

Specification of Pierre Jacques Ferier : vapour and hot-air baths.

Contributors

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A.D. 1839 N° 8179.

SPECIFICATION

OF

PIERRE JACQUES FERIER.

VAPOUR AND HOT-AIR BATHS.

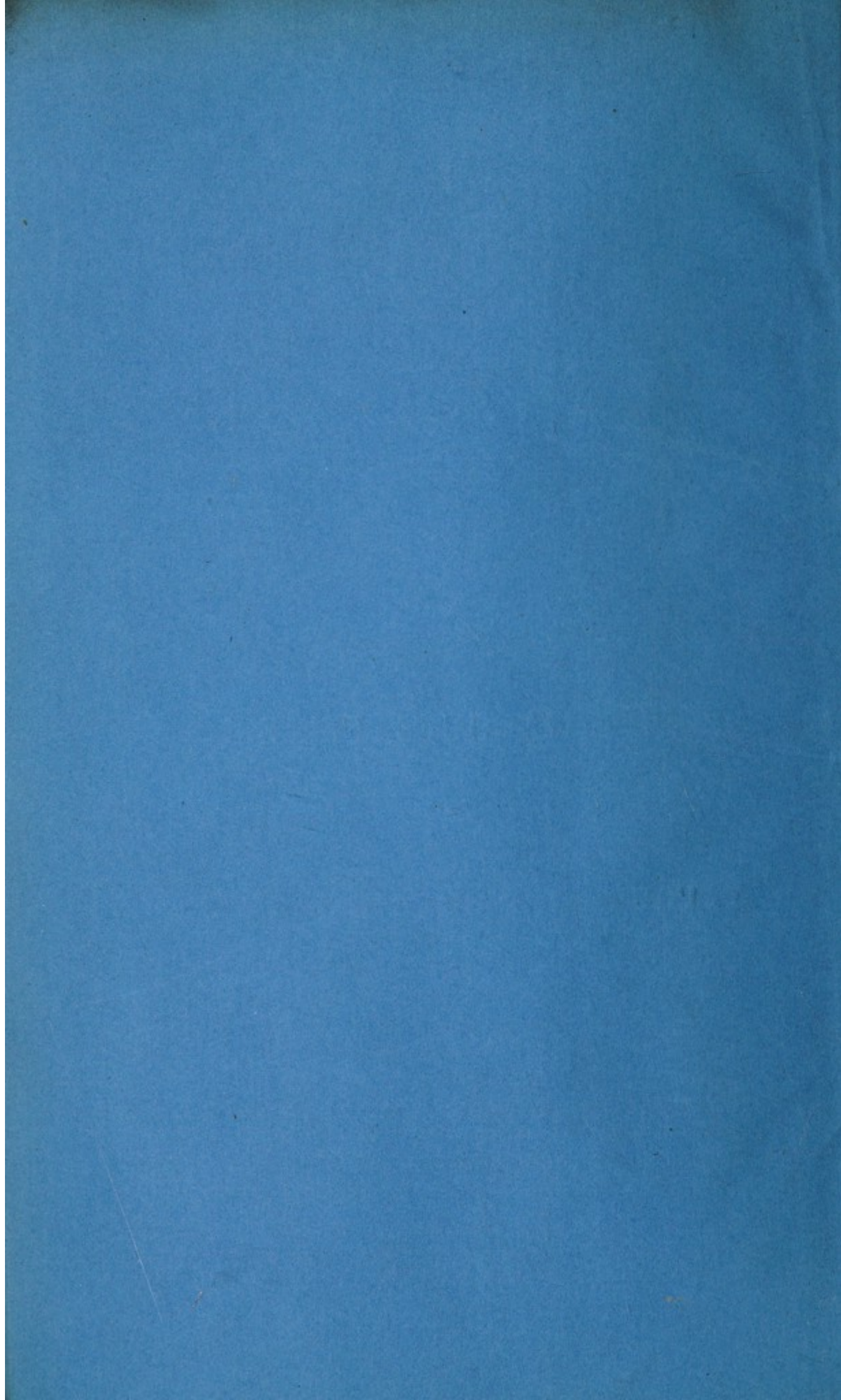
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A.D. 1839 N° 8179.

Vapour and Hot-air Baths.

FERIER'S SPECIFICATION.

TO ALL TO WHOM THESE PRESENTS SHALL COME, I, PIERRE JACQUES FERIER, late of Paris, in the Kingdom of France, but now residing at No. 5, Paul's Chain, St. Paul's Church Yard, in the City of London, Jeweller, send greeting.

5 WHEREAS I did by Petition humbly represent unto Her most Excellent Majesty Queen Victoria, that I had, by a communication made to me by a certain foreigner residing abroad, become possessed of an Invention of "CERTAIN IMPROVEMENTS IN THE CONSTRUCTION OF VAPOUR AND HOT-AIR BATHS," and Her said Majesty being willing to encourage all useful Inventions, did
10 issue Her Letters Patent under the Great Seal of Great Britain, bearing date at Westminster, the First day of August, in the third year of Her reign, whereby Her said Majesty did, for Herself, Her heirs and successors, give and grant unto me, the said Pierre Jacques Ferier, my exors, adñors, and assigns, Her especial licence, full power, sole privilege and authority, that I,
15 the said Pierre Jacques Ferier, my exors, adñors, and assigns, or such others as I, the said Pierre Jacques Ferier, my exors, adñors, 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 expressed, should and lawfully might make, use, exercise, and vend the said Invention within that part of Her said
20 Majesty's United Kingdom of Great Britain and Ireland called England, Her Dominion of Wales, and Town of Berwick-upon-Tweed, and also in all Her Colonies and Plantations abroad; in which said Letters Patent is contained a proviso obliging me, the said Pierre Jacques Ferier, particularly to describe

Ferier's Improvements in the Construction of Vapour and Hot-air Baths.

and ascertain the nature of the said Invention, and in what manner the same is to be performed, by an instrument in writing under my hand and seal, and to cause the same 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 Letters Patent, as in and by the same, reference being thereunto had, will 5 more fully and at large appear.

NOW KNOW YE, that in compliance with the said proviso, I, the said Pierre Jacques Ferier, do hereby declare that the nature of the said Invention, and the manner in which the same is to be performed, are described and ascertained in manner following, reference being had to the three Sheets of 10 Drawings hereunto annexed, that is to say:—

The several Figures drawn on Sheet 1 of the Drawings hereunto annexed represent part of the said improvements applied in the construction of a vapour bath for producing and distributing the vapour of water.

Figure 1 is an external view; Figure 2, a horizontal plan; and Figure 3, 15 a section of the said bath; the remaining Figures represent parts of the bath detached, and will be more particularly referred to herein-after. E, Figures 1, 2, and 3, is a compound vessel, consisting of an external cylindrical vessel 1, 1, see Figure 3 in particular, open at the bottom, and a double internal cylindrical vessel 2, 2, 3, 3, which is brazed to the vessel 1, 1, 20 at its upper edges, the three forming together an annular space or reservoir F, F, serving the purpose of a boiler or generator, in which is placed the water from which vapour is to be generated, and a space G, G, G, surrounding that generator, in the manner of a flue or chimney, see Figure 3. The upper part of the compound vessel E is closed by a moveable cover *j*, which is 25 made to fit close at the upper edges of both of the external cylinders, and of the internal cylinder or tube 3, 3, so as to prevent the escape of vapour from the generator, except through the passages intended for that purpose. The compound vessel E is mounted on a stand D, D, B, B, the lower part of which B, B, forms a cup or tray, in which is placed a lamp A, 30 which will be herein-after more particularly referred to. Holes are formed at *d*, see Figure 3, all round the neck of the cylinder or tube 3, 3, below the cover J, to allow the vapours formed in the generator to pass thence into the space G, in the manner shewn by the arrows, Figure 3. H is a tube, fitting steam-tight over the upper end of the tube 3, 3, and terminating at its upper 35 end in a ball *f*, from which branch out three nozzles, over which are fitted corresponding pipes K, K, and *l*. In the tube H is fitted at *i* a valve, of the kind called by mechanics a throttle valve, which, when in the position shewn by the full lines, Figure 3, closes the passage through the tube H, but allows

Ferrier's Improvements in the Construction of Vapour and Hot-air Baths.

a free passage through such tube when turned round on its axis 6 by the handle 7 into the position shewn by the dotted circle; the mode of making and fitting, and the operation of a throttle valve, are so well known as not to require any further description. To the cover J of the compound vessel E is
 5 fixed a nozzle 5, over which is fitted a bent tube O, for the purpose of conducting the vapour formed in the generator F into a hollow tin vessel or box M. The upper part of the said vessel is perforated with a number of holes *e, e*, see Figure 2, to allow the vapour introduced into it to escape, and it is also furnished with a bent tube P, the use of which will be presently
 10 explained. The vessel M is mounted on a wooden frame N, forming together therewith a footstool, the object of which will also be pointed out herein-after. And note, that the edges of the frame stand up high enough above the vessel M to prevent the feet when placed thereon from coming in contact with the metal of the vessel M. The lamp A is adapted to burn spirits of
 15 wine or naphtha; it is furnished with four wicks *b, b*, (see the three principal Figures, Sheet I., and also Figures 4, 5, and 6,) and also with a small conical tube or funnel in the centre at *c*, the cover of which is perforated with a small hole; the tube *c* serves the double purpose of the filling tube, to pour in spirit to the lamp, and of a safety tube, to allow the escape of the spirit and flame in
 20 case the spirit should take fire inside the lamp. A cover Q, see Figures 4, 7, and 8, is provided to cover up the whole lamp when the apparatus is out of use, or being moved about, to prevent the evaporation of the spirit.

Having now explained the various parts of the vapour bath shewn in Sheet I., I will describe its operation and the mode of using it. Suppose it is
 25 intended to use the said bath for the purpose of taking a vapour bath sitting, the generator F being first filled about half or two-thirds full of water, the cover J is put on, and then the other parts of the bath being put together in the manner shewn in Figures 1 and 3, except that the throttle valve is set open before beginning to work, the lamp is lighted; the flame of the four
 30 wicks striking upon four points of the curved bottom of the generator F, and circulating all round it in the flue G, G, G, will raise the water in due time to the point of ebullition; as soon as the lamp is lighted, and the apparatus so prepared for working, a common chair is placed over the vessel E, and the patient takes his seat on it, placing his feet on the raised wooden rim of the
 35 frame of the vessel or perforated footstool M; he should of course be enveloped in a covering of oiled silk, or some other similar steam-tight covering of the kind ordinarily used in taking a vapour bath, such covering being kept out so as to form a chamber by hoops, or some other similar ordinary arrangement of framework, and extending over the chair and the perforated footstool, so as to

Ferrier's Improvements in the Construction of Vapour and Hot-air Baths.

envelope the whole apparatus as well as the body of the patient. The vapour which is generated in the annular space F, F, passes through the holes *d* into the interior of the tube 3, 3, and thence up through the pipe H (the throttle valve *i* being kept open) into the ball *f*, whence it is distributed by the pipes K, K, upon the parts of the body to which those pipes are directed. The 5 same passage H and pipes K, K, serve as the chimney and passages to carry off the heated air rising up from the flue G, G, G, so that the heated air mixes and escapes with the vapour, and thus contributes to keep up the temperature of such vapour after it has quitted the generation F, independently of the effect of such heated air upon the heating surfaces of the said generator. A 10 part of the vapour generated in the generator will pass away through the pipe O into the perforated footstool M, and rise up through the holes *e*, so as to envelope and bathe the feet of the patient; and a portion of such vapour so introduced into the footstool will ascend through the pipe P, which may be directed by the patient, so as to pour the stream of vapour issuing there- 15 from upon any part of his legs; the pipe P also has the effect of carrying off the hot vapour from the footstool M fast enough to prevent the said footstool from acquiring and giving out to the feet of the patient too great a heat. It must be observed that although the pipes K, K, and P are fitted on their respective nozzles closely, they are not fastened thereto, but are 20 fitted so that they can be turned round freely thereon, in order to give the patient the power of governing the direction of the flow of vapour therefrom. The nozzle *l* is not in general intended to be used in the apparatus when it is applied in the manner above described, and is therefore shewn in the Drawing covered by a cap; but, if necessary, a third tube such as K may be fitted on 25 the nozzle *l* to apply a third stream of vapour to the body of the patient. The throttle valve *i* gives to a certain extent the means, if required, of regulating the quantity of vapour drawn off from the generator by the different distributing pipes, so as neither to allow the vapour to accumulate to too great a density in the generator, nor to be drawn off faster than it can be generated 30 by the quantity of heat applied. When the bath has been in operation long enough, the lamp is easily extinguished by shutting the throttle valve entirely, for then the vapour formed, having no other exit, rushes down through the flue G upon the flame of the lamp and extinguishes it. The shape and length of the pipes K are (as shewn by the Figures) such as that their curved ends 35 shall project out beyond the edges of the seat of a chair and turn upwards in a direction towards the sides of the body of the person sitting on such chair. The shape of the bottom of the generator F should be, in order to obtain the greatest advantage from the heat of the flame of the wicks *b*, a curve, so as to

Ferrier's Improvements in the Construction of Vapour and Hot-air Baths.

cause such flame as it were to lap round the sides of the generator. The curve shewn in the section, Figure 3, is a portion of a circle, and that will answer the purpose very well, but a parabolic form will be still better. And I will observe, finally, as regards this apparatus, that a vapour bath of the

5 proportion shewn by the Drawings Sheet 1, and burning spirits of wine, is calculated for administering a vapour bath of the ordinary heat and duration, but as the quantity and temperature of the vapour produced by any such apparatus will obviously depend on many minute circumstances affecting its operation, it will be proper for a person intending to use such an apparatus to

10 acquaint himself by a few preliminary trials with its power before taking a bath therewith. If, instead of a bath of vapour of water simply, it is required to administer an aromatic vapour bath (*videlicet*) (a bath of vapour generated from water mixed with herbs or other vegetable or animal substances, or with a preparation of any such substances), the necessary substance or preparation

15 for obtaining the particular aromatic vapour desired will be introduced into the generator with the water, and the mode of using the bath will be in no other respect different from that already described. In order to administer a vapour bath to a patient in bed with the apparatus above described, the tube H, with its ball *f* and distributing pipes, are removed, and so of course

20 are the perforated footstool and its supplying pipe O, the nozzle 5 of such pipe being covered up by a suitable cap, see 7, Figure 9, Sheet 2; a bent pipe T is then fitted on the tube 3, 3, see Figure 9, Sheet 2, and to that one or more lengths of pipe, not shewn in the Drawing, are fitted, extending to the bed of the patient to convey into it the vapour generated in the generator F.

25 In order to prevent the bedding from being injured by the heat of the pipe thus introduced into it, the said pipe should be made to enter the bed through a piece of other pipe of considerably larger diameter, so as to leave a vacant space all round the vapour pipe, and, if necessary, the outer or projecting pipe may be clothed also with some non-conducting substance. It is sometimes

30 required to take a bath in which a full stream of vapour is directed on some one part of the patient's body exclusively. In order to apply the apparatus herein-before described to administer such a bath, it is arranged in the manner shewn in Figure 11, Sheet 2 (*videlicet*):—The perforated footstool and its pipe O and the pipes K, K, are removed, but not the pipe H and ball *f*. The

35 nozzle 5 and K, K, are covered up by their caps *r*, *r*, and 7, see Figure 11, Sheet 2, and to the nozzle *l* a bent tube *s* (see Figure 11, Sheet 2,) is fitted, by which a stream of vapour may be directed to the part affected. In using the apparatus in this way, the patient need not in general be enveloped in an oil silk covering, and the vessel E, with its lamp and other parts, may be set

Ferier's Improvements in the Construction of Vapour and Hot-air Baths.

on a table. Of course, if requisite, additional pipes may be fitted on the nozzles *r, r*; in other respects the operation and mode of using the apparatus, Figure 11, require no further description. Sometimes it is required to administer what is called a fumigating bath immediately under the seat of the patient. To use the apparatus, Sheet 1, for this purpose it is arranged in 5 manner shewn in Figure 12, Sheet 2 (videlicet):—The pipe *H* and its ball *f* and distributing pipes are removed, and instead thereof a pipe *H*, Figure 12, Sheet 2, is applied over the tube 3, 3, the upper end of which pipe *H* is furnished with a rose, spout, or cover pierced full of small holes *z*, and then the apparatus so provided being placed under the seat of the patient, the vapour 10 formed in the generator will issue forth from the pierced spout *z* and be projected against the parts requiring the bath in a shower of vapour after the manner of a shower bath; the chair used with the apparatus should of course be one with a cain or otherwise perforated seat.

Figure 10, Sheet 2, represents a combination of parts constituting an 15 improvement in the construction of hot-air baths. A lamp, such as the lamp *A*, is used in this apparatus as well as in the former, and such lamp is applied to heat the volume of air contained in a bell-shaped vessel *U, U*, placed over it, resting in a frame *B, B*, and having fitted on its upper end a pipe *V*. This apparatus is destined more particularly to be used to give a hot-air bath to a patient 20 in bed, and is shewn accordingly in the Drawing furnished with the conducting pipes *X, X*, for carrying the hot air collected in the vessel *U* into the bed; but of course if it were requisite to give sitting bath of hot air, and apply the hot air directly to the body of the patient, in the manner herein-before described for the vapour bath, such effect might be produced by applying over the upper 25 end of the vessel *U*, at *u, u*, Figure 10, a pipe and distributing ball and pipes such as *H, f*, and *K, K*, in the Figures, Sheet 1.

The several Figures in Sheet 3 represent the mode of applying certain apparatus in combination with one or other of the apparatus described in reference to Sheets 1 and 2, for producing a compound apparatus adapted 30 for administering a compound vapour or hot-air bath, videlicet, a bath composed of vapour of water or of hot air mixed with some other vapour, such as, for instance, sulphurous acid gas and sulphuretted hydrogen. Figures 1, 2, 3, and 4 represent the apparatus which is to be used in such combination when a bath is required in which sulphurous acid gas is 35 to be mixed with the vapour of water or with hot air. *B 2* is a generator, supported in the same manner as the vessel *E* in Sheet 1; and *A, A*, is a spirit lamp, of the same kind as the lamp *A*, Sheets 1 and 2. The shape of the generator *B 2* is, however, different from that of the vessel *E*; it

Ferrier's Improvements in the Construction of Vapour and Hot-air Baths.

consists of a bell-shaped vessel, the lower part of which is in form a flat pan *e, e*, (as shewn by dotted lines in Figure 1,) surrounded by an outer cylinder *a, a*, which forms a sort of flue or hot-air chamber underneath it to collect and concentrate upon it the heat produced by the lamp. A, *f*, is a tube
 5 opening into the generator B 2, through which the materials to be operated upon are introduced into such generator. To produce sulphurous acid gas, sulphuric acid is poured into the pan *e, e*, upon a layer of sawdust previously introduced therein, and when the bottom and sides of the pan become heated by the lamp to a sufficient temperature, sulphurous acid gas or vapour is
 10 disengaged; the vapour thus generated passes up into a pipe *g*, which rises and then turns down a little, as shewn by the Drawing. Now, when such a bath is to be administered in the bed of the patient, the apparatus Figure 1, Sheet 3, will be used in combination with the apparatus, Figure 9, Sheet 2, but that apparatus instead of a distributing pipe T will be furnished with a distributing pipe
 15 shewn at *h, h*, Figure 1, Sheet 3, which has a short tube 8 brazed into it. The apparatus, Figure 1, Sheet 3, is placed behind the apparatus, Figure 9, Sheet 2, and the small pipe *g* is inserted in the pipe 8 passing through the same and through the great pipe *h* as far as *i*, where it terminates. The two apparatus thus combined are set to work together, forming thus one compound vapour
 20 bath. The operation is as follows:—The sulphurous acid gas, generated as aforesaid in the vessel B 2, passes through the pipe *g* into the large pipe *h*, which is filled from the generator F with vapour of water, the pipe *g* terminating, as aforesaid, at *i*, Figure 1, Sheet 3. Until that point the sulphurous acid gas is kept separate from the vapour of water that fills
 25 the pipe *h*, but on leaving the pipe *g, i*, the said sulphurous acid gas mixes with the vapour of water and flows on with it through the continuations of the pipe *h, h*, (not shown in the Drawing, Sheet 3,) into the bed of the patient. There is a small waste cistern *j* at the lowest part of the pipe *g*, see Figure 1, Sheet 3, into which will drop such particles
 30 of the sulphurous acid gas as become condensed in their passage along the pipe *g*, and a very small hole must be pierced in such waste cistern to admit atmospheric air. And note.—Although in general the apparatus, Figure 1, Sheet 3, should, when used for administering a bath of the kind above described, be combined with the apparatus, Figure 9, Sheet 2, as above
 35 described it may be sometimes found advisable to dispense with the use of the pipe *h* 8, and to convey the vapour of water from the apparatus, Figure 9, Sheet 2, by its pipe T carrying the sulphurous acid gas from the apparatus, Figure 1, Sheet 3, immediately by the pipe *g* into the bed, the combination of the two vapours taking place there instead of in the pipe *h*;

Ferrier's Improvements in the Construction of Vapour and Hot-air Baths.

the apparatus will of course for that purpose be provided with additional lengths of pipe *g*. If, instead of mixing the sulphurous acid gas with the vapour of water it is desired to take a bath composed of sulphurous acid gas mixed with dry hot air, then such compound hot-air bath will be composed of a combination of the apparatus, Figure 1, Sheet 3, with the apparatus, 5 Figure 10, Sheet 2. For this purpose the pipe *g*, Figure 1, Sheet 3, is replaced by a pipe *j*, Figure 3, and that pipe *j* is laid direct into the bed of the patient side by side with the conducting pipe X of the hot-air bath, Figure 10, Sheet 2. To take a bath of sulphurous acid gas sitting, whether in combination with hot air or with the vapour of water, the tube K, 10 Figure 4, Sheet 3, is fitted on to the apparatus B 2, Figure 1, instead of the tube *g*, and that tube K being introduced under the covering which surrounds the patient will deliver its stream of gas to mix with the vapour or hot air which the patient is taking from one or other of the apparatus, Sheets 1 and 2. *m* is a staple, which may be screwed to the floor to keep 15 the tube K steady.

In Figure 5, Sheet 3, I have represented an apparatus to be combined with the vapour bath represented in Figures 1, 2, and 3, Sheet 1, for the purpose of producing a compound apparatus for giving a bath of vapour of water and sulphuretted hydrogen combined. The sulphuretted hydrogen may 20 be obtained from such chemical solutions and acids as are usually employed for that purpose by chemists; as, for instance, sulphuret of potassium and acetic acid, or sulphuret of iron and dilute sulphuric acid, the same being introduced and mixing in a glass bottle *q*, *q*, as in the ordinary modes of operating to obtain sulphuretted hydrogen. The bottle *q* is for that purpose 25 provided with a funnel and tubes *n* and *p* for introducing the acid used, the tube *p* passing through a cork *s* to make gas-tight fitting, and the other matters may be introduced either previously through the opening *s*, or the bottle may be provided with a second neck tube and funnel for that purpose. As the sulphuretted hydrogen becomes evolved by the action of the chemical 30 agents contained in the bottle *q* it rises up through the bent pipe *r*, which is fitted into the bottle *q* through a cork *t*, and passes up into the short tube 8 of a tube *h* adapted to fit the tube 3, 3, of the apparatus, Sheet 1, in the same manner as I have described in reference to Figure 1, Sheet 3, the tube *r* terminating at *i*. The sulphuretted hydrogen thus conducted into the pipe *h*, 35 mixes therein, on leaving the pipe *r*, *i*, with the vapour of water which fills the pipe *h*, and the two vapours then flow on together into the bed of the patient through the continuation of the pipe *h*, in the same manner as I have described in speaking of the bath of sulphurous acid gas. If it is desired to

Ferrier's Improvements in the Construction of Vapour and Hot-air Baths.

take such a bath as just described on the chair, then the pipe *v*, Figure 6, is used instead of the pipe *r*; the pipe *v* may be supported in the middle like the tube K, Figure 4, by a small bearing staple *x*, screwed to the floor, and the end *y* of the said pipe enters the chamber formed by the covering with which the patient and the apparatus Figures 1, 2, and 3 are surrounded, and mixed with the vapour contained in such chamber in the manner herein-before described in reference to the bath of sulphurous acid gas; and the same directions which I have given for using the apparatus, Figure 1, in combination with the hot-air bath herein-before described, will apply as to using this apparatus in such combination.

I have described the apparatus in Sheet 3 as applied only for obtaining sulphurous acid gas and sulphuretted hydrogen; but I wish it to be understood that this part of the said improvements does not consist in the generating apparatus A and B 2, Figure 1, or *q*, *q*, Figure 5, to which I make no claim, but in the method described of combining such apparatus with the apparatus, Sheets 1 and 2; and it is obvious that other varieties of compound baths may be constructed by combining the vapour or hot-air bath, represented in Sheets 1 and 2, with chemical apparatus of any known kind capable of generating vapours of such qualities as to be advantageously employed for medical purposes in conjunction with the vapour of water or with heated air, such chemical apparatus being connected or adapted to act with the said baths, represented in Sheets 1 and 2, by means of suitable pipes and other parts in a manner similar to that described in reference to the apparatus, Sheet 3. For instance, a bath for administering chlorine combined with vapour of water may be made by connecting a chemical apparatus such as is ordinarily used in obtaining chlorine with the vapour bath, Sheet 1, by means of such pipes as *g* or *r*, and *h* 8, Figures 1 and 5, Sheet 3.

Again, a mercurial bath may be made by using in the generator B 2, Figure 1, Sheet 3, mercury instead of sawdust and sulphuric acid, and so in respect to other cases of the kind herein-before alluded to; and I may observe by way of caution that it will be prudent not to apply the compound aromatic and chemical baths herein-before mentioned without the direction of a person of competent chemical and medical skill, as it is not possible to lay down here any positive directions as to the proper proportions of the several substances for producing a beneficial effect. The dimensions of the several apparatus herein-before described will be found by referring to the scales in the several Drawings, but of course it is not necessary to adhere to such dimensions strictly, provided due proportions are observed; with reference to what has been herein-before pointed out as the proper operation

Ferier's Improvements in the Construction of Vapour and Hot-air Baths.

of the several apparatus, and with respect to the materials of which such apparatus are to be made, no positive rule can be given, but the same will be selected at the convenience and discretion of the manufacturer the apparatus, provided they are of a kind to economise heat and resist the action of the vapours, acids, and other matters to which they are intended to be 5 exposed.

Having now described the said improvements in the construction of vapour and hot-air baths, and the manner of applying such baths, I do hereby declare that under the said Letters Patent, herein-before in part recited, I claim the application to the construction of vapour baths of a vessel, such as 10 the vessel E, herein-before described, in which a boiler or generator and flues surrounding it are combined in one vessel, and in which the same passages serve to convey the vapour from the boiler or generator and the heated air from the flues.

I claim further the application to the construction of vapour baths of a 15 perforated footstool adapted, as herein-before described, to receive vapour from the generator, and to distribute such vapour to the feet and legs of the patient.

I claim the application to the construction of hot-air baths of a lamp to heat a body of air in a hollow vessel placed over such lamp in the manner 20 described in reference to Figure 10, Sheet 2.

And I claim, lastly, as applied to the construction of vapour and hot-air baths, the method, which I have herein-before described, of combining apparatus of any known kind used for obtaining different kinds of chemical vapours possessing the properties herein-before alluded to with the vapour and hot-air 25 baths herein-before described in reference to Sheets 1 and 2; and, save as aforesaid, I do not claim any of the things, apparatus, or modes of operating herein-before described.

In witness whereof, I, the said Pierre Jacques Ferier, have hereunto set my hand and seal, the Thirty-first day of January, in the year of our 30 Lord One thousand eight hundred and forty.

PIERRE JACQUES (L.S.) FERIER.

Signed, sealed, and delivered by the within-named Pierre Jacques Ferier, in the presence of

THOMAS DRY,

21, Lincoln's Inn Fields, Sol^r.

Ferier's Improvements in the Construction of Vapour and Hot-air Baths.

AND BE IT REMEMBERED, that on the Thirty-first day of January, in the year of our Lord 1840, the aforesaid Pierre Jacques Ferier came before our said Lady the Queen in Her Chancery, and acknowledged the Specification aforesaid, and all and every thing therein contained and specified, 5 in form above written. And also the Specification aforesaid was stamped according to the tenor of the Statute made for that purpose.

Inrolled the Thirty-first day of January, in the year of our Lord One thousand eight hundred and forty.

LONDON:

Printed by GEORGE EDWARD EYRE and WILLIAM SPOTTISWOODE,
Printers to the Queen's most Excellent Majesty. 1857.

First of January in the County of Essex and City of London.

AND BE IT REMEMBERED, that on the Fifth day of January, in the year of our Lord 1853, the above-named James Taylor came before our said Lady the Queen in Her Majesty's Court, and acknowledged the Statute in relation aforesaid, and all and every thing therein contained, and the same is in form above written. And also the Statute aforesaid was stamped according to the tenor of the Statute made for that purpose.

Witness the Fifth day of January, in the year of our Lord One thousand eight hundred and forty.

LONDON:
Printed by George Thomas Smith and William Stevenson,
Printers in the Queen's most Excellent Majesty's Court.

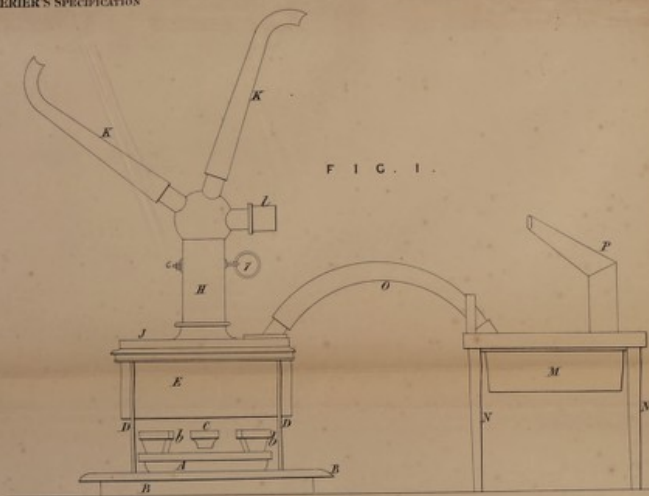


FIG. 1.

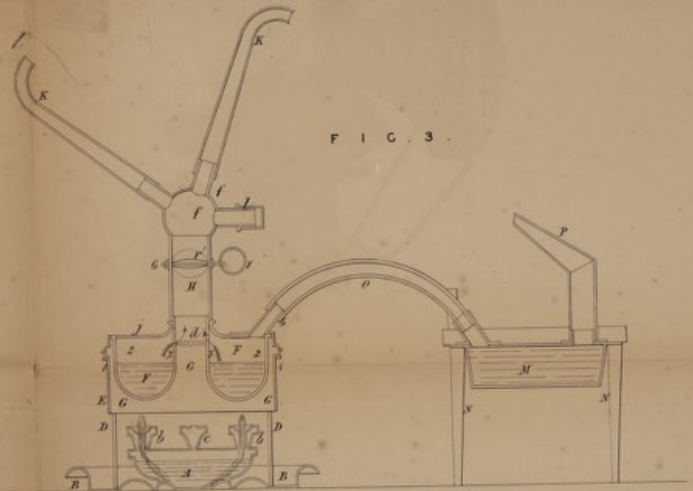


FIG. 3.

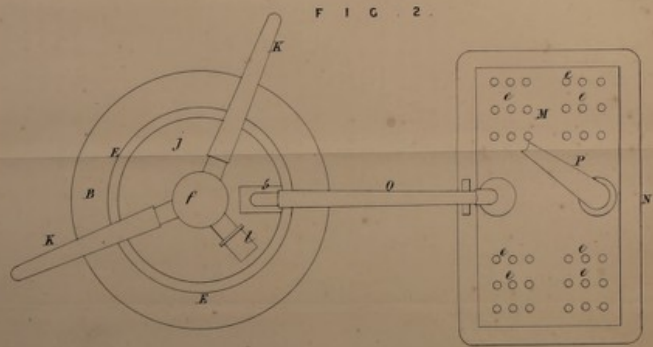


FIG. 2.

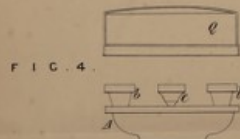


FIG. 4.

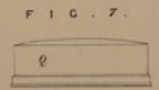


FIG. 7.



FIG. 8.

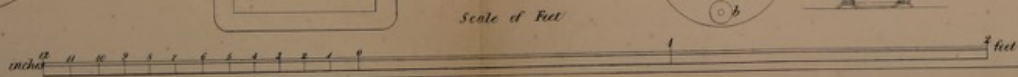


FIG. 5.



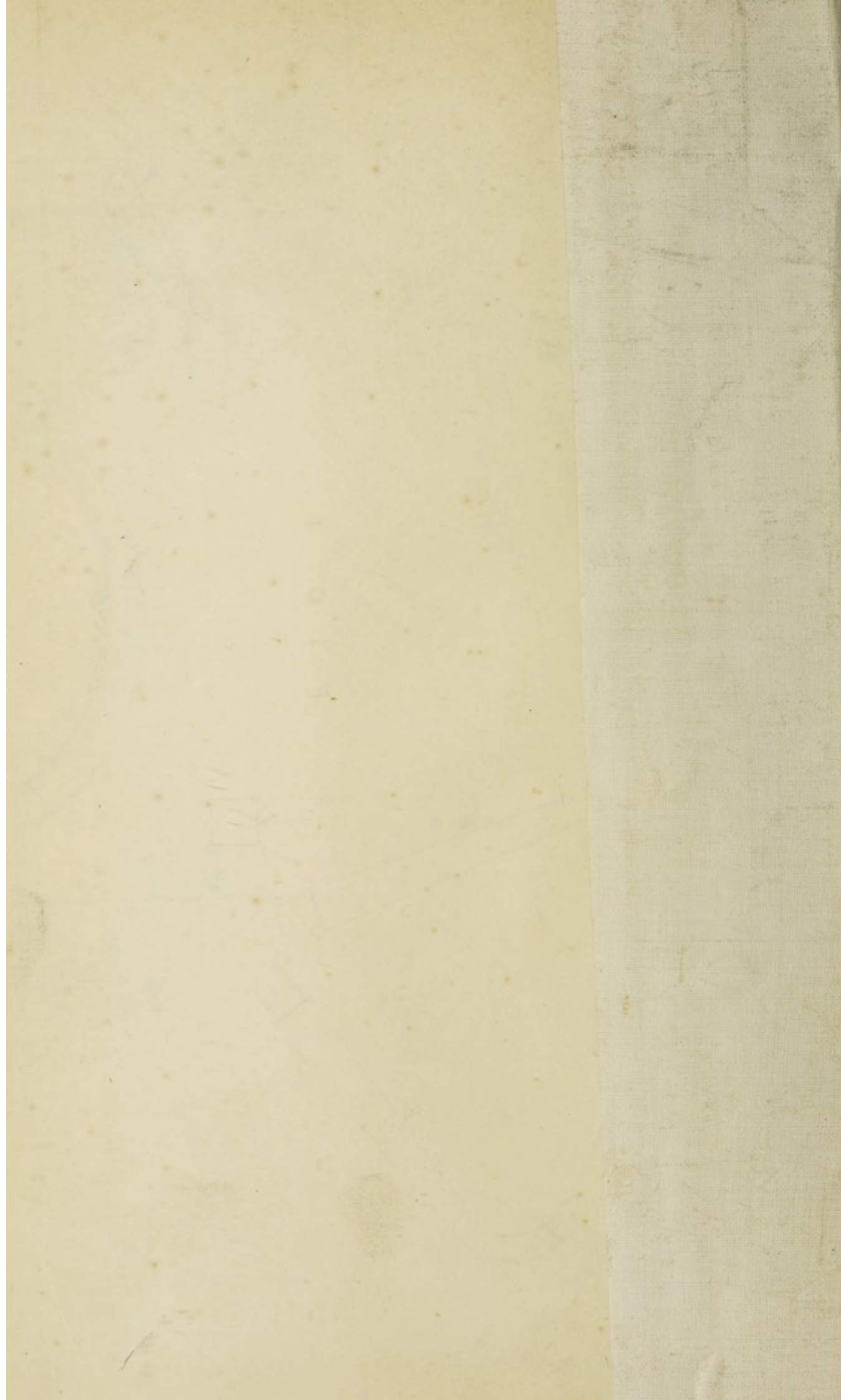
FIG. 6.

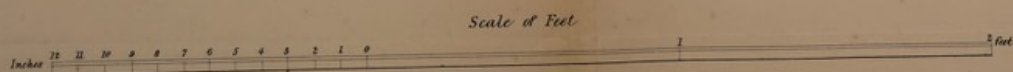
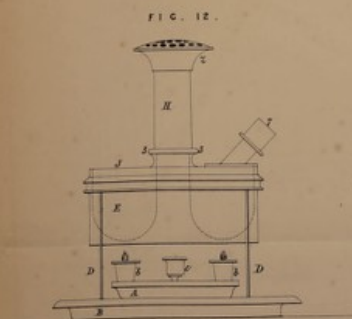
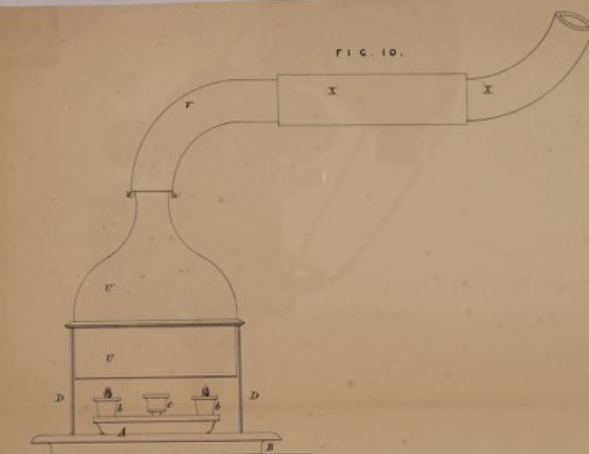
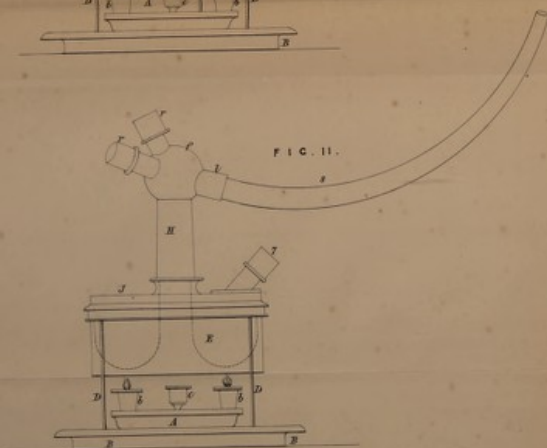
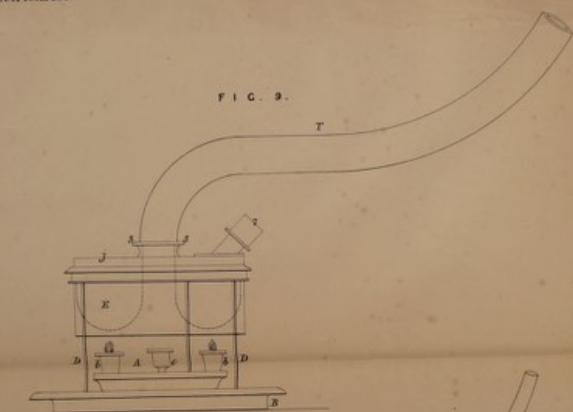
The enrolled drawing is colored



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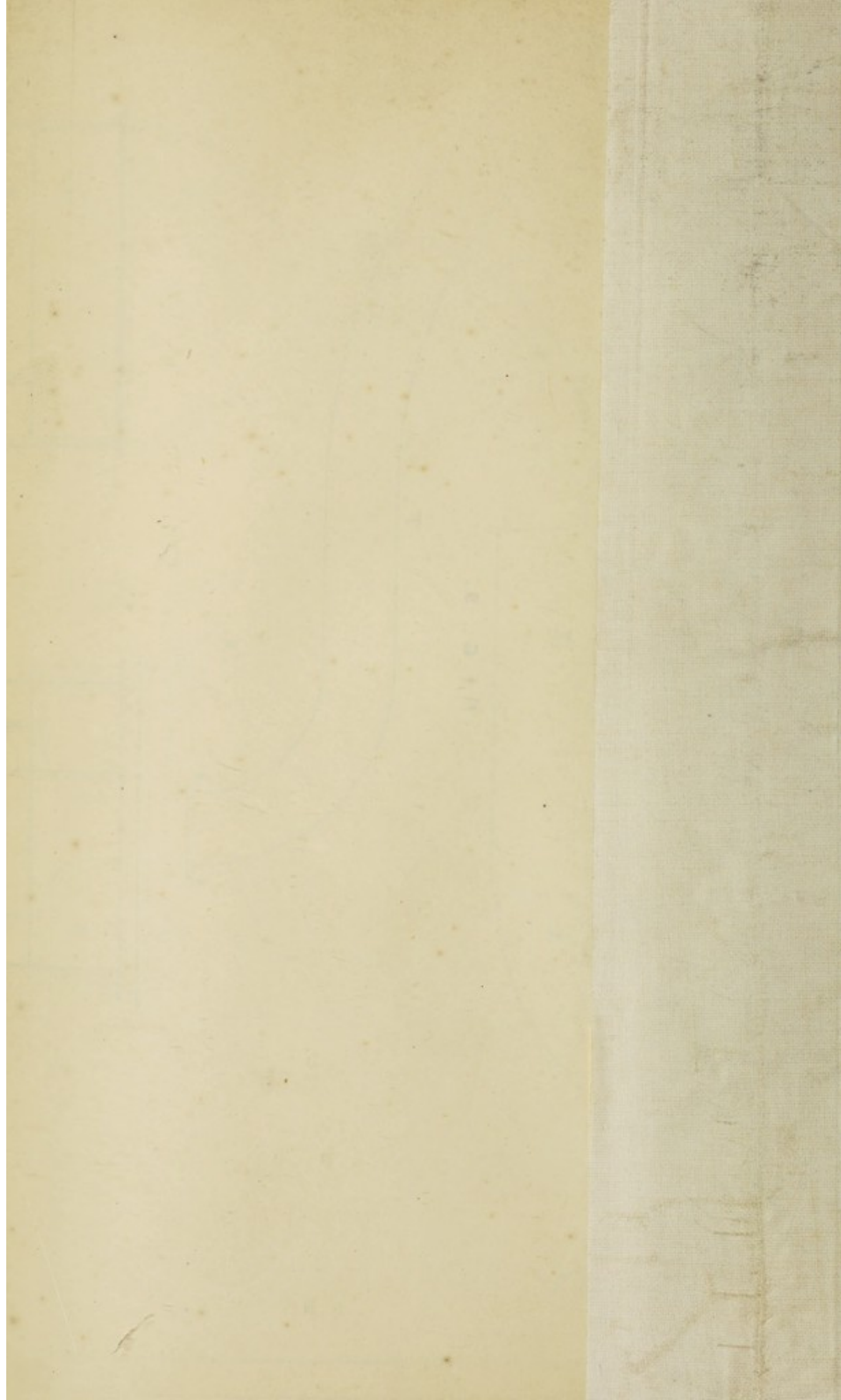




The enrolled drawing is colored.

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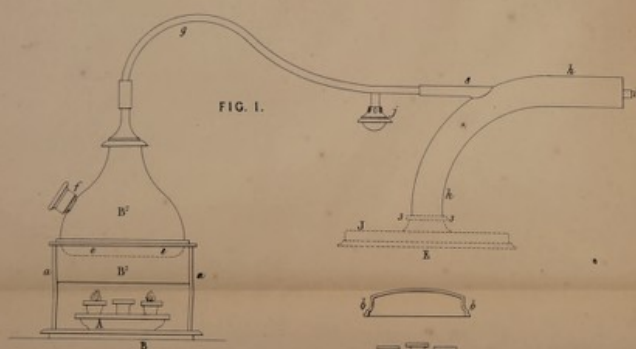


FIG. 1.



FIG. 2.

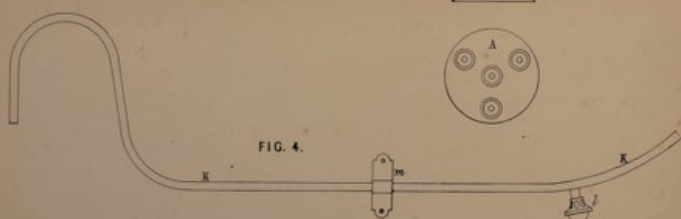


FIG. 4.

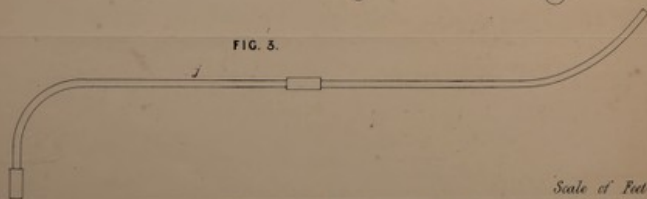


FIG. 3.

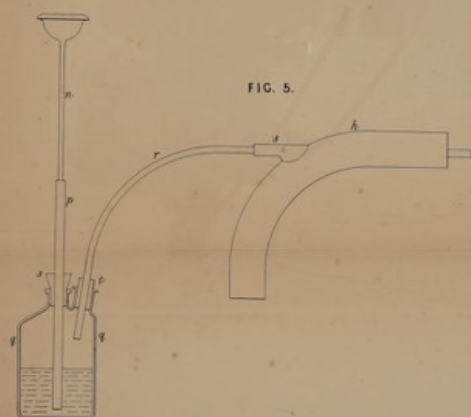


FIG. 5.

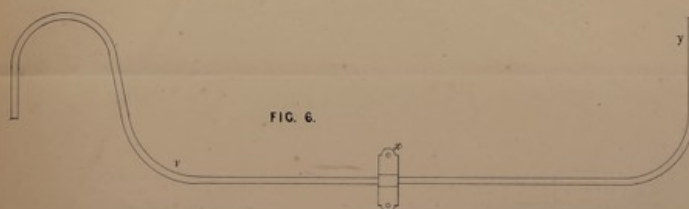
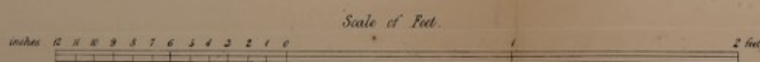


FIG. 6.



Scale of Feet.

The enrolled drawing is altered.

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