—It is the common breakfaſt of the peaſants in Bavaria; and it is infinitely preferable, in all reſpects, to that moſt pernicious waſh, *tea*, with which the lower claſſes of the inhabitants of this iſland drench their ſtomachs, and ruin their conſtitutions.

When tea is mixed with a ſufficient quantity of ſugar and good cream;—when it is taken with a large quantity of bread and butter, or with toaſt and boiled eggs;—and above all,—*when it is not drank too hot*, it is certainly leſs unwholeſome; but a ſimple infuſion of this drug, drank boiling hot, as the Poor uſually take it, is certainly a poiſon which, though it is ſometimes ſlow in its operation, never fails to produce very fatal effects, even in the ſtrongeſt

ſtrongeſt conſtitution, where the free uſe of it is continued for a conſiderable length of time.

Of Rye Bread.

The prejudice in this iſland againſt bread made of Rye, is the more extraordinary, as in many parts of the country no other kind of bread is uſed; and as the general uſe of it in many parts of Europe, for ages, has proved it to be perfectly wholeſome.—In thoſe countries where it is in common uſe, many perſons prefer it to bread made of the beſt wheat flour; and though wheaten bread is commonly preferred to it, yet I am perſuaded that the general diſlike of it, where it is not much in uſe, is more owing to its being *badly prepared*, or not well baked, than to any thing elſe.

As an account of ſome experiments upon baking Rye Bread, which were made under my immediate care and inſpection in the bake-houſe of the Houſe of Induſtry at Munich, may perhaps be of uſe to thoſe who wiſh to know how good Rye Bread may be prepared; as alſo to ſuch as are deſirous of aſcertaining, by ſimilar experiments, what, in any given caſe, the profits of a baker really are; I ſhall publiſh an account in detail of theſe experiments, in the Appendix to this volume.

* I cannot conclude this Eſſay, without once more recommending, in the moſt earneſt manner, to the attention of the Public, and more eſpecially to the attention of all thoſe who are engaged in public affairs,—the ſubject which has here been attempted to be inveſtigated. It is certainly of very great importance,

importance, in whatever light it is conſidered; and it is particularly ſo at the preſent moment: *for however ſtateſmen may differ in opinion with reſpect to the danger or expediency of making any alterations in the conſtitution, or eſtabliſhed forms of government, in times of popular commotion, no doubts can be entertained with reſpect to the policy of diminiſhing, as much as poſſible, at all times,—and more eſpecially in times like the preſent,—the miſery of the lower claſſes of the people.*

END OF THE THIRD ESSAY.

ESSAY IV.

OF

CHIMNEY FIRE-PLACES,

WITH

PROPOSALS for improving them to ſave FUEL; to render Dwelling-houſes more COMFORTABLE and SALUBRIOUS, and effectually to prevent CHIMNIES from SMOKING.

ADVERTISEMENT.

THE Author thinks it his duty to explain the reaſons which have induced him to change the order in which the publication of his Eſſays has been announced to the Public.—Being ſuddenly called upon to ſend to Edinburgh a perſon acquainted with the method of altering Chimney Fire-places, which has lately been carried into execution in a number of houſes in London, in order to introduce theſe improvements in Scotland, he did not think it prudent to ſend any perſon on ſo important an errand without more ample inſtructions than could well be given verbally; and being obliged to write on the ſubject, he thought it beſt to inveſtigate the matter thoroughly, and to publiſh ſuch particular directions reſpecting the improvements in queſtion as may be ſufficient to enable all thoſe, who may be deſirous of adopting them, to make, or direct the neceſſary alterations in their Fire-places without any further aſſiſtance.

The following Letter, which the Author received from Sir John Sinclair, Baronet, Member of Parliament, and Preſident of the Board of Agriculture, will explain this matter more fully:

" You will hear with pleaſure that your mode " of altering Chimnies, ſo as to prevent their " ſmoking, to ſave fuel, and to augment heat, " has anſwered not only with me, but with " many of my friends who have tried it; and that " the Lord Provoſt and Magiſtrates of Edinburgh " have voted a ſum of money to defray the ex- " pences of a bricklayer, who is to be ſent there " for the purpoſe of eſtabliſhing the ſame plan in " that city. I hope that you will have the good- " neſs to expedite your paper upon the manage- " ment of Heat, that the knowledge of ſo uſeful " an art may be as rapidly and as extenſively dif- " fuſed as poſſible.—With my beſt wiſhes for your " ſucceſs in the various important purſuits in which " you are now engaged, believe me, with great " truth and regard,

" Your faithful and
" obedient ſervant,
" JOHN SINCLAIR."

Whitehall, London,
9th February 1796.

ESSAY IV.

CHAP. I.

Fire-places for burning Coals, or Wood, in an open Chimney, are capable of great Improvement.—Smoking Chimnies may in all caſes be completely cured.—The immoderate Size of the Throats of Chimnies the principal Cauſe of all their Imperfections.—Philoſophical Inveſtigation of the Subject.—Remedies propoſed for all the Defects that have been diſcovered in Chimnies and their open Fire-places.—Theſe Remedies applicable to Chimnies deſtined for burning Wood, or Turf, as well as thoſe conſtructed for burning Coals.

THE plague of a ſmoking Chimney is proverbial; but there are many other very great defects in open Fire-places, as they are now commonly conſtructed in this country, and indeed throughout Europe, which, being leſs obvious, are ſeldom attended to; and there are ſome of them very fatal in their conſequences to health; and, I am perſuaded, coſt the lives of thouſands every year in this iſland.

Thoſe cold and chilling draughts of air on one ſide of the body, while the other ſide is ſcorched by a Chimney Fire, which every one who reads this muſt often have felt, cannot but be highly

detrimental to health; and in weak and delicate conſtitutions muſt often produce the moſt fatal effects.—I have not a doubt in my own mind that thouſands die in this country every year of conſumptions occaſioned ſolely by this cauſe.—By a cauſe which might be ſo eaſily removed!—by a cauſe whoſe removal would tend to promote comfort and convenience in ſo many ways.

Strongly impreſſed as my mind is with the importance of this ſubject, it is not poſſible for me to remain ſilent.—The ſubject is too nearly connected with many of the moſt eſſential enjoyments of life not to be highly intereſting to all thoſe who feel pleaſure in promoting, or in contemplating the comfort and happineſs of mankind.—And without ſuffering myſelf to be deterred, either by the fear of being thought to give to the ſubject a degree of importance to which it is not entitled, or by the apprehenſion of being tireſome to my readers by the prolixity of my deſcriptions,—I ſhall proceed to inveſtigate the ſubject in all its parts and details with the utmoſt care and attention.—And firſt with regard to ſmoking Chimnies:

There are various cauſes by which Chimnies may be prevented from carrying ſmoke; but there are none that may not eaſily be diſcovered and completely removed.—This will doubtleſs be conſidered as a bold aſſertion; but I truſt I ſhall be able to make it appear in a manner perfectly ſatisfactory to my readers that I have not ventured to give this opinion but upon good and ſufficient grounds.

Thoſe who will take the trouble to conſider the nature and properties of elaſtic fluids,—of air,—ſmoke,

ſmoke,—and vapour,—and to examine the laws of their motions, and the neceſſary conſequences of their being rarefied by heat, will perceive that it would be as much a miracle if ſmoke ſhould not riſe in a Chimney, (all hindrances to its aſcent being removed,) as that water ſhould refuſe to run in a ſyphon, or to deſcend in a river.

The whole myſtery, therefore, of curing ſmoking Chimnies is compriſed in this ſimple direction,—*find out and remove thoſe local hindrances which forcibly prevent the ſmoke from following its natural tendency to go up the Chimney;* or rather, to ſpeak more accurately, which prevents its being forced up the Chimney by the preſſure of the heavier air of the room.

Although the cauſes, by which the aſcent of ſmoke in a Chimney *may be* obſtructed, are various, yet that cauſe which will moſt commonly, and I may ſay almoſt univerſally be found to operate, is one which it is always very eaſy to diſcover, and as eaſy to remove,—the bad conſtruction of the Chimney *in the neighbourhood of the Fire-place.*

In the courſe of all my experience and practice in curing ſmoking Chimnies, and I certainly have not had leſs than five hundred under my hands, and among them many which were thought to be quite incurable,—I have never been obliged, except in one ſingle inſtance, to have recourſe to any other method of cure than merely reducing the Fire-place and the throat of the Chimney, or that part of it which lies immediately above the Fire-place, to a proper form, and juſt dimenſions.

That my principles for conſtructing Fire-places are equally applicable to thoſe which are deſigned for burning coal, as to thoſe in which wood is burnt, has lately been abundantly proved by experiments made here in London; for of above an hundred and fifty Fire-places which have been altered in this city, under my direction, within theſe laſt two months, there is not one which has not anſwered perfectly well *.—And by ſeveral experiments which have been made with great care, and with the aſſiſtance of thermometers, it has been demonſtrated, that the ſaving of fuel, ariſing from theſe improvements of Fire-places, amounts in all caſes to more than *half*, and in many caſes to more

* Eves and Sutton, bricklayers, Broad Sanctuary, Weſtminſter, have alone altered above 90 Chimnies.—The experiment was firſt made in London at Lord Palmerſton's houſe in Hanover-ſquare;—then two Chimnies were altered in the houſe of Sir John Sinclair, Baronet, Preſident of the Board of Agriculture, one in the room in which the Board meets, and the other in the Secretary's room; which laſt being much frequented by perſons from all parts of Great Britain, it was hoped that circumſtance would tend much to expedite the introduction of theſe improvements in various parts of the kingdom. Several Chimnies were then altered in the houſe of Sir Joſeph Banks, Baronet, K. B. Preſident of the Royal Society. Afterwards a number were altered in Devonſhire-houſe,—in the houſe of Earl Beſborough in Cavendiſh-ſquare, and at his ſeat at Roehampton;—at Holywell-houſe, near St. Alban's, the ſeat of the Counteſs Dowager Spencer;—at Melbourne-houſe;—at Lady Templeton's in Portland-place;—at Mrs. Montagu's in Portman-ſquare;—at Lord Sudley's in Dover-ſtreet;—at the Marquis of Saliſbury's ſeat at Hatfield, and at his houſe in town;—at Lord Palmerſton's ſeat at Broadlands, near Southampton, and at ſeveral gentlemen's houſes in that neighbourhood;—and a great many others: but it would be tireſome to enumerate them all; and even theſe are mentioned merely for the ſatisfaction of thoſe who may wiſh to make inquiries reſpecting the ſucceſs of the experiments.

than

than *two-thirds* of the quantity formerly conſumed. —Now as the alterations in Fire-places which are neceſſary may be made at a very trifling expence, as any kind of grate or ſtove may be made uſe of, and as no iron work, but merely a few bricks and ſome mortar, or a few ſmall pieces of fire-ſtone, are required; the improvement in queſtion is very important, when conſidered merely with a view to economy; but it ſhould be remembered that not only a great ſaving is made of fuel by the alterations propoſed, but that rooms are made much more comfortable, and more ſalubrious;—that they may be more equally warmed, and more eaſily kept at any required temperature;—that all draughts of cold air from the doors and windows towards the Fire-place, which are ſo fatal to delicate conſtitutions, will be completely prevented;—that in conſequence of the air being equally warm all over the room, or in all parts of it, it may be entirely changed with the greateſt facility, and the room completely ventilated, when this air is become unfit for reſpiration, and this merely by throwing open for a moment a door opening into ſome paſſage from whence freſh air may be had, and the upper part of a window; or by opening the upper part of one window and the lower part of another. And as the operation of ventilating the room, even when it is done in the moſt complete manner, will never require the door and window to be open more than one minute; in this ſhort time the walls of the room will not be ſenſibly cooled, and the freſh air which comes into the room will, in a very

few minutes, be ſo completely warmed by theſe walls that the temperature of the room, though the air in it be perfectly changed, will be brought to be very nearly the ſame as it was before the ventilation.

Thoſe who are acquainted with the principles of pneumatics, and know why the warm air in a room ruſhes out at an opening made for it at the top of a window when colder air from without is permitted to enter by the door, or by any other opening ſituated lower than the firſt, will ſee, that it would be quite impoſſible to ventilate a room in the complete and expeditious manner here deſcribed, where the air in a room is partially warmed, or hardly warmed at all, and where the walls of the room, remote from the fire, are conſtantly cold; which muſt always be the caſe where, in conſequence of a ſtrong current up the Chimney, ſtreams of cold air are continually coming in through all the crevices of the doors and windows, and flowing into the Fire-place.

But although rooms, furniſhed with Fire-places conſtructed upon the principles here recommended, may be eaſily and moſt effectually ventilated, (and this is certainly a circumſtance in favour of the propoſed improvements,) yet ſuch total ventilations will very ſeldom, if ever, be neceſſary.—As long as *any fire* is kept up in the room, there is ſo conſiderable a current of air up the Chimney, notwithſtanding all the reduction that can be made in the ſize of its throat, that the continual change of air in the room which this current occaſions will, generally, be found to be quite ſufficient for keeping

keeping the air in the room ſweet and wholeſome; and indeed in rooms in which there is no open Fire-place, and conſequently no current of air from the room ſetting up the Chimney, which is the caſe in Germany, and all the northern parts of Europe, where rooms are heated by ſtoves, whoſe Fire-places opening without are not ſupplied with the air neceſſary for the combuſtion of the fuel from the room;—and although in moſt of the rooms abroad, which are ſo heated, the windows and doors are double, and both are cloſed in the moſt exact manner poſſible, by ſlips of paper paſted over the crevices, or by ſlips of liſt or furr; yet when theſe rooms are tolerably large, and when they are not very much crowded by company, nor filled with a great many burning lamps or candles, the air in them is ſeldom ſo much injured as to become oppreſſive or unwholeſome; and thoſe who inhabit them ſhow by their ruddy countenances, as well as by every other ſign of perfect health, that they ſuffer no inconvenience whatever from their cloſeneſs.—There is frequently, it is true, an oppreſſiveneſs in the air of a room heated by a German ſtove, of which thoſe who are not much accuſtomed to living in thoſe rooms ſeldom fail to complain, and indeed with much reaſon; but this oppreſſiveneſs does not ariſe from the air of the room being injured by the reſpiration and perſpiration of thoſe who inhabit it;—it ariſes from a very different cauſe;—from a fault in the conſtruction of German ſtoves in general, but which may be eaſily and moſt completely remedied, as I

ſhall ſhow more fully in another place. In the mean time, I would juſt obſerve here with regard to theſe ſtoves, that as they are often made of iron, and as this metal is a very good conductor of heat, ſome part of the ſtove in contact with the air of the room becomes ſo hot as to calcine or rather to *roaſt* the duſt which lights upon it; which never can fail to produce a very diſagreeable effect on the air of the room. And even when the ſtove is conſtructed of pantiles or pottery-ware, if any part of it in contact with the air of the room is ſuffered to become very hot, which ſeldom fails to be the caſe in German ſtoves conſtructed on the common principles, nearly the ſame effects will be found to be produced on the air as when the ſtove is made of iron, as I have very frequently had occaſion to obſerve.

Though a room be cloſed in the moſt perfect manner poſſible, yet, as the quantity of air injured and rendered unfit for further uſe by the reſpiration of two or three perſons in a few hours is very ſmall, compared to the immenſe volume of air which a room of a moderate ſize contains; and as a large quantity of freſh air always enters the room, and an equal quantity of the warm air of the room is driven out of it every time the door is opened, there is much leſs danger of the air of a room becoming unwholeſome for the want of ventilation than has been generally imagined; particularly in cold weather, when all the different cauſes which conſpire to change the air of warmed rooms act with increaſed power and effect.

Thoſe

Thoſe who have any doubts reſpecting the very great change of air or ventilation which takes place each time the door of a warm room is opened in cold weather, need only ſet the door of ſuch a room wide open for a moment, and hold two lighted candles in the door-way, one near the top of the door, and the other near the bottom of it; the violence with which the flame of that above will be driven outwards, and that below inwards, by the two ſtrong currents of air which, paſſing in oppoſite directions, ruſh in and out of the room at the ſame time, will be convinced that the change of air which actually takes place muſt be very conſiderable indeed; and theſe currents will be ſtronger, and conſequently the change of air greater, in proportion as the difference is greater between the temperatures of the air within the room and of that without. I have been more particular upon this ſubject,—the ventilation of warmed rooms which are conſtantly inhabited,—as I know that people in general in this country have great apprehenſions of the bad conſequences to health of living in rooms in which there is not a continual influx of cold air from without. I am as much an advocate for a *free circulation* of air as any body, and always ſleep in a bed without curtains on that account; but I am much inclined to think, that the currents of cold air which never fail to be produced in rooms heated by Fire-places conſtructed upon the common principle,—thoſe partial heats on one ſide of the body, and cold blaſts on the other, ſo often felt in houſes in this country, are infinitely more

more detrimental to health than the ſuppoſed cloſeneſs of the air in a room warmed more equally, and by a ſmaller fire.

All theſe advantages, attending the introduction of the improvements in Fire-places here recommended, are certainly important, and I do not know that they are counterbalanced by any one diſadvantage whatſoever. The only complaint that I have ever heard made againſt them was, that they made the rooms *too* warm; but the remedy to this evil is ſo perfectly ſimple and obvious, that I ſhould be almoſt afraid to mention it, leſt it might be conſidered as an inſult to the underſtanding of the perſon to whom ſuch information ſhould be given; for nothing ſurely can be conceived more perfectly ridiculous than the embarraſſment of a perſon on account of the too great heat of his room, when it is in his power to diminiſh *at pleaſure* the fire by which it is warmed; and yet, ſtrange as it may appear, this has ſometimes happened!

Before I proceed to give directions for the conſtruction of Fire-places, it will be proper to examine more carefully the Fire-places now in common uſe;—to point out their faults;—and to eſtabliſh the principles upon which Fire-places ought to be conſtructed.

The great fault of all the open Fire-places, or Chimnies, for burning wood or coals in an open fire, now in common uſe, is, that they are much too large; or rather it is *the throat of the Chimney*, or the lower part of its open canal, in the neighbourhood of the mantle, and immediately over

over the fire, which is too large. This opening has hitherto been left larger than otherwiſe it probably would have been made, in order to give a paſſage to the Chimney-ſweeper; but I ſhall ſhow hereafter how a paſſage for the Chimney-ſweeper may be contrived without leaving the throat of the Chimney of ſuch enormous dimenſions as to ſwallow up and devour all the warm air of the room, inſtead of merely giving a paſſage to the ſmoke and heated vapour which riſe from the fire, for which laſt purpoſe alone it ought to be deſtined.

Were it my intention to treat my ſubject in a formal ſcientific manner, it would doubtleſs be proper, and even neceſſary, to begin by explaining in the fulleſt manner, and upon the principles founded on the laws of nature, relative to the motions of elaſtic fluids, as far as they have been diſcovered and demonſtrated, the cauſes of the aſcent of ſmoke; and alſo to explain and illuſtrate upon the ſame principles, and even to meaſure, or eſtimate by calculations, the preciſe effects of all thoſe mechanical aids which may be propoſed for aſſiſting it in its aſcent, or rather for removing thoſe obſtacles which hinder its motion upwards;—but as it is my wiſh rather to write an uſeful practical treatiſe, than a learned diſſertation, being more deſirous to contribute in diffuſing uſeful knowledge, by which the comforts and enjoyments of mankind may be increaſed, than to acquire the reputation of a philoſopher among learned men, I ſhall endeavour to write in ſuch a manner as to be eaſily underſtood *by thoſe who are moſt likely to profit by the information*

ation I have to communicate, and conſequently moſt likely to aſſiſt in bringing into general uſe the improvements I recommend. This being premiſed, I ſhall proceed, without any farther preface or introduction, to the inveſtigation of the ſubject I have undertaken to treat.

As the immoderate ſize of the throats of Chimnies is the great fault of their conſtruction, it is this fault which ought always to be firſt attended to in every attempt which is made to improve them; for however perfect the conſtruction of a Fire-place may be in other reſpects, if the opening left for the paſſage of the ſmoke is larger than is neceſſary for that purpoſe, nothing can prevent the warm air of the room from eſcaping through it; and whenever this happens, there is not only an unneceſſary loſs of heat, but the warm air which leaves the room to go up the chimney being replaced by cold air from without, the draughts of cold air, ſo often mentioned, cannot fail to be produced in the room, to the great annoyance of thoſe who inhabit it. But although both theſe evils may be effectually remedied by reducing the throat of the Chimney to a proper ſize, yet in doing this ſeveral precautions will be neceſſary. And firſt of all, the throat of the Chimney ſhould be in its proper place; that is to ſay, in that place in which it ought to be, in order that the aſcent of the ſmoke may be moſt facilitated; for every means which can be employed for facilitating the aſcent of the ſmoke in the Chimney muſt naturally tend to prevent the Chimney

ney from ſmoking; now as the ſmoke and hot vapour which riſe from a fire naturally tend *upwards*, the proper place for the throat of the Chimney is evidently perpendicularly *over the fire*.

But there is another circumſtance to be attended to in determining the proper place for the throat of a Chimney, and that is, to aſcertain its diſtance from the fire, or *how far* above the burning fuel it ought to be placed. In determining this point, there are many things to be conſidered, and ſeveral advantages and diſadvantages to be weighed and balanced.

As the ſmoke and vapour which aſcend from burning fuel riſe in conſequence of their being rarefied by heat, and made lighter than the air of the ſurrounding atmoſphere; and as the degree of their rarefaction, and conſequently their tendency to riſe, is in proportion to the intenſity of their heat; and further, as they are hotter near the fire than at a greater diſtance from it, it is clear that the nearer the throat of a Chimney is to the fire, the ſtronger will be, what is commonly called, its *draught*, and the leſs danger there will be of its ſmoking. But, on the other hand, when the draught of a Chimney is very ſtrong, and particularly when this ſtrong draught is occaſioned by the throat of the Chimney being very near the fire, it may ſo happen that the draught of air into the fire may become ſo ſtrong, as to cauſe the fuel to be conſumed too rapidly. There are likewiſe ſeveral other inconveniences which would attend the placing of the throat of a Chimney *very near* the burning fuel.

In

In introducing the improvements propoſed, in Chimnies already built, there can be no queſtion in regard to the height of the throat of the Chimney, for its place will be determined by the height of the mantle. It can hardly be made lower than the mantle; and it ought always to be brought down as nearly upon the level with the bottom of it as poſſible. If the Chimney is apt to ſmoke, it will ſometimes be neceſſary either to lower the mantle, or to diminiſh the height of the opening of the Fire-place, by throwing over a flat arch, or putting in a ſtraight piece of ſtone from one ſide of it to the other, or, which will be ſtill more ſimple and eaſy in practice, building a wall of bricks, ſupported by a flat bar of iron, immediately under the mantle.

Nothing is ſo effectual to prevent Chimnies from ſmoking as diminiſhing the opening of the Fire-place in the manner here deſcribed, and lowering and diminiſhing the throat of the Chimney; and I have always found, except in the ſingle inſtance already mentioned, that a perfect cure may be effected by *theſe means alone*, even in the moſt deſperate caſes. It is true, that when the conſtruction of the Chimney is very bad indeed, or its ſituation very unfavourable to the aſcent of the ſmoke, and eſpecially when both theſe diſadvantages exiſt at the ſame time, it may ſometimes be neceſſary to diminiſh the opening of the Fire-place, and particularly to lower it, and alſo to lower the throat of the Chimney, more than might be wiſhed: but ſtill I think this can produce no inconveniences to be compared with that greateſt of all plagues, a ſmoking Chimney.

The poſition of the throat of a Chimney being determined, the next points to be aſcertained are its ſize and form, and the manner in which it ought to be connected with the Fire-place below, and with the open canal of the Chimney above.

But as theſe inveſtigations are intimately connected with thoſe which relate to the form proper to be given to the Fire-place itſelf, we muſt conſider them all together.

That theſe inquiries may be purſued with due method, and that the concluſions drawn from them may be clear and ſatisfactory, it will be neceſſary to conſider, firſt, what the objects are which ought principally to be had in view in the conſtruction of a Fire-place; and ſecondly, to ſee how theſe objects can beſt be attained.

Now the deſign of a Chimney Fire being ſimply to warm a room, it is neceſſary, firſt of all, to contrive matters ſo that the room ſhall be actually warmed; ſecondly, that it be warmed with the ſmalleſt expence of fuel poſſible; and, thirdly, that in warming it, the air of the room be preſerved perfectly pure, and fit for reſpiration, and free from ſmoke and all diſagreeable ſmells.

In order to take meaſures with certainty for warming a room by means of an open Chimney Fire, it will be neceſſary to conſider *how*, or in *what manner*, ſuch a Fire communicates heat to a room. This queſtion may perhaps, at the firſt view of it, appear to be ſuperfluous and trifling, but a more careful examination of the matter will

ſhow it to be highly deſerving of the moſt attentive inveſtigation.

To determine in what manner a room is heated by an open Chimney Fire, it will be neceſſary firſt of all to find out, *under what form* the heat generated in the combuſtion of the fuel exiſts, and then to ſee how it is communicated to thoſe bodies which are heated by it.

In regard to the firſt of theſe ſubjects of inquiry, it is quite certain that the heat which is generated in the combuſtion of the fuel exiſts under *two* perfectly diſtinct and very different forms. One part of it is *combined* with the ſmoke, vapour, and heated air which riſe from the burning fuel, and goes off with them into the upper regions of the atmoſphere; while the other part, which appears to be *uncombined*, or, as ſome ingenious philoſophers have ſuppoſed, combined only with light, is ſent off from the fire in rays in all poſſible directions.

With reſpect to the ſecond ſubject of inquiry; namely, how this heat, exiſting under theſe two different forms, is communicated to other bodies; it is highly probable that the combined heat can only be communicated to other bodies by *actual contact* with the body with which it is combined; and with regard to the rays which are ſent off by burning fuel, it is certain that *they* communicate or generate heat only *when* and *where* they are ſtopped or abſorbed. In paſſing through air, which is tranſparent, they certainly do not communicate any heat to it; and it ſeems highly probable that

that they do not communicate heat to ſolid bodies by which they are reflected.

In theſe reſpects they ſeem to bear a great reſemblance to the ſolar rays. But in order not to diſtract the attention of my reader, or carry him too far away from the ſubject more immediately under conſideration, I muſt not enter too deeply into theſe inquiries reſpecting the nature and properties of what has been called *radiant heat*. It is certainly a moſt curious ſubject of philoſophical inveſtigation, but more time would be required to do it juſtice than we now have to ſpare. We muſt therefore content ourſelves with ſuch a partial examination of it as will be ſufficient for our preſent purpoſe.

A queſtion which naturally preſents itſelf here is, What proportion does the radiant heat bear to the combined heat?—Though that point has not yet been determined with any conſiderable degree of preciſion, it is, however, quite certain that the quantity of heat which goes off combined with the ſmoke, vapour, and heated air, is much more conſiderable, perhaps three or four times greater at leaſt, than that which is ſent off from the fire in rays.—And yet, ſmall as the quantity is of this radiant heat, it is the only part of the heat generated in the combuſtion of fuel burnt in an open Fire-place which is ever employed, or which can ever be employed, in heating a room.

The whole of the combined heat eſcapes by the Chimney, and is totally loſt; and, indeed, no part of it could ever be brought into a room from an open Fire-place, without bringing along

with it the ſmoke with which it is combined; which, of courſe, would render it impoſſible for the room to be inhabited. There is, however, one method by which combined heat, and even that which ariſes from an open Fire-place, may be made to aſſiſt in warming a room; and that is by making it paſs through ſomething analogous to a German ſtove, placed in the Chimney above the fire.—But of this contrivance I ſhall take occaſion to treat more fully hereafter; in the mean time I ſhall continue to inveſtigate the properties of open Chimney Fire-places, conſtructed upon the moſt ſimple principles, ſuch as are now in common uſe; and ſhall endeavour to point out and explain all thoſe improvements of which *they* appear to me to be capable. When fuel is burnt in Fire-places upon this ſimple conſtruction, where the ſmoke eſcapes immediately by the open canal of the Chimney, it is quite evident that all the combined heat muſt of neceſſity be loſt; and as it is the radiant heat alone which can be employed in heating a room, it becomes an object of much importance to determine how the greateſt quantity of it may be generated in the combuſtion of the fuel, and how the greateſt proportion poſſible of that generated may be brought into the room.

Now the quantity of radiant heat generated in the combuſtion of a given quantity of any kind of fuel depends very much upon the management of the fire, or upon the manner in which the fuel is conſumed. When the fire burns bright, much radiant heat will be ſent off from it; but

but when it is *ſmothered up*, very little will be generated; and indeed very little combined heat, that can be employed to any uſeful purpoſe: moſt of the heat produced will be immediately *expended* in giving elaſticity to a thick denſe vapour or ſmoke which will be ſeen riſing from the fire;—and the combuſtion being very incomplete, a great part of the inflammable matter of the fuel being merely rarefied and driven up the Chimney without being inflamed, the fuel will be waſted to little purpoſe. And hence it appears of how much importance it is, whether it be conſidered with a view to economy, or to cleanlineſs, comfort, and elegance, to pay due attention to the management of a Chimney Fire.

Nothing can be more perfectly void of common ſenſe, and waſteful and ſlovenly at the ſame time, than the manner in which Chimney Fires, and particularly where coals are burned, are commonly managed by ſervants. They throw on a load of coals at once, through which the flame is hours in making its way; and frequently it is not without much trouble that the fire is prevented from going quite out. During this time no heat is communicated to the room: and what is ſtill worſe, the throat of the Chimney being occupied merely by a heavy denſe vapour, not poſſeſſed of any conſiderable degree of heat, and conſequently not having much elaſticity, the warm air of the room finds leſs difficulty in forcing its way up the Chimney and eſcaping, than when the fire burns bright;—and it happens not unfrequently, eſpe-

cially in Chimnies and Fire-places ill conſtructed, that this current of warm air from the room which preſſes into the Chimney, croſſing upon the current of heavy ſmoke which riſes ſlowly from the fire, obſtructs it in its aſcent, and beats it back into the room; hence it is that Chimnies ſo often ſmoke when too large a quantity of freſh coals is put upon the fire. So many coals ſhould never be put on the fire at once as to prevent the free paſſage of the flame between them. In ſhort, a fire ſhould never be ſmothered; and when proper attention is paid to the quantity of coals put on, there will be very little uſe for the poker; and this circumſtance will contribute very much to cleanlineſs, and to the preſervation of furniture.

Thoſe who have feeling enough to be made miſerable, by any thing careleſs, ſlovenly, and waſteful which happens under their eyes,—who know what comfort is, and conſequently are worthy of the enjoyments of a *clean hearth* and a *cheerful fire*, ſhould really either take the trouble themſelves to manage their fires, (which, indeed, would rather be an amuſement to them than a trouble,) or they ſhould inſtruct their ſervants to manage them better.

But to return to the ſubject more immediately under conſideration. As we have ſeen what is neceſſary to the production or generation of radiant heat, it remains to determine how the greateſt proportion of that generated and ſent off from the fire in all directions may be made to enter the room,

room, and aſſiſt in warming it. Now as the rays which are thrown off from burning fuel have this property in common with light, that they generate heat only *when* and *where* they are ſtopped or abſorbed, and alſo in being capable of being reflected *without generating heat* at the ſurfaces of various bodies, the knowledge of theſe properties will enable us to take meaſures, with the utmoſt certainty, for producing the effect required, —that is to ſay, for bringing as much radiant heat as poſſible into the room.

This muſt be done, firſt, by cauſing as many as poſſible of the rays, as they are ſent off from the fire in ſtraight lines, to come *directly* into the room; which can only be effected by bringing the fire as far forward as poſſible, and leaving the opening of the Fire-place as wide and as high as can be done without inconvenience; and ſecondly, by making the ſides and back of the Fire-place of ſuch form, and conſtructing them of ſuch materials, as to cauſe the direct rays from the fire, which ſtrike againſt them, to be ſent into the room *by reflection* in the greateſt abundance.

Now it will be found, upon examination, that the beſt form for the vertical ſides of a Fire-place, or the *covings*, (as they are called,) is that of an upright plane, making an angle with the plane of the back of the Fire-place, of about 135 degrees.——According to the preſent conſtruction of Chimnies this angle is 90 degrees, or forms a right angle; but as in this caſe the two ſides or covings of the Fire-place (AC,

(AC, BD, Fig. 1.) are parallel to each other, it is evident that they are very ill contrived for throwing into the room by reflection the rays from the fire which fall on them.

To have a clear and perfect idea of the alterations I propose in the forms of Fire-places, the reader need only observe, that, whereas the backs of Fire-places, as they are now commonly conſtructed, are as wide as the opening of the Fire-place in front, and the ſides of it are of courſe perpendicular to it, and parallel to each other,—in the Fire-places I recommend, the back (*i k*, Fig. 3.) is only about one-third of the width of the opening of the Fire-place in front (*a b*), and conſequently that the two ſides or covings of the Fire-place (*a i* and *b k*), inſtead of being perpendicular to the back, are inclined to it at an angle of about 135 degrees; and in conſequence of this poſition, inſtead of being parallel to each other, each of them preſents an oblique front towards the opening of the Chimney, by means of which the rays which they reflect are thrown into the room. A bare inſpection of the annexed drawings (Fig. 1. and Fig. 3.) will render this matter perfectly clear and intelligible.

In regard to the materials which it will be moſt advantageous to employ in the conſtruction of Fire-places, ſo much light has, I flatter myſelf, already been thrown on the ſubject we are inveſtigating, and the principles adopted have been eſtabliſhed on ſuch clear and obvious facts, that no great difficulty will attend the determination of that point.—

point.—As the object in view is to bring radiant heat into the room, it is clear that that material is beſt for the conſtruction of a Fire-place which reflects the moſt, or which *abſorbs the leaſt* of it; for that heat which is *abſorbed* cannot be *reflected*.—Now as bodies which abſorb radiant heat are neceſſarily heated in conſequence of that abſorption, to diſcover which of the various materials that can be employed for conſtructing Fire-places are beſt adapted for that purpoſe, we have only to find out by an experiment, very eaſy to be made, what bodies acquire *leaſt heat* when expoſed to the direct rays of a clear fire;—for thoſe which are leaſt heated, evidently abſorb the leaſt, and conſequently reflect the moſt radiant heat. And hence it appears that iron, and, in general, metals of all kinds, which are well known to *grow very hot* when expoſed to the rays projected by burning fuel, are to be reckoned among the *very worſt* materials that it is poſſible to employ in the conſtruction of Fire-places.

The beſt materials I have hitherto been able to diſcover are fire-ſtone, and common bricks and mortar. Both theſe materials are, fortunately, very cheap; and as to their comparative merits, I hardly know to which of them the preference ought to be given.

When bricks are uſed they ſhould be covered with a thin coating of plaſter, which, when it is become perfectly dry, ſhould be white-waſhed. The fire-ſtone ſhould likewiſe be white-waſhed, when that is uſed; and every part of the Fire-place, which

which is not expoſed to being ſoiled and made black by the ſmoke, ſhould be kept as white and clean as poſſible. As *white* reflects more heat, as well as more light than any other colour, it ought always to be preferred for the inſide of a Chimney Fire-place, and *black*, which reflects neither light nor heat, ſhould be moſt avoided.

I am well aware how much the opinion I have here ventured to give, reſpecting the unfitneſs of iron and other metals to be employed in the conſtruction of open Fire-places, differs from the opinion generally received upon that ſubject;—and I even know that the very reaſon which, according to my ideas of the matter, renders them totally unfit for the purpoſe, is commonly aſſigned for making uſe of them, namely, that they ſoon grow very hot. But I would beg leave to aſk what advantage is derived from heating them?

I have ſhewn the diſadvantage of it, namely, that the quantity of radiant heat thrown into the room is diminiſhed;—and it is eaſy to ſhow that almoſt the whole of that abſorbed by the metal is ultimately carried up the Chimney by the air, which, coming into contact with this hot metal, is heated and rarefied by it, and forcing its way upwards, goes off with the ſmoke; and as no current of air ever ſets from any part of the opening of a Fire-place into the room, it is impoſſible to conceive how the heat exiſting in the metal compoſing any part of the apparatus of the Fire-place, and ſituated within its cavity, can come, or be brought into the room.

This

This difficulty may be in part removed, by ſuppoſing, what indeed ſeems to be true in a certain degree, that the heated metal ſends off in rays the heat it acquires from the fire, even when it is not heated red hot; but ſtill, as it never can be admitted that the heat, abſorbed by the metal and afterwards thrown off by it in rays, is *increaſed* by this operation, nothing can be gained by it; and as much muſt neceſſarily be loſt in conſequence of the great quantity of heat communicated by the hot metal to the air in contact with it, which, as has already been ſhewn, always makes its way up the Chimney, and flies off into the atmoſphere, the loſs of heat attending the uſe of it is too evident to require being farther inſiſted on.

There is, however, in Chimney Fire-places deſtined for burning coals, one eſſential part, the grate, which cannot well be made of any thing elſe but iron; but there is no neceſſity whatever for that immenſe quantity of iron which ſurrounds grates as they are now commonly conſtructed and fitted up, and which not only renders them very expenſive, but injures very eſſentially the Fire-place. If it ſhould be neceſſary to diminiſh the opening of a large Chimney in order to prevent its ſmoking, it is much more ſimple, economical, and better in all reſpects, to do this with marble, fire-ſtone, or even with bricks and mortar, than to make uſe of iron, which, as has already been ſhewn, is the very worſt material that can poſſibly be employed for that purpoſe; and as to regiſters, they not only are quite unneceſſary, where the throat of a Chimney is properly

properly conſtructed, and of proper dimenſions, but in that caſe would do much harm. If they act at all, it muſt be by oppoſing their flat ſurfaces to the current of riſing ſmoke in a manner which cannot fail to embarraſs and impede its motion. But we have ſhown that the paſſage of the ſmoke through the throat of a Chimney ought to be facilitated as much as poſſible, in order that it may be enabled to paſs by a ſmall aperture.

Regiſter-ſtoves have often been found to be of uſe, but it is becauſe the great fault of all Fire-places conſtructed upon the common principles being the enormous dimenſions of the throat of the Chimney, this fault has been in ſome meaſure corrected by them; but I will venture to affirm, that there never was a Fire-place ſo corrected that would not have been much more improved, and with infinitely leſs expence, by the alterations here recommended, and which will be more particularly explained in the next Chapter.

CHAP. II.

Practical Directions deſigned for the Uſe of Workmen, ſhowing how they are to proceed in making the Alterations neceſſary to improve Chimney Fire-places, and effectually to cure ſmoking Chimnies.

ALL Chimney Fire-places, without exception, whether they are deſigned for burning wood or coals, and even thoſe which do not ſmoke, as well as thoſe which do, may be greatly improved by making the alterations in them here recommended; for it is by no means *merely* to prevent Chimnies from ſmoking that theſe improvements are recommended, but it is alſo to make them better in all other reſpects as Fire-places; and when the alterations propoſed are properly executed, which may very eaſily be done with the aſſiſtance of the following plain and ſimple directions, the Chimnies will never fail to anſwer, I will venture to ſay, even beyond expectation. The room will be heated much more equally and more pleaſantly with *leſs than half the fuel* uſed before, the fire will be more cheerful and more agreeable; and the general appearance of the Fire-place more neat and elegant, and the Chimney *will never ſmoke.*

The

The advantages which are derived from mechanical inventions and contrivances are, I know, frequently accompanied by diſadvantages which it is not always poſſible to avoid; but in the caſe in queſtion, I can ſay with truth, that I know of no diſadvantage whatever that attends the Fire-places conſtructed upon the principles here recommended.—But to proceed in giving directions for the conſtruction of theſe Fire-places.

That what I have to offer on this ſubject may be the more eaſily underſtood, it will be proper to begin by explaining the preciſe meaning of all thoſe technical words and expreſſions which I may find it neceſſary or convenient to uſe.

By the *throat* of a Chimney, I mean the lower extremity of its canal, where it unites with the upper part of its open Fire-place.—This throat is commonly found about a foot above the level of the lower part of the mantle, and it is ſometimes contracted to a ſmaller ſize than the reſt of the canal of the Chimney, and ſometimes not.

Fig. 5, ſhows the ſection of a Chimney on the common conſtruction, in which *d e* is the throat.

Fig. 6, ſhows the ſection of the ſame Chimney altered and improved, in which *d t* is the reduced throat.

The *breaſt* of a Chimney is that part of it which is immediately behind the mantle.—It is the wall which forms the entrance from below into the throat of the Chimney in front, or towards the room.—It is oppoſite to the upper extremity of the back of the open Fire-place, and parallel to

it;—in ſhort it may be ſaid to be the back part of the mantle itſelf.—In the figures 5 and 6, it is marked by the letter *d*. The *width* of the throat of the Chimney (*d e* fig. 5, and *d i* fig. 6,) is taken from the breaſt of the Chimney to the back, and its *length* is taken at right angles to its width, or in a line parallel to the mantle (*a* fig. 5. and 6.).

Before I proceed to give particular directions reſpecting the exact forms and dimenſions of the different parts of a Fire-place, it may be uſeful to make ſuch general and practical obſervations upon the ſubject as can be clearly underſtood without the aſſiſtance of drawings; for the more complete the knowledge of any ſubject is which can be acquired without drawings, the more eaſy will it be to underſtand the drawings when it becomes neceſſary to have recourſe to them.

The bringing forward of the Fire into the room, or rather bringing it nearer to the front of the opening of the Fire-place;—and the diminiſhing of the throat of the Chimney, being two objects principally had in view in the alterations in Fire-places here recommended, it is evident that both theſe may be attained merely by bringing forward the back of the Chimney.—The only queſtion therefore is, how far it ſhould be brought forward? —The anſwer is ſhort, and eaſy to be underſtood; —bring it forward as far as poſſible without diminiſhing too much the paſſage which muſt be left for the ſmoke. Now as this paſſage, which, in its narroweſt part, I have called the *throat of the Chimney*, ought, for reaſons which are fully explained in the foregoing Chapter, to be immediately,

diately, or perpendicularly over the Fire, it is evident that the back of the Chimney muſt always be built perfectly upright.—To determine therefore the place for the new back, or how far preciſely it ought to be brought forward, nothing more is neceſſary than to aſcertain how wide the throat of the Chimney ought to be left, or what ſpace muſt be left, between the top of the breaſt of the Chimney, where the upright canal of the Chimney begins, and the new back of the Fire-place carried up perpendicularly to that height.

In the courſe of my numerous experiments upon Chimnies, I have taken much pains to determine the width proper to be given to this paſſage, and I have found, that, when the back of the Fire-place is of a proper width, the beſt width for the throat of a Chimney, when the Chimney and the Fire-place are at the uſual form and ſize, is *four inches*.—Three inches might ſometimes anſwer, eſpecially where the Fire-place is very ſmall, and the Chimney good, and well ſituated: but as it is always of much importance to prevent thoſe accidental puffs of ſmoke which are ſometimes thrown into rooms by the careleſſneſs of ſervants in putting on ſuddenly too many coals at once upon the fire, and as I found theſe accidents ſometimes happened when the throats of Chimnies were made very narrow, I found that, upon the whole, all circumſtances being well conſidered, and advantages and diſadvantages compared and balanced, *four inches* is the beſt width that can be given to the throat of a Chimney; and this, whether the Fire-place be deſtined to burn wood, coals, turf,

or

or any other fuel commonly uſed for heating rooms by an open fire.

In Fire-places deſtined for heating very large halls, and where very great fires are kept up, the throat of the Chimney may, if it ſhould be thought neceſſary, be made four inches and an half, or five inches wide;—but I have frequently made Fire-places for halls which have anſwered perfectly well where the throats of the Chimnies have not been wider than four inches.

It may perhaps appear extraordinary, upon the firſt view of the matter, that Fire-places of ſuch different ſizes ſhould all require the throat of the Chimney to be of the ſame width; but when it is conſidered that the *capacity* of the throat of a Chimney does not depend on its width alone, but on its width and *length* taken together; and that in large Fire-places, the width of the back, and conſequently the length of the throat of the Chimney, is greater than in thoſe which are ſmaller, this difficulty vaniſhes.

And this leads us to conſider another important point reſpecting open Fire-places, and that is, the width which it will, in each caſe, be proper to give to the back.—In Fire-places as they are now commonly conſtructed, the back is of equal width with the opening of the Fire-place in front;—but this conſtruction is faulty on two accounts.—Firſt, in a Fire-place, ſo conſtructed, the ſides of the Fire-place, or *covings*, as they are called, are parallel to each other, and conſequently ill-contrived to throw out into the room the heat they receive from the fire in the form of rays;—and

ſecondly, the large open corners which are formed by making the back as wide as the opening of the Fire-place in front occaſion eddies of wind, which frequently diſturb the fire, and embarraſs the ſmoke in its aſcent in ſuch a manner as often to bring it into the room—Both theſe defects may be entirely remedied by diminiſhing the width of the back of the Fire-place.—The width, which, in moſt caſes, it will be beſt to give it, is *one third* of the width of the opening of the Fire-place in front.—But it is not abſolutely neceſſary to conform rigorouſly to this deciſion, nor will it always be poſſible.—It will frequently happen that the back of a Chimney muſt be made wider than, according to the rule here given, it ought to be.—This may be, either to accommodate the Fire-place to a ſtove, which being already on hand, muſt, to avoid the expence of purchaſing a new one, be employed; or for other reaſons;—and any ſmall deviation from the general rule will be attended with no conſiderable inconvenience.—It will always be beſt, however, to conform to it as far as circumſtances will allow.

Where a Chimney is deſigned for warming a room of a middling ſize, and where the thickneſs of the wall of the Chimney in front, meaſured from the front of the mantle to the breaſt of the Chimney, is nine inches, I ſhould ſet off four inches more for the width of the throat of the Chimney, which, ſuppoſing the back of the Chimney to be built upright, as it always ought to be, will give thirteen inches for the depth of the Fire-place, meaſured upon the hearth, from the open-

ing

ing of the Fire-place in front, to the back.—In this caſe thirteen inches would be a good ſize for the width of the back; and three times thirteen inches, or thirty-nine inches, for the width of the opening of the Fire-place in front; and the angle made by the back of the Fire-place and the ſides of it, or covings, would be juſt 135 degrees, which is the beſt poſition they can have for throwing heat into the room.

But I will ſuppoſe that in altering ſuch a Chimney it is found neceſſary, in order to accommodate the Fire-place to a grate or ſtove already on hand, to make the Fire-place ſixteen inches wide.—In that caſe, I ſhould merely increaſe the width of the back, to the dimenſions required, without altering the depth of the Chimney, or increaſing the width of the opening of the Chimney in front.—The covings, it is true, would be ſomewhat reduced in their width, by this alteration; and their poſition with reſpect to the plane of the back of the Chimney would be a little changed; but theſe alterations would produce no bad effects of any conſiderable conſequence, and would be much leſs likely to injure the Fire-place, than an attempt to bring the proportions of its parts nearer to the ſtandard, by increaſing the depth of the Chimney, and the width of its opening in front;—or than an attempt to preſerve that particular obliquity of the covings which is recommended as the beſt, (135 degrees,) by increaſing the width of the opening of the Fire-place, without increaſing its depth.

In order to illuſtrate this ſubject more fully, we will ſuppoſe one caſe more.—We will ſuppoſe

that in the Chimney which is to be altered, the width of the Fire-place in front is either wider or narrower than it ought to be, in order that the different parts of the Fire-place, after it is altered, may be of the proper dimenſions. In this caſe, I ſhould determine the depth of the Fire-place and the width of the back of it, without any regard to the width of the opening of the Fire-place in front; and when this is done, if the opening of the Fire-place ſhould be only two or three inches too wide, that is to ſay, only two or three inches wider than is neceſſary in order that the covings may be brought into their proper poſition with reſpect to the back, I ſhould not alter the width of this opening, but ſhould accommodate the covings to this width, by increaſing their breadth, and increaſing the angle they make with the back of the Fire place;—but if the opening of the Fire-place ſhould be more than three inches too wide; —I ſhould reduce it to the proper width by ſlips of ſtone, or by bricks and mortar.

When the width of the opening of the Fire-place, in front, is very great, compared with the depth of the Fire-place, and with the width of the back, the covings in that caſe being very wide, and conſequently very oblique, and the Fire-place very ſhallow, any ſudden motion of the air in front of the Fire-place, (that motion, for inſtance, which would be occaſioned by the clothes of a woman paſſing haſtily before the fire, and very near it,) would be apt to cauſe eddies in the air, *within the opening of the Fire-place*, by which puffs of ſmoke might eaſily be brought into the room.

Should

Should the opening of the Chimney be too narrow, which however will very ſeldom be found to be the caſe, it will, in general, be adviſable to let it remain as it is, and to accommodate the covings to it, rather than to attempt to increaſe its width, which would be attended with a good deal of trouble, and probably a conſiderable expence.

From all that has been ſaid it is evident, that the points of the greateſt importance, and which ought moſt particularly to be attended to, in altering Fire-places upon the principles here recommended, are, the bringing forward the back to its proper place, and making it of a proper width.—But it is time that I ſhould mention another matter upon which it is probable that my reader is already impatient to receive information.—Proviſion muſt be made for the paſſage of the Chimney-ſweeper up the Chimney.—This may eaſily be done in the following manner:—In building up the new back of the Fire-place; when this wall, (which need never be more than the width of a ſingle brick in thickneſs,) is brought up ſo high that there remains no more than about ten or eleven inches between what is then the top of it, and the inſide of the mantle, or lower extremity of the breaſt of the Chimney, an opening, or doorway, eleven or twelve inches wide, muſt be begun in the middle of the back, and continued quite to the top of it, which, according to the height to which it will commonly be neceſſary to carry up the back, will make the opening about twelve or fourteen inches high; which will be quite ſufficient to allow the Chimney-ſweeper to paſs. When

the Fire-place is finiſhed, this door-way is to be cloſed by a few bricks, by a tile, or a fit piece of ſtone, placed in it, dry, or without mortar, and confined in its place by means of a rabbet made for that purpoſe in the brick-work.—As often as the Chimney is ſwept, the Chimney-ſweeper takes down this temporary wall, which is very eaſily done, and when he has finiſhed his work, he puts it again into its place.—The annexed drawing (No. 6.) will give a clear idea of this contrivance; and the experience I have had of it has proved that it anſwers perfectly well the purpoſe for which it is deſigned.

I obſerved above, that the new back, which it will always be found neceſſary to build in order to bring the fire ſufficiently forward, in altering a Chimney conſtructed on the common principles, need never be thicker than the width of a common brick.—I may ſay the ſame of the thickneſs neceſſary to be given to the new ſides, or covings, of the Chimney; or if the new back and covings are conſtructed of ſtone, one inch and three quarters, or two inches in thickneſs will be ſufficient.—Care ſhould be taken in building up theſe new walls to unite the back to the covings in a ſolid manner.

Whether the new back and covings are conſtructed of ſtone, or built of bricks, the ſpace between them, and the old back and covings of the Chimney ought to be filled up, to give greater ſolidity to the ſtructure.—This may be done with looſe rubbiſh, or pieces of broken bricks, or ſtones, provided the work be ſtrengthened by a few layers

or

or courſes of bricks laid in mortar; but it will be indiſpenſably neceſſary to finiſh the work, where theſe new walls end, that is to ſay, at the top of the throat of the Chimney, where it ends abruptly in the open canal of the Chimney by a horizontal courſe of bricks well ſecured with mortar.—This courſe of bricks will be upon a level with the top of the door-way left for the Chimney-ſweeper.

From theſe deſcriptions it is clear that where the throat of the Chimney has an end, that is to ſay, where it enters into the lower part of the open canal of the Chimney, *there* the three walls which form the two covings and the back of the Fire-place all end abruptly.—It is of much importance that they ſhould end in this manner; for were they to be ſloped outward and raiſed in ſuch a manner as to ſwell out the upper extremity of the throat of the Chimney in the form of a trumpet, and increaſe it by degrees to the ſize of the canal of the Chimney, this manner of uniting the lower extremity of the canal of the Chimney with the throat would tend to aſſiſt the winds which may attempt to blow down the Chimney, in forcing their way through the throat, and throwing the ſmoke backward into the room; but when the throat of the Chimney ends abruptly, and the ends of the new walls form a flat horizontal ſurface, it will be much more difficult for any wind from above, to find, and force its way through the narrow paſſage of the throat of the Chimney.

As the two walls which form the new covings of the Chimney are not parallel to each other; but inclined, preſenting an oblique ſurface towards the front

front of the Chimney, and as they are built perfectly upright and quite flat, from the hearth to the top of the throat, where they end, it is evident that an horizontal ſection of the throat will not be an oblong ſquare; but its deviation from that form is a matter of no conſequence; and no attempts ſhould ever be made, by twiſting the covings above, where they approach the breaſt of the Chimney, to bring it to that form.—All twiſts, bends, prominences, excavations, and other irregularities of form, in the covings of a Chimney, never fail to produce eddies in the current of air which is continually paſſing into, and through an open Fire-place in which a fire is burning;—and all ſuch eddies diſturb, either the fire, or the aſcending current of ſmoke, or both; and not unfrequently cauſe the ſmoke to be thrown back into the room.—Hence it appears, that the covings of Chimnies ſhould never be made circular, or in the form of any other curve; but always quite flat.

For the ſame reaſon, that is to ſay, to prevent eddies, the breaſt of the Chimney, which forms that ſide of the throat that is in front, or neareſt to the room, ſhould be neatly cleaned off, and its ſurface made quite regular and ſmooth.

This may eaſily be done by covering it with a coat of plaiſter, which may be made thicker or thinner in different parts, as may be neceſſary in order to bring the breaſt of the Chimney to be of the proper form.

With regard to the form of the breaſt of a Chimney, this is a matter of very great importance, and which ought always to be particularly attended to.

to.—The worſt form it can have is that of a vertical plane, or upright flat;—and next to this the worſt form is an inclined plane.—Both theſe forms cauſe the current of warm air from the room, which will, in ſpite of every precaution, ſometimes find its way into the Chimney, to croſs upon the current of ſmoke, which riſes from the fire, in a manner moſt likely to embarraſs it in its aſcent, and drive it back.—The inclined plane which is formed by a flat regiſter placed in the throat of a Chimney produces the ſame effects; and this is one reaſon, among many others, which have induced me to diſapprove of regiſter ſtoves.

The current of air, which, paſſing under the mantle, gets into the Chimney, ſhould be made *gradually to bend its courſe upwards*, by which means it will unite *quietly* with the aſcending current of ſmoke, and will be leſs likely to check it, or force it back into the room.—Now this may be effected with the greateſt eaſe and certainty, merely by *rounding off* the breaſt of the Chimney or back part of the mantle, inſtead of leaving it flat, or full of holes and corners; and this of courſe ought always to be done.

I have hitherto given no preciſe directions in regard to the height to which the new back and covings ought to be carried:—This will depend not only on the height of the mantle, but alſo, and more eſpecially, on the height of the breaſt of the Chimney, or of that part of the Chimney where the breaſt ends and the upright canal begins.—The back and covings muſt riſe a few inches, five or ſix for inſtance, higher than this part, other-

otherwiſe the throat of the Chimney will not be properly formed;—but I know of no advantages that would be gained by carrying them up ſtill higher.

I mentioned above, that the ſpace between the walls which form the new back and covings, and the old back and ſides of the Fire-place, ſhould be filled up;—but this muſt not be underſtood to apply to the ſpace between the wall of dry bricks, or the tile which cloſes the paſſage for the Chimney-ſweeper, and the old back of the Chimney; for that ſpace muſt be left void, otherwiſe, though this tile (which at moſt will not be more than two inches in thickneſs) were taken away, there would not be room ſufficient for him to paſs.

In forming this door-way, the beſt method of proceeding is to place the tile or flat piece of ſtone deſtined for cloſing it, in its proper place; and to build round it, or rather by the ſides of it; taking care not to bring any mortar near it, in order that it may be eaſily removed when the door-way is finiſhed.—With regard to the rabbet which ſhould be made in the door-way to receive it and fix it more firmly in its place, this may either be formed at the ſame time when the door-way is built, or it may be made after it is finiſhed, by attaching to its bottom and ſides, with ſtrong mortar, pieces of thin roof tiles. Such as are about half an inch in thickneſs will be beſt for this uſe; if they are thicker, they will diminiſh too much the opening of the door-way, and will likewiſe be more liable to be torn away by the Chimney-ſweeper in paſſing up and down the Chimney.

It

It will hardly be neceſſary for me to add, that the tile, or flat ſtone, or wall of dry bricks, which is uſed for cloſing up this door-way, muſt be of ſufficient height to reach quite up to a level with the top of the walls which form the new back and covings of the Chimnies.

I ought, perhaps, to apologize for having been ſo very particular in theſe deſcriptions and explanations, but it muſt be remembered that this Chapter is written principally for the information of thoſe who, having had few opportunities of employing their attention in abſtruſe philoſophical reſearches, are not ſufficiently practiſed in theſe intricate inveſtigations, to ſeize, with facility, new ideas;—and conſequently, that I have frequently been obliged *to labour* to make myſelf underſtood.

I have only to expreſs my wiſhes that my reader may not be more *fatigued* with this labour than I have been;—for we ſhall then moſt certainly be ſatisfied with each other.—But to return once more to the charge.

There is one important circumſtance reſpecting Chimney Fire-places, deſtined for burning coals, which ſtill remains to be farther examined;—and that is the Grate.

Although there are few grates that may not be uſed in Chimnies conſtructed or altered upon the principles here recommended, yet they are not, by any means, all equally well adapted for that purpoſe.—Thoſe whoſe conſtruction is the moſt ſimple, and which of courſe are the cheapeſt, are beyond compariſon the beſt *on all accounts*.—Nothing being

mented in theſe Chimnies but merely a grate for containing the coals, and in which they will burn with a clear fire;—and all additional apparatus being, not only uſeleſs, but very pernicious, all complicated and expenſive grates ſhould be laid aſide, and ſuch as are more ſimple ſubſtituted in the room of them.—And in the choice of a grate, as in every thing elſe, *beauty* and *elegance* may eaſily be united with the *moſt perfect ſimplicity*.—Indeed they are incompatible with every thing elſe.

In placing the grate, the thing principally to be attended to is, to make the back of it coincide with the back of the Fire-place;—but as many of the grates now in common uſe will be found to be too large, when the Fire-places are altered and improved, it will be neceſſary to diminiſh their capacities by filling them up at the back and ſides with pieces of fire-ſtone. When this is done, it is the front of the flat piece of fire-ſtone which is made to form a new back to the grate, which muſt be made to coincide with, and make part of the back, of the Fire-place.—But in diminiſhing the capacities of grates with pieces of fire-ſtone, care muſt be taken not to make them *too narrow*.

The proper width for grates deſtined for rooms of a middling ſize will be from ſix to eight inches, and their length may be diminiſhed more or leſs, according as the room is heated with more or leſs difficulty, or as the weather is more or leſs ſevere.—But where the width of the grate is not more than five inches, it will be very difficult to prevent the fire from going out.

It

It goes out for the ſame reaſon that a live coal from the grate that falls upon the hearth ſoon ceaſes to be red hot;—it is cooled by the ſurrounding cold air of the atmoſphere.—The knowledge of the cauſe which produces this effect is important, as it indicates the means which may be uſed for preventing it.—But of this ſubject I ſhall treat more fully hereafter.

It frequently happens that the iron backs of grates are not vertical, or upright, but inclined backwards. —When theſe grates are ſo much too wide as to render it neceſſary to fill them up behind with fire-ſtone, the inclination of the back will be of little conſequence; for by making the piece of ſtone with which the width of the grate is to be diminiſhed, in the form of a wedge, or thicker above than below, the front of this ſtone, which in effect will become the back of the grate, may be made perfectly vertical; and the iron back of the grate being hid in the ſolid work of the back of the Fire-place, will produce no effect whatever; but if the grate be already ſo narrow as not to admit of any diminution of its width, in that caſe it will be beſt to take away the iron back of the grate entirely, and fixing the grate firmly in the brick-work, cauſe the back of the Fire-place to ſerve as a back to the grate.—This I have very frequently done, and have always found it to anſwer perfectly well.

Where it is neceſſary that the fire in a grate ſhould be very ſmall, it will be beſt, in reducing the grate with fire-ſtone, to bring its cavity, deſtined

for containing the fuel, to the form of one half of a hollow hemiſphere; the two ſemicircular openings being one above, to receive the coals, and the other in front, or towards the bars of the grate; for when the coals are burnt in ſuch a confined ſpace, and ſurrounded on all ſides, except in the front and above, by fire-ſtone, (a ſubſtance peculiarly well adapted for confining heat,) the heat of the fire will be concentrated, and the cold air of the atmoſphere being kept at a diſtance, a much ſmaller quantity of coals will burn, than could poſſibly be made to burn in a grate where they would be more expoſed to be cooled by the ſurrounding air, or to have their heat carried off by being in contact with iron, or with any other ſubſtance through which heat paſſes with greater facility than through fire-ſtone.

Being perſuaded that if the improvements in Chimney Fire-places here recommended ſhould be generally adopted, (which I cannot help flattering myſelf will be the caſe,) that it will become neceſſary to reduce, very conſiderably, the ſizes of grates, I was deſirous of ſhowing how this may, with the greateſt ſafety and facility, be done.

Where grates, which are deſigned for rooms of a middling ſize, are longer than 14 or 15 inches, it will always be beſt, not merely to diminiſh their lengths, by filling them up at their two ends with fire-ſtone, but, forming the back of the Chimney of a proper width, without paying any regard to the length of the grate, to carry the covings through

through the two ends of the grate in ſuch a manner as to conceal them, or at leaſt to conceal the back corners of them in the walls of the covings.

I cannot help flattering myſelf that the directions here given in regard to the alterations which it may be neceſſary to make in Fire-places, in order to introduce the improvements propoſed, will be found to be ſo perfectly plain and intelligible that no one who reads them will be at any loſs reſpecting the manner in which the work is to be performed;—but as order and arrangement tend much to facilitate all mechanical operations, I ſhall here give a few ſhort directions reſpecting the manner of *laying out the work*, which may be found uſeful, and particularly to gentlemen who may undertake to be their own architects, in ordering and directing the alterations to be made for the improvement of their Fire-places.

Directions for laying out the Work.

If there be a grate in the Chimney which is to be altered, it will always be beſt to take it away; and when this is done, the rubbiſh muſt be removed, and the hearth ſwept perfectly clean.

Suppoſe the annexed figure No. 1. to repreſent the ground plan of ſuch a Fire-place; A B being the opening of it in front, A C and B D the two ſides or covings, and C D the back.

Figure 2 ſhows the elevation of this Fire-place.

Firſt draw a ſtraight line, with chalk, or with a lead pencil, upon the hearth, from one jamb to the other,—even with the front of the jambs. The dotted line A B, figure 3, may repreſent this line.

From the middle C of this line, (A B) another line *c d*, is to be drawn perpendicular to it, acroſs the hearth, to the middle *d*, of the back of the Chimney.

A perſon muſt now ſtand upright in the Chimney, with his back to the back of the Chimney, and hold a plumb-line to the middle of the upper part of the breaſt of the Chimney (*d*, fig. 5,) or where the canal of the Chimney begins to riſe perpendicularly;—taking care to place the line above in ſuch a manner that the plumb may fall on the line *c d*, draw on the hearth from the middle of the opening of the Chimney in front to the middle of the back, and an aſſiſtant muſt mark the preciſe place *e*, on that line where the plumb falls.

This being done, and the perſon in the Chimney having quitted his ſtation, four inches are to be ſet off on the line *c d*, from *e*, towards *d*; and the point *f*, where theſe four inches end, (which muſt be marked with chalk, or with a pencil,) will ſhow how far the new back is to be brought forward.

Through *f*, draw the line *g h*, parallel to the line A B, and this line *g h* will ſhow the direction of the new back, or the ground line upon which it is to be built.

The line *c f* will ſhow the depth of the new Fire-place; and if it ſhould happen that *c f* is

equal to about *one-third* of the line A B; and if the grate can be accommodated to the Fire-place inſtead of its being neceſſary to accommodate the Fire-place to the grate, in that caſe, half the length of the line *c f* is to be ſet off from *f* on the line *g f h*, on one ſide to *k*, and on the other to *i*, and the line *i k* will ſhow the ground line of the fore part of the back of the Chimney.

In all caſes where the width of the opening of the Fire-place in front (A B) happens to be not greater, or not more than two or three inches greater than *three times* the width of the new back of the Chimney *(i k)*, this opening may be left, and lines drawn from *i* to A, and from *k* to B, will ſhow the width and poſition of the front of the new covings;—but when the opening of the Fire-place in front is ſtill wider, it muſt be reduced; which is to be done in the following manner:

From *c*, the middle of the line A B, *c a*, and *c b*, muſt be ſet off equal to the width of the back *(i k)*, added to half its width *(f i)*, and lines drawn from *i* to *a*, and from *k* to *b*, will ſhow the ground plan of the fronts of the new covings.

When this is done, nothing more will be neceſſary than to build up the back and covings; and if the Fire-place is deſigned for burning coals, to fix the grate in its proper place, according to the directions already given.—When the width of the Fire-place is reduced, the edges of the covings *a* A and *b* B are to make a finiſh with the front of the jambs.—And in general it will be beſt, not only for the ſake of the appearance of the Chim-

ney, but for other reaſons alſo, to lower the height of the opening of the Fire-place, whenever its width in front is diminiſhed.

Fig. 4 ſhows a front view of the Chimney after it has been altered according to the directions here given.—By comparing it with fig. 2, (which ſhows a front view of the ſame Chimney before it was altered,) the manner in which the opening of the Fire-place in front is diminiſhed may be ſeen.—In fig. 4 the under part of the door-way by which the Chimney-ſweeper gets up the Chimney is repreſented by white dotted lines. The door-way is repreſented cloſed.

I ſhall finiſh this Chapter with ſome general obſervations relative to the ſubject under conſideration; with directions how to proceed where ſuch local circumſtances exiſt as render modifications of the general plan indiſpenſably neceſſary.

Whether a Chimney be deſigned for burning wood upon the hearth, or wood, or coals in a grate, the form of the Fire-place is, in my opinion, moſt perfect when *the width of the back* is equal to the *depth of the Fire-place*, and the opening of the Fire-place in front equal to *three times* the width of the back, or, which is the ſame thing, to *three times the depth of the Fire-place.*

But if the Chimney be deſigned for burning wood upon the hearth, upon hand irons, or dogs, as they are called, it will ſometimes be neceſſary to accommodate the width of the back to the length of the wood; and when this is the caſe, the covings muſt be accommodated to the width of the back, and the opening of the Chimney in front.

When

When the wall of the Chimney in front, meaſured from the upper part of the breaſt of the Chimney to the front of the mantle, is very thin, it may happen, and eſpecially in Chimnies deſigned for burning wood upon the hearth, or upon dogs, that the depth of the Chimney, determining according to the directions here given, may be too ſmall.

Thus, for example, ſuppoſing the wall of the Chimney in front, from the upper part of the breaſt of the Chimney to the front of the mantle, to be only four inches, (which is ſometimes the caſe, particularly in rooms ſituated near the top of a houſe,) in this caſe, if we take four inches for the width of the throat, this will give eight inches only for the depth of the Fire-place, which would be too little, even were coals to be burnt inſtead of wood.—In this caſe I ſhould increaſe the depth of the Fire-place at the hearth to 12 or 13 inches, and ſhould build the back perpendicular to the height of the top of the burning fuel, (whether it be wood burnt upon the hearth, or coals in a grate,) and then, ſloping the back by a gentle inclination forward, bring it to its proper place, that is to ſay, *perpendicularly under the back part of the throat of the Chimney.* This ſlope, (which will bring the back forward four or five inches, or juſt as much as the depth of the Fire-place is increaſed,) though it ought not to be too abrupt, yet it ought to be quite finiſhed at the height of eight or ten inches above the fire, otherwiſe it may perhaps cauſe the Chimney to ſmoke; but when it is very near the fire, the heat of the fire will enable the current of riſing ſmoke to overcome

come the obſtacle which this ſlope will oppoſe to its aſcent, which it could not do ſo eaſily were the ſlope ſituated at a greater diſtance from the burning fuel

Fig.

* Having been obliged to carry backward the Fire-place in the manner here deſcribed, in order to accommodate it to a Chimney whoſe walls in front were remarkably thin,—I was ſurpriſed to find upon lighting the fire that it appeared to give out more heat into the room than any Fire-place I had ever conſtructed.—This effect was quite unexpected; but the cauſe of it was too obvious not to be immediately diſcovered.—The flame riſing from the fire broke againſt the part of the back which ſloped forward over the fire, and this part of the back being ſoon very much heated, and in conſequence of its being very hot, (and when the fire burnt bright it was frequently quite red hot,) it threw off into the room a great deal of radiant heat.—It is not poſſible that this oblique ſurface (the ſlope of the back of the Fire-place) could have been heated red-hot *merely* by the radiant heat projected by the burning fuel, for other parts of the Fire place nearer the fire, and better ſituated for receiving radiant heat, were never found to be ſo much heated.—and hence it appears that the combined heat in the current of ſmoke and hot vapour which riſes from an open fire *may be*, at leaſt *in part*, ſtopped in its paſſage up the Chimney, changed into radiant heat, and afterwards thrown into the room.—This opens a new and very intereſting field for experiment, and bids fair to lead to important improvements in the conſtruction of Fire-places.—I have of late been much engaged in theſe inveſtigations, and am now actually employed daily in making a variety of experiments with grates and Fire-places, upon different conſtructions, in the room I inhabit in the Royal Hotel in Pall Mall;—and Mr. Hopkins of Greek-ſtreet, Soho, Ironmonger to his Majeſty, and Mrs. Hempel, at her Pottery at Chelſea, are both at work in their different lines of buſineſs, under my direction, in the conſtruction of Fire places upon a principle entirely new, and which, I flatter myſelf, will be found to be not only elegant and convenient, but very economical—But as I mean ſoon to publiſh a particular account of theſe Fire-places,—with drawings and ample directions for conſtructing them, I ſhall not enlarge farther on the ſubject in this place.—It may however not be amiſs juſt to mention here, that theſe new invented Fire-places not being fixed to the walls of the Chimney, but merely ſet down upon the hearth, may be uſed in any open Chimney;

Fig. 7, 8, and 9, ſhow a plan, elevation, and ſection of a Fire-place conſtructed or altered upon this principle.—The wall of the Chimney in front at *a*, fig. 9, being only four inches thick, four inches more added to it for the width of the throat would have left the depth of the Fire-place meaſured upon the hearth *b c* only eight inches, which would have been too little;—a niche *c* and *e*, was therefore made in the new back of the Fire-place for receiving the grate, which niche was ſix inches deep in the centre of it, below 13 inches wide, (or equal in width to the grate,) and 23 inches high; finiſhing above with a ſemicircular arch, which, in its higheſt part, roſe ſeven inches above the upper part of the grate.—The door-way for the Chimney-ſweeper, which begins juſt above the top of the niche, may be ſeen diſtinctly in both the figures 8 and 9.—The ſpace marked *g*, fig. 9, behind this door-way, may either be filled with looſe bricks, or may be left void.—The manner in which the piece of ſtone *f*, fig. 9, which is

ney; and that Chimnies altered or conſtructed on the principles here recommended are particularly well adapted for receiving them.

The Public in general, and more particularly thoſe Tradeſmen and Manufacturers whom it may concern, are requeſted to obſerve, that as the Author does not intend to take out himſelf, or to ſuffer others to take out, any patent for any invention of his which may be of public utility, all perſons are at full liberty to imitate them, and vend them for their own emolument, when and where, and in any way they may think proper; and thoſe who may wiſh for any further information reſpecting any of thoſe inventions or improvements will receive *(gratis)* all the information they can require by applying to the Author, who will take pleaſure in giving them every aſſiſtance in his power.

put under the mantle of the Chimney to reduce the height of the opening of the Fire-place, is rounded off on the inſide in order to give a fair run to the column of ſmoke in its aſcent through the throat of the Chimney, is clearly expreſſed in this figure.

The plan fig. 7, and elevation fig. 8, ſhow how much the width of the opening of the Fire-place in front is diminiſhed, and how the covings in the new Fire-place are formed.

A perfect idea of the form and dimenſion of the Fire-place in its original ſtate, as alſo after its alteration, may be had by a careful inſpection of theſe figures.

I have added the drawing fig. 10, merely to ſhow how a fault, which I have found workmen in general whom I have employed in altering Fire-places are very apt to commit, is to be avoided.—In Chimnies, like that repreſented in this figure, where the jambs A and B project far into the room, and where the front edge of the marble ſlab *o*, which forms the coving, does not come ſo far forward as the front of the jambs, the workmen in conſtructing the new covings are very apt to place them,—not in the line *c A*, which they ought to do,—but in the line *c o*, which is a great fault.—The covings of a Chimney ſhould never range *behind* the front of the jambs, however thoſe jambs may project into the room;—but it is not abſolutely neceſſary that the covings ſhould *make a finiſh* with the internal front corners of the jambs, or that they ſhould be continued from the back *c*, quite

quite to the front of the jambs at *A*.—They may finiſh in front at *a* and *b*, and ſmall corners *A*, *o*, *a*, may be left for placing the ſhovels, tongs, &c.

Were the new coving to range with the front edge of the old coving *o*, the obliquity of the new coving would commonly be too great;—or the angle *d c o* would exceed 135 degrees, *which it never ſhould do*,—or at leaſt never by more than a very few degrees.

No inconvenience of any importance will ariſe from making the obliquity of the covings *leſs* than what is here recommended; but many cannot fail to be produced by making it much greater;—and as I know from experience that workmen are very apt to do this, I have thought it neceſſary to warn them particularly againſt it.

Fig. 11 ſhews how the width and obliquity of the covings of a Chimney are to be accommodated to the width of the back, and to the opening in front and depth of the Fire-place, where the width of the opening of the Fire-place is leſs than three times the width of the new back.

As all thoſe who may be employed in altering Chimnies may not, perhaps, know how to ſet off an angle of any certain number of degrees,—or may not have at hand the inſtruments neceſſary for doing it,—I ſhall here ſhow how an inſtrument may be made which will be found to be very uſeful in laying out the work for the bricklayers.

Upon a board about 18 inches wide and four feet long, or upon the floor or a table, draw three equal ſquares A, B, C, fig. 12, of about 12 or 14 inches

inches each ſide, placed in a ſtraight line, and touching each other.—From the back corner *c* of the centre ſquare B, draw a diagonal line acroſs the ſquare A, to its outward front corner *f*, and the adjoining angle formed by the lines *d c* and *c f* will be equal to 135 degrees,—the angle which the plane of the back of a Chimney Fire-place ought to make with the plane of its covings.—And a bevel *m*, *n*, being made to this angle with thin ſlips of hard wood, this little inſtrument will be found to be very uſeful in marking out on the hearth, with chalk, the plans of the walls which are to form the covings of Fire-places.

As Chimnies which are apt to ſmoke will require the covings to be placed leſs obliquely in reſpect to the back than others which have not that defect, it would be convenient to be provided with ſeveral bevels;—three or four, for inſtance, forming different angles.—That already deſcribed, which may be called No. 1. will meaſure the obliquity of the covings when the Fire-place can be made of the moſt perfect form:—another No. 2. may be made to a ſmaller angle, *d c e*,—and another No. 3. for Chimnies which are very apt to ſmoke at the ſtill ſmaller angle *d c i*.—Or a bevel may be ſo contrived, by means of a joint, and an arch, properly graduated, as to ſerve for all the different degrees of obliquity which it may ever be neceſſary to give to the covings of Fire-places.

Another point of much importance, and particularly in Chimnies which are apt to ſmoke, is to form the throat of the Chimney properly, by carrying

carrying up the back and covings to a proper height.

This workmen are apt to neglect to do, probably on account of the difficulty they find in working where the opening of the canal of the Chimney is ſo much reduced.—But it is abſolutely neceſſary that theſe walls ſhould be carried up five or ſix inches at leaſt above the upper part of the breaſt of the Chimney, or to that point where the wall which forms the front of the throat begins to riſe perpendicularly.—If the workman has intelligence enough to avail himſelf of the opening which is formed in the back of the Fire-place to give a paſſage to the Chimney-ſweeper, he will find little difficulty in finiſhing his work in a proper manner.

In placing the plumb-line againſt the breaſt of the Chimney, in order to aſcertain how far the new back is to be brought forward, great care muſt be taken to place it at the very top of the breaſt, where the canal of the Chimney *begins to riſe perpendicularly;* otherwiſe, when the plumb-line is placed too low, or againſt the ſlope of the breaſt, when the new back comes to be raiſed to its proper height, the throat of the Chimney will be found to be too narrow.

Sometimes, and indeed very often the top of the breaſt of a Chimney lies very high, or far above the fire (ſee the figures 13 and 14, where *d* ſhows the top of the breaſt of the Chimney); when this is the caſe it muſt be brought lower, otherwiſe the Chimney will be very apt to ſmoke.—So much has been ſaid in the Firſt Chapter of this Eſſay of the advan-

advantages to be derived from bringing the throat of a Chimney near to the burning fuel, that I do not think it neceſſary to enlarge on them in this place,—taking it for granted that the utility and neceſſity of that arrangement have already been made ſufficiently evident;—but a few directions for workmen, to ſhow them how the breaſt (and conſequently the throat) of a Chimney can moſt readily be lowered, may not be ſuperfluous.

Where the too great height of the breaſt of a Chimney is owing to the great height of the mantle, (ſee fig. 13,) or, which is the ſame thing, of the opening of the Fire-place in front, which will commonly be found to be the caſe; the only remedy for the evil will be to bring down the mantle lower;—or rather, to make the opening of the Fire-place in front lower, by throwing acroſs the top of this opening, from one jamb to the other, and immediately under the mantle, a very flat arch;—a wall of bricks and mortar, ſupported on ſtraight bars of iron;—or a piece of ſtone (*b*, fig. 13).—When this is done, the ſlope of the old throat of the Chimney, or of the back ſide of the mantle, is to be filled up with plaſter, ſo as to form one continued flat, vertical, or upright plane ſurface with the lower part of the wall of the canal of the Chimney, and a new breaſt is to be formed lower down, care being taken to round it off properly, and make it finiſh at the lower ſurface of the new wall built under the mantle;—which wall forms in fact a new mantle.

The

The annexed drawing, fig. 13, which repreſents the ſection of a Chimney in which the breaſt has been lowered according to the method here deſcribed, will ſhow theſe various alterations in a clear and ſatisfactory manner. In this figure, as well as in moſt of the others in this Eſſay, the old walls are diſtinguiſhed from the new ones by the manner in which they are ſhaded;—the old walls being ſhaded by diagonal lines, and the new ones by vertical lines. The additions, which are formed of plaſter, are ſhaded by dots inſtead of lines.

Where the too great height of the breaſt of a Chimney *is occaſioned, not by the height of the* mantle, but by the too great width of the breaſt, in that caſe, (which however will ſeldom be found to occur,) this defect may be remedied by covering the lower part of the breaſt with a thick coating of plaſter, ſupported, if neceſſary, by nails or ſtuds, driven into the wall which forms the breaſt, and properly rounded off at the lower part of the mantle.—See fig. 14.

CHAP. III.

Of the Cauſe of the Aſcent of Smoke.—Illuſtration of the Subject by familiar Compariſons and Experiments.—Of Chimnies which affect and cauſe each other to ſmoke.—Of Chimnies which ſmoke from Want of Air.—Of the Eddies of Wind which ſometimes blow down Chimnies, and cauſe them to ſmoke.

THOUGH it was my wiſh to avoid all abſtruſe philoſophical inveſtigations in this Eſſay, yet I feel that it is neceſſary to ſay a few words upon a ſubject generally conſidered as difficult to be explained, which is too intimately connected with the matter under conſideration to be paſſed over in ſilence.—A knowledge of the cauſe of the aſcent of Smoke being indiſpenſably neceſſary to thoſe who engage in the improvement of Fire-places, or who are deſirous of forming juſt ideas relative to the operations of fire, and the management of heat, I ſhall devote a few pages to the inveſtigation of that curious and intereſting ſubject.—And as many of thoſe who may derive advantage from theſe inquiries are not much accuſtomed to philoſophical diſquiſitions, and would not readily comprehend either the language or the diagrams commonly uſed by ſcientific writers to explain the phænomena in queſtion,

tion, I ſhall take pains to expreſs myſelf in the moſt familiar manner, and to uſe ſuch compariſons for illuſtration as may eaſily be underſtood.

If ſmall leaden bullets, or large gooſe ſhot, be mixed with peas, and the whole well ſhaken in a buſhel, the ſhot will ſeparate from the peas, and will take its place at the bottom of the buſhel; forcing by its greater weight the peas which are lighter, to move upwards, contrary to their natural tendency, and take their places above.

If water and linſeed oil, which is lighter than water, be mixed in a veſſel by ſhaking them together, upon ſuffering this mixture to remain quiet, the water will deſcend and occupy the bottom of the veſſel, and the oil, being forced out of its place by the greater preſſure downwards of the heavier liquid, will be obliged to riſe and ſwim on the ſurface of the water.

If a bottle containing linſeed oil be plunged in water with its mouth upwards, and open, the oil will aſcend out of the bottle, and paſſing upwards through the maſs of water, in a continued ſtream, will ſpread itſelf over its ſurface.

In like manner when two fluids of any kind, of different denſities, come into contact, or are mixed with each other, that which is the lighteſt will be forced upwards by that which is the heavieſt.

And as heat rarefies all bodies, fluids as well as ſolids, air as well as water, or mercury,—it follows that two portions of the ſame fluid, at different temperatures, being brought into contact with each other,

other, that portion which is the hotteſt being more rarefied, or ſpecifically *lighter* than that which is colder, muſt be forced upwards by this laſt.—And this is what always happens in fact.

When hot water and cold water are mixed, the hotteſt part of the mixture will be found to be at the ſurface above;—and when cold air is admitted into a warmed room, it will always be found to take its place at the bottom of the room, the warmer air being in part expelled, and in part forced upwards to the top of the room.

Both air and water being tranſparent and colourleſs fluids, their internal motions are not eaſily diſcovered by the ſight; and when theſe motions are very ſlow, they make no impreſſion whatever on any of our ſenſes, conſequently they cannot be detected by us without the aid of ſome mechanical contrivance:—but where we have reaſon to think that thoſe motions exiſt, means ſhould be ſought, and may often be found, for rendering them perceptible.

If a bottle containing hot water tinged with logwood, or any other colouring drug, be immerſed, with its mouth open, and upwards, into a deep glaſs jar filled with cold water, the aſcent of the hot water from the bottle through the maſs of cold water will be perfectly viſible through the glaſs.—Now nothing can be more evident than that both of theſe fluids are forced, or *puſhed*, and not *drawn* upwards.—Smoke is frequently ſaid to be drawn up the Chimney;—and that a Chimney draws well or ill;—but

theſe are careleſs expreſſions, and lead to very erroneous ideas reſpecting the cauſe of the aſcent of Smoke, and conſequently tend to prevent the progreſs of improvements in the management of fires.—The experiment juſt mentioned with the coloured water is very ſtriking and beautiful, and it is well calculated to give a juſt idea of the cauſe of the aſcent of Smoke. The cold water in the jar, which, in conſequence of its ſuperior weight or denſity, forces the heated and rarefied water in the bottle to give place to it, and to move upwards out of its way, may repreſent the cold air of the atmoſphere, while the riſing column of coloured water will repreſent the column of Smoke which aſcends from a fire.

If Smoke required a Chimney to *draw* it upwards, how happens it that Smoke riſes from a fire which is made in the open air, where there is no Chimney?

If a tube, open at both ends, and of ſuch a length that its upper end be below the ſurface of the cold water in the jar, be held vertically over the mouth of the bottle which contains the hot coloured water, the hot water will riſe up through it, juſt as Smoke riſes in a Chimney.

If the tube be previouſly heated before it is plunged into the cold water, the aſcent of the hot coloured water will be facilitated and accelerated, in like manner as Smoke is known to riſe with greater facility in a Chimney which is hot, than in one in which no fire has been made for a long time.—But in neither of theſe caſes can it, with any

propriety, be ſaid, that the hot water is *drawn* up the tube.—The hotter the water in the bottle is, and the colder that in the jar, the greater will be the velocity with which the hot water will be forced up through the tube; and the ſame holds of the aſcent of hot Smoke in a Chimney.—When the fire is intenſe, and the weather very cold, the aſcent of the Smoke is very rapid; and under ſuch circumſtances Chimnies ſeldom ſmoke.

As the cold water of the jar immediately ſurrounding the bottle which contains the hot water, will be heated by the bottle while the other parts of the water in the jar will remain cold, this water ſo heated, becoming ſpecifically lighter than that which ſurrounds it, will be forced upwards; and if it finds its way into the tube, will riſe up through it with the coloured hot water.—The warmed air of a room heated by an open Chimney Fire-place has always a tendency to riſe, (if I may uſe that inaccurate expreſſion,) and finding its way into the Chimney, frequently goes off with the Smoke.

What has been ſaid will, I flatter myſelf, be ſufficient to explain and illuſtrate, in a clear and ſatisfactory manner, the cauſe of the aſcent of Smoke; and juſt ideas upon that ſubject are abſolutely neceſſary in order to judge, with certainty, of the merit of any ſcheme propoſed for the improvement of Fire-places; or to take effectual meaſures, in all caſes, for curing ſmoking Chimnies.—For though the perpetual changes and alterations which are produced by accident, whim, and caprice, do ſometimes lead to uſeful diſcoveries, yet the progreſs

of

of improvement under ſuch guidance muſt be exceedingly ſlow, fluctuating, and uncertain.

As to the cauſes of the ſmoking of Chimnies, they are very numerous, and various; but as a general idea of them may be acquired from what has already been ſaid upon that ſubject in various parts of this Eſſay, and as they may, in all caſes, (a very few only excepted,) be completely remedied by making the alterations in Fire-places here pointed out; I do not think it neceſſary to enumerate them all in this place, or to enter into thoſe long details and inveſtigations which would be required to ſhow the preciſe manner in which each of them operates, either alone, or in conjunction with others.

There is however one cauſe of ſmoking Chimnies which I think it is neceſſary to mention more particularly.—In modern-built houſes, where the doors and windows are generally made to cloſe with ſuch accuracy that no crevice is left for the paſſage of the air from without, the Chimnies in rooms adjoining to each other, or connected by cloſe paſſages, are frequently found to affect each other, and this is eaſy to be accounted for.—When there is a fire burning in one of the Chimnies, as the air neceſſary to ſupply the current up the Chimney where the fire burns cannot be had in ſufficient quantities from without, through the very ſmall crevices of the doors and windows, the air in the room becomes rarefied, not by heat, but by ſubtraction of that portion of air which is employed in keeping up the fire, or ſupporting the com-

buſtion of the fuel, and in conſequence of this rarefaction, its elaſticity is diminiſhed, and being at laſt overcome by the preſſure of the external air of the atmoſphere, this external air ruſhes into the room by the only paſſage left for it, namely, by the open Chimney of the neighbouring room:—And the flow of air into the Fire-place, and up the Chimney where the fire is burning being conſtant, this expence of air is ſupplied by a continued current down the other Chimney.

If an attempt be made to light fires in both Chimnies at the ſame time, it will be found to be very difficult to get the fires to burn, and the rooms will both be filled with Smoke.

One of the fires,—that which is made in the Chimney where the conſtruction of the Fire-place is beſt adapted to facilitate the aſcent of the Smoke,—or if both Fire-places are on the ſame conſtruction,—that which has the wind moſt favourable, or in which the fire happens to be ſooneſt kindled,—will overcome the other, and cauſe its Smoke to be beat back into the room by the cold air which deſcends through the Chimney. —The moſt obvious remedy in this caſe is to provide for the ſupply of freſh air neceſſary for keeping up the fires by opening a paſſage for the external air into the room by a ſhorter road than down one of the Chimnies; and when this is done, both Chimnies will be found to be effectually cured.

But Chimnies ſo circumſtanced may very frequently be prevented from ſmoking even without opening any new paſſage for the external air,

merely by diminiſhing the draught, (as it is called,) up the Chimnies; which can beſt be done by altering both Fire-places upon the principles recommended and fully explained in the foregoing Chapters of this Eſſay.

Should the doors and windows of a room be cloſed with ſo much nicety as to leave no crevices by which a ſupply of air can enter ſufficient for maintaining the fire, *after the current of air up the Chimney has been diminiſhed as much as poſſible by diminiſhing the throat of the Fire-place*, in that caſe there would be no other way of preventing the Chimney from ſmoking but by opening a paſſage for the admiſſion of freſh air from without;—but this, I believe, will very ſeldom be found to be the caſe.

A caſe more frequently to be met with is where currents of air ſet down Chimnies in conſequence of a diminution and rarefaction of the air in a room, occaſioned by the doors of the room opening into paſſages or courts where the air is rarefied by the action of ſome particular winds. In ſuch caſes the evil may be remedied, either by cauſing the doors in queſtion to cloſe more accurately,—or, (which will be ſtill more effectual,) by giving a ſupply of air to the paſſage or court which wants it, by ſome other way.

Where the top of a Chimney is commanded by high buildings, by clifts, or by high grounds, it will frequently happen, in windy weather, that the eddies formed in the atmoſphere by theſe obſtacles will blow down the Chimney, and beat

down the Smoke into the room.—This it is true will be much leſs likely to happen when the throat of the Chimney is contracted and properly formed than when it is left quite open, and the Fire-place badly conſtructed; but as it is *poſſible* that a Chimney may be ſo much expoſed to theſe eddies in very high winds as to be made to ſmoke ſometimes when the wind blows with violence from a certain quarter, it is neceſſary to ſhow how the effects of thoſe eddies may be prevented.

Various mechanical contrivances have been imagined for preventing the wind from blowing down Chimnies, and many of them have been found to be uſeful; there are, however, many of theſe inventions, which, though they prevent the wind from blowing down the Chimney, are ſo ill-contrived on other accounts as to obſtruct the aſcent of the Smoke, and do more harm than good.

Of this deſcription are all thoſe Chimney-pots with flat horizontal plates or roofs placed upon ſupporters juſt above the opening of the pot;—and moſt of the caps which turn with the wind are not much better.—One of the moſt ſimple contrivances that can be made uſe of, and which in moſt caſes will be found to anſwer the purpoſe intended as well or better than more complicated machinery, is to cover the top of the Chimney with a hollow truncated pyramid or cone, the diameter of which above, or opening for the paſſage of the Smoke, is about 10 or 11 inches.—This pyramid, or cone, (for either will anſwer,)—ſhould be of earthen ware, or of caſt iron;—its perpendicular height

may be equal to the diameter of its opening above, and the diameter of its opening below equal to three times its height.—It ſhould be placed upon the top of the Chimney, and it may be contrived ſo as to make a handſome finiſh to the brick-work. —Where ſeveral flews come out near each other, or in the ſame ſtack of Chimnies, the form of a pyramid will be better than that of a cone for theſe covers.

The intention of this contrivance is, that the winds and eddies which ſtrike againſt the oblique ſurface of theſe covers may be reflected upwards inſtead of blowing down the Chimney.—The invention is by no means new, but it has not hitherto been often put in practice.—As often as I have ſeen it tried it has been found to be of uſe; I cannot ſay, however, that I was ever obliged to have recourſe to it, or to any ſimilar contrivance; and if I forbear to enlarge upon the ſubject of theſe inventions, it is becauſe I am perſuaded that when Chimnies are properly conſtructed *in the neighbourhood of the Fire-place* little more will be neceſſary to be done at the top of the Chimney than to leave it open.

I cannot conclude this Eſſay without again recommending, in the ſtrongeſt manner, a careful attention to the management of fires in open Chimnies; for not only the quantity of heat produced in the combuſtion of fuel depends much on the manner in which the fire is managed, but even of the heat actually generated a very ſmall part only

only will be ſaved, or uſefully employed, when the fire is made in a careleſs and ſlovenly manner.

In lighting a coal fire more wood ſhould be employed than is commonly uſed, and fewer coals; and as ſoon as the fire burns bright, and the coals are well lighted, and *not before*, more coals ſhould be added to increaſe the fire to its proper ſize *.

The

* *Kindling balls* compoſed of equal parts of coal,—charcoal,—and clay, the two former reduced to a fine powder, well mixed and kneaded together with the clay moiſtened with water, and then formed into balls of the ſize of hens eggs, and thoroughly dried, might be uſed with great advantage inſtead of wood for kindling fires. Theſe *kindling balls* may be made ſo inflammable as to take fire in an inſtant and with the ſmalleſt ſpark, by dipping them in a ſtrong ſolution of nitre and then drying them again, and they would neither be expenſive nor liable to be ſpoiled by long keeping. Perhaps a quantity of pure charcoal reduced to a very fine powder and mixed with the ſolution of nitre in which they are dipped would render them ſtill more inflammable.

I have often wondered that no attempts ſhould have been made to improve the fires which are made in the open Chimnies of elegant apartments, by preparing the fuel, for nothing ſurely was ever more dirty, inelegant, and diſguſting than a common coal fire.

Fire balls of the ſize of gooſe eggs, compoſed of coal and charcoal in powder, mixed up with a due proportion of wet clay, and well dried, would make a much more cleanly and in all reſpects a pleaſanter fire than can be made with crude coals, and I believe would not be more expenſive fuel. In Flanders and in ſeveral parts of Germany, and particularly in the Duchies of Juliers and Bergen, where coals are uſed as fuel, the coals are always prepared before they are uſed, by pounding them to a powder, and mixing them up with an equal weight of clay, and a ſufficient quantity of water to form the whole into a maſs which is kneaded together and formed into cakes, which cakes are afterwards well dried and kept in a dry place for uſe. And it has been found by long experience that the expence attending this preparation is amply repaid by the improvement of the fuel. The coals, thus mixed with clay, not only burn longer, but give much more heat than when they are burnt in their crude ſtate.

It

The enormous waſte of fuel in London may be eſtimated by the vaſt dark cloud which continually hangs over this great metropolis, and frequently overſhadows the whole country far and wide; for this dense cloud is certainly compoſed almoſt entirely of *unconſumed coal*, which having ſtolen wings from the innumerable fires of this great city, has eſcaped by the Chimnies, and continues to ſail about in the air, till having loſt the heat which gave it volatility, it falls in a dry ſhower of extremely fine black duſt to the ground, obſcuring the atmoſphere in its deſcent, and frequently changing the brighteſt day into more than Egyptian darkneſs.

I never view from a diſtance, as I come into town, this black cloud which hangs over London,

It will doubtleſs appear extraordinary to thoſe who have not conſidered the ſubject with ſome attention, that the quantity of heat produced in the combuſtion of any given quantity of coals ſhould be increaſed by mixing the coals with clay, which is certainly an incombuſtible body, but the phenomenon may, I think, be explained in a ſatisfactory manner.

The heat generated in the combuſtion of any ſmall particle of coal exiſting under two diſtinct forms, namely, in that which is *combined* with the flame and ſmoke which riſe from the fire, and which, if means are not found to ſtop it, goes off immediately by the Chimney and is loſt,—and the *radiant heat* which is ſent off from the fire in all directions in right lines:—I think it reaſonable to conclude, that the particles of clay which are ſurrounded on all ſides by the flame arreſt a part at leaſt of the combined heat, and prevent its eſcape; and this combined heat, ſo arreſted, heating the clay red hot, is retained in it, and being changed by this operation to radiant heat, is afterwards emitted, and may be directed and employed to uſeful purpoſes.

In compoſing *fire-balls*, I think it probable that a certain proportion of chaff—of ſtraw cut very fine, or even of ſaw-duſt, might be employed with great advantage. I wiſh thoſe who have leiſure would turn their thoughts to this ſubject, for I am perſuaded that very important improvements would reſult from a thorough inveſtigation of it.

without

without wiſhing to be able to compute the immenſe number of chaldrons of coals of which it is compoſed; for could this be aſcertained, I am perſuaded ſo ſtriking a fact would awaken the curioſity, and excite the aſtoniſhment of all ranks of the inhabitants; and *perhaps* turn their minds to an object of economy to which they have hitherto paid little attention.

Concluſion.

Though the ſaving of fuel which will reſult from the improvements in the forms of *Chimney Fire-places* here recommended will be very conſiderable, yet I hope to be able to ſhow in a future Eſſay, that ſtill greater ſavings may be made, and more important advantages derived from the introduction of improvements I ſhall propoſe in *Kitchen Fire-places*.

I hope likewiſe to be able to ſhow in an Eſſay on *Cottage Fire-places*, which I am now preparing for publication, that *three quarters*, at leaſt, of the fuel which cottagers now conſume in cooking their victuals, and in warming their dwellings, may with great eaſe, and without any expenſive apparatus, be ſaved.

END OF THE FOURTH ESSAY.

EXPLANATION of the FIGURES.

Fig. 1.

The plan of a Fire-place on the common conſtruction.

A B, the opening of the Fire-place in front.

C D, the back of theFire-place.

A C and B D, the covings.

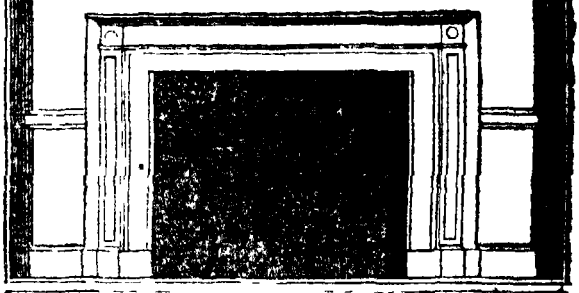
See page 341.

Fig. 2.

This figure ſhows the elevation, or front view of a Fire-place on the common conſtruction.

See page 341.

Fig. 2.



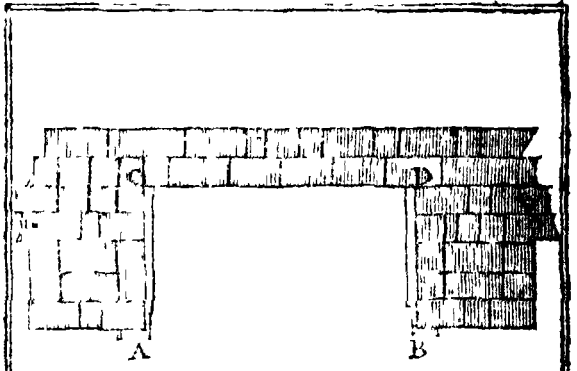


Fig. 1.

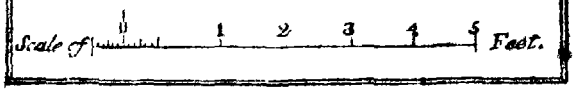


Fig. 3.

This Figure ſhows how the Fire-place repreſented by the Fig. 1. is to be altered in order to its being improved.

A B is the opening in front,—C D, the back, and A C and B D, the covings of the Fire-place in its original ſtate.

a b, its opening in front,—*i k*, its back,—and *a i* and *b k*, its covings after it has been altered, *e* is a point upon the hearth upon which a plum ſuſpended from the middle of the upper part of the breaſt of the Chimney falls. The ſituation for the new back is aſcertained by taking the line *e f* equal to four inches. The new back and covings are repreſented as being built of bricks;—and the ſpace between theſe and the old back and covings as being filled up with rubbiſh. See page 342.

Fig. 4.

This Figure repreſents the elevation or front view of the Fire-place Fig. 3. after it has been altered. The lower part of the door-way left for the Chimney-ſweeper is ſhown in this Figure by white dotted lines. See page 344.

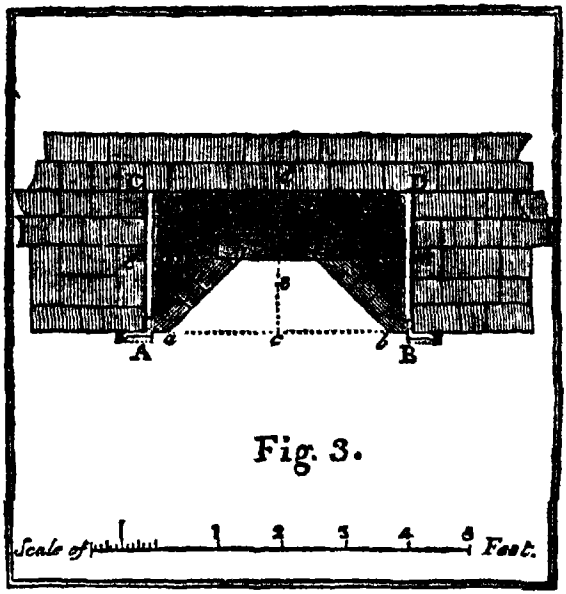


Fig. 3.

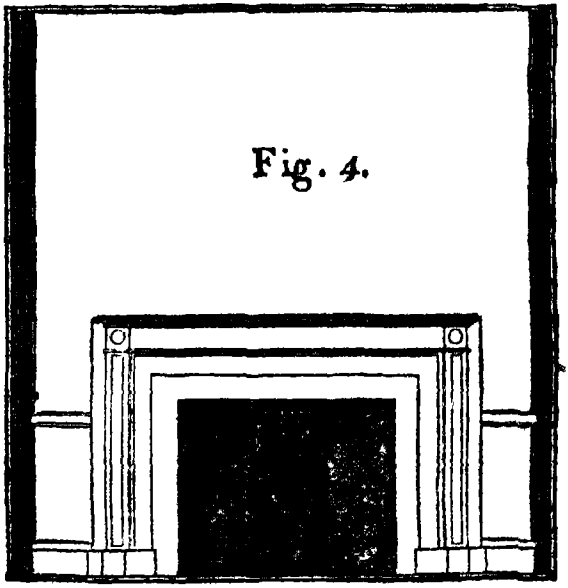


Fig. 4.

Fig. 5.

This Figure ſhows the ſection of a Chimney Fire-place and of a part of the canal of the Chimney, on the common conſtruction.

a b is the opening in front; *b c*, the depth of the Fire-place at the hearth; *d*, the breaſt of the Chimney.

d e, the throat of the Chimney; and *d f*, *g e*, a part of the open canal of the Chimney.

Fig. 6.

Shows a ſection of the ſame Chimney, after it has been altered.

k l is the new back of the Fire-place; *l i*, the tile or ſtone which cloſes the door-way for the Chimney-ſweeper; *d i*, the throat of the Chimney, narrow to four inches; *a*, the mantle, and *b*, the new wall made under the mantle to diminiſh the height of the opening of the Fire-place in front.

N. B. Theſe two Figures are ſections of the ſame Chimney which is repreſented in each of the four preceding Figures.

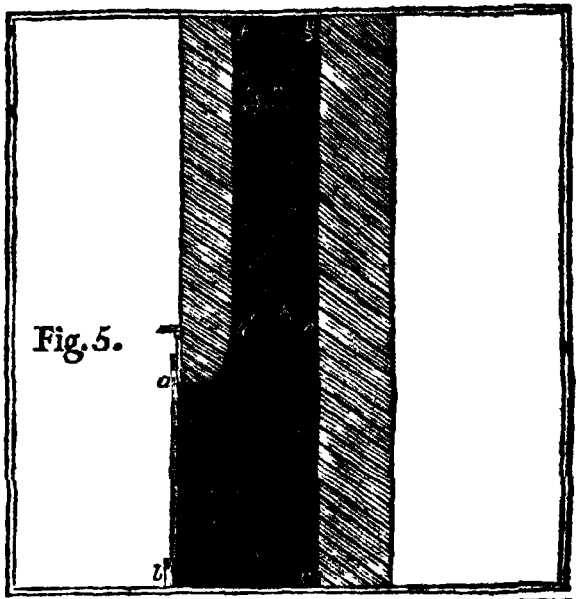


Fig. 5.

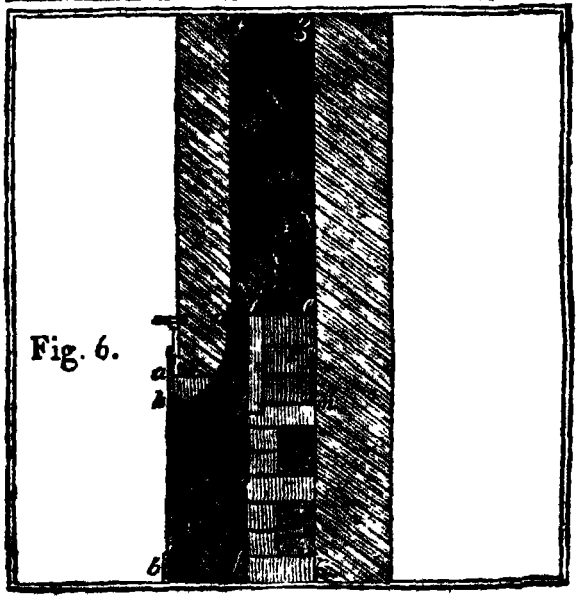


Fig. 6.

Fig. 7.

This Figure repreſents the ground plan of a Chimney Fire-place in which the grate is placed in a niche, and in which the original width A B of the Fire-place is conſiderably diminiſhed.

a b is the opening of the Fire-place in front after it has been altered, and *d* is the back of the niche in which the grate is placed.

See page 347.

Fig. 8.

Shows a front view of the ſame Fire-place after it has been altered; where may be ſeen the grate, and the door-way for the Chimney-ſweeper.

See page 347.

Fig. 9.

Shows a ſection of the ſame Fire-place, *c d e* being a ſection of the niche, *g* the door-way for the Chimney-ſweeper, cloſed by a piece of fire-ſtone, and *f* the new wall under the mantle by which the height of the opening of the Fire-place in front is diminiſhed.

See page 347.

Fig. 7.

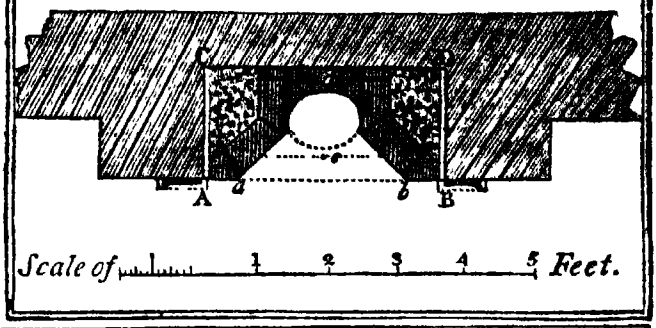
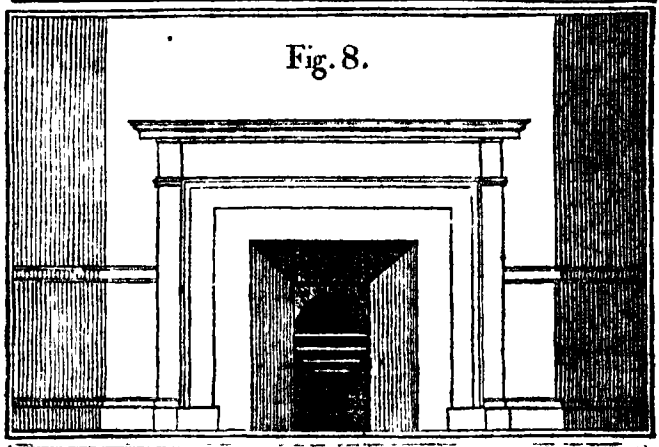


Fig. 8.



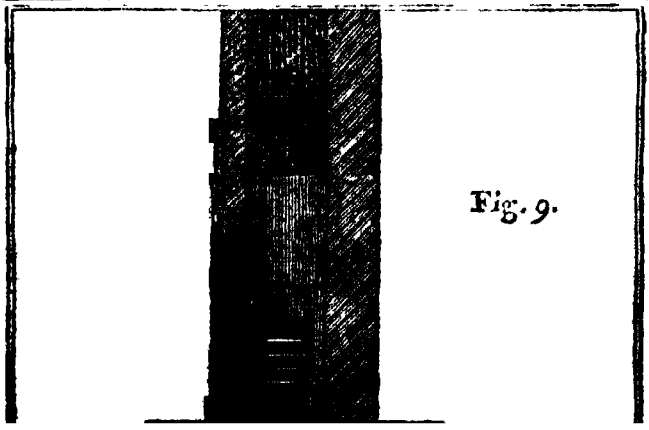


Fig. 9.

Fig. 10.

This Figure ſhows how the covings are to be placed when the front of the covings (*a* and *b*) do not come ſo far forward as the front of the opening of the Fire-place, or the jambs (A and B).

See page 348.

Fig. 11.

This Figure ſhows how the width and obliquity of the covings are to be accommodated to the width of the back of the Fire-place, in caſes where it is neceſſary to make the back very wide.

See page 349.

Fig. 10.

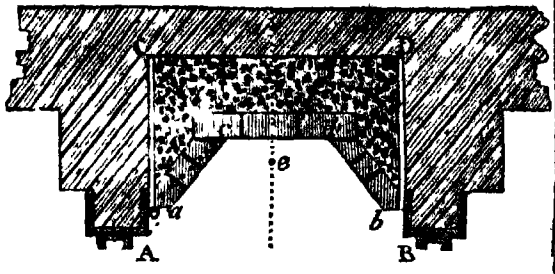
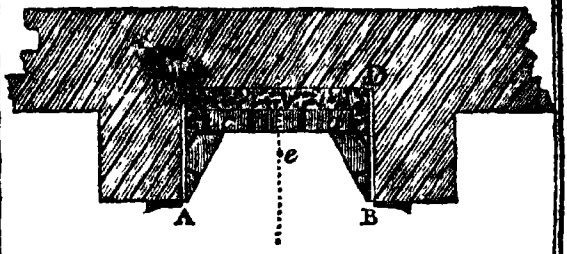


Fig. 11.



Scale of 1 2 3 4 5 Feet

Fig. 12.

This Figure ſhows how an inſtrument called a bevel (*m n*), uſeful in laying out the work in altering Chimney Fire-places, may be conſtructed.

See page 349.

Fig. 13.

This ſhows how, when the breaſt of a Chimney (*d*) is too high, it may be brought down by means of a wall (*b*) placed under the mantle, and a coating of plaſter, which in this Figure is repreſented by the part marked by dots.

See page 351.

Fig. 14.

This ſhows how the breaſt of a Chimney may be brought down merely by a coating of plaſter.

See page 351.

Fig. 12.

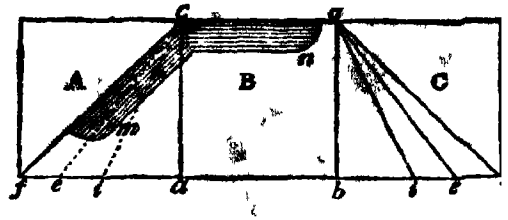


Fig. 13.

Fig. 14.

ESSAY V.

A

SHORT ACCOUNT

OF

SEVERAL PUBLIC INSTITUTIONS

Lately formed in BAVARIA.

TOGETHER WITH THE

APPENDIX TO THE FIRST VOLUME.

ESSAY V.

A ſhort Account of the MILITARY ACADEMY *at* MUNICH.

THOUGH it is certain that too much learning is rather diſadvantageous than otherwiſe to the lower claſſes of the people;—that the introduction of a ſpirit of philoſophical inveſtigation,—literary amuſement,—and metaphyſical ſpeculation, among thoſe who are deſtined by fortune to gain their livelihood by the ſweat of their brow, rather tends to make them diſcontented and unhappy, than to contribute any thing to their real comfort and enjoyments; yet there appears, now and then, a native genius in the moſt humble ſtations, which it would be a pity not to be able to call forth into activity. It was principally with a view to bring forward ſuch extraordinary talents, and to employ them uſefully in the public ſervice, that the *Military Academy* at Munich was inſtituted.

This academy, which conſiſts of 180 eleves or pupils, is divided into three claſſes. The firſt claſs, which is deſigned for the education of orphans and other children of the poorer claſs of Military Officers, and thoſe employed in the Civil Departments of the State, conſiſts of thirty pupils, who are received *gratis*, from the age of eleven to thirteen years, and who remain in the Academy four years. The ſecond claſs, which is deſigned to aſſiſt the poorer nobility, and leſs opulent among the merchants, citizens, and ſervants of government, in giving their ſons a good general education, conſiſts of ſixty pupils, who are received from the age of eleven to fifteen years, and who pay to the Academy twelve florins a month; for which ſum they are fed, clothed, and inſtructed. The third claſs, conſiſting of ninety pupils, from the age of fifteen to twenty years, who are all admitted *gratis*, is deſigned principally to bring forward ſuch youths among the lower claſſes of the people as ſhow evident ſigns of *uncommon talents* and genius, joined to a ſound conſtitution of body, and a good moral character.

All Commanding Officers of regiments, and Public Officers in Civil Departments, and all Civil Magiſtrates, are authorized and *invited* to recommend ſubjects for this claſs of the Academy, and they are not confined in their choice to any particular ranks of ſociety, but they are allowed to recommend perſons of the loweſt extraction, and moſt obſcure origin. Private ſoldiers, and the children of ſoldiers, and even the children of the meaneſt mechanics

mechanics and day-labourers, are admiſſible, provided they poſſeſs the neceſſary requiſites; namely, *very extraordinary natural genius*, a healthy conſtitution, and a good character; but if the ſubject recommended ſhould be found wanting in any of theſe requiſite qualifications, he would not only be refuſed admittance into the Academy, but the perſon who recommended him would be very ſeverely reprimanded.

The greateſt ſeverity is neceſſary upon theſe occaſions, otherwiſe it would be impoſſible to prevent abuſes. An eſtabliſhment, deſigned for the encouragement of genius, and for calling forth into public utility talents which would otherwiſe remain buried and loſt in obſcurity, would ſoon become a job for providing for relations and dependants.

One circumſtance, relative to the internal arrangement of this Academy, may, perhaps, be thought not unworthy of being particularly mentioned, and that is the very moderate expence at which this inſtitution is maintained. By a calculation, founded upon the experience of four years, I find that the whole Academy, conſiſting of 180 pupils, with profeſſors and maſters of every kind, ſervants, clothing, board, lodging, fire-wood, light, repairs, and every other article, houſe-rent alone excepted, amounts to no more than 28,000 florins a-year, which is no more than 155 florins, or about fourteen pounds ſterling a-year for each pupil; a ſmall ſum indeed, conſidering the manner in which they are kept, and the education they receive.

Though this Academy is called a *Military Academy*, it is by no means confined to the education of thoſe who are deſtined for the army; but it is rather an eſtabliſhment of general education, where the youth are inſtructed in every ſcience, and taught every bodily exerciſe, and perſonal accompliſhment, which conſtitute a liberal education; and which fits them equally for the ſtation of a private gentleman,—for the ſtudy of any of the learned profeſſions,—or for any employment, civil or military, under the government.

As this inſtitution is principally deſigned as a nurſery for genius,—as a gymnaſium for the formation of men,—for the formation of *real men*, poſſeſſed of ſtrength and character, as well as talents and accompliſhments, and capable of rendering eſſential ſervice to the ſtate; at all public examinations of the pupils, the heads of all the public departments are invited to be preſent, in order to witneſs the progreſs of the pupils, and to mark thoſe who diſcover talents peculiarly uſeful in any particular department or public employment.

How far the influence of this eſtabliſhment may extend, time muſt diſcover. It has exiſted only ſix years; but even in that ſhort period, we have had ſeveral inſtances of very uncommon talents having been called forth into public view, from the moſt obſcure ſituations. I only wiſh that the inſtitution may be allowed to ſubſiſt.

An Account of the Means uſed to improve the BREED *of* HORSES, *and* HORNED CATTLE, *in* BAVARIA *and the* PALATINATE.

THOUGH many parts of the Elector's dominions are well adapted for the breeding of fine horſes, and great numbers of horſes are actually bred *; yet no great attention had for many years been paid to the improvement of the breed; and moſt of the horſes of diſtinction, ſuch as were uſed by the nobility as ſaddle-horſes and coach-horſes, were imported from Holſtein and Mecklenburg.

Being engaged in the arrangement of a new military ſyſtem for the country, it occurred to me that, in providing horſes for the uſe of the army, and particularly for the train of artillery, ſuch meaſures might be adopted as would tend much to improve the breed of horſes throughout the country; and my propoſals meeting with the approbation of his Moſt Serene Electoral Highneſs, the plan was carried into execution in the following manner:

A number of fine mares were purchaſed with money taken from the military cheſt, and being marked with an M (the initial of *Militaria*), in a

* The number of horſes in Bavaria alone amount to above 160,000.

circle, upon the left hip, with a hot iron, they were given to ſuch of the peaſants, owning or leaſing farms proper for breeding good horſes, as applied for them. The conditions upon which theſe brood mares were given away were as follows:

They were, in the firſt place, given away *gratis*, and the perſon who received one of theſe mares is allowed to conſider her as his own property, and uſe her in any kind of work he thinks proper; he is, however, obliged not only to keep her, and not to ſell her, or give her away, but he is alſo under obligations to keep her as a *brood mare*, and to have her regularly covered every ſeaſon, by a ſtallion pointed out to him by the commiſſioners, who are put at the head of this eſtabliſhment. If ſhe dies, he muſt replace her with another *brood mare*, which muſt be approved by the commiſſioners, and then marked.—If one of theſe mares ſhould be found not to bring good colts, or to have any blemiſh, or eſſential fault or imperfection, ſhe may be changed for another.

The ſtallions which are provided for theſe mares, and which are under the care of the commiſſioners, are provided *gratis*; and the foals are the ſole property of thoſe who keep the mares, and they may ſell them, or diſpoſe of them, when and where, and in any way they may think proper, in the ſame manner as they diſpoſe of any other foal, brought by any other mare.

In caſe the army ſhould be obliged to take the field, *and in no other caſe whatever*, thoſe who are in poſſeſſion of theſe mares are obliged either

to

to return them, or to furniſh, for the uſe of the army, another horſe fit for the ſervice of the artillery.

The advantages of this arrangement to the army are obvious. In caſe of an emergency, horſes are always at hand, and theſe horſes being bought in time of peace, coſt much leſs than it would be neceſſary to pay for them, were they to be purchaſed in a hurry upon the breaking out of a war, upon which occaſions they are always dear, and ſometimes not to be had for money.

It may, perhaps, be objected, that the money being laid out ſo long before the horſes are wanted, the loſs of the intereſt of the purchaſe-money ought to be taken into the account; but as large ſums of money muſt always be kept in readineſs in the military cheſt, to enable the army to take the field ſuddenly, in caſe it ſhould be neceſſary; and as a part of this money muſt be employed in the purchaſe of horſes; it may as well be laid out beforehand, as to lie dead in the military cheſt till the horſes are actually wanted; conſequently the objection is not founded.

I wiſh I could ſay, that this meaſure had been completely ſucceſsful; but I am obliged to own, that it has not anſwered my expectations. Six hundred mares only were at firſt ordered to be purchaſed and diſtributed; but I had hopes of ſeeing that number augmented ſoon to as many thouſands; and I had even flattered myſelf with an idea of the poſſibility of placing in this manner among the peaſants, and conſequently having conſtantly

in readineſs, without any expence, a ſufficient number of horſes for the whole army; for the cavalry as well as for the artillery and baggage; and I had formed a plan for collecting together and exerciſing, every year, ſuch of theſe horſes as were deſtined for the ſervice of the cavalry, and for permitting their riders to go on furlough with their horſes: in ſhort, my views went to the forming of an arrangement, very economical, and in many reſpects ſimilar to that of the ancient feudal military ſyſtem; but the obſtinacy of the peaſantry prevented theſe meaſures being carried into execution. Very few of them could be prevailed upon to accept of theſe horſes; and in proportion as the terms upon which they were offered to them were apparently advantageous, their ſuſpicions were increaſed, and they never would be perſuaded that there was not ſome trick at the bottom of the ſcheme to over-reach them.

It is poſſible that their ſuſpicions were not a little increaſed by the malicious inſinuations of perſons, who, from motives too obvious to require any explanation, took great pains at that time to render abortive every public undertaking in which I was engaged. But be that as it may, the fact is, I could never find means to remove theſe ſuſpicions entirely, and I met with ſo much difficulty in carrying the meaſure into execution, that I was induced at laſt to abandon it, or rather to poſtpone its execution to a more favourable moment. Some few mares (two or three hundred) were placed in different parts of the country; and ſome very fine colts

colts have been produced from them, during the ſix years that have elapſed ſince this inſtitution was formed; but theſe ſlow advances do not ſatisfy the ardour of my zeal for improvement; and if means are not found to accelerate them, Bavaria, with all her natural advantages for breeding fine horſes, muſt be obliged, for many years to come, to continue to import horſes from foreign countries.

My attempts to improve the breed of horned cattle, though infinitely more confined, have been proportionally much more ſucceſsful. Upon forming the public garden at Munich, as the extent of the grounds is very conſiderable, the garden being above ſix Engliſh miles in circumference, and the ſoil being remarkably good, I had an opportunity of making, within the garden, a very fine and a very valuable farm; and this farm being ſtocked with about thirty of the fineſt cows that could be procured from Switzerland, Flanders, Tyrol, and other places upon the Continent famous for a good breed of horned cattle; and this ſtock being refreſhed annually with new importations of cows as well as bulls, all the cows which are produced, are diſtributed in the country, being ſold to any perſon of the country who applies for them, *and with promiſe to rear them*, at the ſame low prices at which the moſt ordinary calves of the common breed of the country are ſold to the butchers.

Though this eſtabliſhment has exiſted only about ſix years, it is quite ſurpriſing what a change it has produced in the country. As there is a great reſort

reſort to Munich from all parts of the country, it being the capital, and the reſidence of the Sovereign, the new Engliſh garden (as it is called), which begins upon the ramparts of the town, and extends near two Engliſh miles in length, and is always kept open, is much frequented, and there are few who go into the garden without paying a viſit to the cows, which are always at home. Their ſtables, which are concealed in a thick wood behind a public coffee-houſe or tavern in the middle of the garden, are elegantly fitted up and kept with great care; and the cows, which are not only large, and remarkably beautiful, but are always kept perfectly clean, and in the higheſt condition, are an object of public curioſity. Thoſe who are not particularly intereſted in the improvement of cattle, go to ſee them as beautiful and extraordinary animals; but farmers and connoiſſeurs go to *examine* them, —to compare them with each other,—and with the common breed of the country, and to get information with reſpect to the manner of feeding them, and the profits derived from them; and ſo rapidly has the flame of improvement ſpread throughout every part of Bavaria from this ſmall ſpark, that I have no doubt but in a very few years the breed of horned cattle will be quite changed.

Not ſatisfied with the ſcanty ſupply furniſhed from the farm in the Engliſh garden, ſeveral of the nobility, and ſome of the moſt wealthy and enterprifing of the farmers, are ſending to Switzerland, and other diſtant countries famous for fine cattle, for

for cows and bulls; and the good effects of theſe exertions are already viſible in many parts of the country.

How very eaſy would it be by ſimilar means to introduce a ſpirit of improvement in any country! and where ſovereigns do not make public gardens to bring together a concourſe of people, individuals might do it by private ſubſcription, or at leaſt they might unite together and rent a large farm in the neighbourhood of the capital, for the purpoſe of making uſeful experiments. If ſuch a farm were well managed, the produce of it would be more than ſufficient to pay all the expences attending it; and if the grounds and fields were laid out with taſte—if good roads for carriages and for thoſe who ride on horſeback were made round it, and between all the fields—if the ſtables were elegantly fitted up—filled with beautiful cattle, kept perfectly clean and neat; and if a handſome inn were erected near the buildings of the farm, where thoſe who viſited it might be furniſhed with refreſhment, it would ſoon become a place of public reſort; and improvements in agriculture would become *a faſhionable amuſement*; the ladies even would take pleaſure in viewing from their carriages the buſy and moſt intereſting ſcenes of rural induſtry, and it would no longer be thought vulgar to underſtand the myſteries of Ceres.

Why ſhould not Parliament purchaſe, or rent ſuch a farm in the neighbourhood of London, and put it under the direction of the Board of Agriculture? The expence would be but a mere trifle, if any thing, and the inſtitution would not only be uſeful, but

but extremely intereſting; and it would be an inexhauſtible ſource of rational and innocent amuſement, as well as of improvement, to vaſt numbers of the moſt reſpectable inhabitants of this great metropolis.

In former times, ſtateſmen conſidered the amuſement of the public as an object of conſiderable importance, and pains were taken to render the public amuſements uſeful in forming the national character.

An Account of the Meaſures adopted for putting an End to USURY *at* MUNICH.

ANOTHER meaſure, more limited in its operations than thoſe before mentioned, but which notwithſtanding was productive of much good, was adopted, in which a part of the treaſure which was lying dead in the military cheſt was uſefully employed for the relief of a conſiderable number of individuals, employed in ſubordinate ſtations under the government, who ſtood in great need of aſſiſtance.

A practice productive of much harm to the public ſervice, as well as to individuals, had prevailed for many years in Bavaria in almoſt all the public departments of the ſtate, that of appointing a great number of ſupernumerary clerks, ſecretaries, counſellors, &c. who, ſerving without pay, or with only ſmall allowances, were obliged, in order to ſubſiſt till ſuch time as they ſhould come into the receipt of the regulated ſalaries annexed to their offices, to contract debts to a conſiderable amount; and as many of them had no other ſecurity to give for the ſums borrowed, than their promiſe to repay them when it ſhould be in their power, no money-lender who contented himſelf with legal intereſt for his money would truſt them; and of courſe they were obliged

to

to have recourſe to Jews and other uſurers, who did not afford them the temporary aſſiſtance they required, but upon the moſt exorbitant and ruinous conditions; ſo that theſe unfortunate people, inſtead of finding themſelves at their eaſe upon coming into poſſeſſion of the emoluments of their offices, were frequently ſo embarraſſed in their circumſtances as to be obliged to mortgage their ſalaries for many months to come, to raiſe money to ſatisfy their clamorous creditors; and from this circumſtance, and from the general prevalence of luxury and diſſipation among all ranks of ſociety, the anticipation of ſalaries had become ſo prevalent, and the conditions upon which money was advanced upon ſuch ſecurity was ſo exorbitant, that this alarming evil called for the moſt ſerious attention of the government.

The intereſt commonly paid for money, advanced upon receipts for ſalaries, was 5 *per cent. per month*, or three creutzers, for the florin; and there were inſtances of even much larger intereſt being given.

The ſevereſt laws had been made to prevent theſe abuſes, but means were conſtantly found to evade them; and, inſtead of putting an end to the evil, they frequently ſerved rather to increaſe it.

It occurred to me, that as any tradeſman may be ruined by another who can afford to underſell him, ſo it might be poſſible to ruin the uſurers, by ſetting up the baſeneſs in oppoſition to them, and furniſhing money to borrowers upon more reaſonable terms. In order to make this experiment, a *caiſe of advance* (Vorſchuſs Caſſa), containing 30,000 florins, was

was eſtabliſhed at the military pay-office, where any perſon in the actual receipt of a ſalary or penſion under government, in any department of the ſtate, civil or military, might receive in advance, upon his perſonal application, his ſalary or penſion for one or for two months upon a deduction of intereſt at the rate of 5 *per cent. per annum*, or one twelfth part of the intereſt commonly extorted by the Jews and other uſurers upon thoſe occaſions.

The great number of perſons who have availed themſelves of the advantages held out to them by this eſtabliſhment, and who ſtill continue to avail themſelves of them, ſhows how effectual the eſtabliſhment has been to remedy the evil it was deſigned to eradicate.

The number of perſons who apply to this cheſt for aſſiſtance each month, is at a medium from 300 to 400, and the ſums actually in advance, amount in general to above 20,000 florins.

As no money is advanced from this cheſt but upon government ſecurities, that is to ſay, upon receipts for ſalaries, and penſions, there is no riſque attending the operation; and as the intereſt ariſing from the money advanced, is more than ſufficient to defray the expence of carrying on the buſineſs, there is no loſs whatever attending it.

An Account of a SCHEME *for employing the* SOLDIERY *in* BAVARIA *in repairing the Highways and Public Roads.*

I HAD formed a plan, which, if it had been executed, would have rendered the military poſts or patroles of cavalry eſtabliſhed in all parts of the Elector's dominions much more intereſting, and more uſeful *. I wiſhed to have employed the ſoldiery excluſively in the repairs of all the highways in the country, and to have united this undertaking with the eſtabliſhment of permanent military ſtations, on all the high roads, for the preſervation of order and public tranquillity.

It is a great hardſhip upon the inhabitants in any country to be obliged to leave their own domeſtic affairs, and turn out with their cattle and ſervants, when called upon, to work upon the public roads; but this was peculiarly grievous in Bavaria, where labourers are ſo ſcarce that the farmers are frequently obliged to leave a great part of their grounds uncultivated for want of hands.

My plan was to meaſure all the public roads from the capital cities in the Elector's dominions to the frontiers, and all croſs country roads; placing mile-ſtones regularly numbered upon each road, at

* A particular account of theſe military poſts is given in the Second Chapter of the Firſt Eſſay.

regular

regular diſtances of one hour, or half a German mile from each other;—to divide each road into as many ſtations as it contained mile-ſtones; each ſtation extending from one mile-ſtone to another; and to erect in the middle of each ſtation, by the road-ſide, a ſmall houſe, with ſtabling for three or four horſes, and with a ſmall garden adjoining to it;—to place in each of theſe houſes, a ſmall detachment of cavalry of three or four men,—a ſoldier on furlough, employed to take care of the road and keep it in repair within the limits of the ſtation;—an invalid ſoldier to take care of the houſe, and to receive orders and meſſages in the abſence of the others,—to take care of the garden, to provide proviſions, and cook for the family.

If any of the ſoldiers ſhould happen to be married, his wife might have been allowed to lodge in the houſe, upon condition of her aſſiſting the invalid ſoldier in this ſervice; or a penſioned ſoldier's widow might have been employed for the ſame purpoſe.

To preſerve order and diſcipline in theſe eſtabliſhments, it was propoſed to employ active and intelligent non commiſſioned officers as overſeers of the highways, and to place theſe under the orders of ſuperior officers appointed to preſide over more extenſive diſtricts.

It was propoſed likewiſe to plant rows of uſeful trees by the road-ſide from one ſtation to another throughout the whole country, and it was calculated that after a certain number of years the produce of thoſe trees would have been nearly ſufficient to defray all the expences of repairing the roads.

Such an arrangement, with the ſtriking appearance of order and regularity that would accompany it, could not have failed to intereſt every perſon of feeling who ſaw it; and I am perſuaded that ſuch a ſcheme might be carried into execution with great advantage in moſt countries where ſtanding armies are kept up in time of peace. The reaſons why this plan was not executed in Bavaria at the time it was propoſed are too long, and too foreign to my preſent purpoſe to be here related. Perhaps a time may come when they will ceaſe to exiſt.

APPENDIX.

APPENDIX.

N° I.

ADDRESS *and* PETITION *to all the Inhabitants and Citizens of* MUNICH, *in the Name of the real Poor and Diſtreſſed.*

(Tranſlated from the German.)

TOO long have the public honour and ſafety, morality and religion, called aloud for the extirpation of an evil, which, though habit has rendered it familiar to us, always appears in all its horrid and diſguſting ſhapes; and whoſe dangerous effects ſhow themſelves every where, and are increaſing every day.

Too long already have the virtuous citizens of this metropolis ſeen with concern the growing numbers of the Beggars, their impudence, and their open and ſhameleſs debaucheries; yet idleneſs and mendicity (thoſe peſts of ſociety) have been ſo feebly counteracted, that, inſtead of being checked and ſuppreſſed, they have triumphed over thoſe weak attempts to reſtrain them, and acquiring freſh vigour and activity from ſucceſs, have ſpread their baleful influence far and wide.

What well-affected citizen can be indifferent to the ſhame that devolves upon himſelf and upon his country, when whole ſwarms of diſſolute rabble, covered with filthy rags, parade the ſtreets, and by tales of real or of fictitious diſtreſs—by clamorous importunity, inſolence, and rudeneſs, extort involuntary contributions from every traveller? When no retreat is to be found, no retirement where poverty, miſery, and impudent hypocriſy, in all their diſguſting and hideous forms, do not continually intrude; when no one is permitted to enjoy a peaceful moment, free from their importunity, either in the churches or in public places, at the tombs of the dead, or at the places of amuſement? What avail the marks of affluence and proſperity which appear in the dreſs and equipage of individuals, in the elegance of their dwellings, and in the magnificence and ſplendid ornaments of our churches, while the voice of woe is heard in every corner, proceeding from the lips of hoary age worn out with labour; from ſtrong and healthy men capable of labour; from young infants and their ſhameleſs and abandoned parents? What reputable citizen would not bluſh, if among the inmates of his houſe ſhould be found a miſerable wretch, who by tales of real or fictitious diſtreſs ſhould attempt to extort charitable donations from his friends and viſitors? What opinion would he expect would be formed of his underſtanding—of his heart—of his circumſtances? What then muſt the foreigner and traveller think, who, after having ſeen no veſtige of Beggary in the neighbouring countries,

countries, ſhould, upon his arrival at Munich, find himſelf ſuddenly ſurrounded by a ſwarm of groaning winching wretches, beſieging and following his carriage?

The public honour calls aloud to have a ſtop put to this diſgraceful evil.

The public ſafety alſo demands it. The dreadful conſequences are obvious, which muſt enſue when great numbers of healthy individuals, and whole families, live in idleneſs, without any ſettled abode, concluding every day with ſchemes for defrauding the public of their ſubſiſtence for the next: where the children belonging to this numerous ſociety are made uſe of to impoſe on the credulity of the benevolent, and where they are regularly trained, from their earlieſt infancy, in all thoſe infamous practices, which are carried on ſyſtematically, and to ſuch an alarming extent among us.

Great numbers of theſe children grow up to die under the hands of the executioner. The only inſtruction they receive from their parents is how to cheat and deceive; and daily practice in lying and ſtealing from their very infancy, renders them uncommonly expert in their infamous trade. The records of the courts of juſtice ſhow in innumerable inſtances, that early habits of Idleneſs and Beggary are a preparation for the gallows; and among the numerous thefts that are daily committed in this capital, there are very few that are not committed by perſons who get into the houſes under the pretext of aſking for charity.

What

What perſon is ignorant of theſe facts? and who can demand further proofs of the neceſſity of a ſolid and durable inſtitution, for the relief and ſupport of the Poor?

The reader would be ſeized with horror, were we to unveil all the ſecret abominations of theſe abandoned wretches. They laugh alike at the laws of God and of man. No crime is too horrible and ſhocking for them, nothing in heaven or on the earth too holy not to be profaned by them without ſcruple, and employed with conſummate hypocriſy to their wicked purpoſes *.

Whence is it that this evil proceeds? Not from the inability of this great capital to provide for its Poor; for no city in the world, of equal extent and population, has ſo many hoſpitals for the ſick and infirm, and other inſtitutions of public charity. Neither is it owing to the hard-heartedneſs of the inhabitants; for a more feeling and charitable people cannot be found. Even the uncommonly great and increaſing numbers of the Beggars ſhow the kindneſs and liberality of the inhabitants; for theſe vagabonds naturally collect together in the greateſt

* Suffice it to mention one among numberleſs facts, which might be brought to prove theſe aſſertions:

The Beggars of our capital carry on an increaſing and very lucrative trade, with confeſſional and communion teſtimonials, which they ſell to people who daringly tranſgreſs the holy eccleſiaſtical laws, by neglecting to confeſs and receive the holy ſacrament of the Lord's Supper at Eaſter. Some of theſe impious wretches receive the ſacrament, at leaſt twice in a day, in order not to loſe their cuſtomers; if the demands for communion teſtimonials are great, or come late.——Ye prieſts and preachers of the goſpel, can you ſtill forbear raiſing your voices againſt Beggars?

numbers,

numbers, where their trade can be carried on to the greateſt advantage.

The injudicious diſpenſation of alms is the real and only ſource of this evil.

In every community there are certainly to be found a greater or leſs number of poor and diſtreſſed perſons, who have juſt claims on the public charity. This is alſo the caſe at Munich; and nature dictates to us the duty of adminiſtering relief to ſuffering humanity, and more eſpecially to our poor and diſtreſſed fellow-citizens; and our Holy Religion promiſes eternal rewards to him who ſupports and relieves the poor and needy, and threatens everlaſting damnation to him who ſends them away without relief.

The Holy Fathers teach, that when there are no other means left for the relief and ſupport of the Poor, the ſuperfluous ornaments of the churches may be diſpoſed of, and even the ſacred veſſels melted down and ſold for that purpoſe.

But what ſhall we think, when we ſee thoſe very perſons, who profeſs to live after the rules and precepts laid down in the word of God, act diametrically contrary to them?

Such, doubtleſs, is the fatal conduct of thoſe who are induced by a miſtaken compaſſion to laviſh their alms upon Beggars, and obſtruct the relief of the really indigent.—Alms that fruſtrate a good and uſeful inſtitution cannot be meritorious, or acceptable to God: and no maxim is leſs founded in truth, than that the merit of the giver is undiminiſhed by the unworthineſs of the object.—

The

The truly diſtreſſed are too baſhful to mix with the herd of common Beggars; neceſſity, it is true, will ſometimes conquer their timidity, and compel them publicly to ſolicit charity; but their modeſt appeal is unheard or unnoticed, whilſt a diſſolute vagabond, who exhibits an hypocritical picture of diſtreſs,—a drunken wretch, who pretends to have a numerous family and to be perſecuted by misfortune,—or an impudent unfeeling woman, who excites pity by the tears and cries of a poor child whom ſhe has hired perhaps for the purpoſe, and tortured into ſuffering, ſteps daringly forward to intercept the alms of the charitable; and the well-intentioned gift which ſhould relieve the indigent is the prize of impudence and impoſition, and the ſupport of vice and idleneſs. —What then is left for the modeſt object of real diſtreſs, but to retire diſpirited and hide himſelf in the obſcurity of his cottage, there to languiſh in miſery, whilſt the bolder Beggar conſumes the ill-beſtowed gift in mirth and riot? And, yet, the charitable donor flatters himſelf that he has performed an exemplary duty!

We earneſtly entreat every citizen and inhabitant of this capital, each in his reſpective ſtation, no longer to countenance mendicity by ſuch a miſapplication of their well-meant charity; contributing thus to augment the fatal conſequences of the evil itſelf, as well as to impede the relief of the real neceſſitous.

We are firmly perſuaded, that by pointing out to our fellow-citizens a method by which they may exerciſe their benevolence towards the indigent and diſ-

treſſed in a meritorious manner, we ſhall gratify their pious zeal and humanity, and at the ſame time eſſentially promote the honour and ſafety of the ſtate, and the intereſts of ſound morality and religion.

And this is the ſole object of the *Military Workhouſe*, which has been inſtituted by the command of his Electoral Highneſs, where, from this time forward, all who are able to work may find employment and wages, and will be cloathed and fed.—*There* will the really indigent find a ſecure aſylum, and thoſe unfortunate perſons who are a prey to ſickneſs and infirmity, or are worn out with age, will be effectually relieved.—

We beg you not to liſten to the falſe repreſentations which may, perhaps, be made to calumniate this inſtitution, by putting it on a level with former imperfect eſtabliſhments.—Why ſhould not an inſtitution proſper at Munich, which has already been ſucceſsful in other places, particularly at Manheim, where above 800 perſons are daily employed in the Military Workhouſe, and heap benedictions on its benevolent founder?—Have the inhabitants of this town leſs good ſenſe, leſs humanity, or leſs zeal for the good of mankind? No—it would be an inſult on the patriotiſm of our fellow-citizens, were we to doubt of their readineſs to concur in our undertaking.

The only efficacious way of promoting an inſtitution ſo intimately connected with the ſafety, honor, and welfare of the ſtate, and with the intereſts of religion and morality, is a general reſolution of the inhabitants to eſtabliſh a voluntary monthly contribution,

tribution, and ſtrictly prohibit the abominable and degrading practice of ſtreet-begging; the unlimited exerciſe of which, notwithſtanding its fatal and diſgraceful conſequences, is perhaps more glaringly indulged in Munich than in any other city in Germany.

In vain will the inſtitution be oppoſed by the prejudices, or the meanneſs and malice of perſons who are themſelves uſed to mendicity, or to exerciſe an inſolent dominion over Beggars.

It will ſubſiſt in ſpite of all their efforts; and we have the fulleſt confidence that the generous and well-diſpoſed inhabitants of this city will be ſenſible how injurious the habits of encouraging public mendicity are, when an opportunity is offered them of contributing to an inſtitution where the really indigent are ſure to find aſſiſtance, and where the benevolent Chriſtian is certain that his neighbours and fellow-citizens are benefited by his charitable donations.

The ſimpleſt and moſt effectual way of aſcertaining the extent of ſuch contribution is to form a liſt of all the citizens and inhabitants of the town, with the name of the ſtreet, and number of the houſe they inhabit. This regiſter may be called an Alms Book. It will be preſented to each inhabitant, that he may put down the ſum which he means voluntarily to ſubſcribe every month towards the ſupport of the Poor. The ſmalleſt donation will be gratefully received, and the objects who are relieved by them will pray for them to the Almighty Rewarder of all good actions.

As

As this charitable contribution is to be abſolutely voluntary, every one, whatever be his rank or property, will ſubſcribe as he pleaſes, a greater or a leſs ſum, or none at all. The names of the benefactors and their donations will be printed and publiſhed quarterly, that every one may know and acknowledge the zealous friends of humanity, by whoſe aſſiſtance an evil of ſuch magnitude, ſo long and ſo univerſally complained of, will be finally rooted out.

We requeſt that the public will not oppoſe ſo ſure and effectual a mode of granting relief to the Poor, but rather give their generous ſupport to an undertaking, which cannot but be productive of much good, and acceptable in the ſight of Heaven.

To convince every one of the faithful application of theſe contributions, an exact detail both of the receipt and expenditure of the inſtitution will be printed and laid before the public every three months; and every ſubſcriber will be allowed to inſpect and examine the original accounts whenever he ſhall think proper.

It muſt be obvious to every one, even to perſons of the moſt ſuſpicious diſpoſitions, that this inſtitution is perfectly diſintereſted, and owes its origin entirely to pure benevolence, and an active zeal for the public good, when it is known that a Committee appointed by his Electoral Highneſs, under the direction of the Preſidents of the Council of War, the Supreme Regency, and the Eccleſiaſtical Council, will have the ſole adminiſtration and direction of the affairs of the inſtitution, and that the

the monthly collections of alms will be made by creditable perſons properly authoriſed; and that no ſalary, or emoluments of any kind, will be levied on the funds of the inſtitution, either for ſalaries for the collectors, or any other perſons employed in the ſervice of the inſtitution, as will clearly appear by the printed quarterly accounts. By ſuch precautions, we truſt, we ſhall obviate all poſſible ſuſpicions, and inſpire every unprejudiced perſon with a firm confidence in this uſeful inſtitution.

Henceforward, then, the infamous practice of begging in the ſtreets will be no longer tolerated in Munich, and the public are from this moment exonerated from a burden which is not leſs troubleſome to individuals than it is diſgraceful to the country. Who can doubt the co-operation of every individual for the accompliſhment of ſo laudable an undertaking? We truſt that no one will encourage idleneſs, by an injudicious and pernicious profuſion of alms given to Beggars; and by promoting the moſt unbridled licentiouſneſs, make himſelf a participator in the dangerous conſequences of mendicity, and ſhare the guilt of all thoſe crimes and offences which endanger the welfare of the ſtate, injure the cauſe of religion, and inſult the diſtreſſes of the really indigent.

No longer will theſe vagabonds impoſe on good-nature and benevolence, by falſe pretences, by ill-founded complaints of the inefficacy of the proviſion for the Poor, or by any other artifices; nor can they eſcape the ſtrict and conſtant vigilance with which

which they will in future be watched; when every perſon they meet will direct them to the Houſe of Induſtry, inſtead of giving them money.

It is this regulation alone which can effectuate our purpoſe, a regulation enforced in the days of primitive Chriſtianity, and ſanctioned by Religion itſelf; the charitable gifts of the wealthier Chriſtians being in thoſe days all depoſited in a common treaſury, for the benefit of their poorer and diſtreſſed Brethren, and not ſquandered away in the encouragement of diſſolute idleneſs.

We therefore entreat and beſeech the public in general, in the name of ſuffering humanity, and of that Almighty Being who cannot but regard ſo laudable an enterpriſe with an eye of favour, to give every poſſible ſupport to our deſign. And we truſt that the clergy of every denomination, but eſpecially the public preachers, will exert their ſplendid abilities to animate their congregations to cooperate with us in this great and important undertaking.

N° II.

SUBSCRIPTION LISTS *diſtributed among the Inhabitants of* MUNICH, *in the Month of* JANUARY 1790, *when the Eſtabliſhment for the Relief of the Poor in that City was formed.*

Tranſlated from the Original German.

VOLUNTARY SUBSCRIPTIONS

FOR

The RELIEF and SUPPORT of
The Induſtrious, Sick, and Helpleſs POOR,

AND

For the total Extirpation of VAGRANTS
and STREET-BEGGARS,

In the CITY of MUNICH.

REMARKS.

THESE voluntary ſubſcriptions will be collected monthly, namely, on the laſt Sunday morning of every month, under the direction of the Committee of Governors of the Inſtitution for the Poor; conſiſting of the Preſident of the Council of War,—the Preſident of the Council of the Regency,

gency,—and the Preſident of the Eccleſiaſtical Council *; and the amount of theſe collections will always be regularly noted down in books kept for that purpoſe; and at the end of every three months a particular detailed account of the application of theſe ſums will be printed, and given *gratis* to the ſubſcribers and to the public.

No part of theſe voluntary contributions will ever be taken, or appropriated to the payment of ſalaries, gratuities, or rewards to any of thoſe perſons who may be employed in carrying on the buſineſs of the inſtitution; but the whole amount of the ſums collected will be faithfully applied to the relief and ſupport of the Poor, and to that charitable purpoſe alone, as the accounts of the expenditures of the inſtitution, which will be publiſhed from time to time, will clearly ſhow and demonſtrate.—All the perſons neceſſary to be employed in the affairs of this eſtabliſhment, will either be ſelected from among ſuch as already are in the receipt of ſalaries, ſufficient for their comfortable maintenance from other funds; or they will be ſuch perſons, in eaſy circumſtances, as may offer themſelves voluntarily for theſe ſervices, from motives of humanity, and a diſintereſted wiſh to be inſtrumental in doing good.

As the preparations which have been made, and are making for the ſupport of the Poor, leave no doubt, but that adequate relief will be afforded to them in future, they will no longer have any pretext for begging; and all perſons are moſt earneſtly requeſted to abſtain henceforward from giving

* To theſe the Preſident of the Chamber of Finances has ſince been added.

alms to Beggars. Inſtead of giving money to ſuch perſons as they may find begging in the ſtreet, they are requeſted to direct them to the Houſe of Induſtry, where they will, without fail, receive ſuch aſſiſtance and ſupport as they may ſtand in need of and deſerve.

Thoſe perſons whoſe names are already inſerted in other liſts, as ſubſcribers to this inſtitution, are, nevertheleſs, requeſted to enter their names upon theſe family-ſheets; for though their names may ſtand on ſeveral liſts, their contributions will be called for upon one of them only, and that one will be the family-ſheet.

Thoſe perſons of either ſex, who have no families, but occupy houſes or lodgings of their own, are, notwithſtanding their being without families, requeſted to put down the amount of the monthly contributions they are willing to give to this inſtitution upon a family-ſheet, and to inſert their names in the liſt as "*head of the family.*"

Under the column deſtined for the names of "*relations and friends, living in the houſe,*" may be included ſtrangers, lodgers, boarders, &c.

The column for "*domeſtics,*" may, in like manner, ſerve, particularly in the houſes of the nobility, and other diſtinguiſhed perſons, for ſtewards, tutors, governeſſes, &c.

Each head of a family will receive two of theſe family-ſheets, namely, one with theſe Remarks, which he will keep for his information,—the other, printed on a half-ſheet of paper, and without remarks, which he will pleaſe to return to the public office of the inſtitution.

In

In caſe of a change in the family, or if one or other of the members of it ſhould think proper to increaſe or to leſſen their contributions, this alteration is to be marked upon the half-ſheet, which is kept by the head of the family; and this ſheet ſo altered is to be ſent to the public office of the inſtitution, to the end that theſe alterations may be made in the general liſts of the ſubſcribers; or new printed forms being procured from the public office, and filled up, theſe new liſts may be exchanged againſt the old ones.

For the accommodation of thoſe who may at any time wiſh to contribute privately to the ſupport of the inſtitution any ſums in addition to their ordinary monthly donations, the banker of the inſtitution, Mr. Dallarmi, will receive ſuch ſums deſtined for that purpoſe, as may be ſent to him privately under any feigned name, motto, or device; and for the ſecurity of the donors, accounts of all the ſums ſo received, with an account of the feigned name, motto, or device, under which each of them was ſent to the banker, will be regularly publiſhed in the Munich Gazette.

The firſt collection will be made on the laſt Sunday of the preſent month, and the following collections on the laſt Monday of every ſucceeding month; and each head of a family is reſpectfully requeſted to cauſe the contributions of his family, and of the inhabitants of his houſe, to be collected at the end of every month, by a domeſtic or a ſervant, and to keep the ſame in readineſs againſt the time of the collection.

All perſons of both ſexes, and of every age and condition, (Paupers only excepted,) are earneſtly requeſted to have their names inſerted in theſe liſts or family-ſheets; and they may reſt aſſured, that any ſum, even the moſt trifling, will be received with thankfulneſs, and applied with care to the great object of the inſtitution—the relief and encouragement of the Poor and the Diſtreſſed.

And finally, as it cannot fail to contribute very much to improve the human heart, if young perſons at an early period of life are accuſtomed to acts of benevolence,—it is recommended to parents, to cauſe all their children to put down their names as ſubſcribers to this undertaking, and this, even though the donations they may be able to ſpare may be the moſt trifling, or even if the parents ſhould be obliged to leſſen their own contributions in order to enable their children to become ſubſcribers.

☞ *The foregoing Remarks were printed on the two firſt pages of a ſheet,* 13 *inches by* 18 *inches, of ſtrong writing-paper. The following Subſcription Liſt was printed on the third page of the ſame ſheet —and alſo on a ſeparate half-ſheet of the ſame kind of paper.*

VOLUNTARY CONTRIBUTIONS for the SUPPORT of the POOR at MUNICH.

FAMILY-SHEET.

Number of the Houſe District Street Floor.
Head of the Family } Monthly Contributions.
His Character, or } Florins. Creutzers.

Other Perſons belonging to the Family.

Wife, Children, Relations, and Friends of both Sexes living with the family. The Chriſtian Name and Surname of each Perſon	Monthly Contributions. Fl	Kr.	Domeſtic, Journymen, Menial Servants, &c. of both Sexes, the Chriſtian and Surname of each Individual	Monthly Contributions Fl	Kr
			(At the lower corner of this half-ſheet was printed in ſmall type): "*This half ſheet is to be ſent into the Public Office of the Inſtitution.*"		

N° III.

An Account of the RECEIPTS *and* EXPENDITURES *of the* INSTITUTION *for the* POOR *at* MUNICH *during Five Years.*

RECEIPTS.

N. B. The pound sterling is equal to 11 florins.	In 1790.	In 1791.	In 1792.	In 1793.	In 1794.	Total in 5 Years.
	Florins.	Florins.	Florins.	Florins.	Florins.	Florins.
From monthly voluntary donations of the inhabitants, including 100 florins given monthly by his Moſt Serene Highneſs the Elector out of his private purſe; 50 florins monthly by the Electreſs Dowager of Bavaria, and 50 florins monthly by the States of Bavaria. — — — —	36,640	38,024	35,847	34,424	33,880	178,815
From the Public Treaſury a ſtated monthly allowance, intended principally to defray the expence of the police of the city, — — — — —	15,400	15,400	16,800	16,800	16,800	81,200
From voluntary donations, particularly deſtined by the donors to aſſiſt the Poor in paying their houſe-rent, —	970	1,043	800	800	802	4,415
Carried forward, — —	53,010	54,467	53,447	52,024	51,482	264,430

RECEIPTS continued.

	In 1790.	In 1791.	In 1792.	In 1793.	In 1794.	Total in 5 Years.
	Florins.	Florins.	Florins.	Florins.	Florins.	Florins.
Brought over — —	53,010	54,467	53,447	52,024	51,482	264,430
From voluntary and unfolicited donations from the foreign merchants and traders aſſembled at Munich at the two annual fairs, — — — — —	179	388	388	411	390	1,756
From the courts of juſtice, being fines for certain petty offences, — — — — —	——	168	392	229	234	1,023
From the magiſtrates of the city; being the amount of ſums received from muſicians for licence to play in the public houſes,	——	——	——	3,216	2,773	5,989
From the poor's boxes in the different churches, — —	318	177	187	610	229	1,521
From the poor's boxes at inns and taverns, — —	99	153	69	168	176	665
From private contributions ſent to the banker of the Inſtitution, under feigned names, devices, &c. — —	3,642	691	815	723	423	6,304
From legacies, — — — —	2,674	1,472	3,528	1,820	12,179	21,673
From intereſt of money due to the Inſtitution, — —	48	128	48	48	——	272
From caſh received in advance, — — —	3,300	4,600	1,500	——	——	9,400
From ſundries, — — — —	824	3,433	910	1,752	346	7,265
Total Annual Receipts, — —	64,094	65,677	61,294	61,001	70,232	320,298

EXPENDITURES.

N. B. The pound ſterling is equal to 11 florins.	In 1790.	In 1791.	In 1792.	In 1793.	In 1794.	Total in 5 Years.
	Florins.	Florins.	Florins.	Florins.	Florins.	Florins.
Given to the Poor in alms, in ready money — —	42,080	46,410	43,055	41,933	43,189	216,667
Expended in feeding the Poor at the Public Kitchen of the Military Workhouſe, and in premiums for the encouragement of induſtry, — — — — —	11,800	9,900	10,300	9,600	9,400	51,000
Given to the Poor to aſſiſt them in paying their houſe-rent, — — — — — —	1,071	1,040	800	861	805	4,517
Paid for medicines adminiſtered to the Poor at their own lodgings, — — — —	450	403	350	1,150	1,500	3,853
Expended in burials, — — —	217	254	272	336	290	1,369
Given with poor children when bound apprentices, —	256	183	219	210	226	1,094
Given as an indemnification for the loſs of the right formerly enjoyed of making collections of alms among the inhabitants:						
——— To perſons who have ſuffered by fires, —	890	564	418	425	594	2,891
——— To travelling journeymen tradeſmen, —	160	187	34	35	94	510
——— To the ſiſters of the religious order of charity,	960	960	960	960	960	4,800
——— To the nuns of the Engliſh convent, —	84	72	72	72	72	372
——— To the hoſpital for lepers on the Gaſteig, —	100	360	288	540	300	1,588
Carried forward, — —	58,008	59 333	56,768	56,122	57,430	288,661

EXPENDITURES continued.

	In 1790.	In 1791.	In 1792.	In 1793.	In 1794.	Total in 5 Years
	Florins.	Florins.	Florins.	Florins.	Florins.	Florins.
Brought over, — —	58,008	59,333	56,768	56,122	57,430	288,661
Given as an indemnification for the loſs of the right formerly enjoyed of making collections of alms among the inhabitants:						
——— To the hoſpital at Schwabing, — —	220	240	240	240	240	1,180
——— To the poor ſcholars of the German ſchool,	480	480	480	480	480	2,400
——— To the poor ſcholars of the Latin ſchool,	440	480	480	480	480	2,360
Paid to the clerks of office of police, — —	318	318	159	———	———	795
Paid to the accountant of the Inſtitution, — —	———	———	———	183	200	383
Paid to the guards of the police *,	1,672	1,824	912	———	———	4,408
Paid to writers employed occaſionally as clerks, —	369	199	189	250	361	1,368
Paid to printers and bookbinders — — —	506	333	150	227	301	1,517
Paid to the ſoldiers of the garriſon for arreſting Beggars,	22	6	———	———	———	28
Gratuities to the ſchoolmaſter at Charles's Gate, —	55	60	60	50	75	300
Paid various ſums due from the Inſtitution, — —	831	300	———	———	———	1,131
Paid intereſt of monies due, — — —	———	———	40	40	40	120
Money advanced for purchaſing grain, — —	———	———	———	———	1,200	1,200
Sundries, — — — —	172	234	261	645	433	1,745
Total Expenditures, — —	63,093	64,807	59,739	58,717	61,240	307,596

* Since the year 1792 the Elector, to relieve the Inſtitution from that burden, has ordered the police guards to be paid out of the Public Treaſury of the Chamber of Finances.

N° IV.

Certificate relative to the EXPENCE *of* FUEL *in the Public Kitchen of the Military Workhouſe at* MUNICH.

WE whoſe Names are underwritten certify, that we have been preſent frequently when experiments have been made to determine the expence of Fuel in cooking for the Poor in the Public Kitchen of the Military Workhouſe at Munich; and that when the ordinary dinner has been prepared for *one thouſand* perſons, the expence for Fuel has not amounted to quite twelve creutzers (leſs than 4½*d.* ſterling).

Baron DE THIBOUT, Colonel.

HEERDAN, Councillor of War.

MUNICH,
1ſt September 1795.

N° V.

Printed Form for the DESCRIPTIONS *of the* POOR.

Deſcription of the poor Perſon, N°

Name

Deſcribed MUNICH, *the th of* 179

AGE Years. Stature Feet Inches.
Bodily Structure Hair
Eye Complexion
Bodily Defects
Other particular Marks
State of Health
Place of Nativity
Lives here ſince
Came here from In what Manner
Profeſſion Religion
Quality Family
Supports himſelf, at preſent, by
Lives at preſent Quarter, Diſtrict, Street,
Houſe, N° Floor,
Can be conſidered as a Pauper belonging to this City, and ought therefore to be

Is

Is capable of doing the following Work:
Could be trained to the following Occupations:

	fl.	kr.
Could gain by this Work *per* Week - -		
Wants for his weekly Support - - -		
Receives at preſent *per* Week from his own Means, gets by way of Penſion, Alms, and - - - - - -		
Wants, therefore, a weekly Allowance of Alms of		

		fl.	kr.
Enjoyed heretofore *per* Week	Income of his own - -		
	Earned by working - -		
	Salary - - - - - - -		
	Penſion - - - - - -		
	Alms. From the Court		
	Alms. From the City -		
	Alms. From private Perſons		
	Got by begging - - -		
	Total		

	fl	kr.
Pays Houſerent - - - - -		
Has Bed of his own, the Value of which is about - - - - -		
Poſſeſſes other Utenſils neceſſary for Houſekeeping, worth about - .		
Is provided with the following working Tools:		

Can

Can work at Home
Could be employed in the Military Workhouſe
Is provided with Raiment, and wants
Articles of Apparel
Life and Conduct, according to the Information received
Is given to and
Is known to have committed Crimes
and has appeared before the Magiſtrates
How long he lives in his preſent Habitation
Year Month Weeks
Name and Reſidence of his preſent Landlord
Where he lived before, and how long

Other Remarks.

Has been ſettled here
Received a Licence to marry, from
Poſſeſſed or received, when married
Value about fl. kr.
Was reduced to Poverty by
Is poor and in want, ſince
Could not extricate himſelf from his Difficulties, becauſe

N. B. *This Form is printed on a Half-ſheet of ſtrong Writing Paper, folded together ſo as to make two Leaves in Quarto; each Leaf being* 8 *Inches high, and* 6½ *Inches wide.*

N° VI.

Printed Form for SPIN-TICKETS, *ſuch as are uſed at the Military Workhouſe at* MUNICH.

Munich Military Workhouſe,
179 the N°
received
lb. of
Delivered back ſkains knots
of weighing lb. oz.
Is entitled to receive *per* xrs.
TOTAL,
Atteſt. this 179

This printed Form is filled up as follows:

Munich Military Workhouſe,
1795, the *1ſt Sept.* N° 134.
Mary Smith received
1 lb. of *Flax*, *N°* 3,
Delivered back 2 ſkains 3 knots
of *Thread*, weighing 1 lb.—oz.
Is entitled to receive per *lb.* xrs. 10.
Total, *ten creutzers.*
Atteſt. this *4th Sept.* 1795.
WILL. WILDMANN.

An

An improved Form for a SPIN-TICKET, *with its* Abſtract; *which Abſtract is to be cut off from the Ticket, and faſtened to the Bundle of Yarn or Thread.*

SPIN-TICKET.	Abſtract of SPIN-TICKET.
Munich Houſe of Induſtry.	Munich Houſe of Induſtry,
1795 the 10*th Sept* N° 230.	1795, the 10*th Sept.* N° 230.
Mary Smith received	2 ſkains 4 knots
1 lb. of *wool*, *N°* 14.	of *woollen yarn*,
Delivered back 2 ſkains 4 knots	weighing 1 lb. — oz.
of *yarn*, weighing 1 lb. — oz.	Spinner, *Mary Smith.*
Wages per *lb.* for ſpinning 12 xrs.	Atteſt. J. Schmidt.
Is entitled to receive *twelve* xrs.	
Atteſt. this 14*th* of *Sept* 1795	
J. Schmidt.	

In order that the original entry of the Spin-Tickets in the general tables, kept by the clerks of the Spinners, may more readily be found, all the Tickets for the ſame material, (flax for inſtance,) iſſued by the ſame clerk, during the courſe of each month, muſt be regularly numbered.

N° VII.

An Account of EXPERIMENTS *made at the* BAKE-HOUSE *of the* MILITARY WORKHOUSE *at* MUNICH, November *the 4th and 5th*, 1794.

In baking RYE BREAD.

☞ *The oven, which is of an oval form, is* 12 *feet deep, meaſured from the mouth to the end;* 11 *feet* 10 *inches wide, and* 1 *foot* 11 *inches high, in the middle.*

NOVEMBER 4th, at 10 o'clock in the morning, 1736 lbs. * of rye meal were taken out of the ſtore room, and ſent to the bakehouſe, where it was worked and baked into bread, at ſix different times, in the following manner:—

FIRST BATCH.

At 45 minutes after 10 o'clock, the meal was mixed for the firſt time, for which purpoſe 16 quarts (Bavarian meaſure) of lukewarm water, weighing 28 lbs. 28 loths, were uſed.

At 3 o'clock in the afternoon, the *little leaven* (as it is called) was made, for which purpoſe 24 quarts, or 43 lbs. 10 loths, of water were uſed; and at half an hour after 7 o'clock, the *great leaven*

* The Bavarian pound which was uſed in theſe experiments, and which is divided into 32 *loths*, is to the pound Avoirdupois as 12,384 is to 10,000,—or nearly as 5 to 4.

was

was made with 40 quarts, or 72 lbs. 6 loths, of water. At 11 o'clock this maſs was prepared for kneading, by the addition of 40 quarts, or 72 lbs. 6 loths, more of water.

At 15 minutes after 10 o'clock at night, the kneading of the dough was commenced; $2\frac{1}{2}$ lbs. of ſalt being firſt mixed with the maſs. The dough having been ſuffered to riſe till a quarter before 2 o'clock, it was kneaded a ſecond time, and then made, in half an hour's time, into 191 loaves, each of them weighing 2 lbs. 16 loths. Theſe loaves having been ſuffered to riſe half an hour, they were put into the oven 10 minutes before 3 o'clock, and in an hour after taken out again, when 25 loaves being immediately weighed, were found to weigh 55 lbs. 15 loths. Each loaf, therefore, when baked, weighed 2 lbs. $5\frac{1}{2}$ loths; and as it weighed 2 lbs. 16 loths when it was put into the oven, it loſt $10\frac{1}{2}$ loths in being baked.

The whole quantity of water uſed in this experiment, in making the leaven and the dough, was 216 lbs. 18 loths.—The quantity of meal uſed was about 310 lbs.

Firſt Heating of the Oven.

This was begun 35 minutes after four o'clock, with $220\frac{1}{2}$ lbs. of pine-wood, which was in full flame 15 minutes after 5 o'clock.—At 8 minutes after 8 o'clock, 51 lbs. more of wood were added;—12 minutes after 11 o'clock, 32 lbs. more were put into the oven;—51 lbs. at 1 o'clock, and 12 lbs. more at 30 minutes after 2

o'clock; ſo that 366 lbs. 16 loths of wood were uſed for the firſt heating.

Second Batch.

At 20 minutes after 11 o'clock, the proper quantity of leaven was mixed with the meal, and 44 quarts, or 79 lbs. 25 loths, of water added to it. At 10 minutes after 3 o'clock, the meal was prepared for kneading, by adding to it 52 quarts, or 93 lbs. 27 loths, of water.

At 30 minutes after 5 o'clock, the kneading of the dough was begun; 2½ lbs. of ſalt having been previouſly added. At 15 minutes after 6 o'clock, the dough was kneaded a ſecond time, and formed into 186 loaves, which were put into the oven at 15 minutes after 7 o'clock, and taken out again 9 minutes after 8 o'clock, when 25 loaves being immediately weighed, were found to weigh 55 lbs. 4 loths.—Water uſed in making the ſecond dough, 173 lbs. 8 loths.

Second Heating of the Oven.

This was begun 20 minutes after 4 o'clock in the morning, with 54½ lbs. of wood; 20 lbs. were added 10 minutes after 5 o'clock, and 60 lbs. more 6 minutes after 6 o'clock; ſo that the ſecond heating of the oven required 134 lbs. 16 loths of wood.

Third Batch.

At 20 minutes after 3 o'clock, the proper quantity of leaven was mixed with the meal, and 48 quarts, or 86 lbs. 20 loths, of water were put to it.

At

At 6 minutes after 8 o'clock, this maſs was prepared for kneading, by adding to it 48 quarts, or 86 lbs. 20 loths, of water.—At 30 minutes after 9 o'clock, this dough was mixed with 2½ lbs. of ſalt; and at 30 minutes after 10 o'clock, it was made into 189 loaves, which, after having been ſuffered to riſe for half an hour, were put into the oven 10 minutes after 11 o'clock, and taken out again at 12 o'clock.

Fifty loaves of bread, which were weighed immediately upon their being taken out of the oven, were found to weigh 110 lbs. 30 loths; which gives 2 lbs. 5½ loths for the weight of each loaf. The water uſed in making this batch of bread was 173 lbs. 8 loths.

Third Heating of the Oven.

This was begun 30 minutes after 8 o'clock, with 50 lbs. of wood; and 50 lbs. more being added 30 minutes after 9 o'clock, the whole quantity uſed was 100 lbs.

FOURTH BATCH.

At a quarter before 8 o'clock, the proper quantity of leaven was mixed with the meal, and 48 quarts, or 86 lbs. 20 loths, of water being added, at 30 minutes paſt 11 o'clock, this maſs was prepared for kneading, by adding to it 52 quarts, or 93 lbs. 27 loths, of water.

Four minutes after 1 o'clock, 2½ lbs. of ſalt were added. The dough being kneaded at 15 minutes

after 2 o'clock, 188 loaves of bread were made, which were put into the oven 5 minutes before 3 o'clock, and taken out again at the end of one hour, when 25 of them were weighed, and found to weigh, one with the other, 2 lbs. $5\frac{1}{2}$ loths.

The water uſed in making this batch of bread was 180 lbs. 15 loths.

Fourth Heating of the Oven.

This was begun 15 minutes after 12 o'clock, with 40 lbs. of wood, and 50 lbs. more being added at 30 minutes after 1 o'clock, the total quantity uſed was 90 lbs.

FIFTH BATCH.

At $\frac{1}{4}$ before 12 o'clock, the proper quantity of leaven was mixed with the meal, and 52 quarts, or 93 lbs. 27 loths, of water put to it.—This maſs was prepared for kneading at 15 minutes after 4 o'clock, by the addition of 48 quarts, or 86 lbs. 20 loths, of water. The kneading of the dough was begun at 5 o'clock, and at 30 minutes after 5 it was made into loaves, $2\frac{1}{2}$ lbs. of ſalt having been previouſly added. 186 loaves being made out of this dough, they were put into the oven at 10 minutes before 7 o'clock, and taken out again at the end of one hour, when 25 loaves were weighed, and found to weigh 55 lbs. 18 loths.—The quantity of water uſed in making the dough for this batch of bread was 180 lbs. 15 loths.

Fifth

Fifth Heating of the Oven.

The oven was begun to be heated the fifth time at 15 minutes after four o'clock, with 40 lbs. of wood, and 40 lbs. more were added at 6 o'clock; ſo that in this heating no more than 80 lbs. of wood were conſumed.

SIXTH BATCH.

The meal was mixed with leaven at 30 minutes after 3 o'clock; for which purpoſe 32 quarts, or 57 lbs. 24 loths, of water were uſed at 15 minutes after 7 o'clock. This maſs was prepared for kneading by the addition of 44 quarts, or 79 lbs. 13 loths, of water, and a proportion of ſalt; at 19 minutes after 9 o'clock the dough was kneaded the firſt, and at ¼ before 10 the ſecond time; and in the courſe of half an hour 160 loaves were made out of it, which were put into the oven at 10 minutes before 11 o'clock, and taken out again at 8 minutes before 12 o'clock at midnight.

The water uſed in making the dough for this batch of bread was 137 lbs. 5 loths.

Sixth Heating of the Oven.

At ¼ after 8 o'clock, the ſixth and laſt fire was made with 40 lbs. of wood; to which, at 15 minutes before 10 o'clock at night, 34½ lbs. more were added; ſo that in the laſt heating 74½ lbs. of wood only were conſumed.

GENERAL RESULTS *of theſe* EXPERIMENTS.

THE ingredients employed in making the bread in theſe ſix experiments were as follows: *viz.*

	lbs.	loths.
Of rye meal, - -	1736	0
Of water, - - -	1061	5
Of ſalt, - - - -	15	0
In all,	2812	5 in weight.

Of this maſs 1102 loaves of bread were formed, each of which, before it was baked, weighed 2½ lbs.; conſequently, theſe 1102 loaves, before they were put into the oven, weighed 2755 lbs.: but the ingredients uſed in making them weighed 2812 lbs. 5 loths. Hence it appears, that the loſs of weight in theſe ſix experiments, in preparing the leaven,—from evaporation, before the bread was put into the oven,—from waſte, &c.—amounted to no leſs than 57 lbs. 5 loths.

In ſubſequent experiments, where leſs water was uſed, this loſs appeared to be leſs by more than one half.

In theſe experiments 1061 lbs. 5 loths of water were uſed to 1736 lbs. of meal, which gives 61 lbs. 4¾ loths of water to 100 lbs. of meal. But ſubſequent experiments ſhowed 56 lbs. of water to be quite ſufficient for 100 lbs. of the meal.

Theſe

Theſe 1102 loaves, when baked, weighed at a medium 2 lbs. $5\frac{1}{2}$ loths each; conſequently, taken together, they weighed 2393 lbs. 13 loths: and as they weighed 2755 lbs. when they were put into the oven, they muſt have loſt 361 lbs. 19 loths in being baked, which gives $10\frac{1}{4}$ loths, equal to $\frac{21}{160}$ or nearly $\frac{1}{8}$ of its original weight before it was baked, for the diminution of the weight of each loaf.

According to the ſtanding regulations of the baking buſineſs carried on in the bakehouſe of the Military Workhouſe at Munich, for each 100 lbs. of rye meal which the baker receives from the ſtore-keeper, he is obliged to deliver 139 lbs. of well-baked bread; namely, 64 loaves, each weighing 2 lbs. $5\frac{1}{4}$ loths. And as in the before-mentioned ſix experiments, 1736 lbs. of meal were uſed, it is evident that 1111 loaves, inſtead of 1102 loaves, ought to have been produced; for 100 lbs. of meal are to 64 loaves as 1736 lbs. to 1111 loaves. Hence it appears that 9 loaves leſs were produced in theſe experiments than ought to have been produced.

There were reaſons to ſuſpect that this was ſo contrived by the baker, with a deſign to get the number of loaves he was obliged to deliver for each 100 lbs. of meal leſſened;—but in this attempt he did not ſucceed.

Quantity of FUEL *conſumed in theſe Experiments.*

	Dry pine-wood. lbs	loths.
In heating the oven firſt time, - - -	366	16
ſecond time, - -	134	16
third time, - - -	100	0
fourth time, - -	90	0
fifth time, - - -	80	0
ſixth time, - - -	74	16
Total,	845	16
Employed in keeping up a ſmall fire near the mouth of the oven while the bread was putting into it,	34	16
Total conſumption of wood in the ſix experiments,	880 lbs.	

The reſults of theſe experiments ſhew, in a ſtriking manner, how important it is to the ſaving of fuel in baking bread, to keep the oven continually going, without ever letting it cool: for in the firſt experiment when the oven was cold, when it was begun to be heated, the quantity of wood required to heat it was 366½ lbs.; but in the ſixth experiment, after the oven had been well warmed in the preceding experiments, the quantity of fuel required was only 74½ lbs.

As in theſe experiments 2393 lbs. 13 loths of bread were baked with the heat generated in the combuſtion

tion of 880 lbs. of wood, this gives to each pound of bread $11\frac{1}{7}$ loths, or $\frac{11}{16}$ of a pound, of wood.

In the fifth experiment, or batch, 186 loaves weighing (at 2lb. $5\frac{1}{2}$ loths each) 304 lbs. were baked, and only 80 lbs. of wood conſumed, which gives but a trifle more than $\frac{1}{4}$ of a pound of wood to each pound of bread; or 1 pound of wood to 4 pounds of bread.

As each loaf weighed 2 lbs. 16 loths when it was put into the oven, and only 2 lbs. $5\frac{1}{2}$ loths when it came out of it, the loſs of weight each loaf ſuſtained in being baked was $10\frac{1}{2}$ loths, as has already been obſerved. Now this loſs of weight could only ariſe from the evaporation of the ſuperabundant water exiſting in the dough; and as it is known how much heat, and conſequently *how much fuel* is required to reduce any given quantity of water, at any given temperature, to ſteam, it is poſſible, from theſe data, to determine how much fuel would be required to bake any given quantity of bread, upon the ſuppoſition that *no part of the heat generated in the combuſtion of the fuel was loſt*, either in heating the apparatus, or in any other way; but that the whole of it was employed in baking the bread, and in that proceſs alone. And though theſe computations will not ſhow how the heat which is loſt might be ſaved, yet, as they aſcertain what the amount of this loſs really is in any given caſe, they enable us to determine, with a conſiderable degree of preciſion, not only the relative merit of different arrangements for economizing fuel in the proceſs of baking, but they ſhow alſo, at the ſame time, the preciſe diſtance of

of each from that point of perfection, where any farther improvements would be impoſſible: And on that account, theſe computations are certainly intereſting.

In computing how much heat is *neceſſary* to bake any given quantity of bread, it will tend much to ſimplify the inveſtigation, if we conſider the loaf as being firſt heated to the temperature of boiling water, and then baked in conſequence of its redundant water being ſent off from it in ſteam.

But as the dough is compoſed of two different ſubſtances, *viz.* rye meal and water, and as theſe ſubſtances have been found by experiment to contain different quantities of abſolute heat; or, in other words, to require different quantities of heat, to heat equal quantities or weights of them to any given temperature, or any given number of degrees, it will be neceſſary to determine how much of each of theſe ingredients is employed in forming any given quantity of dough.

Now, in the foregoing experiments, as 1102 loaves of bread were formed of 1736 lbs. of rye meal, it appears, that there muſt have been $1\frac{47}{100}$ lb. of the meal in each loaf; and as theſe loaves weighed $2\frac{1}{2}$ lbs. each when they were put into the oven, each of them muſt, in a ſtate of dough, have been compoſed of $1\frac{47}{100}$ lb. of rye meal, and $1\frac{3}{100}$ lb. of water.

Suppoſing theſe loaves to have been at the temperature of 55° of Fahrenheit's Thermometer when they were put into the oven, the heat neceſſary to heat

heat one of them to the temperature of 212°, or the point of boiling water, may be thus computed.

By an experiment, of which I intend hereafter to give an account to the Public, I found, that 20 lbs. of ice-cold water might be made to boil, with the heat generated in the combuſtion of 1 lb. of dry pine-wood, ſuch as was uſed in baking the bread in the ſix experiments before mentioned. Now, if 20 lbs. of water may be heated 180 degrees, (namely from 32° to 212°,) by the heat generated in the combuſtion of 1 lb. of wood, $1\frac{3}{10}$ lb. of water may be heated 157 degrees, (from 55°, or temperate, to 212°,) with $\frac{4}{10}\frac{1}{0}\frac{3}{0}\frac{6}{0}$ of a pound of the wood.

Suppoſe now that rye meal contained the ſame quantity of abſolute heat as water,—as the quantity of meal in each loaf was $1\frac{7}{10}$ lb., it appears, that this quantity would have required, (upon the above ſuppoſition,) to heat it from the temperature of 55°, to that of 212°; a quantity of heat equal to that which would be generated in the combuſtion of $\frac{6}{10}\frac{4}{0}\frac{0}{0}\frac{5}{0}\frac{}{0}\frac{}{2}$ of a pound of the wood in queſtion.

But it appears, by the reſult of experiments publiſhed by Dr. Crawford, that the quantities of heat required to heat any number of degrees, the ſame given quantity (in weight) of water and of wheat, (and it is preſumed, that the ſpecific or abſolute heat of rye cannot be very different from that of wheat,) are to each other, as $2\frac{7}{10}$ to 1,—water requiring more heat to heat it, than the grain in that proportion: Conſequently, the quantity of wood required to heat from 55° to 212°, the $1\frac{47}{100}$ lb. of rye meal which enters into the compoſition of each loaf,

loaf, inſtead of being $\frac{6405}{10000}$ of a pound, as above determined, upon the falſe ſuppoſition that the ſpecific heat of water and of rye were the ſame, would, in fact, amount to no more than $\frac{2899}{10000}$; for $2\frac{9}{10}$ (the ſpecific heat of water) is to 1 (the ſpecific heat of rye), as $\frac{6405}{10000}$ is to $\frac{2899}{10000}$.

Hence it appears, that the wood required as fuel to heat (from the temperature of 55° to that of 212°) a loaf of rye bread (in the ſtate of dough), weighing $2\frac{1}{2}$ lbs., would be as follows, namely:

	Of pine-wood.
To heat $1\frac{1}{10}$ lb. of water, which enters into the compoſition of the dough,	$\frac{4436}{10000}$
To heat the rye meal, $1\frac{7}{10}$ lb. in weight,	$\frac{2899}{10000}$
Total,	$\frac{7335}{10000}$ lb.

To complete the computation of the quantity of fuel neceſſary in the proceſs of baking bread, it remains to determine, how much heat is required, to ſend off in ſteam, from one of the loaves in queſtion (after it has been heated to the temperature of 212°), the $10\frac{1}{2}$ loths, equal to $\frac{21}{64}$ of a pound of water, which each loaf is known to loſe in being baked.

Now it appears, from the reſult of Mr. Watt's ingenious experiments on the quantity of latent heat in ſteam, that the quantity of heat neceſſary to change any given quantity of water *already boiling hot* to ſteam, is about five times and a half greater than would be ſufficient to heat the ſame quantity of

of water, from the temperature of freezing, to that of boiling water.

But we have juſt obſerved, that 20 lbs. of ice-cold water may be heated to the boiling point, with the heat generated in the combuſtion of 1 lb. of pine-wood; it appears therefore that 20 lbs. of boiling water would require $5\frac{1}{4}$ times as much, or $5\frac{1}{4}$ lbs. of wood to reduce it to ſteam.

And if 20 lbs. of boiling water require $5\frac{1}{4}$ lbs. of wood, $\frac{1}{64}$ of a pound of water boiling hot will require $\frac{21}{1000}$ of a pound of wood to reduce it to ſteam.

	Of pine-wood.
If now, to this quantity of fuel, -	$\frac{2025}{10000}$ lb.
we add that neceſſary for heating the loaf to the temperature of boiling water, as above determined, - -	$\frac{7375}{10000}$ lb.
this gives the total quantity of fuel neceſſary for baking one of theſe loaves of bread, - - -	$\frac{1613}{10000}$ lb.

Now as theſe loaves, when baked into bread, weighed 2 lbs. $5\frac{1}{4}$ loths $= 2\frac{17}{64}$ lbs. each, and required, in being baked, the conſumption of $\frac{1538}{10000}$ of a pound of wood, this gives for the expence of fuel in baking bread $\frac{7}{8}\frac{5}{0}\frac{1}{0}\frac{2}{0}\frac{}{0}$ of a pound of pine-wood to each pound of rye bread; which is about $13\frac{1}{4}$ lbs. of bread to each pound of wood.

But we have ſeen, from the reſults of the before-mentioned experiments, that when the bread was baked under circumſtances the moſt favourable to

the economy of fuel, no leſs than 80 lbs. of pine-wood were employed in heating the oven to bake 304 lbs. of bread, which gives leſs than 4 lbs. of bread to each pound of wood; conſequently, *two thirds* at leaſt of the heat generated in the combuſtion of the fuel muſt, in that caſe, have been loſt; and in all the other experiments the loſs of heat appears to have been ſtill much greater.

A conſiderable loſs of heat in baking will always be inevitable; but it ſeems probable, that this loſs might, with proper attention to the conſtruction of the oven, and to the management of the fire, be reduced at leaſt to one half the quantity generated from the fuel in its combuſtion. In the manner in which the baking buſineſs is now generally carried on, much more than three quarters of the heat generated, or which might be generated from the fuel conſumed, is loſt.

N° VIII.

THE following Account of the Perſons in the HOUSE of INDUSTRY in DUBLIN, the 30th of April 1796, and of the Details of the Manner and Expence of feeding them, was given to the Author, by order of the Governors of that Inſtitution.

Average of the Deſcription of POOR *for the Week ending 30th of April* 1796.

	Males.	Females.	Total.
Employed - -	74 —	352 —	426
Infirm and Incurable -	172 —	585 —	757
Idiots - - -	16 —	13 —	29
Blind - - -	5 —	10 —	15
	267	960	1227
In the INFIRMARY.			
Sick Patients, Servants, &c.	88 —	200 }	—343
Lunaticks - - -	15 —	40 }	
		Total	1570

Employed at actual labour 322 Perſons.
Ditto at menial offices - 104 ditto.

Total 426

Amongſt the 1570 Perſons above mentioned, are 282 Children and 447 compelled Perſons.

Of the Children, 205 are taught to ſpell, read, and write

Saturday, April 30, 1796.

1227 Perſons fed at Breakfaſt.

		lbs.	loaves.	lb.	value.
120 Servants in New-Houſe, *a* 8 oz. bread - 60					
336 Incurables, Children, &c. *a* 6 ditto - - 126		186	is 41	1½	£. 1 14
771 Workers, &c. got Stirabout.					
1227					

Weight of meal for Stirabout 4 cwt. coſts £. 3 1 8

	Gal. P.	
120 Servants in New-Houſe get 1 quart butter-milk each - -	30 0	167 gallons of butter-milk, value 1 *l.*
1084 Workers, Incurables, &c. 1 pint ditto - -	135 4	
23 Sucklers get no butter-milk		
—— Allowed for waſte -	1 4	
1227		

		s.	d.		
Brought down,				£. 5	15 8
Fuel to cook the Stirabout, 3 buſh. coſt		2	3	0	3 9½
Salt for ditto, 1 qr. 3 lb. coſt -		0	9½		
The Breakfaſt coſt				£. 5	18 8½

Quantity of water, 5 barrels 6 gallons.

1227 *Perſons fed at Dinner.*—BREAD *and* MEAL POTTAGE.

	lbs.	lbs.	loaves. lb.	value.
120 Servants *a* 9 oz. bread -	68	621½	is 138 0½	£. 5 10 4
1107 Workers, Incurables, &c. 8oz. ditto -	553½			

Weight of meal for the pottage, 1 cwt. 3 qrs.	0	13	5
Pepper for ditto, half a pound - -	0	1	1
Ginger for ditto, 1 pound - - -	0	1	3
Salt for ditto, 21 pound - - -	0	0	7
Fuel for ditto, 3 buſhels 2 pecks - -	0	2	7½
Dinner coſt £.	6	9	3½

SUPPER.

	lbs.	lbs.	loaves lb.	value.
For 165 Sickly Women on 6 oz. bread	62	109	is 24 1	0 19 11
251 Children, 3oz. do.	47			

N. B. The expences of Food for the Hoſpital, in which there are 343 perſons, is not included in the above account.

Sunday, May 1, 1796.

1220 Perſons fed at Breakfaſt.

120 Servants, *a* 8oz. bread.
330 Incurables, Children, &c. 6 oz. do.
770 Workers, &c. get Stirabout.

1220

The ſame quantity of proviſions delivered this day for Breakfaſt as on Saturday, and coſt the ſame: viz. 5 *l.* 18 *s.* 8½ *d.*

1220 *Perſons fed at Dinner.*—BREAD, BEEF, *and* BROTH.

		lbs.	loaves	lbs	Coſt l	s.	d.
120 Servants, *a* 9 oz. bread, - 68	618	is 137	1½	5	9	6
1100 Workers, Incurables, &c. 8 do. 550							

1220 Perſons.

	Cwt	qrs.	lbs.		l	s.	d.
Weight of raw beef,	4	2	10				
Allowed for bone, -	1	0	0				
	3	2	10	-	7	19	3
Meal for the broth,	1	2	0	-	1	3	1½
Waſte bread for do.	1	0	0	-	0	0	0
Salt for do.	0	0	24	-	0	0	8
Pepper for do.	0	0	0½	-	0	1	1
Fuel, 4 buſhels 2 pecks,		-		-	0	3	4½
				Total £.	14	17	0

SUPPER.

The ſame number of women and children as yeſterday, and the Supper coſt the ſame: viz. 19 *s.* 11 *d.*

Wedneſday, May 4, 1706.

1216 Perſons fed at Breakfaſt.

120 Servants in New-Houſe, *a* 8 oz. bread.
334 Incurables, Children, &c. *a* 6 oz. do.
762 Workers, &c. get Stirabout.

1216 Perſons.

The ſame quantity of proviſions, &c. delivered this day for Breakfaſt as for Saturday, and coſt the ſame: viz. 5 *l.* 18 *s.* 8½ *d.*

1216 *Perſons fed at Dinner.*—CALECANNON *and* BEER.

	Cwt	qrs	lbs.		Coſt. l.	s.	d.
Weight of raw potatoes for Calecannon,	19	0	0	-	3	6	6
An allowance for waſte,	1	0	0				
Weight uſed,	18	0	0				
Raw greens for ditto, -	8	0	0	-	1	6	0
Butter for ditto, - -	1	0	0	-	3	12	0
Pepper for ditto, - -	0	0	0½	-	0	1	1
Ginger for ditto, - -	0	0	1	-	0	1	3
Onions for ditto, - -	0	0	14	-	0	2	0
Salt for ditto, - -	0	0	24	-	0	0	8
Fuel, 4 buſhels 2 pecks,	-		-	-	0	3	4

Time of boiling about four hours.

		Gall. p.	Barrs.	Galls.			
1193	Perſons get 1 pint of beer each, making	149 1	151	3	31	2	5	3
23	On the breaſt get no beer.						
1216							
	Allowed for waſte,	1 7					
Bread to Incurables and Children on the breaſt, 43 loaves,						1	15	4
					Total £.	12	13	5

SUPPER.

The ſame number of Women and Children as on Saturday, and coſt the ſame · viz. 19 *s.* 11 *d.*

N. B. All theſe accounts are in Avoirdupois weight, and Iriſh money.

N° IX.

An Account of an EXPERIMENT *made (under the Direction of the* AUTHOR*) in the Kitchen of the* HOUSE *of* INDUSTRY *at* DUBLIN, *in* COOKING *for the* POOR.

MAY the 6th, 1796, a dinner was provided for 927 perſons of *Caleeannon*, a kind of food in great repute in Ireland, compoſed of *Potatoes*, boiled and maſhed, mixed with about one-fifth of their weight of boiled *Greens*, cut fine with ſharp ſhovels, and ſeaſoned with *butter*, *onions*, *ſalt*, *pepper*, and *ginger*. The ingredients were boiled in a very large iron boiler, of a circular, or rather hemiſpherical form, capable of containing near 400 gallons, and remarkably thick and heavy. 273 gallons of pump water were put into this boiler; and the following Table will ſhow, in a ſatisfactory manner, the progreſs and the reſult of the experiment:

Time.		Fuel laid on. Coals.		Heat of the Liquid.	Contents of the Boiler.		
						Quantity	
Hours.	Minutes.	Pecks.	Weight.		Ingredients.	in measures.	in weight.
7	48	4	106 lb.	55°	*Water* to boil the Greens and Potatoes	Gal. 273	lbs.
8	15	1	26½				
—	40	1	26½				
9	—	1	26½				
—	15	2	53	80°			
—	30	1	26½	90°			
—	45	2	53	110°			
10	—	1	26½	150°			
—	20	—	—	212°	The *Greens* were now put in.		295½
—	2	—	—	180°			
—	30	1	26½	190°			
—	45	—	—	212°			
11	—	—	—	—	The Greens taken out and *Potatoes* put in.		1615
11	10	2	53	180°			
—	20	1	26½	200°			
—	30	—	—	212°			
—	45	—	—	—	Potatoes done.		

GENERAL RESULTS *of the* EXPERIMENT.

The fuel uſed was Whitehaven coal: the quantity 17 pecks, weighing 450½ lbs.

The potatoes being maſhed, (without peeling them,) and the greens chopped fine with a ſharp ſhovel, they were mixed together, and 98 lbs. of butter, 14 lbs. of onions boiled and chopped fine, 40 lbs. of ſalt, 1 lb. of black pepper in powder, and ½ lb. of ginger, being added, and the whole well mixed together, this food was ſerved out in portions of 1 quart, or about 2 lbs. each, in wooden noggins, holding each 1 quart when full.

Each of theſe portions of Calecannon (as this food is called in Ireland) ſerved one perſon for dinner and ſupper; and each portion coſt about $2\frac{1}{12}$ pence Iriſh money, or it coſt ſomething leſs than *one penny* ſterling per pound.

Twelve pence ſterling, make thirteen pence Iriſh.

The expence (reckoned in Iriſh money) of preparing this food, was as follows: viz.

	l.	s.	d.
Potatoes, 19 cwt. at 3*s.* 6*d.* per cwt. (N. B. *They weighed no more than* 1615 *lbs. when picked and waſhed.*)	3	6	6
Greens, 26 flaſkets, at 10*d.* each, -	1	1	10
Butter, 98 lbs. at 72*s.* per cwt. - -	3	3	0
Onions, 14 lbs. at 2*s.* per ſtone, - -	0	2	0
Carried forward, £.	7	13	4

Brought

	l.	s.	d.
Brought forward,	7	13	4
Ginger, ½ lb. - - - -	0	1	3
Salt, 40 lbs. - - - -	0	1	1
Pepper, 1 lb. - - - -	0	1	1
Total coſt of the ingredients, £.	7	16	9
Expence for fuel, 17 pecks of coals, at 1*l.* 3*s.* 3*d.* per ton,	0	3	2½
Total £.	7	19	11½

With this kind of food there is no allowance of bread, nor is any neceſſary.

It would be hardly poſſible to invent a more nouriſhing or more palatable kind of food, than Calecannon, as it is made in Ireland; but the expence of it might be conſiderably diminiſhed, by uſing leſs butter in preparing it.

Salted herrings (which do not in general coſt much more than a penny the pound) might be uſed with great advantage to give it a *reliſh*, particularly when a ſmall proportion of butter is uſed.

In this experiment, 273 gallons of water, weighing about 2224 lbs. Avoirdupois, and being at the temperature of 55°, was made to boil, (in two hours and 32 minutes,) with the combuſtion of 346¼ lbs. of coal; which gives rather leſs than 6½ lbs. of water, to each pound of coal conſumed; the water being heated 157 degrees, or from 55° to 212°.

According to my experiments, 20 lbs. of water may be heated 180 degrees, (namely, from 32° the

freezing point, to 212° the temperature of boiling water,) with the heat generated in the combuſtion of 1 lb. of pine-wood; conſequently the ſame quantity of wood (1 lb.) would heat 23 lbs. of water 157°, or from 55° to 212°.

But M. Lavoiſier has ſhown us by his experiments, that the quantity of heat generated in the combuſtion of any given weight of coal, is greater than that generated in the combuſtion of the ſame weight of dry wood, in the proportion of 1089 to 600; conſequently, 1 lb. of coal ought to make $40\frac{1}{4}$ lbs. of water, at the temperature 55°, boil.

But in the foregoing experiment, 1 lb. of coal was conſumed in making $6\frac{1}{4}$ lbs. of water boil; conſequently, more than $\frac{5}{6}$ of the heat generated, or which might with proper management have been generated in the combuſtion of the coal, was loſt, owing to the bad conſtruction of the boiler and of the fire-place.

Had the conſtruction of the boiler and of the fire-place been as perfect as they were in my experiments, a quantity of fuel would have been ſufficient, ſmaller than that actually uſed, in the proportion of $6\frac{1}{4}$ to $40\frac{1}{4}$, or inſtead of $450\frac{1}{2}$ lbs. of coal, $71\frac{3}{4}$ lbs. would have done the buſineſs; and, inſtead of coſting 3*s.* $2\frac{1}{2}d.$, they would have coſt leſs than $6\frac{1}{4}d.$ Iriſh money, or $5\frac{3}{4}d.$ ſterling, which is only about $\frac{1}{3}$ per cent. of the coſt of the ingredients uſed in preparing the food, for the expence of fuel for cooking it.

Theſe computations may ſerve to ſhow, that I did not exaggerate, when I gave it as my opinion, (in my Eſſay on Food,) that the expence for the fuel neceſſary

ceſſary to be employed in cooking ought never to exceed, even in this country, *two per Cent.* of the value of the ingredients of which the food is compoſed; that is to ſay, when kitchen fire-places are well conſtructed.

Had the ingredients uſed in this experiment, viz.

2234 lbs. of water,
1615 lbs. of potatoes,
98 lbs. of butter,
14 lbs. of onions,
40 lbs. of ſalt,
1 lb. of pepper, and
$0\frac{1}{2}$ lb. of ginger,

making in all $3992\frac{1}{2}$ lbs., been made into a ſoup, inſtead of being made into Calecannon, this, at $1\frac{1}{4}$ lb. (equal to one pint and a quarter), the portion would have ſerved to feed 3210 perſons.

But if I can ſhow, that in Ireland, where all the coals they burn are imported from England, a good and ſufficient meal of victuals for 3210 perſons may be provided with the expence of only $5\frac{1}{4}d.$ for the fuel neceſſary to cook it; I truſt that the account I ventured to publiſh in my Firſt Eſſay, of the expence for fuel in the kitchen of the Military Workhouſe at Munich, namely, that it did not amount to ſo much as $4\frac{1}{2}d.$ a-day, when 1000 perſons were fed, will no longer appear quite ſo incredible, as it certainly muſt appear to thoſe who are not aware of the enormous waſte which is made of fuel in the various proceſſes in which it is employed.

I ſhall

I ſhall think myſelf very fortunate, if what I have done in the proſecution of theſe my favourite ſtudies, ſhould induce ingenious men to turn their attention to the inveſtigation of a ſcience, hitherto much neglected, and where every new improvement muſt tend directly and powerfully to increaſe the comforts and enjoyments of mankind.

END OF THE FIRST VOLUME.