Specification of Stephen White : apparatus for the manufacture of gases; furnaces and boilers of steam engines, &c.;

Contributors

White, Stephen.

Publication/Creation

London : Queen's Printing Office, 1854 (London : George E. Eyre and William Spottiswoode)

Persistent URL

https://wellcomecollection.org/works/pgy9bj2a

License and attribution

Wellcome Collection
183 Euston Road
London NW1 2BE UK
T +44 (0)20 7611 8722
E library@wellcomecollection.org
https://wellcomecollection.org

A.D. 1849 . . . . . N° 12,536.

SPECIFICATION

OF

STEPHEN WHITE.

PPARATUS FOR THE MANUFACTURE OF GASES; FURNACES AND BOILERS OF STEAM ENGINES, &c.

LONDON:
PRINTED BY GEORGE E. EYRE AND WILLIAM SPOTTISWOODE,
PRINTERS TO THE QUEEN'S MOST EXCELLENT MAJESTY:
LISHED AT THE QUEEN'S PRINTING OFFICE, EAST HARDING STREET,
NEAR FLEET STREET.
2s. 1d. 1854.

A.D. 1849 . . . . . N° 12,536.

Apparatus for the Manufacture of Gases; Furnaces and Boilers of Steam Engines, &c.

WHITE'S SPECIFICATION.

TO ALL TO WHOM THESE PRESENTS SHALL COME, I, STEPHEN WHITE, of Manchester, in the County of Lancaster, Gas Engineer, send greeting.

WHEREAS Her most Excellent Majesty Queen Victoria, by Her Letters Patent under the Great Seal of the United Kingdom of Great Britain and Ireland, bearing date at Westminster, the Twenty-sixth day of March, in the twelfth year of Her reign, did give and grant unto me, the said Stephen White, my exors, admors, and assigns, Her especial license, full power, sole privilege and authority, that I, the said Stephen White, my exors, admors, and assigns, and such others as I, the said Stephen White, my exors, admors, or assigns, should at any time agree with, and no others, from time to time and at all times thereafter during the term of years therein mentioned, should and lawfully might make, use, and exercise, and vend, within that part of the United Kingdom of Great Britain and Ireland called England, Her Dominion of Wales, and Town of Berwick-upon-Tweed, (and also in the Islands of Jersey, Guernsey, Alderney, Sark, and Man, and in all Her Colonies and Plantations abroad,) my Invention of "IMPROVEMENTS IN THE MANUFACTURE OF GASES, AND IN THE APPLICATION THEREOF TO THE PURPOSES OF HEATING AND CONSUMING SMOKE; ALSO IMPROVEMENTS IN FURNACES FOR ECONOMISING HEAT, AND IN APPARATUS FOR THE CONSUMPTION OF GASES;" in which said Letters Patent there is contained a proviso, requiring that I, the said Stephen White, shall particularly describe and ascertain the nature of my said Invention, and in what manner the same is to be performed,

by an instrument in writing under my hand and seal, to be enrolled in Her said Majesty's High Court of Chancery within (six) calendar months next and immediately after the date of the said in part recited Letters Patent, as, reference being thereunto had, will more fully and at large appear: And whereas Her said Majesty by Her Letters Patent bearing date the Fifteenth day of April, One thousand eight hundred and forty-seven, granted to me, my exors, admors, and assigns, the sole privilege of making, using, and vending my Invention of "A New Means of producing Gas both as to Apparatus and Materials from which the Gas is produced," and my said Invention consisted, or was described in the Specification thereof, which was duly inrolled by me in Her Majesty's High Court of Chancery, to consist, so far as it related to the materials from which gas for the purpose of illumination is produced, in decomposing water by bringing it into contact, in the manner in the said Specification described, with charcoal, coke, or anthracite coal, and small thin plates of iron, or small pieces of thin iron wire, or with charcoal, or coke, or anthracite coal, and lime at a very high temperature, and thereby producing from such combination of materials, so treated, hydrogen gas and oxide of carbon gas mixed; and afterwards in combining such compound gas with carburetted hydrogen gas, produced by bringing tar, oil, or fat, or certain other substances thereinafter designated or described, in contact with heated materials, so as to produce ultimately a compound gas composed of hydrogen gas, oxide of carbon gas, and carburetted hydrogen gas, mixed together; which compound gas was therein described as fitted for the purpose of illumination; and in my said Specification I claimed the method therein described of producing hydrogen gas and oxide of carbon gas combined, freed or nearly freed from the presence of carbonic acid gas, by passing the gas evolved by the decomposition of water through a mass of materials composed of charcoal, coke, or anthracite coal, and iron plates, or iron wires, or lime heated to a high temperature, and of combining such compound gas with carburetted hydrogen gas, produced by the decomposition of oil, or fat, or tar, or such other substances as therein-before designated. But I did not claim any part of the retorts directed to be used, nor any part of the apparatus described, except certain colanders, a certain apparatus designated as a dispurser, and the use of certain chains described.

NOW KNOW YE, that in compliance with the said proviso contained in the Letters Patent so granted to me as aforesaid, bearing date the Twenty-sixth day of March, One thousand eight hundred and forty-nine, I, the said Stephen White, do hereby declare that the nature of my said Invention, and the manner in which the same is to be performed, are particularly described

and ascertained in manner following, reference being had to the plans or Drawings hereunto annexed, that is to say:—

A part of may improvement in the manufacture of gases is applicable to the manufacture of the compound gas fitted for the purpose of illumination, described in the Specification of my said former Patent of the Fifteenth April, One thousand eight hundred and forty-seven, and consists in a particular arrangement and construction of apparatus to be used in the manufacture of such compound gas, and which I will now proceed to describe with reference to the Sheets of Drawings hereto annexed, numbered 1 and 2. The Drawing in Sheet 1 represents a front view of the apparatus; and the Drawing in Sheet 2 a side view of part, and a section of part thereof. *a*, *b*, in the Drawing, Sheet 1 annexed, represents two cylinders or retorts, made either of fire-clay or of cast iron, placed perpendicularly, and supported by fire-tiles or brickwork over the furnace. These retorts are supplied each with an internal flue shewn by the dotted lines *c*, *d*, Sheet 1, cast with the retort running from the bottom thereof to within a few inches of the top, such flues being intended to carry the fire from the furnace up through the centres of the retorts, and out near the upper ends thereof, whence it returns to the oven in which the retorts stand, so as to heat the retorts both within and without, and to maintain their contents always at what is termed by gas manufacturers a good white red heat. The cylinders or retorts *a* and *b* are to be filled nearly with charcoal, or coke, or anthracite coal, and iron plates, iron turnings or iron wires, the charcoal, or coke, or anthracite coal being broken in small pieces, and mixed with the iron in the proportion of one pound of iron to six pounds of charcoal, coke, or anthracite coal, which proportion of the materials I find the best for the production by means of the decomposition of water of the compound gas consisting of hydrogen gas and oxide of carbon gas combined, described in the Specification of my said former Patent. E, E, on the Drawing, Sheet 1, are cocks placed in pipes leading from a convenient vessel containing water, which is caused to pass in a rapid succession of drops, or in a small stream, according to the size of the retorts used, the supply being regulated by means of the said cocks through the syphon tubes F F into the retorts *a b*. The water is conveyed through the said pipe *f f* into the upper ends of the retorts, and diffuses itself over and penetrates through the heated materials therein contained, by means of which it is converted into vapour, and such vapour having no outlett at the upper end of the retorts (which are closed), gas-light penetrates and passes through the whole body of such before-mentioned materials contained in the retorts down to the bottom of the said retorts, whence it is allowed to escape through the connecting tubes *n n* into

the horizontal retorts *i*, *i*, where it combines with the bi-carburetted hydrogen gas which is produced in the retorts *i*, *i*, in the manner herein-after mentioned.

The bi-carburetted hydrogen gas with which the compound gas produced by the decomposition of the water in the retorts *a*, *b*, is to be combined, is produced in the horizontal retorts *i*, *i*, Sheets 1 and 2, in manner following, that is to say :—The vessels *j*, *j*, Sheets 1 and 2, contains resin, oil, fat, tallow, or common tar, or some other substance of a similar character, which decomposed at a high temperature gives out bi-carburetted hydrogen gas in large quantities, and contains a large amount of olefiant gas.

I shall describe the process as conducted with resin, tar, or fats, which are the three substances I propose principally to use. The resin, tar, or fats should be kept in the melting vessels *j*, *j*, Sheet 1, in a liquid state; and for the purpose of keeping those vessels sufficiently heated they are placed on and partly let into the brickwork at the top of the oven. Note.—When resin is used as the material for producing the bi-carburetted hydrogen, it should be melted with an equal weight of oil; and for that purpose the oil that is condensed during the process in the cooling pipes or condensor from the resin itself may be used. By thus mixing oil with the resin it is always kept in a thin fluid state, The resin, tar, or fat, or other material used, is admitted from the vessels *j*, *j*, in a small continued stream regulated by the service pipes *k*, *k*, and the cocks *l*, *l*, Sheets 1 and 2, through the syphon pipes *m*, *m*, Sheet 1, into the lower divisions of the retorts *i*, *i*, where it falls on the bottom of such retorts.

In order to regulate the stream of the resin, fat, oil, or other substance, the pipes *k*, *k*, have caps screwed on at their lower ends, which caps are drilled each with a small hole or aperture, which may be from $\frac{1}{16}$ to $\frac{1}{6}$ of an inch in diameter, according to the size of the retorts and quantity of resin or other material required to flow continuously. The pipes *k*, *k*, should also be enclosed in tubular casings of about twice their diameter (not shewn in the Drawing), the space surrounding each pipe *k* being filled with sand, water, or some similar non-conducting material, to preserve an uniform temperature in the pipes *k*, *k*. Each of the retorts *i*, *i*, is divided in the centre by a horizontal partition, as shewn at *s*, Sheets 1 and 2, which partition is continued to within about six inches of the extreme ends of the retort. The mouth or aperture of the retorts *i*, *i*, are made gas-tight by means of doors, bolts, screws, and luting, as shewn at "*o*," Sheets 1 and 2; the doors of these retorts are, as it will be seen at *o*, Sheet 2, made with a groove running across the centre longitudinally, to receive the end of the division or plate *s*, which is cemented

therein with luting; thus the retorts are divided into two compartments which are air-tight at the door end.

The retorts *i*, *i*, are half filled with small iron or copper chains, arranged as shewn in Sheet 2 (I prefer iron or copper chains being used, but any other metal capable of sustaining a white red heat may be used, or instead of iron or copper chains pieces of thick iron wire or copper wire, made spiral similar to a cork screw, or such similar shaped pieces of metal, may be used), the object being to expose the gas, which is passed through the retorts *i*, to the slight resistance of a heated material, but yet so as not materially to check the passage of the gas through the retort. The retorts *i* are to be kept during the process heated to a moderate red heat, and the whole apparatus is heated by means of the furnace *g*, *g*, which has nothing peculiar in its construction. The bi-carburetted hydrogen gas is formed by the resin, oil, fat, or other substance of the kind herein-before designated coming in contact with the heated surface of the retort *i*, and of the chains or other materials with which they are, as herein-before described, partially filled. The resin, oil, fat, or other substance being introduced as described into the lower portion of the retorts *i*, the gas as it is formed flows, together with the gas, introduced into the same lower divisions of the retorts *i*, from the retorts *a*, *b*, as above described, along the lower part of the retort *i* in the direction shewn by the arrows, and then turns back by the ends of the divisions *s*, and flows out through the ascending pipes *t*, see Sheet 2, into the hydraulic main *u*, thence through the cooling pipes, and an ordinary purifying vessel or washer, containing lime water or milk of lime, to remove any portion of carbonic acid that may be formed during the process, and thence into the gas holder for use. Note.—I have described only one division in the retorts *i i*, which is most convenient for an apparatus of moderate size; but the object being to cause the gases to make a sort of circuit, so as to expose them in their passage to as extensive a surface of the retorts and of the heated materials contained therein as can conveniently be done, it is obvious that in a large apparatus it may be convenient to increase the circut made by the gas by having the retorts *i* divided into four or more compartments.

The heat of the whole apparatus should be raised, and during the process herein-after described kept up to such a degree as to maintain the charcoal, or coke, or anthracite coal, and thin pieces of iron plates or iron turnings, or iron wires, contained in the retorts *a*, *b*, at a good white red heat, and the iron chains or other such like metal contained in the horizontal retorts at a good red heat.

If iron plates are used in the retorts *a*, *b*, there should be (in order to operate to the greatest advantage, thin flat pieces of hoop iron or other thin plates of iron, and about two inches wide). If iron wires are used, they should be of small diameter, say about one-tenth of an inch diameter, and from three to four inches long.

The charcoal, or coke, or anthracite coal, and iron plates or wires, contained in the retorts *a* and *b*, Sheets 1 and 2, are replaced as occasion requires through the openings *r*, *r*, Sheet 1, at the upper ends of the retorts, which are otherwise of course previously to and during the process of manufacturing gas closed by doors luted on to the necks of the retorts, and fastened down by means of clamps and screws; the same is required for the retorts *i*, *i*, the doors of which are fastened gas-tight during the process of making gas. But the chains or pieces of iron or other metals employed can, when required, be taken out, to remove any incrustation of carbon that may be formed in the retorts during the manufacture of gas.

I have hitherto spoken only of oil, tar, fat, and other similar substances in reference to the production of the bicarburetted hydrogen; but in the apparatus above described the said gas may be obtained from pit coals. In this case such pit coals only should be selected as shall be rich in carbon and olefiant gas.

The retorts *i*, *i*, are then, instead of being partially filled as herein-before described with chains or other such like pieces of metal, as before mentioned, charged with the pit coal placed in thin layers, as well on the divisions *s* of the retorts as on the bottom of the retorts, taking care to allow sufficient room for the disengaged gases to pass freely through the retort.

The retorts *i* will, if pit coal is used, be heated just in the same way as herein-before described for generating gas from resin, oils, fats, &c., only instead of raising them to a good red heat they should be raised to a white red heat.

In manufacturing with the apparatus above described, the compound illuminating gas, composed of hydrogen gas and oxide of carbon gas, combined with carburetted or bicarburetted hydrogen, I find it advantageous, if the carburetted hydrogen is produced from pit coal, that the charge of the retorts *a*, *b*, and *i*, *i*, shall be relatively such, and the proportion between the quantity of water used in the retorts *a*, *b*, and of pit coal in the retorts *i*, that the gas coming from the retorts *a*, *b*, shall be in the proportion of about four to six of that produced in the retorts *i*, *i*.

The compound gas produced as above described should be tested during its manufacture on its way from the apparatus to the gasometer, by means of a

test burner. If the gas burns with a thick smoky flame, more of the gas produced by the decomposition of water should be employed in the manufacture; but if, on the contrary, the gas burns with a weak or bluish flame, then more of the carburetted hydrogen should be used.

The Drawings hereto annexed are on a scale of one and a half inches to the foot, but of course the sizes of retorts will be decreased or increased as occasion may require.

Now in reference to the part of my said Invention above described, I have described the process of manufacturing the gas, for the purpose of explaining the apparatus shewn by the Drawings; but I do not claim the combination of hydrogen gas and oxide of carbon gas with carburetted hydrogen gas as a chemical process, nor any part of the process herein-before described as a chemical process; nor do I, except as herein-after stated with reference to the retorts *i*, claim any particular part of the apparatus described separately and distinctly; but I claim the special and particular arrangement and combination of parts and things constituting the apparatus delineated in the Drawings, Sheets 1 and 2, and in particular I claim the mode which I have described of constructing the retorts *i* with a division or divisions adapted to extend the length of heating surface in contact with which the generation of the carburetted hydrogen, and its combination with the hydrogen gas and oxide of carbon gas, take place.

Another part of my said Invention is applicable to the manufacture of oxygen gas, and is described in reference to Figures 1 and 2 on the Drawing, Sheet 3, hereto annexed.

Figure 1, Sheet 3, shews a front view of an apparatus, consisting of three retorts *b*, *c*, *d*, made of good clay, with their ascending pipes *n*, *n*, *n*, and hydraulic main *i*, also of fire clay, the retorts being set in a brick work oven heated by the furnace *e*.

Figure 2 is a side view of the same apparatus. *a*, Figure 1, represents a crucible made of fire clay or similar material, or of iron, or of some material that will bear a good white red heat. Several, usually three or four of such crucibles, are placed in each retort, and the crucibles are three-fourths filled with nitrate of soda or nitrate of potash. When the retorts are thus charged, the doors are cemented and fastened by means of clamps and screws in the ordinary way, and the retorts being subjected to a strong white red heat, oxygen gas is given off in large quantities, which passes up the ascending pipes *n*, *n*, *n*, into the hydraulic main *i*, Figure 1, which will contain water or lime water.

With the oxygen gas disengage nitrous acid fumes in small quantities are

given off, which become washed in the water contained in the hydraulic main, and are taken up or absorbed by the water, which should be drawn off by the cock *j*, and fresh water supplied by means of the syphon *k*, every twelve hours.

The gas after passing the hydraulic main is conducted to cooling pipes, to condense any portion of aqueous vapour that may be found during the process herein-before described, thence into a gasometer, which may be of the ordinary kind, to be thence drawn off for use.

If nitrate of potash be used, potassa will be obtained as a residuum in the crucibles.

If nitrate of soda be the material employed, soda will be the residuum. Whenever the generation of oxygen gas has ceased, the crucibles will be removed, and that should be done while they are still in a hot state, so that the residuum contained in them, which will then be liquid, may be removed from them.

The residue so obtained from either nitrate of potash or nitrate of soda are, as is well known, valuable articles of commerce, and may be used for a variety of purposes. But I propose, in reference to this part of my Invention, to treat such residue by a known process of mixing the same with nitric acid, diluted with twice its volume of water, and placing the mixture in a boiler of clay or iron, and then evaporating the water, the result of which process is that nitrate of potash or nitrate of soda will remain (according to the residuum that has been used), and such nitrate of potash or nitrate of soda may be returned into the crucibles, for the reproduction of oxgen gas.

The length of time required for the perfect decomposition of either nitrate of potash or nitrate of soda, whichever may be employed in the process, will of course depend on the capacity of the retorts, and the quantity of material placed within the crucibles at each charge, but, generally speaking, it will require from four to six hours to complete the process. The gas should, however, be tested during the process by means of a test burner communicating from the main pipe as the gas is passing to the gas holders. If on applying a lighted taper to such test burner the flame should not be increased in brilliancy, it follows that all the oxygen that the substances used can give out has been obtained, and then the retorts should be opened, and the crucibles with their contents removed, and fresh charges of nitrate of potash or nitrate of soda be replaced; but if on the application of a taper as before mentioned during the process the flame becomes more bright and luminous, then the process should be continued until it is found that on applying a light no increase of brilliancy as above described takes place.

Now, in reference to this part of my said Invention, I do not claim the chemical process of producing oxygen gas from either nitrate of soda or nitrate of potash; neither do I claim the use of retorts, as the manufacture of oxygen gas by exposing it to heat in retorts is well known; but what I claim is the manufacture of oxygen gas by exposing the material from which it is to be obtained, as above described, to heat in detached and moveable crucibles, placed within retorts of any suitable construction, heated in any ordinary way.

A further part of my said Invention consists in the application of the compound gas herein-before and in the Specification of my said former Patent described, and obtained from the decomposition of water, consisting of a combination of hydrogen gas and oxide of carbon gas combined with atmospheric air, or with oxygen gas, for the purpose of generating heat, or with atmospheric air for the purpose of consuming smoke. If an apparatus is to be constructed for the purpose of applying this part of my Invention, of course only the retorts for generating the gas produced by the decomposition of water will be required, and the gas generated therefrom, instead of passing into retorts, such as *i*, *i*, Sheets 1 and 2, should be conducted from the bottom of retorts, such as *a*, *b*, by means of pipes fixed therein to an hydraulic main placed beneath below the fire-place, and from thence into ordinary condensing pipes to the gasometer for use.

The compound gas so prepared by the decomposition of water, in order that the greatest amount of heat may be obtained, should, in being applied in combination with atmospheric air, be combined with one half its volume of common atmospheric air, or if with oxygen gas, with from one fourth to one half its volume of oxygen gas. It will of course be understood that the compound gas produced from the decomposition of water must not be mixed with the atmospheric air or hydrogen gas in the same vessel; that they will be conducted through separate pipes or vessels, and only meet at the point where they are to be ignited.

It is needless for me to describe any particular apparatus for the purpose of applying this part of my Invention to the production of heat in any particular form, as the form of apparatus by means of which heat resulting from the combustion of the compound gas described combined with atmospheric air or oxygen will be as various as the purposes to which heat may be applied; and my Invention does not consist at all in the construction of any particular apparatus, but only in the application of the gas produced by the decomposition of water in the manner herein-before and in the Specification of my said former Patent described, combined with atmospheric air or with oxygen gas, for the purpose of producing heat.

So, in regard to the application of this part of my Invention for the purpose of consuming smoke, my Invention does not consist in any particular arrangement of apparatus for bringing a current of the above-mentioned compound gas combined with atmospheric air into contact with a current of smoke arising from any furnace, but generally in the application of such combination of compound gas and air, to mix with and consume a current of smoke. I have however exhibited in the Drawings, Figures 1 and 2 of Sheet 4, a mode of applying this part of my said Invention to consume the smoke of a common steam engine furnace. *a*, Figure 1, represents a side view of an ordinary boiler; *b* the fire bridge, Figure 2 shews an end view of the same; *c*, *d*, shew two tubes made of stout welded iron, the tube *c* admitting a stream of the compound gas produced by the decomposition of water in manner herein-before mentioned.

The tube *d*, which has a trumpet-shaped mouth piece or opening *f*, admits a current of atmospheric air from without, by the draft of the furnace. By this means a regular current of the above-mentioned gas, combined with atmospheric air, will be supplied, and come in contact and mix with the smoke given off from the coals or other fuel used, and pass around and traverse the flues of the boiler. By this means the carbonaceous and other matters given off in the form of smoke become consumed or taken up. Each side of the boiler or furnace should be supplied with two tubes for the admission of atmospheric air, as shewn at *c*, *c*, Figure 2; the other two for the introduction of the compound gas produced by the decomposition of water; see *d*, *d*, Figure 2. Generally it will be proper to admit the atmospheric air and compound gas combined at the point where the smoke is first seen to rise.

With respect to this part of my Invention, I do not claim any particular form of apparatus; but I claim the application herein-before described of the gas produced by the decomposition of water in the manner herein-before and in the said Specification of my said former Patent described, combined with atmospheric air, or with oxygen gas, to produce heat, or with atmospheric air to consume smoke, by directing a current of such gas and air combined into the current of smoke in the flues through which the smoke passes.

In witness whereof, I, the said Stephen White, have hereunto set my hand and seal, this Twenty-sixth day of September, One thousand eight hundred and forty-nine.

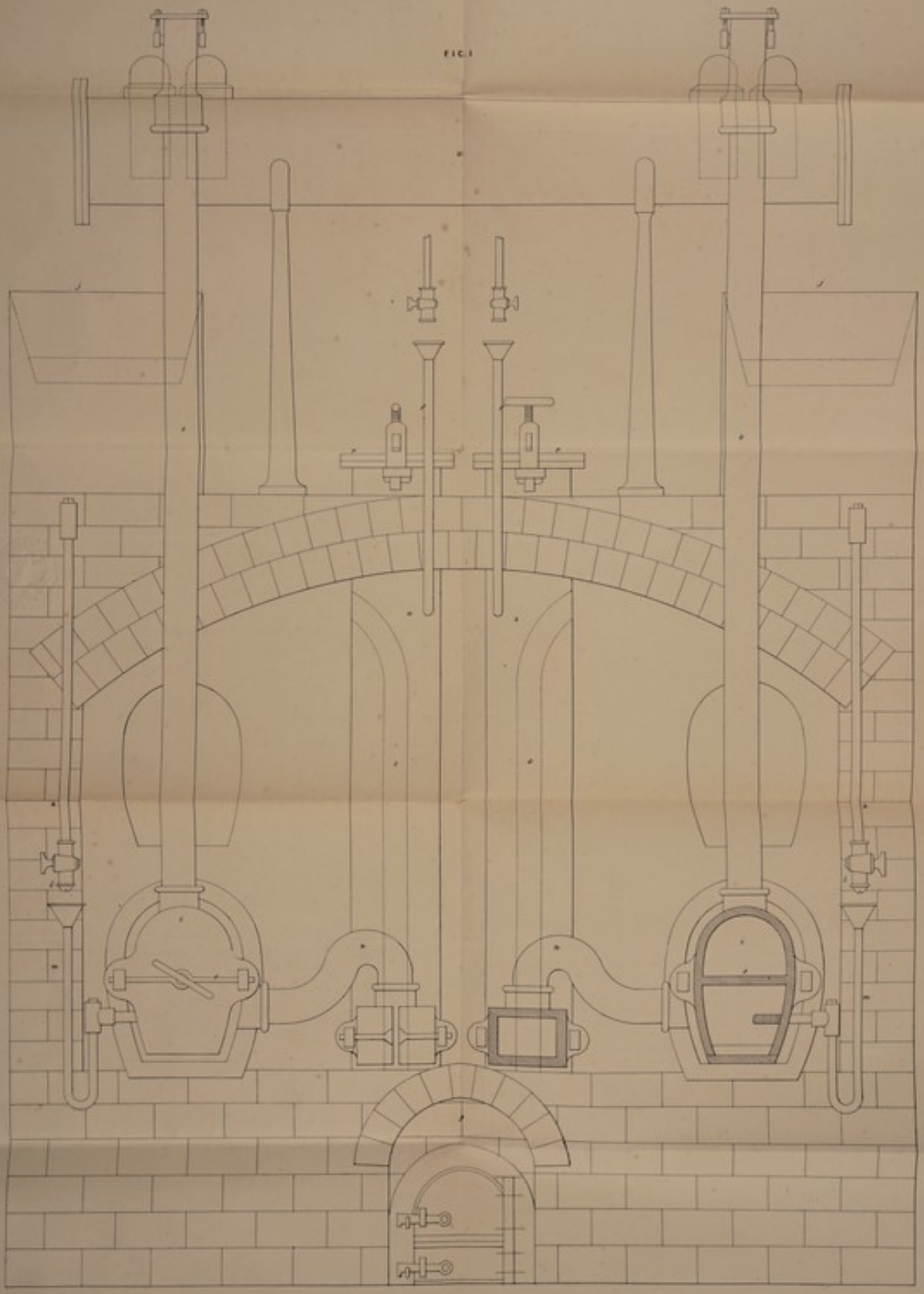
STEPHEN (L.S.) WHITE.

Signed, sealed, and delivered by the within-named
Stephen White in the presence of

A. D. 1849. March 26. N° 12586.
WHITES Specification

4 SHEETS
SHEET 1

FIG. 1

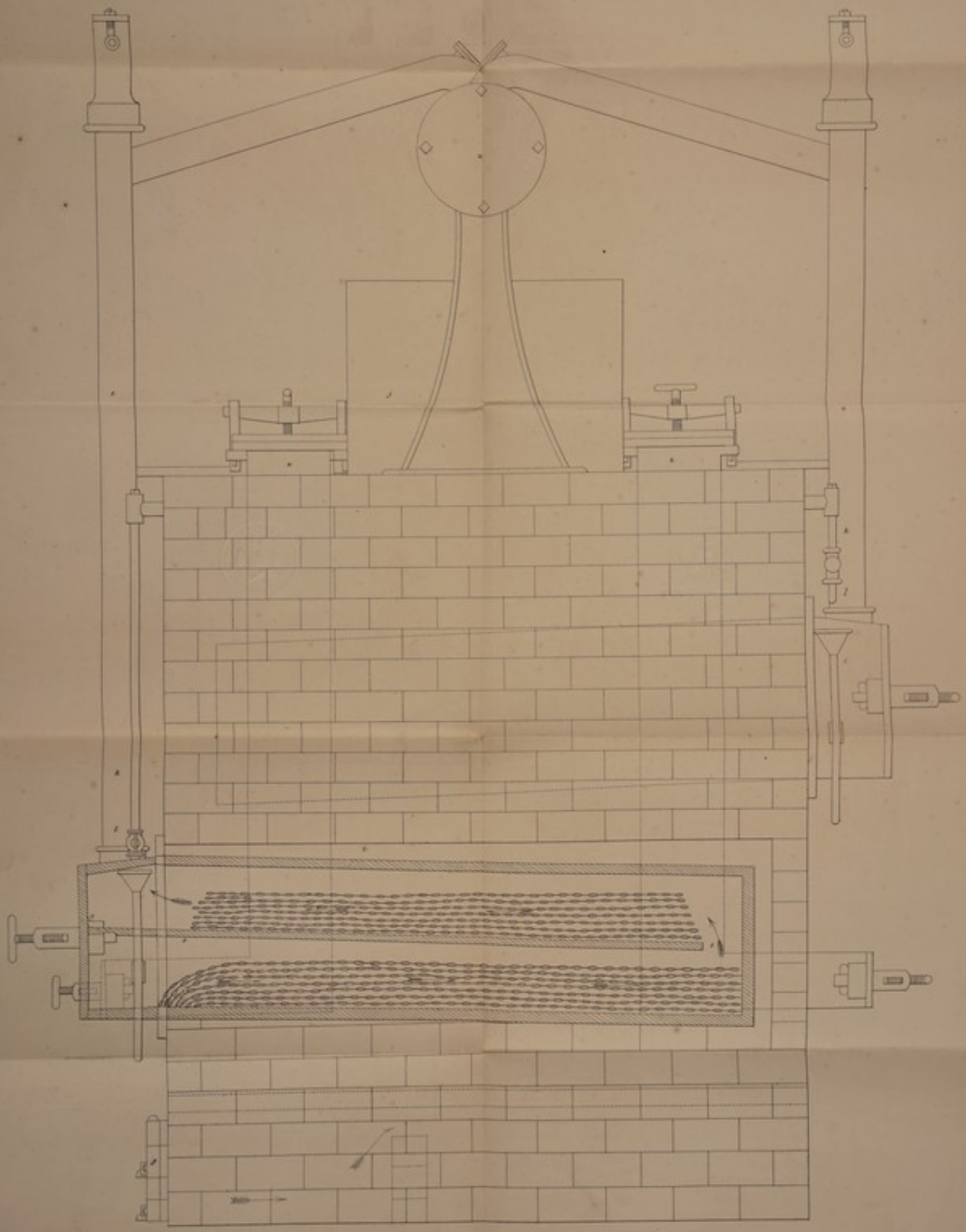


Scale 1/8 inches to the foot.

The Enrolled drawing is not colored.

Wesley & Sons, Lith.

London: Printed by George Edward Eyre and William Spottiswoode,
Printers to the Queens most Excellent Majesty. 1850.



The Enrolled drawing is not colored.

LONDON: Printed by GEORGE EDWARD EYRE and WILLIAM SPOTTISWOODE,
Printers to the Queens most Excellent Majesty. 1854.

A. D. 1849. March 26. N° 12,536.
WHITE'S Specification.

4 SHEETS
SHEET 3

FIG. 1.

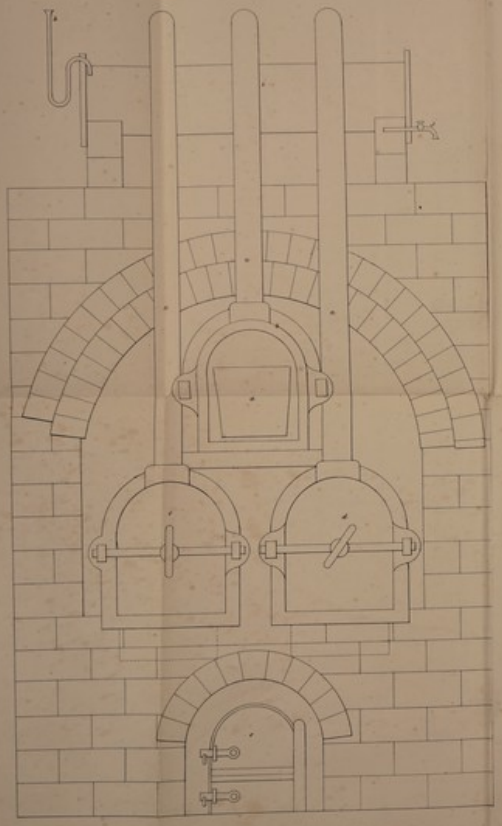
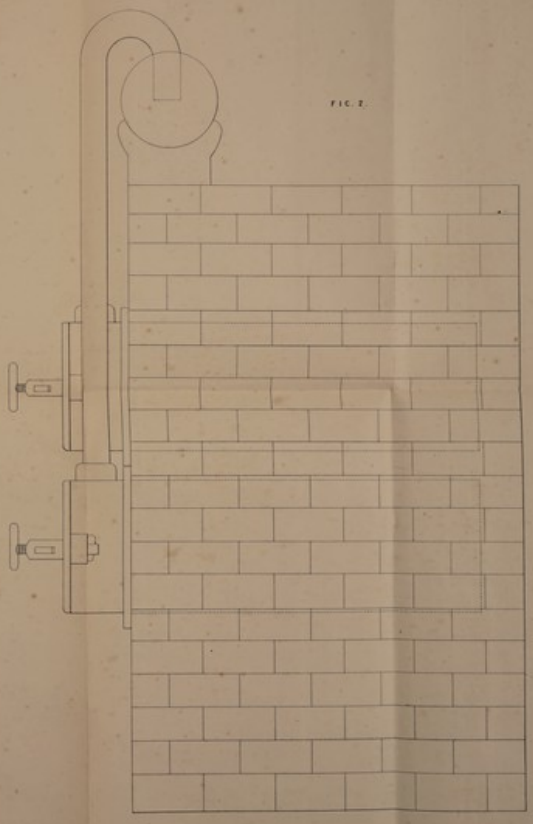


FIG. 2.



The Enrolled drawing is not colored.

London: Printed by George Edward Eyre and William Spottiswoode,
Printers to the Queen's most Excellent Majesty. 1849.

Hasler & Sons. Lith.

FIG. 1.

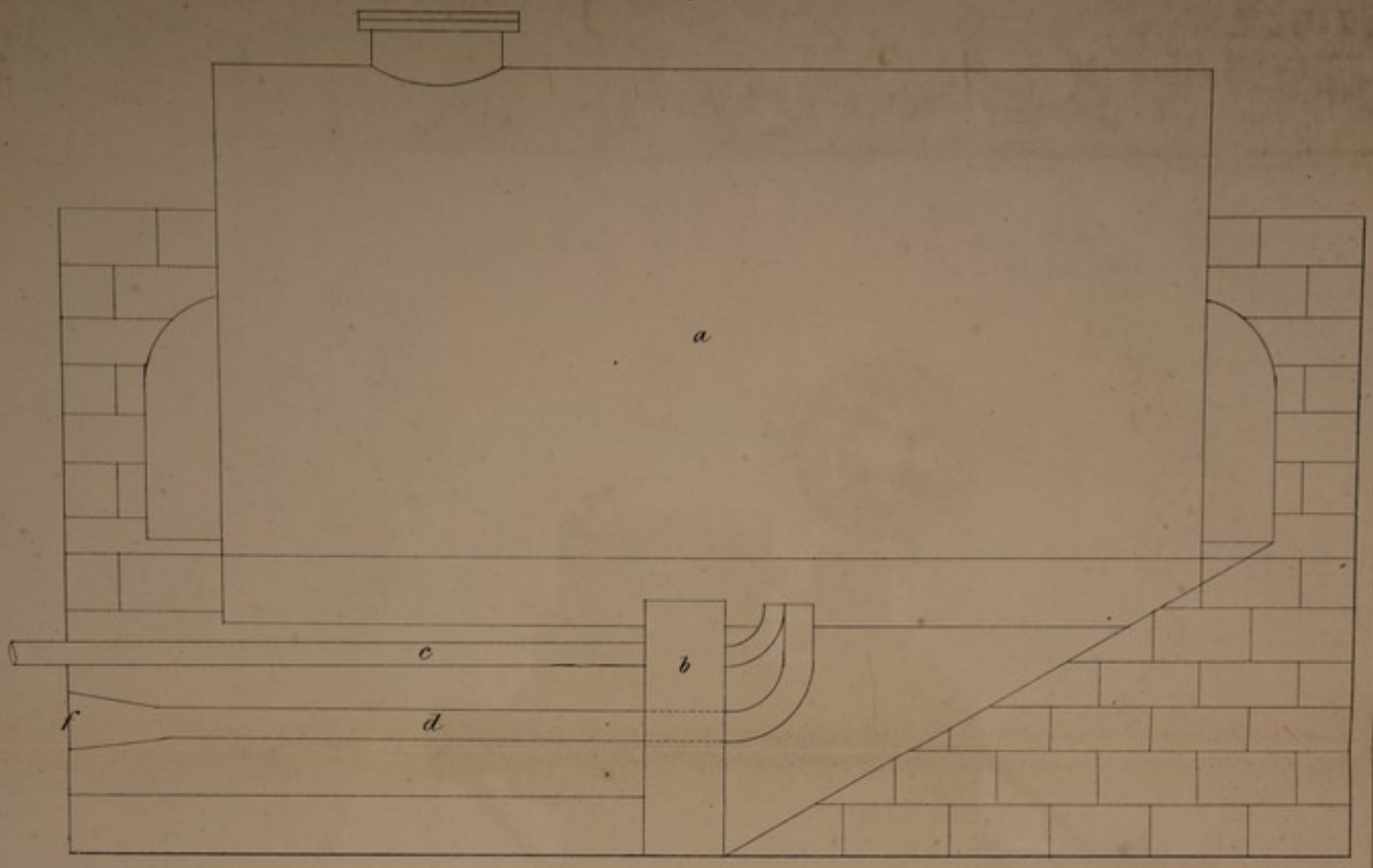
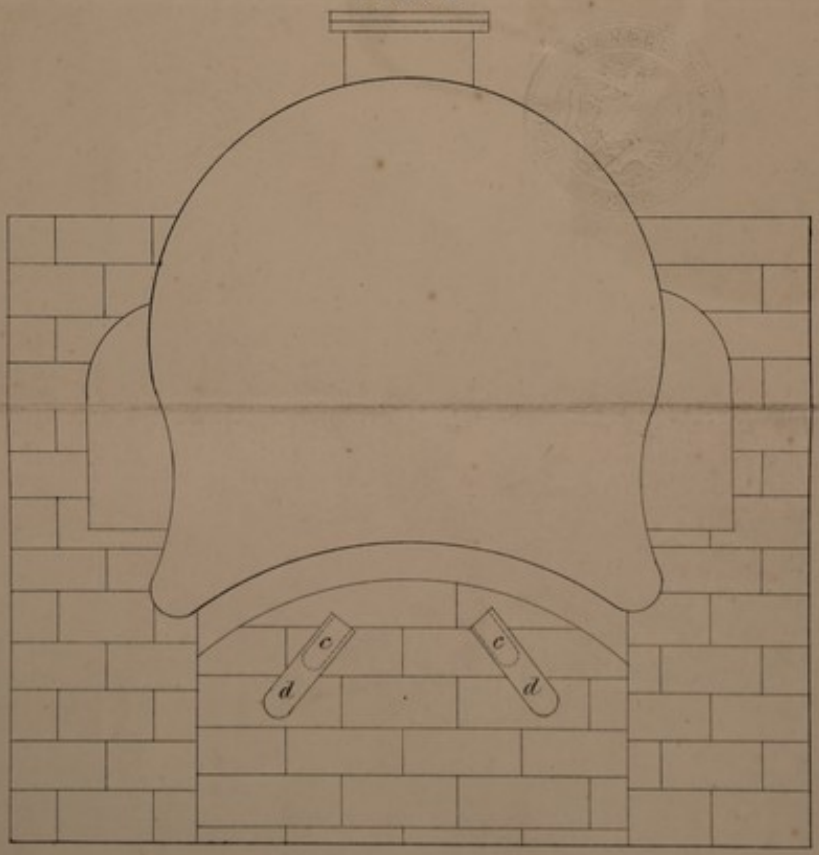


FIG. 2.



The enrolled drawing is not colored.

Malby & Sons, lith.

London: Printed by George Edward Eyre and William Spottiswoode,
Printers to the Queen's most Excellent Majesty. 1854.

AND BE IT REMEMBERED, that on the Twenty-sixth day of September, in the year of our Lord 1849, the aforesaid Stephen White came before our said Lady the Queen, in Her Chancery, and acknowledged the Specification aforesaid, and all and every thing therein contained and specified in form above written. And also the Specification aforesaid was stamped according to the tenor of the Statute made for that purpose.

Enrolled the Twenty-sixth day of September, in the year of our Lord One thousand eight hundred and forty-nine.

LONDON:
Printed by GEORGE EDWARD EYRE and WILLIAM SPOTTISWOODE,
Printers to the Queen's most Excellent Majesty. 1854.