THE REPERTORY OF ARTS AND MANUFACTURES:

CONSISTING OF

ORIGINAL COMMUNICATIONS,

SPECIFICATIONS OF PATENT INVENTIONS,

AND

SELECTIONS OF USEFUL PRACTICAL PAPERS

FROM THE

TRANSACTIONS

OF THE

PHILOSOPHICAL SOCIETIES

OF ALL NATIONS, *&c. &c.*

VOL. VIII.

LONDON:

PRINTED BY JOHN NICHOLS,

RED-LION-PASSAGE, FLEET-STREET,

FOR, AND SOLD BY, THE PROPRIETORS, NO. 182, FLEET-STREET; WHERE COMMUNICATIONS FOR THIS WORK ARE REQUESTED TO BE ADDRESSED.

1798.

CONTENTS

OF THE

EIGHTH VOLUME.

PLATES

PLATES

IN THE

EIGHTH VOLUME.

REPERTORY

OF

ARTS AND MANUFACTURES.

NUMBER XLIII.

I. *Specification of the Patent granted to Mr.* THOMAS HARRIS, *of the City of Briſtol, Diſtiller, and Mr.* JOHN LONG, *of Dublin, in the Kingdom of Ireland; for their Invention of a certain Utenſil or Apparatus, to be uſed in Breweries, Diſtilleries, &c. for the Purpoſe of cooling Worts of all Kinds.*

Dated July 28, 1790.

TO all to whom theſe preſents ſhall come, &c. NOW KNOW YE that, in compliance with the ſaid proviſo, we the ſaid Thomas Harris and John Long do hereby declare, that our ſaid invention of a certain utenſil or apparatus, to be uſed

in breweries, diſtilleries, &c. for the purpoſe of cooling worts of all kinds, is deſcribed in manner following; that is to ſay, the original and preſent mode of cooling worts brewed from malt and raw grains, at all the breweries and diſtilleries in this kingdom, is effected by extending and expoſing them over a large ſurface of wooden coolers, erected at a great expence for that purpoſe; by which, much of the ſaccharine ſubſtance is loſt by evaporation and abſorption; and, in the heat of ſummer, it is impoſſible to bring the worts to a proper temperature or degree of coolneſs. This new-invented mode of cooling worts is intended to remedy theſe inconveniences, and is performed by running the wort through an apparatus conſtructed of metal or other tubes or worms, of ſpiral or other forms, as opinion and local circumſtances may require, and having as many revolutions as poſſible; the diameters of which tubes or worms muſt be proportioned to the ſize and extent of the manufactory, from the tenth part of an inch to one hundred inches, or upwards. This apparatus is to be placed either in a worm-tub or ciſtern, pond or river, or other ſituation,

ſituation, where a ſufficient body of cold water may be conſtantly circulating on the external ſurface thereof; which will effectually and expeditiouſly cool the worts, in the courſe of their paſſage through ſuch tubes or worms. If the apparatus is placed in a tub or ciſtern, the beſt and moſt effectual method is, to let the worts deſcend through it, and in that caſe the water muſt come in at the bottom; but, if the ſituation of the utenſils is ſuch that the worts are required to aſcend, the water muſt be admitted in at the top of ſuch tub or ciſtern; ſo that a contrary direction of the water and wort is uniformly required, and a continual ſtream of cold water kept running in, while the wort is preſſing through the tube or worm; by which means, the worts may be, at all ſeaſons of the year, reduced to a degree of coolneſs proper for fermentation. In witneſs whereof, &c.

II. *Specification of the Patent granted to Mr.* JAMES TATE, *of Tottenham-Court Road, in the County of Middlesex, Ironmonger; for a Machine for cooking, on improved Principles.*

WITH A PLATE.

Dated December 5, 1796.

TO all to whom these presents shall come, &c. NOW KNOW YE that, in compliance with the said proviso, I the said James Tate do hereby declare, that the nature of my said invention, and in what manner the same is to be performed, is particularly described and ascertained in the plans or drawings hereto annexed, and as hereafter follows; that is to say, the machine for cooking, which I call the *œconomic ship-stove or hearth*, consists of sundry improvements, reductions, applications, and additions, to and from a machine with utensils for cooking, on improved principles, and for which his Majesty granted me his

his letters patent, bearing date the 2d of March, in the 32d year of his reign; as, by reference being thereunto had, will more fully and at large appear; and the different improvements, reductions, applications, and additions, hereafter to be deſcribed, are for the purpoſe of rendering the whole machine a complete and convenient apparatus, for the uſe of his Majeſty's navy, and other ſhips and veſſels, and alſo for the uſe of camps, barracks, and other places. And, as many of the improvements and additions which are to be deſcribed, as forming a part or parts of the œconomic ſhip-ſtove or hearth, will alſo be improvements and additions, if applied to other cooking machines or utenſils, I therefore apply the ſaid improvements and additions to other cooking machines or utenſils, in order to render them more complete and uſeful. I ſhall, therefore, firſt make mention of, and deſcribe, the different articles that compoſe the improvements, applications, and additions, which are to be applied to and with the forementioned machine, for which I have already a patent, as aforeſaid, and then explain and ſpecify the whole together, as

forming and completing my preſent invention of a ſhip-ſtove or hearth; and alſo of the ſame made portable, for the uſe of officers in the army and navy, and others, compoſed only of ſuch parts of the whole as will render it convenient and uſeful; with the fuel to be uſed therewith, which, inſtead of the common fuels uſed for cooking, is to be oil, or ſpirits; and the different articles hereafter mentioned, as forming this portable machine for cooking, are to be applied to and with a lamp or lamps, for the purpoſe of cooking, as aforeſaid.

Deſcription of the above-mentioned different improved and applied articles, that are to form a part or parts of the œconomic ſhip-ſtove or hearth; that is to ſay, the firſt article conſiſts in the application of one or more open boiling veſſels or cauldrons.

The ſecond article conſiſts of an improvement in the above-mentioned open boiling veſſels or cauldrons, which renders them capable of performing two different operations at the ſame time; that is, to boil in the common way with water, and to generate ſteam to be conveyed to other veſſels,

veſſels, to boil in them, by or with ſteam; at the ſame time that nine-tenths, or any other convenient ſpace, of the top or mouth of the ſaid veſſel or cauldron may remain open, and without a cover. This improved veſſel is conſtructed in the following manner: if the veſſel or cauldron is required to be made ſquare, the improvement is made by placing a partition in it, in the following manner, *viz.* join the partition to the two oppoſite ſides of the veſſel from the brim, and within one inch (more or leſs) of one of the ends of the ſaid veſſel: then conduct the partition downwards into the veſſel, and in a ſloping direction, extending towards the oppoſite end, and terminate the ſaid partition within three inches (more or leſs) of the bottom of the veſſel: then cloſe up the ſpace of the one inch (more or leſs) that remains open, between the partition and the end of the veſſel, and make it air-tight: then, inſide this partition, and near the top of the veſſel, inſert a pipe, to convey the ſteam to other veſſels, that are to be boiled in, by or with ſteam. The greateſt part of the ſteam, generated inſide this partition, will aſcend to the narrow ſpace at the top,

top, and ſo into the pipe, and to the other veſſels to boil in, by or with ſteam. This mode of raiſing ſteam for cooking, and other purpoſes, in many caſes, will be very advantageous, as that part of the ſaid veſſel or cauldron appropriated for raiſing or generating ſteam can never be without water, while any remains in the other or open part; and, by extending the lower part of the partition over the bottom of the veſſel, or by making the veſſel with two partitions, any proportion of the whole ſteam, raiſed by or in the veſſel or cauldron, may be diverted into the ſteam pipe or pipes already mentioned, leaving the greateſt part of the veſſel to be employed for common boiling in the water, as has been uſual. And this veſſel is one of the improvements that can and may be applied to other cooking and boiling utenſils, and I therefore apply it accordingly. If this veſſel or cauldron is to be made round, or any other ſhape, the partition or partitions may be varied accordingly.

The third article is the application of a ſteam-oven or cupboard, with a door or doors, ſhelf or ſhelves, for the purpoſe of boiling in, by or with

with ſteam; the ſteam to be let in at one or more places, as moſt convenient. This article, having been uſed and well known, needs no farther explanation.

The fourth article is an improved roaſting-jack; and the improvement is, the application of ſteam, to turn any of the common roaſting-jacks now in uſe (whether made on the weight, ſmoke, or water principle) in a ſimple manner; and therefore, if ſteam is to be applied to turn a jack on the ſmoke-principle, the only eſſential alteration will be in the fly, which, inſtead of being made with fans, as uſual, would be better, in all reſpects, to be made like the water-wheel of a mill, either under or over ſhot, (except in magnitude;) it does not ſignify in what direction this wheel is placed, either vertical, horizontal, or any other poſition, will do equally well. The ſteam to turn this wheel or fly muſt be from an incloſed or cloſe boiler, and the aperture through which it communicates to the fly or wheel muſt be very ſmall. This jack may be placed in any convenient place on or about the machine; and the ſteam conveyed from the incloſed boiler (to

be mentioned hereafter) by a ſmall pipe, ending in a ſmall hole, to jet the ſteam on the fly, which will force it round with equal velocity as the ſmoke of a fire. The ſame application will anſwer equally well to a jack made on the wind-up principle; and, in general, what is called a two-wheel jack will anſwer beſt, omitting the barrel for the line. Then place the fly, already deſcribed, in the place of a common fly, and apply the ſteam as before; and in like manner for any other ſort of jack. And this application of ſteam, to a roaſting-jack, is another of the improvements that can and may be applied to any cooking-machine whatever, and from a boiler heated in any way for that purpoſe. Steam may alſo be applied to jacks already in uſe; and, in like manner, to the common fly of a ſmoke-jack; but, in this laſt, the ſteam would do better to be divided into two or more jets.

The fifth article is an improved portable pan or plate for broiling upon. This plate or pan may be made with a handle to put it on or off the fire, or on the broiling-plate, or in the furnace of the œconomic ſhip-ſtove or hearth, to receive its heat.

heat. The improvement of this plate or pan conſiſts in the application of a metal or other thermometer, fixed thereto; by which, the different degrees of heat received by the pan or plate, from the fire or broiling-plate, will be expreſſed by the hand of the thermometer on marks or an index. By this means, the difficulty of broiling properly upon a heated iron-plate will be removed; the difficulty having ariſen for want of ſome certain method of aſcertaining the heat proper for the operation; becauſe, if the plate was too much heated, the ſteaks would be ſcorched, and the fat burned, and turned rancid, and therefore diſagreeable in taſte and ſmell: and, if the plate was not enough heated, the ſteaks would be ſodden. What I mean by ſodden is, that they are neither broiled or boiled, but ſeem as if they had partaken of both operations. A few times uſing this pan will furniſh experience to uſe it afterwards; and this pan or plate is another of the improved articles that can and may be applied to any fire whatever, for the purpoſe of broiling or frying.

Deſcription and Specification of this machine made portable, for the uſe of officers in the army or navy, and others, which operates by a lamp or lamps, and is made as follows; that is to ſay, I make a lamp with any number of burners or wicks, according to the ſize of the machine; in general it will be better that theſe burners or wicks ſhould be placed in one or more ſtraight lines. To one ſide of this lamp, I place an oven, for the purpoſe of roaſting or baking in: one ſide of this oven is applied to one ſide of the lamp; and the ſide of the oven ſo applied to the ſide of the lamp had better be made in a ſloping direction, ſo as nearly to fall or incline over the burners or wicks of the lamp, and to come in contact with the flare of the ſaid burners or wicks. On the other ſide of this lamp, I place another oven, either with a ſtraight ſide next the lamp, or to incline in the ſame direction as the other; but this laſt oven, inclining from the flare of the lamp, as the firſt does to it, will only anſwer the purpoſe of keeping any thing hot. The two ſides of theſe ovens will form a flew or chimney, to draw the lamp, (much in the nature of the glaſs

tubes

tubes uſed to the air or Argand's lamps,) and convey the remainder of the heat to a veſſel for raiſing ſteam to boil by or with, turn one of the jacks already deſcribed, or boil water, for tea or other purpoſes. This veſſel may be of any ſhape, and may have a ſteaming-veſſel on the top of it. This veſſel is then placed over the flue formed by the ſides of the two ovens, and reſting partly on both: a frying or broiling pan is alſo made and applied in the ſituation of the laſt-mentioned veſſel, when that is not in uſe. And let it be remarked, that any of theſe utenſils may be uſed ſeparately, with or over the lamp, as occaſion may require; and, if only baking or roaſting is wanted, an oven of a different conſtruction will be better than the one deſcribed. This laſt-mentioned oven ſhould be conſtructed, in that caſe, to receive the whole heat of the lamp or lamps, and made with a caſe round it, to confine the heat to it, with an open ſpace at the bottom, to receive the heat, and another open ſpace at the top, to let it out.

Specification and deſcription of the different articles, as they are combined to form the whole machine,

machine, or œconomic ſhip-ſtove or hearth, with references to the drawings; that is to ſay, firſt, an incloſed fire-place or furnace, with doors, frame, and bars: the two ſides of this furnace form two places for roaſting at or by. Fig. 1, A, (ſee Plate I.) the furnace doors and frame. B, B, the two roaſting ſides of the ſaid furnace. Over this furnace, or partly over, I place a broiling or ſtewing plate, which, in the drawing, is repreſented with three ſaucepans upon it, C, C, C. To the ſide of this plate, I apply the open boiling veſſels or cauldrons, either with or without the improvement for generating ſteam, as already deſcribed in Fig. 1, D, D. To the ſide of theſe open boiling veſſels or cauldrons, is placed an incloſed or cloſe boiler, to generate ſteam to cook with or by, in any other veſſel or veſſels; and alſo to generate ſteam for the purpoſe of turning the jack already deſcribed, or jointly for both purpoſes, or ſeparately for either. (See the end of this boiler at E.) Then, to the ſide of this incloſed boiler, is placed the baking-oven. (See F.) Then, over or partly over the baking-oven and cloſe boiler, is applied the ſteam-oven or veſſel

for

for boiling in, with or by ſteam. (See G, G.) On a frame above the ſteam-oven, or in any other convenient part, I place the improved jack, to go by ſteam from the incloſed boiler, as already deſcribed. (See H H.) I, is the chimney or flue to carry away the ſmoke. One of the ſides of the incloſed furnace (ſay ſide B) may be made to open occaſionally, and ſhews bars like a grate, but when at work muſt be cloſed up. I conſider every ſort of fire-place to be an incloſed furnace, where the external air has no other paſſage to the flue or chimney but directly through the fuel, whether the bars or other things that admit the air to the fuel be at the bottom, or ſide, or ſides, of the furnace. One fire, in the furnace A, will ſet the whole machine to work, except when the machine is very large and extended; in that caſe, ſome of the articles would be placed at too great a diſtance from the furnace to be properly heated thereby. When that is the caſe, it will be proper to annex another fire-place to the machine, (ſay at the oppoſite end to the furnace.) This fire-place may be either an open one, or an incloſed furnace, and may be appropriated to raiſe ſteam,

by

by the incloſed boiler, for turning the jack, and otherwiſe be made to aſſiſt the operation of the great furnace A; and the different articles, deſcribed as forming the combination of the whole machine, may be interchanged, and one article put where another is now deſcribed to be placed. And, according to the ſize or uſe that theſe machines may be wanted for, it may be neceſſary to reduce or omit a part or parts of the whole combination: ſometimes the broiling or ſtewing plate might not be wanted; and ſometimes the jack or incloſed boiler could not be neceſſary, and eſpecially in the combination of a ſmall œconomic ſhip-ſtove or hearth.

Reference to the drawing of the improved open veſſel or cauldron, for generating ſteam, and boiling in the common way. Fig. 2, is a ſection of the ſaid improved veſſel or cauldron, repreſented as having two partitions. K, is the open part of the ſaid veſſel, for boiling in water as uſual. L, L, are the two ſpaces appropriated for generating ſteam. M, M, are the partitions, terminating near the bottom of the ſaid veſſel or cauldron. N, N, are the pipes for conveying the

the ſteam generated into other veſſels or ovens. The great utility of this improved veſſel will farther appear, by conſidering that large quantities of ſalted proviſions boiled at once are often rendered hard and dry, by the too quick boiling of the veſſel they are cooked in; which may be completely remedied by the uſe of this veſſel, as, with the two partitions, any given quantity of the heat may be prevented penetrating the open part K. Doors, with ſmall holes in them, may be fixed with hinges to each partition at the bottom, in order to prevent any ſmall matters, boiled in the open part K, getting behind the partitions into the ſpaces L, L.

Specification and deſcription of the different articles, as they are combined to form this machine, when made portable, for the uſe of officers in the army or navy, and others, with references to the drawings; that is to ſay, Fig. 3, R, is the lamp for the ſaid machine. Fig. 4, is the ſaid lamp in combination with the two ovens, and the boiler or veſſel for raiſing ſteam, and boiling any thing in water. P, is the baking-oven. Q,

is the heating-oven. R, is the end of the lamp. S, is the veſſel for boiling in, and raiſing ſteam for other purpoſes. Theſe machines, and the different parts of which they are compoſed, may be made of any of the different ſorts of metals ſuch like articles are uſually compoſed or made of.

I have deſcribed this machine, when made portable, as only to operate with a lamp and oil, or ſpirits, I mean, nevertheleſs, to conſtruct thoſe that are to be uſed with common fuels, of wood, coal, and other fuels, upon different ſcales or ſizes; ſo that a ſmall machine, to uſe with coal, wood, and other fuels, may alſo be ſaid to be portable. In witneſs whereof, &c.

III.

Fig. 1.

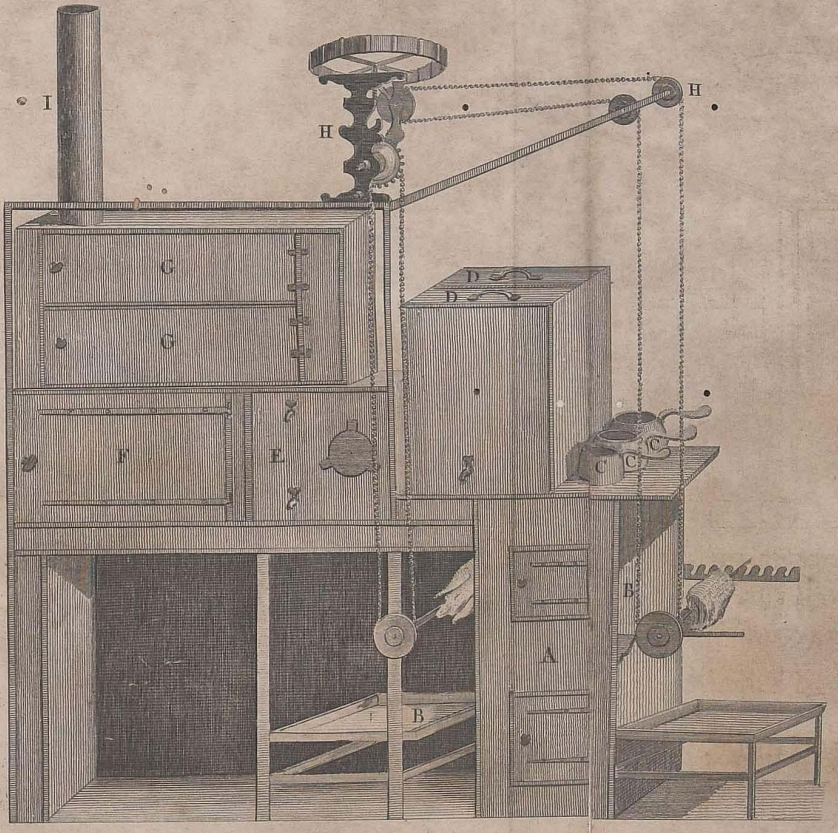


Fig. 2.

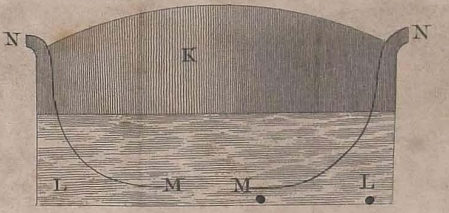


Fig. 3.

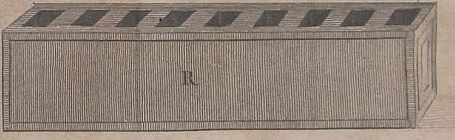
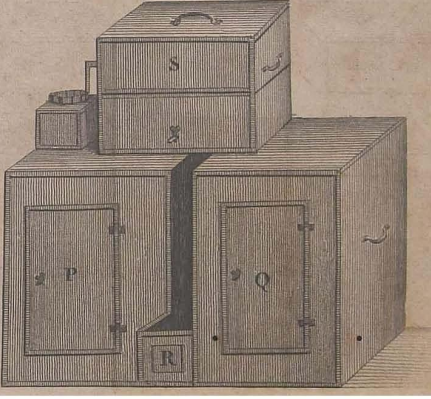


Fig. 4.



III. *Specification of the Patent granted to Mr.* JOHN JOHNSON, *of Ludham, in the County of Norfolk; for his new Method of tanning Leather.*

Dated May 23, 1770.—Term expired.

TO all to whom theſe preſents ſhall come, &c. NOW KNOW YE, that in compliance with the ſaid proviſo, I the ſaid John Johnſon do hereby declare, that my ſaid invention of a new method of tanning leather is deſcribed in the manner following; that is to ſay, into a ſouring-vat, which will contain about ſix barrels, are put about five barrels of water, as it comes from the pump, or ſpring. Into that quantity of water I put ſeven pounds of the ſpirit of vitriol, or the ſame quantity of either the ſpirit of ſea-ſalt, or aquafortis, though I more frequently make uſe of the vitriol

 only.

only. When the ſouring is thus made, the hides that are deſigned for ſole-leather are put into it for working, or more generally in an older ſouring firſt, and, if kept handling and ſhifting, as in the common way of working ſoles, will be completely wrought in twenty-four hours. A worker thus made will completely work ſix, ſometimes ſeven, ſole-hides. When the hides are thus wrought, they are laid away with bark, and treated as in the common way of tanning, until they come into the ſecond layer of bark; then, before the leather is laid in the vats, (which will hold fifteen ſole-hides when barked down with about fifteen buſhels of bark,) into fourteen barrels of ooze, I put ſeven pounds, or if neceſſary ten pounds, of the ſpirit of vitriol, or the ſame quantity of the ſpirit of ſea-ſalt, or aquafortis; though I, in this caſe, more frequently make uſe of the vitriol only. When the vat of leather is thus laid down in the ſecond layer, it lies ſtill for at leaſt ten or twelve weeks. When it has lain that time, the leather is taken out of that vat and laid into another vat, (where ſoles of the third

third layer have been drawn out for ſale,) in the ſame manner as it was laid into the ſecond layer. When it has lain about twelve or fourteen weeks in the third layer, it is drawn out of the vat, in order to be dried for ſale, completely tanned.

As to what we call crop-leather, when the hides are oozed enough for laying away, I have a very ſtrong ooze drawn from them, into a handler that will contain fifteen hides. I put therein ſeven pounds of the ſpirit of vitriol, or the ſame quantity of the ſpirit of ſea-ſalt, or aquafortis; though here I more frequently uſe the ſpirit of vitriol only, as it does the buſineſs as effectually, and at much leſs expence. When I have put the above quantity of vitriol into the handler, the hides are put into it, with the duſt or bark, as in the common way of tanning, and kept within, handling two or three times a day, for ſeven or eight days. After that time, they are laid in a layer-vat, with upper-leather hides, and proceeded with as in the uſual way of tanning, until they are laid in the laſt layer, in a vat that will contain

tain forty hides. When laid down with bark, I put ſeven pounds, ſometimes ten pounds, of the ſpirit of vitriol, or the ſame quantity of the ſpirit of ſea-ſalt, or aquafortis; but I prefer the ſpirit of vitriol, for the reaſon before given.

In calf-ſkin tanning, I do not go out of the common way of tanning, until the laſt layer; when, into a vat that will hold twelve dozen ſkins, I put the ſame quantity that I put for forty hides, of the ſpirit of vitriol, or the ſpirit of ſea-ſalt, or aquafortis. In witneſs whereof, &c.

IV.

IV. *Specification of the Patent granted to* Mr. ROBERT HOAKESLY, *of the City of Cheſter, Merchant; for his Method of making Britiſh Pot-Aſh, for the Uſe of all Kinds of Manufactures in which foreign Pot-Aſh, or any Alkali, is uſeful.*

WITH A PLATE.

Dated July 20, 1796.

TO all to whom theſe preſents ſhall come, &c. NOW KNOW YE, that the ſaid Robert Hoakeſly, in purſuance of, and compliance with, the ſaid letters patent, by theſe preſents under his hand and ſeal, doth deſcribe and aſcertain the nature of his ſaid invention, and in what manner the ſame is to be performed, as follows; that is to ſay; the pot-aſh is made of the following materials, *viz.* Engliſh, Scotch, Welch, or Iriſh kelp;

kept; foreign barilla; or ſalts obtained from ſoap-leys, by evaporation, or in their calcined ſtate, commonly called black aſhes; or of ſoap-waſtes. It may be made of any of the above materials, mixed with a certain proportion of the ſalts extracted from ſoap-leys; or by mixing certain proportions of any two or more together, ſo as to ſuit the particular manufacture it may be adapted for. It is alſo made of rock-ſalt, mixed with a certain proportion of any foreign or other alkali. The materials are pounded or ground into ſmall pieces; and ſuch kinds as are deſigned to make a pot-aſh of a particular quality are mixed together: they are then thrown into an oven or furnace of a particular conſtruction, (a drawing of which is hereupon delineated,) and there, by an extraordinary degree of heat, are melted into ſo liquid a ſtate as to run out with great eaſe, at a channel made in a convenient part of the oven or furnace, and there collected into pots. Either of the kinds, when cold, aſſume the appearance of foreign pot-aſh, and are uſed without any farther proceſs. In witneſs whereof, &c.

RE-

References to the Figure.

(See Plate II. Fig. i.)

A. Furnace-door.

B. Door in which the materials are thrown.

C. Bottom of the furnace.

D. Vent of the chimney.

E. Chimney.

F. Small hole, out of which the pot-ash runs.

V. *Description of a simple Contrivance for preventing the Wheels of Carriages making Ruts in Roads. By* ROBERT BEATSON, *Esq. Member of the Society for the Encouragement of Arts, Manufactures, and Commerce; Honorary Member of the Board of Agriculture, &c.*

WITH A PLATE.

ALTHOUGH several machines have, at different times, been invented for facilitating the repair of roads, and filling up the ruts made by wheel-carriages, yet no method has ever been proposed, so far as I know, to prevent the wheels of carriages making ruts; it being taken for granted, that however hard and solid the road may be, such ruts must unavoidably be made in it. But, in my humble apprehension, the common observation, that "it is easier to prevent an "evil than to cure it afterwards," may justly be applied in this case; for, it appears to me that a method

a method may be deviſed, which will, in a great meaſure, prevent ruts being made, and thereby ſave much expence, not only in keeping roads in repair, but in their original conſtruction.

Broad wheels have long been in uſe; but, although they are certainly a great ſafeguard to the roads, when properly conſtructed, yet, while they are allowed to be ſhod and formed in the convex manner that ſome waggon-wheels are, with ſo many ſeparate rings detached from each other, and the heads of the large nails projecting ſo far, it is impoſſible for even the hardeſt road to withſtand the cruſh of ſuch deſtructive engines, eſpecially when loaded with ſo enormous a weight as is ſometimes contained in a large waggon. Beſides, as broad wheels are very expenſive, and cannot therefore become general for agricultural purpoſes, it would be of the greateſt conſequence to the community at large if ſome other method of protecting the roads were pointed out, that could be more eaſily attained, and of more general utility. The following method is, therefore, with deference ſubmitted to the public, not

only as being very eaſily attained, but as being applicable to any wheel-carriage, without altering its preſent wheels.

Suppoſe Fig. 2, (Plate II.) to repreſent the head-view of a cart or waggon. The wheels A and B, when heavily loaded, aided by a ſucceſſion of carriages following the ſame tract, will make the ruts complained of, while the horſe-path in the middle of the road often remains intire; and yet this frequently gives way too, near the places where the wheels ſink in, owing to the additional force it requires to draw them out again, and not perhaps to the road being ſofter there than in any other place; conſequently, wherever any obſtacle comes in the way to impede the draught, or to occaſion a greater exertion to draw the carriage forward, the road will in that place the ſooner fail. This muſt always be the caſe where there are deep ruts, which often require a greater exertion of power to get through them, than even to ſurmount the moſt hilly roads. To prevent wheels forming theſe ruts, or ſinking into thoſe already made, let a ſmall broad wheel or roller be placed

between

between the other wheels, as at E; being fixed directly under the axle-tree, and so strongly secured thereto as to be able to support the whole weight of the carriage when necessary, which it will always do when the wheels come to any deep ruts formed by other carriages. The lower part of the circumference of this roller (which may with propriety be called a *protector*) should be about an inch and a half above the level of the line C D; the upper part about the same distance from the axle-tree, to which there should be a scraper fixed, to keep it always clear. The size of the wheels will accordingly regulate the size of the protector; but, in general, about twenty-two inches, or two feet, in diameter will do for single carts: for double carts, or waggons, it may be larger and broader. By keeping the protector a little higher than the lower level of the wheels, it is evident that on good hard roads, or streets, the wheels will always bear the weight of the load, nor can they make any ruts, or sink into any old ones, however deep they may be, while the middle of the road remains firm; for the

the protector will roll upon the middle, which will certainly be a much eaſier draught for the horſes than if the wheels were in deep ruts. For large carts, or waggons, there might even be more than one of theſe between each pair of wheels; but, in general, one will be ſufficient. It may by ſome be objected, that even one will occaſion too much additional weight; but this can by no means be the caſe, for, if properly conſtructed, the weight will be inconſiderable, when compared to the utility, in ſaving the roads, and leſſening the firſt expence of making them; beſides, the wheels and other parts of the carriage may be made a great deal lighter, as they will never jolt ſo violently from ſide to ſide in bad rords, which is not only a great ſtrain upon every part of the carriage, but upon the horſes alſo.

VI.

Fig. 1.

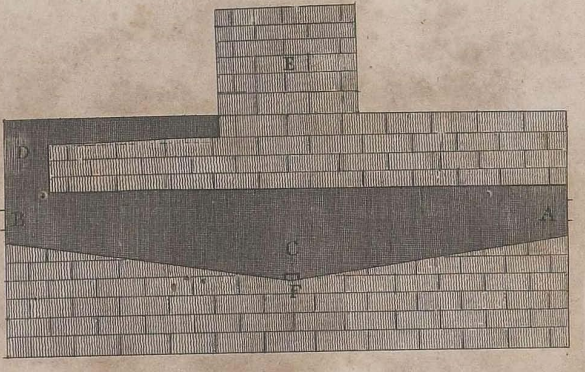
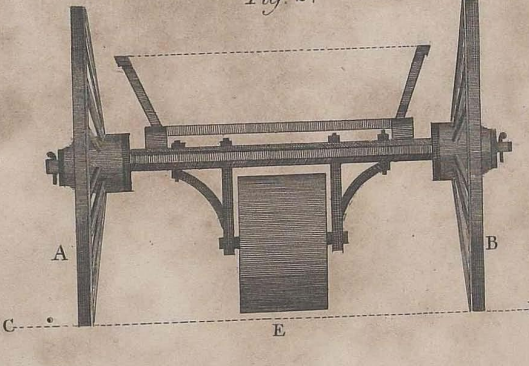


Fig. 2.



VI. *Experiments and Obſervations on the Vegetation of Seeds. By Mr.* JOHN GOUGH.

From the MEMOIRS of the LITERARY and PHILOSOPHICAL SOCIETY of MANCHESTER.

EVERY one at all acquainted with natural hiſtory knows, that the ſeeds of many plants will, after lying in the ground for many years in a ſtate of perfect inactivity, ſpring up when the ſoil is broken, in full vigour, and with a profuſion that ſhews the earth to have contained them in great numbers. Reflecting on this curious phænomenon, in July, 1787, I made the following experiments, with a view to diſcover what are the contingent circumſtances that give life and energy to the vegetative principle, in the embryos of plants.

Experiment I. Having nearly filled two phials with barley, that had been ſteeped in water for forty-eight hours, I corked one of them ſecurely,

curely, and placed it in the dark: the other was buried, at the ſame time, in a box of light dry mould, its mouth being previouſly covered with a piece of thin cloth, to prevent ſand and other impurities from falling into it. The contents of the latter bottle were found, at the end of three days, in a ſtate of vigorous vegetation; every grain having one ſprout, or more, of a conſiderable length. The grain in the phial which was corked retained its former appearance; but had contracted a ſmell that was diſagreeable, and very different from that which it had when newly taken out of the water.

The only juſt concluſion from the preceding experiment is, that a given quantity of ſoaked grain, either requires a given quantity of air, to make it vegetate, or a free communication with the atmoſphere at large. The philoſophers of the laſt century knew that the preſence of air is neceſſary to the vegetation of ſeeds, becauſe they remain unanimated *in vacuo*; but, if my memory do not deceive me, they were ignorant of the fact juſt now ſtated. I have, therefore, given it a place in this eſſay, partly becauſe it appeared to be

be new, and partly becauſe it occaſioned the ſucceeding experiments, which are of a more deciſive nature. But, before I enter on the detail, it may not be improper to ſay ſomething on the ſtructure and the conſtituent principles of vegetables.

A plant is an organized body, conſiſting of fibres, veſſels, and different organs, intended to produce different ſecretions by their ſpecific modes of action: ſuch are, the gummy matter of the *Stigmata*, the *Pollen* of the *Antheræ*, the honey of the *Nectarium*, and the different vegetable acids commonly contained in the *Pericarpium*.

The ſubſtances enumerated above, though very diſſimilar in their ſenſible qualities, are made of but a few primary elements, that are combined, in various proportions, in the reſpective compounds.

Theſe are, 1. Oxygen, or the baſis of reſpirable air. 2. Hydrogen, or the baſis of inflammable gas. 3. Carbon, which, when ſeparated from the other two, forms charcoal. Water, which is itſelf a compound, enters the abſorbing

veſſels of all vegetables, where it ſerves as a vehicle for the unaſſimilated particles, and afterwards eſcapes by perſpiration, either wholly or in part.

The foregoing matters are found in the compoſition of all vegetables; and azote, or the baſis of mephitic gas, alſo contributes to the materials diſcovered in the plants of the claſs *Tetradynamia*. This ſubſtance unites, during putrefaction, with hydrogen, and compoſes *volatile alkali*, a property which is peculiar to the genera of the claſs in queſtion. The parts of a ſeed are, the *germ*, and the *ſeed-lobes*. The former is a ſmall bud, that appears to be the receptacle of the vegetative principle, where it lies torpid, till its activity is excited by foreign cauſes. The ſeed-lobes are two ſoft bodies, which, cohering cloſely, leave a notch between them for the reception of the germ. They conſiſt of a vegetable *oxyd*, or of a baſis compounded of carbon and hydrogen, and impregnated with oxygen: a quantity of oil, or of the baſis not oxydated, is diffuſed through their ſubſtance. When ſeeds are covered with water, or buried in wet earth, they imbibe a portion of humidity;

humidity; in conſequence of which, the vegetative principle begins to exert itſelf, if not prevented by want of a proper degree of warmth, or by other cauſes. It is highly probable, that no two kinds of ſeed abſorb equal quantities of water: for I have found, that barley takes up only one third of its weight of this fluid, in forty-eight hours; but that peas charge themſelves with three quarters of their weight, in the ſame time. Having ſtated the foregoing facts, which the nature of this eſſay ſeemed to demand, I ſhall proceed in the detail of my experiments.

Experiment II. One ounce of ſteeped barley being put into a bottle, which would hold one ounce and three drachms of rain-water; and alſo three drachms of the ſame grain, prepared in the ſame manner, into a ſecond bottle, capable of containing four ounces of water; they were both cloſely corked, and placed in a dark room, where the mean height of the thermometer was fifty-eight degrees, during the experiment. At the end of four days, the three drachms of barley, in the large bottle, had vegetated much; but the greater quantity, in the leſs bottle, had not produced

one ſprout. The ſame change in ſmell was however obſerved, which I have noted in the former caſes. Hence it is evident, that a free communication with the atmoſphere is not abſolutely required, to bring the vegetative principle of ſeeds into action. On the other hand, it is equally manifeſt, both from this and the preceding experiment, that a given quantity of grain muſt be placed in a given quantity of air, to make it vegetate *.

Experiment III. Since permanently-elaſtic fluids eſcape very copiouſly from vegetables ſubjected to the vinous and putrefactive fermentations, it might be ſuppoſed, that the ſame thing happens with ſeeds in the act of vegetating; and that this diſcharge being ſuppreſſed, for want of room, in the ſmall bottle uſed in the laſt experiment, the expanſion of the germs was thereby prevented. In order to examine this matter with ſome care, I began with putting ſeveral parcels of peas and

* The ſecond and ſucceeding experiments were repeated in the autumn of this year, (1793;) when the preſent concluſions, founded on the new theory of chemiſtry, were alſo added.

barley,

barley, previouſly ſteeped, into ſmall jars, and then covering them, to different depths, with water, both clean and foul. The ſeeds, thus treated, ſhewed no ſigns of vegetation, after ſpecimens of the ſame kind, ſtanding near them, in open bottles, had made a conſiderable progreſs. At the time, I attributed this inability to vegetate, to the air being excluded by the incumbent fluids; which ſuppoſition appeared more reaſonable than the contrary opinion, namely, that ſome elaſtic matter was prevented from quitting the ſeeds, by columns of water not exceeding one inch in length, which can only preſs with a very ſlight force *.

Experiment IV. I put three drachms of dry peas into a bell-glaſs filled with water, and inverted it in a ſmall veſſel of the ſame fluid. At the end of forty-eight hours, the jar remained full; but a quantity of water taken from the baſon in which it ſtood, rendered lime-water

* Since this experiment was made, I find it not to be new. *Malpighi* did the ſame thing, with the ſame reſult. *Vide Opera ejus*, tom. I. p. 108.

turbid;

turbid; a proof that it contained carbonic acid.

The ſame experiment was repeated with four drachms of barley, and the reſult was nearly the ſame; only the preſence of the carbonic acid was not ſo ſtrongly indicated by the teſt of lime-water.

Experiment V. Two ounces of water, in which barley had been ſoaked forty-eight hours, were put into a pint-bottle: an ounce-phial, half filled with lime-water, was ſuſpended by a thread in the veſſel, ſo as not to touch the liquor; the bottle was then cloſely ſtopped with a clean cork. The lime was precipitated from the water in the phial at the end of forty-eight hours. Hence we are authoriſed to infer, that carbonic acid gas had been generated in the bottle, during the courſe of the experiment.

Experiment VI. Being by this time convinced, that carbonic acid is produced by the vegetation of ſeeds; and believing, with M. Lavoiſier, that the acid in queſtion conſiſts of carbon united to oxygen; I endeavoured, in the next place, to diſcover, whether the atmoſphere, or the vegetable

oxyds

oxyds of the materials uſed in my experiment, ſupplied the acidifying principle. For this purpoſe, I placed ſeven drachms, twenty three grains, of ſteeped peas in a new phial, the mouth of which I covered with a piece of clean window-glaſs, which was intended to condenſe the vapour, ſhould any aſcend into the neck. The bottle, thus prepared, was ſcreened from the action of the light, ſo as not to prevent the free acceſs of the air to its contents. At the end of one hundred and twenty hours, the peas were found to be vegetating freely, many of them having ſprouts two inches long. The neck of the phial, and the glaſs that covered it, were free from moiſture. The whole was then carefully weighed; and, the neceſſary deduction being made for the bottle and glaſs, the peas were neither more nor leſs than ſeven drachms, twenty-three grains, their original weight. The mean height of the thermometer, during the courſe of the experiment, was 59°,5. I made the ſame trial, at another time, with a bottle containing one ounce, three drachms, of ſteeped barley, and 6,16 cubic inches of air. Beſides uſing the ſame precautions obſerved

obſerved in the laſt caſe, I frequently changed the air of the phial, by ſucking it out through a ſlender glaſs ſyphon. At the end of ninety-ſix hours, the weight was decreaſed two drachms, five grains. The loſs of this ſmall quantity was probably occaſioned by water eſcaping through the ſyphon, in combination with the carbonic acid gas, and other permanently-elaſtic fluids. Thus it appears, that the vegetation of ſeeds cauſes very little diminution of their weight, if any at all. On the contrary, the vinous fermentation of vegetable ſubſtances is attended with a very ſenſible loſs in this reſpect. Nevertheleſs, carbonic acid gas is generated in both proceſſes, and often ſo plentifully in the latter, as to burſt the veſſels containing the fermenting materials, provided a free egreſs be denied it; but no ſuch force is obſervable in the former caſe. I therefore found it neceſſary to follow a different method, in order to diſcover the origin of this gas, during the firſt ſtage of vegetation.

Experiment VII. Six drachms of ſteeped barley were put into a bell-glaſs, in the upper part of which it was ſecured, by a muſlin ſtrainer, ſtretched

ſtretched on a hoop of whalebone, tightly fitted to the inſide of the bell. Seven ounce-meaſures of atmoſpheric air were then introduced into the jar, through the water in which it was inverted; care being taken that the height of the water within the glaſs ſhould be on a level with that in the baſon; which point was exactly marked on the outſide. The barometer, at the ſame time, ſtood at 30,25 inches; the thermometer at 54°,5. In the ſpace of eighteen hours, the barometer had riſen to 30,31 inches, the thermometer being at 55°,5; and the water incloſing the air appeared above the mark. Upon ſhaking the jar, the air contracted, which could only be occaſioned by the abſorption of carbonic acid gas, uniting with the agitated water: at the end of ſixty-ſix hours, the grain had ſprouted as much as could be expected in the time. It was then thought proper to put an end to the experiment, becauſe the barometer and thermometer ſtood exactly at 30,25 inches, and 54°,5. The height of the water in the jar was carefully marked in the next place; and the contents of that part of the veſſel lying between this point, and that fixed on at firſt, being

accurately aſcertained, it appeared that the air in contact with the barley had loſt one-tenth of its original bulk. The diminution would undoubtedly have been made ſtill greater, by expoſing it to lime-water, but I did not purſue the ſubject any farther at that time; being contented, for the preſent, with determining the vegetative proceſs to differ eſſentially from the vinous fermentation; for, the carbonic acid gas that eſcapes from fermenting ſubſtances, during the converſion of ſugar into alcohol, is generated by thoſe ſubſtances themſelves. On the contrary, a part of the ſurrounding air is either abſorbed by ſeeds in the act of vegetation, or a portion of its oxygen is charged with carbon derived from them. But this will be placed in a clearer light by the next experiment.

Experiment VIII. I put ſeveral parcels of ſteeped peas and barley, at different times, into phials, which were left to ſtand for three or four minutes in ſpring-water, of the heat of 46°,5, to reduce them to a known temperature. They were then ſecurely corked, and removed into a room, the temperature of which was never leſs than

than 53°. After remaining from four to ſix days in this ſituation, they were again placed in the ſame ſpring-water, and opened in an inverted poſition; care being taken that the barometer ſtood at the time nearly where it did at firſt. When a cork was thus drawn, a quantity of water ruſhed in immediately, more than was ſufficient to fill the neck. The air, being paſſed through lime-water, contracted very ſenſibly, and precipitated the lime. The reſiduum, freed in this manner from carbonic acid, extinguiſhed a lighted taper like water; and this it did repeatedly. I made one of theſe experiments with more attention than the reſt; from which it appeared, that four ounces, one drachm, forty grains, by meaſure, of atmoſpheric air, loſt one-ſixth of its original bulk, by being confined five days with one ounce of ſteeped barley. Now, if the imperfections of my apparatus do not lead me into error, it is plain that ſeeds, in the act of vegetation, take oxygen from the atmoſphere; part of which they retain, and reject the reſt, charged with carbon. The ſubſtances of the ſeed-lobes are hereby changed; an additional quantity of oxygen being introduced

into their compoſition, and a part of their carbon loſt. This change, in the proportion of their elementary principles, generates ſugar, as is evident from the proceſs of malting. But, ſugar and carbonic acid are more ſoluble in water than the farinaceous oxyd. They therefore combine with the humidity in the capillary tubes of the ſeed, and find a ready paſſage to the germ; the vegetative principle of which they call into action, by a ſtimulus ſuited to its nature. A nutritious liquor being thus prepared, by the decompoſition of the ſeed-lobes, and diſtributed through the infant-plant, its organs begin to exert their ſpecific actions, by decompounding the nouriſhment conveyed to them, and forming new oxyds from the elementary principles of it, for the encreaſe of the veſſels and fibres; and, in this manner the firſt ſtage of vegetation commences. One principal uſe of the ſeed-lobes being aſcertained, we are enabled to underſtand ſome experiments made by Malpighi. This induſtrious philoſopher ſtripped the germs of a great number of beans, and a variety of other ſeeds, of their external coverings, and placed them naked in the ground. Of

all

all that he treated in this manner, only three beans vegetated, not in the uſual way, but very imperfectly. *Vide Malpighii Opera*, Tom. I. p. 109. It is evident then, from the experiment of the Italian philoſopher, that the juices of the earth, though fit for the nutrition of maturer plants, are inſufficient to awake the latent energy of their germs. But, if the ſeeds be planted in the earth unmutilated, theſe juices are imbibed by their ſeed-lobes, and there receive the impregnation which is neceſſary for the vegetative proceſs; the atmoſpheric air, which contributes ſo much to the change in their compoſition, having free acceſs to the ſeeds, through the pores of the ſoil, as may be ſafely inferred from the firſt experiment. It is highly probable, that the germs of the beans which attempted to vegetate, were not perfectly freed from the farinaceous matter; they therefore ſprouted, but withered ſoon after, for want of proper nouriſhment.

TO BE CONTINUED IN OUR NEXT.

VII.

VII. *Description of an improved Packing-Press. By Mr.* JOHN PEEK, *of the New Road, near the 'Adam and Eve.*

WITH A PLATE.

From the TRANSACTIONS of the SOCIETY for the Encouragement of ARTS, MANUFACTURES, and COMMERCE.

A reward of Thirty Guineas was voted to Mr. PEEK for this Improvement.

I HAVE been a good deal accustomed both to packing and making packing-presses; and, from the experience I have had, it seems to me that the packing-press here described would be a very material improvement on that machine, as it would render the operation much less laborious, and expedite the business very much.

One

One very conſiderable improvement is, that much time would be ſaved by its being a double-preſs; for it will very readily be perceived, that when the lower package has been ſufficiently preſſed, as the bed or preſſer is raiſed, (another package being thereon,) the upper package begins to be preſſed, as that one underneath is relieved, and ſo alternately, during the whole operation.

References to the Figure of the Press.

(See Plate III.)

A A. The frame of the preſs.

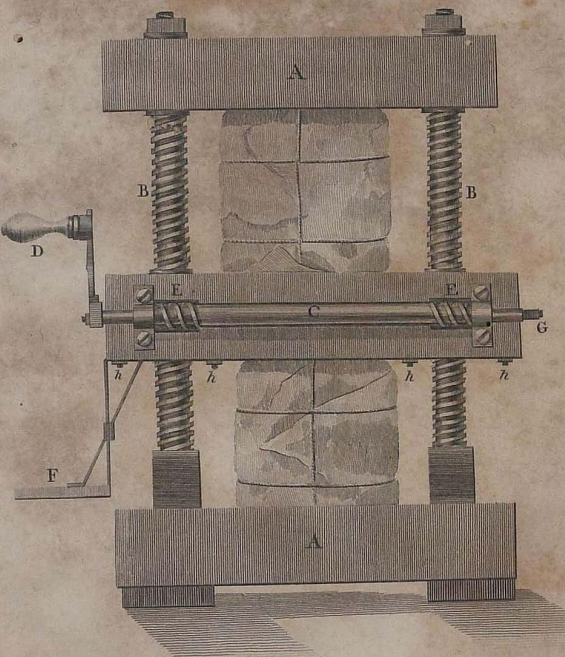
B, B. The large ſcrews, which, in this preſs, contrary to thoſe in common uſe, are fixed and immoveable.

C. A circular iron bar, extending beyond the ſides of the preſs, and having thereon two worms or endleſs ſcrews, E, E, which work in two toothed wheels fixed to the nuts. By turning the winch D, the nuts and bed are driven up and down the ſcrews, as may be found neceſſary.

F. A ſtage, ſuſpended from the bed, and on which the men ſtand who work the preſs: ſuch a ſtage may, if found neceſſary, be fixed at the other end of the bar, another winch being put upon the ſquare ſhoulder, G.

The bed of this preſs muſt be formed of two pieces of ſtrong wood, which are held together by ſcrews and nuts, paſſed through them, as ſhewn at *h*, *h*, *h*, *h*.

VIII.


A
B
B
D
E
E'
C
G
h
h
h
h
F
A

VIII. *Account of an Experiment made to diſcover whether whole Potatoes or Cuttings are preferable for planting, with ſome Obſervations on taking up Potatoe-Crops. By Mr.* JOSEPH WIMPEY, *of North-Bockhampton.*

From the Letters and Papers of the Bath and Weſt-of-England Society for the Encouragement of Agriculture, &c.

EARLY in the ſpring of this year, I had a large quantity of potatoes, out of which I ſelected forty-eight-buſhels of the faireſt for ſets. The ground intended for them, the ſummer before, had borne oats and vetches, which were mowed green, and given to the horſes in the ſtables; after which, it was depaſtured till January. It was then clean ploughed, and lay till the end of March. Twenty-four cart-loads of long dung, forty buſhels to the load, were then ſpread over

it equally; and furrows were drawn the length-way of the field, at a yard diſtance from each other. In eleven of theſe furrows, containing ſixty perches or poles, were dropped fourteen buſhels of whole or uncut potatoes, the ſize generally from a large pullet's egg to that of a gooſe. The remainder of the ground, being 265 poles, (making in the whole 325 poles, or two ſtatute-acres and five poles,) was planted with thirty-four buſhels of cut potatoes, being the remainder of the forty-eight buſhels. Theſe were cut moſtly out of large potatoes, in pieces about the ſize of a large pullet's egg. The largeſt were cut into ſix or eight pieces, the leſs into four; being careful to preſerve a proper number of eyes or buds in each cutting. The ſets of both cut and uncut were planted about fourteen inches aſunder, in the rows. The furrows were turned out with a plough having a double mould-board, and, when planted, were completely covered, by running the ſame plough up the middle of each interval, which threw the mould half one way and half the other; this is the ſpeedieſt, eaſieſt, and cheapeſt method of planting I am acquainted with.

with. The ground was planted the 14th and 15th days of April.

In June they were horſe-hoed, with a ſmall one-wheeled plough, which I keep for horſe-hoeing; and this was all the labour and expence beſtowed upon them during their growth.

The 30th of October, the taking of them up was completed. The whole produce was only 378 buſhels; a very indifferent crop! little more than half the produce *per* acre of laſt year. The expence of ploughing them up, harrowing, dragging, picking up, loading, carrying home, (about a quarter of a mile,) unloading, and carrying into the barn, &c. was not quite three pence a bag, or one penny a buſhel. The ſtate of the account, in a comparative view, I make out as follows.

The meaſure of all the ground planted was 325 poles: the whole produce was 378 buſhels. The meaſure of the ground planted with *cut* potatoes was 265 poles: the produce 312 buſhels. The ground planted with whole or *uncut* ſets was 60 poles; and the produce of the ſame was 66 buſhels.

Now, if 325 poles, the whole meaſure of the ground planted, produced 378 buſhels, then 265 poles ſhould produce 308 buſhels, (I omit the fractions;) but this quantity of ground, planted with cut potatoes, produced nearly four buſhels more, that is, 312 buſhels. Again, as 325 poles produced 378 buſhels, 60 poles ſhould have produced 69 buſhels and a fraction; but it produced only 66 buſhels, which is upwards of three buſhels ſhort of its proportion. It is true, the difference is too trivial to be worthy of notice; but what it is is in favour of the cut potatoes. With reſpect to the produce *per* acre then, it is a matter of little importance whether the ground be planted with *cut* or *uncut* potatoes.

The produce *per* acre being nearly the ſame, whether planted with whole or cut potatoes, the great and intereſting comparative queſtion remains, *viz.* What is the difference of the expence in the planting of cut or uncut potatoes? this is very ſatisfactorily aſcertained as follows.

If 48 buſhels, the whole quantity of ſets uſed, produced 378 buſhels, then 34 buſhels, the quantity

tity cut, ſhould produce 267 buſhels; but they produced 312, which is 45 buſhels more than the proportion. Again, if 48 buſhels produced 378 buſhels, then 14 buſhels ſhould have produced 110 buſhels; but 14 buſhels of uncut produced only 66 buſhels, which is 44 buſhels leſs than the proportion. A preference of 40 *per cent.* in favour of cut potatoes, in compariſon with whole ſets!

By this ſtatement it clearly appears, that any quantity of land planted with potatoes cut into pieces of the ſize above-mentioned, will, *cæteris paribus*, produce as great a crop as an equal quantity of land planted with uncut potatoes, the weight of which ſhould be 40 *per cent.* more: for example,

To plant a ſtatute-acre with potatoes, as above, would require, of uncut, 37½ buſhels; of cut, only 20½ buſhels; the difference nearly 17 buſhels; which, at two ſhillings and four pence *per* buſhel, (the price they ſold at in March and April laſt,) amounts to 1 *l.* 19 *s.* 8 *d.* An object much too conſiderable to be neglected by the planter

planter of many acres, even when the price may be as low as three ſhillings a ſack.

N. B. Potatoes in this country are uſually ſold by the bag. By a bag is underſtood a ſack which will hold four buſhels of corn, nine-gallon meaſure, which they fill as full as they can, leaving room to admit of its being tied; and the uſual weight is 12 ſcore or 240lb. This ſack holds three buſhels of potatoes heaped.

The foregoing experiment was conducted with all imaginable care and preciſion; the facts are truly ſtated, and the writer hopes the calculations are juſt.

P. S. In claſs 3, article 4, a premium is offered to the inventor of the beſt new-conſtructed plough for ploughing up potatoe-crops, by which the work may be done with the leaſt loſs, or damage to the crop. As my method of taking up potatoe-crops is not attended with the leaſt loſs or damage, and is, I conceive, as expeditious and as little expenſive as can be deſired, I requeſt leave to lay it before the Society.

As obſerved before, I plant my potatoes in rows, with intervals of about three feet, for the

the convenience of horſe-hoeing them. When the haulm is decayed, I proceed to take them up in the following manner, with a common foot or one-wheel plough, much uſed in this part of Hants, and in Wilts; the ploughman (having firſt taken out the coulter, and adjuſted the wheel ſo that the point of the ſhare may be deep enough to paſs under the bed of potatoes) begins at one end, juſt under the middle of the row, and with one furrow turns them out on the ſurface of the ground. Two or three boys or girls follow the plough, and pick them up as they appear; ſo that the ground of one row is cleared before the ploughman has finiſhed another; and thus they proceed, without the leaſt hindrance or interruption to each other.

When the whole is ploughed and picked in this manner, a pair of drags is run over the whole, which ſeparates and expoſes the potatoes that may happen to adhere to the clods of earth, which are then alſo picked up, and the ground nearly cleared. The ſeaſon being now come for ſowing wheat, the ground is clean ploughed, and the

the few potatoes that may poſſibly remain fully expoſed to view, which being alſo picked, the ground is rendered very clean. In this way, the whole expence of harveſting the crop is little more than picking up and carrying home; for the expence of ploughing, &c. is little, if any, more than would have been incurred in tilling the ground equally well for the wheat-crop.

Now I think it impoſſible, by any invention or device whatever, to take up a potatoe-crop with leſs loſs or damage. The crop of the above experiment was taken up under my own eye; and I can with great truth and confidence aver, that there was not ſo much as a ſingle gallon bruiſed, cut, or damaged, in any degree whatever.

IX.

IX. *On the Duration of the Wood of different Kinds of Trees, in their different Application, when expoſed to the Weather. By Sir* THOMAS BEEVOR, *Bart. of Hethel-Hall, Norfolk.*

From the Letters and Papers of the Bath and Weſt-of-England Society for the Encouragement of Agriculture, &c.

AS the raiſing plantations of trees is not only an object of great national concern, but falls likewiſe within the compaſs of the Society's plan to encourage; and as the value and duration of the ſeveral kinds of them, in their different applications and uſes, is a ſubject of much utility, as well as curioſity; I ſhall give a ſhort account of an experiment made on ſome of them, by a worthy friend of mine, a nobleman of this county, who is as much diſtinguiſhed for his thirſt after, and

poſſeſſion of, claſſical and philoſophical knowledge, as he is honoured and beloved for his extenſive philanthropy.

Wiſhing to know the duration of ſome of the trees with which his noble plantations abound, he ordered, in the year 1774, three poſts, forming two ſides of a quadrangle, to be fixed in the earth, upon a riſing ground, in his park. Into theſe poſts were mortiſed planks of the following trees; of which, ſix faced ſouth and north, and ſix eaſt and weſt. In the firſt were put planks of Cedar, Larch, Spruce Fir, Silver Fir, Scotch Fir, and Pineaſter. In the ſecond, planks of Spaniſh Cheſnut, Abele, Beech, Walnut, Sycamore, and Birch.

Theſe, after being expoſed to the injuries of the weather, from the year 1774 until laſt March, (1784.) the time at which I viewed them, were then found to be in the following ſtate and condition.

The Cedar was perfectly ſound.

The Larch, the heart ſound, but the ſap quite decayed.

The

The Spruce Fir, ſound.

The Silver Fir, in decay.

The Scotch Fir, much decayed.

The Pineaſter, quite rotten.

The Cheſnut, perfectly ſound.

The Abele, ſound.

The Beech, ſound.

The Walnut, in decay.

The Sycamore, much decayed.

The Birch, quite rotten.

Theſe planks were cut out, an inch and a half thick, from trees of thirty years growth.

The above-mentioned appearances, in ſome inſtances, much diſappointed my expectation. However, thus I found them; and, as every experiment of this kind may be ſo eaſily conducted by any body, I hope it will be again and again made, upon an enlarged plan, with additional trees, of different ages, abroad, and under cover; whereby the moſt profitable application of them may be fully aſcertained.

You will find, by the date of my letter, that I have kept it ſome time ſince it was written. The

delay, however, has enabled me to ſet right one fact contained in it. I was laſt week at Houghton, and, wiſhing to ſee that my account was true in every particular, on queſtioning the ſteward, I found, to my mortification, that, in ſome of the woods above mentioned, there was a difference, of ten or fifteen years, in the growth of the trees from which the planks were cut. Though, for the ſake of truth, I was glad to make this diſcovery; yet, I am ſorry to find, that it leſſens, in ſome degree, the value of the experiment.

X.

X. *On the Means of promoting the Growth of young Fruit-Trees, particularly in Graſs-Land. By the Rev. Mr.* GERMERSHAUSEN.

From the TRANSACTIONS of the ŒCONOMICAL SOCIETY of LEIPSIC.

WHEN young trees ſtand in graſs-land, or in gardens where the earth is not dug up every year around them, and freed from weeds, they do not at firſt encreaſe properly in growth, and will not thrive ſo well as thoſe which have been planted in cultivated ground. It has been remarked alſo, in orchards, that the more the ground becomes graſſy, and, as it were, converted into turf, the fruit is ſmaller and not ſo well taſted. The latter circumſtance takes place particularly with regard to plums.

Having

Having planted ſeveral young plum-trees, I covered the ground, for ſome years, around the trunks, as far as the roots extended, with flax-ſhows *, by which means theſe trees, though in a graſs-field, encreaſed in a wonderful manner, and far excelled others planted in cultivated ground. As far as the ſhows reached, the graſs and weeds were choaked; and the ſoil under them was ſo tender and ſoft, that no better mould could have been wiſhed for by a florift.

When I obſerved this, I covered the ground with the ſame ſubſtance, as far as the roots extended, around an old plum-tree, which appeared to be in a languiſhing ſtate, and which ſtood in a graſs-field. The conſequences were, that it acquired a ſtrong new bark; produced larger and better-taſted fruit; and that thoſe young ſhoots which before grew up around the ſtem, and which it was every year neceſſary to deſtroy, were prevented from ſprouting forth, as the covering of flax-ſhows impeded the free acceſs of air at the bottom of the trunk.

* Shows are the refuſe of flax when it is ſcutched or heckled.

Laſt

Laſt year (1793) I tranſplanted from ſeed-beds, into the nurſery, ſeveral fruit-trees; the ground around ſome of which I covered, as above, with flax-ſhows. Notwithſtanding the great heat of the ſummer, none of thoſe trees where the earth was covered with ſhows, died or decayed; becauſe the ſhows prevented the earth under them from being dried by the ſun. Of thoſe trees around which the ground was not covered, as before mentioned, the fourth part miſcarried; and thoſe that continued alive were far weaker than the former.

The leaves which fall from trees in autumn may alſo be employed for covering the ground, in like manner: but ſtones, or logs of wood, muſt be laid on them, to prevent their being diſperſed by the wind. In graſs-land, a ſmall trench may be made around the roots of the tree, when planted, in order to receive the leaves. If flax-ſhows are uſed, this is not neceſſary; they lie on the ſurface of the ground ſo faſt as to reſiſt the force of the moſt violent ſtorm. The leaves which I have found moſt effectual, in promoting the growth

growth and fertility of fruit-trees, are thoſe of the walnut-tree. Whether it is, that, on account of their containing a greater abundance of ſaline particles, they communicate manure to the ground, which thereby becomes tender under them; or that they attract nitrous particles from the atmoſphere; or that, by both theſe means, they tend to nouriſh the tree, both above and below.

Thoſe who are deſirous of raiſing tender exotic trees from the ſeed, in order to accuſtom them to our climate, may, when they tranſplant them, employ flax-ſhows with great advantage. This covering will prevent the froſt from making its way to the roots; and rats and mice, on account of the ſharp prickly points of the flax-ſhows, will not be able to ſhelter themſelves under them.

XI.

XI. *Account of ſome Experiments on the Exploſion of the ſuper-oxygenated Muriat of Pot-Aſh. By MM.* FOURCROY *and* VAUQUELIN.

FROM THE *ANNALES DE CHIMIE.*

THE violence and rapidity with which the ſuper-oxygenated muriat of pot-aſh inflames, and burns the greateſt number of combuſtible ſubſtances, have given riſe to the following experiments. Many chemiſts had already obſerved that this ſalt (which was diſcovered by Berthollet, about nine years ago, and which ſeems to contain within itſelf the elements of the phænomena of thunder), decrepitated, threw out ſmall electric ſparks when rubbed, and ſet fire to ſulphur. An unfortunate experiment, made at Eſſonne, had alſo ſhewn that this ſalt, when ground with charcoal and ſulphur, for the purpoſe of making gunpowder, took fire of itſelf. Such were the firſt obſervations made by MM. Lavoiſier, Pelletier, and Van Monge, when MM. Fourcroy and Vau-

quelin undertook to investigate the effects of the super-oxygenated muriat of pot-ash upon the various known combustible substances. The following are the principal facts they have discovered.

1. Three parts of super-oxygenated muriat of pot-ash, and one part of powdered sulphur, rubbed together in a metal mortar, produce numerous successive explosions, resembling the smacking of a whip, or even as loud as the report of a pistol or musket, according to the rapidity of the motion, and the force of the pressure, made use of. A few grains of the same mixture, by being struck smartly upon an anvil with a hammer, occasion a report equal to that of a musket; and torrents of purplish light are seen about the anvil. If this mixture be thrown into concentrated vitriolic acid, it instantly takes fire, and burns, without noise, with a flame of a dazzling whiteness.

2. A mixture of three parts of this salt, half a part of sulphur, and half a part of charcoal, causes stronger explosions than the preceding, when rubbed in a mortar; and a louder noise, when

when ſtruck upon an anvil. Its flame alſo, when the mixture is made to explode, or when it is thrown into vitriolic acid, is more rapid, more lively, and of a redder colour, than that of the preceding.

3. A mixture of equal parts of ſuper-oxygenated muriat of pot-aſh and antimony in powder, explodes with noiſe, by percuſſion; but produces only reddiſh ſparks, when thrown into vitriolic acid. If zinc be ſubſtituted in the place of antimony, a ſimilar exploſion takes place, accompanied by a white flame. Vitriolic acid has no effect upon this laſt mixture.

4. With regulus of arſenic, this ſalt explodes very violently by the ſtroke of a hammer; it inflames, with ſingular rapidity and brilliancy, by the contact of vitriolic acid. In this laſt experiment there ariſes a ſmoke, which, in the air, takes the form of a crown; in the ſame manner as phoſphorated hydrogenous gas does, when it inflames ſpontaneouſly in a ſtill atmoſphere.

5. Sulphuret of iron or martial pyrites inflames rapidly, but without noiſe, when rubbed in a metal mortar with ſuper-oxygenated muriat of

pot-ash: this mixture, when struck upon an anvil, explodes violently, and with a red-flame.

6. The red sulphuret of mercury or cinnabar, and the sulphurated calces of antimony, explode with the super-oxygenated muriat of pot-ash, by percussion, but they do not inflame by vitriolic acid. The same thing happens when charcoal alone is mixed with this salt.

Any of the following substances, namely, sugar, gums, oils, (both fixed and volatile,) alcohol, ether, when mixed with super-oxygenated muriat of pot-ash, have the property of exploding very violently by the stroke of a hammer, and all of them send forth a brisk flame, at the time of their explosion: the liquid combustible substances above mentioned are to be mixed with the salt, in such a manner as to form a kind of paste. None of these mixtures explode or inflame by being rubbed in a mortar; but some of them inflame by being mixed with concentrated vitriolic acid, their combustion being slow and progressive.

8. All the substances above mentioned, which, being mixed with the super-oxygenated muriat of pot-ash, take fire and burn instantly, and with considerable

conſiderable noiſe, by the quick preſſure of the ſtrokes of a hammer, produce a much ſtronger exploſion when they are ſo cloſely wrapped up in paper, two or three times doubled, as to be thereby compreſſed, before they are ſtruck.

9. An electric ſhock from a battery of large ſurface, charged by a ſtrong electric machine, cauſes all the fore-mentioned mixtures to explode, in the ſame manner as percuſſion, and their exploſion is alſo accompanied by a bright light.

To the above-mentioned facts, the authors add, that it was already well known, that gunpowder would explode by a violent blow, or very ſtrong preſſure; but, they obſerve, that the ſtroke, which is neceſſary for that purpoſe, muſt be much ſtronger than that which ſuffices to produce an exploſion in the above-mentioned mixtures of combuſtible ſubſtances with the ſuper-oxygenated muriat of pot-aſh; and that its exploſion is by no means ſo remarkable, as that which is produced by the help of this new ſalt.

With reſpect to the theory of this ſingular phænomenon, it appears to them ſimilar to that which M. Berthollet has already given, relative

to

to that explosion which takes place in fulminating silver, by the slightest contact. Pressure, particularly that which is made very rapidly, as is the case when it is caused by percussion, favours the union of oxygen with combustible substances. This combination, arising from the oxygen which is suddenly separated from the super-oxygenated muriat of pot-ash, is accompanied by a quick dilatation, and instantaneous formation of gaseous substances, which strike and compress the surrounding air, with such velocity as to occasion a considerable noise. The light, the vapour, and the particular smell, of every combustible body made use of, prove that a real inflammation takes place, and that the explosion which ensues is the consequence of its violence and rapidity.

The inflammation produced by concentrated vitriolic acid proceeds from the disengagement of super-oxygenated muriatic acid, in the form of gas; in the midst of which, the combustible matters, mixed with the salt, take fire more rapidly than they do in common oxygenated muriatic acid.

XII.

XII. *List of Patents for Inventions, &c.*

(Continued from Vol. VII. Page 432.)

GEORGE HODSON, of the city of Chester; for an improved method of separating the fossil or mineral alkali from various substances. Dated February 23, 1797.

THOMAS OXENHAM, of Oxford-street, Mangle and Press Maker; for a portable lever-mangle, for calendering linen, &c. Dated February 28, 1797.

JOHN SILVESTER, of the parish of St. Pancras, in the county of Middlesex, Millwright; for a method of mashing and mixing malt, and all kinds of grain, for the purpose of brewing and distilling. Dated March 9, 1797.

HENRY GOODWYN, of Lower East Smithfield, in the county of Middlesex, Porter-Brewer; for mixing and mashing malt, and all kinds of grain used for the purpose of brewing and distilling, by means of an improved mash-tun and mashing-machine. Dated March 9, 1797.

WILLIAM

WILLIAM SELLARS, of Briſtol, Manufacturer; for machines for drawing out wool or flax, combed by hand, into a perpetual length or ſliver, &c. Dated March 11, 1797.

WILLIAM SIDDON, of Weſt Bromwick, in the county of Stafford, Gun-lock-maker; for a method of ſcrewing and faſtening the hammer-ſprings and ſear-ſprings to gun-locks and piſtol-locks. Dated March 14, 1797.

EDMUND BUNTING, of Pittman's Buildings, Old-ſtreet; for a method of producing a forward and retrograde motion, capable of being applied to mangles, pumps, calenders, rolling-preſſes, &c. Dated March 25, 1797.

ROBERT BARBER, of Bilborough, in the county of Nottingham; for an improvement on the machine called a ſtocking-frame, otherwiſe the gigger ſtocking-frame. Dated March 25, 1797.

JOSEPH BARTON, of Biſhopſgate-ſtreet, London; for preparing indigo for dying wool, ſilk, linen, cotton, &c. Dated March 25, 1797.

JOHN PASSMAN, of Doncaſter, in the city of York; for an improvement in machinery for drawing, roving, and ſpinning, wool, hemp, flax, ſilk, mohair, &c. Dated March 25, 1797.

REPERTORY OF ARTS AND MANUFACTURES.

NUMBER XLIV.

PRINTED BY JOHN NICHOLS, RED LION-PASSAGE, FLEET-STREET.

XIII. *Specification of the Patent granted to Mr.* WILLIAM SABATIER, *of the Pariſh of St. Mary-le-bone, in the County of Middleſex, Gentleman; for his Invention of a certain improved Method of retaining Cotton, Tobacco, Hemp, Flax, Hops, Hay, and other Articles, in nearly the ſame Compaſs in which they can be compreſſed by any Machinery now in uſe, or which may be hereafter invented for great Compreſſion, without being liable, as they are at preſent, to any material Expanſion after they are removed from the ſaid Machinery; by which, they will not only be kept in their origi-*

nal, native, or improved Excellence, but they will occupy a much ſmaller Space than can be effected by any other Method now in Uſe, and may conſequently be imported, exported, ſtored, removed, at a decreaſed Price of Freight, Carriage, or Warehouſe-Rent.

WITH A PLATE.

Dated July 4, 1796.

To all to whom theſe preſents ſhall come, &c. Now know ye, that in compliance with the ſaid proviſo, I the ſaid William Sabatier do hereby declare, that my ſaid invention is deſcribed in the plan and deſcription thereof hereunto annexed. In witneſs whereof, &c.

Specification of a Principle and Method invented by William Sabatier, *for retaining certain Articles in a much leſs Space than has hitherto been practiſed.*

The moſt perfect bale, or other package, for ſtowage, is cubical, or oblong; and, if the article

ticle can be prevented from expanding in an eſſential degree, the invention is complete. Theſe are the objects I have in view.

The Principle.

All bodies that are pliable or elaſtic, are more ſo when a force is exerted againſt them ſideways, than when that ſame force is exerted to draw them lengthways; for example, a bar of iron, or other the like body, ſupported at each end, eaſily gives way to a force exerted againſt it ſideways; but if the force is applied to each end, and it is drawn in contrary directions, it will not ſo readily give way. If, however, we make uſe of a rope, or even a piece of thin iron, round a bale, or caſk, though it is drawn lengthways, that does not happen, until the ſide-operation has brought it nearly, or entirely, into the ſhape of a circle; but then a circle contains much leſs than a ſquare of the ſame diameter, and yet, in ſtowage, will occupy nearly the ſame

ſpace. I have alſo found, from experiment, that after compreſſure, the efforts which cotton, tobacco, hemp, flax, hops, hay, and other articles, make to expand, are almoſt ſolely in the contrary direction in which they are compreſſed. If they are compreſſed in a ſquare box or caſe, they will aſſume the ſhape of a ſquare; though the box or caſe be afterwards removed, they will ſtill continue, whilſt the preſs is on them, nearly in the ſame ſhape as before. To retain them thus, after the preſs is removed, I apply iron, or any other body which has little or no elaſticity when drawn lengthways, in ſuch a manner as to place the force of the expanſion upon it in that direction; the method of doing which is as follows.

The Method. (See Plate IV.)

A, repreſents the opening of the box; here the article is put in: its ſtrength muſt be in proportion to the power which is exerted. This box, where one is neceſſary, and the nature of the article will admit of it, ſhould be perforated with abundance

abu dance of holes, to let the air out; and muſt open readily, at that place where the bale or package is to be taken out.

a, *a*, *a*, *a*, are ſtrips of wood, or iron, which go from the top to the bottom of the box, and are faſtened to two of the ſides, and ſerve to make four grooves in the bale or package, to lay the links *(f)* in.

B and C are two boards, which are made exactly alike; but B repreſents one ſide, and C the other.

b, *b*, are two triangular battens, which ſerve the double purpoſe to ſtrengthen the boards, and to connect them when there are more pieces than one.

c, *c*, are ſmall grooves, near the edges of the upper ſides of the boards, which ſerve to lay the bolts *(g)* in, to prevent their ſlipping off.

d, ſhews one edge of the boards, and the ends of the battens.

e, ſhews the other edge.

f, ſhews the form of the iron links; but, no doubt, cane, or any other ſuch article, may be uſed,

uſed, but not with ſuch ſafety, or effect. They are put in grooves formed by *a*, *a*, *a*, *a*.

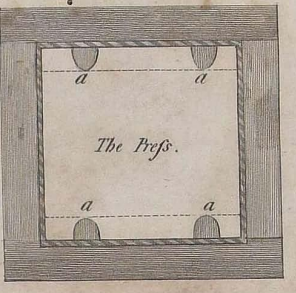
g, ſhews the iron bolts, which go through the eyes of the links, (*f*), and lie in the grooves, (*c*, *c*.)

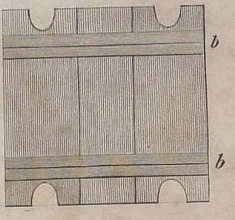
D, repreſents a bale complete; with the bolts, (*g*,) links, (*f*,) and the boards B and C, in their places.

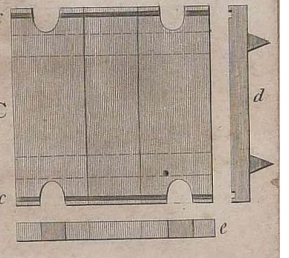
Note, there are four links, four bolts, and two boards, to each package or bale.

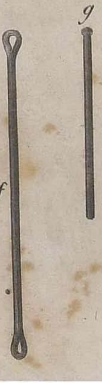
When a bale is to be made, place a board, as B, at the bottom of the box; then throw in the article; then put the board, laid as C, on it; then preſs low enough to put on the irons, and two or three inches more; then open the box and put the irons on: let go the preſs gently, and the bale is finiſhed.

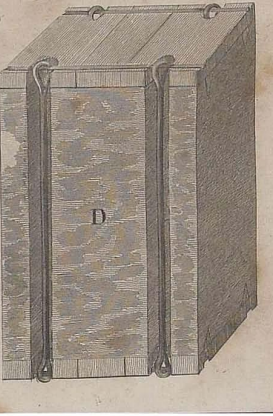
XIV.


A
a
a
The Press.
a
a


B
b
b


c
C
d
c
e


g
f


D

XIV. *Specification of the Patent granted to* ARCHIBALD, *Earl of* DUNDONALD; *for his Invention of a Method or Methods of preparing certain Salts, Saline Matters, and other Substances, capable of being applied to sundry useful Purposes, particularly to the Purposes of Agriculture or Improvement of Ground, and to the Destruction of Insects.*

Dated March 11, 1795.

TO all to whom these presents shall come, &c. NOW KNOW YE, that I the said Archibald, Earl of Dundonald, in compliance with the said proviso, do hereby describe and ascertain the nature of my said invention, and declare that my method or methods of preparing and manufacturing certain salts, saline matters, and other substances, capable of being applied to sundry useful purposes, particularly to the purposes of agriculture or improvement of ground, and destruction of insects,

inſects, are fully deſcribed in this ſpecification, in manner following.

Preparation of Coal-Tar, as a Manure. Take clay, loam, or mould, as free as poſſible from gravel or ſtones, and make it, by the means of water, into a thick puddle or *ſlip*, as it is called by the potters; into this ſlip pour the requiſite quantity of coal-tar, coal-pitch, or eſſential oil of coal-tar, and mix it or them intimately with the ſlip or puddle, by the means of a paddle or plunger. The mixture is then to be allowed to dry, to a certain degree, in the pit or hole in which it had been prepared; it is then to be taken out, and dried, either in the air or under a ſhed: when dried, the mixture has the appearance of a dark-coloured bluiſh or blackiſh clay or earth. To render it fit to be ſown or ſpread on ground, it ſhould be broken, bruiſed, or cruſhed, to the ſtate of a moderately-fine powder.

The excluſive preparation and application of coal-tar, in the method above deſcribed, to the purpoſes of agriculture, or to promote vegetation, as well as for the deſtruction of inſects, is claimed by me under theſe patents.

Proceſs

Proceſs ſecond. *For making and collecting Soot from Pit or Foſſil Coal, for the Purpoſe of Manure for Ground, or for other Purpoſes; preparing, at the ſame Time, Coak, an Article to be uſed for ſmelting Iron, or other Metals, calcining Limeſtone, or burning Bricks; or which may be uſed as a Manure, in different States of Preparation.* Let a building or veſſel be conſtructed or prepared, of a proper depth and width, ſomewhat ſimilar to the conſtruction of the kilns or ovens uſed by me for making coal-tar, having a grate at the bottom, an aperture at the top, and an opening or door at the ſide, for putting in or taking out the coal, coak, or ſoot. The kiln or veſſel is then to be charged with coal; building up or ſecuring the door-way as the charging of the kiln advances; putting in the remainder of the charge at the hole at the top, which ſhould be made no wider than to allow of the charge being put in, and which, when the charge is in, ſhould be farther contracted by a plate or cover; making perhaps the exit, paſſage, or vent, for the ſmoke, to communicate with a flue or paſſage, either per-

pendicular, horizontal, or oblique, as the proceſs, and the condenſation or collecting of the ſoot, may require. The kiln, thus conſtructed and charged, is then to be kindled at the top, by putting on the raw coals a proper quantity of live or kindled coals, or other ignited fuel; the fire will ſink downwards, as it is ſupplied with air from below, by the means of the fire-grate and paſſage communicating with the external air, or by the means of lateral air-holes or pipes, ſuch as are uſed in the kilns invented by me for the diſtillation of coal-tar. The proceſs I am now deſcribing may be termed a kindling, igniting, coaking of coal, and preparation of ſoot, *per deſcenſum*; in which proceſs, as the volatile alkaline gas, marine acid gas, and carbonic acid gas, are formed or diſengaged from the coals in a ſtate of ignition, theſe gaſes extinguiſh the fire or heat in the ſuper-incumbent ſtratum of coak, and are in part abſorbed by the coak, while the ſoot or ſuliginous matter of the coal condenſes upon, or adheres to, its ſurface. By this means, both coak and ſoot are preſerved for their reſpective uſes. So ſoon as

the

the operation is finiſhed, by the fuel having become properly ignited at the bottom of the kiln or level of the fire-grate, the kiln ſhould be damped, ſo as to extinguiſh the live coals at the bottom of the kiln. This may be done by ſteam, or water, or by cutting off the communication with the external air: were this precaution neglected, the fire would again aſcend, rekindle the coak, and conſume both ſoot and coak. When the kiln has been properly damped, and the fire extinguiſhed, the charging-door is to be opened, the charge to be taken out, and the coak ſeparated from the ſoot. The ſoot is to be uſed or applied as a manure for ground; while the coak may be uſed for the purpoſes already deſcribed; or as an article of manure, when ground, and applied by itſelf, or mixed with, or forming a part of, alkaline, calcareous, or magneſian hepars.

Proceſs third. *The next Invention or Diſcovery I claim under theſe Patents, is a Method of rendering Foſſil Coal, and inert vegetable Matter or Peat, ſoluble in Water, by the Means of Vegetable, Mineral,*

and Volatile Alkaline Salts, and their Hepars; these Alkalies and Hepars being prepared according to the Processes for which I have obtained his Majesty's Letters Patent. Take fossil coal, in the state fit to be acted upon, here called oxygenated coal: or take turf or peat, particularly that part of the turf or peat which has been a sufficient length of time exposed to the action of the air, and has become oxygenated. To the coal or peat thus described, add the necessary proportion of the above-mentioned alkaline salts, or their hepars. Mix them intimately, either with or without water, with or without the application of heat, with or without lime or calcareous earth. Apply this article as a manure to ground, in the proportion which shall be found requisite.

Process fourth. *Method of disengaging Ammoniac or Volatile Alkali, from Peat or decayed inert Vegetable Matter.* Take peat, and grind or reduce it to powder: let it be intimately mixed with a due proportion of lime, which has been newly slaked, and reduced to an extremely fine powder. The reduction of the lime to this fine powder,

der, and its effects in acting on the peat, are promoted or increaſed by ſlaking, or boiling, hot lime, newly drawn from the kiln, in an iron or other veſſel, with boiling water. By this means, the lime is fully ſlaked, and reduced to the moſt extreme poſſible diviſion of parts, and is vaſtly more pungent or acrid, to the taſte or tongue, than lime ſlaked in the uſual method. When too great a proportion of water is not uſed in this proceſs, the lime, after the ſlaking is over, and when cooled, becomes quite dry. In that ſtate, it is to be mixed with the peat, in the requiſite proportion; and the peat and lime ſubmitted to heat and diſtillation, in a brick, caſt metal, or other cylinder or veſſel. On a due application of heat, ammoniac or volatile alkali is diſengaged, and may be condenſed and collected in proper veſſels, either by itſelf, or combined with acid gaſes, or other ſubſtances, particularly with peat, when the ammoniac or volatile alkali is intended to be applied as a manure. The lime and peat in the kiln, ſtill, or furnace, may be uſed as a manure; with which view, the proceſs and appli-

cation

cation of heat ſhould not be continued for too long a time; that is to ſay, not ſo long as ſhall have the effect to reduce to carbonaceous matter the vegetable ſubſtance of the peat; in which caſe, the lime, by means of the carbonic acid diſengaged, is returned to the ſtate of a chalk or carbonate of lime.

Proceſs fifth. *Proceſs for ſeparating Ardent Spirit, the Acetous Acid, Volatile Alkali, Empyreumatic Oil, Phoſphat of Lime, Phoſphoric Acid, any or all of theſe Subſtances, with other Subſtances, from Starch-makers Refuſe or Waſte-liquor, or from the Vegeto-animal Matter of Grain, or its Solutions.* Take ſtarch-makers waſte-liquor; add to it (or not, as may be requiſite) a proportion of water. Put the liquor into an iron or other ſtill, and draw off, by diſtillation, the acid: a proportion of ardent ſpirit will come over with the firſt runnings. When the acetous acid has been drawn off, run the liquor remaining in the ſtill into another iron ſtill, to be kept or applied for the purpoſe after mentioned: or uſe the ſame ſtill, as may be thought proper. Mix with the liquor a due proportion of finely-ſlaked

lime, using the addition of water where neceſſary: apply heat, and diſtill off the volatile alkali, adapting proper worms or condenſing-veſſels. Laſtly, there will come over an empyreumatic oil, ſimilar to that procured by the diſtillation of animal ſubſtances. There will remain in the ſtill, or retort, phoſphat of lime, and a proportion of uncombined lime.

Remarks on the above Proceſs, and on the Application of the different Products to different Purpoſes in Agriculture, or in the Arts; from which laſt, I apprehend, theſe Patents will not debar me, although the Patents have been principally taken out under the Title of Manure-Patents; a Name I gave to them, from the principal Uſes or Purpoſes to which the Preparations might be applied. The firſt article obtained in the proceſs is vinegar or acetous acid. This may be applied to the following purpoſes: to the manufacture of ceruſe or white lead; to the preparation of verdegris; to medical and culinary purpoſes; to making acetite of iron, or iron liquor, for the uſes of printing or dying cotton, woollen, or linen cloth; to make the acetite

of

of alumine, or alum preparatory liquor, for dying or printing cloths as above; and for decompoſing vegetable and mineral alkaline ſulphurets or hepars. The volatile alkali may be applied to the ſcouring of wool; to the making of ſal-ammoniac or muriat of ammoniac; to the making of nitrous acid; and to the ſolution of oxygenated peat and coal, for the purpoſes of agriculture. The phoſphat of lime may be applied as a manure to ground, eſpecially when mixed with alkaline ſalts, or alkaline hepars. It may be uſed for making phoſphat of ſoda, and the phoſphoric acid, and phoſphorus, proceſſes too well known to require being deſcribed here. The empyreumatic oil may be applied to different purpoſes, particularly to cleanſing wool.

Proceſs ſixth. *Formation of Calcareous, Magneſian, and Argillaceous or Aluminous Hepar or Sulphuret, from Sulphat of Lime or Gypſum, Sulphat of Magneſia or Epſom Salt, and Sulphat of Argil or Alum.* Take any of theſe ſubſtances, or ſalts or ſubſtances containing any one or more of them, ſuch as alum-ſlam, or refuſe ſalts from the alum-works: let them

them be ground to a powder, and mix with the powder a due proportion of vegetable or carbonaceous matter, or peat. The mixture is then to be put into a covered pot, crucible, ſtill, or furnace, and ſuch a degree of heat applied thereto, as ſhall bring the preparation to the ſtate of a hepar or ſulphuret. Theſe preparations will promote vegetation much more powerfully than they would have done had they not been made into hepars; and, as hepatic vapours, whilſt they promote vegetation, are noxious to animal life, there is the greateſt reaſon to believe, not only on that account, but on account of the very bitter taſte of ſolutions of earthy hepars, that they will deſtroy thoſe inſects which feed on the tender roots and leaves of plants. The above-mentioned preparations of hepar may be conſidered as a valuable improvement on the application to ground of Epſom ſalt, but more particularly of gypſum or plaſter of Paris. This laſt ſubſtance, in its native ſtate, is very inſoluble, whereas the hepar made from it is very ſoluble; and as nothing is capable of promoting vegetation, or,

more properly ſpeaking, of yielding food to plants, but what is capable of ſolution, therefore, the diſcovery of a method, for the uſes of agriculture, of rendering gypſum more ſoluble muſt be reckoned a valuable improvement; promoting the growth of vegetables and plants much more than crude gypſum or plaſter of Paris, a ſubſtance from which, even in that ſtate, ſuch beneficial conſequences have been experienced, in America, Switzerland, and Hungary; of which abundance is to be had in many parts of Britain, and an inexhauſtible ſupply in Nova Scotia; whence it may be ſent to the United States of America, inſtead of their being ſupplied with it from France. In witneſs whereof, &c.

XV.

XV. *Specification of the Patent granted to Mr.* JAMES SPEARS, *of Tilmouth, in the County Palatine of Durham; for his Invention of certain new Improvements in the Conſtruction of Locks.*

Dated Auguſt 25, 1795.

WITH TWO PLATES.

TO all to whom theſe preſents ſhall come, &c. NOW KNOW YE, that in compliance with the ſaid proviſo, I the ſaid James Spears do hereby declare, that my ſaid invention of certain new improvements in the conſtruction of locks, is deſcribed in the plan and deſcription thereof hereunto annexed. In witneſs whereof, &c.

Fig. 1. (Plate V.) View of the lock with the inſide plate off.

Fig. 2. View of the inſide of the lock.

Fig. 3. (Plate VI.) A ſection of the key, ſhewing the pump which produces the action of opening or ſhutting it.

Fig. 4. A view of the work which prevents its being locked or opened, by the action of pumping.

Fig. 5. The inside of the fluted crown, P in Fig. 1, on which the key turns; the form of which can be varied at pleasure, so as to alter the ward-parts of the key.

B 1. (Plate V.) A strengthening bar (*n*, in Fig. 1.) to the bolt, which is moved by the key, and falls into the bolt at L, Fig. 2.

B 2. A plate which covers the aperture through which the catch rises from A to B, Fig. 1.

B 3. The spring which acts on B 1, as represented at I, Fig. 1.

D, D, D, D, D, D. (Plate VI.) The different parts of the key.

O. The pin or spear which passes through the drill-pin *d*, Fig. 1.

N. (Plate V.) The balance-catch. The pin S is centered in the plate, and the end T in the bolt, as at F, Fig. 2.

To open or shut the lock, press gently on the pump in the key, which comes in contact with the pin or spear O, which passes through the drill-

pin

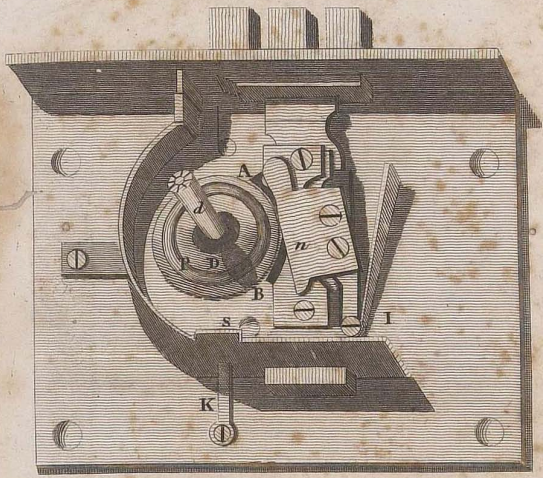
pin *d*, Fig. 1; and, acting upon the balance-catch at *u*, in Fig. 2, raiſes up the catch *i*; (at A or B in Fig. 1;) which, being taken by the key, is moved upon a float, by turning until it comes to C or D in Fig. 2, two ſinks in the plate at each end of the float, into which the catch drops, when the bolt is ſhut by means of the ſpring E, and the key loſes it; ſo that the turning of the key has no effect whatever afterwards in ſhooting or touching the bolt, until the act of pumping is again renewed.

When the key is loſt, or it is thought neceſſary to prevent the opening or locking upon the firſt principle, a ſmall wire or pin, paſſing through the hole S, Fig. 1, on to the ſpring K, and being gently preſſed down, throws the ſpring off the end of the notched-bar W in Fig. 4, at C; when the ſpring Y forces the bar W, with the notch, over the end of the pin O, at S in Fig. 4; which prevents the action of pumping, and conſequently the lock cannot be opened or ſhut, while the bar W remains in that ſituation. To remove this bar, it is neceſſary to preſs the ſame pin or wire on the ſpring K, and paſs a

pin

pin or wire, through the key-hole, into a hole on the crown P, Fig. 1, at D: then, with the wire you put into the key-hole, move round the crown, which has a catch in the inside, R, Fig. 5, which raises up the bar, as represented in Fig. 4, at V; then the spring K comes behind the end of the bar W, at C, and keeps the bar in the situation it is represented in Fig. 4. The plate B 2 covers the aperture A to B, Fig. 1, so close as to prevent the admission of any instrument to pick the lock; which cannot be done without raising up the balance-catch N, and throwing off the bar B 1, which is impossible: the plate B 2 also forms a ward for the key, as represented in the section, Fig. 3, at H.

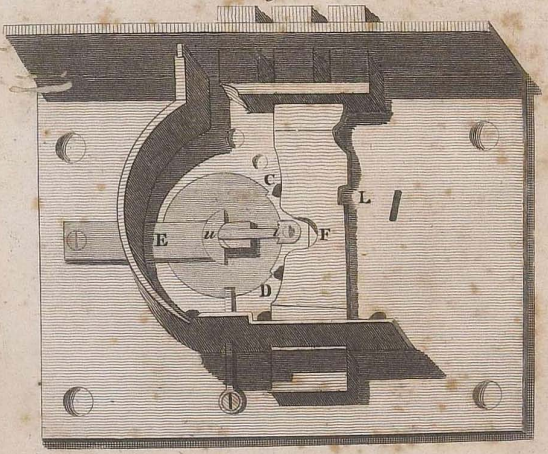
Fig. 1.



B.1.

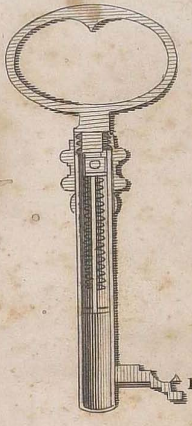
B.2.

Fig. 2.



B.3.

Fig. 3.



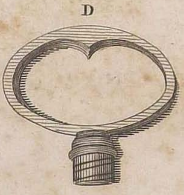


Fig. 4.

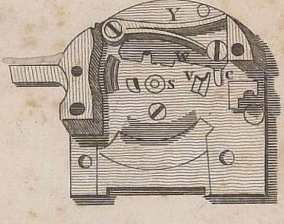


Fig. 5.

XVI. *Specification of the Patent granted to Mr.* WILLIAM BAYLEY, *of the Pariſh of St. Martin in the Fields, in the County of Middleſex, Perfumer; for preparing a Compoſition, in Cakes, Rolls, or Balls, for making liquid Blacking for Shoes, Boots, &c.*

Dated Jan. 17, 1771.—Term expired.

TO all to whom theſe preſents ſhall come, &c. NOW KNOW YE, that in compliance with the ſaid proviſo, I the ſaid William Bayley do hereby declare, that my ſaid invention of preparing a compoſition, in cakes, rolls, or balls, or in any other ſolid form, for making, by the addition of water only, an excellent ſhining liquid blacking for ſhoes, boots, or any leather that requires to be kept black, is deſcribed in the manner following; that is to ſay, take one part of the

the gummy juice that iſſues, in the months of June, July, and Auguſt, from the ſhrub called the Goat's Thorn; four parts of river-water; two parts of neat's foot or ſome other ſoftening lubricating oil; two parts of ſuperfine ivory-black; two parts of deep blue, prepared from iron and copper; four parts of brown ſugar-candy. Let the water be evaporated; and, when the compoſition is of a proper conſiſtence, let it be formed into cakes, of ſuch a ſize that each cake may make a pint of liquid blacking. In witneſs whereof, &c.

XVII.

XVII. *Deſcription of a Greaſing-Machine, to be applied to Water-Wheels. In a Letter to the Editors.*

WITH A PLATE.

THE conſideration, that the great utility of water-wheels renders important the ſmalleſt thing conducive to their improvement, has induced me to offer to the public a ſimple contrivance, applicable to wheels of a certain deſcription, which, after conſiderable experience, I have found very beneficial.

It is obvious, that of the various conſtructions of water-wheels, that is the ſtrongeſt which communicates its motion by means of a ring of teeth immediately attached to its rim; the leaſt poſſible ſtrain being thus thrown on the arms and axle; and, were it not for the hitherto impracticability of keeping the teeth properly greaſed, this

conſtruction would poſſeſs every advantage. But, the teeth being conſtantly wet, greaſe will not adhere, and the uſual mode of occaſional greaſing being thereby of little or no uſe, the ſand in the water is ſuffered to grind away the teeth; or, were the water even free of ſand, there would be much unneceſſary friction, and waſte of power.

I was led to attend particularly to this circumſtance in two water-wheels under my inſpection. Their rings of teeth were wearing very faſt, and, knowing the trouble and expence of renewing them, I was ſolicitous to diſcover ſome means of rendering them more durable; the only way which preſented itſelf was, by ſome contrivance to keep them well greaſed.

I therefore had the greaſer made which I am now to deſcribe, and ſoon found it to ſucceed beyond all expectation; for, beſides preventing the wear of the teeth, it appears to produce a ſaving of water, to a much greater extent than I had imagined; and it has been adopted by ſome of my friends, with equal ſucceſs.

The machine is nothing more than a kind of pinion, with one or more of its teeth made hollow,

low, (to contain a greaſy ſubſtance,) and perforated with ſmall holes, for exudation, in that part which comes in contact with the teeth of the wheel.

The number of leaves in the greaſer ſhould be ſuch, that thoſe containing the greaſe ſhall apply themſelves, in the courſe of ſeveral revolutions of the wheel, to each of its teeth. I found a greaſer of 12 leaves, 4 of which contained greaſe, had this effect upon a wheel of 304 teeth; and one of 13 leaves, with one tooth only filled with greaſe, ſerved a wheel of 168 teeth.

We uſe a mixture of tallow, oil, and black-lead, for greaſing, made of a conſiſtence to feed regularly; and we freſhen it about twice in the week.

The teeth for containing the greaſe are made of plate-copper, or iron; and, to make the perforated ſide of the greaſing-leaves come in cloſe contact with the face of the teeth of the wheel, a lever, with a ſmall weight on it, acts on a pulley fixed on the axle of the pinion, and ſerves to retard it.

Annexed is a drawing of the greaſer, with references, which will ſerve for any farther explanation.

I am, &c.

Rothſay, Dec. 1, 1797.

R. B.

References to the Plate.

(See Plate VII.)

Fig. 1. A. Section of the greaſing-machine.

B. Part of the ring of teeth on the water-wheel.

C. The retarding-lever.

Fig. 2. is a bird's eye view of the machine.

Figs. 1 and 2. *a*, *a*, &c. The hollow teeth for containing the greaſe.

b, *b*, &c. The ſolid teeth made of wood.

c, *c*, &c. Slipboards for admitting the greaſe into the hollow teeth.

Fig. 1.

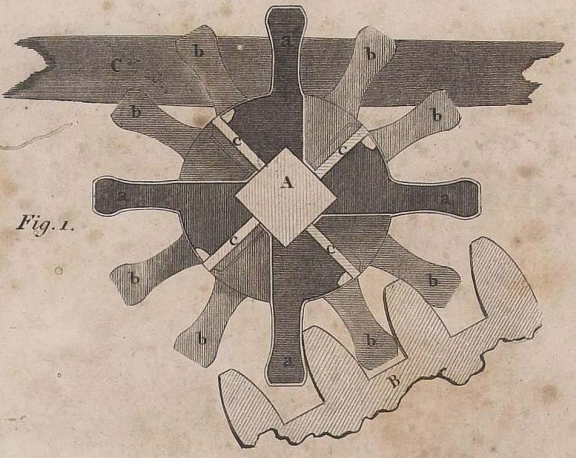
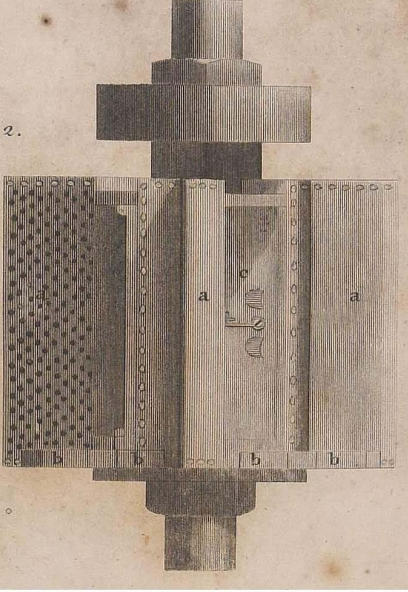


Fig. 2.



XVIII. *Continuation of Mr.* GOUGH's *Experiments and Obſervations on the Vegetation of Seeds.*

(From Page 45.)

EXPERIMENT IX. Having now diſcovered the uſe of oxygen to plants, in the firſt ſtages of their growth, I enquired, in the next place, what would be the conſequence of incloſing ſeeds in azote, after ſaturating them with water. For this purpoſe, I put two equal quantities of ſteeped barley, *viz.* one ounce, one drachm, and thirty grains, into ſeparate bell-glaſſes, where they were ſupported by ſtrainers, as in the ſeventh experiment. One bell was then ſet, with its mouth downwards, on a table, a ſmall bottle of lime-water being placed under it. After filling the other with rain-water, and inverting it in a veſſel of the ſame, I introduced into it ſeven and one-fourth ounce-meaſures

meaſures of air that had been confined more than a week with putrid fleſh, in a veſſel ſtanding in water. The barometer was at the time at 29,81 inches: a thermometer, placed beſide the jars, ſtood at 56°. The lime-water, in the bottle under the firſt glaſs, became turbid in the ſpace of twenty-four hours. At the end of three days, the barley it contained had ſprouted conſiderably, while the parcel in the other jar remained unaltered; nor was the bulk of the azote confined with it encreaſed or diminiſhed perceptibly. The barometer and thermometer ſtanding very nearly at the points ſpecified above, when the bell-glaſs was agitated in water, the incloſed air did not contract in the leaſt; a proof that no carbonic acid gas was mixed with it. The jar being taken out of the water, and cleared of the gas, was placed on the table, with a bottle half full of lime-water under it. In fourteen hours, part of the lime-water was precipitated; and, in ſeventy-two hours, the grain had ſprouted, juſt as if it had never been expoſed to any thing but atmoſpheric air. I repeated this experiment, at another time, with four

four drachms of ſteeped barley, and two ounce-meaſures and a half of air, being part of the reſiduum of a quantity of common air that had been in contact with a ſolution of liver of ſulphur for eight days. The experiment was continued ſix days, without ſhewing the leaſt ſign of vegetation; but, on admitting common air into the glaſs, its contents ſprouted freely. This experiment proves, deciſively, that ſeeds ſaturated with moiſture have no affinity to azotic gas. It alſo appears, that the firſt ſtage of vegetation is analogous to combuſtion and reſpiration; all the three proceſſes depending on oxydation by the atmoſphere. I ſhall cloſe this ſubject with the following remarks.

I. The only inference in this paper which ſeems to be doubtful is, that ſeeds impregnated with water retain a part of the oxygen they abſorb. To determine the matter with more certainty than I have done, the ſixth experiment ſhould be repeated over mercury.

II. It is probable, that ſome hydrogen eſcapes from vegetating ſeeds, combined with carbon; becauſe

becauſe the veſſels uſed in the foregoing experiments retained a peculiar ſmell, even after being waſhed in clean water, but the action of the air deſtroyed it in a few hours.

III. I have found, that ſteeped grain confined, for four or five days, in ſmall quantities of common air, will ſometimes vegetate, and not in other caſes. This, perhaps, is owing to variations in the general temperature; for, when the thermometer ſtands higher than 56°, it is probable that the putrefactive fermentation commences ſooner than when it is below that point. Laſtly, the uſe, and even the neceſſity, of having the ſoil very well pulverized, for the reception of a crop of grain or pulſe, is explained by the preceding facts and obſervations: for, when the turf of a field is reduced to a fine powder, the air finds free acceſs to every part of it; and the ſeeds it contains, being placed in a temperature that is nearly uniform, and ſupplied with a neceſſary portion of humidity from the moiſt ground, are expoſed, in the moſt favourable manner, to the united effects of thoſe cauſes which are intended

by

by nature to promote the growth and profperity of the infant plant.

SECOND PART.

It was remarked, in the concluding paragraph of the former part, that feeds foaked in water, and confined in fmall quantities of air, do not always lofe the faculty of vegetating. At the fame time, it was hinted, that this difference arifes from the changes which are conftantly taking place in the temperature of the atmofphere, and confequently in all bodies furrounded by it. I fhall now endeavour to prove experimentally the truth of what I before advanced as a probable conjecture, by fhewing that the vegetable principle in feeds is deftroyed by the putrefactive fermentation; and that the commencement of this procefs depends on the changes in queftion being accelerated or retarded, as the temperature increafes or diminifhes.

Experiment X. Jan. 31, 1794. Three ounces of dry peas were put to foak in rain water. February 2, four drachms of the peas, which had

now been ſteeped forty-eight hours, were removed into a phial, which was then filled with water, and inverted in an earthen jar of the ſame; that part of the bottle which was out of the veſſel being ſcreened from the light, by a caſe of brown paper. It was then placed, in a window looking to the the north, (where a thermometer was hanging,) cloſe to the veſſel containing the water in which the remaining part of the three ounces was immerſed.

At the ſame time, I placed two drachms of the peas, thus ſoaked, in a phial; and removed them to a much warmer room, where they ſoon vegetated. The ſame was repeated, with equal ſucceſs, at the end of every forty-eight hours, to the eighth day of the month.

In the mean time, the thermometer was between 38° and 48°, being commonly at 43°. The bottle remained full of water to the ſixth; but the weather then became warmer, (the thermometer ſtanding at 46° or 48°), and two large bubbles of air were ſeen in the upper part of the glaſs on the eighth. Theſe bubbles were ſomewhat larger

on

on the tenth; and nearly two drachm-meaſures of air occupied the higher part of the inverted phial on the twelfth.

The uſual quantity of peas, *viz.* two drachms, placed in a dry bottle, on the evening of the tenth, ſhewed hardly any ſigns of vegetation on the 13th, (thermometer from 46° to 48°,) but, on the 15th, ſix, out of ſeventeen, had produced ſprouts. An equal quantity of the peas which were yet lying in the water, was treated in the ſame manner on the 12th; but they ſhewed no ſigns of vegetating on the 17th. This is a proof that the peas yet in water had been ſpoiled by putrefaction; the commencement of which was certainly indicated by the air extricated from thoſe in the inverted bottle. The gas that was collected by the bottle, in the courſe of the experiment, conſiſted principally of carbonated hydrogen, mixed with nearly one quarter of its bulk of carbonic acid gas.

One circumſtance ſeems worthy of notice, though not ſtrictly applicable to the ſubject of the preſent enquiry. The peas appeared to be

ſaturated with water at the end of two days; at leaſt I judged it to be the caſe from the following circumſtances. Seventeen of them weighed two drachms on the ſecond of February; and the ſame number came within a very few grains of the ſame weight, over or under, to the end of the experiment. Thus it ſeems clear, that it is a matter of indifference, whether ſoaked ſeeds be ſeparated from the air by the interpoſition of water, or azote; becauſe it is almoſt certain, from the preceding remark, that the former fluid has no power to change the nature of them, after they are fully charged with it. It is evident, from this experiment, that the putrefactive fermentation, or an emiſſion of gas from their ſubſtance, deſtroys the vegetative faculty of peas; from which we may venture to conclude, that it has, ſooner or later, the ſame effect on all other ſeeds expoſed to its influence.

This experiment being made in cold weather, the deſtructive proceſs proceeded but ſlowly, and the peas uſed were long in loſing the power of producing. In order, therefore, to determine how

how far an increaſe of temperature would accelerate the commencement of putrefaction, I repeated it twice, during the warmer months of ſummer, in a room where the thermometer varied from 60° to 66°. In the former of theſe trials, a very ſtrong fermentation took place, before forty-eight hours were expired; and, when a part of the peas thus treated was expoſed to the air, at the end of two days, none of them ſprouted. In the ſecond, they were not ſo ſoon injured; for a few of thoſe which were tried on the third day vegetated. Thus it appears, that an increaſe of temperature proves injurious to ſeeds ſecluded from the air, by promoting putrefaction in them, and thereby deſtroying their vegetative power.

Experiment XI. Seeds properly moiſtened emit carbonated hydrogen, mixed with carbonic acid, when ſurrounded with azote, as freely as others of the ſame kind do when immerſed in water; for, if wet peas or barley be confined in a known quantity of azote, as in Experiment IX, the volume of gas will remain the ſame for a few days,

days, but will begin to increaſe, more or leſs rapidly, at the end of an indeterminate time; which is longer when the temperature is lower, and the contrary. Hence it is evident, that a portion of freſh gas is afforded by the materials incloſed with that contained in the jar; and thus is the bulk of the given quantity enlarged. Moreover, if a bottle, charged as in experiment VIII, be left cloſely ſtopped for twelve or fourteen days, in a moderate temperature, the common air contained in it will be firſt rarefied, as we have proved before; but its denſity will, in a ſhort time, begin to increaſe again, from the gas emitted by the wet grain, as will appear if the inverted bottle be opened under water; for, upon removing the ſtopper, a quantity of elaſtic inflammable fluid will ruſh from the neck immediately, which will be ſucceeded by a diſcharge of bubbles of the ſame kind. Hence it appears, that the putrefactive fermentation deſtroys the vegetative power of ſeeds ſurrounded by azote, or covered by water; conſequently, the preſence of oxygen is neceſſary for preventing this deſtructive

ſtructive proceſs; which it does by producing another, that may be called the vegetative fermentation.

The reaſon why one of the two kinds of fermentation in queſtion always takes place, in ſeeds prepared by ſoaking, ſeems to be this; the water, thus introduced into their compoſition, changes that proportion of their component parts which is required to preſerve them in a ſound ſtate. If they be then expoſed to the atmoſphere, the action of its oxygen awakes the faculty of vegetation in them. On the contrary, when they are ſurrounded by azote, or water, which do not appear to act on them, the component particles in their texture are left to form new combinations among themſelves, and are partly converted into gas; the appearance of which indicates the commencement of that ſtage of putrefaction by which the faculty of vegetating in the atmoſphere is deſtroyed. We may now venture to explain, on rational grounds, a curious circumſtance alluded to in the firſt paragraph of this paper, (Page 31.) I mean a property, which the ſeeds of particular plants poſſeſs, of continuing

ing found and uninjured in the ground for many years, provided it remains fallow; but which vegetate vigorouſly as ſoon as the ſoil is pulverized by the plough. For, it has been ſhewn, that an increaſe of heat accelerates the putrefaction of ſeeds charged with water, and deprived of air; from which it may be ſafely inferred, that the preſervation of theſe bodies may be infinitely prolonged by ſecluding them from the atmoſphere, in a ſituation where the temperature never exceeds a certain degree, which is not the ſame for all ſeeds, but depends on their reſpective properties. Thus, for example, though peas, immerſed in water, loſe the faculty of producing in ten or twelve days, when the thermometer is between 40° and 50°, and much ſooner in warmer weather, we are not to conclude that all other ſeeds are as quickly rendered uſeleſs in ſimilar circumſtances. For I repeated the tenth experiment, in July, with ſeveral kinds, in a room where the thermometer was commonly higher than 62°; when it appeared that barley began to putrefy on the fourth day; wheat on the ſixth; white

white muſtard-ſeed on the eleventh; but beans, treated in the ſame manner, continued ſound, and vegetated, at the end of three weeks. Hence no one has a right to affirm, without actual making the experiment, that the ſeeds of broom, cockle, and many more plants that might be enumerated, would be ſoon deprived of the vegetative principle. On the contrary, we may venture to aſſert, that if ſuch ſeeds will not putrefy, with the ſummer temperature of the ground, at the depth of five or ſix inches, when placed out of the reach of the air, they will immediately vegetate upon being again expoſed to its influence. This is at leaſt a plauſible explanation of the phænomenon in queſtion. But, in order to put it to the teſt of experiment, I took ſome ſeeds of Broom, which had been ſoaked for three days in water, on the fifteenth of Auguſt, and, after mixing them with moiſt ſand, filled a ſmall phial with the mixture. The phial, being well corked and wrapped in paper, was kept to the thirteenth of September, in a room where the thermometer was commonly at 65°, and ſometimes roſe to 70°.

Theſe ſeeds, being planted afterwards in a pot filled with earth, vegetated.

Experiment XII. On the nineteenth of January, I put a quantity of onions, weighing four ounces Troy, into a quart-bottle containing common air, and introduced, at the ſame time, two ſmall bulbs, of the ſame kind, into another bottle, of equal capacity. The veſſels were then ſecurely ſtopped, the corks being covered with wax and pieces of wet bladder. The two bulbs that were incloſed apart, began to vegetate before the end of March; and had ſprouts, nearly three inches long, before the middle of April: no ſigns of vegetation ever appeared in the larger parcel. The two bottles were opened on the twenty-ſecond of May, being firſt inverted in water; when a quantity of gas, containing a conſiderable portion of carbonic acid, iſſued from both of them, particularly from that where the onions weighing four ounces were lodged, which continued to diſcharge numerous bubbles of a fœtid elaſtic fluid through the water, for more than a quarter of an hour, which was as long

long as I attended to the ſubject. The ſprouts of the two bulbs were flaccid, and evidently in a ſtate of decay; their vegetation undoubtedly ceaſed when the oxygen in the bottle was conſumed; upon which the putrefactive fermentation commenced, and deſtroyed their texture. The onions of the other parcel did not vegetate when expoſed to the atmoſphere, but became ſoft, and rotted. The great diſcharge of gas which took place when the bottle was firſt opened, proves that they were prediſpoſed to putrefy; the elaſtic matter being compreſſed in their pores ſolely for want of room to expand in; and the ſubſequent part of the experiment ſhews, that they were too much injured to be reclaimed by the action of the air.

Experiment XIII. About the middle of February, I placed two ſmall onions, on a muſlin ſtrainer, in a glaſs jar, which contained azote, and ſtood in water. They remained in this ſituation nearly ſix weeks, without altering the leaſt in appearance; though ſome bulbs of the ſame kind, ſtanding in an open glaſs on the ſame ſhelf, ve-

getated vigorouſly before the concluſion of the experiment. We may venture to infer, from the two laſt experiments, that what has been hitherto proved, reſpecting the vegetation of ſeeds, is alſo applicable to that of bulbs; with this difference, that the former muſt be prepared to make them ſprout, by receiving an acceſſion of humidity from an external ſource, which the latter do not require, becauſe they naturally contain within themſelves a portion of water ſufficient for that purpoſe. Hence it happens, that ſeeds, particularly ſuch as are natives of temperate climates, may be conveyed to a great diſtance, merely by guarding them from humidity; which cannot be done with bulbs, for they ſoon vegetate in a proper temperature, if not deprived of oxygen, without which they begin to putrefy in a ſhort time.

The preceding experiments relate almoſt entirely to the firſt period of vegetation, during which, the rudiment of the future root comes into view from between the ſeed-lobes; and, as this is the commencement of the proceſs, it does not

appear

appear improbable, that the extraordinary ſtimulus which is required, to excite the latent energy of the germ, ceaſes to be of uſe as ſoon as the effect is accompliſhed; for a number of experiments, made by that induſtrious philoſopher Dr. Prieſtley, prove that plants are capable of living and growing in azote. Whence it would appear, that a change takes place in their nature, at a period ſubſequent to the commencement of vegetation; which ſuppoſition only can reconcile what has been delivered, in this and my former part on the ſame ſubject, to the doctrine that has been very powerfully ſupported by the labours and authority of a man of the higheſt reputation in the philoſophical world. The following article will however prove, that the infant plant does not undergo the alteration laſt pointed out, while the ſeed-lobes ſupply it with nutriment.

TO BE CONCLUDED IN OUR NEXT.

XIX.

XIX. *On the Nature of the Diamond.* By SMITHSON TENNANT, *Esq. F. R. S.*

From the PHILOSOPHICAL TRANSACTIONS of the ROYAL SOCIETY of LONDON.

SIR Iſaac Newton, having obſerved that inflammable bodies had a greater refraction, in proportion to their denſity, than other bodies, and that the diamond reſembled them in this property, was induced to conjecture that the diamond itſelf was of an inflammable nature. The inflammable ſubſtances which he employed were, camphire, oil of turpentine, oil of olives, and amber; theſe he called "fat, ſulphureous, unctuous bodies;" and, uſing the ſame expreſſion reſpecting the diamond, he ſays, it is probably "an unctuous body coagulated." This remarkable conjecture of Sir Iſaac Newton has been ſince confirmed by repeated experiments.

ments. It was found that, though the diamond was capable of refifting the effects of a violent heat, when the air was carefully excluded, yet that, on being expofed to the action of heat and air, it might be entirely conſumed. But, as the ſole object of theſe experiments was to aſcertain the inflammable nature of the diamond, no attention was paid to the products afforded by its combuſtion; and it ſtill, therefore, remained to be determined, whether the diamond was a diſtinct ſubſtance, or one of the known inflammable bodies; nor was any attempt made to decide this queſtion, till M. Lavoiſier, in 1772, undertook a ſeries of experiments for this purpoſe. He expoſed the diamond to the heat produced by a large lens, and was thus enabled to burn it in cloſe glaſs veſſels. He obſerved, that the air in which the inflammation had taken place had become partly ſoluble in water, and precipitated from lime-water a white powder, which appeared to be chalk, being ſoluble in acids, with effervefcence. As M. Lavoiſier ſeems to have had little doubt that this precipitation was occaſioned by the production of fixed air, ſimilar to that which

is

is afforded by calcareous ſubſtances, he might, as we know at preſent, have inferred that the diamond contained charcoal; but the relation between that ſubſtance and fixed air was then too imperfectly underſtood to juſtify this concluſion. Though he obſerved the reſemblance of charcoal to the diamond, yet he thought that nothing more could be reaſonably deduced from their analogy, than that each of thoſe ſubſtances belonged to the claſs of inflammable bodies.

As the nature of the diamond is ſo extremely ſingular, it ſeemed deſerving of farther examination; and it will appear, from the following experiments, that it conſiſts entirely of charcoal, differing from the uſual ſtate of that ſubſtance only by its cryſtallized form. From the extreme hardneſs of the diamond, a ſtronger degree of heat is required to inflame it, when expoſed merely to air, than can eaſily be applied in cloſe veſſels, except by means of a ſtrong burning lens; but with nitre its combuſtion may be effected in a moderate heat. To expoſe it to the action of heated nitre, free from extraneous matters, I procured

procured a tube of gold, which, by having one end clofed, might ferve the purpofe of a retort; a glafs tube being adapted to the open end, for collecting the air produced. To be certain that the gold veffel was perfectly clofed, and that it did not contain any unperceived impurities which could occafion the production of fixed air, fome nitre was heated in it, till it had become alkaline, and afterwards diffolved out by water; but the folution was perfectly free from fixed air, as it did not affect the tranfparency of lime-water. When the diamond was deftroyed in the gold veffel, by nitre, the fubftance which remained precipitated lime from lime-water; and, with acids, afforded nitrous and fixed air; and it appeared folely to confift of nitre, partly decompofed, and of aërated alkali.

In order to eftimate the quantity of fixed air which might be obtained from a given weight of diamonds, two grains and a half of fmall diamonds were weighed with great accuracy, and, being put into the tube, with a quarter of an ounce of nitre, were kept in a ftrong red heat for about an hour and a half. The heat being gra-

dually increaſed, the nitre was in ſome degree rendered alkaline, before the diamonds began to be inflamed; by which means, almoſt all the fixed air was retained by the alkali of the nitre. The air which came over was produced by the decompoſition of the nitre, and contained ſo little fixed air as to occaſion only a very ſlight precipitation from lime-water. After the tube had grown cold, the alkaline matter contained in it was diſſolved in water, and the whole of the diamonds was found to have been deſtroyed. As an acid would diſengage nitrous air from this ſolution, as well as the fixed air, the quantity of the latter could not, in that manner, be accurately determined. To obviate this inconveniency, the fixed air was made to unite with calcareous earth, by pouring into the alkaline ſolution a ſufficient quantity of a ſaturated ſolution of marble in marine acid. The veſſel which contained them, being cloſed, was left undiſturbed till the precipitate had fallen to the bottom; the ſolution having been previouſly heated, that it might ſubſide more perfectly. The clear liquor being found, by means of lime-water,

to

to be quite free from fixed air, was carefully poured off from the calcareous precipitate *. The veſſel which was uſed on this occaſion was a glaſs globe, having a tube annexed to it, that the quantity of the fixed air might be more accurately meaſured. After as much quickſilver had been poured into the glaſs globe containing the calcareous precipitate as was neceſſary to fill it, it was inverted in a veſſel of the ſame fluid. Some marine acid being then made to paſs up into it, the fixed air was expelled from the calcareous earth; and, in this experiment, in which two grains and a half of diamonds had been employed, occupied the ſpace of a little more than 10.1 ounces of water.

The temperature of the room, when the air was meaſured, was at 55°, and the barometer ſtood at about 29.8 inches.

* If much water had remained, a conſiderable portion of the fixed air would have been abſorbed by it. But, by the ſame method as that deſcribed above, I obſerved, that as much fixed air might be obtained from a ſolution of mineral alkali, as by adding an acid to an equal quantity of the ſame kind of alkali.

From another experiment, made in a ſimilar manner, with one grain and a half of diamonds, the air which was obtained occupied the ſpace of 6.18 ounces of water; according to which proportion, the bulk of the fixed air from two grains and a half would have been equal to 10.3 ounces.

The quantity of fixed air, which was thus produced by the diamond, does not differ much from that which, according to M. Lavoiſier, might be obtained from an equal weight of charcoal. In the Memoirs of the French Academy of Sciences, for the year 1781, he has related the various experiments which he made to aſcertain the proportion of charcoal and oxygen in fixed air. From thoſe which he conſidered as moſt accurate, he concluded, that 100 parts of fixed air contain nearly 28 parts of charcoal, and 72 of oxygen. He eſtimates the weight of a cubic inch of fixed air, under the preſſure and in the temperature above mentioned, to be .695 parts of a grain. If we reduce the French weights and meaſures to Engliſh, and then compute how much

much fixed air, according to this proportion, two grains and a half of charcoal would produce, we ſhall find, that it ought to occupy very nearly the bulk of 10 ounces of water.

M. Lavoiſier ſeems to have thought that the aërial fluid, produced by the combuſtion of the diamond, was not ſo ſoluble in water as that procured from calcareous ſubſtances. From its reſemblance, however, in various properties, hardly any doubt could remain that it conſiſted of the ſame ingredients; and I found, upon combining it with lime, and expoſing it to heat with phoſphorus, that it afforded charcoal, in the ſame manner as any other calcareous ſubſtance.

XX.

XX. *Account of a Compoſition for preſerving Weather-boarding, &c. By* WILLIAM PATTENSON, *Eſq. of Ibornden, Kent.*

From the TRANSACTIONS of the SOCIETY for the Encouragement of ARTS, MANUFACTURES, and COMMERCE.

I HAVE often thought ſomething much wanted for preſerving weather-boarding, &c. from the injuries of the weather. Tar and oker, and other mixtures recommended for the purpoſe, I have tried, but do not find they anſwer. I therefore made many experiments to diſcover a compoſition better adapted to the purpoſe, and think I have found one which anſwers my expectation: it is impenetrable to water, is not injured by the action of the weather, or heat of the ſun, which hardens it, and conſequently increaſes its durability;

bility; it is much cheaper than paint, and more laſting.

The compoſition is as follows: three parts of air-ſlaked lime, two of wood-aſhes, and one of fine ſand, or ſea-coal aſhes; ſift theſe through a fine ſieve, and add as much linſeed-oil as will bring the mixture to a conſiſtence for working with a painter's bruſh. Great care muſt be taken to mix it perfectly: I believe grinding it as paint would be an improvement. Two coats are neceſſary; the firſt rather thin, the ſecond as thick as can conveniently be worked. From the nature of this compoſition, there is no doubt but it is very durable; as it certainly will improve in hardneſs by time, and is much ſuperior for the purpoſe than any thing I know of.

XXI.

XXI. *Account of the Experiments made, in the large Way, at Romilli, upon Bell-metal, in order to ſeparate the Copper from it. By MM.* PELLETIER *and* DARCET.

FROM THE *ANNALES DE CHIMIE.*

THE poſſibility of ſeparating the copper from bell-metal, which makes about four-fifths of it, is no longer doubtful. The experiments made at Paris, in the year 1791, by MM. Auguſte, Pelletier, and Dizè; the report made to the Conſtituent Aſſembly, and to the Academy of Sciences; and the Memoir publiſhed by M. Fourcroy, in the ninth volume of the *Annales de Chimie*, have diſſipated all the doubts which could be entertained, reſpecting the ſucceſs of this operation.

M. Auguſte employed ſea-ſalt as a medium. In two experiments, made at Chaillot, one upon 1200 pounds, the other upon 2500 pounds, of bell-metal, copper was obtained, ſufficiently refined

fined to be forged, flattened, and used for striking medals; in short, this copper did not any longer contain above four pounds of tin in the hundred.

M. Pelletier had already employed himself in the same research: the medium he made use of was manganese. As this mineral contains a great quantity of oxygen, he thought it very fit for the purpose of calcining the tin; particularly as that metal receives oxygen with great avidity, and the manganese gives it out very freely.

M. Dizè, after calcining the bell-metal, made use of sand and glass, to bring about a separation of the tin.

The facility with which tin is calcined, by itself, led to the idea of trying to produce the separation in question, by operating upon the bell-metal alone. Many of the experiments of M. Fourcroy, which are related in his Memoir, and which constitute the basis of his theory, threw great light upon this subject.

At last M. Pelletier had the opportunity of taking a journey to Romilli, where he made,

with great eaſe, his firſt experiment, upon the thirtieth of July, 1791; in which he operated upon 500 pounds of bell-metal. Part of this was firſt calcined ſeparately, and afterwards mixed with 300 pounds of the ſame metal in fuſion. He obtained copper of a good quality, in the proportion of rather more than 60 pounds in the hundred.

He made, at the ſame place, a ſecond experiment, upon 400 pounds of bell-metal; in which he employed manganeſe as a medium. From this, he obtained copper in a very refined ſtate, in the proportion of 75 pounds in the hundred.

It is impoſſible to ſay why, after ſuch certain data, theſe proceſſes ſhould have been as it were forgotten. Perhaps the eaſe with which copper could then be procured was the cauſe why this important enquiry was neglected; but the ceſſation of every kind of commerce, in conſequence of the war in which we are engaged, and the abſolute neceſſity of copper, to furniſh us with the means of defence, both by ſea and by land, have led us to ſee very plainly the certain reſource afforded

us

us by our bells; and the National Convention, no leſs attentive to the means of our ſafety than to thoſe of our ſubſiſtence, has at laſt, if I may employ an expreſſion lately come into uſe, made theſe proceſſes the order of the day.

The committee of public ſafety charged us, without delay, to examine the different proceſſes which have been propoſed for ſeparating the copper from bell-metal, and to determine the beſt manner of ſpeedily producing that ſeparation.

In conſequence of which, without loſing time, we made our firſt eſſay in a furnace belonging to M. Daumy; but, as this furnace, which had been conſtructed for the performance of an operation which requires leſs fire than is neceſſary for refining copper, did not anſwer our expectations, we were authorized to go to Romilli, and continue our labours there, where M. Pelletier had, in 1791, obtained very great ſucceſs. That we might not neglect any thing in an object of ſo much importance, we deſired that M. Daumy, and his foreman M. Herba, might accompany us, in order that theſe artiſts might acquire, from ſee-

ing the experiments themſelves, more juſt and certain inſtructions on the ſubject.

The following is a detail of the two experiments we made there, which we ſhall deſcribe in ſuch a manner as to leave nothing to be wiſhed for, by any artiſt who may have occaſion to repeat them.

Having arrived at Romilli the 28th of February, we immediately began our operations, all of which were executed in the preſence, and with the aſſiſtance, of M. Laine, director, and M. Grimpret, inſpector, of the foundery.

We proceeded immediately to the calcination of four hundred pounds of bell-metal: for this operation, we made uſe of a ſmall furnace, which had been conſtructed for the purpoſe of nealing ſmall pieces of copper.

The four hundred pounds of metal were calcined in five parts; the furnace not being big enough to permit the operation being done at once. When the metal, now become red-hot, began to melt, it was conſtantly divided and ſtirred with an iron bar; and this ſtirring of the metal was continued, keeping it at a red heat, during an hour

hour and an half. The point which appeared to us the moſt favourable for determining the degree of calcination, is when the matter, reduced to a calx, appears of a reddiſh colour, and the lumps ſhew ſome ſolidity, with the appearance of copper already half ſeparated: this obſervation had already been made by M. Auguſte, at the firſt trials of his proceſs.

When the whole of the four hundred pounds of metal was calcined, it weighed 425 pounds, 2 ounces; conſequently the increaſe of weight was in the proportion of 6 pounds, 4 ounces and a half, in the hundred. There is no doubt that nothing was wanting, but a larger furnace, to have been able to calcine a ſtill greater quantity of metal at once.

The next day we put 800 pounds of bell-metal into a reverberatory-furnace, uſed for refining copper, and heated by means of pit-coal; taking care to have the fire lighted the evening before. We began the operation at half paſt ſeven in the morning; towards nine o'clock the metal was in complete fuſion: we then added, by degrees, the 425 pounds of calcined metal, produced from the

the operation of the preceding day. The whole was well ſtirred together, for fifteen or twenty minutes, by means of a bar of iron, and the fire was continued.

At eleven o'clock, a ſample was taken out, which ſhewed that the quality of the metal began to mend. The ſtirring was repeated, for ſome minutes, keeping up the fire.

At half paſt two, another ſmall ſample was taken out, which appeared to us to be more ſoft to the file, and not unlike gun-metal.

Towards four o'clock, the ſample which was taken out preſented a metal the broken ſurface of which was fibrous, and which began to have the colour of copper; it was very ſoft to the file. The ſtirring was again repeated, that the whole might be well mixed, and the bottom part brought to the ſurface, where the ſeparation always begins: for we obſerved, in the ſamples which were taken out, that the metal at the ſurface was more like copper than that at the bottom of the pot.

About ſix o'clock, we took out a ſample, which was very red and fibrous, and which poſſeſſed

poſſeſſed very nearly the properties of pure copper. The metal was then, by means of ladles, poured into ingot-moulds, which had been previouſly placed around the furnace; the door of which was then cloſed with ſand, and the fire kept up half an hour longer, to melt out the metal which might remain in the ſcoria; from which we obtained a freſh quantity of copper, ſtill more pure than that which was poured into ingot-moulds.

The weight of the copper firſt poured off was 761 pounds, 12 ounces: that we obtained from the ſcoria was found to weigh 46 pounds: that which was ſpilt in pouring the metal into the ingot-moulds was alſo collected, and weighed; it weighed 6 pounds: laſtly, we weighed the various ſamples which were taken out during the operation, and found that they weighed 1 pound, 4 ounces.

The ſcoria was then taken out of the furnace; it was black and clammy, but, by cooling, became very hard: it contained grains of copper ſcattered throughout its ſubſtance, and weighed 474 pounds.

Reca-

Recapitulation.

	Pounds.	Ounces.
Copper poured into ingot-moulds,	761	12
Ditto melted out from the ſcoria,	46	0
Ditto ſpilt in pouring out, -	6	0
Weight of the various ſamples, -	1	4
Scoria, - - -	474	0
Total -	1289	0

In this operation we find an increaſe of 89 pounds; this increaſe ariſes, firſt, from the oxygen which combined itſelf with the tin, and with a portion of the calcined copper; ſecondly, from a part of the bottom of the furnace, which, being already in a decayed ſtate, was ſtill more injured by the operation, and melted amongſt the ſcoria.

The copper obtained by this experiment was ſufficiently ſoft to be flattened. A ſmall portion of it was melted in a crucible, from which three plates were caſt; after being nealed, they were flattened

flattened between the rollers, which operation they bore very well.

The reſult of this experiment, therefore, was that we obtained 67 pounds, 14 ounces, 5 drachms, 24 grains of copper, ſufficiently ſoft to be flattened, from a hundred pounds of bell-metal, taken promiſcuouſly.

In this we do not comprehend that portion of copper which remained in the ſcoria, in which it is ſo fixt that it can only be ſeparated by powdering and waſhing: that it may be ſeparated by theſe means, we took care to aſſure ourſelves.

We did not, in the proceſs we have deſcribed, make uſe of any foreign ſubſtance; it is therefore certain, that by calcining one part of bell-metal, and melting the product in a reverberatory-furnace, (ſuch as is uſed for refining copper,) with two parts of the ſame metal not calcined, we ſucceeded (and others no doubt may have the ſame ſucceſs) in obtaining copper which was ſoft, and fit for being flattened.

Second Experiment.

The following day we charged the ſame furnace, which had been kept hot during the night, with 800 pounds of bell-metal. By nine o'clock, the metal was in perfect fuſion, and very red; this was neceſſary, to prevent the cooling of the matter, which would certainly happen if it were not kept ſufficiently hot. Twenty five pounds of Schomberg manganeſe were now thrown in, and well mixed, by ſtirring; a ſample was then taken out, which ſhewed that the metal had already changed colour, in a ſlight degree. The fire was continued till eleven o'clock; when fifteen pounds more of manganeſe were added, ſtirring as before: another ſample was taken out, which appeared evidently to be more purified than the firſt. In this manner, by throwing in, at five different times, from nine o'clock till three, as much manganeſe as amounted, in the whole, to one hundred pounds, the metal was gradually purified.

At laſt, at half an hour after ſix o'clock, upon taking out a ſample, the metal was found to be

of

of a good quality, fibrous, and ſoft; a ſtrong heat was therefore given to it, and it was poured off. The copper, which was poured into the ingot-moulds, amounted, including the ſamples, to 520 pounds. The ſcoria was leſs hard, but alſo leſs melted, than that of the preceding operation; it contained a great many grains of copper, of various ſizes; theſe grains were very red, and were to be ſeen in every part of the ſcoria, which weighed 344 pounds.

Uſed in the Operation.

	Pounds.
Bell-metal, - -	800
Manganeſe, - - -	100
	900

Product.

	Pounds.
Copper, - -	520
Scoria, - - -	344
	864

The loſs of weight, in this experiment, was thirty-ſix pounds, and the quantity of copper obtained was in the proportion of ſixty-five pounds in the hundred; not including the metal which remained, in the form of grains, in the ſcoria, and which may be ſeparated from it by powdering and waſhing.

From the ſcoria of the firſt experiment, which amounted to 474 pounds, there were obtained, by the means above mentioned,

	Pounds.	
Metal in large grains, -	18	363
Ditto waſhed out, - -	345	
Loſs, - - -	111	
	474	

The ſcoria of the ſecond operation, in which manganeſe was uſed, was alſo powdered and waſhed. The grains of metal, and that procured by waſhing, amounted together to 290 pounds; the loſs was 54 pounds.

It

It muſt be noticed, that the copper obtained by the laſt experiment was not ſo pure as that obtained by the firſt; nor is it ſo pure as that which was obtained, by means of manganeſe, in the year 1791. But this difference is to be attributed, not to the proceſs, but to the bad ſtate of the furnace, particularly that part of it in which the metal was contained.

A remark, which is of importance to be made, is, that it appears, from the detail here given, that, by attending to the progreſs of the operation from the time the metal is brought into fuſion, we may very eaſily put a ſtop to the refinement of it, either when it is in a ſtate of alloy proper for caſting guns; or when it is in a more refined ſtate, ſo as to be fit for making money, or weights; or we may carry on the operation, till it is brought into the ſtate of pure copper. The practicability of what is above ſtated has been proved at Romilli, in various purifications of bell-metal, made ſince our return from that place.

We did not think it neceſſary to repeat the proceſs of M. Auguſte, becauſe he had already executed

executed it ſeveral times, at his own houſe, upon ſome pounds of metal, and twice at Chaillot, in the large way, with ſucceſs. His proceſs is undoubtedly a good one, but it may be mentioned, as a fault in it, that a part of the tin which might be ſaved is loſt by the ſea-ſalt volatilizing it; and alſo, that the furnaces are very much injured by it, the ſea-ſalt and the [illegible] appearing to act upon them very ſtro[illegible]. Beſides, we muſt confeſs, that the proce[illegible] which is performed merely by calcining a [illegible] of the metal, being the moſt ſimple, appears to us to deſerve the preference.

We ſhall only add to what we have already ſaid, that there is no doubt that this proceſs, which at preſent appears very advantageous, will become ſtill more ſo; becauſe, it will not only be ſtill farther ſimplified, by being repeated, but alſo the errors and loſſes of one operation will be repaired and compenſated, by the additions and improvements made in thoſe which follow.

XXII.

XXII. *Liſt of Patents for Inventions, &c.*

(Continued from Page 72.)

JOHN MANTON, of Dover-ſtreet, in the pariſh of St. George, Hanover-ſquare, Gun-maker; for an invention, or improvement, in the conſtruction of guns and piſtols. Dated April 12, 1797.

ROBERT CROSS, of Quaker Brook, in the county of Lancaſter, Tanner; for a new-invented tan-pit, and mode of tanning. Dated April 26, 1797.

THOMAS TODD, of Kingſton-upon-Hull, Ironmonger; for an hydraulic pump or machine for raiſing water. Dated May 9, 1797.

RICHARD VARLEY, of Damſide, near Bolton-le-Moors, in the county of Lancaſter, Merchant and Cotton-Manufacturer; for a perpetual moving-power. Dated May 29, 1797.

TIMOTHY

TIMOTHY HARRIS, of Waltham-Abbey, in the county of Eſſex, Pin-maker; for a method of manufacturing pins, with iron and other metals, and making the ſame white. Dated July 4, 1797.

JOSEPH SLATER, of Sharples, near Bolton-le-Moors, in the county of Lancaſter, Bleacher; for an improvement in a machine for finiſhing bleached, dyed, and printed muſlins. Dated July 4, 1797.

ANTHONY GEORGE ECKHARDT, of Charing-Croſs, Gentleman; for a method of making draw or bench looms, for manufacturing carpets, borders, and other things. Dated July 4, 1797.

JOHN HAWKSLEY, of ————————; for a method of combing wool, cotton, ſilk, flax, hemp, and mohair. Dated July 4, 1797.

JOHN MAULE, of Caſtle-ſtreet, Oxford-ſtreet, Engine-maker; for an improvement on a machine for cleaning grain from the ſtraw. Dated July 4, 1797.

Printed by JOHN NICHOLS, Red-Lion-Paſſage, Fleet-Street, London.

REPERTORY

OF

ARTS AND MANUFACTURES.

NUMBER XLV.

Printed by JOHN NICHOLS, Red-Lion-Paſſage, Fleet-Street, London.

XXIII. *Specification of the Patent granted to* SAMUEL BENTHAM, *of Queen-Square Place, in the County of Middleſex, Eſquire; for a new Method of making Fire-Irons.*

Dated April 12, 1793.

TO all to whom theſe preſents ſhall come, &c. NOW KNOW YE that, in compliance with the ſaid proviſo, I the ſaid Samuel Bentham do hereby declare, that my ſaid invention is deſcribed in manner following; that is to ſay, by fire-irons are meant poker, ſhovel, and different ſorts of tongs; which, being all inſtruments deſigned for lifting weight, ſhould themſelves have as little

weight as poſſible. Hitherto, under the notion of ornament, they have been more or leſs loaded with parts, which, whether they add to ornament, add nothing at all to uſe. Theſe new-invented ones, beſides being ſo much better adapted to uſe, poſſeſs the beſt ornament, ſimplicity. The invention conſiſts in making the inſtruments in queſtion tubular; the tubes being cloſed at the ends, for the ſake of ſtrength, and to keep out dirt; hence a degree of lightneſs, which can by no other means be given to ſuch inſtruments, with the ſame degree of ſtrength. They may be either plain, or, for ornament-ſake, of open work. As to the tongs, the joint may either be made in the manner of thoſe moſt commonly in uſe; or in the manner of the ſpring-joint, lately come into uſe for ſugar-tongs; or, in ſhort, in any other manner. But what ſeems beſt, on account of its ſimplicity and lightneſs, is to join the two legs together by a flat plate, bent arch-wiſe, and hardened ſo as to give it the elaſticity required. The broader the plate, ſo as that the breadth adds not too much to the bulk and weight, the better; becauſe, the broader that

part

part is, the more effectually the ends of the tongs are ſecured againſt ſlipping aſide, and twiſting in ſuch manner as to let go their hold. The ends of the tongs may be either flat, as it is moſt commonly the caſe with the fire-tongs in preſent uſe, or ſpoon-faſhioned, in the manner of ſugar-tongs. In either caſe, they may be either made of one piece with the ſtem, as in the common fire-tongs; or in ſeparate pieces connected by ſcrews; or otherwiſe: the latter mode will facilitate the poliſhing of the tubular parts. As to the materials, they may either be made all of iron; or ſuch of the parts as are not expoſed to come in contact with the burning fuel may, for ornament-ſake, be of ſilver, or plated work, or any other material. Tongs made on this principle, and proportionably ſmaller, are particularly proper for beef-ſteak tongs. As to the poker and fire-ſhovel, the ends may, for the reaſon above-mentioned, be in ſeparate pieces from the ſtems; and the end of the poker, as it is to be expoſed to frequent ignition, muſt, if tubular, be made at any rate much thicker than the ſtem. In witneſs whereof, &c.

XXIV. *Specification of the Patent granted to Mr.* ROBERT MILLER, *Calico-Printer, at Milton Printfield, in the County of Dumbarton, Scotland; for a Method of weaving all Kinds of Linen, Cotton, Woollen, and Worſted Cloths, by Means of Looms wrought by Water, and which may be wrought by Steam-Engines, Horſes, or any other Power; the Weaving being done at much leſs Expence, and much more expeditiouſly, than it is done at preſent by Weavers; and the Cloth ſo weaved being of a more regular Texture, and ſuperior to what can be wrought by Hand.*

Dated June 26, 1796.

WITH TWO PLATES.

TO all to whom theſe preſents ſhall come, &c. NOW KNOW YE, that the ſaid Robert Miller, in purſuance of, and compliance with, the ſaid proviſo,

viſo, in the ſaid letters patent contained, and the purport and true intent and meaning thereof, and of his Majeſty's ſaid moſt gracious intentions, doth by this inſtrument in writing, under his hand and ſeal duly executed, particularly deſcribe and aſcertain the nature of his ſaid new-invented weaving-loom, and the manner in which the weaving is to be performed, according to the plan or drawing thereof hereunto annexed, in manner and form following; that is to ſay, Fig. 1. (Plate VIII.) repreſents a ſide-view of the loom, AA, BB, CC, DD, being the frame. *a* is an axis (which we ſhall call the ſpindle) acroſs the frame. On this axis is a ſheeve *b*, two inches thick, having a groove round it, two inches deep, and half an inch wide. The bottom of this groove is circular, except in one part, *c*, where it is filled up to the top; a lever *d* reſts on the bottom of this groove, and is lifted up by it, when the elevation *c* comes round to the ſituation repreſented in the figure. By this motion, the lever *d* acts on the ratchet-wheel *e*, by the catch *t*, and draws it forward one tooth, each revolution of the ſheeve. This ratchet-wheel is in

an

an iron frame *g g*, which alſo properly carries the two catches *t* and *u*, which are connected with it at *v*. The catch *u* holds the ratchet-wheel in its poſition, while the lever *d*, and the catch *t*, are moved by the groove *c* in the ſheeve. On the arbor of the ratchet is a ſmall pinion *b*, working in the wheel *f*; this wheel is fixed on the end of the roller *e*, of Fig. 3. On the ſide of the ſheeve *b* is fixed a wiper *k*, which lifts the treadle *l*. This treadle turns on its joints in the ſheeve E, which is fixed to the ſide of the frame A and D; it is kept preſſing on the bottom of the groove in the ſheeve, by a ſpring *m*, fixed to the frame ſide A, and having a ſlender rod *n*, from its extremity, joining it with the treadle at *l*. From the point of the treadle there goes a belt *o*, which paſſes over the pulley *p*, which is ſeen edgeways in this figure, and is joined to the top of the fly-pin *q*, of Fig. 2. At the end of the frame A is the ſhort poſt F; on this reſts the yarn-beam *j*, having a ſheeve *r*, over which paſſes a cord, having a weight *s* ſuſpended to it. The other end of this cord is faſtened to the ſpring *v*; the weight cauſes the yarn-beam to

ſtretch

ſtretch the web from the ratchet-wheel *e*, with its catch *u*; and the ſpring *v* allows the rope to ſlide on the ſheeve, as the ratchet is drawn round during the working.

Fig. 2. (Plate VIII.) is a front view of the loom. *a a* is the ſpindle which carries the ſheeve *b*, and the wipers *d* and *d*, which move the treadles *w*, *w*, of Fig. 1. Theſe uſe the treadles of the headles, with which they are connected, by cords from the ſhafts of the headles *s*, *s*. From the upper ſhaft there go two leathern belts *f*, *f*, to the roller *y*, furniſhed each with a buckle, for tightening them at pleaſure. The two wipers *c*, *c*, on the ſhaft *a*, which ſerve for taking back the lay, have the two treadles *x*, *x*, in Fig. 3, with a belt from each, paſſing over the roller *h* 2 of Fig. 1. and fixed to the ſword of the lay. From the ſwords of the lay forward is fixed a belt to each end of the roller *i*; from this roller there goes a cord to the ſpring *j*, which ſerves for taking forward the lay, which is hinged on the rocking-tree *t*. The ſtar-wheel *b*, of Fig. 3, and the ſheeve *b*, of Fig. 1, are fixed to the oppoſite ends of the ſpindle *a*, without the frame; and both

both the wheel and ſheeve have a wiper *k* fixed to them, for moving the treadles. In order to drive the ſhuttle, the belts *o*, *o*, go from the points of the treadles, over the pullies *p*, *p*, to the top of the fly-pin *q*; this turns on a pin-joint, in a rail *r*, which goes acroſs the loom. From its lower end there go two ſmall cords to the ſhuttle drivers *g*, *g*, which ſlide on the iron rods *n*, *n*. A long iron rod *v* goes acroſs the lay, and is hung on two centres at the ends. In this rod *v* are fixed two ſmall crooked wires *w*, *w*, which are more diſtinctly marked in the little figure *w* above, which repreſents a ſection of the lay. The dot at the lower end of the wire *w*, in this figure, is the ſection of the rod *v*. The ſhuttle paſſes between theſe wires and the lay, every ſhot, and lifts them up, cauſing the rod *v* to turn round a little. But, if the ſhuttle ſhould not paſs theſe wires, nor lift them, it would be drawn home by the lay, and deſtroy the web. To prevent this, there is fixed on one end of the rod *v*, a ſtout crooked wire *z*, having a broad or flat head, which naturally reſts on a plate of iron, marked and fixed to the back of the lay.

This

This plate has a ſlit in its middle, about an inch deep. In this ſlit reſts the rod *a* 2, of Fig. 3, on which is a ſhort ſtud, which is caught by the wire *z*, when the wire *w* is not lifted back by the paſſing ſhuttle. This will ſtop the lay from coming home, and will ſet off the loom.

Fig. 3. (Plate IX.) is another ſide-view of the loom, oppoſite to Fig. 1. On the ſpindle *a* is the ſtar-wheel *b*, on the outſide of the loom-frame, on the arms of which wheel is fixed the wiper *k*, as the ſimilar wiper is fixed to the ſheeves on the other end of the ſpindle. The wipers, which drive the ſhuttles, are fixed on oppoſite ſquares of the ſpindle, and work alternately. Below the ſtar-wheel is a pinion *c*, which is on a round ſpindle, turned by the water-wheel, by means of a wheel on this ſpindle. In a wheel on this ſpindle are two ſtuds, on which the pinion *c* ſlides off and on, as the loom is ſet off and on by the lever *d*. At the farther end of this lever is the weight *s*, hanging by a cord which paſſes over a pulley *t*, fixed at the outer end of the ſpring-catch on which the lever *d* reſts; and thus

the loom is drawn in at the upper end of the lever *d*: but, when the ſhuttle does not lift the wire *z*, it catches on the ſtud on the rod *a* 2, which is connected with the ſpring-catch, and the lever *d* flies off, with the weight *s*, and the loom ſtops working. On the head of the poſt F is the yarn-beam. The rollers *e* and *f* are cylinders, preſſed together by a ſcrew-lever, and take away the cloth between them at a proper rate. In the roller *f* is a groove for a band, for driving the roller *g*, on which the cloth winds itſelf as it is wrought. Wherever ſprings are mentioned to be uſed in the above deſcription, weights may be uſed in their ſtead, and to the ſame effect, and more eſpecially upon the treadle of Fig. 1, for driving the ſhuttle; and it is put in practice by the ſaid Robert Miller, Patentee. In witneſs whereof, &c.

XXV.

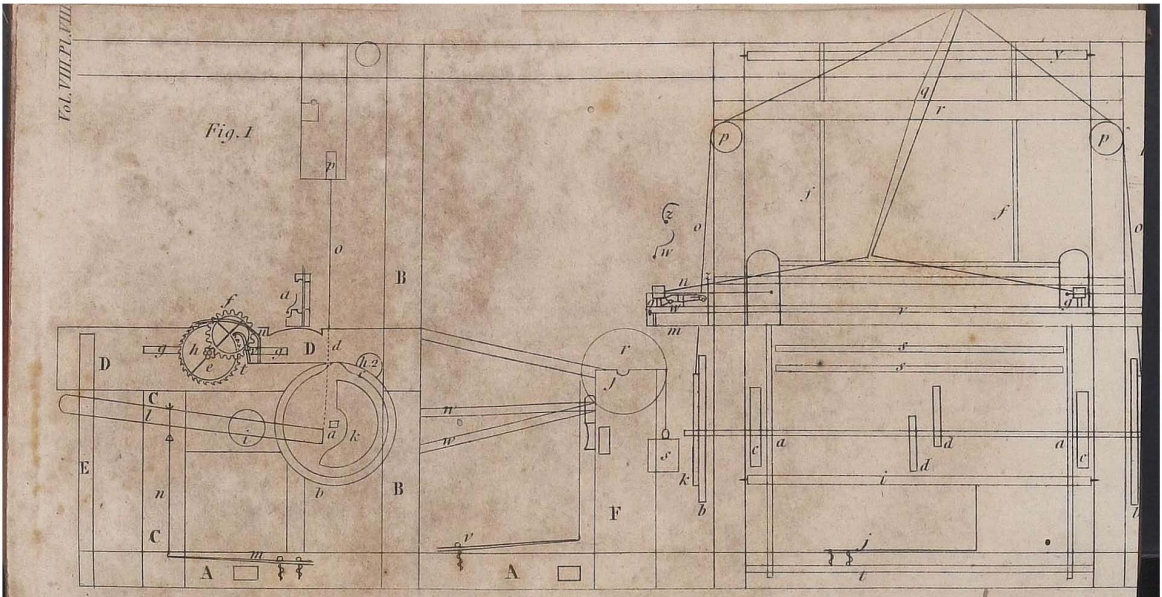
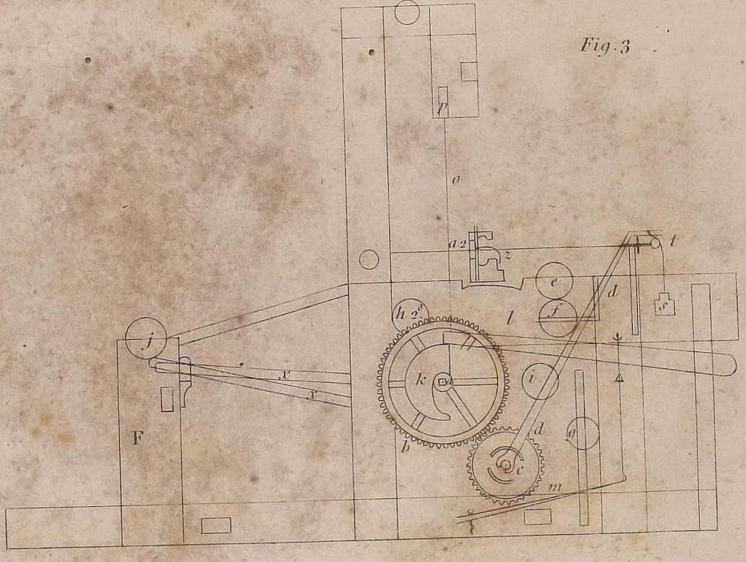


Fig. 1
A
B
C
D
E
F
a
b
c
d
e
f
g
h
h 2
i
j
k
l
m
n
o
p
q
r
s
t
u
v
w
x
y

Fig. 3



XXV. *Specification of the Patent granted to the Rev.* EDMUND CARTWRIGHT, *of the Parish of Saint Mary-le-bone, in the County of Middlesex, M. A. for a certain incumbustible Substitute for certain Materials commonly used in constructing Dwelling-Houses, and other Buildings, so as to render them secure from Fire.*

Dated October 11, 1797.

TO all to whom these presents shall come, &c. NOW KNOW YE that, in compliance with the said proviso, I the said Edmund Cartwright do hereby declare, that my said invention consists in applying tiles, as a substitute for laths, reeds, or boards, in making cielings, partitions, or floors of rooms; and also as a substitute for any other material that has hitherto been applied for stopping the progress of fire. The manner of applying them is as follows: the tiles being of sufficient length to extend from centre to centre, or thereabouts, of the spars, joists, or sleepers, under, against, or upon which they are to be fasten-

ed; and having holes, or notches, previouſly made in them at each end, for receiving the nails, ſcrews, or cramps; they are, by means of ſuch nails, ſcrews, or cramps, (which, to prevent their drawing, will be better if driven obliquely,) affixed to the ſaid joiſts, ſpars, or ſleepers: or they may be affixed by any other means that the workman may prefer; care being taken, in each caſe, to ſecure the joints where the tiles meet, by mortar, plaſter of Paris, ſparging, tempered brick-earth, loam, or any other cement, at the option of the workman. The work being finiſhed, (unleſs it be for a floor, when nothing farther will be neceſſary,) it may be thinly coated over with plaſter, as a common cieling or partition, with this advantage, that in two or three days it will be perfectly dry; whereas, where laths, or reeds, are uſed, the cielings commonly require twice as many weeks, at leaſt, before the rooms are completely habitable. In tiling the partitions between room and room, it is almoſt needleſs to obſerve, that care muſt be taken to ſecure the bottoms, the door-ways, and other openings, in caſes where tiles cannot conveniently be applied, with brick-work, metal-plates, or any other effectual method.

Reſpecting

Reſpecting the tiles themſelves, they ſhould be made of ſuch earths, or mixtures of earths, as will be leaſt apt to fly in the fire; and they will alſo be beſt for this uſe, if they are not burned ſo hard as when they are to be expoſed to the weather. To make the plaſter adhere more effectually to them, they had better be ſcored, or roughened, on the ſide that is to receive it; though, if the plaſter be prepared and applied properly, this precaution is unneceſſary. As there will be ſome difficulty in cutting the tiles, for finiſhing off the work, tiles of different breadths ſhould be provided, which would not require cutting.

As a ſecurity againſt fire, this cheap and ſimple method has every advantage attending the moſt complicated and expenſive. Tiles effectually exclude air; they tranſmit heat more ſlowly than metal; and are not affected by any degree of fire leſs intenſe than that in which they are burned: a fire more intenſe, it is, morally ſpeaking, impoſſible, in a building, they ſhould be expoſed to. By this invention, the uſe of laths, or reeds, the moſt inflammable material that is now applied in building, is entirely done away. In witneſs whereof, &c.

XXVI.

XXVI. *Specification of the Patent granted to Mr.* WILLIAM PLAYFAIR, *of Howland-ſtreet, in the Pariſh of Saint Pancras, Engineer; for his Method of making Bars for Saſh Windows, of Copper, Iron, or any mixed Metal containing Copper; alſo Metal Ornaments and Mouldings for Grates and Fenders, and ornamented Metal Borders for Tea-Waiters, Trays, and Bottle-Stands; likewiſe Horſe-Shoes, and Curtain-Rods of Iron.*

WITH A PLATE.

Dated May 24, 1783.—Term expired.

TO all to whom theſe preſents ſhall come, &c. NOW KNOW YE, that the ſaid William Playfair, in purſuance of the ſaid recited proviſo, doth by this inſtrument in writing, under his hand and ſeal, particularly deſcribe and aſcertain the nature of his ſaid invention, and the manner in which the ſame is to be performed, in manner

and

and form following; that is to say, the principle upon which the said invention, and method of making window-bars, metal ornaments and mouldings for grates and fenders, ornamented metal borders for tea-waiters, trays, and bottle-stands, likewise horse-shoes, and curtain-rods, is founded, is this: that by forcing a piece of metal (intended to be made into window-bars, ornamented mouldings, ornamented borders, horse-shoes, or curtain-rods,) to pass through a cavity or hole formed by one or more instruments or tools of steel, or other metal fit for the purpose, (which cavity or hole shall be less in area than the transverse section of the piece of metal, so forced to pass through the said cavity or hole,) the said piece of metal, during its said passage, shall acquire a breadth, thickness, form, and impression, correspondent to, but the reverse of, the surface of the said cavity or hole; which said form or impression shall be continued through the whole length of the said piece of metal, so forced to pass through the said cavity or hole. Thus, if the transverse area of the said cavity or

hole

hole be a rectangle, the tranſverſe ſection of the ſaid piece of metal, after its ſaid paſſage, will alſo be rectangular, and nearly of the ſame dimenſions as the tranſverſe area of the ſaid cavity or hole. And, if the tranſverſe area of the ſaid cavity or hole be defined by curve lines, or indentations, then alſo will the tranſverſe ſection of the ſaid piece of metal, after the ſaid paſſage, be defined by curve lines, or indentations; but ſo that the convex lines, and ſalient angular indentations, of the ſaid piece of metal ſo paſſed through, or of the tranſverſe ſection of the ſaid piece of metal, ſhall reſpectively correſpond and coincide with the concave lines, and entering angular indentations, of the area of the ſaid cavity or hole. This principle may be applied to the making of window-bars, ornaments and mouldings for grates and fenders, ornamented borders for tea-waiters, trays, and bottle-ſtands, horſe-ſhoes, and curtain-rods, by means of different inſtruments or tools, of which two are deſcribed in manner following. One of theſe ſaid inſtruments or tools conſiſts of two rollers or cylinders,

linders, of ſteel, iron, or other matter fit for the purpoſe, mounted in a frame, as is repreſented in the firſt and ſecond figures annexed.

Fig. 1. (Plate X.) repreſents the ſide-view of a pair of rollers or cylinders, marked A, A, and moving upon the axes B, B, which paſs through the frame C C, and are held together by means of that frame, and ſcrews D, D: theſe rollers having grooves, hollows, or other impreſſions, as before ſpecified, made in their ſurfaces, or in the ſurface of one of them. On the axes are fixed pinions with teeth, ſo that one of the rollers being made to turn, by being connected with a water-mill, or other power, the other roller ſhall be turned round alſo.

Fig. 2. is an end-view of the ſame machine, wherein the ſame letters refer to the ſame parts of the machine. If the ornaments for grates and fenders be required to be plain, as thin flat plates of ſilver, or other metal ſilvered or covered with ſilver, then no impreſſion is to be made on the rollers or cylinders, between which the ſaid plates of ſilver, or other

metal filvered or covered with filver, is to be paſſed; but the ſaid filver, or other metal filvered or covered with filver, is to be paſſed through or between a pair of plain rollers, and thus brought to the proper thickneſs for covering, and thereby ornamenting, the jambs and other parts of grates, and alſo fenders. Or the jambs and other parts of grates, and fenders, may be made of the pieces of metal ſo covered and ornamented with filver, and thus rolled to a proper thickneſs.

The ſecond inſtrument or tool, with which the above-mentioned principle may be applied, to give certain determinate forms to window-bars, ornaments and mouldings for grates and fenders, ornamented borders for tea-waiters, trays, and bottle-ſtands, and curtain-rods, conſiſts of a plate of ſteel, or other metal fit for the purpoſe, in which a hole is cut, of ſuch dimenſions and form as are required for the intended window-bar, ornament, moulding, border, or curtain-rod; the ſaid plate being firmly fixed in a proper frame, or otherwiſe. The piece of metal intended

to

to be made into window-bar, ornament, moulding, ornamented border, or curtain-rod, is to be drawn by a force, applied for that purpoſe, through the ſaid hole; by which means it carries the intended form and dimenſions along its whole length. Inſtead of one plate of ſteel, or other metal, through which the hole is made, there may be two or more plates of ſteel, or other metal, ſo ſhaped and placed together as to leave a hole or cavity, through which pieces of metal may be drawn, as aforeſaid, for window-bars, ornaments, mouldings, borders, and curtain-rods. A tool or inſtrument of this kind is repreſented by the third figure annexed, in which figure, A, repreſents the piece of metal to be made into a window-bar, ornament, moulding, border, or curtain-rod, by being drawn through a hole in the plate P. by means of the plyers B, which take faſt hold of the ſaid piece of metal, and of the rope R, to which the plyers are faſtened, and of the barrel C, round which the rope is wound; the ſaid barrel being turned round by the wheel W, mounted on the ſame axis as the ſaid barrel; which wheel is moved by the pinion whoſe teeth work in the

teeth of the ſaid wheel; which pinion is made to turn round by a man, or other power, applied to the handles or ſpokes D, D, D, D, fixed upon the ſame axis as the ſaid pinion. E, is a plank of wood, on which the above-deſcribed machinery is fixed.

The fourth figure repreſents a front-view of the plate P, with its hole or cavity.

Horſe-ſhoes are made in the manner following: in the circular ſurface of a roller a groove is cut, of ſuch dimenſions as may admit (when the roller is mounted in its proper frame, along with another plain roller, as is deſcribed above, and repreſented by the firſt and ſecond figures,) a piece of iron to enter into, and paſs through it, of the proper ſize to be bent, and made into a horſe-ſhoe. In this groove one or more eminences project, which give to the ſaid piece of iron intended to be made into a horſe-ſhoe, while it paſſes along the ſaid groove, and between the two rollers, the impreſſion of the channel or channels of the horſe-ſhoe; in which channels the heads of the nails uſed for faſtening the horſe-ſhoe to the horſe's foot are lodged. The ſaid piece of iron, thus brought, by rolling, to

the

the proper thickneſs and ſize, and impreſſed with the ſaid channels, is then to be bent into the form of a horſe-ſhoe.

And whereas the common method of bending horſe-ſhoes is by ſtriking them with a hammer, upon an anvil, or beak of an anvil, or beak iron, till they come into the proper form; the method of bending the ſaid horſe-ſhoes, invented by the ſaid William Playfair, and hereby ſpecified, is practiſed in the following manner, and repreſented in the fifth figure annexed; where A B repreſents the piece of iron intended to be made into a horſe-ſhoe, after it has received its proper thickneſs and impreſſion of channels, by being made to paſs the rollers as aforeſaid; and D repreſents a pair of tongs, graſping the end A of the ſaid piece of iron, and preſſing it firmly againſt the ſide of a fixed body, C, made of caſt-iron, or other ſubſtance, and ſo ſhaped, that when the piece of iron A B is bent round its edge, the ſaid piece of iron A B ſhall acquire the proper form of a horſe-ſhoe; and this bending is effected by means of another pair of tongs F, which graſp the end B of the piece of iron A B;

and

and which, being moved by a man, or otherwiſe, in the direction E E E, will bring along, and bend, the piece of iron A B, till the ſaid piece of iron A B ſhall coincide with the curved edge of the fixed body C, and thereby ſhall acquire its proper form. Or, inſtead of the tongs D, the end A of the piece of iron A B may be kept fixed, during the bending, by means of a fixed point, fulcrum, or other contrivance, at A; and, inſtead of drawing the other end B, by means of the tongs F, the ſaid piece of iron A B may be made to correſpond to the curvature of the body C, by being preſſed with ſufficient force upon its convex-ſurface, by ſome body made to move along the ſaid convex-ſurface, and in a direction parallel to, or concentric with, the curvature of the body C. And, in general, the above drawings and deſcriptions, do duly repreſent and give ſuch methods as are found to be good by the experience of the ſaid William Playfair; but the variations of machinery and apparatus, by which this principle may be applied, and the invention imitated, are without number. In witneſs whereof, &c.

XXVII.

Fig. 2.

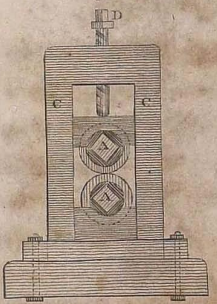


Fig. 1.

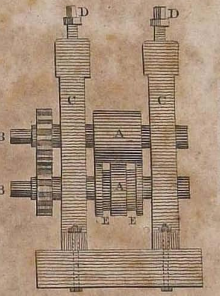
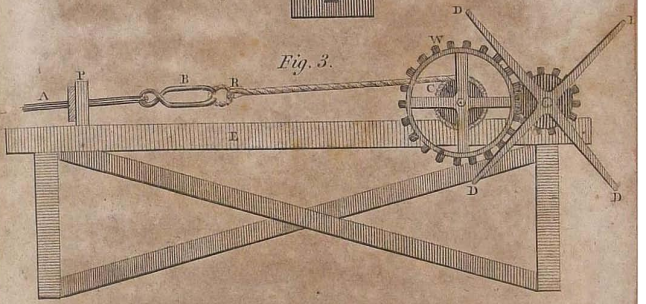


Fig. 4.

Fig. 3.



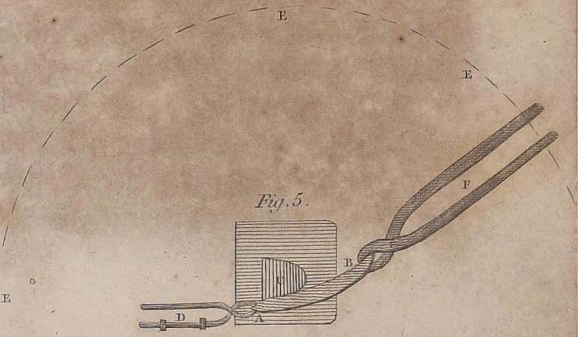


Fig. 5.

XXVII. *Conclusion of Mr.* Gough's *Experiments and Observations on the Vegetation of Seeds.*

(From Page 117.)

Experiment XIV. On the eighth of April, I put twelve peas into azote, confined in a glass jar inverted in water. They had been previously permitted to sprout in wet sand, contained in another pot covered with a lid to exclude the light; and the rudiments of their roots, which appear first, were at that time from one inch to one inch and a half long, being undivided, and of a conical figure. In this situation they remained till the fourteenth, in a window looking to the east without making a visible progress in growth: they were therefore taken out of the jar, and the longest sprout, being compared with a measure to which it exactly corresponded on the eighth, was found not to have altered in the least.

An

An equal number of peas, in the ſame ſtate, were placed under a jar containing common air, ſtanding in the ſame window, at the beginning of the experiment. In theſe, vegetation made a viſible progreſs; for the upper extremity of the ſprout appeared in moſt of them on the twelfth, and ſoon aſſumed a green colour, from the action of light: but, though the experiment was prolonged to the twenty-ſecond, in which time the roots attained the length of four inches at leaſt, and became branched, they ſtill preſerved their primitive whiteneſs. The ſame experiment was repeated between the twenty-ſecond and twenty-eighth of the ſame month, with two parcels of ſprouted beans; and the reſult correſponded exactly to the facts that have now been ſtated.

Experiment XV. Six ſeeds of white muſtard *(Sinapis alba)* were planted, about the middle of March, in a glaſs bottle; the bottom of which was covered with moiſt earth, the upper part being occupied with common air. The mouth was then well corked, and ſecured with cement. The young plants puſhed their tips into view in the courſe of a few days, and appeared in a thri-

ving

ving condition; but began to droop before the end of the week, and died in a ſhort time after. The air was found to be unfit for combuſtion. Probably the wet mould, confined in it, contributed not a little towards depriving it of its oxygen; for the mud of rivers and ponds has been diſcovered to poſſeſs this property in a high degree.

The facts related in the two laſt articles prove, in a clear manner, that ſeeds which have been permitted to grow for a time in the atmoſphere, ceaſe to do ſo when they are ſurrounded with azote; whence it may be ſafely inferred, that a germ, in the act of vegetation, requires to be continually excited by the ſtimulus of oxygen. But, as ſoon as the ſeed-lobes are exhauſted, the young plant is in a ſtate to derive its nutrition from the ground: and then (and not till then) it finds itſelf in a ſituation capable of making future advances, unaſſiſted by the ſtimulus of reſpirable air.

The infant ſprout, at firſt, ſuffers only a ſuſpenſion of its energy from the abſence of pure air; but, if this neceſſary ſupport be withheld too long,

it periſhes by the putrefactive fermentation; for, if ſeeds, treated as in experiment XIV, be taken out of the azote in which they are confined at the end of two or three days, they begin to vegetate afreſh with unimpaired vigour; but, if their ſtay in the gas be protracted three or four days longer, when the weather is moderately warm, they loſe their natural colour, and putrefy.

Experiment XVI. The lively green, which the ſtems and leaves of plants receive from the action of light, cannot be imparted to them, provided the energy of the vegetative principle in them be ſuſpended; for, after permitting a number of peas to produce both extremities of their ſprouts in wet ſand, covered from the light by an earthen pot, I placed five of them, on the twenty-ninth of April, in an inverted glaſs jar, containing azote confined by water; and three in another jar, in which a portion of common air was alſo incloſed by the ſame means. On the thirtieth, the upper extremities of the ſprouts of the parcel laſt-mentioned were green; but, though the experiment was prolonged to the ſecond of May, thoſe

thoſe in the other glaſs did not exhibit any perceptible alteration in ſize or colour. Two of them were now placed in a glaſs filled with atmoſpheric air, where they were left unobſerved to the fifth, at the end of which time the germs had vegetated conſiderably; the lower parts of them ſtill remained white, but their oppoſite extremities had changed to their proper green. It may here be remarked, though the obſervation has but little connection with our preſent enquiry, that the circumſtance of the inferior part of the germ, in peas and beans, conſtantly preſerving its primitive whiteneſs, may be conſidered as a proof of the roots of annuals being different, in their internal ſtructure, from perennials, ſhrubs, and trees; for, many inſtances have been noted by naturaliſts, ſome of which are recorded in the ſecond volume of Lowthorp's Abridgement of the Philoſophical Tranſactions, (Page 673.) of the branches of woody vegetables taking root when planted in an inverted poſition, and producing perfect plants in this unnatural poſture; which ſhews, that the rudiments of all the different fibres appertaining to a complete vegetable, are compriſed in a parti-

cular part of it, when this is the caſe. But the circumſtance juſt now mentioned is a ſtrong evidence of a contrary nature in annuals; for, ſince the rudiment of the root is not ſuſceptible of a green colour, it is plain that the part in queſtion is deſtitute of ſomething which is natural to the ſtem and its appendages. Hence we perceive, that though a perennial may by accident become an annual, the contrary cannot poſſibly take place. In the courſe of May I repeated the laſt experiment with beans; and the event of this trial correſponded exactly to what has been already ſaid on the ſubject. Hence it may be ſafely inferred, that greenneſs cannot be imparted to the ſprouts of ſeeds, without the joint action of light and oxygen; in which they are very different from the ſhoots that frequently proceed from maturer plants, when ſecluded from the atmoſphere; for, as theſe grow freely in cloſe glaſs veſſels placed in a window, and containing water and azote, the parts which are recently produced continue to vegetate, in conſequence of their connection with the parent ſtock, and acquire the colour in queſtion, without the aſſiſtance of

of reſpirable air, as is evident from the following article.

Experiment XVII. On the ſecond of July, I introduced a ſlip of ſpear-mint into a ſix-ounce phial, in ſuch a direction that the end of its ſtalk remained in the neck. The bottle was then filled with river water; and, being inverted in a veſſel of the ſame, about four ounces of the water were diſplaced by azote: after which, the mouth was ſtopped with a cork, in the veſſel, and a thick covering of cement was applied, after the glaſs had been made dry with a cloth. Theſe precautions were uſed with a view to intercept all communication with the external air. The bottle was then expoſed to the light, in an inverted poſition, ſo that the extremity of the ſlip was in the water, and its top remained in the incloſed gas. The leaves began to wither in a few days, and a number of freſh ſhoots appeared in their places, both under the water and above its ſurface, before the tenth, which were green, and clothed with leaves. This experiment appears to prove clearly, that parts which are in a condition to grow without the help of reſpirable air, can give a green colour

to

to ſuch freſh ſprouts as they may chance to produce when ſeparated from the atmoſphere, provided the light ſhine on them. We alſo know that the functions of vegetables are but imperfectly performed during the ſun's abſence. They perſpire, upon an average, ten times more in twelve hours of day, than in an equal ſpace of night. When expoſed to a moderate light, they diſcharge oxygen freely; this proceſs ceaſes, as ſoon as they are removed into the dark. Many herbs fold up their leaves at ſunſet, cloſe their bloſſoms, and experience a kind of torpor, analogous to the ſleep of animals, during which their internal œconomy is ſuſpended. Light is therefore the chief exciting power, in adult vegetables, which gives activity to their different organs; and hence greenneſs, which indicates a plant to be in a healthy ſtate, ariſes from its juices being properly aſſimilated; to which the influence of the ſolar rays contributes, by giving its veſſels their neceſſary tone. Thus the different ſecretions required in its œconomy are elaborated; its fibres receive their juſt texture; and the hue which Nature has diffuſed ſo univerſally over this

part

part of creation, beſpeaks its vigour and proſperity. But oxygen diſcharges that function in ſeeds, which light diſcharges in maturer vegetables; and this temporary difference, in the nature of the ſame organized body, is a wiſe precaution; for, ſince the germ is intended to expand itſelf in the ground, the Author of the Univerſe has endued it with properties ſuſceptible of neceſſary impreſſions, from a cauſe that has free acceſs to its dark retreat.

With the aſſiſtance of this agent, it performs a kind of imperfect vegetation; which continues till the rudiment of the ſtem breaks the ſoil and comes into day, where it immediately experiences the influence of the light; which, by a change in its colour, gives it the appearance of a plant.

All the preceding concluſions apply ſolely to plants growing on dry land; for it is evident, from a ſlight conſideration of the ſubject, that the œconomy of aquatic vegetables conſiſts of a claſs of habits of a very different nature, which cannot be rightly underſtood, until they be inveſtigated by a courſe of experiments.

XXVIII.

XXVIII. *Deſcription of an improved Calender-Mill. By Mr.* EDMUND BUNTING.

WITH A PLATE.

From the TRANSACTIONS of the SOCIETY for the Encouragement of ARTS, MANUFACTURES, and COMMERCE.

A reward of Twenty Guineas was voted to Mr. BUNTING for this Improvement.

AAAA. (Plate XI. Fig. 1.) The frame-work.

B. The horſe-track.

C. The horſe-traces.

D. An upright-ſhaft.

E. A wheel fixed on the upper end of the ſhaft.

F. A wheel working in the wheel E, and moveable on a ſtud or pin fixed in the frame-work.

G.

G. A pin, with a roller on it, fixed in one of the arms or the rim of the wheel F.

H. A connecting-rod or piece, having a mortise or slit, at right angles with the line of direction; which mortise receives the pin and roller G.

I. A roller to support the end of the connecting-rod H.

K, K. Chains, with nuts and screws at their ends, to adjust them; one end of each is fixed to the upper quadrant, the other ends to the connecting-rod H.

L. A double-headed quadrant, moveable on the strong pin M, which pin serves the quadrant as a fulcrum: the pin M is firmly fixed in a piece N, the upper end of which is made fast to the frame-work.

O, O. Chains, with nuts and screws at one end, to adjust them: one end of each is fixed to the lower head of the quadrant L, the other ends are fixed, by their nuts and screws, to the piece P; which piece has a mortise in its centre, to receive the strong pin Q; which pin serves the press as a fulcrum, when it pitches, to take the

goods out. The pin Q is faſtened to the loaded preſs R, as deſcribed by the dotted lines in the plate.

S, S. Rollers to put the goods on.

Fig. 2. ſhews the parts deſcribed under the letters E, F, G, H and I, more diſtinctly.

Prefixed to the above deſcription is a certificate, ſigned by ſeveral perſons, ſtating that they have carefully examined Mr. Bunting's calender-mill, and do approve of it, as a valuable acquiſition to perſons in that branch of buſineſs, and calculated to deſerve attention, as well from its cheapneſs as from its practicability.

Fig. 1

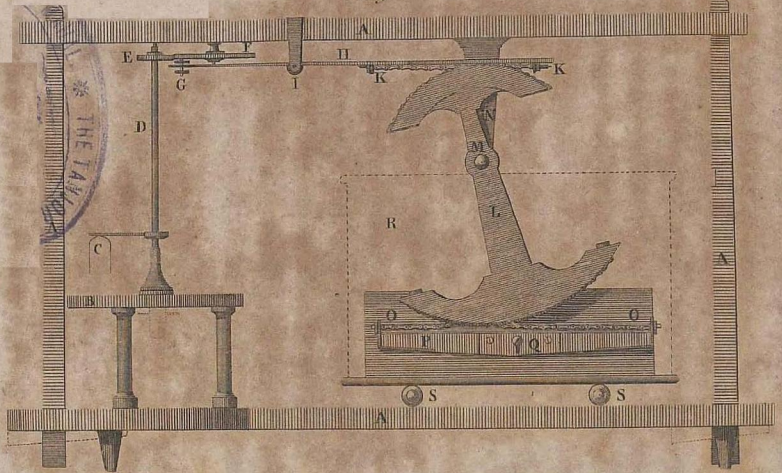


Fig. 2

XXIX. *On the Action of Nitre upon Gold and Platina.* *By* SMITHSON TENNANT, *Esq. F. R. S.*

From the PHILOSOPHICAL TRANSACTIONS of the ROYAL SOCIETY of LONDON.

GOLD, which cannot be calcined by expoſure to heat and air, has been alſo conſidered as incapable of being affected by nitre. But, in the courſe of ſome experiments on the diamond, an account of which has been communicated to the Royal Society, I obſerved, that when nitre was heated in a tube of gold, and the diamond was not in ſufficient quantity to ſupply the alkali of the nitre with fixed air, a part of the gold was diſſolved. From this obſervation, I was induced to examine more particularly the action of nitre upon gold, as well as to enquire whether it would produce any effect upon ſilver and platina.

With this intention, I put ſome thin pieces of gold into the tube together with nitre, and expoſed them to a ſtrong red heat for two or three hours. After the tube was taken from the fire, the part of the nitre which remained, conſiſting of cauſtic alkali and of nitre partially decompoſed, weighed 140 grains; and 60 grains of the gold were found to have been diſſolved. Upon the addition of water, about 50 grains of the gold were precipitated, in the form of a black powder. The gold which was thus precipitated was principally in its metallic ſtate, the greater portion of it being inſoluble in marine acid. The remaining gold, about 10 grains in weight, communicated to the alkaline ſolution, in which it was retained, a light yellow colour. By dropping into this ſolution diluted vitriolic or nitrous acid, it became at firſt of a deeper yellow; but, if viewed by the tranſmitted light, it ſoon appeared green, and afterwards blue. This alteration of the colour, from yellow to blue, ariſes from the gradual precipitation of the gold in its metallic form, which, by the tranſmitted light, is of a blue colour.

lour. Though the gold is precipitated from this ſolution in its metallic form, yet there ſeems to be no doubt that, while it remains diſſolved, it is entirely in the ſtate of calx. Its precipitation, in the metallic ſtate, is occaſioned by the nitre contained in the ſolution, which, having loſt part of its oxygen by heat, appears to be capable of attracting it from the calx of gold; for I found, that if the calx of gold is diſſolved, by being boiled in cauſtic alkali, and a ſufficient quantity of nitre, which has loſt ſome of its air by heat, is mixed with it, the gold is precipitated by an acid in its metallic ſtate*.

Having

* As the precipitation of gold in its metallic form, by nitre which has loſt ſome of its oxygen, has not, I believe, been noticed, it may not be improper to mention ſome of thoſe facts relating to it which ſeem moſt entitled to attention. Nitre which has been heated ſome time, precipitates gold in its metallic ſtate, from a ſolution in *aqua regia*, if it is diluted with water. If a ſolution of gold in nitrous acid is dropped into pure water, the calx of gold is ſeparated, which is of a yellow colour; but, if the water contains a very ſmall portion of nitre which has loſt ſome of its air by heat, (as one grain in ſix ounces,) the gold is deprived of its oxygen, and becomes blue. The alkali of the nitre does

Having found that nitre would diſſolve gold, I tried whether it would produce any effect upon platina.

It has been formerly obſerved, that the grains of platina, in the impure ſtate in which it is originally found, might, by being long heated in a crucible with nitre, be reduced to powder. Lewis, from his own experiments, and thoſe of Margraaf, thought that the iron only, which is contained in the grains of platina, was corroded by the nitre. But, by heating nitre with ſome thin pieces of pure platina, in a cup of the ſame metal, I found that the platina was eaſily diſ-

does not aſſiſt in producing this effect. Nitrous acid alone, which does not contain its full proportion of oxygen, occaſions the ſame precipitation, unleſs it is very ſtrong; and, if a mixture of ſuch ſtrong nitrous acid, and of a ſolution of gold in nitrous acid, is dropped into water, the gold is deprived of its oxygen, and is precipitated of a blue colour. Two cauſes contribute to produce this effect upon the addition of water. The adheſion of the calx of gold to nitrous acid is by that means weakened; and the oxygen is attached more ſtrongly to the imperfect nitrous acid, in conſequence of their attraction for water when they are united.

ſolved;

folved; the cup being much corroded, and the thin pieces entirely deſtroyed. By diſſolving the ſaline matter in water, the greater part of the platina was precipitated in the form of a brown powder. This powder, which was entirely ſoluble in marine acid, conſiſted of the calx of platina, combined with a portion of alkali, which could not be ſeparated by being boiled in water. The platina, which was retained by the alkaline ſolution, communicated to it a brown yellow colour. By adding an acid to it, a precipitate was formed, which conſiſted of the calx of platina, of alkali, and of the acid which was employed.

Silver, I found to be a little corroded by nitre. But, as its action upon that metal was very inconſiderable, it did not appear to be deſerving of a more particular examination.

XXX. *On the Management of the Dairy, particularly with Reſpect to the making and curing of Butter. By* J. ANDERSON, *L.L.D. F.R.S. and F.S.A.S.*

WITH A PLATE.

From the Letters and Papers of the Bath and Weſt-of-England Society for the Encouragement of Agriculture, &c.

WHEN a dairy is eſtabliſhed, the undertaker may ſometimes think it his intereſt to obtain the greateſt poſſible *quantity* of produce; ſometimes it may be more beneficial for him to have it of the *fineſt quality*; and at other times it may be neceſſary to have both theſe objects in view, the one or the other in a greater or leſs proportion; it is therefore of importance that he ſhould know how he may accompliſh the one or the other of theſe purpoſes, in the eaſieſt and moſt direct manner.

To

To be able to convert his milk to the higheſt poſſible profit, in every caſe, he ought to be fully acquainted with every circumſtance reſpecting the manufacture both of butter and of cheeſe; as it may in ſome caſes happen, that a certain portion of that milk may be more advantageouſly converted into butter than into cheeſe, while another portion of it would return more profit if made into cheeſe. It is not, however, intended in the preſent eſſay to enter into this wide diſcuſſion. Here, it is only propoſed to treat of the manufacture of butter, leaving the ſubject of cheeſe-making to ſome other perſon to treat of, who is more converſant in that department than the author of this eſſay.

The firſt thing to be adverted to, in an undertaking of this nature, is to chooſe cows of a proper ſort. Among this claſs of animals, it is found by experience, that ſome kinds give milk of a much thicker conſiſtence, and richer quality, than others; nor is this richneſs of *quality* neceſſarily connected with the ſmallneſs of the *quantity* yielded by cows of nearly an equal ſize; it therefore behoves the owner of a dairy to be

peculiarly attentive to this circumſtance. In judging of the value of a cow, it ought rather to be the quantity and the quality of the *cream* produced from the milk of the cow, in a given time, than the quantity of the milk itſelf: this is a circumſtance that will be ſhewn hereafter to be of more importance than is generally imagined. The ſmall cows of the Alderney breed afford the richeſt milk hitherto known; but individual cows in every country may be found, by a careful ſelection, that afford much thicker milk than others; theſe therefore ought to be ſearched for with care, and their breed reared with attention, as being peculiarly valuable.

Few perſons, who have had any experience at all in the dairy, can be ignorant, however, that in comparing the milk of two cows, to judge of their reſpective qualities, particular attention muſt be paid to the time that has elapſed ſince their calving; for the milk of the ſame cow is always thinner ſoon after calving, than it is afterwards; as it gradually becomes thicker, though generally leſs in quantity, in proportion to the time ſince the cow has calved. The colour of the milk,

milk, ſoon after calving, is richer than it is afterwards; but this, eſpecially for the firſt two weeks, is a faulty colour, that ought not to be coveted.

To make the cows give abundance of milk, and of a good quality, they muſt at all times have plenty of food. Graſs is the beſt food yet known for this purpoſe, and that kind of graſs which ſprings up ſpontaneouſly on rich dry ſoils is the beſt of all *. If the temperature of the

* So little attention has hitherto been beſtowed on this ſubject, that I do not know of any ſet of experiments that has ever yet been made, with a view to aſcertain the effects of any of the natural graſſes that ſpontaneouſly ſpring up in abundance in our fields, either on the quantity or the quality of the milk of cows, and few that have been attempted, even with regard to thoſe plants that have been cultivated by art, as green forage for them; though it is well known that ſome particular kinds of plants ſtrongly affect the taſte, and alter the quality of particular products, of milk. It is, indeed, in all caſes, confidently aſſerted, that old paſtures alone can ever be made to afford rich butter or cheeſe. This however I know, from my own repeated experience, to be a popular error; as I have frequently ſeen much richer butter made, by one perſon, from cows that were fed in the houſe, chiefly

the climate be ſuch as to permit the cows to graze at eaſe throughout the day, they ſhould be ſuffered to range on ſuch paſtures at freedom; but, if the cows are ſo much incommoded by the heat as to be prevented from eating through the day, they ought in that caſe to be taken into cool ſhades for protection, where, after allowing them a proper time to ruminate, they ſhould be ſupplied with abundance of green food, freſh-cut for the purpoſe, and given to them by hand frequently, in ſmall quantities, freſh and freſh, ſo as to induce them to eat it with pleaſure *. When the

with cut clover and rye graſs, than that which was made by others, where the cows were fed on very rich old paſtures. Mankind are in general diſpoſed to throw the blame of every failure upon ſome circumſtance that does not reflect upon themſelves as bad managers. Hence it is, that the graſs of a farm is often blamed for the want of richneſs of the butter produced upon it; when, if the circumſtances were fully inveſtigated, it would be found to be occaſioned by the unſkilfulneſs of the dairy-maid, or the want of attention in the choice of proper cows.

* In very warm climates, where the heat is extremely oppreſſive to cows, and the flies are exceedingly troubleſome, ſheds

the heat of the day is over, and they can remain abroad with eaſe, they may be again turned into the paſture, where they ſhould be allowed to range with freedom all night, during the mild weather of ſummer.

Cows, if abundantly fed, ſhould be milked three times a day, during the whole of the ſummer ſeaſon *; in the morning early, at noon, and

ſheds open on one ſide, the roof being only ſupported there by pillars, would not afford them ſuch effectual ſhelter as they would require. In theſe caſes, the ſheds ſhould be walled up on both ſides, and be left open only at the two ends, which, if properly placed, would produce a continued ſtream of air throughout the whole building, that would prove highly ſalutary to the cattle.

* If cows be milked only twice in the day, (24 hours,) while they have abundance of ſucculent food, they will yield a much ſmaller quantity of milk, in the ſame time, than if they be milked three times. Some attentive obſervers I have met with, think a cow, in theſe circumſtances, will give nearly as much milk at *each* time, if milked three times, as if ſhe were milked only twice. This fact, however, has not, that I know of, been aſcertained by experiment. There can be no doubt but they give more, how much more is not aſcertained;

and in the evening, juſt before night-fall. In the choice of perſons for milking the cows, great caution ſhould be employed; for, if that operation be not carefully and properly performed, not only the quantity of the produce of the dairy will be greatly diminiſhed, but its quality alſo will be very much debaſed; for, if all the milk be not thoroughly drawn from a cow when ſhe is milked, that portion of milk which is left in the udder ſeems to be gradually abſorbed into the ſyſtem, and Nature generates no more than to ſupply the waſte of what has been taken away. If this leſſened quantity be not again thoroughly drawn off, it occaſions a yet farther diminution of the quantity of milk generated; and thus it may be made to proceed, in perpetual progreſſion from little to leſs, till none at all is produced. In ſhort, this is the practice in all caſes followed, when it is meant to allow a cow's milk to dry up entirely, without doing her hurt. In this manner, therefore, the profits of

aſcertained; nor, whether it would be advantageous, in any caſe, to milk them four times, or oftener; nor, what effect frequent milking produces on the *quality* of the milk.

a dairy

a diary might be wonderfully diminiſhed; ſo that it much behoves the owner of it to be extremely attentive to this circumſtance, if he wiſhes to avoid ruin. It ought to be a rule without an exception, never to allow this important department to be entruſted, without controul, to the management of hired ſervants*. Its importance will be ſtill more manifeſt from what follows.

In the management of a dairy, the following peculiarities reſpecting milk ought to be very particularly adverted to; ſome of them are, no doubt, known in part to attentive houſewives; but they never yet, I have reaſon to believe,

* Cows ſhould always be treated with great gentleneſs, and ſoothed by mild uſage, eſpecially when young and ticklish, or when the paps are tender; in which laſt caſe, the udder ought to be fomented with warm water before milking, and touched with the greateſt gentleneſs, otherwiſe the cow will be in danger of contracting bad habits, becoming ſtubborn and unruly, and retaining her milk ever after. A cow never lets down her milk pleaſantly to the perſon ſhe dreads or diſlikes. The udder and paps ſhould always be waſhed with clean water before milking; but care ſhould be taken that none of that water be admitted into the milking-pail.

have

have been adverted to as their importance deſerves; and by many have never been thought of at all. I ſhall put them down in the form of aphoriſms, that they may be the more eaſily adverted to, and retained.

APHORISM I.

Of the Milk that is drawn from any Cow at one Time, that which comes off at the firſt is always thinner, and of a much worſe Quality, than that which comes afterwards; and the richneſs goes on continually increaſing, to the very laſt drop that can be drawn from the Udder at that Time.

Few perſons are ignorant, that the milk which is laſt of all taken from the cow, at milking, (in this country called *ſtroakings*,) is richer than the reſt of the milk; but fewer ſtill are aware of the greatneſs of the diſproportion between the quality of the firſt and the laſt drawn milk, from the ſame cow, at one milking. The following facts reſpecting this circumſtance were aſcertained by me many years ago, and have been con-

confirmed by many ſubſequent experiments and obſervations.

Having taken ſeveral large tea-cups, exactly of the ſame ſize and ſhape, one of theſe tea-cups was filled at the beginning of the milking, and the others at regular intervals, till the laſt, which was filled with the dregs of the ſtroakings. Theſe cups were then weighed, the weight of each having been ſettled, ſo as to aſcertain that the quantity of milk in each was preciſely the ſame; and, from a great number of experiments, frequently repeated with many different cows, the reſult was in all caſes as follows.

The quantity of cream obtained from the firſt-drawn cup was, *in every caſe*, much ſmaller than from that which was laſt drawn; and thoſe between afforded leſs or more, as they were nearer the beginning or the end. It is unneceſſary here to ſpecify theſe intermediate proportions; but it is proper the reader ſhould be informed, that the quantity of cream obtained from the laſt-drawn cup, from ſome cows, exceeded that from the firſt in the proportion of *ſixteen* to *one*. In other cows, however, and in particular circum-

ſtances, the diſproportion was not quite ſo great; but in no caſe did I find it fall ſhort of the rate of *eight* to *one*. Probably, upon an average of a great many cows, it might be found to run as *ten* or *twelve* to *one*.

Secondly. The difference in the *quality* of the cream, however, obtained from theſe two cups, was much greater than the difference in the quantity. In the firſt cup, the cream was a thin tough film, thinner, and perhaps whiter, than the paper on which I write; in the laſt, the cream was of a thick *butyrous* conſiſtence, and of a glowing richneſs of colour, that no other kind of cream is ever found to poſſeſs.

Thirdly. The difference in the quality of the *milk* that remained, after the cream was ſeparated, was perhaps ſtill greater than either in reſpect to the quantity or the quality of the cream. The milk in the firſt cup was a thin bluiſh liquid, as if a very large proportion of water had been mixed with ordinary milk; that in the laſt cup was of a thick conſiſtence, and yellow colour, more reſembling cream than milk, both in taſte and appearance.

From

From this important experiment it appears, that the perſon who, by bad milking of his cows, loſes but half a pint of his milk, loſes in fact about as much cream as would be afforded by ſix or eight pints at the beginning, and loſes, beſides, that part of the cream which alone can give richneſs and high flavour to his butter. Many other uſeful corollaries may be drawn from it, which I do not at preſent ſtop to enumerate: ſome of them will occur in the ſequel.

APHORISM II.

If Milk be put into a Diſh, and allowed to ſtand till it throws up Cream, that Portion of Cream which riſes firſt to the Surface is richer in Quality, and greater in Quantity, than what riſes in a ſecond equal Space of Time; and the Cream that riſes in the ſecond interval of Time is greater in Quantity, and richer in Quality, than that which riſes in a third equal Space of Time; that of the third than the fourth, and ſo on: the

Cream that riſes decreaſing in Quantity, and declining in Quality, continually, as long as any riſes to the Surface.

My experiments not having been made with ſo much accuracy in this caſe as in the former, I have not been enabled to aſcertain the difference in the proportion that takes place in equal portions of time; but they have been ſo often repeated as not to leave any room to doubt the fact, and it will be allowed to be a fact of no ſmall importance in the management of the dairy. It is not certain, however, but that a greater *quantity* of cream may, upon the whole, be obtained from the milk by taking it away at different times; but the proceſs is ſo troubleſome as not to be counterbalanced by the increaſed quantity obtained, if indeed an increaſed quantity be thus obtained, which is not as yet quite certain.

APHORISM III.

Thick Milk always throws up a ſmaller Proportion of the Cream it actually contains, to the Surface, than

than Milk that is thinner; but that Cream is of a richer Quality. If Water be added to that thick Milk, it will afford a conſiderably greater Quantity of Cream than it would have done if allowed to remain pure, but its Quality is, at the ſame Time, greatly debaſed.

This is a fact that every perſon attentive to a dairy muſt have remarked; but I have never heard of any experiment that could aſcertain, either the preciſe amount of the increaſed quantity of cream that might thus be obtained, or of the ratio in the decreaſe of its quality. The effects of mixing water with the milk in a dairy are at leaſt aſcertained; and the knowledge of this fact will enable attentive perſons to follow that practice which they think will beſt promote their own intereſt.

APHORISM IV.

Milk which is put into a Bucket or other proper Veſſel, and carried in it to any conſiderable Diſtance, ſo as to be much agitated, and in Part cooled, before it be put into the Milk-Pans, to ſettle for Cream,

Cream, never throws up ſo much, nor ſo rich Cream, as if the ſame Milk had been put into the Milk-Pans directly after it was milked.

In this caſe, it is believed the loſs of cream will be nearly in proportion to the time that has elapſed, and the agitation the milk has ſuſtained, after being drawn from the cow. But I am not as yet in poſſeſſion of any experiments that ſufficiently aſcertain how much is to be aſcribed to the time, and the agitation, taken ſeparately. On every branch of agriculture we find experiments wanting, at each ſtep we advance in our enquiries; and it is the duty of every enquirer to point out, as he goes along, where they are wanted, ſince the labours of no one man can poſſibly complete the whole.

TO BE CONTINUED IN OUR NEXT.

XXXI. *Inſtructions reſpecting the Purification of Saltpetre, drawn up by Order of the Committee of Public Safety of Paris; by whoſe Order alſo this Proceſs is adopted in all the Laboratories of the French Republic.*

FROM THE *ANNALES DE CHIMIE.*

THE crude ſaltpetre is firſt to be bruiſed with wooden beaters, that the water, with which it is afterwards to be waſhed, may more eaſily act upon every part of it.

The ſaltpetre, thus bruiſed, is then to be carried to proper tubs or vats, in each of which five or ſix hundred pounds may be put.

Water is to be poured upon the ſaltpetre, in the proportion of twenty parts to a hundred, and the mixture is to be well ſtirred.

It is then to be left to macerate or ſoak, till the liquor will diſſolve no more. Six or ſeven hours are

are ſufficient for this firſt operation; the liquor then indicates from twenty-five to thirty-five degrees, by the *peſe-liqueur*.

This firſt waſhing is then to be drained off, and freſh water, in the proportion of ten parts to a hundred, is to be poured on the ſaltpetre.

The mixture is to be ſtirred, and left to ſoak for the ſpace of an hour: the water is then to be again drained off.

Freſh water is to be once more poured on the ſaltpetre, in the proportion of five parts to a hundred, which water, after ſtirring, is to be immediately drained off.

This drained ſaltpetre is then to be put into a cauldron, containing fifty parts of boiling water to a hundred. When the ſaltpetre is diſſolved, the ſolution ought to indicate from ſixty-ſix to ſixty-eight degrees, by the *peſe-liqueur*.

The ſolution is then to be carried to a cryſtalizing veſſel, in which, by cooling, about two thirds of the ſaltpetre made uſe of will be precipitated; the precipitation begins in about half an hour, and finiſhes from four to ſix hours afterwards. But, as it is of importance that the

ſaltpetre

ſaltpetre ſhould be obtained in the form of thin needles, becauſe in this form it is more eaſily dried, it is neceſſary that the liquor in the cryſtalizing veſſel ſhould be ſtirred the whole time the precipitation is forming. The ſtirring is performed by means of a kind of rake, which gives a ſlight motion to the maſs of liquor, and cauſes the cryſtals to be precipitated in the form of thin needles.

As the precipitation takes place, the cryſtals are to be brought to the border of the cryſtalizing veſſel; to be taken up with a ſkimmer, and put to drain in baſkets placed, for that purpoſe, upon frames, in ſuch a manner that the water which runs from the cryſtals, may fall again into the cryſtalizing veſſel; or it may be received in baſons placed under the baſkets.

The ſaltpetre is then to be thrown into wooden boxes, formed like the hopper of a mill, and having a double bottom. The upper bottom is ſupported, by means of pieces of wood, about two inches above the lower one, and is pierced full of ſmall holes; through theſe holes the liquor drains off, and finally paſſes, through a hole made

in the lower bottom, into a reſervoir beneath. In theſe boxes the ſaltpetre is to be waſhed, with five parts of water to a hundred; this water may be uſed for diſſolving the ſaltpetre, in future operations.

The ſaltpetre, after being well drained, and expoſed to the air for ſome hours, upon proper tables for drying it, may be afterwards made uſe of for making gunpowder.

But, when it is intended to make uſe of the ſaltpetre for making gunpowder according to the proceſs followed ſince the revolution, it muſt be much more highly dried. This may be accompliſhed by placing it in a ſtove; or, what is more ſimple, by heating it in a ſhallow cauldron. For this purpoſe, a layer, five or ſix inches in thickneſs, is to be put in the cauldron, which is to be heated to 40 or 50 degrees of Reaumur's thermometer.

The ſaltpetre is to be ſtirred for two or three hours, and to be ſo much dried, that, when ſtrongly preſſed in the hand, it does not acquire any conſiſtence, nor retain any form, but appears like fine dry ſand.

This

This degree of dryneſs is not neceſſary, when the gunpowder is to be made by beating with peſtles.

It is then evident that, according to the method of purification we have deſcribed, there are two kinds of liquor to conſider; firſt, the water from the various waſhings of the crude ſaltpetre; ſecondly, the water from the cryſtalizing veſſels.

The waſhing of the crude ſaltpetre is repeated three times, as we have already mentioned.

In theſe three operations, thirty-five parts of water to a hundred of ſaltpetre, according to the quantity of it meant to be purified, are employed in waſhing.

Theſe waſhings are founded upon the principle which eſtabliſhes, that cold water diſſolves the muriate of ſoda, (ſea-ſalt,) the earthy nitrates and muriates, and the colouring principle, while it ſcarcely acts upon the nitrate of potaſh, (pure ſaltpetre.)

The water from theſe three waſhings, therefore, contains the muriate of ſoda, the earthy ſalts, the colouring principle, and a ſmall portion of nitrate of potaſh, the quantity of which is in

proportion to the muriate of ſoda, which determines its diſſolution.

The water from the cryſtalizing veſſels contains that portion of muriate of ſoda, and of earthy ſalts, which were not diſſolved by the waſhings, alſo a more conſiderable quantity of nitrate of potaſh than was contained in the water of the waſhings.

The water which is employed at the end of the proceſs, to waſh and whiten the cryſtals placed in the wooden box, holds in ſolution only a ſmall quantity of nitrate of potaſh.

Theſe liquors therefore are of a very different nature.

The waters proceeding from the waſhings, may properly be called mother-waters; they ought to be collected together in baſons, and treated with potaſh, according to the uſual method. At the refinery called *de l'Unité*, they are evaporated to ſixty-ſix degrees, and the muriate of ſoda is taken away, as faſt as it is depoſited; this ſolution is ſaturated with potaſh, in the proportion of two or three to the hundred; it is then ſuffered to ſettle, and the liquor is afterwards

terwards decanted into cryſtalizing veſſels, in which are thrown twenty parts of water to a hundred, that all the muriate of ſoda may be kept in ſolution.

The liquor which remains above the cryſtals, produced by this treatment of the mother-waters, may be mixed with the water of the firſt cryſtalization. The muriate of ſoda may be ſeparated from this liquor by ſimple evaporation; and the nitrate of potaſh which it holds in ſolution may be obtained from it by cooling.

The ſmall quantity of water made uſe of to whiten the refined ſaltpetre, contains only nitrate of potaſh; it may therefore be made uſe of for diſſolving the ſaltpetre in the cauldrons.

From the foregoing account it is evident, that a laboratory deſtined for the purification of ſaltpetre, according to the proceſs here deſcribed, ought to be provided with the following articles.

1. Wooden beaters for bruiſing the crude ſaltpetre.

2. Tubs or vats, in which the ſaltpetre is to be waſhed.

3. A cauldron, in which the ſolution is to be made.

4. A cryſtalizing veſſel, of copper, or of lead, in which the liquor is to be cooled, and the ſaltpetre cryſtalized.

5. Baſkets for draining the cryſtals.

6. A wooden box, in which the cryſtals are to be more thoroughly drained, and the ſaltpetre waſhed for the laſt time.

7. Scales for weighing the ſaltpetre.

8. Thermometers and *peſe-liqueurs*, to determine the degree of heat, and that of conſiſtence.

9. Rakes to ſtir the liquor in the cryſtalizing veſſel.

10. Skimmers to take off the cryſtals and put them into the baſkets.

11. Syphons or cranes to empty the cauldrons.

The number of theſe implements, and their dimenſions, muſt neceſſarily vary, according to the quantity of ſaltpetre propoſed to be purified.

Suppoſing it is wiſhed to purify ten thouſand pounds of crude ſaltpetre *per* day; the number of men and utenſils, neceſſary for that purpoſe, may

may be determined according to the following calculation.

On weighing and bruiſing the crude Saltpetre. A piece of ground muſt be ſet apart, as near the magazine as poſſible, for the purpoſe of beating or bruiſing the crude ſaltpetre.

This ground muſt be covered with broad ſmooth ſtones, or with very thick boards.

For bruiſing the ſaltpetre, wooden beaters may be made uſe of, ſimilar to thoſe which are uſed for beating mortar.

Two men are ſufficient for carrying the ſaltpetre to the magazine, for weighing it, and bruiſing it.

On waſhing the Saltpetre. As the three waſhings take up the ſpace of two days *, and as each of the tubs or vats will contain only five or ſix hundred pounds of ſaltpetre, twenty of them

* This neither agrees with the time ſtated, in the beginning of the paper, as neceſſary for the three waſhings, nor with what has juſt now been ſaid, that ten thouſand pounds may be thus refined *per* day. We notice this, leſt our readers ſhould think our tranſlation erroneous.

will

will be neceſſary for the purification of ten thouſand pounds.

Theſe tubs are to be two feet and a half in height, and the ſame in breadth.

They muſt be conſtructed with the greateſt care, that the water uſed in waſhing the ſaltpetre may not eſcape through them.

They ſhould be firmly fixed upon a plane, ſlightly inclined, of ſuch a nature that the water from the ſaltpetre cannot ſoak into it. This plane ſhould be terminated by a gutter, to receive the water from the ſaltpetre, and to conduct it into a reſervoir placed at the end of the row of tubs.

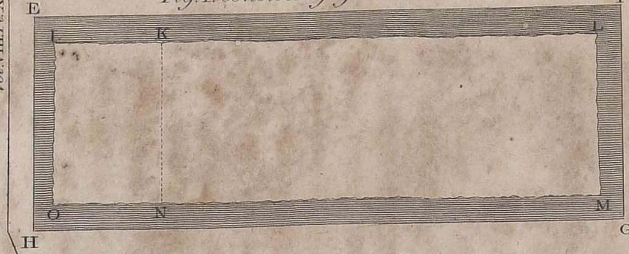
Theſe twenty tubs may be diſpoſed in two parallel lines. The planes upon which they are fixed may be inclined towards each other; ſo that their union may form the gutter or channel which is to conduct into the common reſervoir the water that runs off.

Theſe tubs are to have an aperture at the diſtance of two fingers breadth from the bottom; which aperture (beſides the ſtopper which cloſes it) muſt have a grated or perforated cover.

Four

Vol. VIII. Pl. LIX.

Fig. 1. consisting of several Parts.



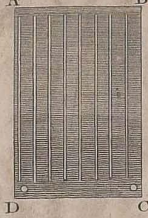


Fig. 3.

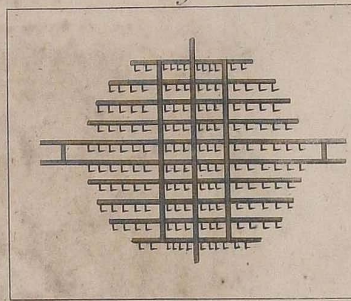
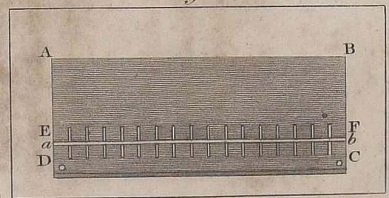
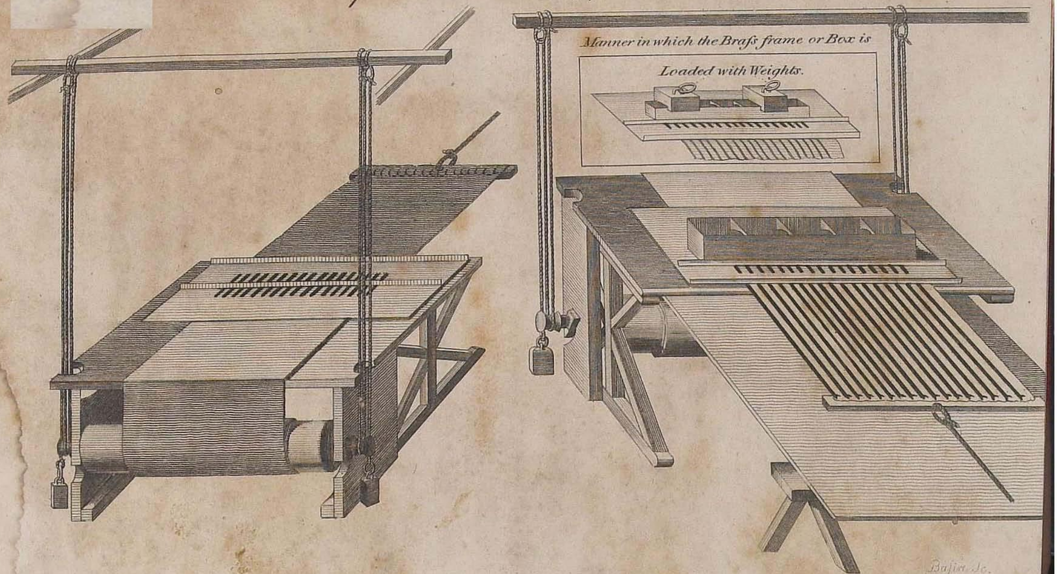


Fig. 2.



Two Views of the Machine,



Four men may be allotted to the waſhing of the ſaltpetre: they ſhould alſo have the charge of carrying the ſaltpetre from the magazine to the tubs, and from the tubs to the cauldron.

It is hardly neceſſary to mention, that the tubs ſhould be ſeparate from each other, and diſpoſed in ſuch a manner that they may be eaſily ſerved.

On the Cauldron. A conical cauldron, five feet broad, and four feet deep, will ſupply three operations in the day; and conſequently will ſuffice for the purification of fifteen thouſand pounds of ſaltpetre.

One man is ſufficient for the ſervice of the cauldron.

On the Veſſel for Cryſtalization. The cryſtalizing veſſel ſhould be made of lead, or of copper, and ſhould be placed as near the cauldron as poſſible.

It ſhould be fifteen inches in depth, ten feet in length, and eight in breadth.

It ſhould be fixed upon very ſolid ground, in ſuch a manner that every point of the bottom may be ſupported. The ſtone or brick work on which it is placed, ſhould be raiſed twelve inches above

the ground; by this means, the brink of the cryſtalizing veſſel will be twenty-ſeven inches above the ground, which will render the ſervice of it more eaſy and convenient.

It appeared to us advantageous, to give the bottom of the cryſtalizing veſſel an inclination of four inches (in the longitudinal direction only) from the ſides to the centre.

The ſolutions from the cauldron may be emptied ſeveral times ſucceſſively into the veſſel, after having taken away the depoſition of cryſtals ariſing from each ſolution.

Four men ſeem neceſſary for the ſervice of the cryſtalizing veſſel. They muſt keep the liquor conſtantly ſtirred, by moving the rakes therein; they muſt continually bring towards the edges of the veſſel the cryſtals which are formed; they muſt take them out with a ſkimmer, and carry them to the baſkets which are to receive them, and in which they are to drain.

The ſame men may put the ſaltpetre into the wooden boxes in which the draining is completed, and may afterwards carry it into the magazine for purified ſaltpetre.

For

For want of a large veſſel for cryſtalization, a ſhallow cauldron may be made uſe of.

On drying the Saltpetre. To render the ſaltpetre fit to be made uſe of in the preparation of gunpowder, as ſoon as it is purified, it may be dried by either of the two following proceſſes. Firſt, by expoſing it to the open air, or to the ſun, during ſome hours, upon ſuch tables as are uſed for drying gunpowder. Secondly, by putting it into a ſhallow cauldron, and keeping it, for the ſpace of two hours, in a heat of from 40 to 50 degrees.

In either caſe, the ſaltpetre muſt be inceſſantly ſtirred and ſhaken, that it may dry quickly and equally.

General remarks on the foregoing Proceſs. A pretty long experience has ſhewn us, that the proceſs here deſcribed is the moſt ſimple, and the moſt œconomical.

But, to ſpare others the trouble of trying ſuch means of improving this proceſs as have occupied our attention, but which we thought it right to reject, we ſhall ſubmit to them the following reflections.

1. It has been tried to diſſolve the crude ſaltpetre; to cryſtalize it; and afterwards to waſh it, in order to ſeparate the ſea-ſalt from it.

This proceſs at firſt ſight appears more advantageous, becauſe it is then unneceſſary to bruiſe the ſaltpetre, but it is attended with great inconveniences. Firſt, the crude ſaltpetre, diſſolved in fifty parts of water to a hundred, and poured into the cryſtalizing veſſel, does not depoſit the ſame quantity of ſaltpetre as when it is waſhed before it is diſſolved. This difference takes place, becauſe the ſea-ſalt, which exiſts in the crude ſaltpetre, facilitates the diſſolution of the nitrate of potaſh; and conſequently, the water in the cryſtalizing veſſel muſt neceſſarily hold in ſolution a greater quantity of nitrate of potaſh, when the crude ſaltpetre is diſſolved, than when it is previouſly waſhed in cold water, and thereby deprived of the ſea-ſalt it contained. Secondly, the waſhing of the ſaltpetre, when done after its diſſolution and cryſtalization, requires forty or fifty parts of water to a hundred, inſtead of thirty-five.

2. It has been tried to diſſolve the ſaltpetre in twenty or twenty-five parts of water to a hundred;

dred; to take away the muriate of ſoda, as faſt as it is precipitated by the boiling of the liquor; to dilute this ſolution with thirty parts of freſh water to a hundred, and then to carry it to the cryſtalizing veſſel. It was ſuppoſed, that by this means, the waſhings with cold water might be omitted, or conſiderably diminiſhed. But, a continued boiling, kept up for four or five hours, in order to ſeparate the ſea-ſalt, is attended with a great waſte of time, of fuel, and of ſaltpetre; and the waſhings are ſtill indiſpenſably neceſſary, both to take away the colouring matter, and to extract the laſt portions of ſea-ſalt.

3. It may be ſuppoſed, that it would perhaps be poſſible to diminiſh the quantity of water uſed in waſhing; but we muſt obſerve, that it is to be feared, that when the ſaltpetre contains a great quantity of ſea-ſalt, the purification of it would not be complete, if a leſs quantity of water were made uſe of than that we have preſcribed.

4. One might perhaps be tempted to diminiſh the quantity of water made uſe of in the ſolution; but we are convinced, by repeated experiments,

ments, that the proportion we have pointed out is the moſt proper: if it is augmented, the ſalt-petre remains diſſolved in the liquor; if it is decreaſed, it congeals or precipitates itſelf in a maſs. We found, by obſervation, that the degree of ſaturation, moſt proper for our operations, was between the ſixty-ſixth and ſixty-eighth degree of the *peſe-liqueur*.

5. It might alſo be thought, that it would be more ſimple, and more œconomical, to treat the ſolutions of crude ſalt-petre with potaſh; but it is to be feared, that by ſo doing, a part of this alkali might have the effect of decompoſing the muriate of ſoda, and converting it into muriate of potaſh; and it muſt be obſerved, that the laſt-mentioned ſalt is by no means proper for decompoſing earthy nitrates, whatever ſome able chemiſts may have ſaid of it.

It therefore appears more proper, not to treat the mother-waters, nor to make any uſe of potaſh, till all the ſea-ſalt has been ſeparated by evaporation.

XXXII.

XXXII. *List of Patents for Inventions, &c.*

(Continued from Page 144.)

JOHN RICHARDSON, of the Parish of St. Giles in the Fields, Optician; for a machine to be applied to glasses and pebbles of every description, for the use of sights in general. Dated July 4, 1797.

HENRY JOHNSON, of London, Gentleman; for a water-proof compound, and a vegetable liquid for bleaching, whitening, and cleansing woollens, linens, cottons, &c. and also for preparing stuffs or cloths made of wool, linen, cotton, or silk, in order, by the application of the aforesaid water-proof compound, to render them impenetrable to wet. Dated July 7, 1797.

ARCHIBALD, Earl of DUNDONALD; for a method of preparing cerusе, or white lead, which he conceives will be of great public utility, particularly as he has reason to believe it will not be injurious to the health of persons employed therein. Dated August 16, 1797.

ANTHONY

ANTHONY GEORGE ECKHARDT, of Hans Square, in the county of Middlesex, Gentleman; for a method of constructing pumps and engines for evacuating water or other fluids, extinguishing of fires, &c. Dated August 18, 1797.

WILLIAM CHAPMAN, of Newcastle-upon-Tyne, Gentleman; for a method of laying, twisting, or making ropes or cordage, of any number of yarns or strands, or any number of threads, tarred or untarred. Dated, Sept. 13, 1797.

SAMUEL STANFIELD, of Stayley-Bridge, in the county of Lancaster, Clock-maker; for a machine for roving or spinning of cotton, flax, hemp, worsted, yarn, wool, &c. and for doubling and twisting silk, cotton, and thread. Dated Sept. 13, 1797.

CHARLES BAKER, of the city of Bristol, Seedsman; for a method of preventing the smut in wheat. Dated October 11, 1797.

EDMUND CARTWRIGHT, of the parish of St. Mary-le-Bone, in the county of Middlesex, M. A.; for an incombustible substitute for certain materials commonly used in constructing dwelling-houses and other buildings. Dated October 11, 1797.

Printed by JOHN NICHOLS, Red-Lion-Passage, Fleet-Street, London.

REPERTORY
OF
ARTS AND MANUFACTURES.

NUMBER XLVI.

Printed by JOHN NICHOLS, Red-Lion-Paſſage, Fleet-Street, London.

XXXIII. *Specification of the Patent granted to Mr.* JOHN HAWKSLEY, *of Arnold, in the County of Nottingham, Worſted Manufacturer; for certain Improvements and Additions to Machinery for combing Wool, Cotton, Silk, Flax, Hemp, and Mohair; being a circular revolving Comb-Pot, to heat the Combs, to aid in the combing of Wool; and a Laſher or Layer-on of Wool, or other Materials, on the ſaid Combing Machine; and a Socket or Holſter, in which to place the Combs, in their reſpective Compartments, for drawing off the Wool, or other Materials, from the ſaid Machine.*

WITH TWO PLATES.

Dated July 4, 1797.

TO all to whom theſe preſents ſhall come, &c. NOW KNOW YE that, in compliance with the

ſaid priviſo, I the ſaid John Hawkſley do hereby deſcribe and aſcertain the nature of my ſaid invention, of improvements and additions to the ſaid machinery for combing wool, cotton, ſilk, flax, hemp, and mohair, and the manner in which the ſame is to be performed, as well by the figures or delineations of machinery, as by the deſcription or explanation ſet forth; that is to ſay, Fig. 1, (Plate XII.) A, is the fire-door. B, B, are the ſpaces in which the comb-teeth are admitted, to receive the heat. C, C, handles by which the ſtove may be impelled to revolve. D, pipe to convey the ſmoke away. E, a braſs ſtep in which the ſtove ſtands.

Fig. 2, is the drawing or combing machine for which a patent was granted in the year 1793 *, but now drawn horizontally, in order more clearly to ſhew what I deſcribe as an holſter or holſters, lettered F; which are made of caſt-iron, but which may be made of any other ſubſtance,

* For the ſpecification of the patent here referred to, ſee our ſecond volume, page 217.

and

and down the inſide of which the comb-handles are put, ready for the wool, or other materials, to be drawn off in a perpetual ſliver, (oppoſite which, marked G, are the combs, fixed in their ſeveral compartments, for the wool, &c. to be drawn off,) more readily than in the former patent in Fig. 5. A B C, by the long-cogged wheels, fully deſcribed (in the former patent) in Fig. 1, Q Q.

Fig. 3, (Plate XIII.) is a laſher or layer-on of wool, or other materials, that may be uſed and applied to the ſaid machines, as in the former patent, inſtead of the comb-wheel I, in Fig. 1, and K, in Fig. 5. H, is a ſhaft which runs through a ſtationary wheel I. K, is a wheel that revolves round the wheel I. L, L, are two coupling links. M, is a wheel fixed on its axis. N, is another wheel, alſo fixed on its axis. O, the centre-wheel, revolving with its axis. V, is a pinion, driving the wheel W, which gives motion to the rollers or long-cogged wheels R. P P, is wool, or other materials. Q, is a tube through which the wool

paſſes, or is drawn along, by the long-cogged wheels R.

S S, are two other views of the ſides or arms T, T, of Fig. 3.

In caſe it ſhould be preferred to lay or laſh the wool, or other materials, on the combs, and clear or work it by hand-labour, as has been done for ages, inſtead of the comb-wheels I, in Fig. 1, and K, in Fig. 5, of former patent, or Fig. 3, above deſcribed, I recommend that the combs ſhould be ſo ſmall that children may be able to do the office as well as men. In witneſs whereof, &c.

Fig. 2.

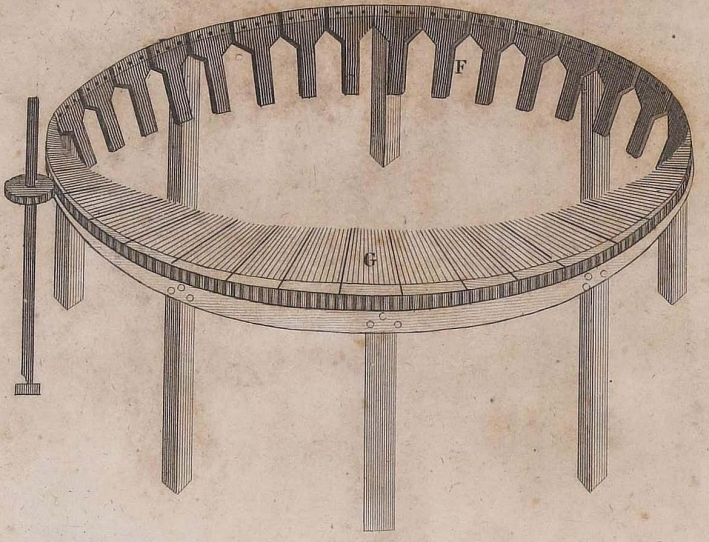


Fig. 1.

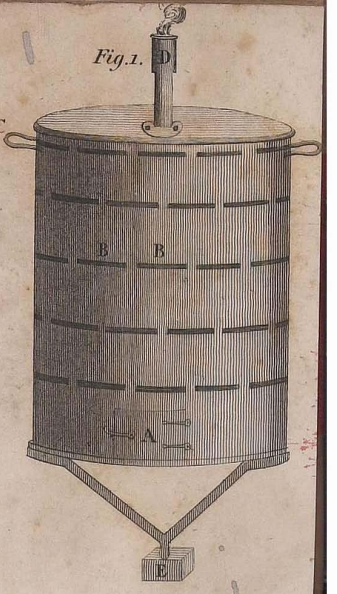
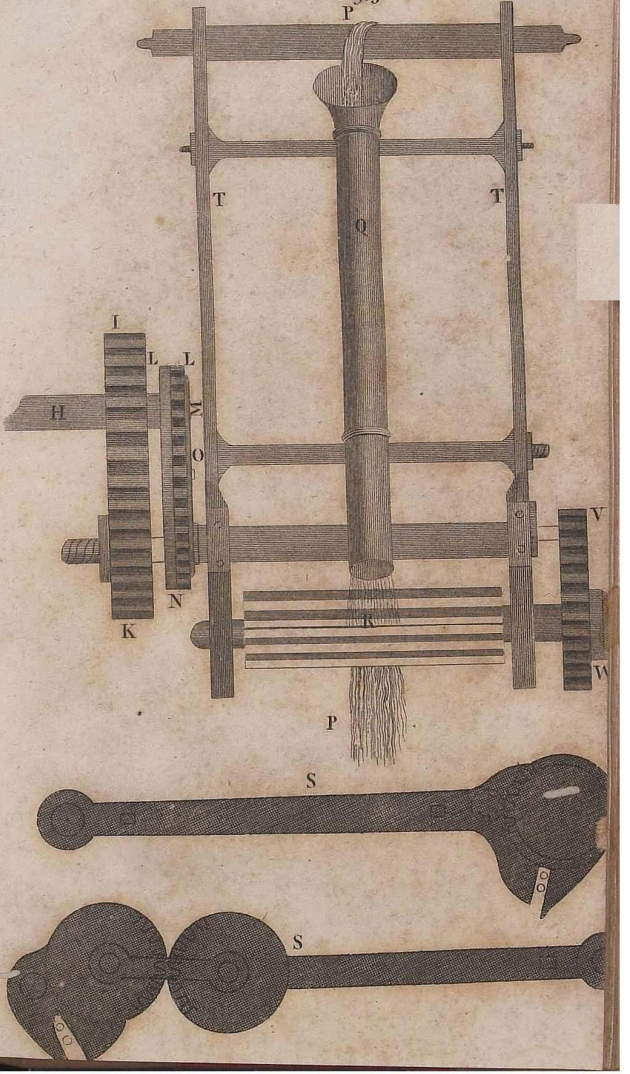


Fig. 3



XXXIV. *Specification of the Patent granted to Mr.* EDWARD LUCAS, *of the Town of Sheffield, in the Weſt Riding of the County of York, Iron-Maſter; for a Method of fuſing Ores, Metals, and Calx of Metals, whereby a conſiderable ſaving is made in Fuel and Labour.*

Dated October 30, 1792.

TO all to whom theſe preſents ſhall come, &c. NOW KNOW YE, that in compliance with the ſaid proviſo, I the ſaid Edward Lucas do hereby declare, that my ſaid invention of a method of fuſing ores, metals, and calx of metals, whereby a conſiderable ſaving is made in fuel and labour, is deſcribed in the manner following; that is to ſay, the furnaces to be employed in theſe operations may be built on the principle of a ſteel converting furnace, that is, by applying the heat of the fire to a fixed pot or pots, by means

means of flues, or by having the pots ſo placed as to be ſurrounded with the fire. The form and ſize of the pots and furnace may be varied, according to the quantity to be fuſed at one operation. The ſize and form of thoſe commonly uſed for the converſion of ſteel will be found convenient, and anſwer the purpoſe extremely well: with apertures through the ſides of the furnace, to communicate with the lower part of the pots, through which a ſmall opening muſt be made, to let off the melted matter; which opening muſt be ſtopped with ſand, earth, ſtone, or clay, during the operation; and, by having a communication through the dome and vault of the furnace, to the top of the pots, they may be charged while hot, which will expedite the operation; obſerving to cloſe theſe openings as cloſe and quick as may be, after charging, to prevent the loſs of heat. If a more intenſe heat is wanted, a blaſt of air may be conveyed through the fire, by means of air-cylinders, or bellows, in place of the common draught of air. Or thoſe furnaces may be adopted, in which the pot can be ſurrounded with

with the fuel, after the manner of a common air-furnace, and the heat increaſed by the application of a blaſt of air, as before mentioned. Theſe furnaces may be conſtructed of almoſt any form or ſize, and muſt alſo have apertures through the ſides, to communicate with the lower part of the pot, as in the others, whence the melted matter is to flow: they muſt alſo have a communication through the upper part of the furnace, to the top of the pot, through which the matter to be melted is to be introduced into the pot. Then take the ore, or calx, intended to be reduced to a metal, as for ſmelting; be careful it is well freed from ſulphur, or arſenick, which, if left in, would injure the quality of the metal. If the ore is of the refractory kind, a little of the cuſtomary fluxes uſed in ſmelting may be added, to facilitate the fuſion; the proportion muſt be regulated by the quality of the ore, and can only be attained by a little practice: add about a peck of charcoal-duſt (or even leſs will be ſufficient) to every hundred weight of ore, and mix them together. Almoſt every other ſubſtance containing the inflammable principle,

principle, termed by ſome chymiſts phlogiſton, may be ſubſtituted for charcoal-duſt, but none will anſwer the purpoſe better. The ingredients may then be thrown into the pot or pots before mentioned, and the fire applied, till the whole becomes fluid: it muſt then be tapped off, at the opening left at the bottom of the pot for that purpoſe. The pots may then be again filled with freſh materials, and proceed with the operation as before.

For the making of braſs, take the ingredients in the ſame proportions as in the common method, and proceed as with the ores of other metals, as before directed. In witneſs whereof, &c.

XXXV.

XXXV. *Specification of the Patent granted to Mr.* HARRY WATTS, *of Binley, in the County of Warwick, Gentleman; for his Invention of an Implement or Machine for draining Land.*

WITH A PLATE.

Dated October 19, 1797.

TO all to whom theſe preſents ſhall come, &c. NOW KNOW YE, that in compliance with the ſaid proviſo, I the ſaid Harry Watts do hereby deſcribe and aſcertain the nature of my ſaid invention, and in what way the ſame is to be uſed, in manner following; that is to ſay, when the implement or machine, hereafter deſcribed, is to be uſed, take from four to eight horſes, more or leſs, according to the nature of the land, and the depth it is to be worked, with their common harneſs or gearing, and a common ſwingle-tree; to which, hook one end of a chain, ſix feet and

upwards in length, as occaſion may require, and hook the other end of the chain to the hook of the ſaid implement or machine, in the ſame manner as to a common plough. Before the implement or machine is uſed, the land to be drained muſt be examined, in order to find out the moſt convenient place for carrying off the water; which muſt be conſequently the loweſt ſide or end of the field to be drained. Then a trench or open drain muſt be made by hand, with a ſpade, of a ſufficient width and depth to receive and carry off the water, into any adjoining watercourſes or ditches, from the mouths of the different drains intended to be made with the implement or machine, and which muſt be at leaſt two inches deeper than the mouths of the drains made by the ſaid implement or machine. Then ſet and faſten your coulter E (Plate XIV.) in the beam A A, of the ſaid implement or machine, with the bottom of the foot, wedge, or ſhare, parallel with the bottom of the beam A A, a ſufficient depth, ſo as the foot, wedge, or ſhare, will cut your intended drain through the ſoil, and about an inch or more deep into the clay or ſtrong ſoil, which

had

had prevented the water from filtering and abſorbing into the bowels of the earth. When the coulter E is ſo faſtened, then place it in the trench or open drain made by hand, as above mentioned, with the point of the foot, wedge, or ſhare, to cut in the direction in which you intend to make your drain with the implement or machine, ſo as the bottom of the beam A A, at the coulter E, may bear on the ſurface of the land, before the implement or machine is put in motion, which muſt be drawn in the direction you wiſh to make your drain; always obſerving to keep the beam A A quite upright when at work; and, when the drain intended to be made is completed, the implement or machine muſt be turned out on its ſide, ſimilar to a common plough, and then drawn back to the trench made by hand, and thence ſet to work again. When the land to be drained is in ridges or buts, with the headlands higher than the furrows or rains where the drains to be made by the implement or machine are to run, and there is a ditch or watercourſe near the hedge or fence in the land intended to be ſo drained, of a ſufficient depth to receive

and carry off the water, then trenches of a ſufficient width and depth muſt be made, by manual labour, acroſs the headland oppoſite to each furrow or rain where the drains are intended to be made by the implement or machine; which drains, made acroſs the headlands by manual labour, as aforeſaid, muſt be ſomewhat deeper than the ſurface of the furrow or rain where the drain intended to be made by the implement or machine is to run, in order that the water may have a proper current to drain off, into the ditch or watercourſe under the hedge or fence, as aforeſaid: and the turf ſo taken off by manual labour, as aforeſaid, may be afterwards relaid over the drain made by the implement or machine, acroſs the headlands. But, where there is no ditch or watercourſe under the hedge in the field intended to be drained, then cut a trench or open drain, by manual labour, between the headlands and buts, a ſufficient width and depth to carry off the water from the drains intended to be made, into which the foot, wedge, or ſhare, of the coulter E muſt be placed, and then proceed to make your drains as before deſcribed. In working this machine or implement,

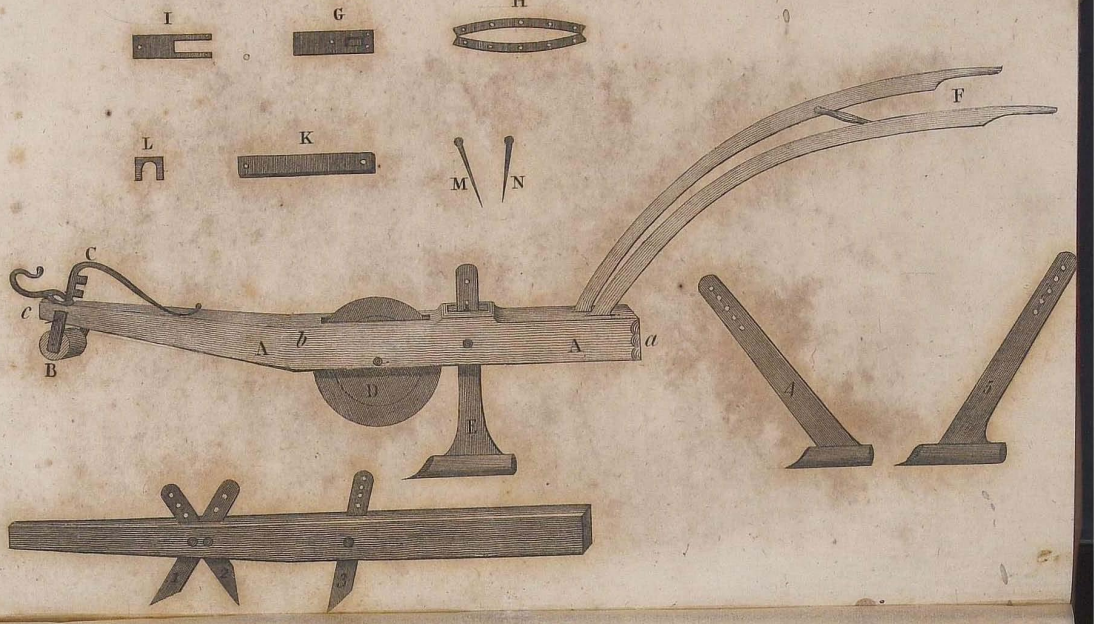
implement, as above deſcribed, it does not throw out any earth, but forms the drains by preſſure from the foot, wedge, or ſhare. When the implement is to be uſed in the furrows or rains of ploughed land, after it is ſown, inſtead of draining the furrows with a common plough, take out the rolling-cutter D, and ſcrew the plate K over the under-ſide of the cavity in the beam, to prevent the earth, &c. filling it up, and work it in the ſame manner as before deſcribed. When the implement or machine is worked in very ſtrong land, and it is found that the ſame preſſes or bears too hard on the thill horſe, the horſe may be very much eaſed by working the implement or machine behind tumbril ſhafts, in the manner in which a common plough is uſed in ſtrong land, and which ſaid implement or machine is more particularly delineated and deſcribed in the ſeveral drawings hereto annexed, and in the ſeveral references hereunder written; that is to ſay, A A, the beam or frame, ſix feet long; from *a* to *b* five inches thick, and ſix inches broad; from *b* to *c* decreaſed in a regular proportion, and three inches thick and five inches broad

at

at *c*. B, wooden bowl or roller, four inches and a half diameter, and four inches and a half broad; with an iron pin or axletree through the centre, which runs in two iron plates, fixed to the beam or frame A A, with a ſcrew-pin. C, cock, three inches and a half high from the beam or frame, with three notches to let up or lower the hook, as occaſion requires; let through the beam A A; faſtened down with an iron plate, at one end, and faſtened down to the beam, at the other end, with a ſtaple. D, rolling-cutter, ſixteen inches diameter, three quarters of an inch thick at the centre, bevelled off, in a regular declivity from the centre, to an edge; turning with a round iron pin or axletree, three quarters of an inch diameter, fixed to the centre of the cutter, and three quarters of an inch long on each ſide of the cutter; and running in a braſs box or ſocket, let into the beam or frame. E, the inſtrument for making the cavity, ſough, or drain, for conveying the water from the ſurface of the land; conſiſting of a wedge, foot, or ſhare, of an oval or any other ſolid form at the baſe; twelve inches long, two inches and a quarter to three inches or more thick,

thick, and two inches and a half to three inches and a half deep at the baſe, and terminating in a point; affixed to a perpendicular or vertical cutter, twenty-four inches long, three inches and a half broad at the top, ſeven inches broad at the bottom, and three quarters of an inch thick at the back part; whence it is bevelled off to an edge, with holes through the ſides, to raiſe the inſtrument, or make it go deeper, as occaſion requires. The above inſtrument E, and the rolling-cutter D, may be made either of caſt-ſteel, caſt-iron, or wrought-iron, ſteeled at the edge. F, two ſtilts, five feet three inches long, fixed in beam A A. G, plate of iron, let into the top of beam AA, to admit the cutter E through the beam. H, two plates of iron, let into the bottom of beam AA, to act as cleaners to the rolling-cutter D. I, plate let into the bottom of beam AA, to admit the cutter E through the beam, and faſtened to plate G, with a ſcrew-pin through the beam. K, plate to ſcrew over the under-ſide of the cavity in the beam AA, occupied by the rolling-cutter D, when the rolling-cutter is taken out in order to work the implement on ploughed land, to prevent the earth,

earth, &c. filling up the cavity. L, braſs, ſteel, or iron box or ſocket, let into the beam A A, for the pin or axle-tree of the rolling-cutter D to run in. M, iron-pin, going through the beam A A and the cutter E, to raiſe or lower the inſtrument E as occaſion requires; or the ſame pin may go through two ſtaples and the cutter, at the top of the beam, for the ſame purpoſe. N, wedge to faſten the inſtrument E in the beam A A. The implement may be uſed with either of the cutters Figs. 1, 2, and 3, inſtead of the circular-cutter D; and the coulter or ſhare, wedge or foot, may be made and uſed in the ſeveral forms deſcribed by the figures 4 and 5, in lieu of that marked E. The implement may be made of any other convenient ſize or dimenſions; but, on trial, the above-mentioned ſize or dimenſions appear to anſwer beſt in moſt kinds of land. In witneſs whereof, &c.


I
G
H
L
K
M
N
F
C
c
B
A
b
A
a
D
E
A
5
1
3

XXXVI. *Specification of the Patent granted to* DAVID HARTLEY, *of Golden-Square, in the Pariſh of St. James, Eſquire; for his Method of ſecuring Buildings and Ships againſt Fire.*

Dated April 1, 1773.—Term expired.

TO all to whom theſe preſents ſhall come, &c. NOW KNOW YE, that in compliance with the ſaid proviſo, I the ſaid David Hartley do hereby declare, that my ſaid invention of a particular method of ſecuring buildings and ſhips againſt the calamities of fire, is deſcribed in the manner following; that is to ſay, by the application of plates of metal, and wire, varniſhed or unvarniſhed, to the ſeveral parts of buildings and ſhips, ſo as to prevent the acceſs of fire, and the current of air; ſecuring the ſeveral joints by doubling-in, overlapping, ſoldering, rivetting, or in any other manner cloſing them up; nailing, ſcrewing, ſewing, or in any other manner faſtening, the ſaid plates of metal in, to, and about, the ſeveral parts of buildings and ſhips, as the caſe may require. In witneſs whereof, &c.

XXXVII. *Continuation of Dr.* ANDERSON'S *Obſervations on the Management of the Dairy.*

(From Page 198.)

FROM the above facts the following corollaries ſeem to be clearly deducible.

Firſt. It is of importance that the cows ſhould be always milked as near the dairy as poſſible, to prevent the neceſſity of carrying and cooling the milk before it is put into the diſhes; and, as cows are much hurt by far driving, it muſt be a great advantage, in a dairy farm, to have the principal graſs fields as near the dairy, or home-ſted, as poſſible.

Secondly. The practice of putting the milk of all the cows of a large dairy into one veſſel, as it is milked, there to remain till the whole milking is finiſhed, before any part of it is put into the milk-pans, ſeems to be highly injudicious; not

not only on account of the loſs that is ſuſtained by agitation and cooling, but alſo, more eſpecially, becauſe it prevents the owner of the dairy from diſtinguiſhing the good from the bad cow's milk, ſo as to ſeparate theſe from each other, where it is neceſſary. He may thus have the whole of his dairy product greatly debaſed by the milk of one bad cow, for years together, without being able to diſcover it *. A better practice therefore would be, to have the milk drawn from each cow put ſeparately into the creaming-pans as ſoon as it is milked, without being ever mixed with any other. Thus would the careful dai † be able, on all occaſions, to obſerve

* I once ſaw a cow that gave milk which could never be made to yield any butter at all, though it had the appearance of being very rich milk. The perſon who ſold that cow had had her ſeveral years, along with a good many others, without having ſo much as had any ſuſpicion of this peculiarity. It was only diſcovered when ſhe came into the poſſeſſion of a perſon who had no other cow.

† I beg leave here to adopt a provincial word, which is ſtrongly expreſſive, and much wanted in the Engliſh lan-

ſerve the particular quality of each individual cow's milk, as well as its quantity, and to know with preciſion which of his cows it was his intereſt to diſpoſe of, and which of them he ought to keep and breed from.

Thirdly. If it be intended to make butter *of a very fine quality*, it will be adviſeable, in all caſes to keep the milk that is firſt drawn ſeparate from that which comes laſt; as it is obvious, that if this be not done, the quality of the butter will be greatly debaſed, without much augmenting its quantity. It is alſo obvious, that the quality of the butter will be improved, in proportion to the ſmallneſs of the quantity of the laſt-drawn milk that is retained; ſo that thoſe who wiſh to be ſingularly nice in this reſpect, will do well to

guage. *Dai* or *dei*, in Aberdeenſhire, denotes the perſon who has the ſuperintendance of a dairy, whether that perſon be male or female: in that ſenſe it is here employed. Dairy-maid, which is the only Engliſh word nearly equivalent to it, denotes a perſon of an inferior ſtation, who, under the ſuperintendance of the former, executes the menial offices of the dairy.

retain

retain only a very ſmall portion of the laſt-drawn milk.

To thoſe owners of dairies who have profit only in view, it muſt ever be a matter of trial and calculation, how far it is expedient for them to carry the improving of the quality of their butter, at the expence of diminiſhing its quantity. In different ſituations, prudence will point out different kinds of practice, as moſt eligible; and all perſons muſt be left, after making accurate trials, to determine for themſelves. It is likewiſe a conſideration of no ſmall importance, to determine in what way the inferior milk, that is thus to be ſet apart where fine butter is wanted, can be employed with the greateſt profit. In the Highlands of Scotland they have adopted, without thinking of the improvement of their butter, a very ſimple and œconomical practice in this reſpect. As the rearing of calves is there a principal object with the farmer, every cow is allowed to ſuckle her own calf with a part of her milk, the remainder only being employed in the dairy. To give the calf its portion regularly, it is ſeparated from the cow, and kept in an inclоſure,

cloſure, with all the other calves belonging to the ſame farm. At regular times, the cows are driven to the door of the incloſure, where the young calves fail not to meet them. Each calf is then ſeparately let out, and runs directly to its mother, where it ſucks till the dairy-maid judges it has had enough; ſhe then orders it to be driven away, having previouſly ſhackled the hinder legs of the mother, by a very ſimple contrivance, to oblige her to ſtand ſtill. Boys drive away the calf with ſwitches, and return it to the incloſure, while the dairy-maid milks off what was left by the calf: thus they proceed, till the whole of the cows are milked. They obtain only a ſmall quantity of milk, it is true, but that milk is of an exceeding rich quality; which, in the hands of ſuch of the inhabitants as know how to manage it, is manufactured into the richeſt marrowy butter that can be any where met with. This richneſs of the Highland butter is univerſally aſcribed to the old graſs the cows feed upon in their remote glens; but it is in fact chiefly to be attributed to the practice here deſcribed, which has long prevailed in theſe regions.

gions *. Whether a ſimilar practice could be œconomically adopted elſewhere, I do not take upon me to ſay; but doubtleſs other ſecondary uſes might be found for the milk of inferior quality. On ſome occaſions, it might be converted into butter of an inferior quality: on other occaſions, it might be ſold ſweet, where the ſituation of the farm was within reach of a market-town: and on others, it might be converted into cheeſes, which, by being made of ſweet-milk, would be of a very fine quality if carefully made †.

Still

* Perhaps alſo in ſome meaſure to the nature of the cows.

† The making of cheeſe has never yet been reduced to ſcientific principles, and conſequently the reaſoning relating to it is very inconcluſive. It is in general ſuppoſed, that the goodneſs of cheeſe depends almoſt entirely upon its richneſs, by which is meant the proportion of oily matter, whether natural or extraneous, it contains; nothing, however, is more certain, than that this opinion is erroneous. Sometimes a very lean cheeſe is much better taſted than one that is much fatter; and, which will appear to moſt perſons ſtill more extraordinary, it frequently happens that a cheeſe that taſtes ſoft and fat, is much leaner than one that is hard, dry, and

ſticky.

Still other uſes might be deviſed for its application,

ſticky. The mode of manufacturing it occaſions this, and not the quantity of cream it contains. It is very poſſible, by art, to make poor ſkim-milk cheeſe aſſume the ſoft buttery taſte and appearance even of cream cheeſe. This ſubject, therefore, deſerves highly to be more particularly elucidated than it has hitherto been.

Connected as they are with the object diſcuſſed in the text, I beg leave to ſuggeſt the following particulars, as proper objects of examination and experiment, viz. Is the quantity of caſeous matter afforded by milk neceſſarily connected with the proportion of cream that milk contains, or does it depend upon ſome other principle, not hitherto inveſtigated? Without pretending to decide this queſtion, I feel myſelf ſtrongly inclined to believe it does not depend upon the quantity of cream. It is well known that cow's milk, which always throws up more cream, and that of a much richer quality, than ewe-milk, does in no caſe afford above one half the proportion of cheeſe that ewe-milk does. Nor can this ſingular tendency of ewe-milk, to yield a great proportion of curd, be attributed to its ſuperior thickneſs; for cow-milk can be often had that is thicker and richer than ewe-milk, but it always affords a much ſmaller proportion of curd. From theſe conſiderations, it is not impoſſible but it might be found, upon a careful inveſtigation, that the refuſe milk,

which

tion, which I cannot now ſtoop to enumerate *.

Fourthly.

which ought to be ſeparated from the other, in making the beſt butter, might be equally proper, or very nearly ſo, for making cheeſe, as if no ſuch ſeparation had been made. I therefore recommend this as a proper object of experimental enquiry.

* I ſhall here mention one mode of managing milk, by means of which the inferior kinds of it might, on many occaſions, eſpecially within reach of towns, be diſpoſed of to great advantage. Take common ſkimmed milk, when it has begun to turn ſour, put it into an upright ſtand-churn, or a barrel with one of its ends out, or any other convenient veſſel. Heat ſome water, and pour it into a tub that is large enough to contain, with eaſe, the veſſel in which the milk was put. Set the veſſel containing the milk into the hot water, and let it remain there for the ſpace of one night. In the morning it will be found that the milk has ſeparated into two parts; a thick cream-like ſubſtance, which occupies the upper part of the veſſel, and a thin watery part, that remains at the bottom. Draw off the thin part, (called here *wigg*,) by opening a ſtop-cock, placed for that purpoſe cloſe above the bottom, and reſerve the cream for uſe. Not much leſs than half of the milk is thus converted into a ſort of cream, which, when well made, ſeems to be as rich and fat as real cream itſelf, and is only diſtinguiſhable from it

Fourthly. If the quality of the butter be the chief object attended to, it will be neceſſary, not only to ſeparate the firſt from the laſt drawn milk, but alſo to take nothing but the cream that is firſt ſeparated from the beſt milk, as it is this firſt riſing cream alone that is of the prime quality. The remainder of the milk, which will be ſtill ſweet, may be either employed for the purpoſe of making ſweet milk cheeſes, or may be allowed to ſtand, to throw up cream for making butter of an inferior quality, as circumſtances may direct.

Fifthly. From the above facts we are enabled to perceive, that butter of the very beſt poſſible quality can only be obtained from a dairy of conſiderable extent, judiciouſly managed; for, when only a ſmall portion of each cow's milk

by its fourneſs. It is eaten with ſugar, and eſteemed a great delicacy, and uſually ſells at double the price of freſh unſkimmed milk. It requires practice, however, to be able to make this nicely; the degree of the heat of the water, and many other circumſtances, greatly affecting the operation. Theſe things practice beſt diſcovers.

can

can be ſet apart for throwing up cream, and when only a ſmall proportion of that cream can be reſerved, of the prime quality, it follows, (the quantity of milk being upon the whole very inconſiderable,) that the quantity of prime cream produced would be ſo ſmall, as to be ſcarcely worth manufacturing ſeparately.

Sixthly. From theſe premiſes we are alſo led to draw another concluſion, extremely different from the opinion that is commonly entertained on this ſubject, *viz.* That it ſeems probable, that the very beſt butter could be made, with œconomy, in thoſe dairies only where the manufacture of cheeſe is the principal object. The reaſons are obvious: if only a ſmall portion of the milk ſhould be ſet apart for butter, all the reſt may be made into cheeſe, while it is yet warm from the cow, and perfectly ſweet; and, if only that portion of cream which riſes during the firſt three or four hours after milking is to be reſerved for butter, the rich milk which is left after that cream is ſeparated, being ſtill perfectly ſweet, may be converted into cheeſe,

with as great advantage nearly as the newly-milked milk itſelf.

But, as it is not probable that many perſons could be found, who would be willing to purchaſe the very fineſt butter, made in the manner above pointed out, at a price that would be ſufficient to indemnify the farmer for his trouble in making it, theſe hints are thrown out merely to ſhew the curious, in what way butter poſſeſſing this ſuperior degree of excellence may be obtained, if they chooſe to be at the expence; but, for an ordinary market, I am ſatisfied, from experience and attentive obſervation, that if, in general, about the firſt drawn half of the milk be ſeparated at each milking, and the remainder only ſet up for producing cream; and if that milk be allowed to ſtand to throw up the whole of its cream, (even till it begins ſenſibly to taſte ſouriſh,) and that cream be afterwards carefully managed, the butter thus obtained will be of a quality greatly ſuperior to what can uſually be procured at market, and its quantity not conſiderably leſs than if the whole of the milk had been

treated

treated alike *. This, therefore, is the practice that I ſhould think moſt likely to ſuit the frugal farmer, as his butter, though of a ſuperior quality, could be afforded at a price that would always enſure it a rapid ſale.

* Among other reaſons that induced me to ſeparate about half of the milk, the following may be ſtated. Whilſt I was employed in making the above mentioned experiments on milk, it chanced that among my cows there was one which had miſſed having a calf that ſeaſon, and ſtill continued to give milk: (a cow in theſe circumſtances we here call a *farrow* or *farra* cow:) her milk, as is not uncommon in theſe circumſtances, taſted ſenſibly ſalt. On trying different parcels of that milk, however, it was perceived that the firſt-drawn milk was extremely ſalt to the taſte, and that the laſt was perfectly ſweet. On an after-trial, made with a view to aſcertain what proportion of the milk was ſalt, it was found that the ſaltneſs decreaſed gradually from the beginning, and was entirely gone when nearly one half of the milk was drawn off, ſo that the laſt-drawn half of the milk was quite ſweet. I intended to have tried if other naufeous taſtes that ſometimes affect milk, ſuch as that from turnips, cabbages, &c. were peculiarly confined to the firſt-drawn milk or not, but other avocations prevented me from aſcertaining this fact.

From

From theſe general obſervations on milk, it is neceſſary we ſhould proceed to particulars. No dairy can be managed with profit, unleſs a place properly adapted for keeping the milk, and for carrying on the different operations of the dairy, be firſt provided. The neceſſary requiſites of a good milk-houſe are, that it be cool in ſummer, and warm in winter, ſo as to preſerve a temperature nearly the ſame throughout the whole year; and that it be dry, ſo as to admit of being kept clean and ſweet at all times. As it is on moſt occaſions difficult to contrive a place within the dwelling-houſe, that can poſſeſs all theſe requiſites, I would adviſe that a ſeparate building ſhould be always erected; which, upon the plan I ſhall now deſcribe, may in every ſituation be reared at a very ſmall expence, and will anſwer the purpoſe much better than any of thoſe expenſive ſtructures I have ſeen, that were built by noblemen or gentlemen for this uſe.

This building ought, if poſſible, to be erected near a cool ſpring, or running water, to which eaſy acceſs can be had by the cows, and which is not liable to be incommoded by ſtagnant water.

The

The ſtructure ſhould conſiſt of a range of narrow buildings, as in the plan; (ſee Plate XV.) that diviſion in the middle, marked A, being the milk-houſe, properly ſo called. The walls of this building ſhould be made of brick, or of ſtone and lime, all round the inſide; this wall need not exceed in thickneſs one brick lengthways; or, if of ſtone, about one foot; beyond that, the wall, which ought to be full ſix feet in thickneſs, ſhould be made of ſod on the outſide, with earth rammed firm within that. The inſide wall of this building may be ſeven or eight feet high at the ſides, on which may be placed the couples to ſupport the roof; and the walls at the gables may be carried up to the height of the couples. Upon theſe ſhould be laid a roof of reeds, or thatch, that ſhould not be leſs than three feet in thickneſs; which ſhould be produced downwards, till it covers the whole of the walls on each ſide: but here, if thatch or reeds be not in ſuch plenty as could be wiſhed, there is no occaſion for laying it quite ſo thick. In the roof, exactly above the middle of the building, ſhould be placed a wooden pipe, of a ſufficient length to riſe a foot or two above the roof,

roof, to ſerve occaſionally as a ventilator. The top of this funnel ſhould be covered, to prevent rain from getting through it; and a valve fitted to it, which, by means of a ſtring, could be opened or ſhut at pleaſure. A window alſo ſhould be made upon one ſide, for giving light; the ſtructure of which will be beſt underſtood from the ſection of this part of the building, which is repreſented at Fig. 2, F G. It is neceſſary to ſpecify, however, that this aperture ſhould be cloſed by means of two glazed frames, one on the outſide, at G, the other on the inſide, at F. I preſume it is hardly neceſſary to inform the reader, that the uſe of this double ſaſh, as well as of the great thickneſs of the wall, and of the thatch upon the roof, as alſo of the buildings at the end of it, are to render the temperature of this apartment as equal as poſſible, at all ſeaſons of the year, by effectually cutting it off from any direct communication with the external air.

The apartment marked B is intended to ſerve as a repoſitory for the utenſils of the dairy, and as a place in which they may be cleaned, and put in order, to be ready when they are wanted. For this

this purpoſe, ranges of ſhelves may be fixed all round the walls; and tables, and other conveniences, placed where neceſſary. Here the walls are thinner than the other, and may be built wholly of brick, or ſtone; nor is there a neceſſity for having the thatch here ſo thick laid on as in the middle diviſion. In one corner, at H, is placed a cauldron, of a ſize proportioned to the dairy, for warming water to ſcald the veſſels, over a cloſe furnace; the flue of which terminates in a chimney carried ſlanting over the door in the gable, above which it riſes upright, and there emits the ſmoke.

The other apartment, C, may be employed as a kind of ſtore-room, in which the cured butter, and other products of the dairy, and ſpare utenſils, may be locked up, till it becomes convenient to tranſport them elſewhere *.

If

* If the dairy be ſituated ſo near a town as that ice could be diſpoſed of with profit in ſummer, it might be very uſeful to convert this apartment into an ice-houſe, which would be, on many occaſions, a very convenient appendage of the dairy.

If cheeſe were the object of the dairy, another additional building, very differently conſtructed,

All that would be neceſſary in this caſe, would be to build the walls in the ſame manner, and make them of the ſame thickneſs, with thoſe of the apartment A, as marked by the dotted lines *i*, *k*, *l*, *m*; the thatch being alſo laid on to the ſame thickneſs. If this were intended, firm poſts of wood ought to be placed in the floor, as marked in the plan, *n*, *o*, *p*, *q*, ſo as to form an inner ſquare, with an open walk, all round, of two feet in breadth. Within theſe poſts ſhould be placed hurdles of a convenient ſhape, formed of wicker-work; the wands of which they are made having been all peeled, and previouſly dipped in warm coal tar, to preſerve them from rotting: within this ſquare is the receptacle for the ice. The ice-houſe to be filled by opening the double doors at K, L, which ſhould then be cloſed, not to be opened till it was again to be filled, and the aperture between the doors to be filled with ſtraw, rammed firm, to prevent the admiſſion of air. The ice to be taken out occaſionally, as it may be wanted, through the milk-houſe.

Many would be the conveniences the dairy would derive from this accommodation, and ſmall the expence. By means of it, the products of the dairy could be always cooled, in ſummer, to the degree that ſhould be found to give them their greateſt perfection. Other advantages might occaſionally be derived,

ſtructed, would be wanted, which I do not here ſpecify.

The

derived, by the attentive farmer, from this eaſily obtained accommodation, one of which I ſhall here mention.

Bees, in this climate, are found to be a very precarious kind of ſtock, though where they do thrive they are extremely profitable. The circumſtance that chiefly occaſions their failure here, is the variableneſs of our climate. In winter we have often mild warm days, little inferior to what we experience in ſummer; and, in the ſpring eſpecially, it frequently happens that a warm morning is ſuddenly changed to a nipping froſt, or ſleety rain. During theſe mild intervals in winter, the bees are rouſed from their ſleepy ſtate, and, being unable to get any food abroad, they are under the neceſſity of conſuming the ſtores they had provided for themſelves; which being ſoon exhauſted, they then periſh for want. In the ſpring alſo, when they are invited abroad by the warmth of the weather, they in vain ſearch for flowers from which they may derive nouriſhment, and are frequently chilled by the cold, before they can return to the hive. No mode would be ſo effectual, in preventing theſe accidents, as that of putting them into an ice-houſe in the beginning of winter; where they might be kept, till the ſpring was ſo far advanced as that little danger was to be apprehended from bad weather. During all this time, they would remain in a ſtate of torpor,

The ſmaller apartments, R and S, are merely cavities formed in the thickneſs of the partition-wall, that may be employed for any uſe that ſhall be found convenient; the double doors in theſe paſſages being intended merely to cut off more effectually all communication between the external air and the milk-houſe, when either the great heat or great cold of that may render it neceſſary. The thatch above theſe ſmall apartments ought to come one foot lower within than in the milk-houſe, the more effectually to bar all communication of air from the outer apartments at the place where the couples are placed. When the air is temperate, the door at T may in general be left open, to facilitate the entry to and from the

ſo as to have no need of food; and would be ready to begin their labours with vigour in the ſpring, when the mild weather invited them abroad. Some will think that the cold of an ice-houſe would make them periſh entirely; but bees often experience, in Ruſſia, and in Poland, a degree of cold that is ſufficient to freeze even quickſilver, without being killed; which is ſo much beyond any cold that ever takes place in a Britiſh ice-houſe, as to leave no room for anxiety on that head.

milk-

milk-houſe on ordinary occaſions: all the doors open in the direction ſhewn by the dotted lines.

In each of theſe doors, and alſo in the outer doors of the apartments B and C, an aperture of about a foot ſquare ought to be made, having a ſmall door exactly fitted to it, that can be opened and ſhut at pleaſure. Over the inſide of each of theſe apertures ſhould be ſtretched a piece of fine gauze, covered with a fine netting of wire; ſo that, when the air was temperate, and the wind blowing in a proper direction, by opening theſe little doors, a draught of air would be carried through the whole of theſe buildings; which would keep them ſweet and dry, without admitting flies, or other vermin.

The whole of theſe apartments ſhould be neatly plaſtered with lime, on the inſide of the walls and cieling. The apartment A, at leaſt, ſhould alſo be paved with flat ſtones; which ſhould be raiſed ſix inches higher than the ſurface of the ground without; having ſlanting gutters, readily to convey water or any other liquid that might be accidentally ſpilt there; but it is a ſlovenly

ſlovenly dairy-maid who ſlabbers her floor. The walls all round ſhould be furniſhed with ſhelves of a convenient breadth, in ranges one above the other, on which the diſhes may be placed; and in the middle ſhould ſtand a large table, (marked by dotted lines in the plan,) which, if made of ſtone, will be found to be more cleanly and convenient than of any other material. Beneath it, a part of the pavement, about a foot in breadth, ſhould be raiſed all round ſix inches higher than the level of the floor, ſo as to form a trough within it for holding water, the uſes of which will be afterwards ſpecified. This baſon may be emptied entirely at pleaſure, by opening a hole that allows the water to run into the common gutters.

The intention of all theſe contrivances, as will eaſily appear, is to enable the attentive owner of a dairy to keep his milk in a proper degree of temperature, both during the ſummer and the winter ſeaſon, without much trouble or expence to himſelf; as any conſiderable variation in the degree of heat tends greatly to derange his

his operations, and to diminiſh the value of the products of his dairy. If the heat be too great, the milk ſuddenly coagulates, without admitting any ſeparation of the cream, and it is ſo ſuddenly rendered ſour as greatly to marr every operation: if, on the other hand, the milk be kept in too cold a temperature, the cream ſeparates from it ſlowly, and with difficulty; it acquires a bitter and diſagreeable taſte; the butter can ſcarcely be made to come at all; and, when is is obtained, is ſo pale in colour, ſo ſmall in quantity, ſo poor to the taſte, ſo hard and brittle in conſiſtence, and of ſo little value in every reſpect, as to bring a very low price at market, compared to what it would have produced had it been preſerved in a proper degree of warmth. To avoid therefore, as much as poſſible, both theſe extremes, the milk-houſe, properly ſo called, is here placed in the centre of the building; into which there is no acceſs directly from the open air, nor even from the porch, but through a double door; one door of which ought always to be ſhut before the other is opened, when either the heat

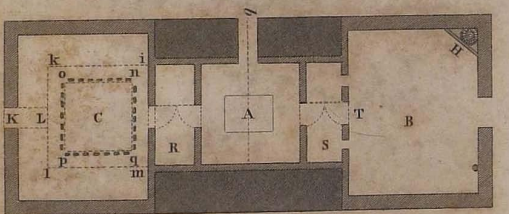
heat or the cold of the weather is exceſſive, though at other times this precaution may be omitted. The walls of this part of the building ſhould be made of earth; which, as well as the roof of thatch, is directed to be made very thick. It is found that theſe ſubſtances tranſmit heat or cold with leſs facility than any others that can eaſily be had; ſo that a very long continuance, either of hot or cold weather, would have no ſenſible effect in altering the temperature of this chamber; and, if it ſhould at any time acquire a ſmall degree of heat or cold more than was deſirable, and this were corrected by artificial means, it would retain that artificial temperature for a long time. Theſe are the advantages propoſed to be derived from the mode of conſtruction here propoſed.

TO BE CONTINUED IN OUR NEXT.

Fig. 2

Section of a milk-house through the line a.b.

Fig. 1



Plan of a milk-house, with its necessary appurtenances.

XXXVIII. *Account of a Method of transferring Pictures from Pannels, Walls, &c. to Canvaſs. By Mr.* ROBERT SALMON, *of Woburn, Bedfordſhire.*

From the TRANSACTIONS of the SOCIETY for the Encouragement of ARTS, MANUFACTURES, and COMMERCE.

The greater Silver Pallet was voted to Mr. SALMON, for the Communication of this Method.

THE art I am about to deſcribe, and which, from every enquiry I have been able to make, I am inclined to think new, conſiſts in transferring paintings from one ſubſtance to another, without defacing or injuring the ſame. By which means, any old and valuable pictures, painted on boards, plaſter-cielings, or walls, may be transferred from thoſe ſubſtances, and placed on canvaſs and ſtraining-frames, ſo as to be equally ſound and durable

as if originally painted thereon; and thereby rendered more perfect than they are generally found on decayed and broken boards, cielings, walls, or other ſuch ſubſtances that it may be requiſite to transfer them from. By this art, any paintings on the cielings, walls, or wainſcots, of old buildings, however large, on curved or ſtraight ſurfaces, and of whatſoever ſhape, may be preſerved from ruin, and handed down to poſterity, when otherwiſe they would be loſt.

Such is the ſubſtance of my invention, which, after many trials, I have, by my own experience, ſucceſsfully put in practice, in the following manner.

The firſt thing to be attended to with reſpect to paintings, either on plaſter walls or cielings, or on boards, is, that the place in which they are be ſecure from wet or damp. If the paintings are on old walls in large buildings, or other places where this cannot be attained by art, then the ſummer ſeaſon ſhould be taken for the purpoſe, as the picture will rarely eſcape damage, if wet or damp gets at it while under the proceſs. At the ſame time, care ſhould be taken

that

that the room, or other place, be not over-heated; as that would produce equally bad effects. Theſe precautions being taken, the next thing is, to examine the ſurface of the painting. If there are any holes in the ſame, they muſt be carefully filled up with a paſte or putty, made of glue and whiting: this, if the holes are large, ſhould be twice or thrice done, ſo as entirely to fill them up, and leave the ſurface even and ſmooth; but, if there are any bruiſed places, with paint ſtill remaining on the ſurface of the bruiſed parts, then this ſtopping muſt not be applied, but the ſecuring-canvaſs, hereafter deſcribed, muſt be preſſed down into theſe places. In the places that are ſtopped, there will of courſe appear blemiſhes when the picture is transferred; but the proceſs is rendered much more certain and ſure by being ſo done. Attention muſt next be paid, to lay down any bliſters, or places where the paint is leaving the ground: this is done by introducing, between the paint and the ground, ſome very ſtrong paſte of flour and water; and the ſurface of the bliſtered paint being damped with a wet ſponge or bruſh, it may be

preſſed with the hand home to the ground, to which it will then adhere. All the unſound places being thus ſecured, care muſt be taken to clear the ſurface of any greaſe or dirt, as alſo of any particles of the paſte that may happen to be left on it. The next thing is, to determine the ſize of the painting meant to be taken off: if it is on a plain ſurface, a board of the ſize of the picture muſt be procured, not leſs than an inch in thickneſs, and framed together with well-ſeaſoned wood, in ſmall pannels, ſmooth and fluſh on one ſide. This done, a piece of fine open canvaſs muſt be provided, ſuch as the fineſt ſort uſed for hanging paper on; which canvaſs is to be ſomewhat larger than the picture, and ſo ſewed together, and the ſeam ſo preſſed, that it be perfectly ſmooth and even. This is what I call the ſecuring-canvaſs; which, being ſo prepared, is to be ſtuck on the ſurface of the picture, with a paſte made of ſtrong beer, boiled till it is half reduced, and then mixed with a ſufficient quantity of flour to give it a very ſtrong conſiſtence. To large pictures on walls or cielings, the canvaſs muſt for ſome time be preſſed, and rubbed with the hand,

as

as ſmooth as poſſible, working it from the middle to the outſide, ſo as to make it tolerably tight; obſerving, as it dries, to preſs it, with the hand or a cloth, into any hollow or bruiſed places, ſo that it may adhere to every part of the painting: this done, it is left to dry, which it will generally do in a day or two. When dry, a ſecond canvaſs, of a ſtronger and cloſer ſort, and of the ſame ſize as the other, is in like manner to be attached on the top of the firſt. This laſt will want very little attention, as it will readily adhere to the firſt; and, being dry, attention muſt be paid to take off any ſmall knots, or unevenneſs that may be upon the ſurface of it; which done, the whole ſhould be again covered with a thin paſte of ſize and whiting; which is to be pumiced over, when dry, ſo as to make the whole perfectly ſmooth and even. The painting being thus ſecured, the board, already prepared to the ſize of the picture, is to be put with the ſmooth ſide againſt the ſurface thereof, ſo as exactly to cover as much as is intended to be tranſferred. The edges of the canvaſs, which, as before directed, is to be larger than the painting,

are

are then to be pulled tight over, and clofely nailed to the edge of the board. If the painting is large, and either on a cieling or wall, the board muft, by proper fupports, be firmly fixed againft it, fo that it can readily be lowered down, when the plafter and painting are detached.

The canvafs and board being fixed, the painting is to be freed from the wall or cieling, together with a certain portion of the plaftering; this, with proper care and attention, may be readily done. If on a cieling, the firft thing is, to make fome holes through the plaftering, round the outfide of the board and painting; and, with a fmall faw, to faw the plaftering from one hole to another, till the whole is difunited from the other parts of the cieling; this done, the workman muft get at the upper fide of the cieling, where he muft free the plaftering from the laths, by breaking off the keys thereof, and, with a chifel, cut out the laths, whereby the plaftering, together with the picture, will be left refting on the board and fupports. If there are apartments over the cieling, the readieft way will be to take up a few of the floor-boards above: if the

the cieling is next the roof, means may always be found to get at it; and, although at firſt this operation may appear difficult, yet, it is preſumed, no difficulty will be found by any ingenious workman.

If the painting is on a brick or ſtone wall, the wall muſt be cut away at top, and down the ſides of the painting; and then, by means of chiſels or ſaws in wooden handles, of different lengths, the wall muſt be cut away quite behind the painting; leaving the ſame, together with the plaſtering, reſting on the board. This operation may ſometimes be done with a ſaw; or, if the wall be not thick, nor the other ſide of much conſequence, the bricks or ſtones may be taken out from that ſide, leaving the plaſtering and painting as before. This laſt method I have not practiſed; the other, of cutting away ſome part of the wall, I have, and ſee no difficulty, or very great labour, in the operation; but that of courſe, muſt be various, according to the texture of the wall and mortar.

If the paintings are on curved ſurfaces, ſuch as the coves of cielings, then the only difference of operation

operation is, that ſome ribs of wood muſt be cut out, and boarded ſmooth to the curve of the ſurface of the painting, and then fixed up thereto, in place of the before-deſcribed bearing-board; the painting is then to be freed, and left with the plaſtering, reſting on the bearers.

For paintings on wainſcot or boards, the ſame ſecuring and proceſs is to be exactly followed; only that, as the wainſcot or board can always be cut to the ſize wanted, and laid horizontal, the ſecuring-canvaſs is to be ſtretched thereon, and turned over the edges of the ſame, till it is dry; after which, the edges are again to be turned up, and nailed to the board, in the ſame manner as with reſpect to paintings from walls.

Having, as before deſcribed, in any of the aforementioned caſes, freed the paintings from their original places, you have got them ſecured to two thickneſſes of canvaſs, with their ſurfaces on the board prepared for that purpoſe; this being the caſe, they can readily be removed to any room or ſhop, to be finiſhed as follows. Having carried the painting into the ſhop or room, which ſhould be moderately warm and dry, but by no means

means overheated, lay the board on a bench, or treſſels, ſo that the back of the picture be uppermoſt: the plaſtering, or wood, as may happen, is then to be cleared away, leaving nothing but the body of paint, which will be firmly attached to the ſecuring-canvaſs. To perform this, a large raſp, a narrow plane, and chiſels, will be requiſite: this operation is difficult to deſcribe, but would ſoon be learnt by any one who ſhould make the attempt; nor is it very tedious; and, being performed, the picture is ready to be attached to its new canvaſs, as follows.

The painting being cleared, and lying on the board, the back thereof is to be painted three or four times over ſucceſſively, with any good ſtrong-bodied paint; leaving one coat to dry before another comes on: a day or two between each will generally be found ſufficient. Each of theſe coats, and particularly the firſt, ſhould be laid on with great care, taking but a ſmall quantity in the bruſh at a time, and laying it very thin. This precaution is neceſſary, to prevent any of the oil or paint from paſſing through any ſmall cracks or holes in the ſurface of the picture; as ſuch oil or paint would run into the

paſte, and ſo attach the ſecuring-canvaſs to the picture, as to prevent its being afterwards got off. If any ſuch holes or cracks are obſerved, they ſhould be ſtopped up with the glue and whiting paſte, and the painting then repeated, till a complete coat is formed on the back of the picture. It is then ready for attaching to its canvaſs, which is done by ſpreading all over the picture a paſte made of copal varniſh, mixed with ſtiff white-lead, and a ſmall quantity of any other old fat paint; all which being ſpread equally over, with a pallet-knife, ſuch a canvaſs as the firſt ſecuring-canvaſs is laid thereon, and ſtrained and nailed round the edges of the board, in which ſtate it is left till it becomes tolerably dry: then a ſecond canvaſs, of a ſtronger ſort, muſt be in like manner attached on the firſt, and left till it is perfectly dry and hard. This generally takes about two months; and the longer the painting is left, the more ſecurely it will be attached to its canvaſs, and leſs liable to crack or fly therefrom. When ſufficiently dry, all the four canvaſſes are to be unnailed from the board, and the edges turned up the reverſe way, and nailed to a proper ſtretching-frame: this is done by unnailing from the board

board a part on each ſide at a time, and immediately nailing it to the ſtretching-frame, ſo as never to leave the canvaſs to crack or partially ſtretch, which would damage the picture. In this manner, by degrees, the cloths are entirely detached from the board, and firmly fixed on the ſtretching-frame: the ſuperfluous canvaſs, left larger than the frame, may then be cut off, and the wedges put in the frame, and moderately tightened up. There remains then only to clear the ſurface of the painting from the ſecuring-canvaſs; which is done by repeatedly waſhing the ſurface with a ſponge and moderately warm water. In doing this, no violence or force muſt be uſed; and, by frequent and gentle waſhings, the paſte will all be worked out with the ſponge. The edges of the outer canvaſs are then to be cut round, and ſtripped off: the other, next the ſurface of the picture, is to be ſerved in like manner; which done, nothing remains but to take the paſte clean off, and repair any defects; the picture will then be as ſtrong as if painted on the canvaſs.

For taking pictures off walls, without taking the walls down, or cutting away more thereof

than the plaſtering, the following proceſs is propoſed.

The ſurface of the picture is to be firſt ſecured, in the manner before deſcribed; but, inſtead of the plain board, a bearer ſhould be prepared with a convex ſurface, compoſed of ribs, boarded over, ſo as to form part of a cylinder, of not leſs than five feet radius, and as long as the height of the picture. This bearer being prepared, in order to apply it, a floor or platform ſhould be erected, and placed horizontally, with its ſurface level, and its edge immediately in contact with the bottom of the picture meant to be transferred. The uſe of this platform is for the above-deſcribed bearer to reſt and move upon; which bearer ſhould be ſet on its end, with one edge in contact with the wall, at one ſide of the picture; conſequently the other edge will be at ſome diſtance from the wall, according to the ſize of the picture and convexity of the bearer. Being thus placed, the ſuperfluous edge of the ſecuring canvaſs ſhould be turned over, and nailed to that edge of the bearer that is next the wall: this done, the operation of cutting away the plaſtering ſhould be begun; which may be done with the

the corner and end of a ſhort ſaw; ſawing between the brick-work and plaſtering, and leaving the thickneſs, or part of the thickneſs, of the plaſtering, on the painting faſtened to the bearer. When this edge of the picture is freed, the whole height, for nine or ten inches under the edge of the bearer that is fartheſt from the wall, muſt then be gently forced nearer; conſequently the other edge, together with the painting and plaſter that is freed, will leave the wall, and give an opportunity of introducing the ſaw behind, and cutting away the ſame to a certain diſtance farther under; and, by repeating this, the whole of the picture will at length be freed, and left on the bearer. Each time the bearer is removed, and, as it were, rolled on the vertical ſurface of the wall, care muſt be taken to turn and nail the ſecuring-canvaſs on the top and bottom edges of the bearer, ſo as to ſecure the freed plaſtering and picture from moving about; and, laſtly, before the bearer and plaſtering be moved, to nail the other edge of the picture in the ſame way, which will ſecure the whole to the bearer. This done, the picture and bearer are at liberty to be moved to a proper place, in order to be freed from

from the remaining plaſter: the edges may then be unnailed; the painting and canvaſs ſlipped from this bearer on to a plain board; and the new canvaſs may be then put on, which is to remain till dry, as in other caſes.

It may appear, that the bending of the canvaſs and plaſtering to the convex bearer will crack the plaſter, and damage the painting; but, from experience, I have obſerved, that, to a curve of ſuch or even leſs radius, plaſtering will bend, without any viſible crack, even on the exterior part thereof; and that part next the bearer, not having occaſion, in bending, to extend its parts, will conſequently be much leſs liable to be diſturbed by ſuch bending.

In clearing the wood from the paintings, I have never made uſe of aquafortis, or any other liquid, the uſe of which I conceive would be very tedious, and attended with danger, leſt it ſhould get through the paint, and wet or damp the paſte by which the ſecuring-canvaſs is fixed; the bad conſequence of which I have, by accident, experienced, and find that ſuch places, ſo wetted, have been blemiſhed. In working off the wood, I have moſtly made uſe of planes alone, the management

nagement of which requires ſome dexterity, but may ſoon be obtained by care and practice. The ſort of planes I have uſed are what, by the joiners, are called the levelled rabbet-plane, and ſmall rounds; by the corners of the former, and proper handling of the latter, the wood is cleared off without force or violence; even the ſmalleſt particles may in general be got off, although in ſome paintings, and in particular parts of others, I have met with places on which I have thought it beſt to leave ſome particles, or fine ſplinters, of wood, but nothing more. Raſps, and ſometimes a fine chiſel, are uſeful, to clear off ſuch parts as may be in hollow places, or where particles of wood are left, as above. The time required will be various, according to the manner in which the painting was originally done; ſome being painted on boards previouſly prepared with a water colour, others immediately painted with oil on the wood: this laſt ſort is by much the moſt difficult; the other is more eaſy, as the previous preparation prevents the wood from imbibing the oil, and conſequently admits it to be more eaſily ſeparated.

XXXIX.

XXXIX. *Account of the new Method of Tanning propoſed by M.* Seguin. *By MM.* Lelievre *and* Pelletier.

FROM THE *ANNALES DE CHIMIE.*

THE operations of M. Seguin conſiſt, as in the other known methods of tanning, in waſhing the hides, taking off the fleſh and hair, raiſing or ſwelling, and tanning, properly ſo called. But, the modifications and alterations he has made in theſe proceſſes accelerate them ſo much, that a few days are ſufficient to complete that which uſed to be the work of years. M. Seguin operated, in our preſence, upon a hundred and ten hides of oxen, cows, calves, horſes, ſheep, and goats: and we ſhall join to our account a table, ſhewing the time employed in tanning theſe various kinds of hides. The reſults given in that table (as well as the following account) are extracted from a journal of the experiments, which we

we kept with great exactneſs during the courſe of M. Seguin's operations, which were begun the 19th of July; conſequently, we have nothing to do but to bring the facts together, and by that means to exhibit, in one point of view, the whole of this method of tanning.

On waſhing and cleaning the Hides. M. Seguin has not made any alterations in waſhing and cleaning the hides; he does not however put them promiſcuouſly into the water, as ſome tanners do, but ſtretches them out, ſo that the water comes in contact with every part of them. This precaution had already been recommended by others.

On taking off the Hair. With reſpect to the proceſs of taking off the hair, M. Seguin began by ſlaking ſome lime. This lime was afterwards put into a pit, and mixed with a great quantity of water: the whole was then well ſtirred, that the water might be ſaturated with lime; but, as there was a great deal more lime than the water could diſſolve, a great quantity of it was precipitated, and fell to the bottom of the pit. M. Seguin placed the hides in the clear lime-

water, diſpoſing them in ſuch a manner, that they were ſuſpended perpendicularly in it. For this purpoſe, ſeveral wooden poles were fixed acroſs the pit; to theſe poles, the hides (each of which had been previouſly cut in two) were faſtened, lengthways, by ſtrings fixed at proper diſtances. The hides, as ſaid above, were not laid in the lime, but were only ſteeped in the lime-water; and, as that loſt its ſtrength, M. Seguin cauſed the lime, which was at the bottom, to be frequently ſtirred up, that the water might be again ſaturated with a freſh quantity of lime. The hair came off the hides with great eaſe, after they had remained about eight days in the pit.

M. Seguin hopes to be able to take off the hair in a much ſhorter ſpace of time; in two days, for example. The method he intends to follow is, to plunge the hides, after being waſhed and cleaned, in a ſolution of tan which (having been already uſed) contains no longer any of the tanning principle, mixed with a five hundredth part, or even ſometimes with only a thouſandth part, of ſulphuric acid. Pieces of hides treated in this manner, during the courſe

of

of the experiments here deſcribed, had the hair taken off of them with great eaſe, and were very completely raiſed or ſwelled: what we here mention we were eye witneſſes of. We could not however purſue this experiment any farther, as our operations were nearly at an end, when M. Seguin tried this new method of taking off the hair; and he told us afterwards, that the reaſon he did not make uſe of that method, in the former proceſſes, was, that he had no infuſion of tan that had been made uſe of; but that his confidence in this proceſs was ſo great, that, in a tan-yard, he would adopt it, in preference to any other.

On taking off the Hair by Heat. There is alſo another method of taking off the hair, which M. Seguin thinks might be advantageouſly made uſe of in a tan-yard, namely, by heat. This heat is to be produced by means of a ſtove kept conſtantly heated to thirty degrees, (Reaumur,) in which ſtove the hides are to be hung up *.

* We preſume, that if a little ſulphur were burnt in the ſtove, in ſuch a way that the ſulphureous acid gas ariſing from it were equally diffuſed, the hides would be much ſooner in a fit ſtate for having the hair taken off.

On the disadvantages of shaving off the Hair. With respect to taking off the hair by shaving, which, as it has always been thought, is the most expeditious method, M. Seguin at first considered it as one which might be made use of; but his later trials have shewn him, that it is attended with some disadvantages. He remarked, first, that hides are covered with a particular kind of epidermis, which is destroyed by the common method of taking off the hair; and that shaving a fresh hide does not take off this epidermis, which, when it remains on the hide, is a great obstacle to the action of the tan, as it hinders the solution of it from penetrating the hide on the grain side; in consequence of which, a longer time is required for the process of tanning.

Alkalies might be employed in taking off the hair, and also in swelling the hides; but they are too dear to be generally made use of.

On swelling or raising the Hides. In order to proceed to the swelling or raising of the hides, M. Seguin had caused one of the pits already spoken of to be filled with water; this pit was lined internally with a cement, in the composi-

tion

tion of which, a ſmall quantity of lime was uſed. He had added to the water, a fifteen hundredth part of ſulphuric acid; and in this water, thus mixed with ſulphuric acid, M. Seguin put the firſt hides, after they were well waſhed, and perfectly cleanſed from hair, &c. The event was not ſuch as M. Seguin expected; becauſe the ſulphuric acid, inſtead of acting upon the hides, combined with the lime of the cement. Large wooden tubs, well and firmly joined together, would have been more proper for this new manner of raiſing the hides: but, as M. Seguin had no ſuch veſſels, and could not, for want of time, get any made, he next made uſe of caſks, in which the hides were put, in water mixed with a fifteen hundredth part of very concentrated ſulphuric acid; this quantity of acid was afterwards increaſed to one thouſandth. The hides began to ſwell after they had remained a ſhort time in the liquor; and, in the ſpace of forty-eight hours, the ſwelling was completed. The hides had now acquired a yellow colour, even in the interior part of their ſubſtance. When they are in this ſtate, M. Seguin judges that the proceſs of ſwelling is finiſhed; to determine this, one of the corners of the hide muſt

be

be cut, and, if it is in a proper ſtate, there will not appear any white ſtreak in the middle; but the hide, through its whole ſubſtance, will have acquired a yellow colour, and a ſemi-tranſparent appearance. The above method is the ſame as that of Dr. Macbride; except that the proportion of ſulphuric acid is much diminiſhed.

M. Seguin told us, afterwards, that he did not conſider the ſwelling of the hides as an indiſpenſable operation; and aſſured us, that he had tanned hides, which, although they had not undergone the operation of ſwelling, were not at all inferior to thoſe which had been completely ſwelled. He alſo added, that leather prepared in the latter manner was leſs porous, and conſequently leſs permeable to water. All this may be very true; but, as we did not ſee any experiments on this head, we only mention it as the opinion of M. Seguin.

On Tanning, according to the method of M. Seguin. Tanning, properly ſo called, is performed by M. Seguin according to a particular method. He does not lay the hides in a pit, as is uſually practiſed, but tans them by means of a ſolution of tan. We will now proceed to deſcribe the

manner

manner in which (in our preſence) he prepared the ſaid ſolution.

He placed ſeveral rows of caſks upon ſtands; which ſtands were elevated ſo much above the ground, that a veſſel might be placed under each of them, for receiving the liquor which ran from them. The diſpoſition of the caſks was like that which is adopted in ſaltpetre manufactories, for the lye of the ſaltpetre earths. Theſe caſks were filled with freſh tan; after which, a certain quantity of water was poured into the firſt of them; which water, as it ran through the tan, extracted the ſoluble part, and, as faſt as it ran into the veſſel below, was taken away, and poured into the ſecond caſk; and ſo on, ſucceſſively, till the ſolution was ſufficiently ſaturated; it may be brought to ten or twelve degrees of the areometer for ſalts. In order to exhauſt the tan of the firſt caſks, M. Seguin poured freſh water through it, till the water ran off quite clear, and the tan was completely deprived of its ſoluble part. Theſe liquors, as may eaſily be conceived, were carefully kept for future operations; following in that reſpect the cuſtom of ſaltpetre-makers, of which at preſent no one is ignorant.

In

In a tan-yard, M. Seguin propoſes to make uſe of large wooden vats, for the preparation of the ſolution of tan.

It is particularly in the uſe of this ſolution of tan, that M. Seguin's method conſiſts. The quickneſs with which the ſolution acts is aſtoniſhing; and when one ſees it, one is ſurprized that no perſon before him has attempted to put this method in practice, in the large way.

As ſoon as the hides are taken out of the water impregnated with ſulphuric acid, M. Seguin puts them into a weak ſolution of tan, in which he leaves them for the ſpace of one or two hours: he afterwards plunges them into other ſolutions of tan, more or leſs charged with the principle proper for tanning. Theſe ſolutions accelerate the proceſs of tanning, according to their ſtrength; ſo that, in the experiments at which we were preſent, ſome ſtrong hides were tanned in ſix or eight days, others in fifteen days, others in twenty or twenty-five days. In placing the hides in theſe ſolutions, ſome precautions are neceſſary.

M. Seguin propoſes to have large vats, which are to be filled with ſolution of tan. The hides are to be placed in theſe vats in ſuch a manner as

to

to be ſuſpended perpendicularly within them; and to be kept ſeparated from each other, at about an inch diſtance, ſo as not to touch in any part, as that would impede the action of the ſolution. As this could not be done, if the hides were whole, on account of their being apt to form pouches or projections, (while ſuſpended in the ſolution,) which would cauſe them to touch at ſeveral points, M. Seguin propoſes to cut off the head, and a ſlip down each of the ſides, in which ſlip the feet and belly part are to be comprehended. Another circumſtance which determines M. Seguin to cut the hide in this manner is, that the feet and the parts which are near the belly are more ſpongy, and more eaſily penetrated by the tan; and, as they produce leather of an inferior quality, they may be tanned ſeparately, and put promiſcuouſly into the ſolutions of tan. The remaining part of the hide is to be divided into two or more pieces, ſo as to be eaſily placed in the vats.

The above is the manner in which M. Seguin operated in our preſence; and as, at the beginning of his labours, he was not able to procure very large vats, he was obliged to cut the

hides into ſeveral pieces, proportioned to the length and depth of the vats which he had to make uſe of. But, having afterwards obtained a vat of a conſiderable capacity, all the hides laſt operated upon were cut accordingly; conſequently, the leather of the latter operations is in much larger pieces than that of the former. Both one and the other were carefully marked by us, (before they were tanned,) in ſuch a way that we had no difficulty in aſcertaining their identity afterwards.

The hides, when taken out of the ſolution of tan, muſt be dried with the uſual precautions; that is to ſay, ſo ſlowly that the ſkin does not ſhrink on the fleſh ſide. With reſpect to thinner hides, for the upper-leathers of ſhoes, &c. M. Seguin begins by waſhing and taking off the fleſh, in the manner we have already deſcribed for ſtrong ſole-leather; he then takes off the hair by means of clear lime-water. He does not make them undergo the operation of ſwelling, but puts them immediately into weak ſolutions of tan; the ſtrength of which he gradually increaſes, but without ever bringing it to that degree of concentration which he gives it when it is to be uſed for tanning thick leather.

leather. Two, three, or four days are ſufficient for tanning this thinner kind of leather.

Leather which has not been ſufficiently impregnated with the tanning principle, is generally known by a white ſtreak, which is obſervable in the middle of its ſubſtance. We can affirm, that thoſe hides which were tanned in our preſence, in a few days, were completely tanned, as the above-mentioned white ſtreak was not perceptible. We may alſo add, that M. Seguin's method has the advantage of affording the opportunity of examining, from time to time, the progreſs of the operation. For this purpoſe, nothing is neceſſary but to take a ſlip of the hide out of the vat, and to cut off a corner of it; the white ſtreak, already ſpoken of, will appear more or leſs thick, until the tanning is completed.

It has been generally ſuppoſed, that the tan in the tan-pits had no other effect upon leather than that of hardening and bracing the fibres of the ſkin, which had been relaxed by the preliminary operations of tanning. M. Seguin, however, examined the operation more cloſely, and diſcovered, that there exiſted in the tan a principle which was ſoluble in water, by which the

tanning was brought about; that this principle afterwards became fixed in the leather, in conſequence of a particular combination between the ſaid principle and the ſkin; and that this combination produced a ſubſtance which was inſoluble in water. All this has been demonſtrated by M. Seguin, in the moſt evident manner.

It is well known, that if leather which has not been tanned is boiled in water, it is in a ſhort time almoſt entirely diſſolved therein; this ſolution, by being concentrated, produces a jelly or ſize, which, by farther evaporation, and being dried in the air, becomes what is called glue.

M. Seguin having, in the courſe of his experiments, examined the effect of a ſolution of tan upon a ſolution of glue, obſerved that they were hardly mixed together before a white filamentous precipitate took place, owing to a combination of the glue with the tanning principle contained in the ſolution of tan. This precipitate is inſoluble both in hot and cold water, and acquires colour by being expoſed to the light.

The foregoing experiment furniſhes a true explanation of the proceſs of tanning; for it will eaſily be conceived, that the ſolution of tan acts upon

upon the hides (from which glue is produced) in the ſame manner as it acts upon glue. This is what really happens, both in common tan-pits and in M. Seguin's new method of tanning; in which, the ſolution of tan gradually penetrates the hide, and, as it penetrates, combines with it; producing a gradual change of colour that is very obſervable, till at laſt the colour of the hide is changed throughout, and it acquires a compact texture and marbled appearance, like that of a nutmeg. By this it plainly appears, that a precipitation alſo takes place in the action of tanning, although the hide is not diſſolved, but merely ſwelled, ſo as to enable the ſolution of tan to penetrate it more eaſily.

The property which animal glue or jelly poſſeſſes, of being precipitated by a ſolution of the tanning principle, furniſhes a means of diſcovering what ſubſtances may be uſeful in tanning. Nothing more is neceſſary, than to make a ſolution, or infuſion, of the vegetable ſubſtance ſuppoſed proper for that purpoſe, and that, upon being mixed with a ſolution of glue, will ſhew, by the greater or leſs quantity of precipitate produced, what

what probability there is that such substance may be advantageously employed in tanning.

Lime-water, as M. Seguin has observed, also offers an excellent means of discovering such substances. If lime-water be added to a solution of tan, the mixture instantly produces a copious precipitate; and if a sufficient quantity of lime-water be added to neutralize the whole of the tanning principle, then the supernatant liquor, although still possessing colour, will not form any precipitate with a solution of glue. In like manner, the liquor separated from a precipitation caused by the mixture of a solution of tan with one of glue, will not produce any precipitate with lime-water, if, during the precipitation, the tanning principle had been completely neutralized. This shews evidently, that Dr. Macbride's method of extracting the tan, by means of lime-water, is defective; and that, by so doing, a loss of the tanning principle takes place, in proportion to the quantity of it combined with the lime dissolved in the lime-water.

TO BE CONCLUDED IN OUR NEXT.

XL.

XL. *Liſt of Patents for Inventions, &c.*

(Continued from Page 216.)

HARRY WATTS, of Binley, in the county of Warwick, Gentleman; for an implement for draining land. Dated October 19, 1797.

JOSEPH BRAMAH, of Piccadilly, in the county of Middleſex, Engineer; for a method of retaining, clarifying, preſerving, and drawing off all kinds of liquors; with ſundry improved caſks, and implements, neceſſary to give his contrivance the full effect. Dated October 31, 1797.

JOHN HARRIOTT, of Preſcott-ſtreet, Goodman's-fields, in the county of Middleſex, Eſquire; for a new-invented cog-wheel crab, or capſtan, with geers, to work ſhips' pumps, engines, and hydraulic machines, to give a ſhip way through the water, in calms or light winds. Dated October 31, 1797.

THOMAS

THOMAS PATON, of Chriſtchurch, in the county of Surrey, Engine-maker; for a new-invented preſs. Dated October 31, 1797.

JOHN PARRISH, of ————, in the county of Somerſet; for a method of rendering all kinds of woollen cloth impenetrable to moiſture or wet, or water-proof, without affecting their beauty, colour, or wear. Dated October 31, 1797.

ROBERT BEATSON, of Kilrie, in the county of Fife, Eſquire; for a method of applying the power of wind or water to horizontal mills, the principle of which may be alſo applied to ſeveral other purpoſes. Dated October 31, 1797.

HENRY OVEREND of the city of Briſtol, Gentleman: for a machine which may be uſed as a waggon, cart, or dray, in a more perfect and expeditious manner, and with fewer horſes, than uſually and heretofore done. Dated November 9, 1797.

EDMUND CARTWRIGHT, of the pariſh of St. Mary-le-Bone, in the county of Middleſex, M. A.; for improvements in the conſtruction, working, and application of ſteam-engines. Dated November 11, 1797.

REPERTORY

OF

ARTS AND MANUFACTURES.

NUMBER XLVII.

Printed by JOHN NICHOLS, Red-Lion-Paſſage, Fleet-Street, London.

XLI. *Specification of the Patent granted to Mr.* PETER KEIR, *of Edinburgh, in Scotland, Mathematical Inſtrument-maker; for a Method of raiſing the Supply of Oil in Lamps.*

Dated January 29, 1787.

TO all to whom theſe preſents ſhall come, &c. NOW KNOW YE, that I the ſaid Peter Keir, in purſuance of the ſaid proviſo, in the ſaid letters patent contained, do hereby deſcribe and aſcertain the nature of my ſaid invention, and in what

manner the ſame is to be performed, as follows; that is to ſay, my method of raiſing the ſupply of oil in lamps is, by the application and uſe of another fluid, whoſe ſpecific gravity is greater than that of the oil uſed; communicating with each other by means of certain receivers, pipes, tubes, veſſels, or conductors, herein after deſcribed, ſo conſtructed, formed, and placed, that a ſufficient quantity of a heavier fluid may, by its weight, be brought to act upon, and preſs upwards, a column of oil, to any altitude to which the oil may be required to be raiſed, for the purpoſe of gradually feeding and ſupplying the lamp with oil for conſumption: and, by ſuch action and preſſure upwards, may ſupport, elevate, and raiſe, the column of oil to the required altitude; which will be effected by making the perpendicular altitude of a column of the heavier fluid bear the ſame proportion to the perpendicular altitude of the column of oil, that the ſpecific gravity of the oil bears to the ſpecific gravity of the fluid. And, by continuing the pipe, tube, veſſel, or conductor, in which the fluid is contained, be-

low

low the lower ſurface of the column of oil, which will alſo be the ſurface of contact between the two fluids when in equilibrium, the weight of the fluid will be brought to act on the lower ſurface of the oil, and ſupport the column; by which means, the lamp will not only be ſupplied with the pureſt particles of the oil from the upper ſurface, but alſo the flame will be greatly elevated above the body of the veſſel containing the fluid, and be ſupplied from a contracted ſurface of oil, and therefore diffuſe a more extended light, with a conſiderable diminution of ſhade. The continuance of the ſupply of oil to the lamp, for any time required, is effected by means of two veſſels or receivers, of ſimilar dimenſions; one of which I call the upper receiver, intended to contain the heavier fluid, and communicating with the other, which I call the lower receiver, by means of a pipe, tube, veſſel, or conductor, through which the heavier fluid is made to paſs into the lower receiver, and to fill the lower parts of that receiver. The lower receiver, being cloſed on all ſides, except as to the aperture for the tubes

or conductors, may be made to contain any quantity of oil ſufficient for the ſupply of the lamp for the time being; which muſt be raiſed by means of a pipe, tube, or conductor, fixed to the upper part of the lower receiver, and extending above the upper receiver, in any convenient direction, to the height to which the oil is required to be raiſed, for the purpoſe of ſuch ſupply; and the upper receiver, being open at the top, for the admiſſion of air, muſt be likewiſe made to contain a ſufficient quantity of fluid, for the purpoſe of gradually raiſing the oil out of the other receiver, through the ſaid pipe, tube, veſſel, or conductor, placed in the lower receiver, and communicating with the burner, for the ſupply of the lamp. The preſſure upwards of the heavier fluid, upon the lower ſurface of the volume of oil, being in proportion to the weight of the perpendicular volume, it is evident that the larger the ſuperficies of thoſe receivers is made, with a given altitude, the greater will be their contents, and the longer will the lamp be continued to be ſupplied with oil. The upper part of the pipe, tube, veſſel, or conductor,

conductor, made for the paſſage of the oil to the flame, may be made ſuitable to any kind of burner required to be uſed, and may be applied as well to ſuch lamps as have an internal and external current of air as to common lamps. The veſſels being thus conſtructed, a quantity of the heavier fluid muſt be firſt poured in, ſufficient to ſupport the oil that is intended to be uſed at the height required, and the oil and fluid in equilibrium; the ſurface of the contact of the oil and fluid ſhall be within the lower receiver, and above the mouth or opening of the tube, pipe, veſſel, or conductor, through which the fluid paſſes from the upper or lower receiver, which will prevent the aſcent of the oil through that tube. The fluid thus poured in will deſcend to the loweſt of the veſſels; after which, the oil may be poured in at the upper end of the pipe, veſſel, or conductor, near the burner; which, deſcending through that tube, pipe, veſſel, or conductor, will come into contact with the fluid, and continually preſs, by its weight, upon the upper ſurface of the fluid, and thereby impel the fluid back,

back, through the lower pipe, tube, veſſel, or conductor, into the upper receiver, until the oil and fluid are in equilibrium; whereby the upper ſurface of the oil will be raiſed above the upper ſurface of the fluid, in the inverſe proportions of their ſpecific gravity; and the oil, being prevented from aſcending through the lower conductor into the upper receiver, by the weight of the fluid, will remain in the upper pipe, veſſel, or conductor, and the higher parts of the lower receiver; ſo that, during the burning of the lamp, and the gradual conſumption of oil, the ſubſequent decreaſe on the lower ſurface of the oil will be diminiſhed, ſo that the oil will no longer be repelled or drawn up to the flame; that continuance evidently depending upon the deſcent of the fluid in the upper receiver, which deſcent will be accelerated or retarded, by the leſs or greater quantity of fluid contained in a given perpendicular height of the upper receiver. The fluid to be made uſe of may be a ſolution of ſalts in water, or any other fluid ſpecifically heavier than the oil uſed, according to the length

required

required to raiſe the oil above the ſurface of the heavier fluid; and of ſuch a quality that it will not eaſily incorporate with the oil, nor injure the materials of which the veſſels or lamps are to be made. The veſſels may be made of tin, braſs, copper, ſilver, glaſs, or porcelain, and various other materials, and in various forms, ſhapes, and conſtructions, adapted to the various lamps. This invention may alſo be applied to raiſe a ſupply of oil in lamps with various branches or burners, by conſtructing the veſſels in ſuch a manner that the column of the heavier fluid may ſupport various columns of oil, according to the number of branches or burners. In witneſs whereof, &c.

XLII.

XLII. *Specification of the Patent granted to Mr.* GEORGE JEFFREYS, *of the Pariſh of St. Luke, Old-ſtreet, Scarlet-dyer; for a Method of dying Woollen Cloths, Stuffs, and other Materials, in various Colours, and of any Figure, Pattern, or Deſign required, by Means entirely new.*

WITH TWO PLATES.

Dated March 18, 1791.

TO all to whom theſe preſents ſhall come, &c. NOW KNOW YE, that in compliance with the ſaid proviſo, I the ſaid George Jeffreys do hereby declare, that my ſaid invention of a method of dying woollen cloths, ſtuffs, and other materials, in various colours, and of any figure, pattern, or deſign required, by means entirely new, is deſcribed in the ſeveral drawings hereunto annexed, and in manner following; that is to ſay, let well-dried tobacco-pipe-clay be finely powdered, and gradually added, with inceſſant agitation,

tation, to an equal weight of tallow, of the beſt kind, heated previouſly to its boiling heat. Continue the heat for two or three hours, or until the mixture acquires ſuch conſiſtence that it will grow ſolid by cooling, and that, when the whole charge is ſuffered to cool in the boiler, no part of the tallow ſhall appear diſtinct and unmixed near the ſurface. If any tallow ſhould thus appear, the whole muſt be boiled and agitated again, for two or three hours, or more, if the quantity be great. If the compoſition be duly prepared, it will have the following properties, and ſerve for the following purpoſes. When heated ſo much as to acquire the fluidity of thick cream, it will run freely through the perforated plates hereafter deſcribed, and ſink deeply into woollen ſtuffs placed under the plates, without ſpreading laterally beyond the limit of the perforations in the plates; and any traces made with the melted and liquid compoſition on woollen ſtuffs, will become hard, and dry, as quickly as they are ſuffered to cool; and woollen ſtuffs, ſtriped, or traced, or figured with the compoſition, will not ſmear each other by contact after they become

cold. The compoſition duly applied, in the manner hereafter deſcribed, to woollen ſtuffs, ſo as to ſink into them, and cover the nap in form of ſtripes, or in figures, will prevent the parts of the woollen ſtuffs which are charged with it from receiving a dye or colour, in any uſual dying proceſs that is competent for the dying of all the other parts of ſuch ſtuff; and thus it enables the artiſt to preſerve the native colour of the woollen ſtuff in the form of ſtripes or figures, or any died colour of the woollen ſtuff in ſtripes or figures, whilſt all the other parts of the woollen ſtuff may be made to receive any choſen dye; and thus a great variety of ſtripes, figures, and colours, may be made in woollen ſtuffs. The compoſition has alſo this property, that it may be eaſily extracted from the woollen ſtuff, by means of fullers-earth, in the fulling-mill or ſtocks; and the extraction requires only twice as much fullers-earth as is commonly uſed for extracting the greaſe out of cloths.

The mechanical part of the art of making ſtripes acroſs the breadth of a piece of woollen ſtuff, is as follows. Let the figure A B C D

(Plate

(Plate XVI. Fig. 1.) repreſent a plate of braſs, one-twentieth of an inch in thickneſs; let the black parts of this figure repreſent the ſubſtance of the plate of braſs, and let the white ſpaces or lines repreſent the long parallel apertures, made by cutting through the ſubſtance of the plate, ſo as to make it into a kind of grate, whoſe apertures ſhall be long enough to extend quite acroſs the breadth of the woollen ſtuff which is to be ſtriped, and whoſe apertures ſhall have the width of the intended ſtripes. Let E F G H repreſent the horizontal plane of a long table; and let I K L M N O repreſent a piece of woollen ſtuff lying ſmooth upon the table. When the braſs grate is to be applied to this piece of ſtuff, the edge A B muſt be parallel with I K, and beyond the edge of the woollen ſtuff at I K; and the edge D C muſt be parallel with the line O N, ſo that the whole breadth of the woollen ſtuff may be ſeen through the braſs grate. Let 1 2 3 4 repreſent a braſs frame or box, whoſe four ſides are parallel, and incloſe a ſpace of the length and breadth repreſented, and of the depth of one inch and a half, or two inches; and let this frame, when it

is placed on a true plane, touch and fit the plane ſo accurately, that the braſs frame may be filled with the melted compoſition, without ſuffering any of it to paſs away between the frame and the plane. Now let this braſs frame 1 2 3 4 be placed on the braſs grate, at D C, ſo that the ſide at 4 3 ſhall ſtand within D C, and ſhall be parallel with D C, and that the ſide 1 2 ſhall be at ſome diſtance from the apertures of the braſs grate; and ſo that the unperforated parts of the braſs grate, near D C, ſhall ſerve as a bottom to the braſs frame, and that thus a trough be formed, capable of holding the liquid compoſition. Now let the frame 1 2 3 4, ſo placed, and charged with the melted compoſition, be briſkly ſlided along the braſs grate to the end A B; the compoſition will ſink upon the woollen ſtuff, forming ſtripes upon it, in the order and direction of the apertures of the braſs grate, whoſe thickneſs determines the quantity of compoſition thus to be lodged on the woollen ſtuff. When the braſs frame is thus ſlided beyond the edge A B of the braſs grate, whatever part of the charge of the compoſition is ſuperfluous runs off into a trough, placed under the

edge

edge of the table, between E and H, and is therein ſaved for future uſe. In order that the frame 1 2 3 4 may ſlide regularly on the braſs grate, from the end D C to the end A B, the braſs grate is provided with a ledge or riſing at the edge A D, and at the edge B C; within which ledges the braſs frame may ſlide freely, always maintaining its firſt parallelism. 5 6, repreſents the horizontal plane, and prominent ledge, of the braſs grate A B C D. When the compoſition is thus depoſited in ſtripes, the braſs grate is to be taken off the cloth, by raiſing it perpendicularly, and rather in the direction of the ſtripes than acroſs them; and this braſs grate (or another of the like apertures) is to be cleared for farther uſe, by heating it on a hot iron plate, and rubbing it clean with coarſe woollen cloths; and, on the next application of the braſs grate, in order to continue the proceſs of ſtriping with the compoſition, care muſt be taken that the edge A D, of the braſs plate, ſhall be parallel with the former ſtripes made on the woollen ſtuff, and at ſuch diſtance from the contiguous ſtripe, that all the ſtripes ſucceſſively made ſhall have the required

diſtances

diſtances and parallelisms. As the braſs frame, when charged with the melted compoſition, is too hot to be griped by the naked hand, a wooden cover with a ledge is put on each end of the braſs-frame; by the intervention of which, the workman can catch and ſlide the frame, without touching the hot parts. Any perſon who will conſtruct theſe inſtruments, and arrange them to uſe, in the manner above deſcribed, will readily perceive, that the braſs grate A B C D may be ſtayed in the required poſition on the woollen ſtuff, either by an aſſiſtant, or by pins ſo placed that they ſhall not obſtruct the motion of the braſs ſliding-frame; and will alſo perceive, that if the apertures in the braſs grate are ſpiral lines, or repreſent figures of various kinds, the compoſition will be depoſited on the woollen ſtuff in ſpiral lines, or figures correſponding with ſuch apertures, ſo as to produce a great variety of patterns of different ſtripes or figures, and of different colours, as may more fully appear under the deſcription of dying ſtuffs ſo ſtriped or figured with the compoſition. With the aforeſaid compoſition, work may be executed in the manner of the

wax

wax calico-printers or dyers, particularly on thin woollen ſtuffs; and it is to be obſerved, that when the compoſition is applied to cloth or thick ſtuff, care muſt be taken that it ſhall penetrate, and alſo completely cover the nap.

To make the compoſition run in ſtripes along the whole length of the ſtuff or cloth, the mechaniſm is as follows. A braſs plate A B C D (Plate XVI. Fig. 2.) is cut, from the edge D C to the extent between D E and C F, ſo as to form apertures, of the breadth of the intended ſtripes of the compoſition. On the unperforated part of this braſs plate, and within A B F E, a braſs frame or box, ſimilar to that above deſcribed, but much larger and deeper, in order that it may hold a much greater charge of the melted compoſition, is to be placed, preparatory to the intended operation. When a piece of ſtuff or cloth is drawn over a ſmooth table, and between it and the braſs plate, and advances under the braſs plate to meet the line *a b*, then the braſs frame, charged with the compoſition, is made to ſlide quickly, from the unperforated part of the braſs plate to the perforated part thereof, between E F

and

and *a b*: the ſtuff or cloth is at the ſame time drawn, with uniform and briſk motion, in the direction A D B C, and this receives the compoſition, in the form of parallel ſtripes, through its whole length; the braſs frame being all the while ſupplied with the compoſition, as faſt as it is expended. At the line *a b*, a ledge of braſs is ſcrewed on the braſs plate, and ſerves two purpoſes; the firſt is, to ſtop the charged braſs frame, and to determine the poſition of it, when it reſts over the apertures: the ſecond is, to determine the depth or quantity of the compoſition which forms the ſtripes; and, in order to produce this latter effect, the braſs ledge *a b* ſinks into the apertures acroſs which it lies, to ſuch depth as is found convenient for different kinds of woollen ſtuff. If a thin ſtratum or ſtripe of the compoſition be required, the braſs ledge is made to ſink into the apertures deeply; if a thick ſtratum or ſtripe of the compoſition be required, the braſs ledge is made not to ſink ſo deeply; in general, the facets of the braſs ledge, which ſink into the apertures, ought not to be above one-thirtieth of an inch from the under ſurface of the

plate

plate ABCD. In order that the ſtuff or cloth may run freely, ſteadily, and ſmoothly, under the perforated braſs plate, it is previouſly rolled ſmoothly on a cylinder of wood, whoſe axis is parallel with AB; and the beds in which the extremities of this axis move round, are made in the foot or frame of the table on which the work is executed. In order that the cylinder may deliver the cloth with a ſteady uniform motion, the axis of the cylinder is made to project half a foot beyond the bed; ſo that a rope, which is faſtened to the cieling, may paſs round the projecting axis, then upwards, and then, turning over a pulley, may have a weight ſuſpended to it. According to the quantity of weight thus applied, the axis of the cylinder will be preſſed, more or leſs forcibly, to one ſide of the box in which it turns round; by which means, a tremulous motion is prevented, at the ſame time that the friction of the rope, on the axis, makes the cylinder to deliver the ſtuff or cloth more ſteadily. It is to be obſerved, that the plate ABCD muſt be faſtened on the table by bolts or pins, placed near the edges CD. It is alſo to be obſerved, that the

braſs frame or box, in order to be kept ſteady and cloſe when charged, and made to deliver the compoſition, is required to be loaded with leaden weights; and, when this braſs frame or box is large, its oppoſite ſides require to be ſtayed or ſupported by ſeveral pieces of thick braſs, ſtanding at right angles with them, and ſoldered or rivetted to them. In order that the ſtuff or cloth, in paſſing under the braſs plate, may be preſſed equally at all parts within the ſpace E F *a b*, a pad is faſtened to the table, under E F *a b*; which pad riſes one-eighth of an inch, or leſs, above the plane of the table, and conſiſts of near two folds of woollen cloth, covered with parchment, in order to leſſen the friction of the cloth againſt the pad. When many pieces of cloth are to be thus treated, they are to be neatly darned end to end; and, being duly placed on the cylinder above deſcribed, they may be ſtriped with the compoſition, as faſt as they can be conveniently drawn through; the frame or box containing the compoſition being kept conſtantly ſupplied, whilſt the ſtuff or cloth is paſſing. When woollen ſtuff or cloth, thus placed on the cylinder, is

to

to be drawn through, and ſtriped with the compoſition, the end on which the operation is to commence is to be hooked to a piece of wood, of a yard or more in length, having tenter-hooks on the upper ſurface thereof, for that purpoſe; and, to this piece of wood a rope is to be faſtened, exactly at the middle of the breadth of the ſtuff; the other end of the rope, being paſſed over a pulley, at any required diſtance, and in the proper direction, is then faſtened to a windlaſs. As faſt as a workman turns the windlaſs round, the piece of wood is drawn towards the windlaſs, and the cloth is drawn through and ſtriped with the compoſition, which ſets and dries, by cooling, as faſt as it is neceſſary; inſomuch that in a few ſeconds the ſtuff or cloth may be thrown into folds, or otherwiſe, without ſmutting. If the table or plane, along which the woollen ſtuff is to be drawn, be made to ſlope a little downwards towards the windlaſs, the operation will be the more eaſily performed.

Plate XVII. contains two views of the machine, ſuppoſed to be at work.

In dying woollen cloth or ſtuff that has been charged with the ſtripes or figures of the com-

poſition, care muſt be taken that the ſurfaces of the cloths ſhall not touch each other. Their contact is prevented by means of a frame, (Plate XVI. Fig. 3.) fitted to the top of the kettle, to the ſeveral bars of which frame one of the liſts of the cloth is hooked, whilſt leaden weights are hung to the other liſt. The middle or longeſt bars of this frame extend beyond the circumference of the kettle, reſting upon the top of it, and ſerve as handles, by which the frame is raiſed and lowered, from, and into, the dying-liquor, ſo as to produce an even dye, without cauſing the ſurfaces of the cloth to touch each other. Divers compoſitions may be made with earthy powders and unctuous bodies, which may be uſed as ſubſtitutes for the compoſition, provided they poſſeſs the general properties above deſcribed; and the compoſition may be delivered on ſtuffs or cloths by various mechaniſm, and in ways different from thoſe deſcribed; all which will naturally occur to an artiſt, after he has practiſed in the manner above deſcribed, and thus learns the general principle and purpoſe of this art. In witneſs whereof, &c.

XLIII.

XLIII. *Specification of the Patent granted to Mr.* JOHN ATKINSON, *of Harrington, near Liverpool, Colour Manufacturer; for his Invention or Diſcovery of the Uſe and Application of certain Materials, for making a valuable White Paint or Colour, and of making Paint or Colour from the ſaid Materials, which will, in a great Degree, anſwer the Purpoſes of White-Lead.*

Dated March 8, 1796.

TO all to whom theſe preſents ſhall come, &c. NOW KNOW YE, that I the ſaid John Atkinſon, in compliance with, and conformity to, the ſaid proviſo, do hereby particularly deſcribe and aſcertain the nature of my ſaid invention, as followeth: I do declare that the materials of which I have diſcovered the uſe and application, for making a valuable white paint or colour, are a mineral calx, called blende or black jack, lapis calaminaris or calamine, or any other ore of

of zinc, called or known by the name of zinc-ſpar, or any other calx, ore, mineral, or metal, reducible to zinc, or from which the ſame may be obtained. And that the method of making paint or colour from the ſaid materials, which will, in a great degree, anſwer the purpoſes of white-lead, is as follows; that is to ſay, firſt convey the mineral calx, calamine, ore of zinc, zinc-ſpar, or other materials as aforeſaid, to an oven or furnace, commonly called a reverberatory furnace; where the flame muſt paſs over it for the ſpace of ſix hours, or thereabouts, in which proceſs it parts with, or from, all the ferruginous volatile principles which it contained. Thence convey it to a mill, and lay the ſame upon a flat ſurface, where, by means of ſtone which is to roll over it, it is cruſhed or bruiſed ſmall; or make uſe of any other machine which will anſwer that purpoſe; and, when the ſame has been ſo cruſhed or bruiſed, mix it with about one-eighth part of its weight of powdered charcoal; after which, it is to be removed to a furnace, commonly called a cloſe-furnace or muffled furnace. This furnace ſhould be provided with two apertures

tures or openings, one on each ſide, and dilated at the end from the furnace by a diſtance of about twenty feet; but a greater or leſs diſtance may be uſed, as the caſe may require: the other end immediately joins and enters the body of the furnace. In this ſtate the ore ſhould be introduced, through the top or crown of the ſaid furnace; and, when it is perfectly ignited or made red-hot throughout, a large thick white cloud or ſmoke, with a bright blue flame, will be produced, which will convey itſelf into the apertures or openings before mentioned and deſcribed, and will be collected in the form of a very pure white metallic calx. Theſe apertures or openings ſhould each be provided with a door at the fartheſt extremity, in height about five feet, or ſufficiently large to admit a man to go in, for the purpoſe of collecting the colour. It ſhould then be conveyed to a mill or machine, and be ground, (regard being had to the colour,) being firſt duly mixed with water ſufficient to dilute it; after which, it ſhould be conveyed from the mill or machine, by a plug to be fixed about twelve inches from the bottom of the tub, into gutters or

ſpouts,

ſpouts, to convey it into fine ſieves; whence it may be received into ciſterns or veſſels, which communicate one with another by means of gutters or ſpouts, or otherwiſe, by which means, the finer particles float into the fartheſt ciſterns. I make uſe of ſix ciſterns, but a greater or leſs number may be uſed; and, after ſtanding about twenty-four hours in this ſtate, the water may be drawn from it, and the colour be collected and removed to a pan or receiver, or other veſſel, made of bricks, or other materials capable of bearing heat, by which it may be dried, by means of fire or otherwiſe; in which ſtate it will become ſaleable, but when it is wanted in powder it ſhould be finely ground. In witneſs whereof, &c.

XLIV.

XLIV. *Specification of the Patent granted to Mr.* JOHN BARBER, *of Attleborough, in the Pariſh of Nuneaton, in the County of Warwick, Gentleman; for a Method of ſmelting and purifying Foſſil-Coal, Iron-ſtone, Iron-Ore, &c. by Steam, Air, and Fire, and impregnating the ſame with inflammable Air, producing thereby a tough Metal.*

Dated Dec. 22, 1792.

TO all to whom theſe preſents ſhall come, &c. NOW KNOW YE, that in compliance with the ſaid proviſo, I the ſaid John Barber do hereby declare, that my ſaid invention of a method of ſmelting and purifying foſſil-coal, iron-ſtone, iron-ore, and other metallic ores, and the calces thereof, by ſteam, air, and fire, and impregnating the ſame, and the matrix thereof, with inflammable air, producing thereby a tough metal, is deſcribed, and is to be performed, in the manner following; that is to ſay, take a quantity of iron-

ſtone, or iron-ore, with a quantity of foſſil-coal, put them into a furnace, or any proper building, into which admit fire, and convey ſteam, from a boiler or boilers, by a pipe or pipes, through an aperture or apertures, made or left in the hearth. Obſerve that the pipe or pipes which convey the ſteam, ſhould not project into the furnace, but fall ſo far ſhort thereof as to permit the ſteam to carry a quantity of atmoſpheric air in with it, by which means there will, in general, be a ſufficiently purified calx produced; but, in caſe the calx ſo produced is not, upon trial, found ſufficiently purified, it muſt undergo the like operation of purifying, by means of ſteam, coals, and fire, and ſo on, until it is effectually purified; as ſteam, conjointly with coals and fire, will eventually purify iron-ſtones, iron-ores, and the calces thereof, and may, in ſome inſtances, ſmelt them at the ſame time. The purification may be facilitated, by having a laver of water placed at the bottom of the furnace or building, to receive the hot calx as it falls, or is drawn out. In ſome caſes, injecting amongſt your ſtones, ores, and coals, a proper portion of ſal ammoniac, or other menſtruum,

menſtruum, with the ſteam, whilſt they are purifying, will be found beneficial. Gold, platina, ſilver, copper, lead, and tin ores, muſt be reduced to a calx, in the manner above ſpecified, and the effects will be the ſame. When the calces are thus properly prepared, take a quantity of them, and alſo a quantity of foſſil-coal, or purified coals; put them into a ſmelting-furnace, in the hearth of which admit fire; and likewiſe make or leave an aperture or apertures, to admit and inject inflammable air, from a retort or retorts, by a pipe or pipes, either ſingly or conjointly with air blaſt. Obſerve that lime-ſtone, charcoal, and other materials which abound with inflammable air, by adding them, in proper quantities, with your purified calces, may have a ſimilar effect to the inflammable air being admitted or injected; and, in caſe the retort ſhould be out of order, may be applied as a ſubſtitute. The proportionate quantities of each of the materials neceſſary to be mixed, can only be attained by experience. This proceſs will produce a tough metal. In witneſs whereof, &c.

XLV. *Description of a Machine for draining Land, called a Mole-Plough. By Mr.* ADAM SCOTT, *of Guildford, Surrey.*

WITH A PLATE.

From the TRANSACTIONS of the SOCIETY for the Encouragement of ARTS, MANUFACTURES, and COMMERCE.

For this Invention, a Bounty of Thirty Guineas was voted to Mr. SCOTT *; who has described the Manner of using the Machine in the following Letter.

THE mole-plough has been used in Sutton Park, for John Webbe Weston, Esq. these three years

* When bounties for machines, &c. are given by the Society, it is always upon condition that the machine, or a model thereof, shall be deposited in the Society's collection, for

years paſt, and is found to anſwer every purpoſe of under-ground draining, without breaking the ſurface any more than by a thin coulter being drawn along, the mark of which diſappears in a few days. A man and a boy, with four houſes, may drain thirty acres in a day, provided there is an open gripe or ditch cut at the lower ſide of

for the uſe of the public; it is alſo expreſsly ſtated, that "no perſon ſhall receive any premium, bounty, or encou-"ragement, from the Society, for any matter for which he "has obtained, or propoſes to obtain, a patent."

The bounty abovementioned was given to Mr. Scott in the ſpring of the year 1797, and, in the month of October following, a patent (of which we have given the ſpecification, with a plate, in our laſt number, p. 225) was taken out by Mr. Harry Watts, for an implement for draining land, the ſimilarity of which to Mr. Scott's mole-plough, it is unneceſſary for us to point out; but what we think highly important to inform the public is, that Mr. Scott, who ſold his mole-plough for two guineas and a half, (indeed Mr. Weſton's letter ſays "the price of the plough compleat is about "two guineas,") is now an agent for the ſale of Mr. Watts's patent implement, at the enormous price of ten guineas. Such of our readers as deſire a farther account of this matter, will find a long letter concerning it, in the Gentleman's Magazine for February.

the

the ground to be thus drained, in order to receive the water from thoſe ſmall cavities which the plough forms in the ground, at the depth of twelve inches, or more. The method of uſing it is, to go down and up, at the diſtance of fifteen, twenty, or thirty feet, as the land may require: this alludes to graſs land; but it is equally good in turnip ground, where it is too wet for ſheep to feed them off, or on any land that is too wet to ſow; either of which evils it will remedy in a very ſhort time, provided there is ſome declivity in the ground. The beſt time for this operation, in graſs land, is in October or November, when the land has received moiſture enough for the plough to work, and not ſo much as to injure the land, or render it ſoft.

A further account of this plough is given in the following letter from Mr. Weſton, dated Sutton Place, December 9, 1795.

With reſpect to the mole-plough, I really think too much cannot be ſaid in its commendation,

tion, for the purpoſe of temporary draining, where ſuch is uſeful, as is the caſe with great part of my land laid down to graſs; it being on a declivity, and is too wet (in the autumn and winter only) after great falls of rain or ſnow. It being free from land-ſprings, I conceived it improper to be under-drained in the uſual way, as thereby the moiſture neceſſary for its producing a crop of graſs would be carried off equally at all ſeaſons.

The ſoil is very light, but not ſandy, to the depth of from nine to eighteen inches, or more; and underneath is a ſtrong clay, which renders the ſurface abſolutely poachy in winter; but, from the uſe of this inſtrument, the ground on which a man could not walk, will, in the courſe of forty-eight hours, be enabled to carry any cattle. From ten to twenty acres may eaſily be drained in one day, by a ſingle team, which makes the expence trifling, though it ſhould be neceſſary to be done every year.

The drains made by the plough ſhould be in direct lines, at from ten to twenty feet apart, and all vent themſelves into an open furrow or gripe,

gripe, at the bottom. I have uſed this machine for four ſeaſons paſt; and with great ſucceſs. The price of the plough, complete, is about two guineas.

The plough, to the beſt of my knowledge, is the ſole invention of my ſteward Adam Scott, whoſe ingenuity on this and many other occaſions deſerves every encouragement.

There are alſo two letters from Edmund Boehm, Eſquire; the firſt, from Burwood Park, dated March 20, 1796, is as follows.

Mr. Scott's mole-plough is ſo contrived, that it makes the drains from one foot to eighteen inches deep; the bore, two inches and a half diameter; the ſoil, rather a ſtiff clay. I made uſe of ſix horſes, but am inclined to think, from the eaſe with which they worked it, that four would be fully ſufficient. I ſhall have, next ſeaſon, a better opportunity of coming to a certainty on the ſubject; ſhould you wiſh for farther information, I ſhall then be happy to communicate what may have occurred.

I ap-

I apprehend this plough can only anſwer in ſoils where it is not likely to meet with any material obſtruction; in mine, I flatter myſelf I ſhall find much benefit reſult from its uſe.

In his ſecond letter, from Otterſhaw Park, dated February 12, 1797, Mr. Boehm ſays,

On the firſt of this month, on light land, my drain fourteen inches deep, I worked the plough, without difficulty, with two oxen and three horſes; but, in the ſtrong clays, found it work enough for four horſes and two oxen, although I reduced my depth two inches. The drains I have drawn on low wet lands and clay, run inſtantly after the plough; on theſe lands I have generally drawn the drains about twenty feet aſunder, and find them much firmer and drier. I conceive that, except in very heavy land, four oxen would be ſufficient, and fully equal to two oxen and three horſes; as the former ſtep, and conſequently draw, much better together.

The mole-plough, in my opinion, fully anſwers the intent, in ſuch lands as it can properly work in; my only objection being to the ſtrength

required to work it, which makes it impracticable where a large team is not kept.

It may be worthy remark, that the laſt year's drains, which were in clay, are as entire, and run as freely, as the firſt moment they were made.

References to the Figure.

(See Plate XVIII.)

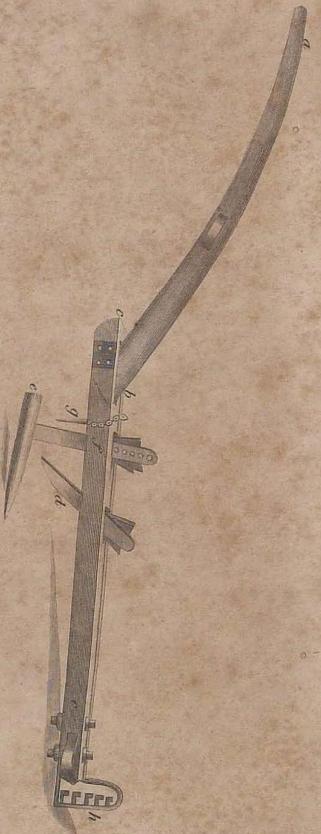
a. The handle, for only one is uſed, mortiſed into the beam at *b.*

cc. The beam.

d. The coulter, held faſt, in the uſual manner, by wedges.

e. The cone or mole, of caſt-iron, having an upright piece of bar-iron faſtened to it, which, paſſing through the beam at *f*, is tightened by wedges; the pin *g*, being put through one of the holes in the upright bar, ſerves to regulate the depth of the cavity below the ſurface of the land.

b. The copſe, by which the cattle draw.



XLVI. *Continuation of Dr.* ANDERSON'S *Obſervations on the Management of the Dairy.*

(From Page 256.)

EXPERIMENTS have not yet been made to aſcertain what is the preciſe degree of heat moſt favourable for the different operations of the dairy. From the trials I have made myſelf, I have reaſon to believe, that when the heat is from 50 to 55 degrees of Fahrenheit's thermometer, the ſeparation of the cream from the milk, which is the moſt important operation of the dairy, goes forward with the greateſt regularity: I am therefore inclined to think, that this will be found to be the temperature that ought to be aimed at in the dairy. I do not here pretend to decide with a dogmatic preciſion; a conſiderable degree of latitude, in this reſpect, may perhaps be allowable; but, from the beſt obſervations I have

been able to make, it ſeems to me highly probable, that when the heat exceeds 60 degrees, the operations become difficult and dangerous; and, when it falls below the 40th degree, they can ſcarcely be carried forward with any degree of œconomy or propriety. Till farther experiments, therefore, ſhall aſcertain this point, we may take it as a ſafe rule, that the heat ſhould be kept up, if poſſible, between the 50th and 55th degree; and, to aſcertain this point, a thermometer, graduated by Fahrenheit's ſcale, ſhould be hung up conſtantly in the milk-houſe, to give notice to the owner of any alterations in the temperature that might affect his intereſt. Luckily it happens, that this is very nearly about the average temperature that a building, ſecured in the manner above deſcribed from the external air, would naturally bear at all ſeaſons of the year in this climate, were it not affected by external objects. But, as the heat of the milk, if it were in conſiderable quantities, would tend in ſummer to affect the temperature of the air, there is no impoſſibility but it might thus be raiſed, on ſome occaſions, to a higher degree than was proper. It was to have

have at hand, at all times, an eaſy cure for this diſorder, that I wiſhed to call in the aſſiſtance of the ice-houſe; as a ſmall quantity of ice, brought into the milk-houſe at any time, would quickly moderate the heat to a proper degree. Beſides, in the two ſmall chambers adjoining to the ice-houſe, or in the paſſages around it, the butter might be kept cooler than in the milk-houſe itſelf. Other advantages would ariſe from this ſmall additional building, too obvious to be mentioned *.

In winter, ſhould the cold ever become too great, it might be occaſionally diſpelled, either by placing a barrel full of hot water, cloſe bunged up, upon the table, where it might be allowed to remain till it cooled; or by making uſe of ſome hot bricks for the ſame purpoſe. This I ſhould prefer to any kind of chafing-diſh with burning embers in it, as the vapour from the coals (which very ſoon affects the taſte of the milk) would thus be avoided.

The

* Where a houſe is not well accommodated with cellars, it is ſufficiently obvious that they might be built upon the plan

The next object that demands attention is, the utenſils of the dairy. Theſe in general muſt, from the nature of the buſineſs, be made of wood. Of late, many perſons, who affect a ſuperior degree of elegance and neatneſs, have employed veſſels made of lead, or common earthen-ware, for various purpoſes in the dairy. But, as the acid of milk very readily diſſolves lead, braſs, or copper, and with theſe forms a compound of a poiſonous nature, ſuch veſſels muſt be accounted highly pernicious in a dairy, and therefore ought to be baniſhed from it. The ſame may be ſaid of any of the common kinds of earthen-ware; which, being glazed with lead, and the glazing being ſoluble in acids, are equally improper. Mr. Hayes has recommended caſt-iron as a ſubſtitute for theſe; but this metal alſo is ſoluble in acids, and though the ſolution be not poiſonous, like the others, yet, as it may affect the taſte of the products of the dairy, and render their

plan here recommended for a milk-houſe; and thus, at a ſmall expence, might be reared cellars that would be, in every reſpect, as good as the beſt vaults ſunk deep under ground.

medical

medical qualities different from what they would naturally have been, the uſe of theſe alſo ſhould be omitted. In ſhort, excepting veſſels of true porcelain, or glaſs, which are greatly too expenſive, I know of none that could be with propriety ſubſtituted for wooden veſſels in the dairy. China, or glaſs veſſels, however, for obvious reaſons, can never come into general uſe in the dairy; nor will the ſenſible huſbandman ever think of any other than wooden veſſels for his milk; as theſe, if properly managed, can be kept as ſweet and pure as the imagination can conceive. This fact is ſo generally known, as to render wooden dairy utenſils common in moſt parts of the country, ſo that they can be readily procured every where of a proper quality, and form of conſtruction, and therefore nothing more on this ſubject need be here ſaid.

The creaming-diſhes, (ſo I call the veſſels in which the milk is placed for throwing up cream,) when properly cleaned, ſweet, and *cool*, are to be filled with the milk as ſoon after it is drawn from the cow as poſſible; it having been firſt ſtrained

ſtrained carefully through a ſtrainer, formed of a large wooden bowl, with a hole at the bottom, covered with a very cloſe ſieve of fine wire, (ſilver wire is beſt,) or hair web-woven, for that purpoſe, ſo as to keep back hairs, &c. that may accidentally fall from the cow: thin cloth of any kind may be uſed inſtead of theſe, but I ſhould prefer wire, as being moſt durable and cleanly. The diſhes ſhould never exceed three inches in depth, whatever be their other dimenſions; and, if the plan recommended above, of ſeparating the milk into two parts, and of keeping each cow's milk by itſelf, ſhall be followed, it will be convenient to have them made of ſuch dimenſions as to contain about one gallon and a half, or two gallons. As ſoon as they are filled, they are to be placed on the ſhelves in the milk-houſe, where they ſhould be allowed to remain perfectly undiſturbed, till it be judged expedient to ſeparate the cream from the milk.

The length of time that ſhould elapſe before the cream be ſeparated, will depend upon the degree of heat at the time, and the particular

views

views of the owner of the dairy. In a moderately warm temperature of the air, if very fine butter be defired, it ſhould not be allowed to ſtand more than ſix or eight hours. For ordinary good butter, it may ſafely be ſuffered to ſtand twelve hours, or more; but, where the dairy is ſo large as to afford a ſufficient quantity of cream, and where the very beſt butter is intended, (the milk being to be converted to ſome other uſe while yet ſweet,) it may be ſeparated after ſtanding only two, three, or four hours.

When the cream is to be ſeparated, the milk-pan ſhould be taken from the ſhelf, and placed on the table. The cream is then to be ſeparated from the edges of the veſſel, to which it firmly adheres, by means of a knife with a blunt edge, provided for that purpoſe, (the blade formed either of *pure* ſilver, or of fine ivory,) which ſhould be carried round the edges of the whole. The cream is then to be carefully drawn towards one ſide, by means of a ſkimming-diſh, and then lifted up with great nicety, ſo as to take up the whole, without any of the milk, if poſſible. This

requires a dexterity of manipulation that is to be acquired by practice alone; but it is of great importance to the ſucceſs of the dairy that it be well done; for, if any part of the cream be left, the *quantity* of butter will be diminiſhed; and, if any part of the milk be taken, its quality will be debaſed. The wooden ſkimming-diſhes commonly employed, ſeem not to be ſo handy for this purpoſe as could be wiſhed: an improvement in this utenſil might be ſuggeſted, but this I decline at preſent to enlarge upon.

When the cream is thus obtained, it ought to be immediately put into a veſſel by itſelf, there to be kept, till a proper quantity is collected for being made into butter. No veſſel can be better adapted for that purpoſe than a firm neat-made wooden barrel, in ſize proportioned to the extent of the dairy, open at one end, with a lid exactly fitted to cloſe it. In the under-part of this veſſel, cloſe to the bottom, ſhould be placed a cock or ſpigot, for drawing off, from time to time, any thin ſerous part of the milk that may chance to be there ſeparated; for, if this

be

be allowed to remain, it acts upon the cream in a powerful manner, and greatly diminiſhes the richneſs of the quality of the butter. The inſide of the opening of the barrel ſhould be covered with a bit of cloſe gauze netting, (made of fine ſilver wire,) to keep back the cream, while the ſerum is allowed to paſs; and the barrel on its ſtand ſhould be inclined a little forward at the top, to allow the whole to run off.

Many perſons, who have had little experience in the dairy, believe that butter cannot be made of the firſt quality, unleſs it be made from cream that has not been kept above one day; but this is a very great miſtake. So far indeed is this opinion from being well founded, that in very few caſes only can even tolerably good butter be obtained from cream that is not more than one day old. The ſeparation of butter from cream does not take place till after the cream has attained a certain degree of acidity: If it be agitated before that acidity has begun to take place, no butter can be obtained; and the agitation muſt be continued till that four-

neſs is produced, after which the butter begins to form. In ſummer, while the temperature is warm, the beating may be, without very much difficulty, continued till the acidity be produced, ſo that butter may be got; but, in this caſe, the proceſs is long and tedious, and the butter is, for the moſt part, of a ſoft conſiſtence, and tough and gluey to the touch. If this proceſs be attempted during the cold weather in winter, butter can ſcarcely be in any way obtained, except by the application of a great degree of heat, which ſometimes aſſiſts in producing a very inferior kind of butter, that is white, hard, and brittle, with very little taſte, and almoſt unfit for any culinary purpoſe whatever.

The judicious farmer, therefore, will not attempt to imitate this practice, but will allow his cream to remain in the veſſel appropriated for keeping it, until it has acquired that proper degree of acidity that fits it for being made into butter with great eaſe, by a very moderate degree of agitation, by which proceſs only can very fine butter ever be obtained.

How

How long cream muſt be kept, before it attains the preciſe degree of acidity that is neceſſary to form the very beſt butter, and how long it may be kept after that period before its quality be ſenſibly diminiſhed, have never yet, I preſume, been aſcertained by any experiments that can be relied on. So little nicety has been obſerved in this reſpect by practical farmers, even by thoſe who have a high reputation for making good butter, that few of them ever think of obſerving any preciſe rule with regard to the different portions of their cream, ſeeing they in general make into butter all the cream they have collected ſince the former churning, ſo that the new and the old is all beaten up together; and I can find nothing like an uniform rule eſtabliſhed among them, as to the time that ſhould intervene between one churning and another, that being uſually determined by local or accidental circumſtances. I am, myſelf, inclined to believe, that if the cream be carefully kept, and no ſerous matter allowed to lodge about it, a very great latitude may ſafely be admitted in this reſpect.

How

How long cream may be thus kept in our climate, without rendering butter made from it of a bad quality, I cannot ſay; but I can ſay with certainty, that it may be kept good for a much longer time than is in general ſuſpected, even for a great many weeks. It is however certain, that cream which has been kept three or four days in ſummer, is in excellent condition for being made into butter; and I am inclined to believe, that from three days to ſeven may be found, in general, to be the beſt time for keeping cream before churning; though, if circumſtances make it neceſſary, a conſiderable latitude, in this reſpect, may be allowed.

If, however, it ſhould happen that any farmer has ſuch a quantity of cream as may be worth his while to churn once every day, there is nothing to prevent him from doing it. He has only to provide as many ſeparate veſſels for holding the cream as he means it ſhould ſtand days before churning; if three days, three veſſels; if four days, four veſſels; and ſo on. Thus he might churn, every day, cream of three days old,

or

or of four, or of any other number of days, that he might think proper. In the ſame manner, if it were found that the cream of two, of three, or of a greater number of days gathering, was required to make a proper churning, it might be eaſy ſo to contrive it as to churn every day, as will be obvious to any one who ſhall think upon the ſubject. In this way, the operations of a dairy may be kept perfectly regular and eaſy *.

The veſſel in which butter is made, uſually called a *churn*, admits, in the form of it, a conſiderably diverſity. The ſimpleſt that I have ſeen, I ſhould prefer as the beſt, merely becauſe it admits of being better cleaned, and of having the butter more eaſily ſeparated from the milk

* Some perſons chooſe to churn the whole of the milk, without ſeparating any part of the cream. In this way they obtain a greater quantity of butter, though of an inferior quality. By careful management, however, eſpecially if a portion of the firſt-drawn milk be ſeparated, very good butter may be obtained; but I think the practice, on many accounts, is not to be recommended.

than

than any of the others; this is the old-faſhioned upright churn, having a long handle, with a foot to it perforated with holes, for the purpoſe of beating the cream, by being moved upward and downward by hand. But though, for the reaſons aſſigned, I ſhould prefer that form of a churn, other perſons may chooſe that which they like beſt; as all the ſorts, under ſkilful management, will perform the buſineſs perfectly well. Indeed, if the cream be prepared as above directed, the proceſs of churning will be ſo eaſy, as to render thoſe utenſils, in general, the moſt commodious that can be moſt eaſily filled and emptied.

In the proceſs of churning, much greater nicety is required than moſt perſons ſeem to be aware of. A few haſty irregular ſtrokes may render the whole of the butter of ſcarcely any value, which, but for this circumſtance, would have been of the fineſt quality. The owner of an extenſive dairy, therefore, ſhould be extremely attentive to this circumſtance, and ſhould be at great pains to procure a proper perſon for managing this branch of

of buſineſs. This perſon ought to be of a cool phlegmatick temper, ſedate diſpoſition and character, and ought never to allow another perſon, eſpecially thoſe who are young, to touch the churn, without the greateſt caution and circumſpection. Thoſe who have been uſed to ſee cream churned that has not been properly prepared, will think, perhaps, that this would be ſevere labour, in a large dairy, for one perſon; but nothing is more eaſy, as to the bodily labour it requires, than the proceſs of butter-making, where the cream has been duly prepared.

TO BE CONCLUDED IN OUR NEXT.

XLVII. *Account of a Machine for raiſing Water, executed at Oulton, in Cheſhire, in the Year* 1772. *By Mr.* JOHN WHITEHURST.

WITH A PLATE.

From the PHILOSOPHICAL TRANSACTIONS of the ROYAL SOCIETY of LONDON.

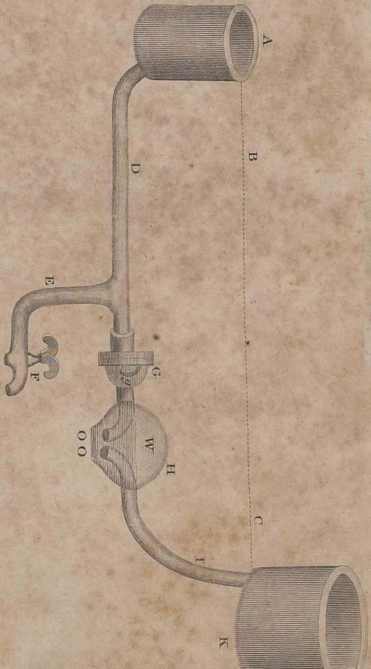
PRESUMING that the mode of raiſing water by its momentum may be new and uſeful to many individuals, I am induced to ſend the incloſed plan and deſcription of a work, executed in the year 1772, at Oulton, in Cheſhire, the ſeat of Philip Egerton, Eſq. for the ſervice of a brewhouſe, and other offices, and which is found to anſwer effectually.

The circumſtances attending this water-work require a particular attention, and are as follows.

A, (Plate XIX.) repreſents the ſpring or original reſervoir, whoſe upper ſurface coincides with

with the horizontal line BC, and the bottom of the reſervoir K. D, is the main pipe, one inch and a half in diameter, and nearly two hundred yards in length. E, a branch-pipe, of the former dimenſions, for the ſervice of the kitchen offices. It is to be obſerved, that the kitchen offices are ſituated at leaſt eighteen or twenty feet below the ſurface of the reſervoir A; and that the cock F is about ſixteen feet below it. G, repreſents a valve-box; *g*, the valve. H, is an air-veſſel. O, O, are the ends of the main pipe, inſerted into H, and bending downwards, to prevent the air from being driven out, when the water is forced into it. W, is the ſurface of the water. Now it is well known, that water diſcharged from an aperture, under a preſſure of ſixteen feet perpendicular height, moves at the rate of thirty-two feet in a ſecond of time; therefore ſuch will be the velocity of the water from the cock F. And, although the aperture of the cock F is not equal to the diameter of the pipe D, yet the velocity of the water contained in the pipe will be very conſiderable: conſequently, when a column of water, two hundred yards in length, is

thus put into motion, and ſuddenly ſtopped by the cock F, its momentous force will open the valve *g*, and condenſe the air in H, as often as water is drawn from F. In what degree the air is thus condenſed, is needleſs to ſay, in the inſtance before us; therefore, I ſhall only obſerve, that it was ſufficiently condenſed to force the water into the reſervoir K, and even to burſt the veſſel H, in a few months after it was firſt conſtructed, though it was apparently very firm, being made of ſheet-lead, about nine or ten pounds weight to a ſquare foot. Whence it ſeems reaſonable to infer, that the momentous force is much ſuperior to the ſimple preſſure of the column I K; and therefore equal to a greater reſiſtance (if required) than a preſſure of four or five feet perpendicular height. It may be neceſſary farther to obſerve, that the conſumption of water in the kitchen-offices is very conſiderable; that is, water is frequently drawing, from morning till night, all the days of the year.


A
B
D
E
G
g
F
W
H
OO
C
I
K

XLVIII. *Concluſion of MM.* LELIEVRE *and* PELLETIER's *Account of M.* Seguin's *new Method of Tanning.*

(From Page 286.)

IT follows, from what we have ſaid reſpecting the action of glue, or of lime-water, upon a ſolution of tan, that every vegetable infuſion which gives a precipitate, upon being mixed with either of theſe reagents, muſt contain, in a greater or leſs proportion, the tanning principle. A decoction of Peruvian bark, for inſtance, (as is conſtantly obſerved in the operations of pharmacy,) gives a precipitate when mixed with lime-water; which precipitation is owing merely to a combination that takes place, between the lime and the tanning principle which exiſts in the bark. It is to be hoped that theſe obſervations may furniſh to the ſcience of medicine, ſome light reſpecting the manner in which aſtringent

ſubſtances

ſubſtances act, either when applied externally, or when given internally.

Since the diſcovery, made by Scheele, of a particular acid in galls, (which has been diſtinguiſhed by the name of *gallic acid,*) many chemiſts have thought that the infuſions of what are called *aſtringent* ſubſtances, owe their action upon metallic ſolutions, and upon various other bodies, merely to the gallic acid which they are ſuppoſed to contain; and ſome chemiſts have conſidered the operation of tanning, as an effect ariſing from the action of the gallic acid upon the hides. To determine whether this opinion had any foundation, we reſolved to examine the effect of the gallic acid upon animal glue: for this purpoſe, we poured a ſolution of gallic acid, obtained from galls, by diſtillation, upon a ſolution of glue. The mixture produced a whitiſh precipitate, which very ſoon turned black, and united into one maſs at the bottom of the glaſs. This experiment ſhews, that gallic acid has an effect in tanning; but we think, nevertheleſs, that tanning is not effected merely by the action of that acid: we alſo preſume, that there exiſts in what are called *aſtringent* vegetables,

bles, (beſides the gallic acid,) a ſubſtance, or combination, of a peculiar nature; and that the reſults obſerved in the various experiments made upon theſe vegetables, are to be attributed to the joint action of the gallic acid and the ſubſtance above mentioned.

To return to the advantages which M. Seguin's method offers, when compared with the methods formerly in uſe, we think we may affirm, firſt, that it is conſiderably ſhorter. Secondly, that it is leſs laborious. Thirdly, that it muſt be leſs expenſive, and muſt produce, from an equal weight of ſkin, at leaſt an equal weight of leather. Fourthly, that the leather produced by it muſt be at leaſt equal in goodneſs.

We ſhall examine each of theſe propoſitions ſeparately.

It is conſiderably ſhorter. The method of tanning with lime requires, for ſtrong ſole-leather, a year for the preliminary operations with lime, &c. and at leaſt another year, ſometimes fifteen months, or even more, for the operation of the tan in the tan-pit: in all, twenty-ſeven months. We here ſpeak of the time generally employed;

employed; for, in thoſe countries where the beſt leather has been hitherto made, the hides remain two years in the tan-pit; and it is pretended, that the ſuperiority of foreign leather is to be attributed to the great length of time the hides are left in the pit.

The method of tanning with barley-ſours requires near two months for the preliminary operations, and a year for that of the tan-pit: in all, near fourteen months. Sometimes, indeed, the hides remain a longer time in the pit.

The method called *a la juſée*, in which old infuſions of tan are uſed in preparing the hides for the tan-pit, requires nearly the ſame time as the laſt, that is to ſay, about fourteen months in the whole. The time the hides are left in the tan-pits is, as we have already mentioned, ſometimes prolonged to fifteen months, ſometimes to two years, and ſometimes even to two years and a half, in ſome tan-yards, for the ſake of obtaining good leather, and of carrying the proceſs of tanning to its greateſt perfection. We muſt however obſerve, that ſome leather is ſold, which has been only five or ſix months in the pit; but ſuch leather

ther is of very inferior quality, and the interior part of its ſubſtance is not tanned.

The duration of the proceſs of tanning, according to M. Seguin's method, is only about twenty days. If, however, we ſuppoſe it to take up a month, or five weeks, upon an average, becauſe in winter it will require rather more time than in the ſummer, there will ſtill remain (with reſpect to time) a conſiderable advantage in its favour.

It is leſs laborious. In this new method of tanning, no manual labour is required, except in taking off the fleſh and the hair; for, as ſoon as the hides are put into the ſolution of tan, they are left therein till the tanning is completed. In the old methods, on the contrary, beſides the trouble of taking off the fleſh and hair, (which is neceſſary in every method,) there is alſo a great deal of labour in taking the hides out of the pits, from time to time, to turn them, &c. It is true, that in the new method there is the labour of making the ſolution of tan; but, when this proceſs is performed in the large way, the water may be raiſed into the tubs by means of a mill, which will reduce the labour to little or nothing; ſo

that, in this point of view, the new method has every poſſible advantage.

It muſt be leſs expenſive, and muſt produce, from an equal weight of ſkin, an equal weight of leather. There is every reaſon to preſume, from the reſults of the fore-mentioned operations, that this ſtatement alſo is true; for, in the firſt place, the manual labour, as we have already ſaid, appears to be diminiſhed. Secondly, as the tanning-principle is made uſe of in a ſtate of ſolution, the whole of that principle muſt be exhauſted; whereas, in the common methods, there is probably no ſuch exhauſtion. Now, as it appears to us demonſtrated, that in tanning, properly ſo called, the hide is ſaturated with this tanning-principle, it follows, that all the tan which is laid aſide, without being exhauſted, is ſo much loſs to the tanner. If it ſhould be objected, that, in the new method of tanning, the hides abſorb more of the tanning-principle than in the old methods, we anſwer that, in that caſe, the leather would weigh more, and conſequently would produce to the tanner (who always ſells his leather by weight) a greater price. But, ſuppoſing that, in the new method,

method, the hides imbibe the ſame quantity of tanning-principle as in the old methods, it is then probable, that the leather produced thereby will be as heavy as if it had been prepared in the uſual manner.

There is, however, one circumſtance in uſing the ſolutions of tan, which we think right to mention: we thought we obſerved, in thoſe ſolutions, a diſpoſition to paſs into the vinous fermentation, which would of courſe terminate in the acid one. If this fermentation ſhould take place before the ſolution of tan is exhauſted, there would ariſe an abſolute loſs of a portion of the tanning-principle; for, fermentation cannot take place without deſtroying ſome of that principle. It is neceſſary, therefore, to watch the ſolution very attentively, particularly in ſummer, and to prepare only as much as is wanted for preſent uſe. It is not neceſſary to pay ſo much attention to the ſolution in winter, as it is not then ſo much diſpoſed to fermentation.

It muſt produce leather at leaſt equal in goodneſs. All who have ſeen the leather prepared by M. Seguin have thought it well made; but, before we

pronounce definitively upon this head, we think it right to mention, that we are now making experiments to determine how it wears. One of us has had ſhoes made of it, which he has worn every day ſince; and M. Seguin has given pieces of leather, prepared by him, to various perſons, that they might make trial of its quality. We ſhall take care to collect the obſervations they may make upon it: and we intend to ſubmit ſome of the leather to the examination of different ſhoe-makers, curriers, and tanners; the reſult of whoſe opinion we ſhall make known to the public.

Beſides the acknowledged advantages of M. Seguin's new method of tanning, there is another, of conſiderable importance, which will hereafter attend this method. Hitherto, bark for tanning has been procured only from ſuch foreſts as were in a ſtate to be felled for uſe; and the great conſumption of that article gives ſome reaſon to fear, that it may not long be poſſible to procure it in ſufficient quantity. The new method of M. Seguin, of making uſe of ſolution of tan, offers the advantage of being able to go into any foreſt,

foreſt, and to prepare the extract of tan upon the ſpot; which, on account of its ſmall volume and weight, compared to the volume and weight of oak-bark, may be afterwards, as M. Seguin obſerves, carried away with the greateſt facility, and, to make uſe of it in the tan-yard, nothing more is neceſſary than to re-diſſolve it in a proper quantity of water. M. Seguin alſo obſerves, that this extract of tan might be made in America, or any other part of the world, whence it might be brought into Europe; and, as there are many other vegetables which contain the principle proper for tanning, an extract might alſo be made from them, after aſcertaining their nature by proper experiments. This may become a very important object with reſpect to commerce; as it opens a new ſource of induſtry, which cannot fail to become very intereſting to all who are concerned in tanning.

Here follows a table of the various hides tanned under our inſpection.

Table

Table ſhewing the Time which was employed in tanning various kinds of Hides, according to M. Seguin's *Method.*

Ox-hides.

Ten ox-hides, taken off Auguſt 17, were tanned by the 6th of September.

Time of each Operation.

Waſhing the hides,	2	Days.
Taking off the hair, &c	5	
Raiſing or ſwelling,	5	
Second waſhing,	2	
Tanning, (properly ſo called,)	6	
In all	20	Days.

Ten ox-hides, taken off the 19th of July, were tanned by the 9th of Auguſt.

Waſhing,	2	Days.
Taking off the hair,	10	
Swelling,	1	
Tanning,	8	
In all	21	Days.

The

The following hides, of different kinds, were begun on the 14th, 16th, and 20th of Auguſt; that is to ſay,

Two hides of Buenos-Aires oxen were begun the 14th of Auguſt.

Ten freſh ox-hides were begun the 16th.

Three Switzerland ox-hides (alſo freſh) were begun the 20th.

Six ſalted Switzerland ox-hides, were alſo begun the 20th.

Theſe hides were all tanned by the 16th of September, being thirty-three days from the time the firſt of them were begun: the time employed in tanning (properly ſo called) was the ſame to all, namely, 15 days.

N. B. During the time of tanning theſe hides, ſome accidents happened to the veſſels in which the operations of taking off the hair and ſwelling were performed; in conſequence of which, theſe operations were prolonged much beyond the time they would otherwiſe have taken up.

A Li-

A Limouſin ox-hide, taken off the 3d of September, was tanned by the 2d of October.

Waſhing,	1	Days.
Taking off the hair and ſwelling,	3	
Tanning,	25	
In all	29	Days.

N.B. The tanning-liquor made uſe of to theſe hides was leſs ſtrong, and of a cooler temperature, than uſual; by which the time employed in tanning was prolonged.

An ox-hide, taken off the 5th of September, was tanned by the 3d of October.

Waſhing,	1	Days.
Taking off the hair and ſwelling,	2	
Tanning,	25	
In all	28	Days.

N. B. The liquor and temperature were the ſame as in the preceding operation.

A Li-

A Limouſin ox-hide, taken off the 6th of September, was tanned by the 29th of the ſame month.

Waſhing,	1	Days.
Taking off the hair and ſwelling,	3	
Tanning,	19	
In all	23	Days.

N. B. The liquor and temperature were the ſame as in the two preceding operations.

Calf-Skins.

Sixteen very thick calf-ſkins, taken off the 18th of July, were tanned by the 31ſt of the ſame month.

Waſhing,	1	Days.
Taking off the hair,	8	
Tanning,	4	
In all	13	Days.

Six calf-ſkins, taken off the 19th of July, were tanned by the 2d of Auguſt.

Waſhing,	2	Days.
Taking off the hair,	9	
Tanning,	3	
In all	14	Days.

Six dried calf-ſkins, begun the 14th of Auguſt, were tanned by the 28th of the ſame month.

Waſhing and taking off the hair,	13	Days.
Tanning,	1	
In all	14	Days.

Six other dried calf-ſkins, begun the 20th of Auguſt, were tanned by the 10th of September.

Waſhing and taking off the hair,	20	Days.
Tanning,	1	
In all	21	Days.

Three

Three calf-ſkins were brought from M. le Compte, tanner. The operation of tanning had already been begun upon them, they having been thirteen days in the tan-pit, in which they were intended to remain eleven months.

Two of theſe ſkins were tanned in twenty-four hours.

The third was tanned in forty-eight hours.

Six more calf-ſkins from M. le Compte, which alſo had been in the pit thirteen days inſtead of eleven months, were begun on the 20th of Auguſt.

Two of them were tanned in two days.

The other four were tanned in four days.

Cow-hides.

One cow-hide, brought the twenty-fifth of July, was tanned by the 7th of Auguſt.

Waſhing and taking off the hair,		6 Days.
Tanning,	- - - -	7
	In all -	13 Days.

Three ſalted cow-hides, brought the 14th of Auguſt, were tanned by the 12th of September.

Waſhing and taking off the hair,	20	Days.
Tanning, - - - -	9	
In all -	29	Days.

Another ſalted cow-hide, brought the 16th of the ſame month, was tanned in about the ſame ſpace of time.

Horse-hides.

One freſh horſe-hide, brought the 30th of Auguſt, was tanned by the 13th of September.

Waſhing, - - - -	1	Days.
Taking off the hair, - -	6	
Tanning, - - - -	7	
In all -	14	Days.

Another

Another horſe-ride, alſo freſh, brought the 4th of September, was tanned by the 19th of the ſame month.

Waſhing, - - - - -	1	Days.
Taking off the hair, - -	7	
Tanning, - - - - -	7	
In all -	15	Days.

Sheep-skins.

Two dried ſheep-ſkins, brought the 14th of Auguſt, were tanned by the 12th of September.

Waſhing and taking off the hair,	25	Days.
Tanning, - - - - -	4	
In all -	29	Days.

Goat-

GOAT-SKINS.

Three goat-ſkins, of bad quality, brought the 16th of Auguſt, were tanned by the 10th of September.

Waſhing and taking off the hair,	23	Days.
Tanning, - - - - -	2	
In all -	25	Days.

Five goat-ſkins, of good quality, brought the 19th of Auguſt, were tanned by the 10th of September.

Waſhing and taking off the hair,	20	Days.
Tanning, - - - - -	2	
In all -	22	Days.

XLIX.

XLIX. *List of Patents for Inventions, &c.*

(Continued from Page 288.)

DANIEL LANGTON, of Wandſworth, in the county of Surrey, Builder; for locks, ſprings, and machinery, for the ſecurity of doors, and for preventing rain or wet from paſſing under them, and which will cauſe doors to paſs over carpets, &c. and will prevent cold air from paſſing under or over the ſame, and, by that means, keep rooms warm. Dated November 18, 1797.

JOHN CROOKS, of Edinburgh, Chemiſt; for a method of making ſoap, and bleaching, by means and uſe of mineral and vegetable alkalies. Dated December 12, 1797.

JAMES WELDON, of Lichfield, in the county of Stafford; for a machine or mill for breaking, grinding, and pulveriſing, patched or chopped bark, for tanning; and for breaking, grinding, and pulveriſing, different kinds of wood, and other hard ſubſtances. Dated December 22, 1797.

WILLIAM

WILLIAM MILTON, of the city of Briſtol, M.A.; for a method of cauſing ſhips, veſſels, barges, boats, and craft of all ſizes, to be built at prices conſiderably below what are given for them, as built in the preſent mode; and for rendering the rudders thereof, in ſome caſes, more effectual. Dated December 23, 1797.

MATTHEW BOULTON, of Soho, in the county of Stafford, Eſquire; for an apparatus and method of raiſing water and other fluids. Dated December 30, 1797.

ANTHONY GEORGE ECKHARDT, of Hans-place, Chelſea, Eſquire, F. R. S.; for a method of making chairs, ſtools, benches, &c. adapted for rooms or carriages, with backs or ſeats and cuſhions fixed in ſuch a manner as inſtantly to change, and ſhew two different ſurfaces in one ſeat or cuſhion. Dated January 16, 1798.

SAMUEL ROBERTS, of Park Grange, in the county of York, Silverſmith and Plater; for working, adjuſting, ſupporting, and fixing, ſlide-tube candle-ſticks of ſilver, ſilver-plated, or other metal. Dated January 23, 1798.

REPERTORY

OF

ARTS AND MANUFACTURES.

NUMBER XLVIII.

Printed by JOHN NICHOLS, Red-Lion-Paſſage, Fleet-Street, London.

L. *Specification of the Patent granted to Mr.* BENJAMIN CHARLES COLLINS, *of the City of Saliſbury, in the County of Wilts; for a Grate on a new Conſtruction, to be uſed in or out of a Chimney.*

Dated March 18, 1791.

TO all to whom theſe preſents ſhall come, &c. NOW KNOW YE, that in purſuance of, and compliance with, the ſaid proviſo, I the ſaid Benjamin Charles Collins do hereby declare, that the nature of my ſaid invention, and the manner in which the ſame is to be performed, is herein-after deſcribed and ſet forth; that is to ſay, the

ſaid invention is calculated to increaſe the action of air upon fire, by augmenting and inverting its paſſage through the ſame; whereby is combined, in an extreme degree, the nitre of atmoſpheric air with the ſulphur of fuel, for it is underſtood that nitre and ſulphur produce the ſtrongeſt fire known; and that, when the invention is applied ſo that no air ſhall paſs, but through the fire, the ſtrength thereof is augmented, ſo that it ſhews a perfect white heat; and, as the draught of air is neceſſarily very great, all, or nearly all, of the un-ignited ſmoak is carried down into the fire, and there conſumed, inſtead of paſſing off, as it would do in the common way: thus I convert the ſmoak into fire, and am alſo enabled to produce a fine clear fire, from ſuch refuſe fuel as other open fire-grates will burn with difficulty only. The principles to which I claim an excluſive right, under the patent, are thoſe of an air-flue or air-flues, and a ſtop or ſtops, whereby, at pleaſure, I increaſe the draught of air in that degree which I may require for a ſtrong bright fire, or indeed any degree of fire exceeding the ſtrength of common fires. Theſe flues may be made of any ſize

or

or ſhape, upright, inclining, circular, or in any other mode, ſo that the paſſage of air be not improperly impeded thereby: they may alſo be made of any metal, or of ſtone, brick, or any other production of nature or art, ſo that the ſame does not burn or conſume; and they may be affixed to the grated part of the grate, or repoſitory for ignited matter, as they may be made in any chimney, or other place ſerving for the purpoſe of a chimney, for burning of fuel. The ſtops are applied to increaſe and to regulate the draught of air, in whatever manner ſuch increaſe or regulation may be required; and may be made of any metal, ſtone, earth, or any other applicable production of nature or art; and grates completed with theſe flues and ſtops are perfectly applicable to the various uſes of all ſorts of rooms, and places where fire is required, in dwelling-houſes, and other places or houſes, and may be made of any ſize or ſhape, at the pleaſure and diſcretion of the perſon wanting them. They are no leſs applicable to light-houſes, and other places requiring a ſtrong light; alſo for laboratories, brewhouſes, ſmelting-furnaces, glaſshouſes, vi-

negar-makers, and all and every perſon requiring ſuch fire as may be hereby produced. And, as the application of the ſaid flue or flues, and ſtop or ſtops, is moſt eaſy, to every ſort of grate, when their principles are known, I therefore proceed to the deſcription how the ſame may be applied for the uſe of rooms in dwelling-houſes, and it is thus: I ſuppoſe that there is a room having a fire-place three feet wide, four feet high, and twenty inches in depth, from the front to the back; for this fire-place, I order a workman to make what is denominated a grate-front, being the ſame ſize, in width and height, as the fire-place, leaving a proper ſpace, in the middle of the front, for the inſertion of a receptacle for fuel intended to be burned therein; the ſame receptacle as is in common uſe, and generally known by the name of the grating or grated part. This ſpace I ſuppoſe to be twenty inches wide, and three feet four inches high, ſo that the left and right hand ſides of the ſaid front are eight inches wide; the top part of the ſaid front is alſo eight inches wide. Croſs-ways, to the inſide inner edges of the left and right hand ſides of the ſaid front, I fix a

flat

flat cheek, that is, a flat cheek to each ſide-front. This cheek may be about half an inch thick, or more or leſs, and ſolid, excepting in thoſe parts where the air is to draw away, after paſſing through the fire: thoſe parts muſt be open, according to the degree of draught wanted; and it is beſt that they ſhould be open, from the hearth to within about three inches of the bottom of the grating or receptacle holding the fire, as thereby the atmoſpheric air muſt then deſcend through the burning fuel to aſcend the flues. Theſe cheeks being fixed, I next fix two other cheeks, within half an inch of the inner outſide edges of the aforeſaid ſide-fronts. The ſecond cheeks ſhould be ſolid, and about half an inch thick, more or leſs; and ſhould be carried up within an inch to the top of the ſaid fronts. This done, I put a ſtrong back, made as other grate-backs are, and of any materials preferred; extending in height from the hearth to the top of the cheeks, and in width ſo as to receive and connect, or become as a ſtrong back to, both pair of cheeks above mentioned. This done, I drill a hole in each left and right handed front, which are now become

become the fronts of flues, according to the principle of my invention: I alſo drill other holes in the back, oppoſite to the holes in each front, whereby I may inſert in each front a ſpindle or rod, ſhewing a ſmall handle or ſcrew on the outſide, for turning the ſame. After this, I affix to each ſpindle a thin plate, as an apt regulating ſtop to the inſide of each flue; ſo that either, or both, may be occaſionally applied to the intent of regulating or ſtopping the draught of air paſſing up the ſame; or, if preferred, I apply an apt valve to each flue, regulating the ſame by a lever or ſcrew. This done, I inſert the grating or receptacle, which, being of the ſame kind as in general uſe, I do not deſcribe. This grating being fixed at the uſual diſtance from the hearth, I learn what ſpace remains open before the aſh-pit: this ſpace I cloſe up, either by a ſtop-plate, by ſliding-doors, or by any other mode preferred; for, by ſuch cloſing up, the common air is prevented paſſing up the ſaid flues, when a ſtrong fire is wanted; but this ſtop-plate, ſliding-doors, or other mode preferred, ſhould be ſo applied as to move eaſily, and all together or in part, for thereby

thereby the ſtrength of the fire will be the better regulated. Farther, I apply, when preferred, a laying-door, or flat plate, after the manner of a common regiſter, with a lever or ſcrew, to raiſe or depreſs the ſame at pleaſure: Farther, where hearths are decayed, or layed upon timber, I apply a plate of metal, or a ſtone, covering the whole ſpace, for greater ſafety. Grates having theſe flues and ſtops, may be made to burn fuel out of a chimney, in an equal degree as in one, by affixing to the tops of them a canopy, of metal, or other production of art or nature, to the height of ſix feet, or more or leſs, with an aperture at the top of the ſaid canopy, ſuitable to the diſcharge of the draught paſſing off from the flues or fire. In witneſs whereof, &c.

LI.

LI. *Specification of the Patent granted to Mr.* THOMAS PROSSER, *of the Parish of St. Giles in the Fields, Joiner; for his Invention of a Machine for printing of Letter-Press.*

WITH A PLATE.

Dated Dec. 9, 1796.

TO all to whom these presents shall come, &c. NOW KNOW YE, that I the said Thomas Prosser, in compliance with the said proviso, do hereby declare, that the nature of my said invention, and the manner in which the same is made, and to be performed, is particularly described and ascertained in the plan hereunto annexed, and the following description thereof; that is to say,

Plate XX. is the machine or press.

A. The cap to hold the cheeks together, as in common presses.

B. The

B. The main top, let into the cheeks, in order to reſiſt the upper ſpring.

C. The upper ſpring, with a regulator at each end, fixed in grooves; by ſhifting theſe regulators nearer to, or farther from, the centre of the head of the preſs, the pull is made either harder or ſofter, as may be neceſſary, or occaſion require.

D. The head of the machine or preſs.

E. The ſpindle, with the common bar-handle.

F. The till, in which is fixed a braſs collar, to ſteady the ſpindle.

G. The regulator to the platen, with two reverſe ſcrews, fixed to iron pillars: theſe ſcrews are made to counteract each other, for the purpoſe of levelling and faſtening the platen to an iron plate, which is faſtened by a nut to the ſpindle. There are alſo four iron pillars, to faſten and fix the platen firm to the ſpindle; and alſo two guides, fixed in an iron plate, and made to run through the till, to ſteady and make firm the platen.

H. The platen.

I. The tympan.

K. The coffin, in which the ſtone is fixed.

L. The carriage.

M. The rounce and ſpit.

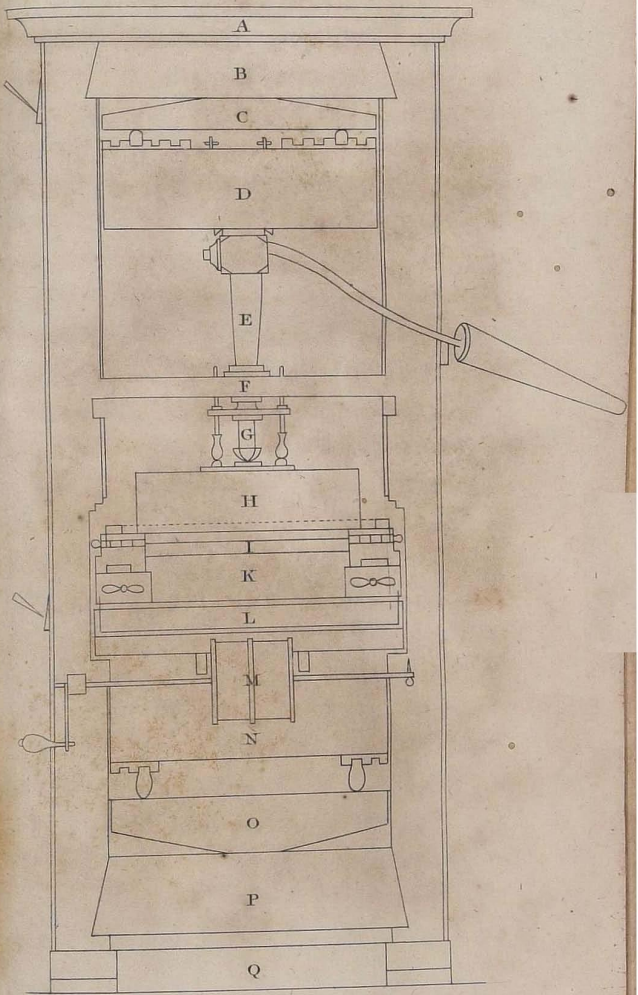
N. The winter.

O. The lower ſpring, with a regulator at each end, fixed in grooves, for the purpoſe and uſe deſcribed in letter C above. Theſe two ſprings are made to act in contact with each other; and thereby the impreſſion is materially increaſed, and the labour conſiderably reduced, as well as the wear of the letter greatly ſaved.

P. The main bottom, let into the cheeks, for the purpoſe and uſe deſcribed in letter B above.

Q. The claws of the machine or preſs, which may be worked in the common way of all other preſſes. In witneſs whereof, &c.

LII.


A
B
C
D
E
F
G
H
I
K
L
M
N
O
P
Q

LII. *Specification of the Patent granted to Mr.* JOHN BARBER, *of Attleborough, in the Parish of Nuneaton, in the County of Warwick, Gentleman; for a Method of using Inflammable Air, for the Purposes of procuring Motion, and facilitating metallurgical Operations.*

WITH A PLATE.

Dated Oct. 31, 1791.

TO all to whom these presents shall come, &c. NOW KNOW YE, that I the said John Barber, in compliance with the said proviso, do hereby describe the nature of the aforesaid invention, and declare that the same is to be performed in manner following; that is to say, it consists of a metallic vessel, called a retort, so contrived that (when heated by a circumambient fire) coal, wood, oil, or any other combustible matter, may be put therein, and the smoke or vapour therein collected may be brought out by a small pipe,

and conveyed, in a regular ſtream, into another metallic veſſel, called an exploder, by means of an air-pump, and a compreſſer or regulating bellows: which pipe oppoſes its orifice to another ſimilar pipe, which enters the exploder, (on the oppoſite ſide from the pipe which brings in the inflammable vapour from the retort,) and injects, by ſimilar means, a proper quantity of atmoſpheric or common air, cauſing an admixture of the two airs; which, ſo mixed, will take fire, on application of a match, or candle, to the mouth of the exploder, and ruſh out with great rapidity, in one continued ſtream of fire, ſo long as the exploder is ſupplied with proper quantities of the reſpective airs. The fluid ſtream is alſo conſiderably augmented, both in quantity and velocity, by water injected into the exploder, by means of another ſmall pipe entering therein; which water is alſo intended to prevent the inward pipes, and the mouth of the exploder, from melting by the velocity and intenſeneſs of the iſſuing flame. This water, as well as the airs, is forced into the exploder by means of a pump; which, in lieu of a common crank, carries upon the

the axis of one of its wheels two S's or double portions of circles, whereby a more regular motion is procured than can be done by any crank-work. This engine is wrought by the ſtream iſſuing from the mouth of the exploder, and may be applied to grinding, rolling, forging, ſpinning, and every other mechanical operation; and the fluid ſtream may be injected into furnaces for ſmelting metallic ores, or paſſed out at the ſtern of any ſhip, boat, barge, or other veſſel, ſo as, by an oppoſing and impelling power, directed againſt the water carrying ſuch veſſel, the veſſel, with its contents, may be driven in any direction whatſoever. In witneſs whereof, &c.

Specification of an Engine for uſing Inflammable Air, for the Purpoſes of procuring Motion, and facilitating metallurgical Operations; and which may be applied to the grinding of Corn, Flint, Manganeſe, or other Matter; alſo to rolling, ſlitting, forging, and battering, Iron, and other Metals; turning of Mills for Spinning, and Engines for turning up Coals, or Minerals, from Mines of all

all Sorts; ſtamping of Ores; raiſing of Water; and any other Motion that may be required.

Fig. 1, (Plate XXI.) is a retort, with its neck A, and a ſtop-cock *a*: I make uſe of two of theſe retorts, in order to keep the engine working with one of them, whilſt the other is cleanſed of the coaks and aſhes of the materials uſed for procuring inflammable air.

Fig. 2, is a receiver, wherein the air from either of the retorts is collected, and cooled, by means of a circumambient ciſtern of water BB, and carried, by a ſmall pipe *b*, into the pump for ſupplying the engine with inflammable air.

Figs. 3, 3, are the air-pumps, which, by means of an admiſſion-valve, through which the reſpective airs are to be drawn into the ciſterns of the inward pipes C, C, (left open at the bottom,) and another valve, where the airs are to paſs out of the ciſtern into the compreſſers, do, upon the alternate raiſing and falling of the outward pipes D, D, (filled with water,) convey the airs into their reſpective compreſſers, by being ſucceſſively raiſed and fallen, by means of the two beams 5, 5.

Figs.

Figs. 4, 4, 4, are compreſſers, which, being filled in their lower parts with water, and the reſpective airs forced into them, by means of their adjoining pumps, do, according to the altitude of the pipes riſing up to their ciſterns, compreſs the air, and force it into the exploders, with a power proportioned to ſuch altitude. In ſome caſes, I chuſe to uſe forcing-pumps, and bellows, for performing this operation.

Figs. 5, 5, two beams, wrought by two S's or portions of circles, fixed on one of the axes of the engine-wheel.

Figs. 6, 6, 6, three ſtop-cocks, to regulate the admiſſion of inflammable air, common air, and water, into the exploder.

Fig. 7, the exploder, with a pipe E, which introduces inflammable air, a pipe F, which introduces common air, and a pipe G, which introduces water into this veſſel; at whoſe mouth or outlet H, (upon the approach of flame,) the combined ſtreams of airs and water do iſſue out, with amazing force and velocity, againſt

Fig. 8, the fly-wheel, on whoſe axis a pinion being placed, turns a toothed wheel of proper dimenſions; and, on the ſame axis are affixed,

Figs.

Figs. 9, 9, two metallic S's or portions of circles, ſet at right angles from each other, ſo as, by rotation of the axis whereon they are faſtened, to bear upon the wheels I, I, in the plug-frame KK, ſuſpended to the beams 5, 5, and thereby work thoſe beams, two ſtrokes each in every rotation.

Fig. 10, is the ſecond wheel in the engine, wrought by the pinion upon the fly-wheel, and upon whoſe axis is fixed another pinion, which, working upon another toothed wheel, of any proper diameter, may, upon the axis thereof, carry either cogs or S's, for lifting hammers, barrels for ropes to wrap upon, cog-wheels for communicating motion to grinding or ſpinning machinery, or for rolling, ſlitting, and preſſing metals, or other ſubſtances, or for any kind of motion whatſoever.

Any ſort of engines and machines, worked upon theſe principles, may be erected at a moderate expence, wrought with very little fuel, and managed with little trouble, in compariſon of any other machinery hitherto invented.

LIII.

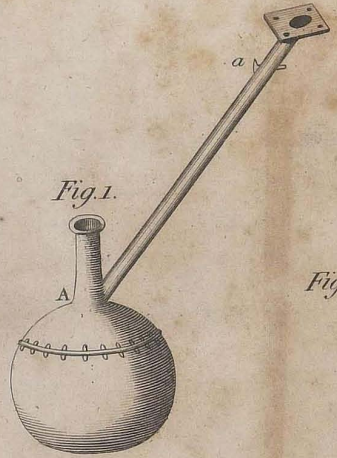


Fig. 1.

Fig. 2.

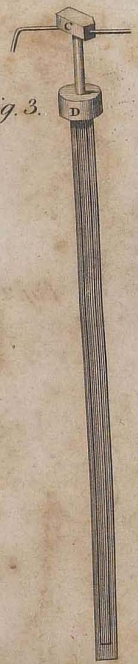


Fig. 3.

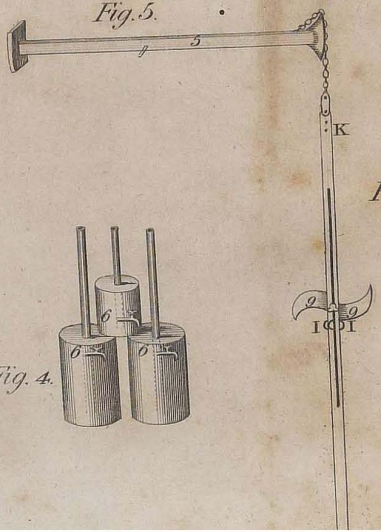


Fig. 5.

Fig. 4.

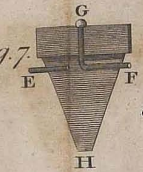


Fig. 7.

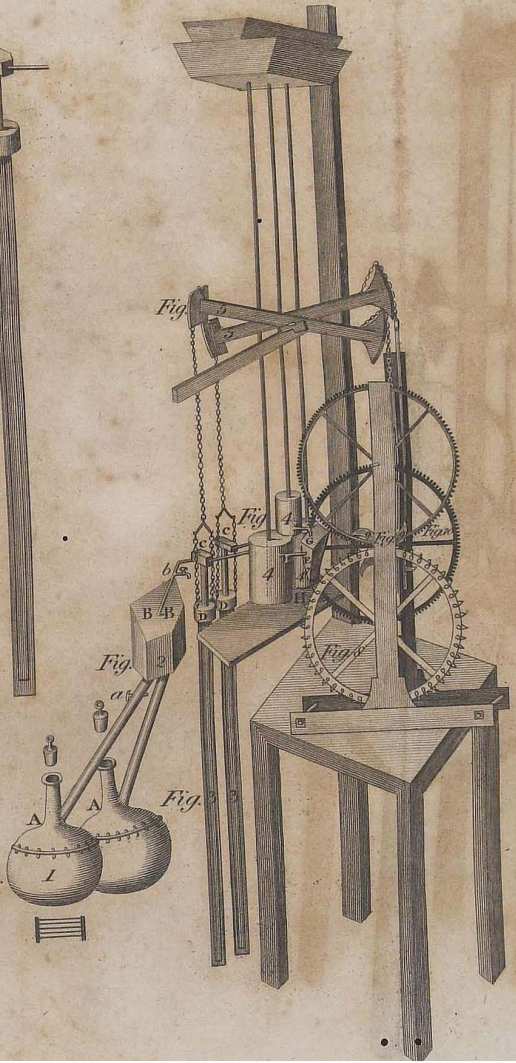


Fig. 1.
Fig. 2.
Fig. 3.
Fig. 4.
Fig. 5.
Fig. 6.
Fig. 7.
Fig. 8.

LIII. *Specification of the Patent granted to* ARCHIBALD *Earl of* DUNDONALD; *for a new Method or Methods of making Ceruſe or White-Lead.*

Dated Auguſt 18, 1797.

TO all to whom theſe preſents ſhall come, &c. NOW KNOW YE, that in compliance with the ſaid proviſo, I the ſaid Archibald Earl of Dundonald do hereby declare, that my ſaid invention, as to one method or proceſs thereof, is deſcribed in manner following; that is to ſay, lead is to be brought to the ſtate of a calx or oxide, the calx is to be mixed with muriat of potaſh or *ſal digeſtivum Sylvii*, or with the oxygenated muriat of potaſh, or with the ſolution of either of theſe ſalts, in the proportion which ſhall be found requiſite; this, for the moſt part, may be reckoned at one part of ſalt, by weight, to five parts of the calx of lead. The materials are to be intimately

mixed by grinding, or otherwiſe, and are to be ſtirred at different times, to expoſe freſh ſurfaces to the action of the air; and are to be alternately wetted with water, (either impregnated, or not, with fixable air or carbonic acid,) and dried by expoſure to atmoſpheric air, or to any air in which carbonic acid is contained, until the complete action of the materials, the one on the other, is effected: in this ſtate, they conſiſt of a ceruſe or white-lead or carbonat of lead, and muriat of potaſh. The muriat of potaſh is, by waſhing, to be ſeparated from the ceruſe or white-lead; to be concentrated by evaporation; and to be preſerved, to act again on more of the calces of lead. Laſtly, the white-lead is to be ground, levigated, and dried. It is proper here to ſtate, that muriat of potaſh or ſalt of Silvius has, in moſt chemical treatiſes, been repreſented to be of little or no uſe in the arts; and, as it is a ſalt which very rarely occurs as a reſiduum from chemical mixtures or combinations, it might the more eaſily eſcape the notice and experiments of chemical perſons, or of perſons in ſearch of diſcoveries connected with different branches of manu-

manufacture. Muriat of potaſh poſſeſſes properties different from muriat of ſoda or ſea-ſalt; and, in the preſent inſtance, produces a change on the calces of lead, not effected when muriat of ſoda only is uſed. The application of muriat of potaſh to the calces of lead, for the production of ceruſe or carbonat of lead, is not therefore to be confounded with the attempts of others to produce a carbonat of lead, by the mixture of muriat of ſoda with the calces of lead. When the muriat of potaſh, or, more properly ſpeaking, its ſolution, is mixed with the calx of lead, a change takes place; the vegetable alkali of the muriat of potaſh is diſengaged in a cauſtic ſtate, while the muriatic acid enters into combination with the calx of lead, and forms muriat of lead. By the expoſure of the materials to atmoſpheric air, or to air containing the carbonic acid, this acid is attracted by the cauſtic vegetable alkali, and, as it is received, is tranſmitted to the lead, forming therewith a carbonat of lead or ceruſe; while, in return, the alkali takes back, from the muriat of lead, the muriatic acid, in a

ſtate more oxygenated than that in which it exiſted in the muriat of pot-aſh when firſt applied. The muriat of potaſh recovered is to be applied for making, with the calces of lead, more ceruſe or carbonat of lead. It has been found moſt advantageous not to uſe the calx of lead very highly calcined: in this highly calcined ſtate, I generally uſe a ſmall proportion of lead in a metallic ſtate along with the calx. The proceſs of mixing lead with the calx or calces of lead, for making, with muriat of potaſh, ceruſe or carbonat of lead, is to be included under the patent to which this ſpecification refers. And I do hereby farther declare, that the other method or proceſs for making ceruſe or white-lead, for which the letters patent herein before recited have been obtained, is as follows; that is to ſay, in this method or proceſs, muriat of ſoda or ſea-ſalt is to be ſubſtituted for muriat of potaſh, and it, or its ſolution, is to be mixed in the ſame manner, with the calx or calces of lead, as in the firſt proceſs or method herein before mentioned. To this mixture, after the proper degree of action has taken place, a ſuf-

a ſufficient quantity of vegetable alkaline ſalt is to be added, to give or procure to the lead the carbonic acid, which is more ſpeedily done when the vegetable alkali is in a ſtate of carbonat. The ſalts are then to be ſeparated from the ceruſe or carbonat of lead, by waſhing off the two ſalts, conſiſting of ſoda or mineral alkali, and muriat of potaſh; or the ſoda may be ſeparated before the potaſh is added to the materials. Laſtly, the ceruſe or carbonat of lead is to be levigated, and dried. The muriat of potaſh, when ſeparated, is to be preſerved, and applied to operate on more of the calx or calces of lead; and this comes under the deſcription given in the firſt method or proceſs herein before mentioned. In witneſs whereof, &c.

LIV.

LIV. *An Account of ſome Appearances attending the Converſion of caſt into malleable Iron.* By THOMAS BEDDOES, *M. D.*

From the PHILOSOPHICAL TRANSACTIONS of the ROYAL SOCIETY of LONDON.

AN alteration has lately been introduced into our manufactories of iron, in conſequence of which, the reverberatory has been ſubſtituted in the place of the finery furnace. The new proceſs is capable of being indefinitely varied; and I have lately been favoured with an opportunity of obſerving one of theſe variations with every advantage I could deſire. As, in this method, the changes undergone by the metal, during the firſt ſeries of operations, lie perfectly open to inſpection, a ſhort deſcription of them may not perhaps be unworthy the notice of philoſophical chemiſts. I muſt premiſe farther, that I did not content myſelf with a ſingle examination:

amination; and, for the ſake of greater accuracy, I took minutes of the phænomena, and of the time when they occurred. A very intelligent workman was, at the ſame time, directed to anſwer all my queſtions, ſo that I enjoyed the benefit of his experience alſo.

In ſomewhat more than half an hour after it was put in, the charge, conſiſting of two hundred weight and a half of grey pig-iron, was nearly melted. The workman now began to ſtir the liquid maſs; for this purpoſe, he uſed ſometimes an iron lever, and ſometimes a kind of hoe, but he firſt turned the flame from off the metal; which is done by letting down a damper, upon the chimney correſponding to that with which ordinary reverberatory furnaces are provided, and raiſing the damper of a ſecond chimney, which proceeds immediately from the fire-place, and carries off the flame, current of air, &c. without allowing it to paſs into the body of the furnace.

In fifty minutes from the commencement of the operation, the metal had become, in conſequence of the conſtant ſtirring, looſe and incoherent;

herent; it appeared about as ſmall as gravel; it was now alſo ſtiff, and much cooled.

55 m. from the ſame period. Flame turned on again. Workman keeps ſtirring and turning over the metal. In 3 minutes it becomes ſoft and ſemi-fluid; flame turned off; the hotteſt part of the maſs begins to heave and ſwell, emitting a deep blue lambent flame. The workman calls this appearance fermentation.

1 h. and 1 m. Blue flame breaking out over the whole maſs; heaving motion alſo general.

1 h. 13 m. Metal full as hot, or, as the workman and myſelf both judged, rather hotter than at the inſtant the flame was turned off, though it is now a quarter of an hour ſince.

1 h. 18 m. Where there is no heaving, and no blue flame, the maſs is ſenſibly cooler, and only of a dull red heat.

1 h. 20 m. Workman obſerves, that the metal ſticks leſs to his tool. Pig-iron, he ſays, faſtens upon it immediately, and muſt be ſhaken off by ſtriking the other end with a hammer; as it approaches more and more towards *nature*, (malleable iron,) it adheres leſs; and, when the tools

come

come clear up out of the mafs, he judges it to be fermented enough.

1 h. 23 m. Little heaving, or blue flame; metal ftiffer, and of a dull red; flame turned on, and foon off again.

1 h. 26 m. By conftant ftirring, the metal is become as fine as fand. Workman remarks, that the flame, which re-appears over the whole mafs, looks more kindly: it is evidently of a lighter blue colour.

1 h. 30 m. Flame turned on, and foon off again. Mafs ferments ftrongly. Hiffing noife heard: this noife was diftinguifhable, in fome degree, ever fince the blue flame and heaving motion became vifible, but always faint till now.

1 h. 40 m. Lefs blue flame.

1 h. 48 m. Flame twice turned on and off in this interval. Metal now clots; ftands wherever it is placed, without any tendency to flow, and no liquid pig-iron now remains in the bafon of the furnace: the mafs has been conftantly ftirred, and turned over.

1 h. 50 m. A little finery cinder appears boiling up amid the mafs. Workman attributes the increafe of the hiffing to this.

1 h. 53 m. Scarce any perceptible blue flame, or heaving. All the metal is now gathered into lumps, which the workman beats and preſſes with a heavy-headed tool. He brings them ſucceſſively into the hotteſt part of the furnace, into which the flame has been admitted. He now ſtops the hole in the door, at which he had introduced his tools, and applies a fierce flame for 6 or 8 minutes. The metal is then rolled.

Theſe appearances, at leaſt the moſt intereſting of them, ſeem to admit of an eaſy explanation; and I offer the following obſervations, as ſupplemental to thoſe for which we are already indebted to the Swediſh and French chemiſts, on this important branch of metallurgy. I aſſume the following propoſitions, as already proved by theſe philoſophers. 1ſt. That caſt-iron is iron imperfectly reduced; or, in other words, that it contains a portion of the baſis of vital air, the oxygen of M. Lavoiſier. 2dly. That it contains a portion of plumbago, with which grey caſt-iron moſt abounds. 3dly. That plumbago conſiſts of iron united to charcoal. 4thly. That fixed air, which I would rather call carbonic acid air, conſiſts of oxygen and the conſtituent parts of charcoal.

The

The heaving or ſwelling motion, ſo conſpicuous in the proceſs, is doubtleſs owing to the diſcharge of an elaſtic fluid; and the lambent deep blue flame, breaking out in ſpots over the whole ſurface, ſhews that this elaſtic fluid is an inflammable gas of the heavy kind. That no doubt might be left upon the former of theſe circumſtances, I directed the workman to take out, at two different periods, a ſample of the metal where it was working moſt ſtrongly. Both ſamples proved, on examination, to be ſpongy, cellular, and full of bladder holes.

The heavy inflammable air, I imagine, is produced in this manner. The oxygen of the imperfectly reduced metal combines with the charcoal, to form fixed air; at the ſame time, another portion of charcoal is thrown into an elaſtic ſtate, that is, into inflammable air, and burns on the ſurface, with a very deep blue flame, on account of the admixture of fixed air. The heat which is ſo obviouſly generated in the maſs at the beginning of the fermentation, I attribute to the combination of the oxygen and charcoal; a fact which, with ſeveral others, as I have already

remarked on another occaſion *, ſhews, if not the falſehood, at leaſt the imperfection, of the modern doctrine on the ſubject of heat. The acidifying principle, it would appear, has ſome power of generating heat, independent of its condenſation. Here abundance of elaſtic matter is diſcharged; yet, notwithſtanding the heat abſorbed by its formation, and that which flows out of the metal in all directions, the whole maſs becomes hotter. The oxygen cannot be ſuppoſed to have much ſpecific or latent heat, becauſe it undoubtedly exiſts in the iron in a very condenſed ſtate: neither does the appearance of the maſs allow me to aſcribe this generation of heat to the burning of the inflammable air at the ſurface, as will alſo be immediately evident for another reaſon. The leſs deep blue colour of the flame, at a ſubſequent period in the operation, is probably owing to the abſence of fixed air, or at leaſt to its being produced more ſparingly, the oxygen being now nearly conſumed. It will not appear ſurprizing, that the oxygen, in this caſe, ſhould be conſumed

* Chemical opinions of a philoſopher of the laſt century.

before

before the charcoal, if it be conſidered, 1ſt, that grey iron contains a large portion of plumbago; and, 2dly, that fixed air contains a much larger quantity of oxygen than of charcoal; near three times as much, according to our beſt experiments on its formation: ſo that I aſcribe the ſubſequent fermentation, accompanied with the lighter coloured flame, almoſt entirely to the converſion of the charcoal into an elaſtic fluid. A very experienced philoſopher, I am well aware, has aſſerted, that water is neceſſary to this converſion; an opinion concerning the juſtneſs of which I have long entertained great doubts. Whenever I have diſtilled charcoal *per ſe*, I have found the firſt portions of gas to contain fixed air; an appearance owing, as I believe, to the decompoſition of water abſorbed from the atmoſphere. After continuing the proceſs for ſome time, there has ſtill been a production of inflammable air; but, from this, neither lime-water nor milk of lime would abſorb any portion, though, when fired with vital or common air, it would produce fixed air; and, if moiſture was added to the charcoal, inflammable and fixed air would be generated anew.

anew. Moreover, it appears, from the experiments of Dr. Auſtin, and ſome others, that charcoal conſiſts of the hydrogen and azote of the French chemiſts. How far it may be difficult or impoſſible entirely to convert charcoal, in its ordinary ſtate, into gas, is a point I wiſh to ſee more fully illuſtrated by future experiments. At preſent it ſeems obvious, that the circumſtances of the operation I have deſcribed are particularly favourable to this converſion; for, 1ſt, not to mention the violence of the heat, we have this ſubſtance in a very attenuated ſtate; ſo that, very probably, the expanſive power of fire is very little, if at all, counteracted by the attraction of coheſion, which cannot be ſaid in the caſe of the moſt minute mechanical diviſion we can effect. 2dly. The attraction of the particles of the iron, for each other, will produce an effort to extrude the intermixed particles of charcoal, and thus enable it more readily to aſſume the elaſtic form.

Now, during the continuance of the lighter coloured blue flame, the maſs, as I obſerved, ſhews no power of generating heat within itſelf; a circumſtance which indicates, that the heat produced,

duced, in the former part of the operation, does not depend on the burning of the gas at the ſurface; and I think inſpection will ſatisfy any one, that it is produced in the heart of the maſs. It may indeed be objected, that the metal, now brought nearer to the ſtate of malleable iron, may require a greater ſupply of heat to keep it at the ſame temperature. It is leſs fuſible, as we are well aſſured. By referring back to the minutes, it may be obſerved, how very often it was neceſſary to turn the flame upon the maſs, during this ſecond fermentation, in order to keep it in a ſtate in which it could be worked.

The very copious production of elaſtic fluids, during an hour, and often during a much longer ſpace, (for in this inſtance the proceſs was remarkably ſucceſsful and ſhort,) does not ſeem favourable to a late ingenious hypotheſis, according to which, water is the embodying principle of all elaſtic fluids. I have never indeed conſidered this as very probable; and, after the obſervations I have related, I ſee no means of defending it. Will it be ſaid that the pig-iron, as being in ſome ſort a calx of iron, contains water?

In

In annealing crude iron, with or without charcoal, it is well known to encreaſe in all its dimenſions. I have ſeen bars, originally ſtraight, bent like an S, when long, expoſed to heat, in circumſtances where they could not extend themſelves endways. I ſuppoſe this phænomenon may be owing to a very ſmall beginning of this fermentative motion, which acts as an internal principle of expanſion. Caſt-iron bars, not in contact with charcoal, would, according to this ſuppoſition, by long annealing, loſe of their weight; or, if the heat was too low for the elaſtic fluid to be diſcharged from their ſubſtance, they would probably bliſter, like ſteel; an appearance undoubtedly owing to the generation of air. Mr. Horne, in his eſſay on iron, ſomewhere remarks, that on opening theſe bliſters he has heard a whiſtling noiſe, as of air ruſhing out.

During the whole of this proceſs, frequent jets of white ſparks, of a dazzling brightneſs, played from the ſurface of the metal. They would have afforded an extremely beautiful ſpectacle, but for the inconvenience of looking on ſo hot a maſs. They aroſe, no doubt, from the burning of ſmall portions of iron.

The

The effect of ſo much ſtirring as I have noted down, does not require to be explained.

The workman was clearly of opinion, that the fermentation of hard or white crude iron is leſs than of grey, in this proceſs; a fact which perfectly coincides with the preceding obſervations, ſince that ſpecies contains leſs plumbago, or, in other words, leſs matter fit to produce elaſtic fluids.

In order to prove the extrication of fixed air, during the fermentation of the metal, I once thought of introducing lime-water, in an iron veſſel, within the body of the furnace; but, when I conſidered that the fire-place was not divided by any partition from the body of the furnace, and that the whole building was full of burned air, I omitted the experiment, from a perſuaſion that, even if the lime-water ſhould become turbid, the fixed air might come from another ſource.

I was not unmindful of the ſulphur which exiſts, as I have reaſon to believe, in every form of iron manufactured with coaks. I cannot, however, aſcribe any of the effects I obſerved to its

preſence. There can be little doubt, that ſome portion was perpetually extricated with the inflammable air, during the whole proceſs; for, on diſſolving pieces of the ſtamped, or rather the rolled iron, in weak muriatic acid, ſilver held in the extricated air was tarniſhed as much, and as ſoon, as by air from ſpecimens taken out of the furnace, at different times, during the proceſs. I could not but conclude, that the tarniſhing matter came from the iron, when I found the air from a ſolution of zinc, in the ſame acid, incapable of producing the colour upon ſilver. The appearance, the want of a martial aſtringent taſte, and the diſſolving action of cauſtic alkali, led me to conclude, that the colour, in each experiment with iron, was derived from ſulphur.

I leave it to the adherents of phlogiſton, to accommodate theſe phænomena to their doctrine; conſidering it, for my own part, as ſuperfluous to beſtow any farther attention upon a ſyſtem which, after a long diſcuſſion, has been fully refuted in all its modifications, and which indeed ſeems on the eve of being univerſally abandoned.

LV.

LV. *Description of a Substitute for a Crank, for communicating Motion to a Foot-Lathe.* By Mr. Joseph Ridley.

WITH A PLATE.

From the Transactions of the Society for the Encouragement of Arts, Manufactures, and Commerce.

A reward of Twenty Guineas was voted to Mr. Ridley for this Invention.

THE difference between the method now recommended, and the common crank, as usually employed for this purpose, is, first, that in order to obtain a proper motion of the crank, with full power, it must be placed in one point of its revolution, which requires time and dexterity; whereas, the mode now before us is at all times ready for the stroke, and the revolution immediately takes place, on putting the foot on the treadle.

Secondly. In the common cranks, the power acts only in a ſmall part of the revolution, and the full power is only exerted at one point; whereas, by the means now propoſed, the power is conſtantly exerted at that point where it can act to the greateſt effect: and this will prove particularly uſeful in the finer and more curious kind of work, where the crank cannot be made to go ſlow enough.

References to the Figures.

(See Plate XXII.)

AA, Figs. 1, and 2. the frame, which incloſes the wheels, and the whole machinery.

B, the floor or platform, on which the frame is fixed.

C, the treadle, movable at the end of the platform, at S, between two centres.

D, a ſpring placed under the treadle, in order to throw the treadle up, and keep it always ready for the foot to ſet to work.

E, the large wheel for the band, to which the mandrel, &c. are to be attached, in the uſual way.

F,

F, (Fig. 2.) is an iron ſpindle, on which the great wheel E, and the ratchet-wheel G, (Fig. 3.) are fixed. The ratchet-wheel is incloſed in a braſs box H, with holes in the centre, on each ſide, and ſmall projections, forming ſhoulders, that work on the cylinder parts, at the centre of the ratchet-wheel G, through which the ſpindle F goes.

I, a piece of braſs, ſliding on the ſurface of the rim of the box H, to govern the click *i*, which is pinned in the inſide of the braſs box, and is worked by three ſtraps going round the box. The double ſtrap KK, is faſtened to the ſlider I, brought over the rim of the box H, and faſtened to the lower part of the ſteel bar L, which is jointed to the end of the treadle, at T. By putting the foot on the treadle, and preſſing it down, the click *i* takes hold of the ratchet-wheel G, by which the power is obtained. To diſlodge the click, and bring the braſs box back, for another ſtroke, there is a ſingle ſtrap M, fixed to the other end of the ſlider I, brought under the rim of the braſs box H, and made faſt to the top of the ſteel bar L.

When

When the foot is up, the great wheel E is at liberty to go backward or forward, for the convenience of running back a ſcrew-mandrel, or taking off a chuck. For diſengaging the click, two ſprings N, lined with cork at the ends, are to be placed one on each ſide the braſs box, preſſing gently againſt it.

O, a ſcrew, which goes through the two ſprings N, and regulates the degree of their preſſure on the braſs box. Theſe ſprings are fixed on a thin piece of ſteel P, riſing from the bottom, to which is ſoldered a piece of braſs Q, having a ſcrew paſſing through it, at R, by which the upright ſteel bar is regulated.

V, a ſmall piece of cork, fixed on the platform, to prevent the treadle making any noiſe in coming down.

The ſame letters of reference are uſed to all the figures.

Fig. 2.

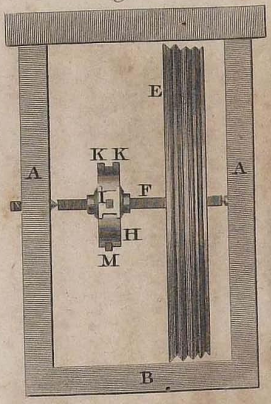
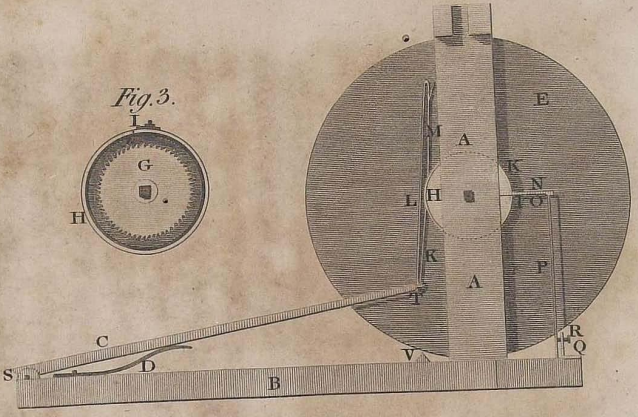


Fig. 3.

Fig. 1.



LVI. *Conclusion of Dr.* ANDERSON'S *Observations on the Management of the Dairy.*

(From Page 337.)

THE butter, when made, ſhould be immediately ſeparated from the milk, and put into a clean diſh, (the moſt convenient ſhape is that of a ſhallow bowl,) the inſide of which, if of wood, ſhould be well rubbed with common ſalt, to prevent the butter from adhering to it. The butter ſhould be preſſed and worked with a flat wooden ladle, or ſkimming-diſh, having a ſhort handle, ſo as to force out all the milk lodged in the cavities of the maſs. A conſiderable degree of ſtrength, as well as of dexterity, is required in this manipulation. The thing wanted is, to force out the milk entirely, with as little working of the butter as poſſible; for, if the milk be not entirely taken away, the butter will infallibly ſpoil

ſpoil in a ſhort time; and, if the butter be much worked, it will become tough and gluey, which greatly debaſes its quality. In ſome places, butter is beaten up by the hand; but that I conſider as an indelicate and barbarous practice.

Some perſons employ cold water in this operation, which they pour upon the butter, and thus, as they ſay, waſh it; but this practice is not only uſeleſs, as the butter can be perfectly cleared of the milk without it, but is alſo pernicious, becauſe the quality of the butter is thus debaſed in an aſtoniſhing degree. Nothing is ſo hurtful in a dairy as water improperly uſed; which, if mixed in any way, either with milk or butter, tends greatly to debaſe the quality of the laſt.

When the butter is entirely freed from the milk, if it is to be ſold freſh, it may be made up into any form that is moſt generally liked at the market where it is to be ſold. If the heat ſhould be ſo great as to render it too ſoft to receive the impreſſion of the mould, it may be put into ſmall veſſels, which may be allowed to

ſwim

ſwim in the trough of cold water under the table, but without allowing any of that water to touch the butter*; there it will, in a ſhort time, acquire the neceſſary degree of firmneſs, (eſpecially if a little bit of ice ſhall have been put into the baſon,) after which, it may be taken out, and moulded into proper form. It ſhould then be put down, in proper diſhes, upon the ſtone border that ſurrounds the trough, where it may be kept cool and firm, till it be packed up to go to market.

In every part of the foregoing proceſs, it is of the utmoſt importance that the veſſels, and every thing elſe about the dairy, be kept perfectly clean and ſweet; for, without this precaution, there neither can be pleaſure nor profit derived from it. This is a circumſtance ſo univerſally admitted,

* The practice that prevails, in many private families, of keeping freſh butter among water, in a glaſs veſſel, and thus ſerving it up to table, is, for the ſame reaſon, much to be cenſured. If coolneſs only is wanted, it would be better to put the butter into a dry glaſs, and that glaſs into a larger one containing water. If the butter is taken out immediately before being put upon the table, it will always have firmneſs enough, in our climate.

that it may ſeem ſuperfluous to take notice of it in this place. Yet, though this be generally known and admitted, and though every perſon who attempts to manage a dairy, of any ſort, may intend to have things clean and proper, they may nevertheleſs be, in ſome caſes, at a loſs for the proper way of effecting their intentions, or of guarding againſt certain evils, which, if once allowed to take place in the dairy, will not be eaſily removed. Some hints, therefore, are ſubjoined, in a note, which may be of ſervice to thoſe who are not well acquainted with this department of buſineſs *.

On

* As ſoon as the cream is ſeparated from the milk, the diſhes ſhould be carried out of the milk-houſe, and immediately emptied, and the ſkimmed milk applied to the uſes that the owner of the dairy judges to be moſt advantageous to him. As ſoon after the diſhes are emptied as poſſible, they muſt be well waſhed with ſcalding-hot water, which ſhould be kept in readineſs for that purpoſe; and, as the naked hand cannot be put into the ſcalding water, a ſcrubbing-bruſh, of a proper conſtruction, muſt be made uſe of for that operation. This may be made of a bunch of wire, firmly bound up with ſtrong packthread, where other materials cannot be had; but

On ſome occaſions, a part, or the whole, of the butter may be diſpoſed of freſh, but in general it

but the ſtumps of an old heath-beeſom, after the ſmall twigs have been worn off, firmly bound together, are found to anſwer this purpoſe remarkably well; nor ought any thing elſe to be ſought for, where that can be had, for this is both firm and tough, ſo as to ſtand the work extremely well.

After the diſhes have been thus perfectly ſcalded, and thoroughly ſcrubbed in every part, they muſt be carefully rinſed with blood-warm water, and well ſcoured by hand, with a coarſe linen cloth. They are then to be turned down, one by one, as they are finiſhed, bottom upwards, upon a clean ſhelving-board, to drip. When the whole are gone over in this way, the dairy-maid returns to the firſt done, and, with a dry cloth, wipes them, one by one, as clean as poſſible. They are then placed in ranges, ſo as to be expoſed fully to the action of the ſun and air on the inſide, that the whole of the moiſture may be dried up as quickly as may be; for nothing tends ſo ſoon to deſtroy that ſweetneſs which is ſo deſirable in dairy veſſels, as allowing the moiſture to remain long about them; therefore, in dull foggy weather, when this cannot be quickly dried up by the external air, it is neceſſary to do it by the aid of fire in the houſe. As ſoon as the diſhes are thoroughly dry, they muſt be carried into the ſhade, and placed in order on ſhelves, to cool, that they may be ready for uſe when they ſhall be again wanted.

it muſt be ſalted before it can be carried to market. As this part of the proceſs requires as great

Should the milk have been ſuffered, at any time, to remain ſo long in the diſh as to become ſour, the wood inſtantly becomes tainted with that acidity, ſo as to act as a leaven upon any milk that ſhall be afterwards put into it, which never fails to coagulate, without ſeparating any cream, and can neither be employed in making butter nor cheeſe, and is conſequently loſt in the dairy. The ſcalding above deſcribed is by no means ſufficient to remove this deſtructive taint, and, as the diſhes are totally uſeleſs till that be removed, the following more efficacious proceſs muſt be adopted.

Fill the diſh with water, ſcalding-hot, and into that put a conſiderable quantity of hot aſhes, and ſmall red embers from the fire. Stir them about, ſcrubbing the diſh well, in every part, with the ſcrubbing-bruſh. Let them remain a conſiderable time; then empty the diſh; ſcrub it as before with ſcalding-hot water, rinſing it well with hot, and then with cold water. Then fill it to the brim with cold water, (better if that water can be made to run into it in a continued ſtream, and flow over the brim,) let it ſtand in this ſtate ten or twelve hours or more, after which, wipe and dry it, and, if the taint has not been very ſtrong, it will then be fit for uſe.

If the aſhes of your fire ſhould chance to contain very little ſalt, this operation may perhaps not prove ſufficient. In that caſe,

great nicety as any other, a few remarks on the ſubject ſhall be added.

Wooden veſſels are, upon the whole, moſt proper to be employed for containing ſalted butter. Theſe ſhould be made of cooper's work, very firm, and tightly joined with ſtrong wooden hoops. It will be adviſeable to make them very ſtrong, where circumſtances permit them to be returned to the dairy; for, as it is a matter of conſiderable difficulty to ſeaſon new veſſels ſo well as that they ſhall not affect the taſte of the butter, it is always adviſeable to employ the old veſſels, rather

caſe, add a ſmall portion of potaſh, along with the embers, &c. or quick lime may be employed, along with the potaſh, which greatly adds to its cleanſing power. But, in all caſes where recourſe is had to this proceſs, take great care that the diſhes be well cleaned by the rubber at each time; and that cold water be allowed to ſtand a conſiderable time in them, which ſhould be frequently changed, that the whole of the ſalts may be extracted by it before they be uſed again.

The diſhes for holding the cream, and the churn, require to be ſcalded, ſcrubbed, rinſed, and dried, after each time they are uſed, in the ſame manner as the milk-diſhes; but, as a ſour taint is not ſo prejudicial to them, it is not neceſſary to guard ſo carefully againſt it as in the milk-diſhes. If ever this taint ſhould become too ſtrong, it may be diminiſhed by the proceſs above deſcribed.

than

than make new ones, as long as they continue firm and ſound. Oak is the beſt wood for the bottom and ſtaves, and broad Dutch ſplit hoops are to be preferred to all others, where they can be had. Iron hoops ſhould be rejected, as the ruſt from them will in time ſink through the wood, even though it be very thick, and injure the colour of the butter: one iron hoop, however, ſhould be put at the top, and another below, beyond the bottom; the projection below the bottom being made deep for this purpoſe. No form is more convenient than that of a barrel, unleſs perhaps it be that of a truncated cone, with the apex uppermoſt; as, in this caſe, the butter never can riſe from the bottom, and float upon the brine, which it will ſometimes do in the under part of a barrel, when brine is neceſſary. But this inconvenience may be eaſily obviated, by driving a wooden peg, with any kind of head, into the bottom of the barrel, before it be filled; the butter, cloſely embracing that head all round, will be kept perfectly firm in its place.

An old veſſel may be prepared for again receiving butter, by the ordinary proceſs of ſcalding,

ing, rinſing, and drying, but to ſeaſon a new veſſel requires greater care; this is to be done by filling it frequently with ſcalding water, allowing the water to remain till it is cold. If hay, or other ſweet vegetables, are put into it, along with the water, it is ſometimes thought to facilitate the proceſs. In all caſes, frequent affuſions of hot water are very neceſſary, and a conſiderable time is required before the veſſel can be rendered fit for uſe. The careful *dai* ought to be particularly guarded, with reſpect to this particular, or he may ſoon loſe his character at market.

After the butter has been beaten up, and cleared from the milk, as before directed, it is ready for being ſalted. Let the veſſel in which it is to be put, after being rendered as clean and ſweet as poſſible, be rubbed all over, in the inſide, with common ſalt; and let a little melted butter be run into the cavity, between the bottom and the ſides, at their joining all round, ſo as to fill it and make it every where flush with the bottom and ſides: the veſſel is then fit to receive the butter.

Common

Common ſalt is almoſt the only ſubſtance that has been hitherto employed for the purpoſe of preſerving butter; but I have found, by experience, that the following compoſition is, in many reſpects, preferable to it; as it not only preſerves the butter more effectually from any taint of rancidity, but makes it alſo look better, and taſte ſweeter, richer, and more marrowy, than if the butter had been cured with common ſalt alone. I have frequently made comparative trials with the ſame butter, and always found the difference much greater than could be well conceived. The compoſition is as follows:

Take of ſugar one part, of nitre one part, and of the beſt Spaniſh great ſalt (or of Doctor Swediaur's beſt ſalt *, which is ſtill better than the former,

* Dr. Swediaur carries on a manufacture of ſalt, at Preſtonpans, near Edinburgh, after the Dutch method: this the Dutch ſell by the name of ſalt-upon-ſalt; it is equally ſtrong with the beſt Spaniſh ſalt, and much freer from impurities of every ſort, and the doctor ſells it at a moderate price. Were this ſalt ſufficiently known to be brought into general uſe, for curing fiſh, butter, beef, pork, bacon, hams, tongues, and

former, being cleaner,) two parts. Beat the whole into a fine powder, mix them well together, and put them by for uſe.

Of this compoſition, one ounce ſhould be put to every ſixteen ounces of butter * : mix this thoroughly

and other articles of proviſion, it would much promote the proſperity of this country; as theſe could be as well cured with it as with foreign ſalt, and at a much ſmaller expence.

* It is of great conſequence, that every proceſs which requires much thought, or nicety, ſhould be baniſhed, if poſſible, from all branches of manufacture. On this principle, as ſome difficulty might ariſe, in proportioning the quantity of ſalt to unequal weights of butter, I ſhould adviſe, that every perſon who means to adopt this practice at large, ſhould provide himſelf with a pair of ſcales, ſo conſtructed as that ſixteen ounces in the one ſcale are exactly balanced by one in the other; and, that he may be at no loſs to provide himſelf with this ſimple apparatus, the following directions may be attended to. Let him procure two ſcales, of equal weight; one of them ſhould be of wood, and flat, for the butter; no matter what form or materials the other is of: let him then take a ſlip of deal, two inches broad, half an inch thick, and two feet long. Near to each end, and at about half an inch from the ſame ſide at each end, let him make a hole through the board, to which the ſcales may be faſtened, by means of a

thoroughly with the butter, as ſoon as it has been freed from the milk, and put it, without loſs of time, into the veſſel prepared to receive it, preſſing it ſo cloſe as to leave no air-holes, or any

loop of wire: obſerve that theſe two holes ſhould be placed exactly at the ſame diſtance from the edge. Let him then load the two ſcales, one of them with one ounce, and the other with ſixteen, and, having drawn a line parallel to what will now appear to be the upper ſide of the beam, at half an inch from the top all along on each ſide, let him be provided with two ſharp-pointed inſtruments, ſuch as ſhoemakers' awls. Let him then try to find a point, in the new-made line on each ſide of the beam, where, when the beam is allowed to vibrate on his awls, placed directly oppoſite to each other, the two weights balance each other; this point he will ſoon diſcover to be much nearer one of the ends of the beam than the other. Through this point let him pierce a hole, by means of a round hot iron; and through the hole let him put a piece of thick iron wire, which, if ſupported at each end, will ſerve as a pivot. The apparatus is now compleat.

Whenever it is afterwards wanted, nothing more is neceſſary than to place the butter, whatever be its weight, into the butter-ſcale, and then put as much of the compoſition into the oppoſite ſcale as will bring the beam to a balance; and this will, in all caſes, be the due proportion of the compoſition, whatever the weight of the butter may be.

kind

kind of cavities, within it. Smooth the ſurface, and, if you expect that it will be above a day or two before you can add more, cover it cloſe up with a piece of clean linen, and above that a piece of wetted parchment, or, for want of that, fine linen that has been dipped in melted butter, and is exactly fitted to the edges of the veſſel all round, ſo as to exclude the air as much as poſſible, without the aſſiſtance of any watery brine: when more butter is to be added, theſe coverings are to be taken off, and the butter applied cloſe above the former, preſſing it down and ſmoothing it, as before, and ſo on, till the veſſel be full. When it is quite full, let the two covers be ſpread over it with the greateſt care, and let a little melted butter be poured all round the edges, ſo as to fill up every cranny, and effectually exclude the air. A little ſalt may be then ſtrewed over the whole, and the cover be firmly fixed down, to remain cloſe ſhut till it be opened for uſe. If all this be carefully done, the butter may be kept perfectly ſound, in this climate, for many years; how many, I cannot tell, but I have ſeen it two years old, and in every re-

ſpect as ſweet and ſound as when it was only a month old.

It deſerves to be remarked, that butter cured in this manner does not taſte well, till it has ſtood at leaſt a fortnight after being cured; but, after that period is elapſed, it has a rich marrowy taſte, that no other butter ever acquires; and it taſtes ſo little ſalt, that a perſon, accuſtomed to eat butter cured with common ſalt only, would not imagine it had got one fourth part of the ſalt that would be neceſſary to preſerve it *.

Butter,

* After this butter has been cured in the moſt perfect manner, it may chance to be much debaſed in its quality, by being improperly treated during the time it is uſing. Therefore obſerve, that, when it is broken up for uſe, a ſmall portion ſhould be pared from the ſurface all over, eſpecially near the edges, in caſe the air ſhould not have been ſo entirely excluded as it ought to have been. If it is to be quickly conſumed, it may then be taken out with a ſpoon, as it is wanted, without any precaution but that of keeping it carefully covered up, ſo as to exclude duſt, &c. from having acceſs to it. But, if it is to be uſed very ſlowly, and the perſon employed in taking it out is not very careful, or is ſo indolent as not to take the trouble of cloſing it up each time with the covers,

Butter, thus cured, would bear to be carried to the Eaſt or the Weſt Indies, and would keep ſweet during the longeſt voyages, if it were ſo packed as not to allow the butter to be ſo much melted as to occaſion the ſalts to ſeparate from it. But, as none of theſe ſalts admit of any chemical union with the butter, it muſt happen that, if ever the butter be ſo melted as to become of a fluid conſiſtence, the ſalts drop to the bottom, and the butter, deprived of their antiſeptic powers, quickly becomes rancid. It would be a great improvement in the culinary art, if any antiſeptic ſubſtance could be found that poſ-

covers, it may happen, that the part which is thus long expoſed to the air may contract a ſmall degree of rancidity. To guard againſt this evil, in theſe circumſtances, when the veſſel is opened, let a ſtrong brine of common ſalt be prepared, that will ſwim an egg, and poured, when cold, upon the ſurface of the butter; this will cover that ſurface effectually, even though the operator ſhould be a little careleſs, and will thus guard againſt the inconvenience complained of: for, though the quality of the butter will thus be injured, in ſome degree, in conſequence of the water acting upon it, yet that is an evil of far leſs moment than the ſlighteſt degree of rancidity would occaſion.

ſeſſed an agreeable taſte and flavour, and was capable of being diſſolved in oily ſubſtances: this might afford a proper ſubject for a premium from the Bath Society. In the mean time, the following hints on this ſubject may be of ſome uſe.

Butter, in its natural ſtate, contains a conſiderable proportion of mucilaginous matter, which matter is more putreſcible than the pure oily parts of the butter. Where it is, therefore, intended that butter ſhould be expoſed to the heat of warm climates, it ought to be freed from that mucilage, before it be cured and packed for keeping. To prepare butter for a diſtant voyage, therefore, in warm climates, let it be put into a veſſel of a proper ſhape, which ſhould be immerſed into another, containing water. Let the water be gradually heated, till the butter be thoroughly melted: let it continue in that ſtate for ſome time, and allow it to ſettle; the mucilaginous part will fall entirely to the bottom, and the pure oil will ſwim at top, perfectly tranſparent, while hot; but, when it cools, it becomes opaque, aſſumes a colour ſomewhat paler than the original butter, before it was melted, and a firmer conſiſtence, more

nearly reſembling that of tallow, and conſequently it will better reſiſt the heat of a warm climate than common butter. When this refined butter is become a little ſtiff, and while it ſtill is ſomewhat ſoft, the pure part ſhould be ſeparated from the dregs, then ſalted, and packed up in the ſame way as is directed for other butter. This would retain the ſalt better, and keep much longer ſweet, in hot climates, than if it had been cured in its original ſtate.

This refined butter may be preſerved in yet another way, which I have ſometimes ſeen practiſed here, by way of medical *bonne bouche*. After the butter is purified, add to it a certain proportion of firm honey; mix them well, and they will incorporate thoroughly: this mixture taſtes very pleaſantly, when ſpread on bread, like butter, and may be given to old people, if they reliſh it, inſtead of marrow, and to others, as being uſeful for coughs and colds. Theſe were the uſes to which I have ſeen this mixture applied; and, on theſe occaſions, the proportion of honey employed was conſiderable. I have ſeen this mixture kept for years, without manifeſting the ſmalleſt tendency

tendency to rancidity; ſo that there can be no doubt but that butter might thus be preſerved in long voyages, without ſpoiling. The only point that remains to be aſcertained is, what is the ſmalleſt proportion of honey that would be ſufficient to preſerve the butter. Sugar is known to be a much more powerful antiſeptic than common ſalt, and probably honey may be, in that reſpect, nearly on a par with ſugar. If ſo, it would be reaſonable to ſuppoſe, that one ounce of honey might be ſufficient to preſerve ſixteen ounces of butter. In that caſe, the taſte of the honey would not be extremely perceptible; ſo that the mixture might prove agreeable, even to thoſe who might not reliſh the compoſition when very ſweet, eſpecially if a little ſalt were mixed with it when about to be uſed. A few experiments would be ſufficient to aſcertain this particular.

From the circumſtances of the honey incorporating with the butter, and not ſeparating from it while in a fluid ſtate, it would promiſe nearly to accompliſh the purpoſe wanted above. Whether, when it became very fluid, and was long

continued

continued in that ſtate, any ſeparation would take place; or whether the honey, in theſe circumſtances, would be in danger of fermenting; are queſtions that experience alone can determine. Sugar, though it would preſerve the butter equally well while it continued in a ſolid ſtate, would doubtleſs ſeparate from it when it became fluid. Whether melaſſes would do ſo, or what effects it would, in this caſe, produce, I cannot tell; but a few experiments would aſcertain theſe points. Should any method of preſerving butter in warm climates be diſcovered, it would be productive of ſo much benefit to individuals, and to the nation at large, by giving an opening for a new branch of commerce and manufacture, that it is much to be wiſhed that the few experiments wanted to aſcertain theſe points were made with ſuch care, under the direction of perſons who would faithfully report the reſult to the public, as ſhould be ſufficient to remove all doubts upon this head.

LVII. *Obſervations on the Metallic Mixture made uſe of for caſting Letters, or Characters, for printing.* *By M.* SAGE.

FROM THE *JOURNAL DE PHYSIQUE.*

LEAD and regulus of antimony, melted together in various proportions, form the metal uſed by letter-founders, for caſting their different types or characters. When I ſay that theſe metals are uſed in various proportions, I mean, that more or leſs of the regulus of antimony is mixed with the lead, according to the degree of hardneſs the types are required to poſſeſs. In general, eighty pounds of lead are added to twenty pounds of regulus of antimony, already melted: but, for the ſmall characters, in which a greater degree of hardneſs is required, ſeventy-five pounds of lead are uſed to twenty-five pounds of regulus of antimony; and, for large ones, eighty-five pounds of lead, and fifteen pounds of regulus of antimony.

Theſe

These two ſubſtances, though of very different ſpecific gravities, remain perfectly combined, and do not ſeparate from each other by fuſion, unleſs the fire made uſe of is ſo ſtrong as to burn and volatilize them; in that caſe, the antimony begins to exhale.

Letter-founders ſhould take care to employ only the pureſt regulus of antimony, or that which is the moſt free from ſulphur; for, when it contains any of that ſubſtance, it acts upon the lead, in the courſe of time, and forms with it a kind of *galena*, which acquires a black colour. The letters caſt with a mixed metal of that kind, inſtead of preſerving their ſhining and poliſhed appearance, become dull, and as it were cracked, forming alſo a ſort of efflorescence. When this ſpontaneous decompoſition takes place, the letters become brittle, and loſe their form. Of this I have been convinced, by having analyzed a mixture of this kind, with which M. Aniſſon had caſt ſome Arabic characters.

Having expoſed ſome of the letters, made with this bad metal, to a violent fire, the ſulphur it contained burnt, and exhaled, in the form of vi-

triolic acid. Having then poured the metal remaining in the crucible into an ingot, it acquired a white brilliant colour, like ſilver; which colour did not become ſenſibly changed, by being left, for the ſpace of ſix months, in a damp place.

Regulus of antimony is prepared, in the large way, by melting calcined antimony, in a reverberatory furnace, with dried wine-lees; from this is obtained the regulus, which is ſold in the form of round cakes, on the ſurface of which are ſeen figures like the leaves of fern, &c. which figures are produced from the elements of octoedral cryſtals. If the regulus, thus prepared, appears more grey in colour than when it is prepared according to Stahl's proceſs, it is becauſe it ſtill retains a portion of ſulphur.

At preſent, there is not found a ſufficient quantity of regulus of antimony in commerce to ſupply the letter-founders. It appears to me that, in the place of regulus of antimony prepared as above, we might ſubſtitute that which may be prepared with iron. One-fifth part of iron is ſufficient to abſorb all the ſulphur with which antimony

timony is mineralized. When this mixture is melted, it muſt be poured into a cone: the ſulphurated iron remains upon the ſurface of the regulus, and is very eaſily ſeparated from it.

This proceſs is leſs expenſive, and produces more regulus, than the proceſs made uſe of by thoſe who work the mines of antimony.

Regulus of antimony, as we have ſeen, gives hardneſs to lead; but a much greater degree of hardneſs is produced by adding tin to the mixture. I analyzed ſome nails which were propoſed to be uſed in ſhip-building, and found them to contain three parts of tin, two parts of lead, and one part of regulus of antimony. Theſe nails were ſufficiently hard to penetrate oak-wood, without being blunted; and this metallic mixture is not acted upon by ſea-water, which very quickly decompoſes iron.

LVIII. *On the Means of dying Linen and Cotton a beautiful, deep, and lasting black Colour.* By Mr. VOGLER, *of Weilburg.*

From CRELL'S CHEMICAL ANNALS.

THAT the art of giving to linen and cotton a deep and lasting black colour is attended with considerable difficulty, I am convinced, not only from the accounts I have received from manufacturers and dyers of eminence in their profession, but also from the experiments I have myself made on the subject. At last, however, after long and frequent trials, I have discovered a method, which, being many times repeated, was found to answer every time. The following is an exact description of it.

§ 1. Take a quart (thirty-two ounces) of very pure soft water, (for instance, rain or snow water, collected in the months of February or March,) and

and mix with it (in a very large bottle) two ounces, or two ounces and a half, of common aquafortis; then throw in gradually, two ounces, or two ounces and a half, (or even more if the aquafortis be pretty ſtrong,) of litharge. The bottle, after being ſlightly corked, muſt be ſet in a warm place, and ſhaken from time to time.

After a few days, the clear liquor may be poured off from the ſediment, into a deep earthen, leaden, or pewter veſſel. In this clear ſolution of litharge in nitrous acid, the cotton or linen intended to be dyed (which ſhould be well waſhed, but need not be bleached) is to be immerſed, and is to macerate or ſoak therein for the ſpace of ten or twelve hours. It may then be taken out, and, after being three times waſhed in pure cold water, (wringing it each time,) it is to be dipped in a ſolution (not too weak a one) of glue in water. Being then again wrung, it muſt, while yet wet, be put to dry in the ſhade; taking care that the glue-water is only wrung out, not waſhed out.

Raw, unbleached, and looſely-ſpun linen or cotton yarn, that has already been ſteeped in warm

warm ley, and afterwards well waſhed in cold water, is more proper for the preſent purpoſe, and takes the application of the mordant, and that of the colour, more readily than the ſame materials after they are knit or woven.

Each ſkain is to be tied with two very looſe and broad ſtrings, of tape or binding; by the help of which, the ſkains, if they ſhould happen to be entangled, during their maceration, or dying, may be ſeparated, and brought into order again.

The glue-water, in which the linen or cotton (after it has been ſteeped in the ſolution of litharge) is to be dipped, may be prepared by reducing common carpenter's glue into a jelly or ſize, by boiling it in a pan with a ſmall quantity of water, and then diſſolving, in boiling water, ſuch a proportion of the jelly as will give to the water a ſticky or glutinous conſiſtence, (when tried between the fingers,) leaving it, at the ſame time, ſufficiently thin and fluid. The uſe of this glue-water, as I have obſerved on a former occaſion, produces a more deep and laſting colour in the ſtuff to be dyed.

§ 2.

§ 2. Take three quarters of an ounce of galls, well bruised, boil them in a full quart, or rather more, of pure water, (rain or river water, for inſtance.) When they have boiled for the ſpace of ſeven or eight minutes, throw in three quarters of an ounce of common ſalt; and, when that is diſſolved, put in the linen or cotton ſtuff that is to be dyed, and that has already been ſoaked in the ſolution of litharge in aquafortis, and dipped in the glue-water, (§ 1.) When the ſtuff has been boiled in the liquor ſeven or eight minutes, it may be taken out; it is then to be three times waſhed and wrung, as before, in clean cold water, and afterwards dried in a ſhady place.

The linen or cotton ſtuff, which before was white, will be found to have acquired, from the foregoing operations, a dark grey colour, with a ſhade of yellow; this may be conſidered as a good ground for a black colour.

I have already ſhewn (in a former paper) that various ſolutions of lead, or of its calx, will render ſtuffs, prepared therewith, capable of acquiring (when boiled with the colouring-matter, of whatever nature, with which they are to be dyed)

a very full and rich colour, and one which penetrates very deeply into the ſubſtance of the ſtuff; but that the colour is dark and dingy, and therefore this mode of preparation may be more advantageouſly practiſed in dying brown and black colours than others.

In the place of galls, oak-bark, in powder, may be uſed; alſo the thin rind of the alder tree, the rind of the root of the walnut tree, the flowers or the ſhells of Pomegranates, Sumach, *(Rhus coriaria,)* the leaves of Tormentil-cinquefoil, *(Potentilla argentea,)* and Tormentil roots; all of which may be uſed in the ſame proportion as the galls.

Common ſalt alſo poſſeſſes the power of rendering the colour more deep and permanent; but it ſhould be added when the boiling of the ſtuffs in the decoction of galls is nearly finiſhed, as it might otherwiſe impede the extraction of the colouring-matter from the galls, or render the penetration of the ſaid matter into the ſubſtance of the ſtuffs leſs ſtrong.

§ 3. Take three quarters of an ounce of common copperas or vitriol of iron, and the ſame quantity

quantity of common salt, and dissolve them in a quart (thirty-two ounces) of clean hot water. Let the stuffs, prepared in the manner before described, (§. 2.) with galls, or other astringent vegetable substances, and which have already acquired a blackish colour, be immersed in this liquor. After eight or ten hours, they may be taken out; washed and wrung three or four times in clean cold water, and then dried in the shade.

The advantage arising from the mixture of common salt, in this solution of copperas, is not only that less of the ground-colour (with which the stuff is already prepared) is taken away, but also, the tints which are afterwards to be given to the stuff, enter them more deeply, and produce a better colour. Of this I am convinced, by some experiments I formerly made.

§ 4. Boil three quarters of an ounce of campeachy or logwood, in rather more than two quarts (thirty-four or thirty-five ounces) of rain or river water. When it has boiled seven or eight minutes, add to the decoction a quarter of an ounce of white starch; which, that it may not

be clotted or lumpy, muſt be firſt well mixed in a tea-cup with a little freſh water. When this, by boiling a few minutes, is diſſolved in the liquor, the linen or cotton ſtuff (already prepared by means of the ſolution of copperas, &c. § 3.) is to be put into the liquor. After it has boiled therein for ſeven or eight minutes, it may be taken out; and, being firſt waſhed and wrung two or three times in clean cold water, as before, may be dried in the ſhade.

If, when the ſtuff is dry, its colour appears to be too faint, that is, if it ſhould not be of a deep and fine black colour, (which however will not be the caſe, unleſs the proceſs is improperly managed,) it muſt be again ſoaked in the ſolution of copperas, (§ 3.) and then boiled once more in the decoction of logwood. It cannot then fail to be of the wiſhed-for black colour: but this colour is not yet ſo fixed as to bear being waſhed in ley, or even in ſoap and water. In order to bring the colour to this degree of perfection, the dyed ſtuff muſt, in the laſt place, be treated in the following manner.

§ 5.

§ 5. One ounce of galls, well bruised, or the same quantity of any of the astringent vegetable substances above mentioned, (§ 2.) and a full quart, or rather more, of glue-water, (of such a consistence as to feel clammy between the fingers,) are to be put over the fire: when the mixture has boiled seven or eight minutes, one ounce of copperas or vitriol of iron is to be added, and, when it is dissolved, the liquor may be taken off the fire. In this decoction, as soon as it is cold, the linen or cotton, prepared in the manner already described, (§ 1, 2, 3, 4,) is to be immersed. After remaining therein for the space of an hour, it may be taken out; and, having first been pressed or wrung, but not washed, may be hung up to dry in the shade. Here it may be left quiet for some time, (as is usual with respect to printed cottons and chintzes,) in order that the dye may incorporate with the stuff, and become fixed therein.

The decoction of logwood (§ 4.) may be kept for several weeks after it is made, even until it has acquired a bad smell; as it does not thereby lose,

loſe, in the ſmalleſt degree, its colouring property, but, on the contrary, becomes more fit for uſe.

The addition of white ſtarch to the decoction of logwood, promotes, in a remarkable manner, the ſolution and extraction of the colouring particles of that wood: it alſo aſſiſts in giving to the linen or cotton a deeper and more beautiful colour.

For boiling the ingredients, and macerating the ſtuffs, veſſels of earth, of braſs, or of copper, may be made uſe of: they ſhould not be too wide, but the deeper they are the better, as, in ſuch, the ſtuffs to be dyed may be more conveniently immerſed, without being liable to riſe up to the ſurface of the liquor.

LIX.

LIX. *List of Patents for Inventions, &c.*

(Continued from Page 360.)

CHARLES TENNANT, of Darnley, near Glaſgow, Bleacher; for a method of uſing calcareous earth, and the earths ſtrontites and baryte, inſtead of alkaline ſubſtances, for neutralizing the muriatic acid gas uſed in bleaching; and for employing thoſe earths in the other parts of the proceſs of bleaching, inſtead of alkaline ſubſtances. Dated January 23, 1798.

ARCHIBALD Earl of DUNDONALD; for a method of manufacturing and procuring certain neutral ſalts, ſubſtances, and things, and of applying thoſe and other neutral ſalts to valuable purpoſes. Dated January 25, 1798.

RICHARD SHANNON, of the pariſh of St. Pancras, M. D.; for a method of improving the proceſſes of brewing, diſtilling, boiling, evaporating, and of raiſing, and condenſing, ſteam or vapour, from aqueous, ſpirituous, ſaccharine, and ſaline fluids. Dated February 1, 1798.

HENRY

HENRY CLAY, of Birmingham, in the county of Warwick, Esquire; for a method of saving part of the water now lost, in passing boat and barges through locks on navigable canals. Dated February 1, 1798.

ROBERT HOWDEN, of Hoxton, in the county of Middlesex; for a portable and moving furnace, for the purpose of heating ovens of every description. Dated February 10, 1798.

FRANCIS FARQUHARSON, of Birmingham, in the county of Warwick; for machinery for making bricks and tiles. Dated February 20, 1798.

JAMES DOUGLAS, of the parish of Christ Church, in the county of Surrey; for a machine for making bricks. Dated February 20, 1798.

WALTER TAYLOR, of Portswood Green, in the county of Southampton, Esquire; for an improvement in the construction of machines for raising water, and clearing ships of the same; also to take off the pressure of the atmosphere, or eddy winds, from the tops of chimnies, to prevent what are commonly called smoaky chimnies. Dated February 21, 1798.

END OF VOL. VIII.

INDEX

TO THE

EIGHTH VOLUME.

A

B

D

E

F

G

Leather,

M

N

O

P

R

S

Salmon,

W

Z

Printed by JOHN NICHOLS, Red Lion-Passage, Fleet-Street, London.