





LONDON

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T R E A T I S E

ON SEVERAL

I M P R O V E M E N T S,

RECENTLY MADE IN

H O T - H O U S E S.

ADVERTISEMENT.

Models as described in the Appendix to this work, are sold at Mr DALZIEL's, *Chapel-Street, Bedford-Row, London*; or at Mess. DICKSONS AND SHADE's, *Edinburgh*; in whose nursery may be seen a hot-house altered agreeably to this Treatise.

A SHORT
TREATISE
ON SEVERAL
IMPROVEMENTS,
RECENTLY MADE IN
HOT-HOUSES:

BY WHICH FROM FOUR-FIFTHS TO NINE-TENTHS OF THE FUEL COMMONLY
USED WILL BE SAVED ; TIME, LABOUR, AND RISK, GREATLY LESSENED ;
AND SEVERAL OTHER ADVANTAGES PRODUCED.

AND WHICH ARE
Applicable to Hot-houses already erected, or to the Construction of
New Hot-houses.

Illustrated by Nine Large Copperplates.

By J. LOUDON,

MEMBER OF THE SOCIETY OF ARTS, COMMERCE, &c. STRAND, LONDON :
AUTHOR OF OBSERVATIONS ON PLANTING, LANDSCAPE GARDENING,
AND EMBANKING, &c.

DESIGNER OF RURAL IMPROVEMENTS.

EDINBURGH :

PRINTED FOR THE AUTHOR :

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John Turnbull, Printer, Edinburgh.

P R E F A C E.

NEARLY four months have elapsed since the improvements to be treated of in the first part of this work, were executed upon Dickfons' and Shade's hothouse. During this period they have been examined by a great number of respectable gentlemen, who, with scarcely a single exception, expressed their warmest approbation of the scheme, and strong convictions of its general utility. Among these gentlemen, were some who have paid particular attention to the subject, and they are decidedly of opinion, that the improvements here submitted, are calculated to be more extensively useful than any thing that has yet appeared.

Encouraged

Encouraged thus, to make them as generally understood as possible, the author has caused to be made *models in wood*, of certain parts which might perhaps puzzle some country artizans, who are not accustomed to work from plans. These may be examined or purchased at the places mentioned in the advertisement.

If required, models can also be made of *the new plan for growing pines*—of *the improved peach-house*, and of *the new pit*, which are described and recommended in this work.

The attention requisite to shew and vend these models, has rendered it necessary for the author to deviate from the common mode of bookfelling.

CON-

C O N T E N T S.

P A R T I.

AN ACCOUNT AND, TREATISE OF SEVERAL
ALTERATIONS MADE UPON A HOTHOUSE
BELONGING TO MESS. DICKSONS AND
SHADE, EDINBURGH.

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ERRATA.

- Page 149, line 3, dele *to the*
— line 5, for *from* read *to*
159, — 4, before *some* read *an account of*
195, — 19, after *training* read *upon*
200, — 17, for *panes* read *frames*.

Some other errors which do not alter the sense, and in particular an erroneous enumeration of the chapters, the reader is intreated to pass without censure.

AN
ACCOUNT
OF
SEVERAL ALTERATIONS, &c.

INTRODUCTION.

IT was the original intention of the author not to have printed any thing respecting these improvements until he published his treatise on *Hothouses, Hotwalls, &c.* This treatise was intended to be pretty full—to be printed in quarto, and to contain many new designs—with an Appendix, containing numerous criticisms upon hothouses erected in different parts of this island. He is however induced to keep back this work at present,

B

partly

partly from want of time to superintend the press, partly from a desire to try the success of several other new and equally important schemes before he submitted them to the public, and partly also, that he might enlarge the number of criticisms, by viewing and examining some hothouses which he has not yet had an opportunity of seeing, but which he expects to see in the ensuing season, in the course of an intended tour through the island.

On the other hand, the author has been induced to write this account, from the advice of several intelligent gentlemen who conceive highly of its utility, and at the desire, and for the benefit of a very considerable number who have already begun to alter their hothouses according to this plan; and in some degree also from a reason, the detail of which would reflect no great honour upon a certain class of men. The thing alluded to, however, is just what the
author

author expected, from the sudden introduction of a plan which strikes at the root of some of the most important points of general, and even much approved practice, in the construction of hothouses. But in consequence of the superior nature and advantage of his scheme, he has nothing to fear, and rests perfectly satisfied, that in this liberal and improving age, these alterations will meet with general approbation, and be adopted according to the degree of their real utility ---and this too, not the less readily, because, at first, they may be decried, or opposed, as all the most useful discoveries in other branches of science or of art have been, by some interested, ignorant, and little minded men.

GENERAL DESCRIPTION OF THE HOTHOUSE, BELONGING TO MESS. DICKSONS AND SHADE, UPON WHICH THE IMPROVEMENTS WERE MADE.

THE hothouse upon which these alterations were made, was built about three years ago, from a plan given by the author, according to the most approved and economical mode of building hothouses at that time. It answered the intention very well; and indeed, from some particular circumstances to be mentioned, fully better than most hothouses; for being of a small size, and the ends being built of solid wall, which is always warmer than glass, it was heated by the flues with more than common ease, and this heat, from the same circumstances, was retained for a more than ordinary length of time.

BUT

BUT in order to give the reader more clear ideas, it may be necessary to observe in the way of description, that this house is twenty-three feet long, fourteen feet broad, ten feet high in the back wall, four and a half feet high in front, (inside measure;) that the two ends, back and front, are built of mason work, and three feet of the slope at the top of the house is covered with deal---the rest of the slope with eleven sashes, glazed with what is called fragment glass, being old ones formerly used for another purpose, and fitted up here for the sake of economy.

The furnace, or fire place, was placed at the north-east corner, in a mass of brick-work, four feet broad, four feet deep, and which projected three feet from the wall in the usual manner.

The flue in the inside of the house was led first along the front, and then round at the bottom of the back wall, and entered a shaft, or chimney, immediately above the furnace.

The

The house was used for forcing flowers, &c. ; and hence the flue surrounded a *bark* or *tan* pit, which reached within four feet of the glass behind, and eighteen inches of it before.

From this description the reader will be aware, that this hothouse is very small, and consequently unfavourable for shewing the effect of the improvements which have been made, on the three following accounts :

1. It was so easily heated by the common mode.
2. Having no glass in front, nor in the ends, but only in part of the roof, the heat raised was longer retained, than happens in the case of any small hothouse, having glass on the ends and front, as well as the roof.
3. A small hothouse, in all cases, consumes

fumes a greater proportion of fuel than a large one, as in dwelling-houses is well known to be the case with small, in comparison with large rooms.

UNDER these disadvantages, it may appear surprising to some, that the author fixed upon this house as a subject of improvement. It is true, indeed, he could have made the alterations upon many gentlemen's hothouses, with a much greater effect; but he judged it better for the public to execute them in some nursery, (a nursery being a kind of public place,) where they might be seen and examined by gentlemen with greater freedom. And though this hothouse belonging to Mess. Dicksons and Shade, is far from being the best in the nurseries about Edinburgh, he preferred it, because (from some knowledge of most of the nurseries and nurserymen in Scotland, and that of a more close and intimate kind than generally

nerally can be the case with landed gentlemen,) he is induced to give this company the preference on most occasions ; and he can, without the least hesitation, recommend them to the gentlemen of this country.

GENERAL

GENERAL DESCRIPTION OF THE SEVERAL
ALTERATIONS.

IN the following pages they shall be described and treated of, in an order, corresponding in some degree, with their importance: *viz.*

1. The *furnace and fuel-chamber* in which the coal or other fuel is consumed.

2. The *smoke-flue*, which conducts the
C smoke

smoke round the house, to the shaft or chimney by which it escapes.

3. The *air-flue*, which collects heated air around and near the furnace, and conveys it to the opposite end of the house.

4. The *inner-roofing*, being a coarse flannel curtain let down under the glass, during night, to prevent the air of the house from coming in contact with the glass.

5. The *air-pump or bellows*, intended for pineries and stoves, to force or draw in fresh air of moderate temperature, during the winter months. This air can generally be obtained from the *back sheds*.

6. The *ventilator*, intended either to put the air of the house in motion during the day; or
at

at pleasure ; and thus to imitate the natural breeze.

After thus describing and treating of these alterations, and the intentions, and use of each of them separately, some observations will be added under the following heads :
viz.

1. On the advantages resulting from these alterations.

2. On the expence of making them, with some hints to gentlemen intending to alter hothouses according to this plan ; and references to workmen in Edinburgh who understand the practical parts of these improvements.

3. On other improvements which may be executed on hothouses.

Among other things in this chapter, will be suggested new plans for pine-stoves, peach-houses, and pits, which the author conceives, will, be considerable improvements.

CHAP.

C H A P I.



OF THE

F U R N A C E

A N D

F U E L - C H A M B E R.

SECTION I.

*Of the Furnace and Fuel-chamber formerly
used.*

BEFORE the alterations were made, the furnace, as already mentioned, and as is generally done, was placed in a large mass of brick work attached to the house. Its chamber or space for containing the fuel, was

was *two feet* long, *eighteen inches* wide, and *eighteen inches* high.

The furnace-door, a single plate of cast iron, ten inches square.

The floor, or bottom of the fuel-chamber, had five iron bars which formed a grate, fourteen inches long, and ten inches wide; having a dead or solid space of four inches on the two sides, and ten inches behind, or in the farther end of the chamber. These dead spaces were intended for the purpose of making the fire burn slowly, and last long, agreeably to the principle recommended and practised by Mr Nicol *.

The ash-pit was eighteen inches long, and ten inches wide, and without any door.

SECT.

* See *The Forcing Gardener*, 3d Edit. pub. 1802.

SECTION II.

*Description of the improved Furnace, and
Fuel-chamber.*

A FURNACE was made so far similar to Count Rumford's that it had double doors, but different in all other respects: for,

1. The outer and inner doors were almost exactly of the same size, and consequently, the sides were nearly at right angles with the front, which is a very great advantage in fixing it in mason work.

2. It contained one opening in each of its sides, for the purpose of communicating with the air flue to be afterwards described.

3. It

3. It has a valve in the centre of the outer door: and,

4. It has four nobs or projections at the corners, which are for the purpose of fixing it in the building. These and the other parts will be best understood from plate I. fig. 1.

THE size of the furnace door used is *seven and a half inches*, which is sufficiently large for this house, though too small for general and convenient use.

A door ten inches square, with a valve in it, was also got for the ash-pit. See plate I. fig. 2.

THE mass of brick work, containing the old furnace and ash-pit, being taken down, the bricks and the five metal bars were reserved to be used in building up the new furnace.

It

It is worthy of remark here, that of all the old materials, the furnace door alone was not re-used; and this, not because it would not answer, but merely to try the effects of one with a valve. But a furnace door with a valve in it, is by no means essentially necessary, and in general gentlemen who make alterations according to this plan, may very safely use the old furnace door as a door to the new ash-pit, in place of sending for a new one with a valve.

A large hole being made in the lower part of the wall of the house, the new ash-pit and furnace were built under it, projecting so far into the house, as that the outer furnace door, and the door of the ash-pit, were even, or "flush" as workmen term it, with the outer face of the wall.

The ash-pit was made fourteen inches long, and ten inches wide: and,

The old bars were laid above it, form-

D

ing

ing the grate, and chamber for the fuel. The furnace was then properly placed, and the grate built round, (except at the neck of the flue, which was of course kept open,) with bricks laid flat, that is "brick on bed," as shewn plate I. fig. 3.

This building was carried up twelve inches, and then arched over in the usual manner. Over this arch was made another of the same thickness, preserving a vacuity betwixt them of three inches, which vacuity joins with each side of the furnace door, in order to communicate with the holes or openings formerly mentioned, and as shewn in plate I, by figures 3, 4, and 5, which are transverse and vertical sections.

In examining these two sections, some things will be seen which deserve attention.

In

In figure 3, the contraction of the air vacuity at *g* and *b*, is made for the purpose of confining and stagnating the air, in order that it may be thoroughly heated before it passes along the air flue into the house.

The valve in the furnace door, and also the holes in each side, which communicate immediately with the vacuity, are also made small, in order that a large body of cool air may never be admitted at once. For it is a fact, that were the vacuity, valves, and air flue, every where of equal width, the air would pass rapidly through into the house scarcely heated at all; unless, perhaps, when the fire was very strong and the furnace door red hot.

It may be observed here, that the arch over the air vacuity, can be supported upon the under one, by making the ends of two or three of the bricks project down and rest
upon

upon the top of it, as shewn in figure 4; or two or three pieces of brick or stone laid carefully upon the under arch, will serve the same purpose.

But there is no absolute necessity for such supports; the intention is merely to guard against the sinking of the upper arch.

It is needless to add what every mason or bricklayer knows, that these arches can easily be "thrown" or built, by filling the fuel-chamber with earth, or by laying in bricks or any such loose materials, which can be taken out as soon as the mortar hardens so as to leave the arch entire.

The arch above the vacuity can easily be made in the same manner.

In figure 5, the large chambers *i* and *z*, and the contraction at the beginning of
the

the air flue *k*, are for the purpose above mentioned. There is no necessity for these chambers being in every case so large as shewn in the plate; although a proportion somewhat similar, will generally be found preferable.

In figure 5 also, a small recess will be observed betwixt the grate and the flue, for the purpose of preserving a portion of the fuel which shall burn slowly; and thus it is presumed live-coals may be had from that recess for twenty-four hours after the fire is kindled. Some may think that a plain dead space larger than this recess would serve equally well; but this on examination will appear an ill founded idea; for if we observe the dotted line, *m n* in the plate, it will appear that it could not preserve the coals alive for a sufficient length of time, unless the throat of the flue were made much more upright; which on the other hand would
 preserve

preserve too much fuel, and very much prevent the heat either from passing through it into the air vacuity, or onwards into the smoke flue.

This improvement I did not think of when the furnace at Dickfons and Shade's hothouse was built; but I now see from the fires then being sometimes totally extinguished in the mornings, that it will be a beneficial addition to the plan.

C H A P. II.

OF THE SMOKE FLUE.

SECTION I.

Of the Flue before it was altered.

As already mentioned in the general description, the direction of this flue was round the house. It was built, very properly, upon supports *, and totally detached from
the

* Mr Nicol always builds his flues upon supports, for which he deserves credit: the practice is totally unknown in several parts of England, and not sufficiently attended to by some in this country.

the front wall, or any other building, which is also an important point to attend to.

But though there was ample room to make the flue of considerable depth, this was neglected, which is a very great, but universal error. Still, however, the depth of three bricks placed on edge was allowed, that is about fifteen inches, which depth is not always given, for we find even some planners and others, who though they generally build their flues of this depth, yet contend that the breadth of two bricks is perfectly sufficient.



SECTION II.

Of the improved Flue.

THIS old flue was taken down, and built up *five bricks in breadth*,—as great a depth as in this case, could be accomplished.

“ Briggs,”

“ Briggs,” or perpendicular partitions, reaching from the covers till within a brick and a half of the bottom, were formed by placing bricks across, and joining the two sides of the flues.

The first of these, was placed twenty feet from the furnace, and the rest about ten or twelve feet distant from one another, as shewn in figure 1. plate II.

These “ briggs” divide the flue into chambers, or compartments, each of which will naturally be completely filled with smoke and heat, before any can occupy the next; and, hence the whole flue must be completely filled, before any can escape at the chimney top.

The flue is made of five bricks breadth in depth, at both ends, and along the front of the house, and in this space it had three briggs, or partitions, *viz.* two in the front, and one

E

in

in that end farthest from the fire. For to have made one in the end where the fire enters, would have had a tendency to make that part of the house too warm.

The back flue was made of the ordinary depth, with only one projection, placed at its termination, immediately before the smoke ascended into the shaft or chimney.

Had the house been large, the whole length of the flue should have been made as deep as possible; and a considerable depth may generally be obtained, particularly in pine or plant stoves, or even in vineries and peach houses, when these are trained under the sloping glass.

But in almost every case that may occur, when vines are trained upon the back wall, it will be improper to make the flues deeper than three bricks; yet even here, the "briggs" should be made to reach the
same

same depth as before, that is, within a brick and a half of the bottom of the flue.

Or, the flues in such houses may be made of double width, or as wide as can be conveniently accomplished, and the " briggs" may be carried up from the bottom, leaving a small hole in the foundation of each brigg, of twelve inches long, by four inches wide, or larger, according to the size of the furnace. Through this hole the smoke will pass from chamber to chamber.

The air flue, built upon the top of such flues as this, need only be its full breadth from the furnace to the first compartment; afterwards it may be carried on in a narrow flue, or in an earthen or plate-iron pipe, to the end of the house. But of the air flue in next section.

In the middle of the shaft is placed a damper, the intention and mode of using which shall be presently explained.



C H A P. III.



OF THE AIR-FLUE.

THE vacuity around the fire-place is continued on each side, and over the top, as well as under the bottom of the smoke flue, for about four feet in length, as shewn in plate I. by figures 4 and 6.

The two side and bottom vacuities, are continued no farther, but there unite with the space at top, which top space is continued on, as an air flue to the opposite end of the house. And there it terminates, allowing the heated air to escape, as shewn plate II. fig. I.

The

The top of the smoke flue serves for the bottom of the air flue, which is one "brick on edge" in depth, and covered with tyle or pavement similar to the smoke flue.

A stone or brick neatly fitted to the end of the air flue, serves to close it up when requisite.

Both the air and smoke flue, were plastered in the outside for the sake of appearance, as the bricks were very coarse and unsightly: but in the inside of the flue, this was, and ought always to be avoided if possible, as plaster is a non-conductor of heat.

But had the bricks been equally neat and beautiful with those made in the neighbourhood of London, no plaster work would have been necessary: the joints would have been neatly puttied of the same colour as the brick, and at most a coat of paint of a brown or cream colour, would have been given.

given. For it is presumed they have no good taste who prefer to this style, walls and flues covered with white plaster, the raw glare of which when opposed and interspersed among the delicate green of vegetation, has a harsh and unharmonious effect.

Having thus endeavoured to describe the alterations made upon the furnace and flue, which it is hoped by the assistance of the plates, will be understood by the reader, and by intelligent workmen, some observations shall next be added respecting the intention of these alterations.

CHAP.

C H A P. IV.

OF THE INTENTION OF THE ALTERATIONS
UPON THE FURNACE AND FLUES.

IN the *first* place, the particular intention of this furnace is to consume or ignite the fuel as quickly as possible. For this purpose no dead space is left on each side, as in Mr Nicol's improved furnaces; but on the contrary, the grate occupies the whole breadth of the chamber, in order that no part of the fuel may remain unkindled. At
the

the same time a recess under the throat of the flue is made to preserve some live-fuel in order to rekindle the fire.

Secondly, The depth of the flue is intended to produce a greater mass of brick work, to be heated at the least expence, which heated mass will continue longer to give out heat to the house, and thus by making one fire serve in place of a number, will consequently save much time, and produce a more steady heat; an advantage independent of the saving of fuel.

In some cases breadth may be used in place of depth, and then the briggs may be literally divisions, or partitions, each with a hole at bottom, six or eight inches square: or of the dimensions given last chapter.

Thirdly, The briggs are intended to heat this mass more uniformly and effectually, by stagnating the smoke. And as the hottest of
that

that contained in each compartment, will always rise to the top, so the coldest, will in the same way be forced out under the partitions. What was the coldest smoke of the first compartment, will be the hottest of the next; of course it will ascend and press out that which is still colder, and thus will the smoke pass through the several compartments until it has given out the greater part of the heat which it contains, and at last, when quite cold, it is forced up the shaft, or chimney.

Besides this very great advantage, these briggs, or partitions, are also found to increase the draught of the fire.

Fourthly, The double furnace-door, and the vacuity around the furnace, are intended to collect that heat, which in other furnaces is totally lost in the adjoining mass of mason work.

F

Fifthly,

Fifthly, This vacuity is also continued around the flue for the distance of some feet from the furnace, in order to collect a quantity of heat, which would otherwise, as is generally the case, make that end of the house considerably warmer than the other, or opposite end.

Sixthly, The vacuity, or air flue, continued from thence along the top of the smoke flue only, is intended to convey the heated air collected as above, to the other end of the house: Which part of the house being farthest from the fire, is, in general, too cold; but by this means it is rendered equally warm with the other,

Some may think that when two fires are used, one being placed at each end of the house, the temperature would be regular, and the heated air would be allowed to escape from the furnace immediately
into

into the house. But without stating any of the many and great arguments against this, it is sufficient to observe, that according to this new plan, in no case whatever, will two fires be necessary. It will always be found more economical to augment the size of the furnace, in proportion to that of the house to be heated.

C H A P. IV.



OF THE MODE OF USING THIS FURNACE AND
THE FLUES.

SUPPOSE the fire lighted, and the fuel thrown in, the furnace doors are to be shut close, and also the valve in the outer door turned round, so as not to admit any air. But the ash-pit door, and the damper within the house, must be thrown open.

As

As soon as the grosser part of the smoke is dissipated, and the general mass of fuel becomes nearly red hot, or almost covered with flames, which, in an ordinary furnace, will generally happen in twenty minutes, or half an hour, after the fire is kindled,—close the ash-pit door, open the valve in the outer furnace-door, and shut the damper.

These operations produce the three following effects, *viz.*

1. The fire is preserved stationary; that is, the fuel is no longer consumed with the same degree of rapidity.
2. The whole heat generated, is stagnated in the flue.
3. The cool air entering by the valve, is rarified, partly on the furnace door, but principally in the vacuity around the furnace,
nace,

nace, and thus is pressed forward into the house.

The fire being preserved in a good degree stationary, the great heat which is contained in the fuel now red hot, does not enter the flue to make a violent irregular heat in the house, but it heats the air in the vacuity which surrounds it.

This heated air being allowed to pass into the house, is a more speedy, effectual, and uniform way of heating it; because it mixes at once with the air already in the house, whereas by the common mode, every particle of the air contained in the same, must come in contact with the flue before the house is properly heated. Now, to allow time sufficient for this process, the fire must be kept burning for a very considerable time, and no sooner is the degree of heat requisite obtained, than the flue, still as hot as before, and now aided

ed by the sun upon the glass, raises the temperature to a height greatly beyond that which was required. This is particularly the case, as every gardener knows, during the mornings of the winter and spring months. The apprentice lad, or in some cases the master himself, comes to the hothouse, perhaps at seven o'clock in a clear frosty morning, in the end of January; he finds the thermometer standing ten or fifteen degrees below the proper or required temperature. To remedy this, he with all speed puts on as large a fire as possible---perhaps it is well kindled by eight o'clock, but no heat is yet added to the house; on the contrary, much heat has been escaping from it, and the thermometer is now six or eight degrees lower than before. About half past nine o'clock, and not always so soon, the thermometer indicates the proper degree of heat. Though the air be frosty, and the morning still cold, yet now the sun-beams dart
upon

upon the glass with much vigour; and about twenty minutes, or half an hour past ten, the thermometer is ten or twenty degrees higher than the proper medium, and continues to rise with rapidity. At eleven the house is at an alarming degree of heat, and no alternative remains for the lad, but to let down the sashes, in order to admit fresh air; for though he had just before opened the furnace doors, its effects are comparatively much slower.

Now it is evident, that no sooner are the sashes thrown down, however little a space, than the gravity of the clear "frosty" air of the atmosphere, rushes into the house, and forcing out the light heated air, which at any rate has a continual tendency to ascend, occupies the house in a few seconds. Thus the plants are brought in one moment from the climate of the torrid zone, to that of the polar regions.

In

In the mean time, the furnace door being thrown open, the cool air entering and rushing through the flue, makes it as cold in an hour as it was before the fire was put on. And again, perhaps ten or fifteen minutes after the sashes were opened, the lad perceives, (for he is under the necessity of being always upon the watch,) that the house is too cold—instantly he draws up the sashes, stirs up the fire, and shuts the furnace door. What is the consequence? The joint effects of the sun, now more powerful than before, and the fire, which not being fully exhausted, is easily rekindled, produce the same extreme as formerly! The same remedy is applied, which again is attended with the same baneful consequences, to vegetation. This rotation of extremes goes on almost without interruption, in the pineries and stoves, every sunshine day, during three quarters of the year, and in vineries peach-

G

houses,

houses, &c. during the beginning of the forcing season*.

The bad consequences which result from this practice, it may safely be said, are incalculable.

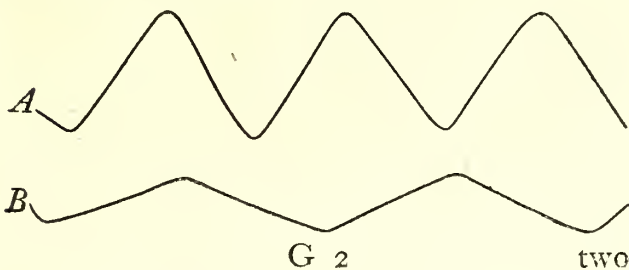
The above will no doubt be agreed to by every one so far; but perhaps when it is said, the one extreme is as the torrid, the other as the frigid zone, it will be denied; for it will be said, the thermometer in the hothouse, never is seen so low, as even in the open air. But this, like many other common ideas, arises from want of
 due

* I had the most complete opportunity of knowing this, about eight years ago, when I was assistant to the late MR MAWER, PLANNER and NURSERYMAN, DALRY, near Edinburgh. I saw it happen every day in his own hothouses, which, as is well known, were at that time, the most extensive, and best constructed in Scotland. Several particulars respecting these hothouses, and particularly about the extensive steam operations then carried on, will appear in the treatise on Hothouses.

due consideration of the subject, and from ignorance of the doctrine of heat.

For, it is evident that the extremes of heat in the house, being so much more rapid than the motion of the mercury in the thermometer; the highest or lowest degree of these extremes, can never be indicated, owing to the impulse of the succeeding extreme, counteracting the true indication of the former one. For it is well known, that a thermometer in air takes several minutes to indicate the true temperature of the medium in which it is placed.

Hence, to be short, if the real temperature of the extremes in the house are as the line *A*, the temperature indicated by the thermometer will be somewhat corresponding to the line *B*,



two lines very different when observed separately.

It may be safely said, that in three minutes after the shades are let down, the house is of the same temperature as the atmosphere: At that temperature, it remains until the thermometer about to indicate it, is checked by heat, suddenly generated by the sun and the flue.

From this short statement of what really happens, the sickly appearance, and debilitated habits of hothouse plants, compared with the fresh robust luxuriance of those reared in the open air, will not appear surprising; and the frequent failure of crops of fruit will be perfectly accounted for.

But the evils recounted can never happen with furnaces and flues, built according to the plan recommended; because,

In the *first* place, The temperature of the
house

house when heated by fire alone, will be at all times so uniform as to render great exertions to counteract any extreme totally unnecessary ; and,

In the *second* place, Supposing the house at the required temperature, and a brisk fire in the furnace at the time, (a case by the bye that could seldom or never happen;) if the valve in the outer furnace door is closed, and also the aperture at the extremity of the air-flue, the heated air will be completely stagnated, and the greater part of the heat will be confined in the furnace and the air-flue, to be let into the house when wanted. It is true, indeed, that a certain quantity of heat will escape through the mason work, notwithstanding these operations; but this will be small comparatively with what happens in the case of common flues, for this particular reason, that air (in this case, the air of the air-flue) is
the

the very worst conductor of heat known :
But supposing that any thing like an over-
heat should occur, it can be completely
over-balanced at once ; and without chil-
ling the plants in the least degree, by the
air-pump, as will be shewn in the proper
place.

C H A P. V.

OF MANAGING THE VALVES IN THE FUR-
NACE AND ASH-PIT DOORS.

Two or three directions on this subject are thrown into distinct heads for the sake of gardeners, who, it is to be observed, may be apt to go considerably wrong, until they have a just idea of the effects of the valves ;
and

and particularly of the one in the outer furnace door.

1. If the house is filled with heat to the proper degree, the fire extinguished, and the flue and furnace quite cold, no evil can arise from having the valves in the ash-pit door, or even the door itself open: And the same may be said respecting the damper.

2. If the house and flues, &c. be in the same state as above, no great evil can arise from having the furnace door, or its valve, open; because such is the stationary nature of air, (so to speak,) particularly in such an intricate, lengthened, and horizontal confinement as this, that it will not enter the house through the vacuities, and the air-flue.

These two cases apply principally to the summer months, and are comparatively of little importance. But,

3. If

3. If a strong fire is put on in the afternoon or evening, and the ash-pit valve, or the ash-pit door itself, be left open during the night, the fire will be soon exhausted, and the house cooled. Care, therefore, must be taken to keep it shut at all times through the night, and always through the day, when the fire is in a proper state for shutting in the damper.

It is proper to notice here, however, that the briggs, for similar reasons to those given in direction 2d, will prevent the flue from being half so much cooled, as is the case in common furnaces and flues.

The valve in the ash-pit door, it may be observed, is of no essential use; for the door itself can be opened, more or less, according to the fresh air wanted for the fire. This valve is principally necessary in large houses, when a small quantity of air may be admitted to enter by the furnace,

H

forcing

forcing an equal quantity of smoke off, by a small opening at the damper, and at the chimney top. This opening is left by not shutting the damper quite close. But these operations are unnecessary in a small house, and can seldom indeed be done without considerable loss of heat.

4. If a strong fire is put on in the afternoon, and when the ash-pit and damper are closed, the valve in the outer furnace door is left fully open; the house will be rendered too hot at the beginning of the night, and too cool before morning; for the air will continue to rush in until it has nearly cooled the fire place. But it deserves to be remarked as above, in direction 2d, That such is the stationary nature of air, and particularly in such an intricate lengthened and horizontal confinement as this vacuity,
that

that though the valve was left fully open, the house would not be greatly cooled*.

Observe, that it is more safe to turn it round, so as to leave an opening about one fourth of the full size. This will keep a small, but uniform current of air entering the house during the whole night.

5. In the morning when the fire then put on, is so far consumed or kindled, as to be in a state fit for closing the ash-pit door and the damper, if the temperature of the house is much too low, open the valve fully; but if it is not required to raise the temperature much, then open it one half only. Shut it entirely if the house is sufficiently

H 2

hot,

* Nothing like what some have experienced, who have placed large plate iron pipes across the chamber, with one end in the house, and the other in the open air. See Evelyn's Account of his Conservatory, in the 10th edition of *Kalendarium Hortense*.

hot, or open it, and while heated air is admitted, pump in cool air to lower the temperature of the house.

These directions, it is to be feared, will give some an idea that this furnace and air-flue, are of too intricate a nature for general practice; but, the contrary may be seen at Dickfons and Shade's nurfery. And the whole alterations will, wherever they are eventually executed, be found to give much less trouble than the common furnace and flues.

6. This may be a proper place to observe, that, from the experience of the above hothouse, in January and February last, in severe weather, one fire put on in the afternoon, twenty or thirty minutes before the men gave over working—was ready for shutting the ash-pit and damper, and turning the valve one fourth open at that time,

time, and that this fire served until next morning. That a small fire put on in the morning, and managed as above directed, (see direction 5.) lasted till the afternoon. That in mild weather, one fire put on in the afternoon, lasted for twenty-four hours.

In that furnace in Dicksons & Shade's hothouse, no recess, as advised, is made for preserving live-coals to rekindle with, yet when the fire is not too much exhausted, by throwing in a shovel full of coals or ashes, before the damper is shut in, it can be lighted perfectly from the red ashes next morning.

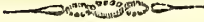
From the very small size of this furnace, and from the gardener allowing the fuel to be too much consumed before he shut in the damper, it was, when first tried, generally extinguished in the morning; but, by taking care to shut in the damper as soon as the grosser smoke was expelled, it has remained in a state proper for being re-kindled

kindled for twenty hours, and had it been of such a size as is represented in the plate, I should scarcely think the recess necessary.


Every gardener knows, that in kindling the fire from the ashes, the live coals must be drawn over the grate to the front of the furnace, and the fresh fuel thrown in immediately behind them.

It may be remarked here, that when a few coals are thrown into the furnace in the evening, immediately before shutting in the damper, the fire is lighted with uncommon ease next morning. The mere opening of the ash-pit door and the damper, has frequently made it blaze without being stirred up. This is owing to the presence of the betuminous part of the coal, which could not be carried off in the form of smoke, because, by shutting in the damper, &c. no fresh air was allowed to come in contact with it.

C H A P. VI.



OF THE INNER ROOFING.



SECTION I.

*Of its Construction, and the Mode of Fitting
it to the House.*

THE inner roofing is simply a collection of curtains of coarse woollen cloth, which are made so as to slide down upon wires, six or eight inches within the glafs.

These

These curtains can be drawn up, and let down at pleasure, by means of cords and pullies. Each curtain may be made ten or fifteen feet broad, and of such a length as will reach from the top down the slope and upright glafs, to the front wall.

Along the one end of each curtain is attached a rod of wood about an inch or two inches square, and the other end is fixed to the top of the house: or, in some cases, to the bottom of the upright glafs. This is done—either by simply nailing on the edge of the curtain; or by fixing it previously upon a piece of wood, which wood can be fixed up, and may be taken down, along with the curtain whenever the inner roofing becomes unnecessary.

Whatever be the breadth of the curtains, each has along one edge a row of hooks, about two feet asunder, and at the other edge, a stripe of cloth, six or eight inches broad,

is

is left unfixed at top, and without being attached to the rod at bottom: which is by way of overlay, to be used after the curtains are let down. In the edge of this overlay are fixed rings which are intended, in conjunction with the hooks, to fix and join the curtains together after they are dropped. The overlay, rings, and hooks, &c. will be seen in fig. 1. plate III. where *a a* is the overlay, *b b* the rings, *c c* the hooks, *d d* the cord, and *e e* the rod fixed to the end of the curtain.

There are too ways of using the cords and pullies, which shall be described.

In the *first* way, a row of rings are fixed about eighteen inches asunder, in a line down the centre of the curtain. Through these rings a cord is passed and fixed to the rod of wood at bottom, as is shewn in plate III. fig. 1. The other end of the cord is passed through a small hole in the upper end of the curtain, and (after the

I

curtain

curtain is fixed) from thence over a pulley to a pin or hook, as shewn in fig. 2. plate III. During the day, when this curtain is “tucked” up, it assumes the form exhibited by the dotted lines in the same figure, or as more fully shewn in fig. 6. plate II. Thus by having the appearance of a cornice, it will be a great ornament to the house.

When the curtain is put up according to this plan, which is the cheapest, and will answer in most cases, the trellis, if there is any, must be kept at least one foot under it, or about eighteen inches from the glass. This is recommended in order that the leaves of the trees trained on the trellis, may suffer no injury from the folds of the curtain when it is drawing up.

The *second* mode is exactly upon the same principle with the practice followed by upholsterers in hanging window-blinds.

The curtain, in this case, is rolled upon a
small

small round piece of wood, on one end of which is fixed a pulley, and directly under this pulley, upon the back wall, is fixed a *rack* pulley. A cord is made tight over both the pullies, and by moving this cord upwards or downwards, the curtain is either let down or rolled up. See plate IV. fig. 2.

When either of these curtains is placed at the top of the house, it will generally roll down upon the wires, (one of which is fixed under each rafter,) with its own weight. But,

If either be placed at the bottom of the front glass, or if the house is so flat that the weight of the curtain will not cause it to run down, then a cord must be attached to the centre of the rod of each curtain, and that cord passed over a pulley, placed either at the top of the house, or upon the top of the upright trellis or wire, as at *a*, in fig. 3. plate IV. according as it may hap-

pen, that the curtain is to be drawn down from the top, or drawn up from the bottom.

In general, however, when the curtains are fixed at top, and do not slide down freely, this operation may be sufficiently accelerated by a small rod, six or eight feet long, with a hook at one end. And,

This rod will serve at the same time to hook on the overlays of the curtains.

For the glass ends of houses, a curtain should be made exactly in the same form as the end. It may be contrived, either to be drawn up from the bottom, or to roll outwards from a pole placed upright in the angle next the back wall. If of this last form, it should have small rods run through it in a perpendicular direction, to preserve it exactly the size of the end. These rods will prove no detriment in rolling the curtain round the pole.

In

In this end curtain a slit must be made immediately opposite the door, that the operator after he has let down and fastened all the curtains, may be allowed to pass out of the house.

The roof curtains, may either be fixed to the end curtains, by rings and hooks, or when the ends of the house are of mason work no end curtain will be necessary. The roofing can then be fastened to it, either by common tenter hooks, or by a narrow slip of cloth nailed to the wall by way of overlay.

It is almost needless to add, that when two adjoining houses are separated only by a glass division, unless the one house be a stove, and the other a greenhouse, or such like, an end curtain will not be requisite.

In the case of a circular house, or one
containing

containing a number of fides, the curtain must be fixed at bottom, and should be made exactly in the shape of three or four fashes. For example, in the case of a house circular at base, and terminating in a point at top, the curtain may cover four fashes, and may be something of the shape of fig. 3. plate III. ; the narrow end of each curtain, can easily be drawn up to the top by a cord, and one or two pullies.

In such a curtain as this, small jointed rods of wood may be introduced across it, as shewn in the figure, which will serve to stretch it to the proper width.

Rods of this kind, will generally be unnecessary where the curtain is equally wide at both ends.

When the curtains are to come down from the top along the slope and to the bottom of the front glass, the wires upon which they slide in place of being fixed to the front, must be fixed to an upright rod of
wood

wood or iron, upon which also the wire trellis must be fixed as shewn plate IV. fig. 3.

When the curtains are fixed at the bottom of the upright glafs, in any house, a pulley must be fixed opposite the centre of each curtain, as at *a* in fig. 1. plate IV. at the top of the standards which support the wire for the cords to pass over which are used to draw up the curtains.

In a double roofed house, that is, a detached glafs house standing north and south, with the roof on each side wholly of glafs, it will generally be found best to fix on the curtain by this last mode.

In different cases a variety of ways will require to be adopted for fitting up the inner roofing, which are not here mentioned. But it is thought that any person of the least ingenuity, and who understands the hints above in connection with the plates, can
never

never be at a loss how to proceed. Should the contrary happen, by sending a description of the case to the author, he will endeavour to give such directions as shall remove all difficulty.

A number of trifling things which will occur in practice are foreseen by the author; but as they will not prove of any consequence he avoids mentioning them, lest he should confuse the practical reader.

A number of curtains will doubtless appear to some a great inconvenience in a hothouse, and the trouble of hooking on the overlays will be thought too great for general practice. But the contrary will be found true; for the curtains will generally be made ten or twelve feet broad, and thus four curtains will compose an inner roofing for almost any house. In Dicksons' and Shade's hothouse one curtain covers the whole roofing, which is twenty-three feet long. Every
objection

objection of this kind therefore, appears nugatory.

If any think that the danger of the curtain taking fire is a powerful objection, they have only to wet it with *alum* water before putting it up, which as any one may easily prove by experiment, will very much hinder it from taking fire, and wholly prevent it from bursting into flames.



SECTION II.

Of the intention of the Inner Roofing.

THE use of this inner roofing is to prevent the warm air of the house from coming in contact with the glass. An object by this means completely effected.

The advantages which will result from this roofing, will be understood by every

one, when a well-known fact is adduced: *viz.* That heat passes more rapidly through glass, than through any other material. And that on the contrary, through wool or stagnated air more slowly than through any other body.

These facts are so well known, especially the former, that it is needless to enlarge upon them. Any person by standing in front of a fire or looking towards the sun, and holding before him a plate of glass, and a piece of woollen cloth alternately, may thus easily convince himself of their different capacities for conducting heat.

It is well known, that heated air always ascends, consequently in hothouses, as the greatest heat is given out from the front flue, because in general and in all good constructed houses, it communicates immediately with the fire, every particle of air, as soon as it is heated, flies up directly to the glass immediately above, and continues rising

ing along the sashes, until it arrives at the top or highest part of the house; unless it has before this time parted with all its heat: A circumstance which may justly be expected to happen, and this more especially, if the joints or interstices betwixt the overlays of the panes are left open, and not puttied up, which is generally neglected; and often most studiously avoided from erroneous principles. It is no wonder that under these circumstances, and during the winter season, so much difficulty should arise, both in raising and keeping a house at a given temperature: for, independent of the interstices betwixt the panes, and the current of air, when the fire begins to decline, passing through and cooling the flue, &c. as mentioned before, *the conductive power of the glass alone* must carry off an inconceivable quantity of heat.

It may be observed here, that all gentlemen who have hothouses, ought to close up the interstices betwixt the panes without

delay, as an immediate saving of fuel. That it is so, must be abundantly evident to him who will think for one moment upon the subject.

It is therefore needless to take time to point out the numerous trifling, and false reasons, which have been given for opposite ideas; such as the letting off drops of condensed steam—permitting foul air to escape—preventing the frost from breaking the glasses, &c. &c. Nor shall any thing be said respecting the superiority of the other mode, but merely that it is adopted and recommended by all the principal, and most enlightened gardeners round London, and even by a number in Scotland; who have uniformly found no evil consequence to result from the practice, (as was found at Mr Mawer's, Dalry, where, from the steam, it was more likely to prove unsuccessful than in any case,) but on the contrary, many and great advantages in saving fuel, and keeping up the temperature

ture of the house. In most cases the panes should overlap one another about three sixteenths of an inch, and the joints betwixt each should be closed with black or red putty.

It will appear evident to every one, who shall consider the nature of the inner roofing adopted, that it will, in a very complete manner, prevent the air of the house from being cooled upon the glass.

To prove the advantage of this, it may be thought requisite to relate the following

EXPERIMENT.

Though the inner roofing in Dicksons' and Shade's hothouse, is made of canvass, in place of coarse flannel, which last material must be vastly superior, yet in very cold weather in the middle of last month, (February) the house being heated in the afternoon, to the proper degree, the inner roofing was let down, and the fire allowed to go out. Next
 morning

morning the heat had only abated two or three degrees—no fire was added, but the roofing allowed to remain down all that day, (which proved to be cold and rainy,) no fire was put on that evening, and next morning at seven o'clock, the thermometer was within less than nineteen degrees of what it stood at when the roofing was let down forty hours before: and still it was fifteen degrees above the temperature of the atmosphere.

Had the inner roofing been of woollen stuff, in place of linen, several chemists who have examined the hothouse, and to whom I mentioned this fact, have no doubt that it would have retained the heat for one week*.

Two

* Coarse linen was used in place of coarse flannel, from an idea that in this trial it would come cheaper; but this is hardly the case, and the superior nature of woollen cloth, renders it decidedly preferable.

Two or three days after, the house was raised to the same degree of heat, about the same hour in the afternoon, and left without putting down the inner roofing, and without putting on any more fires, for the same number of hours as before. And though the weather happened to be better, than in the other experiment, the thermometer in the hothouse, was found at the end of two nights and one day, to be only five degrees above the temperature of the open air.

These facts, which were witnessed by Mess. James and George Dickson, and also by the gardener who had the charge of the hothouse, Mr John Roger, a very attentive young man, will not appear surprising to those, in any degree acquainted with the doctrine of heat.

SECTION III.

Of the Mode of using the Inner Roofing.

LITTLE or nothing requires to be said under this head.

The *time* of using it in stoves and pineries, is during the winter and spring months, and in vineries and peach-houses, during the forcing season. During these periods it ought to be dropped or let down every evening, after sun-set, and drawn up every morning, at or before sun-rise.

In seasons when the curtains are unnecessary, they may be taken out of the house, and preserved dry until winter; or if it is found inconvenient to unfix them, they can be rolled up and covered with a piece of oiled canvass, which will preserve them from that moisture.

moisture which ought always to exist in the air of hothouses.

When the curtains of a hothouse are all let down, though regard must be had to have few interstices, by more or less carefully hooking on the overlays, yet, though some of these may occur, no great loss of heat will arise from them. For the whole air of the house being stagnated, as well as that betwixt the inner roofing and the glass, the quantity of heated air which will escape through these interstices and come in contact with the glass, will be very small indeed.

It may be thought by some, that this roofing would answer equally well if it was placed over the outside of the glass; but this is a great mistake; for supposing it possible to place it there with sufficient exactness, to fix it perfectly secure against all winds, and to glaze it against rains, still the heated air of the house coming in contact with the

L glass,

glafs, would give out fo much of the heat, as that the vacuity betwixt the cloth and the glafs in the outside of the houfe, would be warmer than the general air in the houfe.

It is not affirmed, however, that canvafs placed upon the outside of glafs roofs, as Dr Anderfon recommends, is of no ufe: On the contrary, they have always been found of confiderable advantage. Canvafs *covers* for hothoufes occur in two or three places in England, and at the late Mr Mawer's, Dalry, they were fuccefsfully ufed to protect a greenhouse. The author never heard of any hothoufes where an *inner roofing* fuch as he has made is in ufe,

CHAP.

C H A P. VII.

OF THE AIR-PUMP, OR AIR-BELLOWS.

SECTION I.

Of the different purposes for which Air is admitted into Hothouses.

AIR is, or at least ought, to be admitted into hothouses, for one of the three following purposes, and frequently for all of them together.

L 2

1. For

1. For the purpose of ventilating the house; that is, carrying off all the air in the house, and afterwards passing through it in a current, until the sashes opened are shut, and then the house is left full of new or fresh air.

2. In order to mix with the air of the house, that it may prove more congenial to the plants; and,

3. In order to mix with the air of the house, merely for the purpose of lowering its temperature, when it is too warm.

These three objects being very different, it is plain, that separate modes of accomplishing them ought to be adopted. No difference however of any kind, takes place in practice; but on the contrary, whatever be the object or purpose, the sashes are opened or let down, without any farther thought or trouble.

ble. It is true, indeed, that in mild weather, or when the temperature of the house is very high, more sashes are let down, than when it is very cold, which is so far good, although in fact this difference serves little purpose. But aside from this, the consequence of indiscriminately letting down the sashes, whatever may be the purpose for which air is wanted, is this, that ventilation with the air of the atmosphere, though it should be in the coldest winter day, is unavoidably produced, the house is suddenly deprived of all the heated air which it contained, and not only filled with that of the atmosphere, but fanned or blown upon by a current of it, passing rapidly through among the plants. This must necessarily carry off much heat, chill vegetation, and bring on diseases.

To remedy this evil, it seems requisite to consider the three different purposes for which air is admitted.

The

The common mode of opening or letting down the sashes, must undoubtedly be the most complete way of promoting ventilation with the air of the atmosphere; and in mild weather, when this can be adopted, surely nothing can equal it. Respecting this purpose, therefore, which is the first mentioned, nothing further requires to be said at present.

The two other purposes are accomplished by the same operations, and we have only to consider, which is the best mode of admitting fresh air into a hothouse, for the purpose of being mixed with that which it already contains.

Air is an elastic, or compressible body, and it is well known, that any house or vessel filled with it, in any of its ordinary states of expansion, is capable of containing double or triple the quantity of the same temperature; consequently of containing a greater proportion
still

still if the air to be forced into the house or vessel, is hotter than that which is contained in it, and a lesser proportion if the air to be forced into the house or vessel, is colder than that which it contains.

The great use to be derived from a knowledge of these facts in hothouses, are evidently these:

1. The air of the house may be condensed or cooled to any temperature, not under that of the atmosphere, without allowing any of this heated air, now in the house to escape.

2. The operator has it in his power to enlarge, in a double degree, this medium of respiration (air) for the vegetables, by forcing into the house, once a day or so, double the quantity of air which the house usually contains.

contains. This may be called, “ charging the house.”

3. It is in the power of the operator to admit a much greater quantity of fresh air, than is the case in ordinary hothouses; when it often happens, that for several days together, and frequently for more than a week at a time, none of the sashes can be let down or opened.

4. That this fresh air can be admitted without chilling the plants in any degree.

In proceeding to act upon these principles, it occurred to the author, that as the atmosphere is often extremely cold in the winter season, there might frequently be a degree of difficulty in performing the operations, and some risk of chilling the plants, if the air was forced into the house immediately from without, (though it is proper
to

to notice here, that there is not one tenth part of the danger, which occurs by the common mode;) it would be an advantage, if the air to be forced into the house were of a moderate temperature, at least two or three degrees above the freezing point. Now, as most stoves have, and indeed require, a back shed for covering the furnace, and for containing fuel and other materials, and as the air in these sheds is always temperate, it seems best calculated for being forced into the house.

From these observations, it is presumed, the reader will see the importance of the object in view, and also, that it is so far a convenient and practicable plan. It remains only for the author to point out a machine, which may be used for the purpose of forcing additional air into a house already full of this fluid. The most economical and simple mode of doing this,

M

that

that occurs to him, is by using an air-pump, or bellows, the form and construction of which shall be the subject of next section.



SECTION II.

*Of the construction of the Air-Pump and
Bellows.*

THE pump and bellows, though different in construction, serve exactly the same purpose.

The pump was used in Dicksons' and Shade's hothouse. It is simply a square tube or long box of wood, open at one end
and

and closed at the other. (As will easily be seen by viewing plate II. fig. 4.; where the whole machine is represented with one of the sides taken off.)

In this tube the board *a* (plate II. fig. 4.) was used as a piston or sucker. In this piston will be seen a valve, which in pressing it up (by the handle) from *b* towards *c* opens and lets fresh air into the volume of the pump. In drawing down the handle, the pressure of the air in the tube or volume of the pump, closes the valve at *a* in the piston, and forces open the valve *d*, near the other end of the pump, through which the fresh air passes into the house.

This pump was placed in the top of the roof, and in the centre of the house, (as there happened to be no back-shed to that hot-house.) A shade or cover was suspended over the upper end of it, to keep out the rain; and the under end, from which the

handle *e* proceeds, was suspended in the house.

This pump answered the purpose of drawing in fresh air completely, but as the sashes were very old, ill fitted to the rafters, and not glazed in the interstices *, it was impossible to “charge” the house as mentioned last section, with double its usual contents of air. It serves to shew, however, that a pump may very easily be constructed so as to draw in fresh air, and this is all which was intended in making it.

Since placing that pump, it has occurred to the author, that in the case of stoves and
 pineries,

* The reader may ask, why this operation was not done? It is answered, because the overlays of “fragment glass” are so numerous and so large, (each fragment projecting an inch and often more over the next) that it would have too much darkened the house.

pineries, which have adjoining sheds, the best way would be to have a kind of bellows something of the kind represented by fig. 6. plate II. placed in the shed immediately behind the back wall of the house, and which could be easily worked by a man moving up and down the lever *a*. The air would thus proceed along the tube *b*, and enter the hothouse immediately under the top of the roof; when descending it would diffuse itself with the air which it already contained.

The top, underpart, and tube or nozzle of this bellows, could be made of wood, and the sides of leather. And as from the width of the tube or nozzle, no great degree of strength would be requisite, and also little or no iron work necessary, the whole expence of this machine would be very trifling.

Nor will the working of these bellows be laborious, as the air will not be nearly so
 much

much compressed in passing through the wide wooden tube, as through the small nozzle of those used in smithys, &c.



SECTION III.

*Of the intention and mode of using the Bellows,
or the Air-Pump.*

IT is not proposed to introduce this improvement universally into green-houses, or peach-houses, or into any glasshouse of the same nature; but principally, into pineries and such plant stoves, as are heated by making fires during the whole winter season.

It is thought by the author, that in houses of this kind, two advantages will result

fult from the air-pump or bellows, which deserve the ferious attention of all thofe who poffefs fuch hothoufes, and who wifh to fee their exotics, green, healthy, and luxuriant.

The first advantage, though confiderable, is not fupposed to be the greateft,—it is the faving of fuel.

The fecond, is the advantage which will refult to the plants, or exotics, not only by giving them more frequently fresh air, to refpire in ; but, by greatly increafing its elafticity, and by introducing it in fuch a mild gradual manner, and of fuch a moderate temperature as will not chill the plants.

For thefe beneficial purpofes, the gardener fhould, in every day, which from its coolnefs, will not admit of the houfe being ventilated with the open air, (and this will
be

be the case nine days out of ten, in the winter months) press or force in a quantity of fresh air, with the bellows, having formerly raised the house six or eight degrees above the medium heat, proper for the plants during the day.

It is necessary to repeat, that in pumping in this air, he should not only have a view to bring down the temperature of the house to the proper medium, and give fresh air to the plants ; but he should also have an eye to “ charging the house,” that is, filling it with double the quantity of air, which it naturally contains. The advantages of which, in promoting the vegetable respiration, will be very evident, at once, to chemists and botanists, and it is presumed will soon be seen by practical operators.

In many hothouses, which have not the interstices betwixt the glass puttied, this last use of the air bellows will be frustrated ; and
even

even in the most exact houfes it is not supposed that they will remain “ charged ” in the way mentioned for many hours together ; yet if we suppose them to remain more or less so, for five hours every day, this will certainly prove of such advantage, as amply to compensate for the trouble.

In connection with this plan, and for the purpose of ventilating the house with air of moderate temperature, a long leather pipe could be got, with one extremity of such a size, as to fit the end of the bellows tube, where it enters the house ; and with the other extremity, exactly similar to the rose of a garden watering pot.

This pipe being fixed on, and one person working the bellows in the shed, another in the hothouse, might guide the extreme end of the pipe to any part of the house, or to any particular plant, which in

a more especial manner required ventilation, or a shower of fresh air.

Regard must always be had that the air in the back shed be of a proper or moderate temperature before this operation is commenced. This can be accomplished, by keeping all its doors and windows close, by opening the furnace door, and by shutting the extremity of the air-flue in the house ; but cautions of this kind are unnecessary to most gardeners ; for they are generally speaking, a very attentive and intelligent class of men. It shall only be further observed, for the satisfaction of some, that many gardeners and nursery-men, who are in the practice of raising young exotics and even green-house plants, use the common bellows as a ventilator, for the purpose now mentioned.

C H A P. IV.



OF THE VENTILATOR.



SECTION I.

Of Ventilation.

*V*ENTILATION, and *giving fresh air*, have been generally confounded together in idea, and in practice unavoidably performed at the same time. It has been already shewn, however, that there is a wide difference be-

twixt adding fresh air to the house, and putting that air which it already contains, in motion.

To accomplish this last purpose, that is, to put the heated air contained in hothouses in constant motion, is the intention of the ventilator to be recommended.

In hothouses nature has been imitated, more or less perfectly in most things. Heat is produced from the furnaces and flues. Light is admitted through the glass; rain is supplied from the syringe, or the wateringpot; dew, is raised by pouring water upon the flues, or, by steam apparatus; and fresh air is admitted at pleasure. But what makes up the want of those refreshing and genial breezes, which fan and invigorate real nature. Surely that ponderous volume of frigid air, which perhaps, for an hour or two every day, invades the sultry

try hothouse, and as a rapid current rushes through among the tender plants, can never have the same salutary effect as a breeze of a warm temperature. As well indeed might we suppose, that in Jamaica, a breeze from Iceland would prove genial to the sugar cane or the pine apple. It is granted, that, in the summer months, the open air of this country will prove more refreshing, than any mode of ventilation which we can substitute: and green-house plants may perhaps be most advantageously ventilated by the free admission of the open air, for nine months in the year. But in nature, there is no such thing as vegetables living, for three months in the year, without enjoying the breeze, as is generally the case with all green-house plants; and it is still more unnatural to think, that stove exotics which are deprived of this benefit for nearly nine months, can be equally vigorous, as if they enjoyed what is natural to them during that time.

By

By carefully comparing vegetables in the open air, with those in hothouses, or such as are in sheltered, with those in exposed situations, it will appear, that the effects of the breeze are STRENGTH: which in herbaceous vegetables, is shewn by “ bushiness;” that is, a broad firm like appearance, and numerous surface roots; and in trees is shewn by bulk of timber, increase and vigour of lateral shoots, and strength of surface roots.

We see in nature, that trees and plants in the same soil and climate, and enjoying alike every other advantage, if they do not equally enjoy the breeze, if the one is in a sheltered or pent up, and the other in an open windy exposure, those of the former situation are tall, weak, unable to support themselves, and unfightly, * while those in the latter

* Unfightly only when viewed as single objects, and as specimens of the particular kind of plant or tree. For nothing

latter circumstances are healthy, robust and luxuriant. Now, this difference in effect, is totally independent of all other causes; and hence, in hothouses, supposing the natural soil, climate and situation †, exactly imitated,

thing is farther from the author's intention, than to say, that in wooded dells or forest scenery, tall slender trees, sickly branches, or decayed trunks, contrasted, and sometimes grouped with others having huge trunks and extended arms, have not a fine effect. As well might he transfer the idea to the human species, and wish not only that all mankind were of the same height and thickness, "Made in one mould, cast in one frame;" but of the same condition, age, colour, and *sex*.

† Situation is a thing by no means properly attended to in the culture of exotics. It is certainly ridiculous to think, that the uniform slope of a bark pit, or a greenhouse stage, which exposes alike to the sun, every plant which they contain, can answer equally well for plants and trees which grow on the sides of mountains, in low rich vallies, in thick woods, in shady glens, rocky crevices, and on the sides of dark caverns.

ed, yet there cannot be a doubt, and we see it in fact, that the want of the breeze is a material deficiency.

In the very best managed hothouses, we observe the plants tall, sickly, and unable to support themselves. And one proof that this is owing to a deficiency of wind or breeze, is, that we see the tallest and most slender green-house plants, when exposed to the open air for a few weeks in summer, as they usually are, become broad and bushy, and in general firm, and have their stems greatly increased in thickness, with a numerous addition to their roots:—this every gardener knows.

The same thing may be very evidently seen also by comparing peach houses, which are “forced,” or brought into a vegetating state early in the spring, and those which are forced later, or left nearly to the natural influence of the season. It will occur to the recollection of every one, who has been
accustomed

accustomed to observe them in both states, that the shoots of the latter are always much the thickest and most luxuriant.

Most men confound the effects of the breeze, with the effects of light and fresh air. Light is that which produces colour in vegetables. Air is the medium in which they respire, and on which in a considerable degree they live. The motion of air, or what is called wind, by a mechanical effect upon the whole plant, produces not so much rapid growth, as vigorous bushy shoots: and in trees by the same means it produces timber. Trees which are planted very thick, or in such sheltered situations as not to be put in motion by the wind, are uniformly so tall and slender, as to be good for no use in the arts. The same thing happens with those trees and shrubs, which naturally attach themselves to fixed bodies, (such as walls, trunks of trees, &c.) as the ivy, honeysuckle, &c.

O

and

and with any species of tree, when it is artificially fixed, such as fruit trees trained upon walls, or espaliers, new planted trees fixed to posts, &c.

These cannot be put in motion by the wind, and of course, we always find that the diameter of their trunks and branches, makes little or no increase.

As the wind seems of such consequence to vegetation in real nature, the imitation of it in hothouses must be of very considerable importance.

It has already been stated, that in favourable circumstances, that is, in the summer season, when the weather is of a temperature not greatly below that of the house; the ventilation produced by opening the sashes, and admitting a free current of open air, is best.

But the intention of the ventilator is to put the heated air of the house in motion,
 so

so as to produce a breeze of warm air at pleasure.



SECTION II.

Of the Construction of the Ventilator.

UNFORTUNATELY the author has not been able to get a ventilator constructed in time for this publication; he shall here, however, give some ideas respecting the formation of one which he hopes will lead others to think on the subject, and perhaps to invent a better one than he has any idea of at present. It need not be thought from this, however, that there is any great difficulty in contriving the parts of such a machine. The author is perfectly aware of a

mode which would answer; though he has deferred some weeks giving orders for constructing it, in the daily expectation of seeing MR ANDREW MEIKLE, of Prestonkirk, a singularly ingenious mechanic, whom he believes well qualified to give him some useful hints, if not to invent one in all respects better. At any rate, no time shall be lost in producing to the public a proper machine for the ventilation of hothouses.

In the mean time, in order to lead others to the invention of such a machine, the following thoughts are communicated.

One kind of machine which the author thinks will answer, is to be composed of two parts.

The *first part* is a small box of machinery, about one foot square, nearly upon the
the

the same principle as the patent roasting jack.

The *second part* is a fan, three feet in diameter, somewhat similar to that of a common winnowing machine.

This is intended to be suspended to the first part, and thus the whole machine will be finished.

It is proposed to be hung from the rafters, and to change its place once or twice a day, by this means varying the wind or breeze, in such a way as that none of the exotics might be injured from too great a current, or suffer from a deficiency of breeze. This fan was to be so contrived, as that by some small alterations it could agitate the air, more or less violently at pleasure.

There

There is another machine which the author is apt to think would answer fully better than the former. This one is proposed to be made upon a similar principle to the *common* roasting jack, *viz.* to act by the descending weight as the power. The whole machine is supposed to be contained in a box, not more than two feet broad, four or six feet high, and three or four feet long. It is intended to be placed upon small wheels, for the conveniency of pushing it along the paths of the hothouse. The wind is supposed to proceed from the top of this machine, through a tube in a horizontal direction; and this tube, by a particular contrivance in the machine, is intended to turn continually round, so as to diffuse the wind on every side.

In using it, its situation is supposed to be changed as before, once or twice a day.

It is thought that both these machines
would

would require to be wound up by a key, once every ten or twelve hours.

Other kinds have been thought of, some of them to move by a small wind-mill, or fan, placed without the hothouse, &c.; but it appears probable, that either or both of those above mentioned, will be found to succeed.



SECTION III.

Of the intention and mode of using the Ventilator.

FROM what has been already observed, little more requires to be said upon the subject. A few hints however shall be given, as they
may

may lead gardeners into a proper train of thinking on the subject of air in general.

As in nature, wind prevails principally during the day, and that especially in the time of sunshine; so in hothouses the use of the ventilator must be confined almost solely to the day.

1. Because in the winter season, and especially in green-houses, where no inner roofing is used, putting the air of the house in rapid motion, during the night, might have some little tendency to cause it to give out heat; And,

2. It is found, that the growth of vegetables, which takes place principally during the night, is most rapid when they remain at rest, and in a moist atmosphere.

It will readily occur to the gardener, that as the wind varies in the open air, blowing from different quarters, and in different degrees.

degrees of strength, so ought it to be varied in the hothouse.

This he will be enabled to accomplish from the nature of the ventilator, which may be moved to different parts of the house, and so change the quarter or direction of the wind;—and which may be made to move slower or faster, and so change its force.

Nature must also be imitated in respect to the moisture of the air during wind. We generally find the air clear during a smart breeze. It is a perfect calm in foggy or thick hazy weather, when the atmosphere is loaded with moisture, or during the fall of rain.

These and several other parts of the economy of nature which might be mentioned are not to be followed merely at such times as the operator may choose, for this might often be counteracting nature. We

P

must

must never attempt to produce a dull thick foggy atmosphere in the hothouse in a clear sunshine day. During the winter season, on the other hand, he must withhold fresh water or dew from the exotics though it should rain hard in the open air. For this the natural climate of the different hothouse plants must be his guide, as well as the totally opposite conditions of the plants themselves:—those in the open air being at this season in a dormant state—those in the hothouse being now, and at all seasons, in a growing, and consequently much more tender condition.

But besides this general way of imitating nature, a careful gardener will consider the effects of wind not merely in producing firm bushy plants and robust timber trees, but also in carrying off fogs, and damps, which in certain situations and circumstances, tend to bring on putrefaction or decomposition and other diseases in vegetables. This will teach
him

him, that when any thing of this kind happens with any plant, or in any part of the hothouse, a more than ordinary ventilation is requisite.

By a careful attention to the natural breeze, many other things respecting the imitation of wind will occur, which shall not be entered into at present.

From a proper study of nature also, the safest and most complete mode of managing heat, rain, dew, &c. may be learned by those who shall carefully observe and reflect upon her beautiful economy. But a more full consideration of this, as well as the general subject, must be left for the treatise on hothouses.

C H A P. IX.

ON THE ADVANTAGES RESULTING FROM THESE
ALTERATIONS.

HAVING now described the alterations which were made upon this hothouse, and also shortly treated of the nature of these alterations; in taking notice of the advantages which result from them, it seems requisite to consider the subject under two different heads: *viz.*

1. The advantages which have resulted in this particular case; and,

2. The advantages which will result in general.

SECTION I.

Of the advantages which have resulted from these alterations in the hothouse belonging to Mess. Dicksons and Shade.

THE peculiar and uncommon * circumstances which rendered this hothouse unfavourable

* It is very uncommon to find such a *small* hothouse with not only the *back wall*, but the *ends and front of mason work*, and even part of the slope upon which the sashes are placed covered with *deals*. See page 12.

vourable for shewing the effect of the alterations have been already noticed. The effects which have been produced however, shall be inserted without the least deviation from truth. Should the least degree of dubiety arise in the mind of the reader, he has only to examine the hothouse referred to, himself, and enquire of the particulars at Mess. James or George Dickson, or the lad who manages the house : or though he should be at such a distance as to render this difficult or inconvenient, he may employ some person in Edinburgh to visit the hothouse, and make these enquiries in his room*.

The first and most striking effect of these alterations, was the lessening of labour; for,

Formerly

* This is inserted principally for the sake of those in England who may purchase this work. The utility of the alterations are already pretty generally known in Scotland.

Formerly the fire had to be stirred up, and fresh fuel put on several times a day, and also every night at eight o'clock; and the fuel chamber being then large, there was a continual danger of raising the house to too high a temperature. This kept the lad (John Roger) perpetually employed about the hothouse. After the alterations were made, in the severe weather of the end of December and the beginning of January, it was never found necessary to go to the fire above four times a day: *viz.* The first time in the morning to put on fuel, the second time in about half an hour afterwards to open the valve in the furnace door, the third time in the afternoon to put on another fire, and the fourth time about half an hour afterwards to shut the valve, which commonly happened to be at the time of leaving off work.

At

At present, (end of February) it is only necessary to go twice a day to the fire place ; for one fire serves during twenty four hours.

The second principal effect, was the saving of fuel.

Formerly (in the beginning of December) one barrow load and a half, in twelve hours, and in very cold weather, more was necessary.

After the alterations were made (in December and January as before) a barrow load served more than fifty hours : at present (February) a barrow load serves sixty-two hours.

This appears a saving of more than three fourths of fuel ; but when the difference of temperature of the atmosphere, and also the difference of temperature produced in the house, are taken into account, it appears, that a saving of *four-fifths* of fuel is effected.

The

The next advantage is, the saving of time.

Formerly one lad was constantly employed in attending to this stove and the greenhouse, and frequently he required assistance.

In the course of occasionally calling to see the hothouse, the author has frequently not found any person at hand, and Mr Dickson has informed him, that ever since the alterations were made, the keeper has been every day more or less employed, in distant parts of the nursery.

The fourth advantage was the lessening of risk. Before the alterations were made some accidents were constantly happening, with those plants which were nearest the furnace. Two or three yards of the flue, indeed, was always left without any plants, as they were in continual danger of being scorched. On the other hand, those plants kept at the opposite end of the house, were

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in

in continual danger of being too much cooled.

At present the house is equally warm throughout, as is fully known by a thermometer which is kept at each end, and in the middle. The front flue is uniformly hot throughout with pots of plants from one end to the other, which never sustain the least damage.

The next advantage is the superior health of the plants, which is the natural effect of a more steady climate and more fresh air. Some may think, that sufficient time has not elapsed to judge in this matter. And there may be some truth in this, as it is not yet two months since the alterations were made. But, so conspicuous has been the superiority of the vegetation during this last period, that it has astonished every one who has seen it.

SECT.

SECTION II.

*On the advantages which will result from these
improvements in general cases.*

To know this, it is only necessary to ascertain what relation the hothouse belonging to Mess. Dicksons and Shade, has to the generality of hothouses.

It is presumed, that none who have seen this hothouse, or considered the description given of its state previously to making the alterations, will deny, that it was in a double degree better calculated for saving fuel, than hothouses in general.

This being granted, it is plain that the saving of fuel must in general be more than

than double what happened in this case. So that in all large hothouses, * it may with perfect safety be asserted, that a saving of more than *nine-tenths* of fuel will be effected. And this the author will undertake to do in any hothouse, either in England or Scotland, containing above a thousand cubic yards of air, which is the case with many vineries and pine stoves †.

It is in a great measure unnecessary to add any thing to what has already been said,
respecting

* Because as the dimensions of the house increase, the proportion of fuel saved, will increase also.

† The author will make one single exception, which is the pine stove at Woodlands, Surrey, erected by Mr David Stewart. At the same time, though he is perfectly satisfied he could not save nine-tenths of the fuel used in that house, yet he is fully convinced, that by the addition of the inner roofing, the saving would be very considerable

respecting the other beneficial consequences which will arise. The saving of time and labour is a pecuniary advantage, which in an extensive range of hothouses, will no doubt amount to a tolerable sum yearly. But the certain benefits arising from the superior health of the plants, and the security from extremes, or risk of any kind, are greater than can well be imagined.

What are the sensations of a botanist on entering a stove, where all the plants are of
a

considerable indeed. And he is further of opinion, that by simplifying the whole, according to his plan, time and labour would be greatly lessened, not to say any thing about original expences, or the health of the plants.

That hothouse is, if I recollect, upwards of seventy feet long, and eighteen feet broad, and is wholly covered and surrounded with glass. During the winter and spring months, a vast quantity of heat must escape thro' such a large surface of glass, which the inner roofing would undoubtedly in a great degree prevent.

a pale yellow colour—where they are all drawn up into unfightly forms—where even the leaves and flowers do not assume their true natural shape, and where they all bear marks of diseases?

How different must his feelings be on entering one, where all is health and luxuriance, where the trees or shrubby forts are each assuming their natural form, where the plants are tufted and bushy, and where the natural colours and minute parts of each individual are strongly marked.

Is there any difference betwixt the state of a gentleman who possesses a number of vineries, peachhouses, and pinestoves, and yet is in continual fear of an accident which may destroy all the fruit,—and another gentleman who in all human probability is sure of a good crop?

CHAP.

C H A P. X.

ON THE EXPENCE OF MAKING THESE
ALTERATIONS.

PERHAPS none of the least advantages of these improvements is the ease and economy with which they may be executed; either in the case of altering an old, or already built hothouse, or in erecting one wholly new.

The

The expence of altering one already built must depend a good deal upon the state of the flue; as, in some cases it may require to be wholly taken down and rebuilt, and in others the covers only taken off, the sides heightened, and the "briggs" put in—adding the air-flue, never of greater length, than from the fire place to the other extremity of the house.

As formerly mentioned, one fire place to a house, will in all cases be sufficient. The furnace may be made upon a larger or smaller scale, agreeable to the proportions of the plan given in plate I. But one similar to that in the plate will suffice for all hothouses containing not more than a thousand or twelve hundred cubic yards of air; and indeed for most hothouses.

The price of such a furnace is just L2. : 10. It may be had at the Edinburgh Foundry, or at Mr Dalziel's, (Cabinet Maker,) Chapel-Street, London, on en-
quiring

quiring for LOUDON'S *Improved Hothouse Furnace*, which words are printed upon the door of the furnace. The improved ash-pit door, made according to the figure given in plate I. and the grate, are had along the above furnace, and are included in with the price.

The alterations made upon the flues and furnace in Dickfons' and Shade's hothouse, were executed by workmen belonging to Mr GILCHRIST, *Builder, Head of Leith Walk, Edinburgh*; whom the author can safely recommend to gentlemen for the execution of such improvements, and for building in general. Mr G. can send workmen to alter furnaces and flues to any part of the country; and when gentlemen have not an intelligent mechanic in their neighbourhood, who can work from drawings, or from the plates, given at the end of these sheets, this will be found the safest and most economical mode of procedure.

The expence of the inner roofing is the same both in the case of altering old, and making new hothouses.

The coarse flannel can be had from E. COLLIER & Co. *Lawn Market, opposite Bank-Street*, at sixteen or eighteen pence a yard, the stuff being twenty-seven inches wide. This company have had proper directions for wetting the flannel with alum, to prevent its taking fire.

The pullies, rings, &c. are to be had from Mr JAMES M'LEAN, *Ironmonger, High-Street*.

Mr JAMES PHILIP, *Joiner, Broughton*, understands the mode of fixing up the inner roofing, and of determining the proper shape and dimensions of the curtains which compose it, to any form of hothouse.

Mr P. is also qualified to construct the air-pump or bellows, and the author can recommend him for any thing else, either in the way of hothouses, or in his profession

sion in general, with the greatest certainty that he will give much satisfaction to those who may favour him with their employment.

Having noticed this much respecting the expence of each of these improvements separately, some remarks shall be added respecting the general expence.

In the case of Dickfons' and Shade's hot-house, where, from the novelty of the plan, some blunders were made by the workmen; and where, from the inner roofing being erected in four different ways, before fixing on the present mode, the amount must be much more than what can generally happen. Notwithstanding, however, the whole expence of alteration did not amount to twenty pounds.

The author conceives, that from fifteen to thirty pounds, will generally suffice for

altering any ordinary fixed hothouse in Scotland. In England the additional expence will be very trifling.

The entire expence of erecting a new hothouse, according to this plan, will not be more than half the above sum, or perhaps eight or ten *per cent.* added to the whole expence of the house.

In the course of giving directions for executing these alterations upon hothouses, the author has found Mr JAMES GOULD, Builder, Muithill, near Crieff, in Stirlingshire, a very ingenious and intelligent person. Mr GOULD has for some time past been in the practice of building hothouses in the ordinary way. He has now had such directions from the author, and has given such clear proofs, that he understands the nature of the alterations, that he can warmly recommend him to such gentlemen of the surrounding country, as may be pleased to adopt any part of his plan.

The

The author is sorry he cannot now refer the gentlemen in England to workmen in London and York, who could execute the improvements in the same way, as those he has just recommended in Scotland. In a few weeks however, the author expects to have this in his power ; and he shall take care, that the names and addresses of such artizans as he may fix upon, shall be publicly advertised, for the benefit of all those who may wish to make the alterations, with no trouble and little risk of blunders.

In the mean time, any gentleman who may wish to alter his hothouse immediately, and with his own workmen, if he finds any difficulty, by sending to the author a general sketch, or description * of the
present

* This can be done in very few words as follows :

Length—breadth—height of front glass—height of back wall—two furnaces, one in each end, placed behind the back wall. The flue of one, is led round the house,
immediately

present state of the house proposed to be altered, such directions, plans, or models shall be sent, as are suitable to the case, and as will be clearly understood. The author's mode of constructing the fire-place and flue, is so plain as to be understood by the simplest mason or bricklayer.

CHAP.

Immediately within the ends and front glass, the other makes several courses in the back wall. Such a description as this is amply sufficient.

C H A P. XI.

ON OTHER IMPROVEMENTS WHICH MAY BE
MADE IN HOTHOUSES.

SECTION I.

Of the Introduction of Improvements in Hothouses.

THAT the construction of hothouses, is very imperfectly understood, among those who are generally employed to erect them, will appear very evident, to any who shall investigate the subject in a very slight manner.

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Nor will this appear surprizing, when we consider the very recent date in which they have become general in gentlemens gardens.

It is presumed, that there were few green-houses in England before Mr EVELYN erected his Conservatory, at *****, near London. Now the very same general form has uniformly been followed, till within these two or three years. Not indeed exactly the same construction, for certain iron "pipes" which Mr E. ingeniously, but rather unsuccessfully introduced for the purpose of supplying heated air, have been rejected; and this evidently without that enquiry into their intended use, which was due to every scheme devised by that great man.

The first stove erected in Scotland, was that which belonged to the late Mr JAMES JUSTICE *, at Crichton, near Edinburgh, and

* A great enthusiast in gardening, particularly in the culture of flowers.

and if we observe the plan of this hothouse, as given in Justice's British Gardener, we shall observe little or no difference between it, and the most improved construction of pine stoves at the present day.

With respect to books on hothouses, there has never yet been published any thing in the way of enquiry into the principles of their construction and general management.

Mr EVELYN in describing his conservatory, gives two or three hints respecting the properties and management of air, which are deserving of attention. But in the several books of designs, which have been published, and are to be had at Mr TAYLOR's architectural library, Holborn, London, not a word is added respecting the principles, or even the properties of the designs recommended. Indeed these designs are impracticable, and such as could not answer the purposes of horticulture. The natural conse-

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quence

quence which has ever followed hothouses, designed by mere house architects.

The plans given and recommended by Mr ABERCROMBIE, Mr SPEECHLY, and several others, answer better; but, they contain no deviation from general practice; nor do we find that these men have ever thought or written upon the principles of their construction.

The same observations will apply to the designs recently published, by Mr WALTER NICOL in his *Forcing Gardener* *. It is proper to remark, however, that these designs, tho' exactly upon the principle with those mentioned above, are perhaps, upon the whole, better adapted for the purposes of forcing. At any rate they are preferable to any thing that has hitherto appeared in this country.

The

* By Creech, Edinburgh 1802.

The public are greatly indebted to Dr ANDERSON, for the many ingenious hints contained in the account of his patent house, * and this single volume is certainly of more importance, than all the other designs or books upon the subject which have yet appeared. But though in some of the warmest counties in England, the Doctor's hothouse may, perhaps succeed for a year or two after the house is erected, it is the humble opinion of the author, that it will never come into general use.

In different parts of the island, there are, and have long been, peculiarities in the construction of some hothouses, which, had they been understood and attended to by planners, would, long ere now, have made a material difference in the construction of hothouses.

S 2

At

* Published by R. Cumming, Holborn, 1803.

At Abercairnie, near Crieff, in Stirlingshire, heated air introduced by the furnaces and flues, has long been used in a peach-house. And though the construction by which this is effected, is extremely imperfect *, yet the end is answered in a considerable degree, and a tolerable saving of fuel is produced.

The author has been told by a gentleman (Mr L**, Hammerfmith) in whom, he can place the utmost confidence, that heated air was introduced into a hothouse in the neighbourhood of Manchester, near forty years ago; and as it is probable there may be some other cases in England, which has not yet come under the author's eye, it is likely,

* Imperfect, but not so completely erroneous, as at Archerfield, East Lothian, where heated air was lately brought from the furnaces in a vacuity immediately under the smoke flue.

likely, (however strange it may seem,) that the practice may be traced as far back as Mr EVELYN's time. This beneficial improvement, having escaped the attention of planners, who must have seen or heard of some of the instances mentioned, but who evidently have not understood its nature, would have been lost to the public, had not Mr STEWART, gardener to J. J. ANGIERSTEEN Esq. Blackheath, Surrey, brought it boldly forward to public notice, in his patent hot-house. Mr S. deserves much credit for bringing the thing into public notice, and it is to be hoped, he will find such a demand for his kind of patent hothouses * as amply to recompense his ingenuity.

The author by adverting to those hot-houses formerly mentioned, conceived his
plan

* Which are very different from Dr ANDERSON's. Fuel being in them considered as necessary. See some description of Mr STEWART's pine stove, chap. 8. section 2.

plan of collecting and introducing heated air in hothouses : and by thinking on the subject, and by considering the nature of heat, he also formed the idea of an inner roofing, and of the air-pump or bellows. These he has carried into execution, in the hothouse in Broughton park nursery, at so trifling an expence, and with such uncommon success, as will induce him, when an opportunity presents itself, to execute several other improvements. Some of these he shall mention in the remaining part of this chapter, partly with the view that some may have it in their power to try them, and partly to draw the attention of others to devise still greater improvements.

The author would at the same time beg leave, to caution gentlemen against too suddenly making alterations upon any plan in the way of improving upon it. During the time that the operation

tions treated of in these pages were going on in DICKSON'S and SHADE'S nursery, it afforded much amusement to the author, to hear the conjectures and remarks made by some gardeners and planners about the intention of the different parts; and after they were finished, it was still more curious to hear, what they proposed as additional improvements; most of which were so completely opposite to the nature of the plan, that had they been executed, more heat would have been lost, than is by the common mode of construction. Such would have been the effect of carrying the air flue a certain length around the smoke flue, and afterwards below it only. Or, as was proposed by another, or carrying it a certain length around the smoke flue, and then making it occupy the narrow vacuity betwixt it and the front wall. Several other improvements were proposed, but it is sufficient to mention these as specimens, in
the

order to guard gentlemen against an over-
rashness in adopting opinions.

When a proprietor is about to make improvements, either upon his grounds, garden, or mansion, he would do well to distinguish betwixt sound argument and mere assertion, even though they should be the assertions of professional men. For when two men are attending to the same subject, that is a proprietor and his designer, why should not the arguments which convince the one, reach conviction to the other also. These arguments should, at least be candidly stated by designers, and attentively listened to by gentlemen before any thing is done. And were this the case, a practice would take place in rural improvement, very different from that which prevails at present.

SECTION II.

Of additional improvements in the modes of heating Hothouses.

MIGHT not many hothouses, in certain situations be heated without having flues within the house ?

First, Suppose, as is very frequently the case, that the journeymen gardeners are lodged in an apartment in the sheds, placed behind the range of hothouses; let the smoke of their fire, be conducted in a flue throughout a close compartment in the shed, containing perhaps, from fifty to five hundred
T cubic

cubic yards of air. From this compartment, which, for the sake of distinction, we shall call the air chamber, let pipes be led to as many of the hothouses, as it may be supposed capable of supplying with heated air. Suppose that two pine stoves are to be heated by this mode. Two pipes must be conducted from the top of the air chamber, to each of the stoves, and having their extremities placed at some distance from one another, near the bottom of the upright front glass. Let other two proceed from the bottom of the back wall, or the lowest part of the house, wherever it may be, to the lowest part of the air chamber. The consequence of this arrangement will be, that, as the air in the air chamber becomes heated, it expands, and the hot air ascends, and is forced through the upper pipe into the hothouses; while to supply the waste of air in the air chamber, and also, to make room for the heated air to enter the house, a current of cooler

cooler air will naturally be forced into the chamber through the lower pipes. The heat thus added to the stoves, could be regulated by closing one or both the pipes occasionally. And if at any time, it was found requisite, suddenly to raise the temperature of the heat of the stoves, a pair of bellows with a nozzle, which may be joined to any of the upper pipes, may be used, which will thus force the heated air into the house with rapidity.

Secondly, But as air is of such a stationary nature, the above mode could only answer in some cases, and therefore the following mode appears more generally useful.

In the air chamber, let an air flue be conducted along the top and sides of the smoke flue, and let the pipes for drawing off the cool air from the house, enter at one extremity; and the other pipes which are to conduct

the hot air to the houses, be led from the other extremity. In this way, it is certain, such a circulation would be produced, as could not fail to answer the proposed end. The air added or taken from the pine stoves, could easily be regulated as before. In this case, there would be no need for bellows. The only disadvantage attending it, would be the loss of some heat, which would escape from the air flue, but this would not be great.

This scheme, the author is of opinion, would in many cases prove highly advantageous. The flue would be at all times hot and ready to deliver heated air, to at least two or three ordinary sized hothouses, constructed with an inner roofing.

Thirdly, In some cases, it may be inconvenient to have an air chamber or flue from the fire place, which happens to be near hothouses. Here a vacuity, formed by plates
of

of iron can be made round the fire itself, and sometimes round the whole, or part of the chimney, and from the top and to the bottom of this vacuity, pipes may be conducted from the hothouse as before. If this was carefully done, it is probable, that the command of heated air, would be greater than in the former case.

Fourthly, This last plan might be adopted in the case of fire-places at considerable distance from the garden.

The pipes, except where they joined the vacuity, might be of wood. One square pipe or tube, could be placed within another, and so fixed by props as not to come in contact with its sides. This sort of double pipe might be made to serve at the same time for conducting the cool air of the hothouse to the vacuity, and round the fire-place and chimney. This vacuity formed around the pipe of hot air, would
greatly

greatly prevent the air in the inner pipe from being cooled. This double pipe could be led from the fire-place to the hothouse in a wall if such happened to be at hand, or, in the centre of a small mass of mason work which could be built under ground. In building *in* this tube, it would be a great advantage to wrap it round with straw, an inch or more thick; and in two or three places to drive in nails, so as that their points might just enter the wood, and their heads be even with the outer surface of the straw.

These straw covered pipes being built in a wall, or in the mass of mason work under ground, in a few years the straw would rot and leave the double pipes in the centre of a vacuity supported by nails, as shewn in plate VI. figure 3. by which means very little of the heat conveyed in the air of the small centre pipe could escape.

The cases, where this plan could be adopted, are very numerous; indeed we can
hardly

hardly imagine a hothouse in such a solitary situation, as would, if proper arrangements were made, prevent the plan from having its full effect.

If the gardener's house was not at hand, perhaps some cottage, or wash house, dairy, &c. might not be far distant, or even the kitchen of the mansion, may frequently happen to be within a quarter of a mile of the garden, than which there could not be a better source for obtaining heat at all times. And thus, without the trouble of carrying the vacuity for heating the air up the chimney, a double plate carried round the fire-place, would in general, prove sufficient for any two hothouses; and were this vacuity continued up the sides of the chimney which would make no difference in the external appearance, nor produce any inconvenience in the kitchen, it is presumed, that hothouses, though placed a quarter of a mile distant from the kitchen, might be heated by the
fires

fires commonly made in such, with perfect ease.

The author would not have advanced so much on this head, had he not tried the effect of kitchen fires, in heating lobbies, and rooms at considerable distance. But of this, the public shall hear more in a short time.

Fifthly. A vacuity and conducting pipes might perhaps be made around dung hills with advantage. The effect of M'PHAIL's cucumber frame, and of some hothouses heated by dung, strongly justifies the supposition.

Sixthly. Hothouses might frequently be erected with advantage upon the tops of other houses as stables, cowhouses, or even cottages, or other sorts of dwelling-houses. Various are the modes by which this may be done.

When a mere greenhouse or conservatory is wanted, nothing more is necessary than
than

than in place of the ordinary roofing of slate, tile, or thatch, to substitute a roofing of glass; having the sashes constructed similar to those in hothouses, for the purpose of giving air. This kind of green-house will answer perfectly upon any kind of house, cottage, or stable, &c. and the heat of the apartment below will be communicated to the greenhouse above, through the ceiling of the lower apartment. In cottages, or some houses, this ceiling may be made of any material, and small holes about an inch in diameter made in it in different places; but in stables &c. the ceiling may be made of large tiles, or thin pavement and no apertures left.

When it is required to make a vinery or stove above a house or cottage, the chimney, or shaft of the fires in the apartments below may be carried around it as flues, which will give an amply supply of heat at all times. But as this will not be required

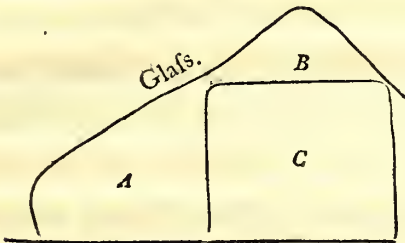
in the summer season, a damper must be fixed in the flue, at its junction with the chimney, and by shutting or opening this damper, the smoke can be prevented from entering the flue. Another damper would also require to be fixed in the chimney, a little above this junction, so as to force, or rather direct, the smoke into the flue.

The air vacuity around the fire-place may also be used as formerly recommended.

In both these cases the principal thing to be attended to, is so to contrive the situation of the house, cottage, or stable, as that the entrance and access to the green-house, pine-ry or stove, may be easy and elegant.

When these, or such houses, can be placed along the outside of the north garden wall, this will easily be accomplished. A range of cottages may be placed along the outside
of

of the wall, (the wall may serve for one side of these buildings.) Glass may be placed in front of the wall, and with the same slope be continued to the top of the cottage roof, as under.



The lower glass house *A*, may be heated by the air from the fire-place, and the upper one *B*, by the smoke in the flue, and by the heat of the under apartment *C*.

The hothouse *A* may be made a pinery; and vines may be trained under each rafter, and at the top of this house enter the bottom of the upper one, where they may be trained upon a trellis forming it into a vinery.

It is probable, however, that the best way, when a row of cottages can be commanded, is to place the glass upon the wall only, forming one such house as *A* which could be easily heated by the air from the fires, &c.

But in small gardens in towns, or in mere plots, or court yards, it may often be agreeable to have a green-house or vinery upon the top of a house or stable, where to place glass upon its sides would serve no purpose. The roof alone must be covered.

It may be remarked here, that there can hardly be a case supposed, either in a town or village, where the hothouse could not be warmed by part of the air collected around either the kitchen fire-place of the house to which it belonged, or round some other adjoining fire-places. This the author considers of considerable importance to
 many

many in London, who have, or who may intend to build hothouses.



SECTION III.

Of heating hothouses by Steam, and of Steaming in general.

PERHAPS the operation of steaming hothouses, by boilers was no where carried on more extensively than at Dalry, by the late Mr MAWER, a well known Planner and Nurferyman ; as the author was for a considerable time his draughtfman and general affiftant, he had every opportunity of observing the whole process, from the erection of the boilers in 1794, to the death of Mr MAWER in 1798.

It

It is not the intention of this section to treat fully on the subject, but merely to state the general result; because many persons more fond of speculation than well grounded in science, think that steam may be used with immense advantage in hot-houses.

At Dalry we had five very large boilers, which steamed two pineries, two peach-houses, and two vineries; we tried boilers of a variety of forms, and various modes of supplying them with water. We also tried copper, *tinned*, and *white iron* pipes for conducting the steam to the house. We tried also to heat the house by filling it with vapour from the pipes, and also by making the vapour pass through it, and thus heating it by the heat emitted from the pipe alone. In the pineries, we had also steam pipes in the barkbed, the vapour of which we could either allow to be spent among the bark, or to disperse itself through the
the

air of the house—we tried also a great variety of other ways, and made a great number of experiments both as to its effects and as to the expence attending it, (some of which experiments were sent to the Board of Agriculture.) But the result of the whole, although never confessed nor made public, was, that “ *Steaming by boilers is not only unnecessary, but an immense expence.*”

Steaming by boilers is totally unnecessary; because as every gardener knows, a hothouse can be sufficiently filled with steam at all times, by pouring water upon the flues or even upon the floor.

If it is unnecessary, it is evident the whole expence of the apparatus, which is considerable, and the trouble and risk, which are enormous, must be all thrown away. The author therefore is clearly of opinion, that it is the most absurd thing imaginable, to erect boilers for supplying hothouses with steam.

steam. If any kind of implement or utensil were even to become necessary a carron plate, with edges one inch in height of any convenient size, may be placed upon the hottest part of the flue, and filled with water. A vase or any utensil, close shut at top, and with a very small hole about half an inch from its bottom, may be placed upon it, which will thus keep the plate constantly covered with water, and at the same time allow none to run over. A plate of this kind containing six superficial feet, and placed upon the hottest part of the flue, will produce abundance of steam, for a very large house—and when steam was not wanted, it would be in no danger of being rent by the heat, as boilers continually are.

Steaming of hothouses, whether accomplished by boilers, carron plates, or what is certainly better, mere watering in the house, is of great importance when properly done; and

and equally dangerous when done at an improper season and in a wrong manner. It must be considered, that when the house is sufficiently filled with steam, the greater part of the heated air is driven out—and that as soon as the steam condenses, which it does in a very rapid manner, the space which it occupied is replaced with cool air from without.

Steaming therefore in winter, in cold weather, and particularly in the night time, must be very dangerous; for it is evidently next to impossible to keep up the house to a proper temperature in these cases.

In moist weather, and in the winter season, steaming is also very dangerous for bringing on the “damp” as every gardener knows. At all times it has a tendency to dirty the glass and rot the wooden work. But on the other hand it is most excellently adapted for destroying and preventing insects; particularly the red spider; and like the dew in

the open air, it is admirably calculated to promote vegetation in every stage from the bud to the swelling of the fruits or seeds. The air in hothouses should never be more charged with steam, than the open air, appears to be charged with dew in the evenings. Nature affords the best examples and instructions for steaming.

To procure a flow constant steam, may be thought by some a matter of difficulty, as it is not obtained by pouring water upon the flues, which may be very proper sometimes, but by watering the more cool parts of the house, as the floor, passages, &c. or by giving the whole plants and house a gentle shower with the seringe.

No rules can be given equal to what every one may learn by attentively observing the dews and evening showers in the spring and summer months. And indeed a careful attention to the state of vegetables in foggy, clear, blowy, and rainy weather, are of
great

great importance in directing our practice in the hothouse ; every operation performed in which should be in imitation of the more perfect economy of nature.

It is easy to conceive, that if a hothouse were infected with insects, they might be eradicated by steaming it two or three times with some liquid, the steam of which would prove deleterious ; or by placing in it retorts charged with some deleterious matter, to be heated by lamps, which would soon fill the air with a noxious gas that would destroy all the insects without the least degree of trouble in shifting the plants. This scheme would probably save a vast deal of labour and expence.

It is needless to observe that a degree of caution would be necessary in entering the hothouse after this operation. The sashes ought to be let down, or pushed up, and the doors thrown open to admit a free current of air before any person ventured in ; and

even afterwards a brisk fire should be lighted and the house well watered in order that a strong steam might carry off every remaining noxious effluvia.

At Dalry we never had occasion to try this experiment, for excepting a few of the scaly insects (coccus) we never had any other. The coccus is completely eradicated with soap suds and sulphur.

Constant steaming rots the blossoms of strawberries, injures succulents, as Cactus, Aloë, &c. and destroys the aroma or flavour of fruits, when too much used at, or near, their ripe state.

A mode of using steam will be detailed in next section, which the author conceives will be very advantageous.

SECT.

SECTION IV.

Of a new plan for growing Pine Apples.

OF all the different kinds of hothouses which are made in this country, pine-stoves are the most expensive, both to erect at first and manage afterwards.

There are three things which have rendered them more expensive, when first made, *viz.*

1. More furnaces, and a greater length, or more windings of flue are required than in other hothouses, in order to produce the
higher

higher degree of heat requisite for maturing the pine apple.

2. The expence of the pit for the bark in which the plants are “plunged” or inserted.

3. The expence of paved passages around the house.

The great expence which is incurred in the future management of the pine-stoves, is owing to the following causes:

1. Attendance being necessary throughout the whole year, and constant fires being requisite during three-fourths of it. These two things may be greatly lessened, but can never be fully removed.

2. The expence of the renewal of the bark in the pit; and,

3. The

3. The continual expence attending the operation of renewals, and of turning over the bark when it cools, so as to regenerate fermentation, and thus produce a fresh heat.

The original and after expence of the bark, and a considerable part of the expence of attendance in general, the author hopes will be effected by the following plan, which will answer either for altering stoves already built, or for erecting new stoves, or pine pits.

1. The general form of the hothouse is of no consequence as to this scheme. But whatever that may be, an inner roofing, &c. are supposed to be used, and the furnace built as formerly directed.

2. Convey the flue throughout the house, as is represented in plate V. fig. 1. where *a* represents

represents the furnace, above which is the shaft or chimney.

The air-flue must be continued upon the top of the flue from the furnace to *b*, where it must terminate in an opening, which may be closed or shut by a "dove-tail" iron cover, or register valve to be afterwards described: a similar opening must be made at the other end of the house, as at *c*, of the same size, and with a cover fitted to it in the same manner.

The smoke-flue need not be made above *two bricks breadth* in depth, but of considerable width, say two feet. Tyle covers of a suitable size, must be had, or stone covers will answer better where they can be economically procured.

The flue being thus finished, a large air-chamber of the breadth and length of the house, is to be formed around and above it, by flooring the whole house with pavement, or large tiles placed upon supports, as shewn
in

in fig. 2. plate VI. By this figure it will also appear, that the first turn of the flue, upon which alone the air-flue is made, has its foundation so much lower than the rest.

The house being wholly paved, a passage must next be marked off, through the middle of the house, above the openings which communicate with the air-flue, as shewn in fig. 2. plate V. This passage forms the house into two beds or pits for the plants, *viz.* *A* and *B*. In each of these above the pavement may be laid broken bricks, stones, or (in England) flints, four or six inches diameter, for six or eight inches depth, above these may be laid two inches of rough gravel,—over that one inch of coarse sand, and afterwards the soil for the plants. See these shewn in plate VI. fig 2.

The intention of these rough stones is to preserve an air-vacuity betwixt the earth in
Y
which

which the plants are placed, and the heated pavement. And the great advantage of having it formed in this way, is, that these stones and gravel, &c. will preserve the heat a much longer time, and completely prevent any danger of over-heating the roots of the pines. This will be guarded against with absolute certainty, by the current of air which will enter by holes made at equal distances, in the passage wall, as at *fff*, plate VI. fig. 1. and being rarified among these stones will pass off into the house by the upright tubes *g g g*, &c. in fig. 2. plate V.

These holes and tubes have each covers or stoppers, neatly fitted to them, the use of which will appear afterwards. Water may also be poured in at these holes, in the passage parapet, or by the tubes *g g*, which will raise a moist natural heat, (so congenial to vegetation,) and will pass out of the tubes as steam. In this way a moist heat,
equally

equally salutary with that of bark, leaves, or dung, may be had, without the least risk of producing those dangerous extremes to which these fermentable materials are liable; and without any of the trouble of renewing them, or of shifting the plants in order to stir up or augment the “*bark bed.*”

When the water is poured into the rubble stone vacuity under the plants, by shutting all the holes in the parapet, and also putting on the covers of the tubes, the steam generated would ascend through the gravel and sand into the plant-bed: And there it will be condensed among the earth and the roots of the plants, which would prove very beneficial. Even when no fire is used by pouring in water in this way, (although the precaution of shutting the hole and tubes were not taken,) it would prove of great advantage to the plants, by producing a moist “*natural*” heat in the soil.

The tubes could be left open at pleasure, and then the water poured in would fill the house with steam. Or when the house was too warm they could be shut, and then the heat would be retained, &c. So that independent of the moist and uniform heat produced in the bed by those tubes, and by the vacuity, the temperature of the air of the house could also be raised or lowered at pleasure.

There are also openings in the passage which communicate with the large chamber that surround all the flues, by opening which the whole heated air can be admitted into the house at once *

Any person capable of reflecting upon
the

* It is almost needless to add, that by pouring in water in these openings, the air given out from this large chamber will also be moist.

the subject, will perceive, that from this large air-chamber, and the large mass of mason work, which will be continually hot, three consequences will follow of the utmost importance: *viz.*

1. During the season when fires are used the temperature of the house can be raised at pleasure.

2. There can be no danger of overheating the house.

3. During the season fires are used, steam could be produced in the greatest abundance, by pouring water into the air-flue by the openings *k k* into the passage.

But should it be found that these advantages will be produced, and the author has little doubt but they will, there are others which will also result from the scheme.

The

The plants which are intended to come into fruit, in these hothouses may be planted at proper distances among the earth, without being potted. And as for some time after they were planted, the spaces betwixt them would be very wide, pine plants in pots might be plunged there, until the plants intended to remain and produce fruit, grew so large as to cover the surface. Those in pots might then be removed to hotbeds or pits, where they would remain until they were required to replace any which might have fruited, &c.

This method of placing plants in pots among these planted in the bed, will be understood by the following diagram, where o represents the plants in pots, x those planted in the bed.

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 x ○ x ○ x ○ x ○ x ○ x ○ x ○ x ○
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About six or eight months before the plants were intended to come into fruit, those in pots should be removed, and then the others would remain thus,

x x x x x x
 x x x x x x x
 x x x x x x
 x x x x x x x
 x x x x x x

Some gardeners will produce as an objection to this mode of “plunging out the plants” in the bed, that “hereby they are prevented from coming into fruit so soon as when grown in pots.” But the experience of several gardeners in England proves, that this is owing to the plants being put into an
 improper

improper foil—that is, a foil too rich, and deficient in sand. But even in a rich foil, such as one composed wholly of rotted leaves, many gardeners know that if when fruit is speedily desired, the plants have their roots cut round six inches from the stem or centre of the plant, they never fail to “shew” fruit soon after.

Another advantage, and one of no small consequence for the health and beauty of the plants, and the flavour and magnitude of the fruit is, that by using earth, in place of bark, the plants may easily be placed on a slope corresponding to that of the glass, which will bring them all equally near the light.

By having a passage in the centre of the hothouse only, in place of one around it, as shewn fig. 2. plate V. and fig. 2. plate VI. nearly *one third* more pines can be grown in an ordinary sized house.

It

This plan for a pine-stove, the author conceives will cost much less when erected, and prove afterwards more economical than any in present use. While at the same time he thinks it will produce a larger quantity of better flavoured fruit.

Besides these advantages there are several others which the author thinks would attend this mode; but these, and some minute particulars respecting it, he shall omit at present, until he finds an opportunity of putting the plan in practice. He cannot however, avoid giving it as his opinion, that if pits or hotbeds were uniformly constructed according to this mode, though in some cases it would perhaps be a little more expensive at first, yet it would succeed much better, produce healthier plants, larger and better flavoured fruit,—do away all risk and danger from extremes of heat or cold, and save much labour, time, and expence.

SECTION V.

*Of an improved pit for growing young Pines,
Cucumbers, Melons, &c. or for forcing
fruits or flowers.*

BY preserving in view the principles of the pine-stove, recommended in the preceding Section, the author presumes that a pit for growing young pines, raising cucumbers, melons, for blowing early flowers, or for any such purpose, may be made, as superior to those in common use, as it is supposed the pine-stove will be.

A

A plan and also sections of this kind of pit are given in plate VII. which are rendered clear by the letter press explanations.

It is supposed a hundred feet long, and is divided into four compartments, all of which are heated by one furnace. These divisions can be kept at the same, or of different degrees of heat, by means of the heated air collected around and near the furnace.

It will be seen in fig. 1. plate VII. that two flues proceed from the same furnace, and enter immediately into two different divisions of the pit.

The heated air collected around the furnace and flues, in these two divisions may be allowed to escape into any one of the four apartments of the pit.

This is accomplished by keeping all the different registers shut, except the one in the division in which the air is to be admitted: or, the heated air may be permit-

ted to enter into two, three, or the whole of the divisions at pleasure, by properly opening and shutting the valves.

The intention of the two flues which proceed from the furnace, is in case it should seem requisite to heat only one half of the pit at a time, or to produce an early and late crop of melons and cucumbers.

When one half of the pit only is to be heated, one of the flues must be stopped by bricks or clay, and the air registers in the cold half of the pit kept constantly shut, in order that the whole of the heated air generated, may be conveyed to the heated divisions.

When one half of the pit is to be raised much hotter than the other, as may often happen in the case of forcing different plants, or growing different exotics, one half the throat of the flue which leads to the half to be least heated, can be built up, which

which will permit only one half the quantity of smoke and heat to enter it.

By means of the air-flue and the two smoke-flues, the four divisions of the pit may very easily be kept of four different temperatures. For example, suppose that three-fourths of the smoke enters one flue, and only one-fourth the other, (from its being half closed ;) it follows, that the heat of two-divisions of the pit, must be as three, and that of the other two as one; and the same may be said of the heated air in the flues. Now, suppose all the heated air generated by three-fourths of the smoke allowed to pass into one of the hottest apartments, and all the heated air generated by one-fourth of the smoke, let off into one of the coldest apartments; it follows, that there will be four different temperatures in the pit. The first in the
 diagram

diagram below *A*, supposed equal to one; *B*, will be equal to two; *C* to three, and *D* to four.

A 1	B 2	C 3	D 4
Asparagus.	Roses and Straw- berries.	Pine Ap- ples.	Cucumbers and Melons.

And thus in a pit so constructed will one furnace serve for forcing asparagus, strawberries, roses, pine apples, cucumbers, and melons as in the above diagram.

It is almost needless to mention here, what must be understood from the improved pine-stove, and from the plate, that each of these apartments is supplied with steam and heated air from the tubes. The holes for pouring in the water which is

to produce this steam, are shewn in fig. 2. These holes are also intended occasionally to admit air, to be rarified in the vacuity, but this must be done with caution, particularly in the winter months.

The tubes which serve for occasionally admitting all the heated air contained in the lower chamber, are also seen in the plate.

The inner roofing proposed for this kind of pit, is somewhat different from that used in large hothouses. It is simply a roll of woolen cloth, as shewn fig. 7. plate VII. It is the breadth of three fathoms, and has a small round rod of wood, fixed to each end, on either of which it can be rolled up. Wires as before, are fixed under each rafter for it to slide down upon. In the evening, when the inner roofing is to be used, a ash is opened at one end, and a curtain introduced at the top of the pit, and laid upon the wires, and allowed to roll down, the operator holding the rod of one end
in

in his hand. When it has rolled out, he fixes the two ends of the rod in the iron hooks shewn by *a*, plate VII. fig. 6. he then introduces another curtain, and lets it down in same way. Thus with almost no trouble the whole may be made quite close and tight. In the morning when this roofing is to be removed, the operator goes to the top and rolls up the curtains, one by one. He may then either take them out of the pit, and lay them in a dry shed, or in the winter season, allow them to remain in the pit, as shewn by the dotted lines in fig. 6.

No overlay is required in these curtains, as the one can easily be made to project over the other. But two or three small rods should be fixed to each curtain, parallel to the end rods, which when they are rolled down, will preserve them stretched out to the proper breadth.

It is the opinion of the author, that this plan of a pit is perfectly practicable, and he thinks the advantages which it will produce
in

in saving much time, labour, and expence afterwards, and in maturing crops of fruits or early flowers, are of much importance to gentlemen who indulge in these things. He is certain, that in many places of Scotland, by substituting pits of this kind, in place of long ranges of ugly dung hotbeds, the manure saved, if judiciously formed into compost heaps with peat, (as was long ago practised in Ayrshire, and recently with great success by LORD MEADOWBANK,) would be no inconsiderable profit to several proprietors, and by producing more corn or butcher meat, of some advantage to the nation in general *.

SECT.

* For this purpose no gentleman in the neighbourhood of peat or moss, ought to allow a single cartfull of stable dung to be made into hotbeds. Nor indeed to be used in any way whatever, until it has changed or decomposed a proper proportion of peat into manure. Gardeners may no doubt cry out for manure to the garden, but let them be told, that they can have this in equal abundance from the "*Meadowbank middens.*" They will have no occasion to

SECTION VI.

Of an improved Peach-house.

WHAT has been submitted in the two preceding sections, though founded upon facts, may be considered as in a certain degree, theoretical. The plan to be recommended here, as an improved mode of growing peaches, is founded upon experience.

Every one knows that these trees are always "trained" upon a wall or trellis. The
practice

complain on other accounts, as he will soon find his labour greatly lessened by the kind of pits recommended, which he may make of any dimensions, or raise to any temperature, to suit his purpose.

practice of training trees upon walls or espaliers, in the open air, originated from a deficiency in our climate. By training and fastening the branches, the trees were preserved from violent winds, and when this was done on walls, the additional heat produced by the reflection of the sun was considerable. Some may be disposed to add as another advantage of training, that the branches and fruit are thereby uniformly exposed to the sun. But this is not true, for only one side of the tree and fruit is fully exposed; and, as this is completely unnatural to all trees *, it cannot be any benefit, but undoubtedly an injury.

It is certain, that in situations much exposed to the wind, fruit is never so much shaken from espaliers, as from stand-

A a 2

ard

* Ivy, and one or two others excepted; and here it takes place only with the stem and leaves, the fruit being small and in a *corymbus*, is exposed alike on all sides.

ard fruit trees: And it is equally certain, that peaches, nectarines, and apricots, cannot be matured in the open air of our island, unless trained upon walls. But it may be seen by any one who shall attend to the subject, and it can be proven from known facts in the vegetable economy, that in gardens tolerably sheltered, all fruit trees, at least apples, pears, and cherries, always produce the greatest quantity, and the best flavoured fruit, when left to assume their natural shape; with no more pruning than what is necessary to admit the sun and air among their branches. It must follow from this fact, as well as from what has been already alluded to,—the general economy* of vegetables,—that peaches, nectarines, and other tender sorts of fruit trees, could we plant them in a suitable climate, must prosper

* See the chapter on ventilation and giving air, and also Mr KNIGHT's late experiments recorded in the Phil. Transactions.

per much better when left to assume their natural shape, than when bound or fastened.

One principal intention of placing vegetables in glass houses is, that they may enjoy their natural climate, and why they are not also allowed to enjoy their natural freedom, can only be accounted for, by adverting to the deficiency of observation and reflection, in those men who generally have the direction of gentlemen in matters of this kind *.

When

* It is tiresome to observe the errors that men fall into, and the immense labour, difficulty and uncertainty, with which they think or reason upon any subject, when they do not advert to nature. I think I may venture to say, that there are few arts or sciences, and but few topics in each of them, but what we have a precedent for, in nature. And could men at their first outset in any subject, look boldly through the opinions, or works, of those who have gone before them, to nature herself, there can be no doubt that their ideas would be wonderfully enlarged, and that they would receive more light upon the subject by a few hours reflection, than those who may have devoted a whole life time to the trial of experiments, which, though some of them might agree, with—yet the greater part were perhaps at variance with her laws.

When the late Mr JOHN MAWER of Dalry, designed his own hothouses, it happened from a particular circumstance in forming them into a range, that two large spaces were left betwixt the pine-stoves and the narrow peach-houses. As these spaces were more easily connected with the peach-houses than with the pine-stoves, it was thought they could be most economically occupied as part of the former. But as there was no back wall in these spaces, there was no way of growing the trees except as standards. Standard peaches therefore were planted two trees in each space which grew rapidly. To compare them minutely with the trees planted against the walls, in the other part of the house is needless. It shall only be observed, that at Mr MAWER's death, both the wall and standard trees had been six years planted ; the former were pruned and otherwise treated in the usual mode, and bore ordinary crops of fruit, some years, few,

in

in others a considerable quantity. The latter never had one twig cut from them, and every year bore a double proportion of more beautiful, larger sized, and better flavoured fruit, than those of the others.

A double crop of fruit, and much less expence of management (for training and pruning are tedious and expensive operations) are certainly advantages which deserve serious attention; whatever may be the circumstances which produce the overplus. But when the cause assigned for this fact agrees so well with what happens in standard and espalier apples, and with the general economy of nature, it ought (and it cannot fail,) to convince every one capable of reflecting on the subject, of the great superiority of the plan recommended. And consequently, that peaches, nectarines, &c. when grown under glafs, should not be trained either upon the walls, trellis, or espaliers; but should be planted as standards, and left
to

to assume their natural shape and modes of growth.

Supposing this granted, some hints shall now be subjoined respecting the form of a house most proper for this purpose.

The first thing requisite is, that the house shall be glass on all sides, in order to admit light to every side of the trees.

That this may be best effected it follows, that it should be made of an oblong form, and placed south and north; and that the trees should be planted along the middle of the house.

The next thing is, that the side or upright glasses should be made as high as possible, in order that the trees may not be cramped or compressed.

This naturally reminds us, that the house should be of a considerable height, at least twelve or fourteen feet.

In order that no ground in the house be lost, it seems preferable to plant dwarf-trees
that

that they may fill the house with branches, regularly from the ground to the roof.

No vines should be planted against the rafters in this house, but they may be planted near the columns, and trained around them to their tops, where they may be left in a great measure to themselves, and in the progress of their growth they will hang down obliquely, and stretch across among the branches of the trees, forming curious and diversified festoons of grapes and peaches, and producing more fruit than if neatly trained in straight lines, upon a wall or trellis.

I cannot avoid mentioning here, my utter disapprobation of the common mode of training vines, by fixing all their shoots in straight lines; it is just as unnatural as it would be, if a gardener were to insert a plant of ivy in a park

B b and

and endeavour to train it up as a single tree. A single glance at a vine plant, not to mention what we know of its habits when in a wild state, will shew that nature never intended it to grow in a straight direction. Every gentleman in Scotland, (for in England it is better known,) ought to cause his vines be trained crooked, or in a serpentine direction. This will make them spring at, and send out shoots, from every eye, and produce double crops of fruit every year. See *Forfyth on fruit trees*.

The plan for a peach house given in plate VIII. may be placed either with one end against a wall, or made a detached house (as in the plates,) in any part of a garden, or orchard. In this last case the furnace can be concealed under ground, and the shaft or chimney either carried up in a small plate iron column, as in the plate,

or

or in a flue under ground, to the garden wall, or some concealed spot.

It may be worth while to remark, that when the flue is carried under ground, a vacuity must be formed around it, in order to prevent the bad effects of the damp or moisture of the ground, from retarding the draught of the fire.

But though this particular form be recommended as the best construction of a peach-house upon the principle contended for, yet houses may be made much in the ordinary way, and the trees grown as standards with an effect, it is presumed (and indeed it is certain, as the peach-houses at Dalry, where the standards succeeded so well, were placed against a wall, and were also greatly shaded by the pine-stoves)—much superior to the common mode of training a trellis.

The principal thing to be attended to in
this

this case is, to make the upright glass of considerable height, and the house not of great breadth.

A section of such a house is given in plate IX. fig. 4. ; vines are shewn trained upon a trellis placed against the back wall. A plan agreeable to this section, is easily contrived.

It may farther be observed, that standard peaches may be grown in the ordinary kind of peach-houses ; or, indeed in any kind of hothouse, by planting dwarfs, and as they grow up directing their branches in such a way as they may not come much in contact with the glass. A thing more or less necessary in every construction of a house for growing standards, and which even requires to be done when trees are trained upon a trellis. A section of a house altered in this way is given plate IX. fig. 5.

SECTION VI.

Of architectural decorations in bothouses.

IN Architecture which, is intended to please the appearance of solidity and strength are essentially requisite. For this purpose it is a rule with architects, that openings be made above one another, and that every solid appear of sufficient magnitude to support the superincumbent parts of the edifice. When openings are very numerous in one part of a building, and when another part adjoining seen at the same time, contains very few, it
never

never fails to displease. If the heavy part be uppermost, it appears to crush down that which is below; and, if the light and open part be uppermost, it appears disproportionate to the rest and trifling. Hence it is that mason work can seldom be allowed to appear in the elevation of hothouses; and thus old fashioned greenhouses, with stone columns, and a stone parapet above, generally, if not always, look heavy and displeasing. Old greenhouses with wooden columns and a slated roof, as well as modern glasshouses, when the back wall against which they are built appears above them, look exceedingly ill. Custom cannot reconcile us to this effect, tho' we are certain that no part of the wall bears any weight upon the glass. Even the stone coping when seen projecting over the glass, is exceedingly ugly. The modern mode of carrying up summerhouses above hothouses, as at Prestonhall in Scotland, and

Heythrope

Heythropes in England, in the opinion of the author at least, have a very bad effect in scenery; besides their incongruity when considered as overlooking the kitchen garden; which certainly like the kitchen itself is not an object intended for beauty. Mason work in hothouses displeases also in another point of view. Every one knows that their use is to grow vegetables, and none are so ignorant, as not to be aware, that plenty of light is essentially requisite to produce fruit and flowers in perfection. Slate roofs then, thick stone columns, or dead walls, tend to exclude this fluid, and of course to frustrate the end in view.

Thus it appears, that in hothouses, every thing in the elevation which has a heavy appearance, or tends to exclude the light, in some degree frustrates their utility, displeases the eye, and consequently ought to be avoided.

For

For this purpose a good general rule may be,

1. To let no mason work be seen above the level of any part of the glafs.
2. That the whole of the roof be glafs ; and,
3. That the wooden workmanship be made as light as possible.

And it may be observed, that this effect will be most perfect, when they are totally unconnected with any wall or stone building, but merely raised upon a level surface, built on all sides with glafs, and roofed with the same material.

Circular columns, are inadmissible in the sides of hothouses; because they are unfuitable for sashes or panes to slide in, and because they throw more shadow than square ones. In all cases square pillars are best; where they require to be broad, they may be painted

ed green and covered with virgin's bower. Passiflora or some such shrub. When so narrow as not properly to admit of being covered with foliage, they may be painted the general colour of the wood work, which in all cases ought to be a yellowish white or cream colour. In hothouses erected merely for the purpose of utility, such as vineries, peach-houses, &c. the workmanship should be plain, neat, and substantial; in those designed for ornamental productions, such as the greenhouse, exotic stove, &c. elegance should be added. The mouldings, &c. may be more numerous, and delicate, and every thing else in a correspondence. The colour of the walls and flues should be brown or of oaker yellow, the stage in the greenhouse, and all the inside work, except the roof and sides, will have the best effect in one of these colours, particularly under brown. The rafters, pillars, and walls, in the inside of ornamental hothouses should

C c

always

always be covered with exotics. Many beautiful species of which are suitable for this purpose, such as the Passiflora, Morinda, Jasmine, &c. Externally, they should be painted of a cream colour, or yellowish white.



CONCLUSION.

THREE objects have been kept in view in the foregoing pages:

The *first* of them was to give such a description of the alterations made upon DICKSONS' AND SHADE'S hothouse, as would enable practical men, to make the same improvements,

provements upon others, or to build new hothouses agreeable to this plan.

The *second* object was to give a short treatise upon the nature and effects of these improvements, that ingenious gentlemen might understand the principles upon which they operate: And,

The *third* object was to suggest improvements of another kind in hothouses,—and those chiefly in the construction of pinneries, peach-houses, and pits.

With respect to the first object the author observes with much pleasure, that he has every reason to believe, the improvements which he has made, will become general. In regard to the second and last, he will be happy if any thing which he has written shall contribute to enlarge the ideas of hot-house builders and gardeners; and hence either

ther directly or indirectly, to the advancement of the art, and the benefit of gentlemen, who indulge in this amusing and rational luxury.



EXPLANATION

OF THE

PLATES.

E X P L A N A T I O N

OF THE

P L A T E S.

P L A T E I.

FIG. I.

Loudon's improved Hothouse Furnace.

- a* THE opening in each side, which communicates with the air vacuity.
- b* The inner furnace door---9 inches square.
- c* Valve in the outer furnace door for admitting cool air to be heated upon
the

the inner furnace door, and in the vacuity around the fuel-chamber, &c.

d Handle, which opens, shuts, and fastens, both doors at once.

e e " Nobbs," which are for the purpose of fixing the furnace more securely in masonry work *

FIG.

* There is a beautiful variety through all nature, which a person of a contemplative mind is ever admiring. This variety in the animal as well as in the vegetable kingdom, is mightily supported by contrasts or oppositions. The meadow walk at Edinburgh, is shadowed by a row of stately beeches, and though those trees when planted at regular distances are all very much of a shape, yet each of these, are so different from one another, that a person might spend in a most agreeable manner, a very long time in observing their several forms and varied hues of green. In walking along the promenade and examining each tree, how much is the beauty of the whole heightened, when near one end of the row, there suddenly appears, an old shattered trunk with its branches greatly scathed,
and

• FIG. II.

Asb-pit door to Loudon's Hothouse Furnace.

a The valve.

b The handle.

c Part of the frame on which the door is hinged, turned inwards and hooked at the extremities in order that it may be fixed more securely in the mason work.

FIG.

and curtailed.————— I have already said that during the time the alterations were making upon Dicksons and Shade's hothouse, I had been much amused with variety of opinions,—by hearing the workmen relate what some planners and others, purposed as improvements. When the alterations were proven to be of importance, and had in some measure attracted public attention, the author was again amused by reports of what some would call a worse kind. But what a fund of entertainment did he partake of, when after these varied efforts to *skatb* or

blast

FIG. III.

*Ground plan of the Fuel-chamber, Air-vacuity,
and part of the Flue.*

a The fuel-chamber.

b Furnace door.

c Recess for preserving *live fuel*.

d d Bottom of smoke-flue.

b b Vacuity around the fuel-chamber, and part of the flue communicating also with the furnace door.

FIG.

blast, a "landscape gardener" who happened to be getting some common furnaces made, pleased with the one recommended and sold at the foundry, quietly copied (as the Edinburgh Foundry people told me,) one part of it after another, until at last he produced a furnace almost an exact copy of that in the plate. This person affords like the decaying trunk, a strong contrast to the rest of his profession—and like it must strikingly affect the attentive observer, or moral painter.

FIG. IV.

Vertical section of the fuel-chamber, supposing it finished, and cut through in the direction a...b, fig. 3.

- a* The ash-pit.
- b* Bars of the furnace grate.
- c* Upright rise of the flue above the recess, for preserving the live coals, see *m...n*, fig. 5.
- d* Throat of the smoke-flue.
- e* Arch over the fuel-chamber.
- f* Air vacuity.
- g* A brick seen projecting down in order to support the upper arch.
- b* Mass of bricks around the whole, being part of the wall of the hothouse, as may be seen by the dotted line *a b*, in fig. 3.

FIG. V.

Longitudinal section of the furnace, and part of the smoke-flue, supposing them finished and cut down in the direction of e...f, fig. 3.

a Space betwixt the outer and inner furnace doors, in which the hole that communicates with the air vacuity is seen.

b Fuel-chamber.

c Recess for live-fuel.

d Grate.

e Ash-pit.

ff Handles of furnace and ash-pit door.

i and *g* Vacuity for heated air under the "recess" and part of the smoke-flue.

b b Smoke-flue, five bricks breadth in depth.

z Air-vacuity above the fuel-chamber.

k Contraction of this vacuity, immediately before the air-flue commences.

l l The air-flue.

o o Sole

- o o* Sole of the furnace and flue.
- pp* Supports of the flue.
- q* Bottom of the smoke-flue
- r* Covers of ditto, which serve also for the bottom of the air-flue.
- f* Covers of the air-flue.

FIG. VI.

Section of the smoke-flue and air-chamber surrounding it, supposing them finished and cut through in the direction shewn by the dotted line c....d, in figures 3. and 5.

- a* The smoke-flue.
- b* The air vacuity and flue.

The scale shews the form and the dimensions of the bricks supposed to be used in building the furnace, flues, &c.

- 1 Is the end of a common brick.
- 2 The edge of ditto.
- 3 The face or breadth of ditto.

4 The

- 4 The end of a common flooring or pavement tyle.
- 5 The surface of ditto.
- 6 The side and the front of a large tyle cover, supposed made on purpose for covering that part of the air-flue, which from being continued on each side of the smoke-flue, is broader than the other parts. Where the air-flue is continued above the smoke-flue only, common tyles, as No. 5. will answer.

In Scotland pavement will generally be had as conveniently as tyle of this size. In England the tyle covers, will be most economical.

PLATE

Fig. 1.

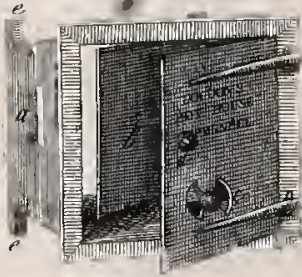


Fig. 2.

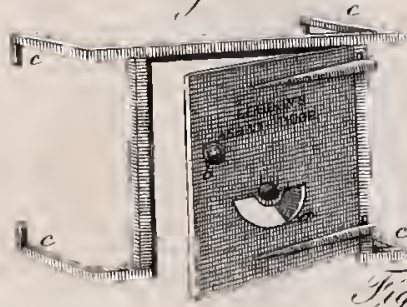


Fig. 3.

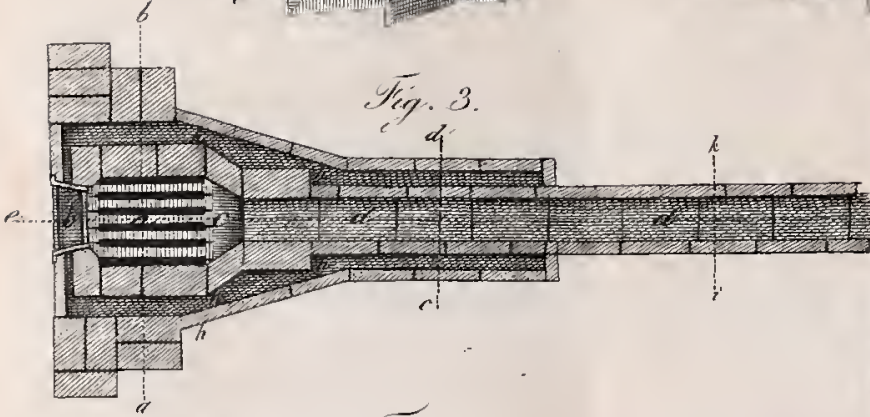


Fig. 4.



Fig. 5.

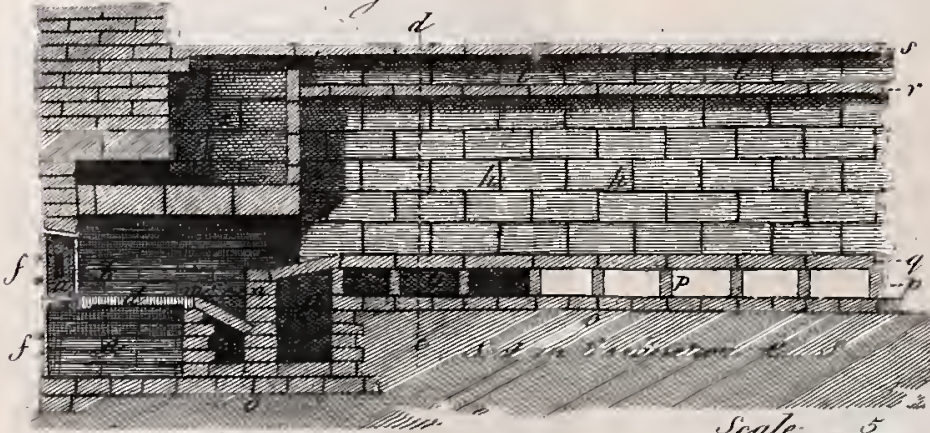
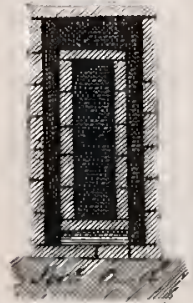
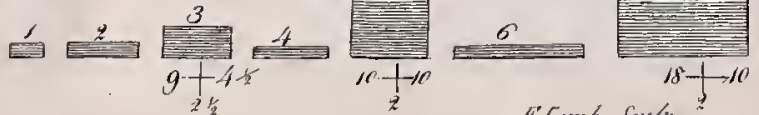


Fig. 6.



Scale



J. Lottem. Del.

F. Lamb. Sculp.

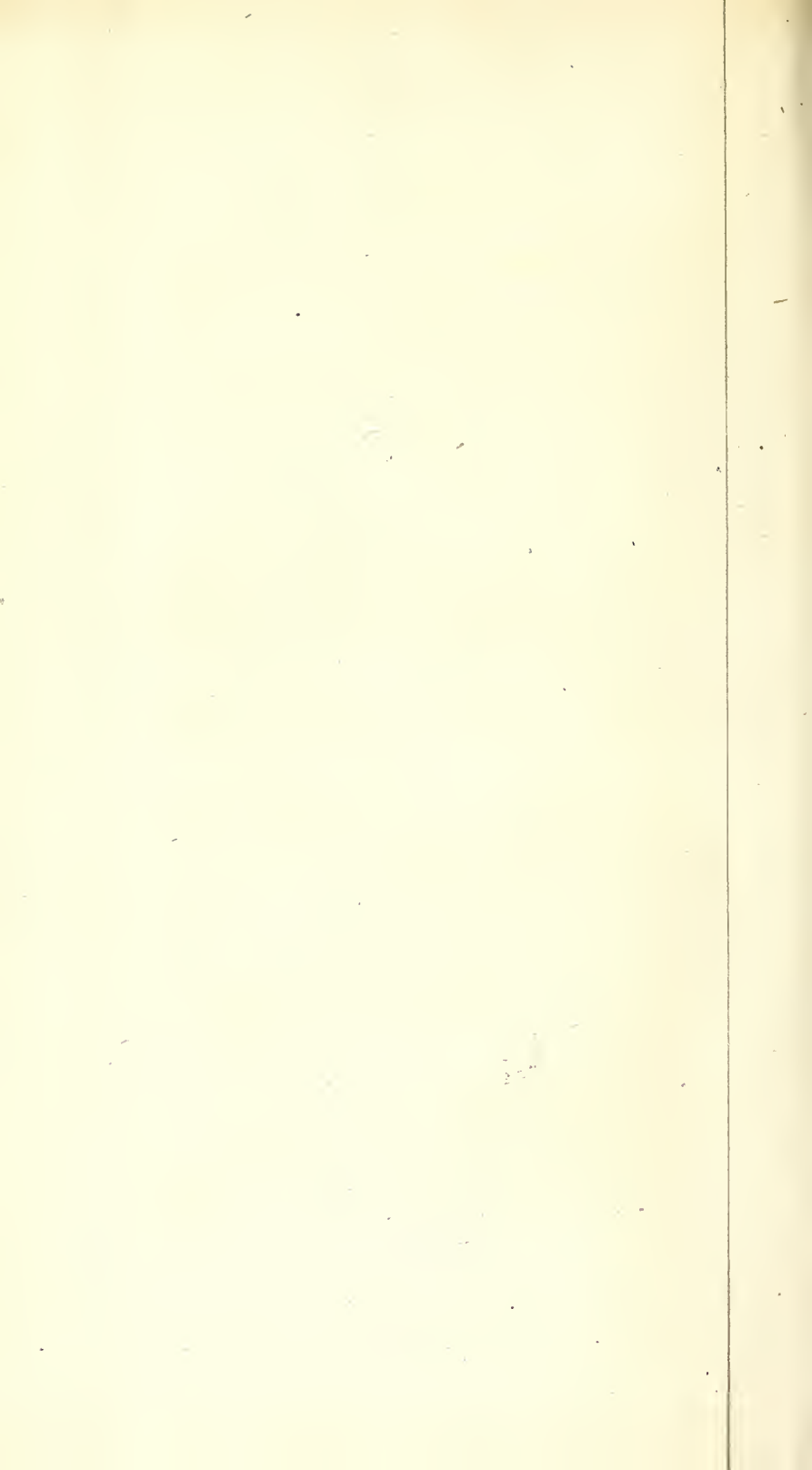


PLATE II.

FIG. I.

*Longitudinal section of the smoke and air flue
as erected in Dicksons' and Shade's hothouse
shewing principally,*

A A THE " briggs" or partitions in the
smoke-flue.

B B The air-flue.

a Sole of the flue, being bricks laid flat.

b Supports of the flues (being bricks set on
edge.)

c Sole of the flue being ordinary tyle covers.

d End of the smoke-flue being bricks on
edge.

e Cover of the smoke-flue.

f Intended to shew heated air coming out
of the air-flue. Here, however it would
be

be better to fix one of the registers described in plate VI, as they would answer better for regulating the quantity of heated air admitted into the house.

FIG. II.

Section of the smoke-flue, and air-flue, supposing them cut across at the dotted line i....k in fig. 3. plate I.

- a* The sole.
- b* The supports.
- c* The smoke-flue.
- d* The air-flue.

FIG. III.

A section intended to shew the manner in which the briggs, or partitions, are formed in wide flues; and also how the heated air may be conducted in an earthen pipe in certain circumstances. See pages 34 and 35.

a Section of the earthen pipe.

b Briggs

b Brigg or partition.

c Hole under it for the smoke to pass through.

d Supports of the flue.

The covers and sole of this flue are supposed to be made of large brick or stone pavement.

FIG. IV.

View of the air pump used in Dicksons and Shade's hotbouse.

a The piston or sucker, with its valve for drawing in cool air.

d The valve for allowing this air to enter the house.

f One of the sides of the pump taken off, in order to shew its internal structure.

e Handle of the pump.

E e

FIG.

FIG 5.

Longitudinal section of a broad shallow flue, showing the best way of constructing the partitions.

- a* The brigg or partition which comes down to the level of the sole of the flue.
- b* A recess, made in order that the smoke may pass under the partition.
- c* Air-flue.
- d* Pipes for conducting the heated air.
- e* Supports of the whole.
- f f* Smoke-flue.

FIG. 6.

Section or end of part of a hot-house supposed to be altered according to the new plan, and having the air bellows.

- a* The handle of the bellows.
- b* The tube which leads the air to the house.
- c* The

- c* The termination of this tube where the air enters the house.
- d* Section of the inner roofing.
- i* The wire upon which the curtains which compose it roll down.
- f* The cord by which they are fastened.
- g* The usual mode of coping the walls of hothouses.

PLATE

PLATE III.

FIG. 1.

A view of one whole curtain, and part of a second mounted with rings, &c. according to the first mode of fixing up the inner roofing.

a a The overlay.

b b Rings fixed to the edge of the overlay.

c c Hooks on which the rings are put when the curtains are let down in order to keep them close.

d d Cord

Fig. 1.

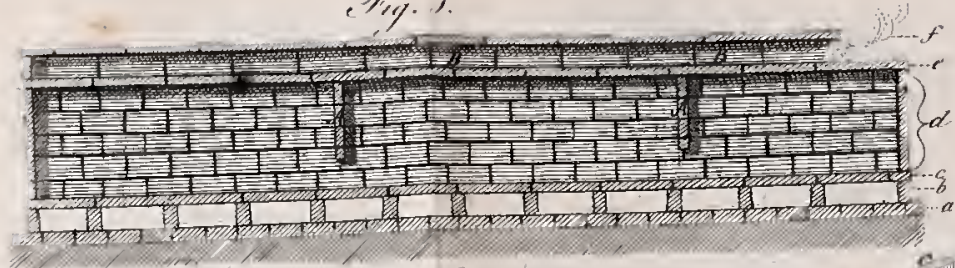


Fig. 2.

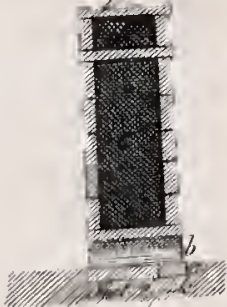


Fig. 3.

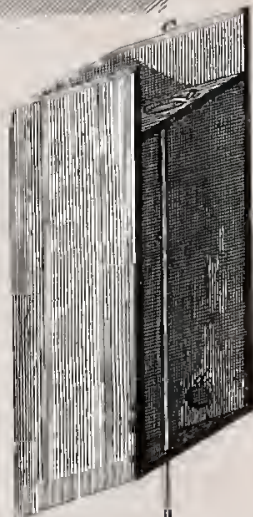


Fig. 4.

Fig. 5.

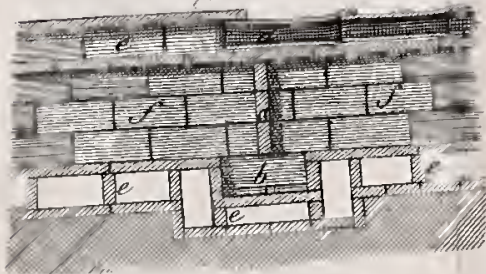
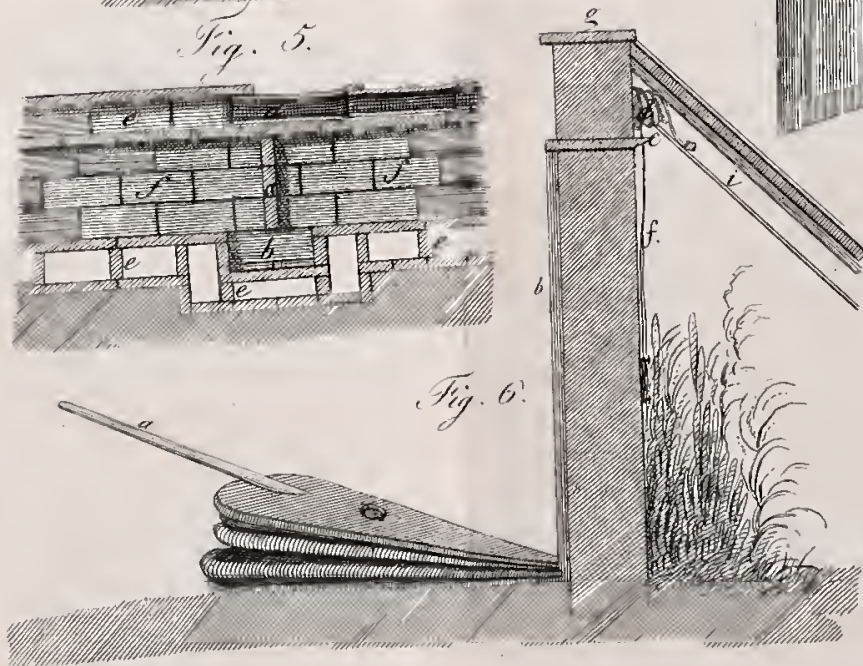


Fig. 6.



d d Cord for pulling up and letting down the curtains.

e e Rod fixed to the lower end of the curtain.

ff End of the curtain to be fixed to the top of the hothouse.

FIG. II.

Section or end view of a hothouse shewing the appearance which this first kind of curtain will have when let down.

a The curtain the rings of which are seen.

b The cord which serves for drawing it up.

c The wire upon which it is supported.

d The hook upon which the cord of the curtain is fixed.

e Dotted lines shewing the appearance which the curtain will have when tucked up, as more clearly shewn fig. 6. plate III.

ff Back wall coped with stone in the usual manner.

FIG. III.

Form of curtain suitable for composing an inner roofing to a circular house.

a b c The three pieces which compose the curtain.

d d The overlay with the rings, &c. as before.

e e e Jointed rods which are for the purpose of stretching the curtain to the proper breadth when it is drawn up.

f Ring at the top of curtain, to which is fixed the cord used for drawing it up. This kind of curtain being supposed to be placed at the bottom of the upright glass.

g The rings and cord for drawing down and tucking up the curtain, which pass through a hole at the bottom, and not at the top, as in fig. 1.

FIG.

FIG. 4.

A section shewing the appearance this last curtain will have when tucked or folded up.

a The bottom of the front glass or front-wall.

b The curtain folded as it remains upon the front parapet at the bottom of the upright glass until it is drawn up.

c The wire upon which it is drawn up.

e A pulley, over which is put the cord used to draw up and let down the curtain.

f The cord which is passed over the pulley.

PLATE IV.

FIG. I.

A view of part of a house with the inner roofing put up, according to the mode of fixing the curtains upon rollers.

- a a* Copping of the wall.
b b Rafters of the house.
c Lower curtain which is first rolled down.
d d Upper curtains which are afterwards let down, and which overlay the others—without the assistance of rings, hooks, &c. as in the first kind.
e End curtain which is rolled outwards, &c.
f Rack pullies for letting down or rolling up the curtains—fixed only at one end of each wall.

g Level

Fig. 1.

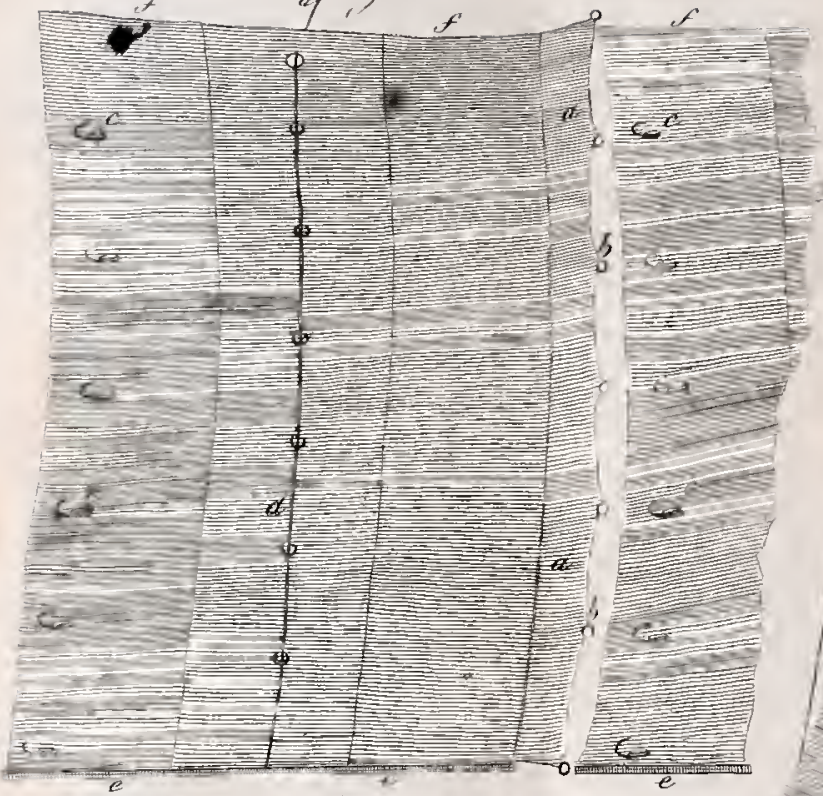


Fig. 1.

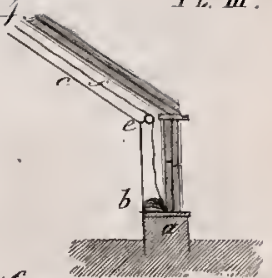


Fig. 2.

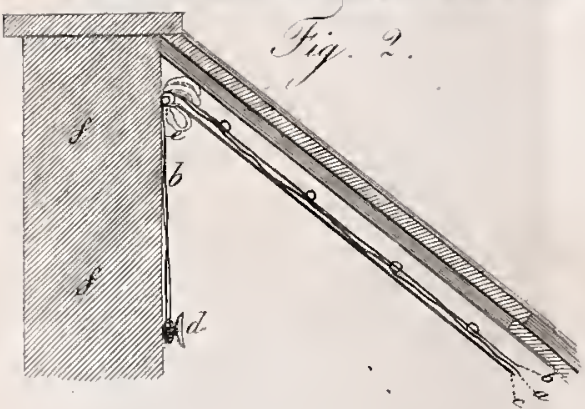
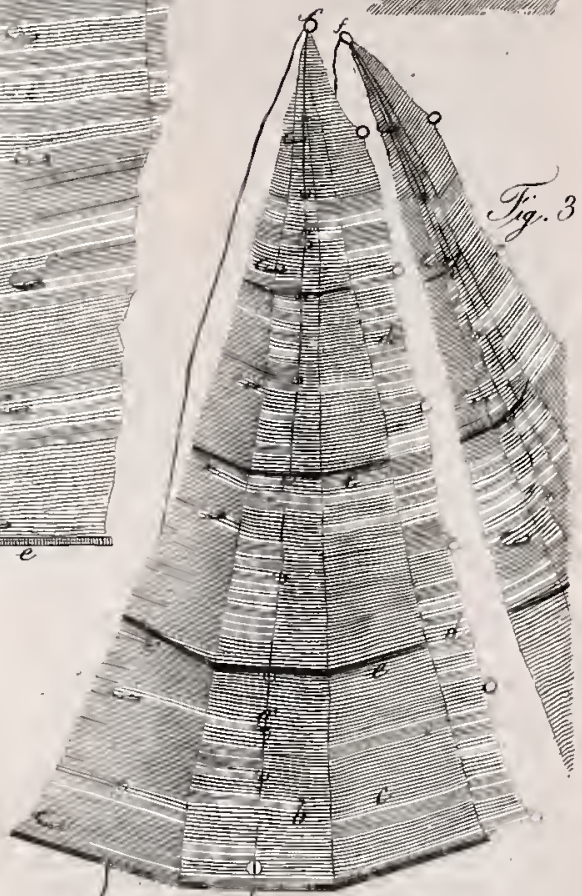


Fig. 3.



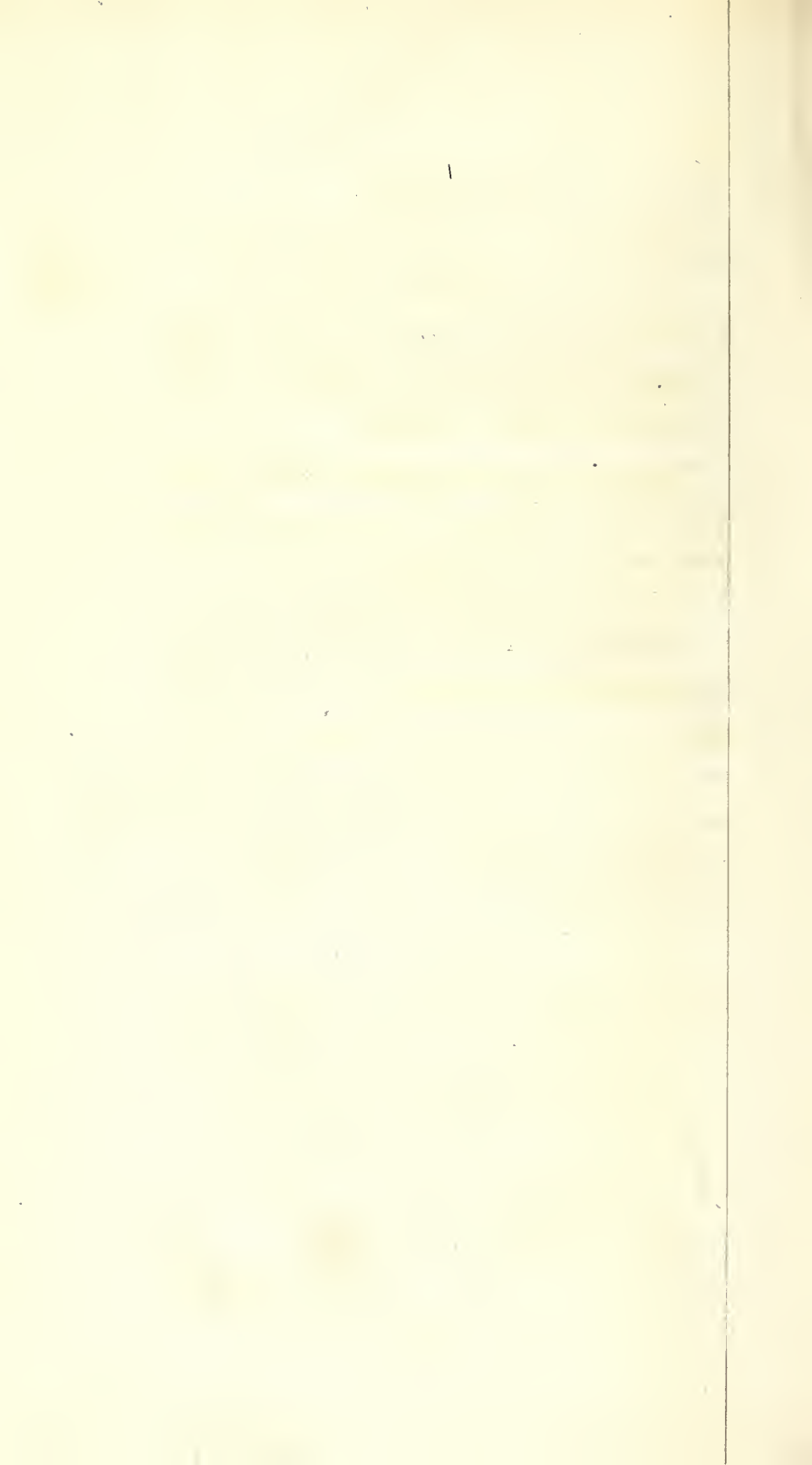


FIG. II.

Shews the manner in which the cord is passed round the pully on the end of the roller, and the rack-pully upon the wall.

This kind of curtain ought to roll down from above as shewn at *e*, fig. 3; and not from below, as in this figure.

If from the description in Chap. VI. Sect. 1. and these two figures, this mode of fixing the inner roofing should appear intricate, which it may do to some who are not acquainted with these things, the author can only refer to the model, which none can be at a loss to understand.

FIG. III.

Section of a vinery supposed to be built according to the proposed plan.---A vinery of this kind is at present constructing at --- Smith's, Esq: Leith Walk, under the author's direction.

A The front flue, made broad and shallow, suited to this situation.

F f

b The

- B* The back flue deep and narrow agreeable to its situation.
- c* Partition seen in this flue.
- d* Dotted lines shewing where the air bellows is placed.
- e* End of the curtain.
- f* Rack pully.
- g* End of the rod of wood which is attached to the curtain.
- b* Wire upon which it slides down.
- i* Trellis on which the vines are trained.
- l l* Upright rods of wood or iron, each being one inch broad, and $\frac{1}{4}$ of an inch thick, to support the wire trellis, and the wire upon which the curtain slides; these rods are fixed to a stone or board at bottom, and joined together at the top. They are also fixed to the rafters at the top, but this only betwixt each curtain, for otherways these fixtures would interrupt the rolling down of the curtain. In this way they only interrupt the hooking on the overlay which

can be prevented by making a slit in it, opposite to the fixture.

- l* A small piece of iron under each rafter which serves to fix the trellis and wires to the back wall.
- m* Upright rafter, placed upon the front parapet.
- n* The sloping rafters.
- o* Mode of coping by lead and slate, by which are joined the roofs of the hot-house and backshed, approved of by the author, as more ornamental and durable.
- p* Water spout continued along the front of the ouse.
- q* Dotted lines in the back wall, shewing how the chimney is carried up.

PLATE V.

THIS PLATE AND PLATE VI. CONTAINS PLANS
AND SECTIONS OF A PINE STOVE UPON A NEW
PRINCIPLE.

FIG. 1.

*The ground or foundation plan of the walls and
flues.*

A Back wall.

B Front wall.

C End walls.

D Flues.

E Back shed.

a Furnace.

c Termination of the side vacuity.

b Termination of the top vacuity or air-flue.

FIG.

Fig. 1.

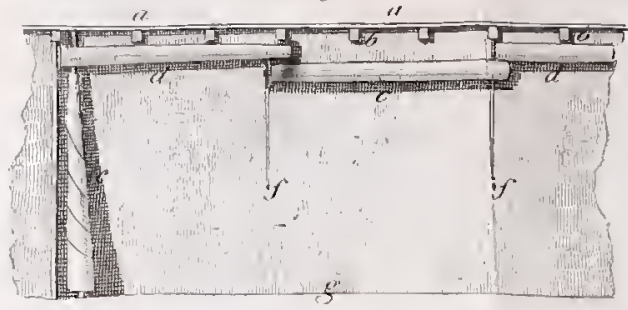


Fig. 2.

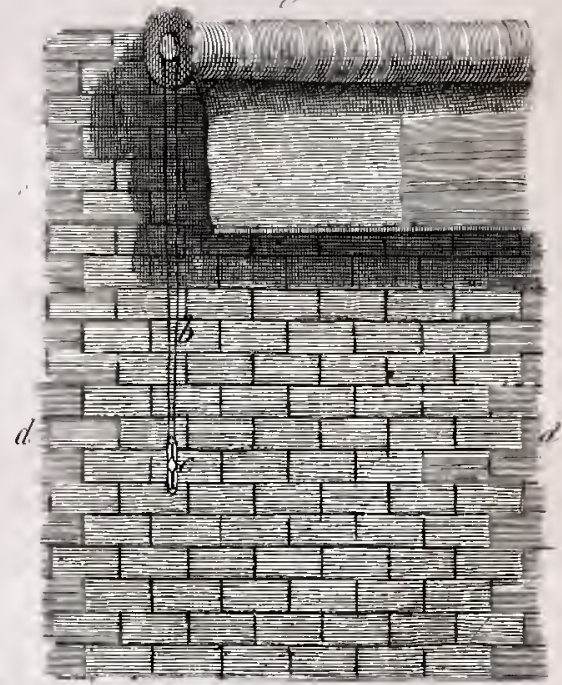


Fig. 3.

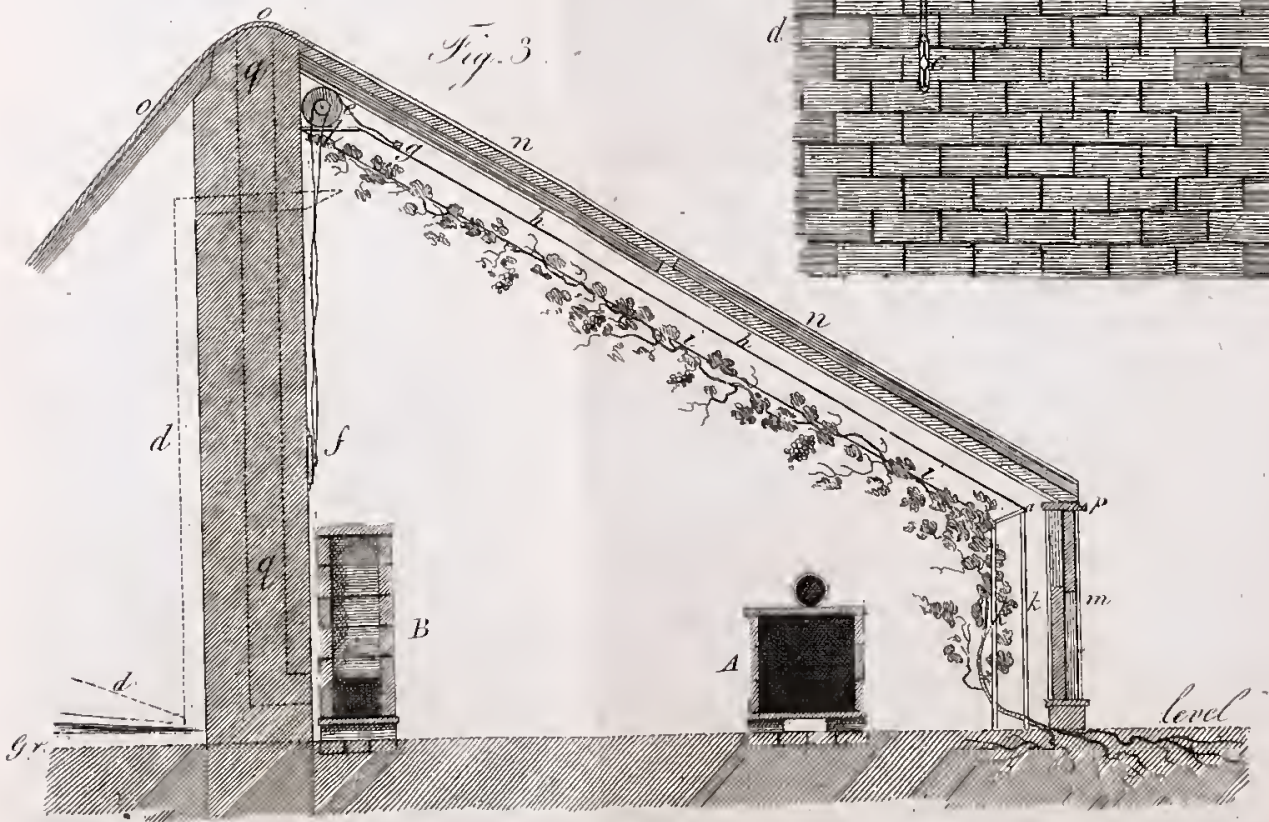


FIG. II.

Surface plan supposing the house cut over by the line a...b, in plate VI. fig. 2.

A and B Two pine pits.

a...b Passage through the centre of the house.

D A vine introduced from behind intended to cover the back wall. Vines may also be introduced at the two front corners to run up the fashes.

g g Air or steam tubes.

K K Registers or valves for admitting heated air either from the air-flue, or from the large vacuity under the pit, or for pouring in water to cover the surface of the whole pit, or to cover the surface of the air-flue, and thus to produce either steam or moist heat in abundance.

f The situation of holes made in the parapets for pouring in water to the rubble stone vacuity under the bed of earth, see B. fig. 2. plate VI.

PLATE VI.


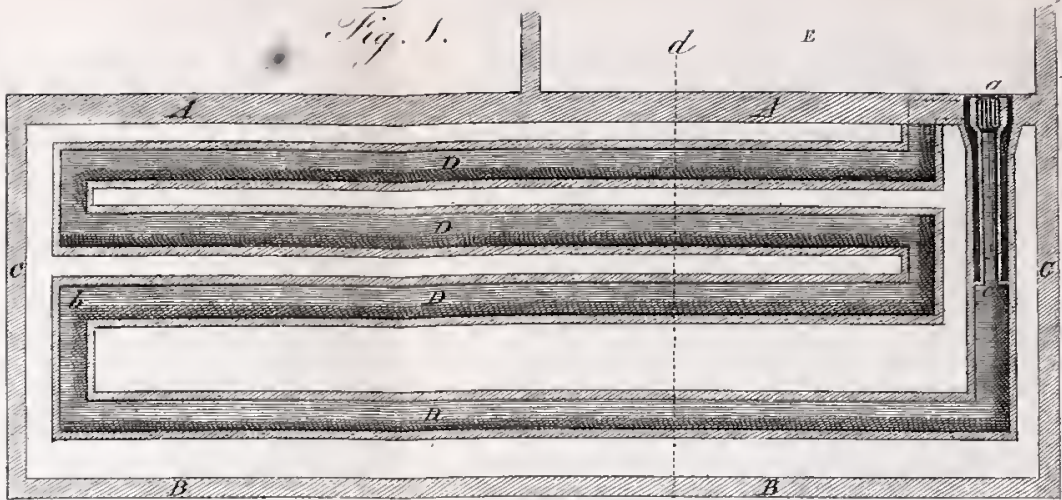


FIG. 1.

*Longitudinal Section of Figures 1 and 2 in
Plate V. according to the line a...b, fig. 2.*

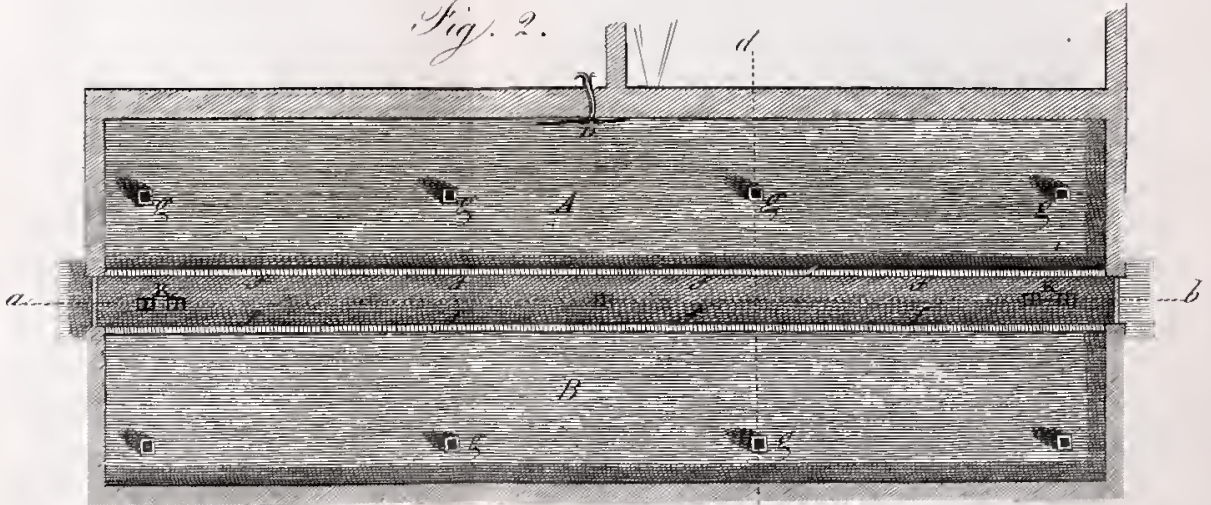
- a* Doors at the ends.
- b* Smoke-flue.
- c* Supports of ditto.
- d* Supports of passage-pavement.
- e* The communication of the air-flue with
the registers, *K K*, in fig. 2. plate V.
- f* Holes

Fig. 1.



Ground Plan c

Fig. 2.

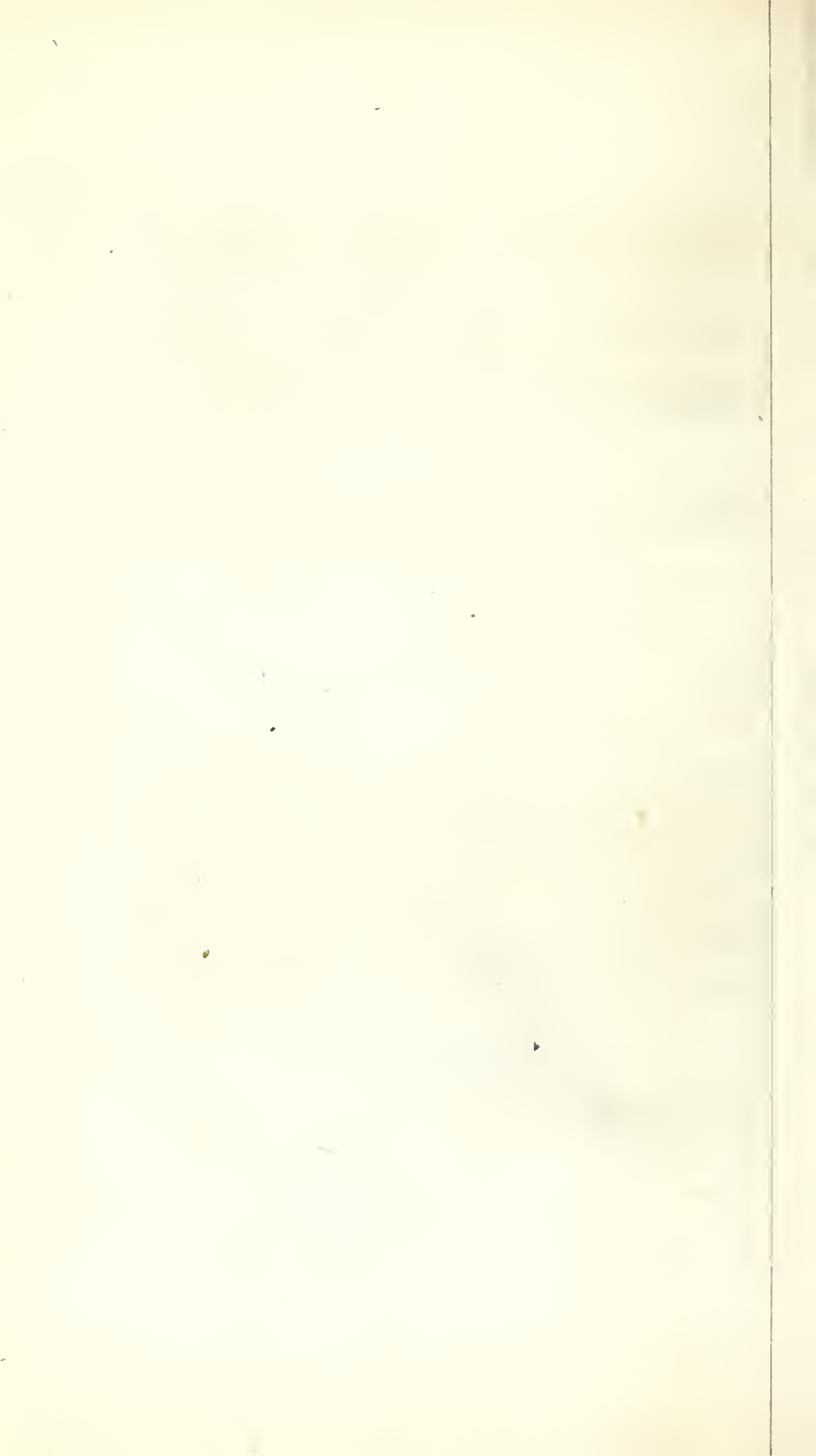


Horizontal Section a-b. Pl. VI. Fig. 2.



J. London Del.

F. Lamb Sculp.



- f* Holes in the wall of the pit for pouring
in water, &c.
- g* End walls.
- b b* Ground level.

FIG. II.

*Transverse Section of fig. 2. plate V. upon a
larger scale.*

- A* Passage through the house.
- B* Ruble stone vacuity.
- C* Earth in which the plants are inserted,
either in pots or otherwise.
- D* Air and steam tubes.
- E* Curtain of the inner roofing.
- F* Rack-pully for ditto. Here also may be
fixed the hooks for fastening the cords
used to pull up or let down the glass
sashes.
- F* Back shed.

G A

- G* A space which may be made an excellent
Mufhrom-bed.
- H* Vacuities around the flues.
- I* Air-flue.
- K* Smoke-flue.
- L* A row of bricks to preserve water over
the whole furface of this chamber, when
it is poured in for the purpose of creating
moift heat, &c.
- M* Dotted lines fhewing the direction of
the shaft or chimney.
- N* Dotted line fhewing the manner in which
the damper is placed.
- O* The author's mode of coping and roofing
hothoufes and backfheds.
- P* Spout for collecting water from the roof.
- Q* Ground level.

FIG. III.

Is a fection of a fmall mafs of mafon
work, containing a circular hole in the
centre

centre, which hole contains two pipes or tubes, one within another. The inner one is for conducting hot air, and the outer cool air, and the space without the outer one is to preserve air stagnated, in order that as little heat as possible may be lost. See a full explanation, Chap. XI. Sect. 2. page 150.

FIG. IV.

Is a perspective view of the carron register or valve for regulating the heated air from the flue, which may be had at the Edinburgh Foundry, Edinburgh, or at Mr DALZIEL's, Cabinet-Maker, Chapel-Street, Bedford-Row, London, along with the furnace, ash-pit door, and damper.

PLATE VII.

PLAN AND SECTIONS OF A PIT UPON A NEW
CONSTRUCTION.

FIG. I.

Ground Plan.

a Front wall.

b Back wall.

c Flues.

d Supports of the pavement, above which is
placed the *rubble stone*, and then the *earth*, &c.

e Furnace.

f Steps

Fig. 1.



Sect a-b Fig. 2 Pl. V.

Fig. 3.

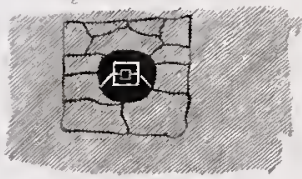
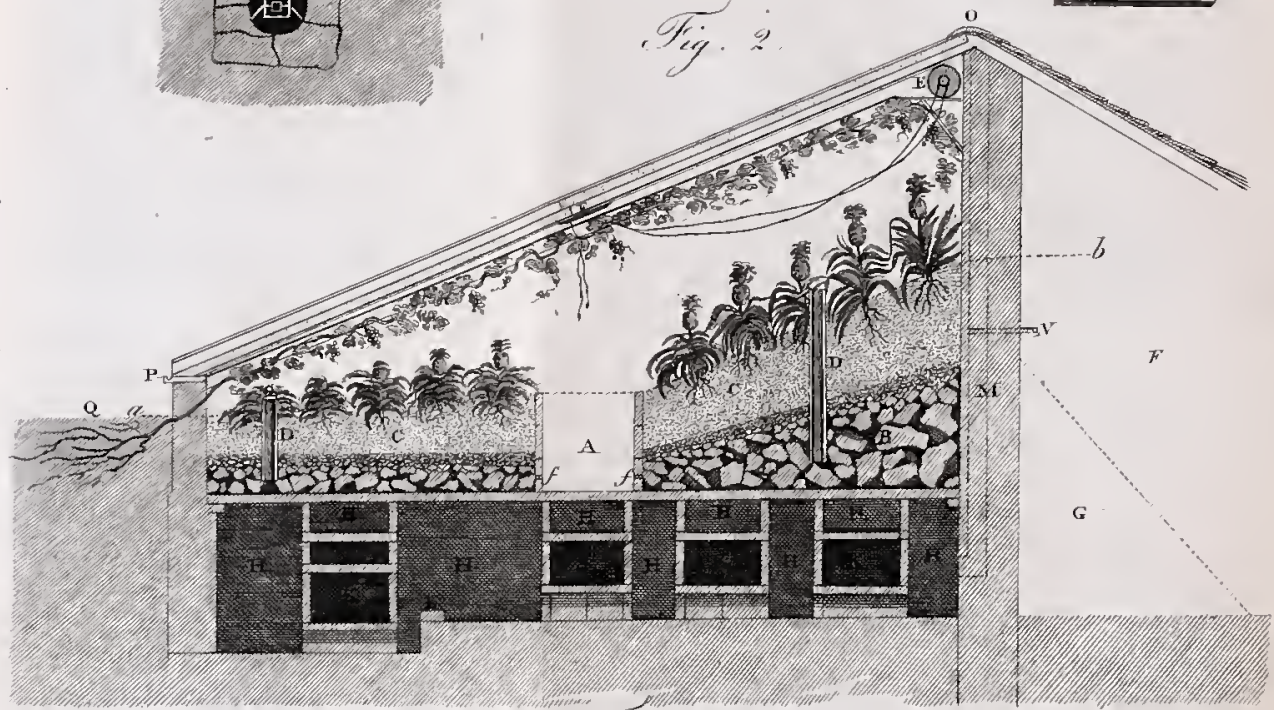


Fig. 4.



Fig. 2.



Sect c-d in Figs 1 & 2 Pl. V.

feet 20 15 10 5 1 2 3 4 5 feet.

J. Loudon Del.

F. Lamb Sculp.

f Steps to the excavation in which the furnace is contained.

g g Chimneys.

b b Dotted lines shewing the situation of the smoke-flue.

FIG. II.

Horizontal Section, or surface plan of this pit, supposing it erected and cut over by the line a....b, fig. 4.

A B C D The four divisions which may be kept of four different temperatures.

e e Air and steam tubes.

f Air registers.

g Covers of the excavation for the fuel and furnace, &c. partly cut over.

FIG.

FIG. III.

Elevation of the Back wall.

- A* Furnace and ash-pit doors.
- B B* Chimneys.
- C* Walk round the back wall of the pit.
- D* Holes for pouring in water, or admitting fresh air to the rubble stone vacuity.

FIG. IV.

Transverse Section of this Pit.

- A* Earth in which the plants are placed.
- B* Partition in the smoke-flue.
- C* Pit for fuel, &c.
- D* Supports, made in this particular form, in order to admit the free circulation of the heated air, and to save bricks in building.

FIG.

FIG. v.

Longitudinal Section.

- A...B* Range of fashes.
C Spaces betwixt the supports of the pavement.
D D Flues.
E Centre division wall.
F F Tubes which admit air and steam from the rubble stone vacuity.
G A tube which admits air and steam from the large vacuity under the rubble stone, which surrounds the flues.

FIG. vi.

Shews the Mode of fixing the wires for the inner roofing.

FIG.

FIG. VII.

A Curtain suitable for a Pit of this Construction.

a a The two poles, one of which are placed
at each end.

b b The small rods for stretching out the
curtain when let down.

Fig. 1. Ground Plan

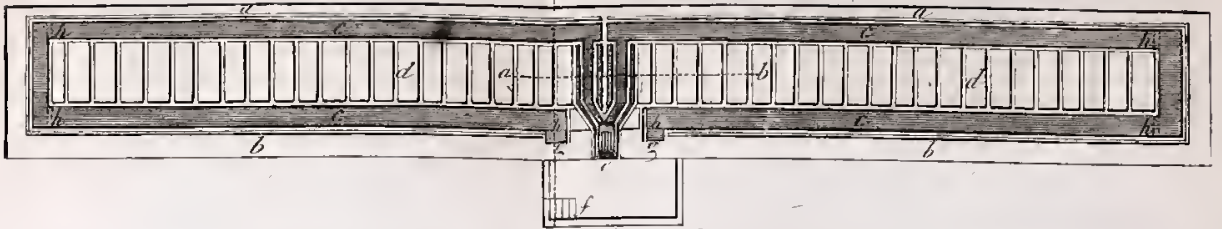


Fig. 2. Horizontal Section a-b Fig. 4.

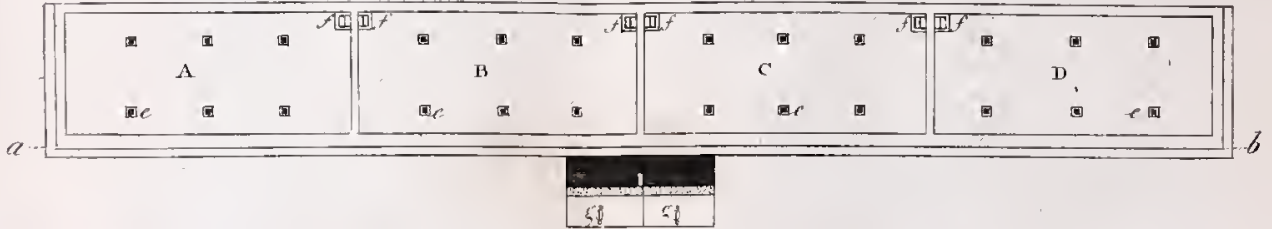


Fig. 3. Elevation of Back wall a-b Fig. 2.



Fig. 4. Sect a-d Fig. 1.

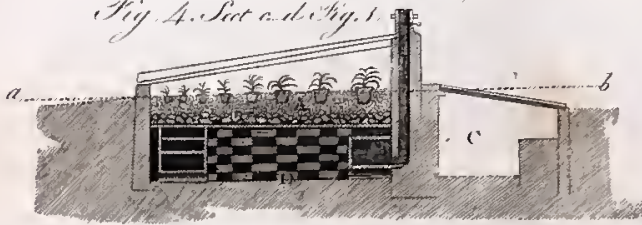


Fig. 5. Sect a-b Fig. 1.

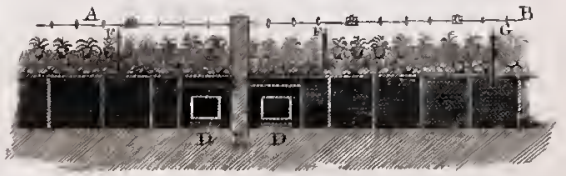


Fig. 6.

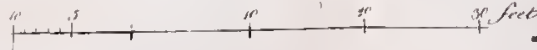


Fig. 7.



J. Loudon Del.

F. Lamb Sculp.

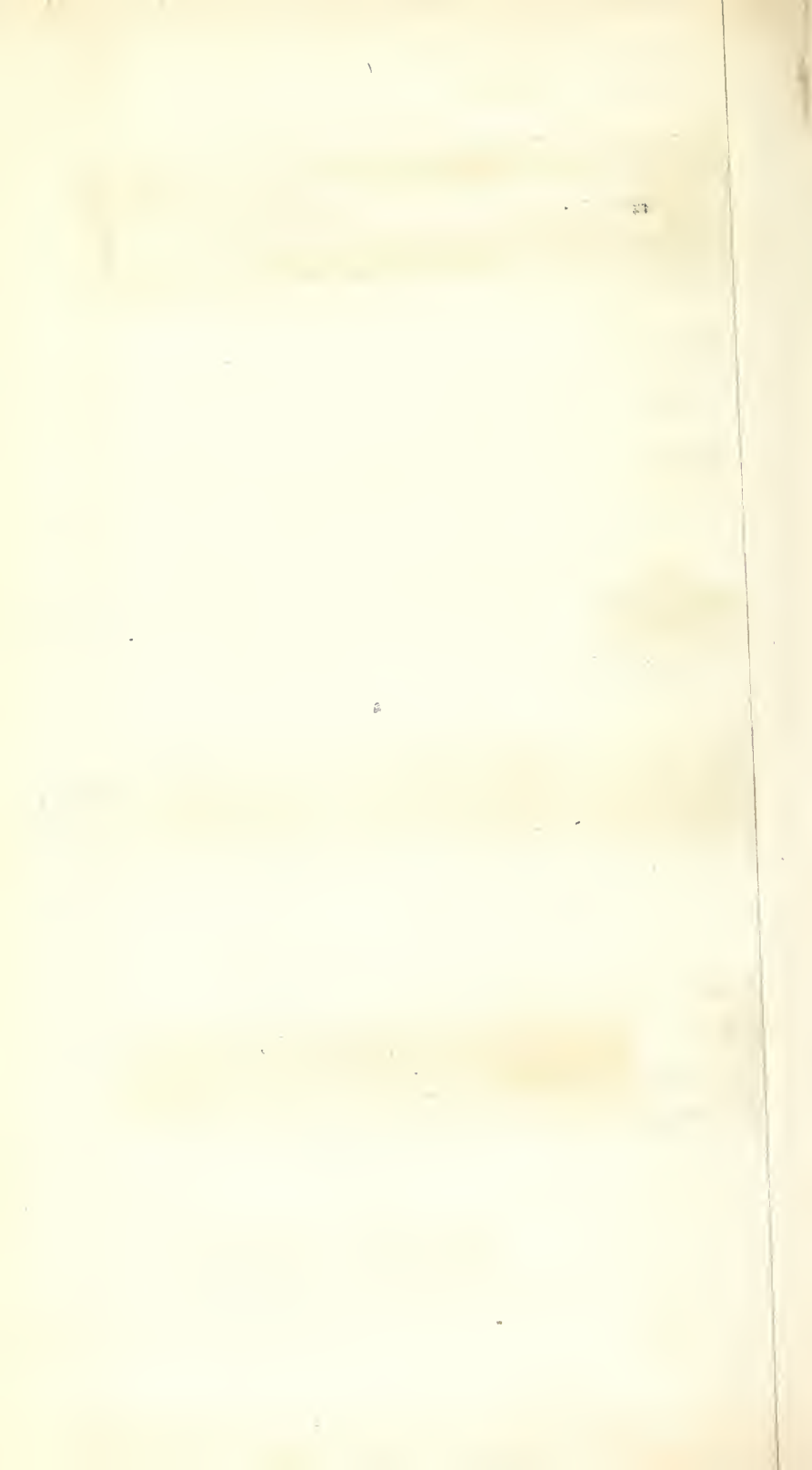


PLATE VIII.

GROUND AND SURFACE PLAN FOR A PEACH-
HOUSE, UPON A NEW CONSTRUCTION.

FIG. I.

Ground Plan.

- a a* Foundation of the surrounding walls.
- b b* Flues.
- c c* Termination of the side vacuity.
- d d* Partitions in the smoke-flue.
- e e* Supports for the columns, which columns are better seen in fig. 2.
- f f* Termination

- f f* Termination of the smoke-flue, where it ascends the centre column as a shaft or chimney.
- g* Furnace, and pit for fuel, &c.

FIG. II.

Surface Plan, or Horizontal Section.

- a* Columns which support the roof.
- b* The column which serves as a shaft or chimney.
- c c* Top of the flue which serves as a passage around the house.
- d* Doors.
- e* Section of the upright rafters, placed on the front walls.
- f* Small holes to admit the heat from the vacuity betwixt the front flue and wall.
- g* Dotts, shewing the end of the wires upon which the inner roofing slides down.
- b b* Cover of the furnace, fuel, pit, &c.

Fig. 1.
GROUND PLAN.

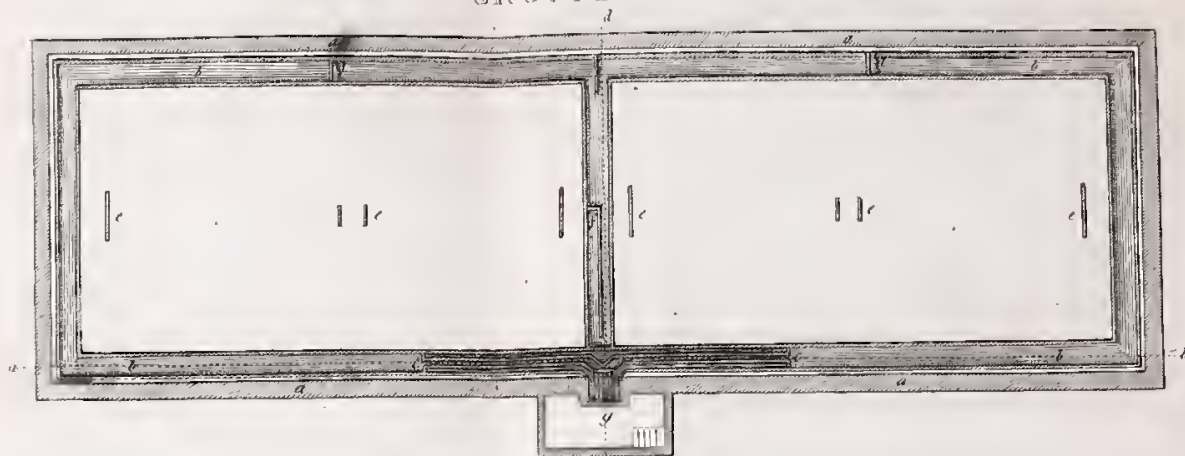
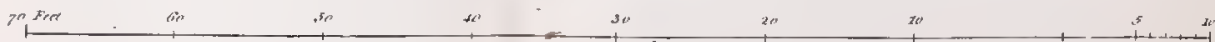
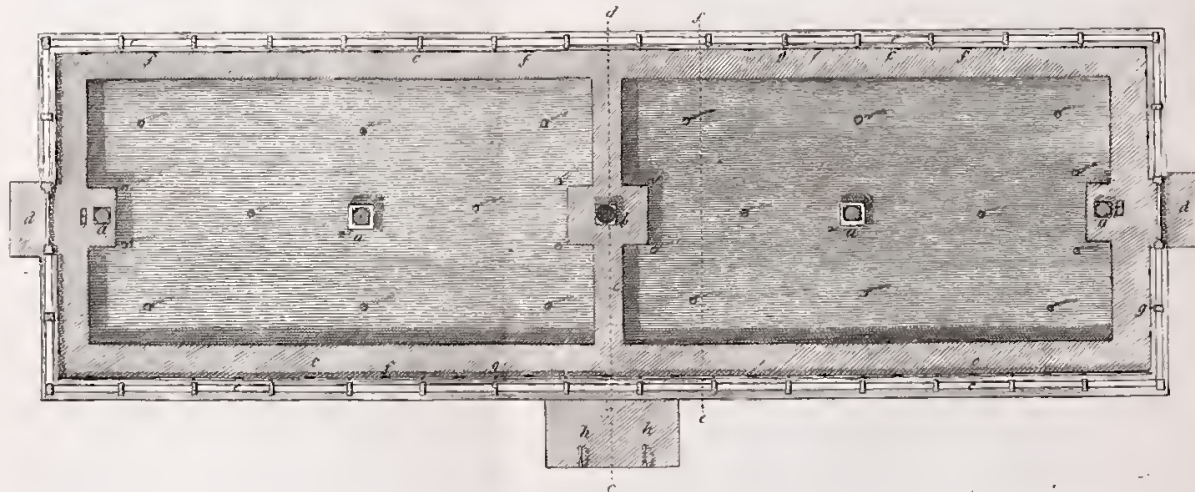


Fig. 2.
HORIZONTAL SECTION of SURFACE PLAN



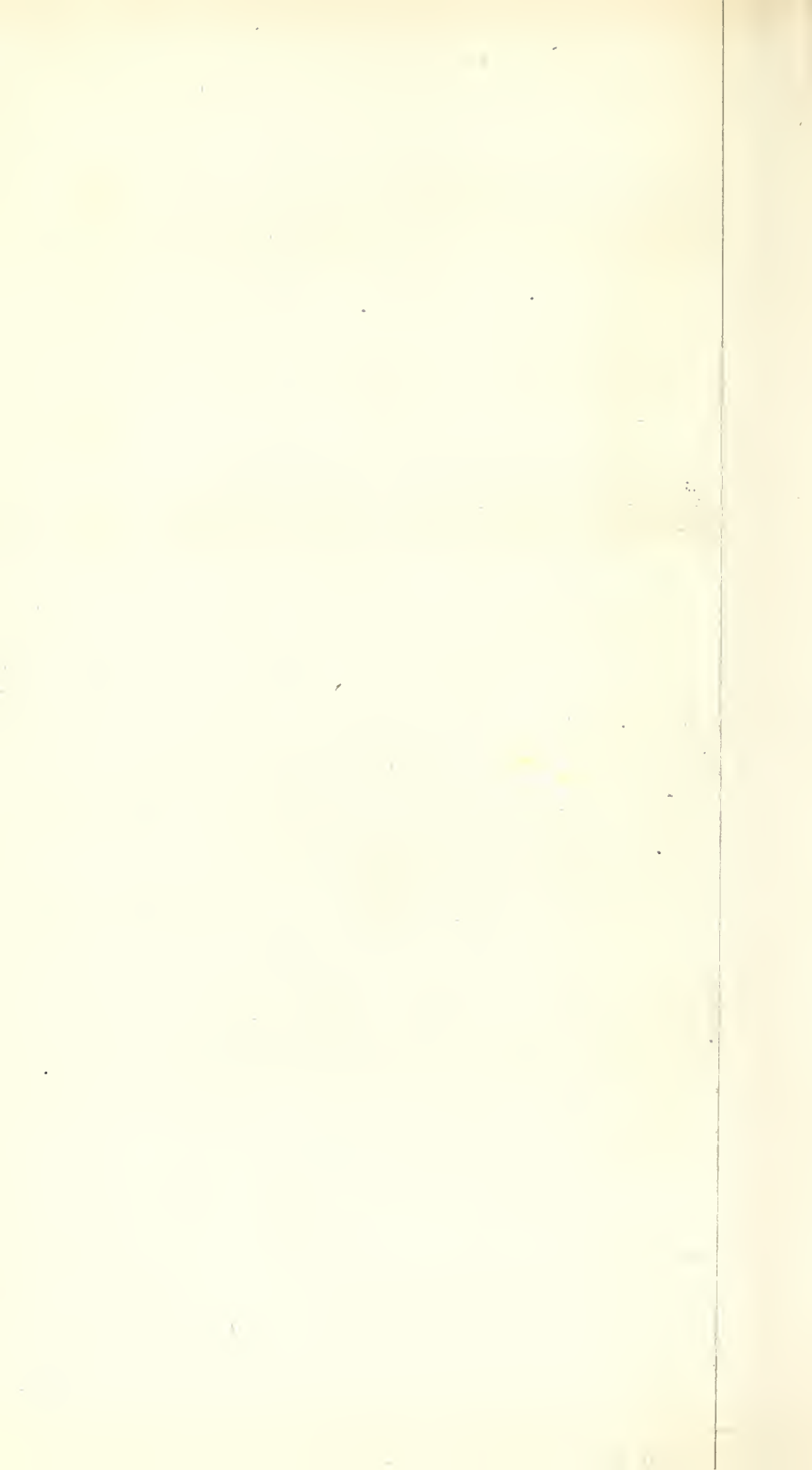


PLATE IX.

FIG. I.

Longitudinal Section of the improved peach-house, which may be easily understood by comparing it with the line a....b, in figures 1 and 2, Plate VIII.

FIG. II.

Transverse Section of the improved peach-house, upon a larger scale than the ground plan. See c....d, of figures 1 and 2, Plate VIII

H h

a A

- a* A part of the column which serves both for a chimney and prop to the roof.
- b* The damper in this column formed in a manner suitable to the internal aperture, which is circular. It is contrived so as to be turned round by the handle seen at *b*; in place of drawing it out in the usual manner.
- c* The furnace, around which will be seen the air vacuities, the smoke-flue, and ash-pit, &c.
- d* Furnace and fuel-pit, which are covered from the view by the cover, which is supposed to be level with the surface of the ground, and painted green.
- e* Supports of the flue, made of considerable depth, in order to allow the roots of the trees to spread in every direction, which they could not do, if a mass of mason work were introduced below the flues and front wall.

f View

f View of one of those supports.

g Surrounding walls, built no higher than the surface of the ground. The line across the wall at *g*, shews the depth of these supports.

Some may think it adviseable to have the level of the ground, within the peach-house, raised as high as that of the open air, in order that the roots may more easily penetrate from the one to the other; but this makes no material difference.

b Upright glass raised upon those walls.

FIG. III.

Section of both the Plan and Elevation of the improved peach-house, supposing it finished and the trees and vines full grown.

In this section it will be observed that the inner roofing is made according to the mode

H h 2

shewn

shewn in plate III. which will have the best effect in a double roofed house.

FIG. IV. AND V.

Are Sections of the approved mode of planting the peaches, and also of introducing vines in peach-houses. See pages 196—7.

FIG. VI.

Is a view of one of the flue, or front wall supports, supposed to be made of a single stone.

FIG. VII.

A view of one of these supports formed of bricks, in such a way as that the roots of the trees may pass through it in every direction.

N. B. The explanations of the models are separately printed, and are had along with them, and included in their price,

POST.

Fig. 1. Sect a-b of Fig. 1. & 2. Pl. VIII.



Fig. 6.

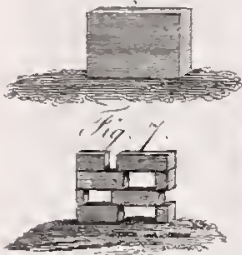


Fig. 2. Sect. c-d of Fig. 1. & 2. Pl. VIII.

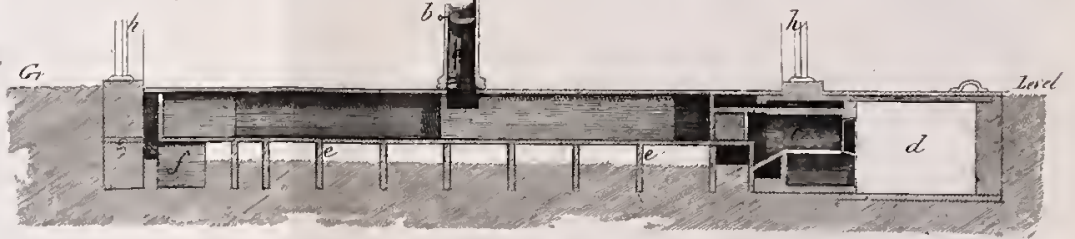


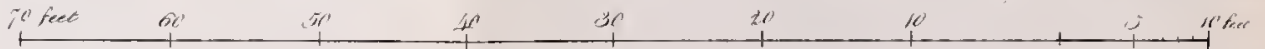
Fig. 5.

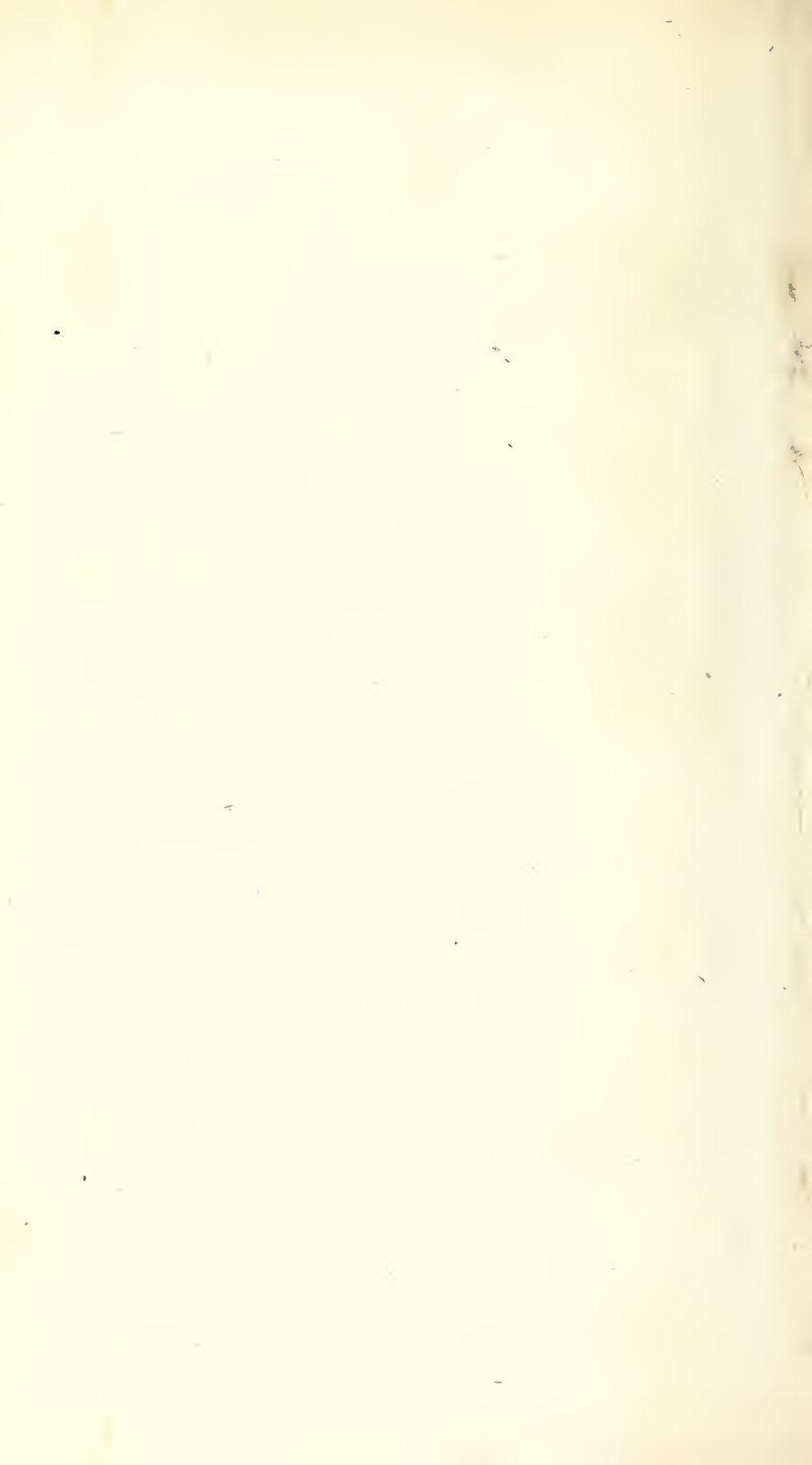


Fig. 4.



Fig. 3. Sect. e-f Fig. 2. Pl. VIII.





P O S T S C R I P T.

THIS work was begun in February last, and the author, in order that gentlemen might have an opportunity of altering their hothouses before the general forcing season, had agreed with the printer and engraver that they should execute their departments in a fortnight or three weeks. A promise which very unfortunately they have been unable to perform.

Just when the author had begun the work, he was called to the west of Scotland, and in order to supply the prefs with copy, he was under the necessity of making the sketches, and writing great part of the *account* in the inns where he occasionally
stopped;

stopped ; and of sending off the manuscript in detached portions to the printer. This accounts for the hurried and careless manner in which the whole is written ; and also for a number of typographical errors which the author regrets exceedingly---Some of these which materially affect the sense are noticed in the errata ; but others, such as those in page 129, lines 5 and 6, page 163, line 15 ; page 158, line 8 ; page 186, foot note, &c. occur so frequently, that nothing can be done but intreat the reader's forgiveness.

Here also the author takes an opportunity of mentioning, that though he has stated in page 122, that the plants in Dickson's and Shade's hothouse after the improvements were made, " never sustained *the least* damage"---which was true at the time the work was written---yet some weeks ago, owing to a small hole having been made in the smoke-flue, the smoke entered the house,
and

and almost killed two or three of the plants which were nearest the hole.---But this is an accident totally unconnected with the nature or effect of the improvements, and therefore cannot injure their utility in the least degree. It is only taken notice of here, because some who are unwilling to approve of the scheme have endeavoured to report otherwise, and thus to prejudice those who have not an opportunity of examining Dickson's and Shade's hothouse themselves. The author rests satisfied, however, that nothing of this kind will affect the mind of any candid reader. The plants injured were completely recovered in a few days, and continue in perfect health and luxuriance.

THE following particulars deserve also to be taken notice of in this place.

1. The author has erected a vinery ac-
I i
cording

cording to this plan, at ----- Smith's, Esq.
Leith-Walk

In this case, it was necessary to build the furnace in one end of the house, to preserve both it, and part of the flue, under the ground level, and also to make the flue of the broad low kind, as shewn in fig. 3. plate II.—to render this as clear as possible, models are also made, which gentlemen may have recourse to, should they find any difficulty in making their workmen comprehend the principle of these furnaces, which is necessary in some degree so as they may be able to vary them agreeably to different situations.

2. The author has also used his *improved furnace*, in the case of a hotwall at Mr Smith's, which he thinks will be a very beneficial improvement. The vacuity as in the case of hothouses, is carried round the furnace, but in place of entering an air-flue

flue at the throat of the smoke-flue, it there enters the smoke-flue itself, and thus the heated air is carried along with the smoke, and like it gives out its heat to the walls.

3. At Col. DUNCAN'S, Glenfuir, near Falkirk, he has also erected a pit according to his new plan, which is answering the purpose of growing cucumbers excellently. From this case, and other circumstances, the author is induced to think, that this kind of pit will be a great benefit to gentlemen, by saving *time, risk, and dung*.

The saving of dung, he thinks, will be of great advantage, in two ways.

1st, Because it is well known among farmers, that dung, when kept so long as to be rotted into a solid black mass, (like old peat,) as is always the case with that used in hotbeds, cannot be applied to the soil, with half so much advantage as when in an earlier stage of putrescency.

2d^{ly}, The

2dly, The dung saved from hotbeds, in places where peat moss abounds, (and there are few places where it cannot be come at,) if formed into composts as directed by Lord MEADOWBANK, * would produce three times the quantity of manure, the first season in which the pits were adopted. This large increase of manure would produce the means of decomposing a greater proportion of peat moss than formerly. In this ratio might the improvement go on, and the consequences would be of very great advantage to many gentlemen farmers; and it is presumed, in some degree to the public in general.

That pits upon this principle may be clearly understood, either for the purpose of erecting larger or smaller ones, the author has caused to be made a model of the one delineated in plate VII. which clearly shews the

* See the Highland Society's transactions.

the flues, rubble stone vacuity, steam and air tubes, &c. and also the form of curtains, and the mode of placing them suitable for pits or hotbeds. Owing to the additional trouble and nicety in forming this model, it became necessary to charge a higher price for it than for the others.

These models are fully described in the letter press explanations which accompany them.



A P P E N D I X.

D E S C R I P T I O N

O F T H E

M O D E L S

O F T H E

F U R N A C E, F L U E S, I N N E R R O O F I N G,
A N D N E W P I T.

S O L D B Y

Dicksons and Shade, Edinburgh; and Mr Dalziel, 4 Chapel-Street,
Bedford-Row, London.

EXPLANATIONS

OF THE

MODELS.

MODEL FIRST.

SCALE ONE FOOT TO AN INCH.

The improved furnace, fuel-chamber, smoke and air-flue, according to the mode adopted in Dicksons and Shade's hothouse: and which is suitable wherever the front flue may be made four feet deep, as is frequently the case in vineries, and almost always in pine stoves, made in the ordinary manner.

The models are made of wood, and the principal parts marked by letters. These parts may be taken off in the order in which they are described.

K k 2 A Represents

A Represents the front wall: or, if the furnace were placed in the back part of the hothouse, it would represent the end wall.

B When taken off discovers the fuel-chamber and ash-pit—the vacuity round the fuel-chamber, and the two holes, *aa*, which communicate with the double furnace doors and that vacuity.

N. B. The furnace and ash-pit doors could not be shewn owing to the smallness of the scale. But any mason upon inspecting this model, and the furnace itself, or even the views given, plate I. fig. 1. and 2. will find no difficulty in constructing it. The furnace may be seen either at Mr DALZIEL's, London, or at Mess. DICKSONS AND SHADE's, Edinburgh, and may be purchased from the Edinburgh Foundry Company.

C The cover of the air-flue and vacuity, which taken off, shews the large open space

space *b b* above, and near the furnace, and also the three holes *c c*, which communicate with the air-flue.

D The air-flue which is always continued along the top of the front flue from the furnace, to the opposite end of the house, and according to its length has three or more registers fixed in it, in order to regulate the heated air with precision. This improvement was not thought of when DICKSONS AND SHADE'S hot-house was altered, and was therefore not mentioned in the Treatise; it has since been adopted in Mr SMITH'S vinery, mentioned in page 248. The air-flue being taken off, shews the smoke-flue—its communication with the fuel-chamber at one end, and the partition at the other. These partitions in deep flues, such as these, are introduced every ten or twelve feet asunder; but at a greater distance in broad shallow flues; (see Description

cription of Model II.) By confining the smoke and heat, and promoting the draught, they are of great service. See the Treatise, p. 40,-1,-2.

E The smoke-flue which, when taken off, discovers the supports *d d*.

F When taken off, shews the arch over the fuel-chamber, and the vacuity around it.

G The arch of the fuel-chamber, which, being taken off, shews the grate and the recess for containing live-fuel.

H Being moved downwards, shews the vacuity under the recess, which communicates with the air-flue.

I May represent the floor of the house; But if the ground be dry, the flue, (in pine-stoves at least,) may be sunk one half or more under the floor, or it may be even wholly sunk, and the cover of the air-flue made the passage or walk. Such variations will naturally present themselves to every ingenious gardener.

MODEL

MODEL SECOND.

SCALE ONE FOOT TO AN INCH.

The improved furnace, fuel-chamber, smoke and air-flues, according to the mode suggested in plate II. by fig. 4. suitable for the front flues of Vineries, Peach-houses, &c. being nothing more than a variation of Model I.

A May either represent the front or end wall of the house, according to the situation of the furnace.

B When taken off discovers the fuel-chamber and ash-pit, and the two holes *a a*, which communicate with the double furnace doors, and that vacuity.

C Cover of the air-vacuity.

D Pipe for conveying the heated air used in place of a flue as it is cheaper in this case.

d Communication

d Communication between the air vacuity and air-flue.

E Smoke flue.

e Partition in the smoke flue, made as shewn in plate II. fig. 5.

g g The supports of the smoke flue.

H When taken off shews,

I The arch over the fuel-chamber.

K Grate.

L Recess for containing live-fuel.

M Being moved downwards shews under this recess, and the throat of the smoke flue, a vacuity for heated air, which communicates with the air-flue.

N. B. The arch over the fuel-chamber, and the throat of the smoke flue ought to be built with fire bricks and fire clay ; and in building the flues, a stone about a foot square ought to be built in the brick work at each part, where it may be judged most convenient to make an opening to cleanse them from soot. In flues such as
Model

Model I. this will generally be on those parts of the fides which are opposite to the partitions. In broad flues such as Model II. they will be mostly made in the top, by taking off one or more of the corners. In the improved pit, Model V. by making openings from the top, at the corners 1, 2, 3, 4, 5, 6, 7, 8. the whole may be cleansed with ease. Ropes may be either pushed through by rods or drawn by a cord, which cord may be previously drawn through by a cat, as was practised at Dalry.

MODEL THIRD.

SCALE TWO FEET AND A HALF TO AN INCH.

The Inner-roofing according to the mode shewn in plate III. and nearly as adopted in Dickens and Shade's hothouse, preferable in

L. 1

pineries

pineries or peach-boufes, when no vines are trained immediately under the ftoping glafs.

The cord *B* ufed to draw up the curtain being loofed, it is pushed down by applying a fmall hooked rod, to the crofs piece of wood *A*. Often, however, their own weight will accomplifh this purpofe, without any thing elfe being done than merely loofening the cords. A cord, however, may eafily be contrived to draw down each curtain, when it is thought neceffary.

The overlays, rings, and hooks, as mentioned in the Treatife, are eafily feen in thefe curtains.

The end curtain is feen exactly as defcribed in the Treatife. *C* is intended to represent the rack pulleys for rolling it up. A fmall rod appears, by which it is drawn out; and on that being done, another appears, which is intended to fretch the curtain to
the

the proper height. A slit is also seen opposite the door, &c. as mentioned in the Treatise.

MODEL FOURTH.

SCALE TWO FEET IX INCHES TO AN INCH.

The Inner-roofing as shewn in plate IV. suitable for vineries and all sorts of hot-houses where fruit-trees are trained immediately under the sloping glass.

The end curtain is drawn out by the small upright rod, seen in the model, and rolled up by the cord at *A*. This cord passes over the pulley *B*, which is intended to represent a rack pulley. The other particulars mentioned in the Treatise respecting this curtain are easily seen without any minute explanation, such as the slit oppo-

site the door for the operator to pass out by when he has let down the inner-roofing, and the rods for keeping the curtain stretched to its proper height, &c.

In the diminutive bulk of a model such as this, the curtains may be pushed down by taking hold of the small rods *C C*. But in a real hot-house this is intended to be done by the rod and hook already mentioned in the proper place. However it will frequently happen, that they will fall down with their own weight, when assisted by turning round the rack pulley in a proper direction for this purpose.

A few wires are put in to represent a trellis for training vines upon, merely to shew that they can be done in connection with the inner-roofing. The uprights by which are supported both the trellis and the wires, upon which the curtain slides, are intended to be made of wood, and joined together at the top, as explained in the Treatise,
and

and shewn in plate IV. fig. 3. but this is so plain that it is unnecessary to say any thing here respecting it. The trellis can also be supported by props, or by a range of small columns in the middle of the house, if found requisite.

From the small size of these models, the inner-roofing appears to take up much more room than it really does when executed upon the proper scale. For the same reason, a greater nicety is requisite in rolling it up and down. But notwithstanding these disadvantages they serve the intended purpose as completely as can reasonably be expected.

Price of these four Models, one guinea each.

Price of the following Model, three guineas. -

MODEL

MODEL FIFTH.

SCALE TWO FEET SIX INCHES TO AN INCH.

A PIT in which cucumbers, melons, pines, &c. may be grown; and roses, flowers, strawberries, asparagus, &c. forced at the same time, or which may be wholly devoted to one or more of these articles at pleasure; it being divided into one or more compartments, which may be kept of the same, or of different temperatures; see pages 178 and 234. A pit of this kind upon a smaller scale, was erected at Glenfuir, near Falkirk, in April last, and has since answered well.

A Excavation for containing fuel, and for managing the furnace, &c. This must be joined to the pit at *a a*.

B B Rafters

B B Rafters and coping which (in the model) are to be taken off: And, which bring off with them a part of the inner-roofing, made to shew the kind of curtains, and mode of fitting them up, suitable for pits and hot-beds. It also brings off the chimney tops, in which at *b b*, the dampers are fixed.

C C C Are the paved coverings of the large vacuity, for heated air. Above this vacuity, all over the surface are spread, first, rubble stones, ten or twelve inches in depth; above them, gravel, then a thin layer of sand; and lastly, the earth or mould in which is placed the plants, either in pots, or inserted in the earth, as is done in the open air. This paved covering may be made in the rudest manner; for though there be interstices between the stones, they will serve to admit the heated air from the vacuity, and if the stones be very thick, they will

will preserve the heat, so much longer when once heated.

d d Round tubes, which are intended to be made square, and to have small pluggs or stoppers fitted to them; one half of these tubes communicate with the rubble stone vacuity, and the other half (alternately) with the large vacuity below. From both these vacuities, supplies of heated, or moist air may be obtained at pleasure, as mentioned in the Treatise.

e e Holes in the back wall, by which water may be poured into the rubble stone vacuity.

ff Tubes for admitting heated air from the air-flue, by which, in connection with the valves at the throats^e of the two smoke flues, the diversities of temperature are produced.

G G Part of the back wall, which may be taken off.

H H, &c.

- H H, &c.* Part of the two ends, and two of the divisions which may next be removed.
- I* Front wall, which may be taken off.
- K* Covers of the air-flue, which being taken off, shews its length.
- k* Supports of the pavement coverings, placed above all the flues.
- l l* Supports of the pavement coverings, built of brick on edge, as shewn plate IX. fig. 7. and plate VII. fig. 4.
- M M* Front smoke-flue, which taken off brings along with it the ends *m m*, which proceed from the furnace. The covers of this flue being taken off, shew the proper mode of making the partitions as at *n n*.
- N N* The cover of the air vacuity, which wholly surrounds the furnace, and part of the smoke-flue, until it enter the air-flue.
- O* Central division which may be next taken off.

M m

PP Covers

P P Covers of the excavation to the furnace, &c.

A The walls, &c. of this excavation may now be taken off in order to shew the furnace.

② Being taken off shews the arch over the fuel-chamber.

R This arch which taken off, shews the grate, the recess for live-fuel, and the throats of the two smoke flues which proceed from it.

S S The beginning of the smoke flues, where a common furnace door, with a handle is fixed on each throat, to serve as valves for regulating the admission of the smoke and heat. See p. 181,-2.

T T Ground level.

The rest of them might be taken to pieces, and also the supports of the pavements taken out; but what has been already described is fully illustrative of the whole, and any other particular may be fully understood by recurring to the plan.

Though

Though this pit be recommended for pines, cucumbers, &c. yet by avoiding to erect any thing in this model, except the air and smoke flues, and by introducing a trellis about eighteen inches from the glafs; the quadruple compartments will make four excellent vineries which may be brought into fruit, at the same number of periods. The general principle of forming vineries in this manner, will be found to answer equally well with those in common use, (as may be seen in several places in England,) and they may be executed at first for less than one half the expence.

This model will serve in connection with plate VI. fig. 2. fully to elucidate the plan recommended for growing pine-apples: were these in general altered agreeably to this plan, in most cases they would produce one third more fruit annually than they do at present.

The following is a list of the names of the
 individuals who were present at the meeting
 held on the 12th day of the month of
 January 1885. The names are given in
 the order in which they were called.
 The names of the individuals who were
 present at the meeting are as follows:
 [The following text is extremely faint and illegible, appearing to be a list of names and possibly addresses or roles, but cannot be transcribed accurately.]

1380-588



