

Presented by H. Marshall

No 647

SUPPLEMENT *to the*

TO THE
DESCRIPTION
OF A

*Bristol
Medical
Library*

PNEUMATIC APPARATUS,

FOR PREPARING

FACTITIOUS AIRS;

CONTAINING A

Description of a Simplified Apparatus,

AND OF A

PORTABLE APPARATUS.

By *JAMES WATT, Engineer.*



Birmingham,

PRINTED BY THOMAS PEARSON.

MDCCXCVI.

Furnace

Fig. 1.

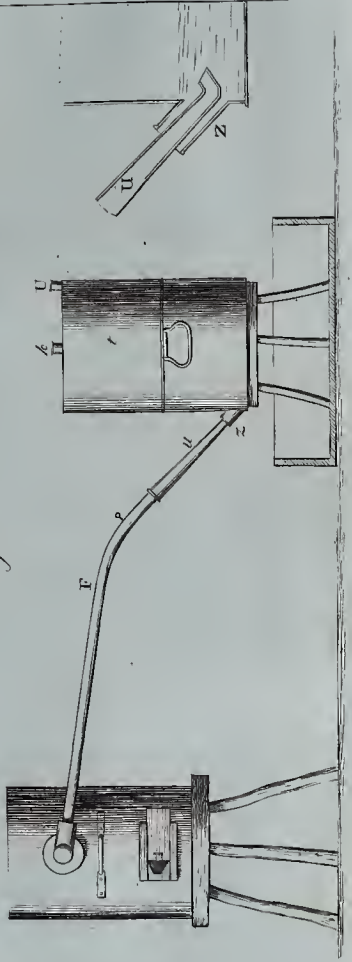
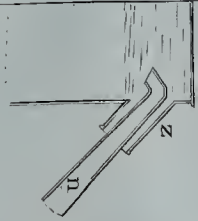


Fig. 2.



DESCRIPTION

OF A

Simplified Pneumatic Apparatus.

MARCH, 1796.

THE Pneumatic Apparatus, described in Dr. Beddoes's Considerations on the Medicinal Use of Factitious Airs, and in a separate description of that apparatus, is found to answer its intention, so as to leave little to desire upon the head of utility or convenience. What is now offered relates merely to a simplification which may effect a reduction of price; at the same time that in the hands of a sensible practitioner, it will not essentially abridge its utility in the preparation of oxygene air, and of the inflammable airs from charcoal and from iron, though it may not be so proper for the preparation of the zincic inflammable air, or the fixed air from chalk.

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If it were natural for mankind to think first upon the simplest methods of performing any process or constructing any machine, some apology might be necessary for not bringing forward this simplification sooner ; but the contrary seems to be the case, at least the method now proposed did not occur to the writer until very lately, and some doubts being entertained whether or not it might answer as well as it does, it was thought proper to refer that matter to the test of experiment, which has occasioned some delay.

The simplification consists in laying aside the hydraulic bellows and refrigeratory, and conveying the air directly from the fire tube wherein it is generated to the air holder. This was always thought a desirable object ; but it was considered that if the air were conveyed from the fire tube into the airholder by the pipe U, which receives it from the bellows, it would require a very nice regulation of the exit of the water at the lower pipe Z, to prevent the water in the airholder from weighing with its whole column, thereby making a degree of exhaustion in the fire tube and conducting pipe, and drawing in the atmospheric air at every ill closed joint; the advantage of washing the airs and condensing the steam in the refrigeratory, would be lost, and there would be no opportunity
of

of examining the quality of the air from time to time. A very simple idea has in great measure obviated these inconveniencies ; it consists in making the lower pipe (z) of the airholder inclined at an angle of 45 degrees, and of such length that the lower edge of its mouth shall be a little higher than the upper edge of the inner opening, by which it communicates with the airholder (see z , plate 4th, fig. 2). The airholder being filled with water, and the pipes $k t$ and U very well corked, so as to be air-tight, it is evident that no water can run out, though the sloping pipe z be opened, because the water cannot issue without the entrance of the air, and the latter is prevented from entering at z by the upper edge of the inner opening being lower than the surface of the external water in that pipe. It is exactly in the same case as the water in the common reservoir glass for birds, into which the air only enters in consequence of the bird exhausting the water in the little cistern.

Now, in order to receive the air from the fire tube, as it is produced, all that is necessary is, instead of fixing the conducting pipe F horizontally, to make it somewhat bent, so that its lower end may be inclined at an angle of 45 degrees to the horizon, or thereabouts, and to fit to that end the tin tube (u) the end of which being introduced

into the sloping pipe *z*, so that its opening, which is in its upper side, shall be fully within the cavity of the airholder; the air as it enters will ascend to the upper part of the airholder, and will displace its own bulk of water, which will issue through the pipe *z* by the side of the pipe (*u*) which occupies only a small part of the opening. The situation of the respective parts of the apparatus, applied in this manner, is shewn in plate 4th, fig. 1, more intelligibly than it can be expressed in words.

TO PREPARE OXYGENE AIR. The manganese being pounded and put into the fire tube, the joints made good, as pointed out in the former part of these directions, and the conducting pipe *F* fixed as has just been explained, and supported at a proper height, the pipe *z* being well stopped with a cork, and the other pipes *k t* and *U* both open, fill the airholder quite full of water, and cork the upper pipes very securely, anointing the corks with some china clay luting, place the airholder upon its stool in the shallow tub, which is to receive the water; bring the pipe *z* close to the small pipe (*u*) and uncork *z*, then move the airholder towards the small pipe, and insert the end of the latter into *z*, as has been directed; raise the end of the small pipe as high as the opening in the airholder within *z* will permit, and support it there by a small wooden

wooden wedge put under it in the mouth of *z*, apply your fire and the air as it is produced will enter the airholder, and the water thus displaced will issue at *z*, and be received in the tub. When the airholder is emptied of water, down to the level of the under edge of the mouth of *z*, air will begin to issue at *z*. The airholder must now be removed, and if more air is wanted, another airholder put in its place.

TO WASH THE AIR. Slack some good quick-lime, and when fallen to dry powder, sift it through a common hair sieve, preserve it in a pot close stopped for use. If the powder feels damp, dry it over the fire. Provide a tin tube, open at both ends, wired at one end and plain at the other end; its dimensions may be three quarters of an inch in diameter and four inches long. Dip this tube with its cutting end downwards into the pot filled with the slacked lime, and if the lime is deep enough, it will be filled with it, otherwise it must be dipped again in a fresh place until it be filled with lime. Insert the end of this pipe into *z*, and push the lime into the airholder by means of a piece of wood. If the air is tolerably pure, two fulls of this pipe will be sufficient for half a cubic foot, and four for a cubic foot airholder. When you have put in the lime, cork *z*, and shake the airholder

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very

NOTE. The lime may also conveniently be put into the airholder, by thoroughly mixing the desired quantity with half a pint, or a pint of water, and pouring it in through a funnel by the pipe *U*, at the top of the air-holder, the pipe *Z* being previously corked.

very briskly in every direction for about three minutes, then removing the stool, place the airholder in the water in the tub, so that the water may cover the opening of *z*; pull out the cork, and the water will enter and supply the place of the fixt air absorbed, repeat the shaking until upon opening the pipe *z* under water none enters. Replace the airholder upon its stool, insert the end of *u* into *z*, and by the introduction of more oxygene, displace the water which had been admitted, cork the pipe *z*, and set the airholder in a cool place till it deposits the suspended manganese, which it will do in less than twelve hours, before which time has elapsed none of the air should be used.

If you want to examine the quality of the air before you receive any into the airholder, place the end of *u* in a basin containing water, in sufficient quantity to cover the end of the pipe, and to stand an inch or two higher, then having filled a common bottle or vial with water, place your thumb upon its mouth, and invert it with its mouth under the surface of the water in the basin, directly over the opening of the pipe *u*; the air as it issues will ascend into the bottle, and may be examined by the common tests; or, by holding a lighted taper over the opening of the pipe, you may see by the brightness

ness of the flame whether or not the air produced is much dephlogisticated.

In general, the air from Exeter manganese has little other admixture than fixed air in small quantity, probably mostly produced by the action of the oxygene on the carbone of the iron tube. When you mean only to try the air by its effects upon flame, that may very conveniently be done, by placing the airholder in such a manner, that the opening of the conducting pipe, instead of being fully within the airholder, may lie in the sloping pipe, though under water (or by pulling out the small peg in the side of F.) When your trials prove satisfactory, the airholder is to be brought so much nearer the furnace, that the opening of the pipe (*u*) may be quite within it.

CAUTION. In operating upon small quantities of manganese, care should be taken to place them in the middle of the fire tube, near the ends it may not receive the due heat.

HYDRO-CARBONATE. In preparing this air, the fire tube should be red hot before any water is admitted by the water pipe, and before the airholder is applied, water should be admitted pretty freely to dislodge any other air which the charcoal

B 4

may

NOTE. Sometimes pieces of a brown toad stone, with whitish spots, are intermixed with manganese; these pieces will be easily distinguished in breaking the manganese, and should be picked out, as they yield fixed air instead of oxygene.

may have imbibed. After about five minutes rapid production of air (which should be conveyed up the chimney by a pipe placed over the opening of *u*) the entry of water should be somewhat restrained, and the airholder set in its place, as has been directed for oxygene.

The process goes on with a proper speed when the large airholder, containing a cubic foot (about 24 ale quarts) is produced in 20 minutes, or half an hour, while the fire tube is fully red hot. If water is admitted too freely, steam will be produced, and would pass into the airholder and heat the water there. Besides, a superfluity of water causes the production of a greater quantity of fixed air, than takes place when the operation goes on slowly. In order to free the Hydro carbonate air perfectly from fixed air, it may be washed with lime, as has been directed ; but may be used as soon as the washing is completed, the suspended charcoal seeming rather advantageous than otherwise.

This species of air is found to be more or less powerful in producing sensible effects upon the human body, according to circumstances in its preparation, which are yet unknown. It merits to be verified by experiments, whether the degree of
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the heat of the charcoal does not affect it; and in the same way it ought to be determined, whether the charcoal of different vegetable substances do not produce airs of somewhat different qualities as to their medicinal effects.

FERRIC INFLAMMABLE AIR, may be prepared as directed for the Hydro carbonate.

It has been observed, that this method is not recommended for the preparation of the zincic inflammable air, nor for the fixed air from chalk; in both of these a superfluity of water seems necessary, and there being no refrigeratory to condense the steam, it would heat the water in the airholder.

In many experiments, the hydraulic bellows and refrigeratory afford a great convenience, the former in readily ascertaining the quantity of air produced, and the latter, by condensing steam; and when quick lime is mixt in the water, by absorbing fixt air and other acid vapours. If the manganese is of a good quality, and no inflammable matter is mixt with it, the mixture of lime with the water of the refrigeratory, and the use of the agitator, will render it sufficiently pure to be breathed, especially if it is administered considerably diluted; but when given with small admixtures of common air, the
utmost

utmost purity is necessary. As in preparing oxygene air, the exact quantity of materials necessary cannot previously be ascertained ; if more than fills an airholder be produced, it may conveniently be retained in the bellows till wanted. If azotic air should prove useful, as it is very probable may be the case, its preparation from burning charcoal requires the use of the hydraulic bellows. These bellows also make a good machine to inhale mixtures of air from, in place of the silk bags.

Every person wanting an apparatus, will see from what has been said, the advantages and disadvantages of this simplified apparatus, and be enabled to judge for himself ; to those who principally wish to prepare oxygene and Hydro carbonate airs, there seems no doubt that it will save money in the first cost, and some trouble each time the apparatus is used ; but to those who wish to make experiments upon various airs, the Hydraulic bellows and refrigeratory seem necessary.

LIGHTING THE FIRE. Some gentlemen complain that the fire in the furnace is difficult to kindle, and that some time elapses before it attains the proper heat. This may be remedied by covering the furnace with a conical tunnel of a foot high, having an opening at the vertex of four or five inches

inches diameter ; but if this tunnel be not removed as soon as the fire tube becomes red hot, which may be neglected, there is a risk of melting or spoiling the fire tube. The readiest and safest way seems to be, to light the fire in the furnace, by means of some chips and a shovel full of live coals, with the proper quantity of coaks, and to let the lining of the furnace become red hot before the fire tube is put in, which may easily be done by taking out some of the coaks, and removing the rest to the sides of the furnace, so as to make a clear passage for the fire tube, which having one of its end pieces previously luted into it, must have the joint of the other made good before it has time to become too hot. The coaks which have been taken out, on being replaced, will readily light again, and much time will be saved in heating the tube.

AIRHOLDERS. This simplified apparatus cannot advantageously be used with fewer than two airholders of a cubic foot each, or more of smaller sizes, and the large furnace and apparatus ought to have at least three airholders of the large size. The large airholders and their contents of water weighing near seventy pounds, it will be found convenient to fill them standing in their place upon the stool in the tub, or which may in several respects be
more

more convenient, though more expensive, to use a double number of three gallon airholders in place of them. Airholders of six quarts are convenient for sending out doses of air to patients.

MOUTH PIECES. Many patients with difficulty acquire the habit of inhaling air from a bag, and returning the air from their lungs through their nose. Some make such deep inspirations and strong exertions, as to fatigue their lungs and the respiratory muscles, whereby spasmodic pains in the breast have arisen, which in some cases have been imputed to the factitious air; but the same pains arise in such persons when only the common air of the atmosphere is inspired in the same manner, and even when no bag is employed; a mouth piece has therefore been constructed with two valves of silk, upon the same principle as that communicated to Dr. Beddoes by Mr. W. Capper, and published in the second edition of the considerations; it is, however, very much smaller, gives less resistance to the air, and is constructed so as to be applied to the small end of the faucet of the oiled silk bags. With this mouth piece a person may breathe perfectly in their natural manner, without straining the muscles of the breast, and without any other subjection than the holding a small pipe in their mouth,
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the end of which is, for the greater ease, made in an oval form.

Queries, however, arise, whether those deep inspirations are not of service, by opening the small vesticles of the lungs, and giving them greater exercise? Also whether the Hydro-carbonate, at least, may not produce good effects, by acting upon the nerves of the nose during the expiration of the air? Without attempting to solve these doubts, it is certain that the use of the mouth piece does not preclude the taking deep inspirations; nor, when thought necessary, the expiration through the nose, though it lays the patient under no subjection to either of them. **ALEMbic, or FIRE-POT.** This vessel may be used for the preparation of oxygene air in this simplified apparatus; *but it ought not to be used for the preparation of Hydro-carbonate air*, for the water coming first into contact with the red hot part of the water pipe, before it reaches the charcoal, Hydrogene air appears to be produced instead of Hydro-carbonate, at least, it frequently happens that the air prepared from charcoal in this vessel, has not the power of causing vertigo, whereby some gentlemen have been disappointed in the effects expected from the air.

DESCRIPTION

DESCRIPTION

OF A

Portable Pneumatic Apparatus.

PERSONS who have not occasion for large quantities of factitious airs, especially invalids while upon a journey, will be enabled by means of this apparatus, to prepare them readily in any situation where they can command a common parlour or kitchen fire.

Practitioners in medicine may also by means of it, make trial of this new branch of their art, at a moderate expence ; but it ought not to be supposed that it can supply the quantities of these airs that some cases require, and still less, that by means of it a number of patients should be supplied.

As oxygene and inflammable airs ought not to be prepared in the same fire tube, the apparatus is
provided

Fig. 1.



Fig. 2.

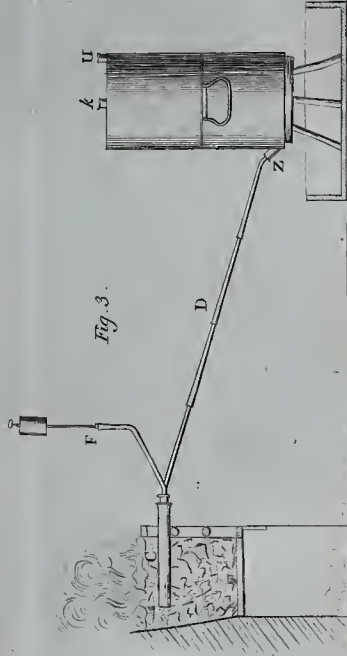


Fig. 3.

provided with one for each of these species of air. The fire tube for oxygene air, is made somewhat like a pocket liquor flask, the flattened form of which permits it to enter between the bars of a common grate. Its dimensions enable it to contain about a pound of powdered manganese, which will generally produce half a cubic foot, or three gallons of air, at one operation.

The figure of this fire tube is delineated in Pl. 5, fig. 1st, A, and its cross section in its widest part at B.

The fire tube for preparing Hydro carbonate air, is delineated at A, Pl. 5, fig. 2, and its transverse section at B. It consists of two parallel hollow cylinders united together, each open at one end, and communicating with one another at the bottom or shut end. The water pipe is adapted to the mouth of one of these hollow cylinders, and the conducting pipe, by which the air issues, is adapted to the mouth of the other cylinder; so that the water, when converted into steam by the heat of the tube, must pass through and among the whole matter contained in both of them, before it can make its exit.

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This fire tube (C) with its water pipe (F) and conducting pipe (D) together with the airholder, are represented in their proper positions when in use, at Fig. 3, Pl. 5. It was judged unnecessary to give a representation of the oxygene fire tube when in use, as such representation would differ in nothing from that given, excepting in the absence of the water pipe, which is not needed in preparing oxygene air.

One joint of the conducting pipe D, is made partly of hammered iron, and the others of tin plate, japanned. In order to avoid too great nicety in adjusting the place of the airholder, a short flexible tube is interposed betwixt two of the four pieces, of which, for convenience of carriage, the pipe is composed.

Either of the fire tubes, when applied to use, being previously charged with the proper material, is to be introduced between two of the bars of the fire grate, or if none of the interstices are wide enough, it may be laid above the upper bar, and the coals heaped over it. If the grate is not deep enough to permit the fire tube to enter far enough into it, when placed at right angles to the bars, it may be put in obliquely, from which the farther advantage will be derived, that the airholder not
standing

standing directly before the fire, may be more easily screened from its rays.

The lower end of the conducting pipe turns up a little, and is to be inserted in the pipe *z* of the airholder, in the manner directed for the simplified apparatus.

It is proper before any operation is commenced, to adjust the height of the support of the airholder, and its place in the tub or pail, which is to receive the water, otherwise if the fire tube heats quickly, some of the air will be lost before these matters can be adjusted. In defect of a stool, bricks or short pieces of boards may be used as a support for the airholder; but where the apparatus is used at home, a stool will be found most convenient.

To prepare OXYGENE AIR, fill the fire tube (of Fig. 1, Pl. 5) with manganese in coarse powder, up to the narrow part of its neck, lute the end piece *E* into the fire tube, and introduce the tube into the fire, lute the iron part of the conducting pipe into the end piece, and when the heat has hardened the lute, apply the other parts of the conducting pipe, previously luted to one another.

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The airholder being filled with water, and set upon its stool in the tub or pail, uncork the pipe *z*, advance the airholder, and insert the end of the pipe *D* into *z*. The operation will then go on as has been said in the description of the simplified apparatus. When the oxygene air has displaced the water, and filled the airholder, the fire tube should be immediately withdrawn from the fire, to prevent the needless calcination of that tube. If the joints have been well luted, it may be pulled out by taking hold of the iron part of the conducting pipe, by means of a cloth, to prevent burning the hands.

The end piece sometimes sticks very fast in the fire tube ; it may be loosened by striking it gently side ways with a small hammer, upon the bead which is formed round its outer end. Violent blows do not answer the end, and are apt to damage the end piece.

To prepare HYDRO-CARBONATE AIR, fill both the cylinders of the fire tube, Fig. 2, Pl. 5, with small bits of charcoal, none of them exceeding a quarter of an inch cube ; insert the water pipe into the mouth of one of the cylinders, and the end piece of the conducting pipe *D* into the mouth of
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the other, luting them properly ; place the fire tube in the fire grate, and when the heat has hardened the lute, proceed to the adjustment of the remainder of the apparatus, as has been directed.

When the fire tube has become perfectly red hot, admit water by the water pipe, pretty freely, in order to expel any noxious matter contained in the charcoal, and suffer any air which is thus produced to escape. When this part of the operation has been continued for five or ten minutes, restrain the water, and bring the airholder into its place. With a proper degree of heat and due exhibition of water, a three gallon airholder may be filled in half an hour, without any steam passing into the conducting pipe, which is known by the tin parts not becoming hot.

To prevent the water in the cup from being heated by the fire, it is necessary to interpose a fire shovel, or something similar, to screen the cup from its rays. If the water is suffered to boil in the cup, or in the perpendicular part of the water pipe, none will enter the fire tube ; therefore it is also proper not to fix that part of the water pipe in its place till all the rest of the apparatus is adjusted. The airholder may be screened from the heat by a sheet of brown paper.

The hydro-carbonate fire tube is made double, that the water may pass through a greater length of heated charcoal, and may act more immediately upon it, and less upon the iron; for if the water were transmitted slowly into a red hot iron pipe, it would act upon the iron, and produce Hydrogene air before it reached the charcoal; and it appears from experiment, that the hydrogene dissolves none of the charcoal in its passage through it. This has sometimes happened in making hydro-carbonate in the alembic of the large apparatus, and renders the fire tubes preferable for that purpose.

CAUTION. Though common stove grates do not generally produce too much heat for this purpose, yet with some sorts of coals, and in particular circumstances that may happen, and if not guarded against, the fire tube may be melted or spoiled. A moderate red heat is sufficient for producing either the oxygene or hydro-carbonate air.

AIRHOLDERS, proper for this apparatus, are two of three gallons each, or one of that size, and two of a gallon and a half each. The latter will be found convenient for carriage in a post chaise.

PACKAGE. Sets of this apparatus are put up in boxes adpted to them, when so desired, for the convenience of carriage.

POSTSCRIPT.

POSTSCRIPT.

OBSERVATIONS

UPON

Hydro-carbonate & Oxygene Air.

WHEN a fire tube is used for the first time, any air which is prepared in it has a bad smell, oxygene air in such cases contains a larger proportion than usual of fixed air and the hydro-carbonate, of sulphurated hydrogen. These have been with justice imputed to the carbone and sulphur contained in the cast iron of the fire tube.

With a view to correct this inconvenience, a new fire tube, which yielded very offensive hydro-carbonate, was loosely filled with dry slacked caustic lime, and subjected to heat, it gave out, as was foreseen, a considerable quantity of ferric hydrogen,

gene, not remarkably ill smelled; when it ceased yielding air, which was after it had been above an hour red hot, it was cooled and filled with charcoal as usual for hydro-carbonate; the air it then yielded smelled like heated steel or burning phosphorus, in short, it had the same sort of smell as good hydrogene air. A query then arose, whether it had the power of causing vertigo, a stout young man inhaled a quart of it, mixed with twenty-two quarts of common air, without being in any ways affected by it, which would not have been the case, if it had been prepared as usual. It would then seem that the vertigo is owing to the admixture of sulphurated hydrogen, which its usual smell indicates this air to contain. If this should prove to be the fact, and any part of its curative powers depends upon its producing vertigo, that effect may be secured or augmented, by mixing the borings or turnings of *cast* iron with the charcoal, or perhaps still better, by the admixture of plumbago or black lead in powder. If, upon the contrary, the vertigo does not contribute to the cure, the medicine will prove more pleasant to the patient, and it is believed may be uniformly prepared free from the sulphureous smell, by mixing a little *perfectly caustic*, and dry slacked lime, with the charcoal powder.

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The effect produced upon the tube by the lime, does not seem to be permanent, for in a second operation with the same tube, and out of which the charcoal had never been emptied, the air produced had some degree of the sulphureous smell.

It has been mentioned, in the first part of these directions, that a mixture of charcoal powder with slacked caustic lime, produces an inflammable air, without the addition of water, and that the charcoal is consumed in the process; and it has since been found, that a mixture of hammered iron turnings and charcoal, produced very good hydrogen air, and that the iron was perfectly calcined by the operation.

This is not quite the proper place to enter upon theory, yet as it will naturally be asked by some of my readers, how these things are to be accounted for, and I wish to throw all the light I can upon the subject, I shall give the explanation of it which appears to me most consonant to the modern theories, though it has perhaps another cause. Slacked lime contains a quantity of water as one of its constituent parts, and which it attracts so strongly, that it will retain the greatest part of it even
when

when red hot, provided no attraction more powerful tends to separate it; but red hot charcoal also attracts water, and it would seem that its attraction for it is stronger than that of the lime; the latter is therefore dispossessed, and left in a *dry* state, and the water united to the charcoal forms, hydro-carbonate or some species of inflammable air, having charcoal for a basis. In the case of the iron, the same thing happens, and hydrogen is formed. Granulated zinc mixed with lime, will probably form zincic inflammable air.

In respect to the medicinal properties, all I know is, that the inflammable air from charcoal and lime contained no fixed air, separable by washing with quick lime and water, and that it did not cause vertigo when inhaled pure.

OXYGENE AIR. This air is also rendered more pure and more free from fixed air, by preparing the fire tube, by heating it full of quick lime, as has been mentioned for the hydro-carbonate, then emptying out the quick lime, and filling it with manganese in coarse powder as usual.

The preparation of the fire tube with lime, should be renewed from time to time, whenever
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an extra produce of fixed air shows the necessity. It might perhaps be serviceable to mix quick lime with the pounded manganese; but it has been found, that when the lime was not perfectly caustic, it gave out its fixed air, and did more hurt than good, serving only to prevent the sulphureous smell that oxygene sometimes has.

Oxygene air should never be prepared in a fire tube used for hydro-carbonate or hydrogen.

THE SIMPLIFIED & PORTABLE
PNEUMATIC APPARATUS,

ARE MANUFACTURED BY
BOULTON & WATT,
OF SOHO, NEAR BIRMINGHAM,
AT THE FOLLOWING PRICES.

The large Size Simplified Apparatus.

The furnace, 18 inches diameter, lined with the best fire bricks, tongs and poker, two fire tubes, two end pieces, two rings, iron plug, water pipe and cup, iron, conducting pipe and its tin end piece, with one large airholder and funnel - - - - - £. 6 16 6

AUXILIARY ARTICLES FOR DITTO.

Two large sized airholders, one spare fire tube, cast iron pot for a sand heat, two oiled silk bags and bellows to fill them with common air - - - - - 3 6 0

The second Size Simplified Apparatus.

The furnace, 13 inches diameter, and other articles as above, suitable - - - - - £. 4 15 9

AUXILIARY ARTICLES AS ABOVE.

But the two airholders, second size - - - - - 2 15 0

The Portable Apparatus.

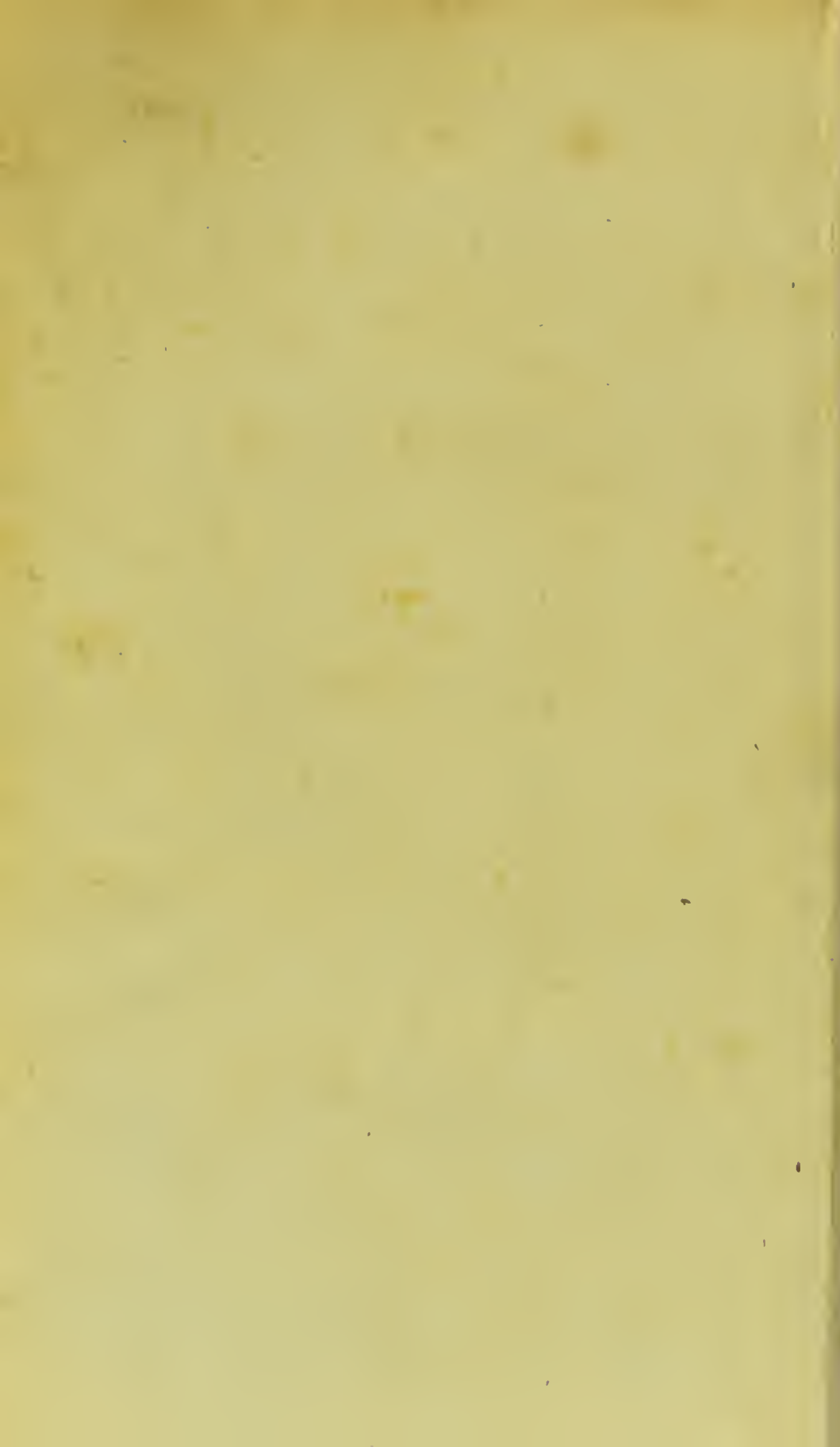
One oxygene and one hydro-carbonate fire tube, with end pieces, water pipe and cup, conducting pipe, one second size airholder and funnel, and an oiled silk bag - - - - - £. 2 12 6

AUXILIARIES.

One second size airholder, two spare fire tubes and bellows to fill the bag with common air - - - - - 1 2 6

 Packing Boxes and Carriage, to be charged extra.

* * * The Pneumatic Apparatus, with Hydraulic Bellows and Refrigeratories, continue to be made as usual.





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