2 Sheets--Sheet 1.

CHARLES G. C. SIMPSON.

Improvement in Vacuum-Stills, &c.

No. 127,197. Patented May 28, 1872.

Fig. 1

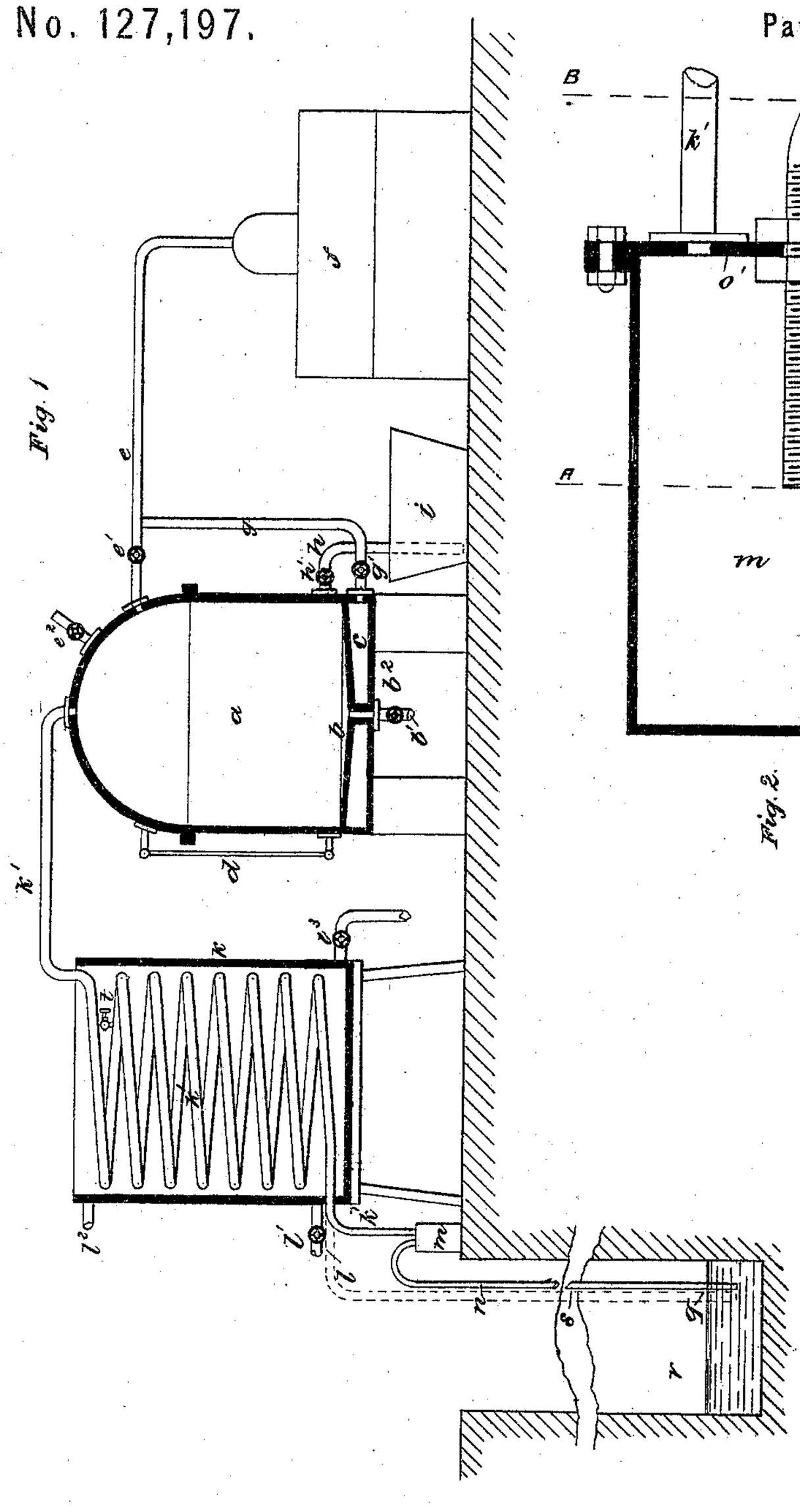
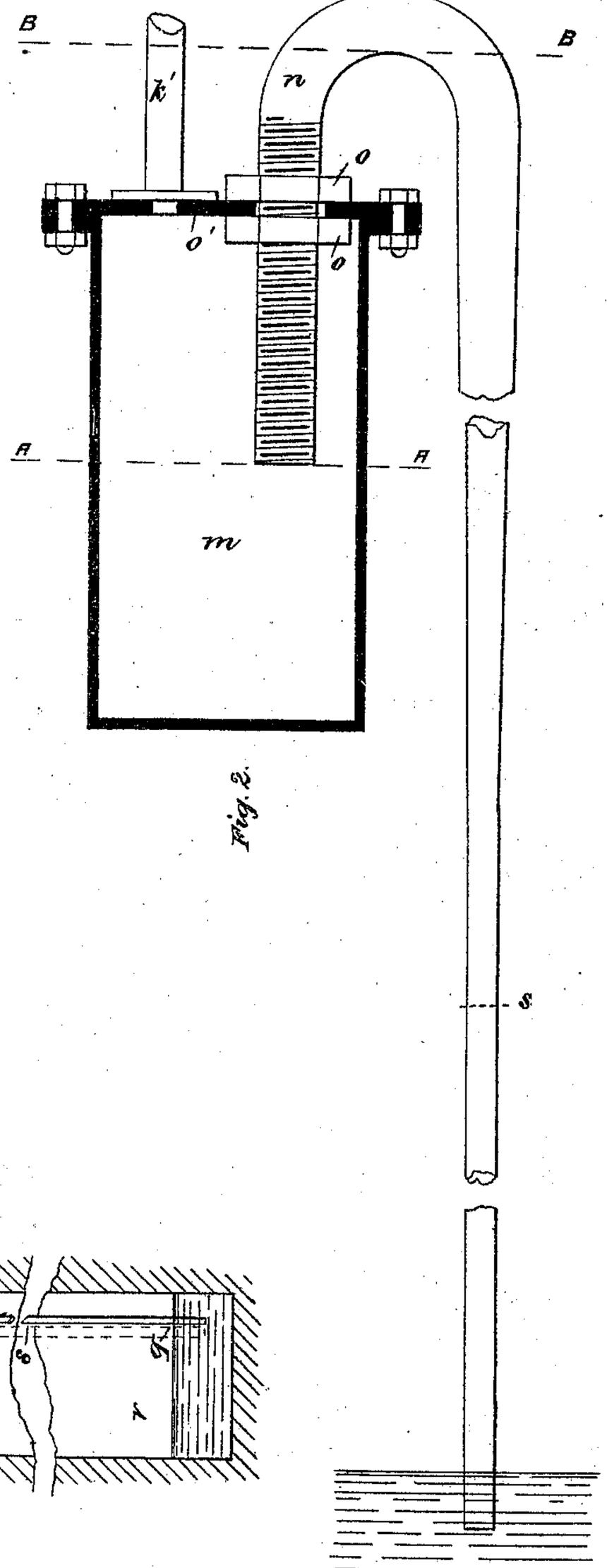


Fig. 2.



Witnesses

Wm. Ryland Reynolds

A. B. Muir.

Inventor

Charles G. C. Simpson

2 Sheets--Sheet 2.

CHARLES G. C. SIMPSON.

Improvement in Vacuum-Stills, &c.

No. 127,197. Patented May 28, 1872.

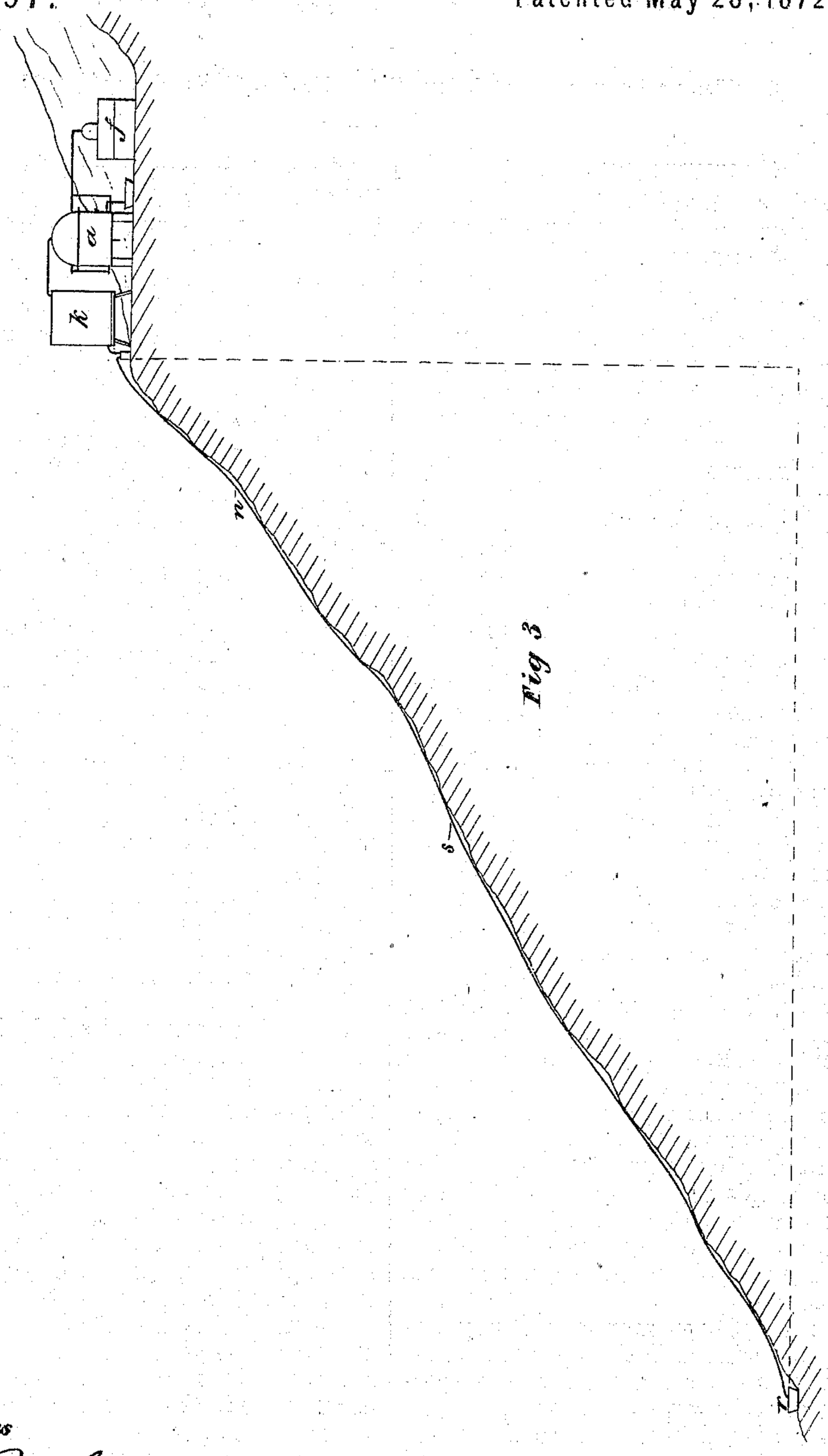


Fig 3

Witnesses

Chas. Hy. Reynolds

A. B. Mann

Inventor

Charles G. C. Simpson

UNITED STATES PATENT OFFICE.

CHARLES G. C. SIMPSON, OF MONTREAL, CANADA.

IMPROVEMENT IN VACUUM-STILLS, &c.

Specification forming part of Letters Patent No. 127,197, dated May 28, 1872.

SPECIFICATION.

To all whom it may concern:

Be it known that I, CHARLES GRAHAM CHAPPELL SIMPSON, of the city of Montreal, in the district of Montreal, in the Province of Quebec, Canada, engineer, have invented new and useful "Improvements on the Construction and Arrangement of Stills, Vacuum-Pans, and Evaporators;" and I do hereby declare that the following is a full, clear, and exact description of the construction and operation of the same, reference being had to the annexed drawing, where—

Figure 1 represents a sectional elevation of the apparatus. Fig. 2 represents a detail elevation of the apparatus. Fig. 3 represents an elevation of the apparatus arranged to take advantage of the natural formation of the earth when circumstances will permit.

This invention has reference to improvements on stills and evaporators used for many purposes, of which the following are some of the principal: Concentrating extracts of bark for tanning; evaporating the water from juices, such as those of the sugar-cane, to manufacture sugar; the evaporation of the water from brine in the manufacture of salt, &c.

It is well known that the ebullition of water takes place under atmospheric pressure at about 212° of heat, Fahrenheit, and that in a perfect vacuum the boiling-point is very much reduced in temperature; many inventions have therefore been made in the construction and arrangement of stills and evaporators, or pans worked in a vacuum; and in this instance a patent is solicited for an improvement upon any existing apparatus for that purpose.

In the drawing hereunto annexed, of which Fig. 1 is made to a scale of about one-quarter of an inch to the foot, Fig. 2 about three inches to the foot, and Fig. 3 about one-sixteenth of an inch to the foot, similar letters of reference indicate like parts.

Letter *a* is a still or vacuum-pan, of any convenient form, or similar in this respect to those at present in use for the above-named purposes. I prefer, however, that it should be made with a dished bottom, *b*, so that when the contents are drawn off by a pipe, b^1, and cock b^2, they may have a proper fall to cause them to flow readily to the last.

The still or pan *a* will be of metal, and the metal used will depend on the service in which the still is engaged—for instance, if it is used for making extract of tan-bark it will be made of copper; if for salt it may be made of iron; and so on, for other purposes, the metal may be changed to suit the chemical qualities of the material operated upon.

The still may be provided with any suitable steam-jacket on its sides and bottom, and an internal coil of pipes may also be employed in the ordinary way; but I prefer, if sufficient heat is obtained from it, to confine the steam-jacket *c* to the bottom of the still, as it will at all times be properly covered with fluid, and a less tendency to burning or caking will be found; if, however, a side jacket is used it must only be in action while the level of the fluid in the still is some inches higher than the highest point of the jacket. The condensed steam in the jacket may, if the position of the still in relation to the boiler allows it, be returned by gravity to the boiler *f*, by any convenient pipe, or led off by a waste-cock.

Internal coils of pipes are apt to become leaky, and are a great hindrance to properly cleaning out the still when it is desired to do so. I provide the still with any suitable glass gauge, *d*, similar to those in use for indicating the level of the fluid within; a thermometer and barometer should also be added in the ordinary way.

The still or pan *a* in itself is similar to those at present in use; but great care should be taken in its construction to make it perfectly air-tight, as well as all the attachments about to be described. To the upper part of the still a pipe, *e*, is connected from any suitable steam-boiler, *f*; a pipe, *g*, is also arranged to connect with the steam-jacket *c*. Each of these pipes is provided with regulating cocks or valves e^1 and g', for stopping off or adjusting the action. e^2 is a cock for the admission of air to the still whenever desired. *h* is a pipe, and h' a stopping-off cock, leading to any suitable reservoir, *i*, where the liquid to be treated is accumulated. *k* is the worm-tank, and k' the worm, attached at one end to the top of the still or pan *a*, as shown in Fig. 1. *l* is the inlet-pipe to the worm-tank, provided with a stop-cock, l^1. l^2 is the outlet-pipe, and l^3 is a

pipe and cock, by means of which the contents of the worm-tank can at any time be drawn off.

The lower end of the worm *k*, after being led out at or near the bottom of the worm-tank, is then introduced into a small air-tight cistern, *m*, shown on a larger scale in Fig. 2; to this cistern a siphon, *n*, is attached, so that its connection may be perfectly air-tight and adjustable. For this purpose I have shown it with a screw-thread on its outside, and two faced nuts, *o*, one on each side of the cover *o'*, for adjusting the exact amount of distance that the end of the syphon *n* is inserted into the cistern *m*. This should be so arranged that the amount of fluid contained in the part of the cistern and pipes between the lines A A and B B will be equal to or a little in excess of the amount of the contents of the other end of the siphon required to form a column in it capable of balancing the atmospheric pressure.

As shown in Fig. 1 the siphon is led into a well, and in Fig. 3 the apparatus is shown as situated on a slope, such as a bank, or the side of a hill; and it is desirable, if such can be obtained, to have a head of water formed by drainage or other means for supplying the worm-tank *k*. If these cannot be got I prefer to sink a well, as before mentioned, and shown in Fig. 1, and situate the tank *k* where the necessary head for supplying it can be obtained without pumping. If this also cannot be obtained then the tank *k* and cistern *m* must be elevated upon any suitable structure for that purpose; in this case the water for the tank *k* must be pumped. The still, boiler, and other parts may be situated on the ground, the pipes being extended to reach up to the elevated tank *k*, and the end of the siphon led into a trough of water, *r*, as shown in Fig. 3, which corresponds with the water in the bottom of the well. The perpendicular height required between the point *g*, where the end of the siphon enters the water, and the bottom of the cistern *n* should be as much as possible in excess of the perpendicular height of the column of water required to balance atmospheric pressure, for it will be hereinafter seen that the greater the excess the more advantage will be gained by the action of the siphon. When a well is used, if a dry one can naturally be obtained, it should be; but if this cannot be got, the well may be rendered dry by hydraulic cement, or otherwise by sinking a pipe of large diameter, and a closed end on it into the well, or the large pipe may be provided with a boring-bit at the end, and thus a sufficient depth be got to lead the siphon into; but whichever way the well is obtained the water of evaporation accumulating in it from the still must from time to time be pumped out. *t* is a small cock or valve attached on the upper part of the worm *k'*, but in such a position that it will be sufficiently immersed to insure its admitting only water to the worm.

The operation of my invention is as follows: The apparatus having been constructed and arranged substantially as described, steam is raised in the boiler *f* to the required pressure, and, if desired, by opening the cock *g'* the bottom of the still may be heated to a considerable degree. If the worm-tank is now full of water, before proceeding further it should be emptied by shutting the cock l^1 and opening l^3; after this has been done the cocks b^2, *h'*, and e^2 should be shut. The cock e^1 may now be opened to blow through the still; the steam having no other means of escape, after driving out the air, follows it down the worm *k'* into the cistern *m*, and from thence by the siphon *n*, at the bottom of which it escapes into the well or trough *r*. As soon as steam is observed to escape at this point the cock *e'* must be shut tight, the cock l^3 must be closed, and l^1 opened to fill the worm-tank and allow a current of cold water to continuously circulate through it. A vacuum will now be formed in the still, and its perfectness indicated by the barometer. If this vacuum is not sufficiently perfect the process of blowing through must be repeated until a satisfactory one is obtained, the water in the well or tank rising in the siphon *n*, giving a column balancing the pressure of the atmosphere and preventing its return. We will suppose the height of this column to be represented by the points *s* in the Figs. 1, 2, and 3. The cock *h'* may now be opened, and the vacuum will cause the liquor in the tank *i* to be drawn into the still, but in doing this care must be taken not to let the level of the fluid come so near the end of the pipe *h* that air will be drawn in also.

When a sufficient amount of liquor is in the still, which will be indicated by the gauge *d*, the cock *h* should then be tightly closed. By the heat of the steam in the jacket *c* the temperature of the liquor is raised to the point of ebullition, and the vapor condensed in the worm *k'* in the ordinary manner. The condensed water falls by gravity into the cistern *m*, where it accumulates until the siphon overflows, and as the length of the siphon is greater than that of the column to resist the atmospheric pressure, a greater amount of exhaustion takes place than that due to the amount of liquor removed from the still. As another means of increasing the exhaustion than that by a simple pipe of equal diameter throughout, I make the siphon *n*, as shown in Fig. 2, with an increasing diameter from the point *s* up to about the siphon bend, so that the exhausting action may be multiplied; but in doing this care must be taken not to overdo the multiplying effects, or the air will drive the column back into the still and follow it up destroying the vacuum. No exact proportion can here be given for making this increased diameter of pipe, as it will in a great measure depend on the amount of superabundant height of the siphon that exists above the point *s*, and the degree of perfection of the vacuum in the

still. To insure greater safety in this respect the siphon may be made of the same diameter as the lower part for some distance above this point. By this exhausting action of the siphon *n* the bad effects of any air or gas contained in the liquor treated, but freed from it by ebullition, will in a great measure be overcome by the vacuum, materially sustained.

It may be well to make the siphon *n* act a greater number of times than that due to amount of evaporation from the still *a*, and for this purpose the cock or valve *t* may be more or less opened, admitting into the worm some of the water in the worm-tank. This plan of action will, when the apparatus is arranged as shown in Fig. 1, involve a greater amount of pumping to keep the well clear.

But if the quality of the liquor is such that no air or gas will be emitted, then the siphon may be dispensed with, as well as the cistern *m*, and the end of the worm *k'* may be led down into the well or tank *r*, as represented by dotted lines in Fig. 1.

After the liquor has been sufficiently concentrated, which may be determined by samples taken from the still by a small pump or other means for that purpose, the cock e^2 may be opened, allowing the atmosphere to enter, and the contents of the still may be drawn off by the cock b^2. Should it be desirable to let air into the still at any time to reduce the perfection of the vacuum during the process, this may be done by the cock e^2, and should the vacuum be altogether lost by mismanagement it can be regained by blowing through, as hereinbefore described.

The still, as above described, has been regarded only for concentrating, but if the liquor requires to be brought to crystallization, the still may be used as an auxiliary, and the liquor treated in it may be brought to or near the point of saturation, and then removed to another evaporator, or it may be carried on to the required extent, and the contents then removed through the man-hole with which the still would, as a matter of course, be provided.

Having now described the construction and operation of my invention, what I claim as my invention, and wish secured by Letters Patent, is—

1. The well or tank *r*, siphon *n*, and cistern *m*, in combination with the worm *k'*, tank *k*, and still *a*, substantially as described.

2. The worm *k'*, provided with the cock *t*, in combination with cistern *m* and siphon *n*, substantially as described.

Montreal, 13th day of February, A. D. 1872.

CHARLES G. C. SIMPSON.

Witnesses:

FRAS. HY. REYNOLDS,

A. B. MUIR.