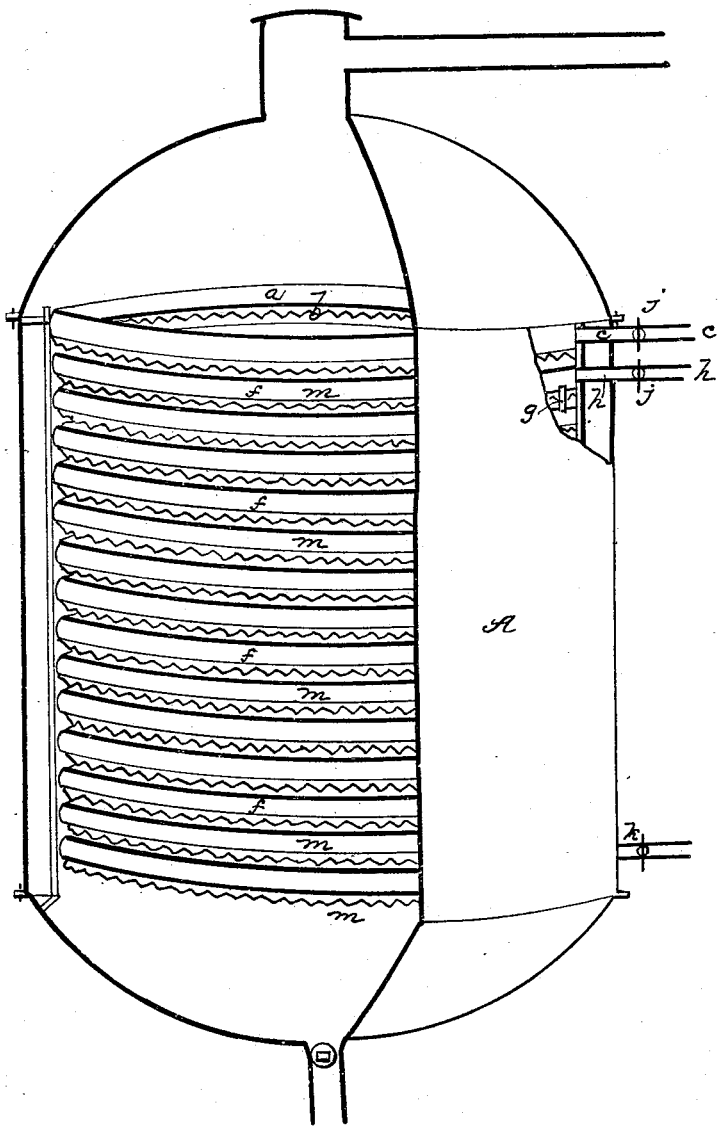
G. R. PERCY.

Vacuum Pan for Condensing Milk, &c.

No. 52,197. Patented Jan'y 23, 1866.



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IMPROVED VACUUM-PAN FOR CONDENSING MILK AND OTHER SUBSTANCES.

Specification forming part of Letters Patent No. **52,197**, dated January 23, 1866.

To all whom it may concern:

Be it known that I, GEORGE R. PERCY, of the city, county, and State of New York, have invented a new and useful Improved Mode of Constructing Vacuum Condensing-Pans; and I do hereby declare the following to be a full and exact description of the same, reference being had to the accompanying drawing, and to the letters of reference marked thereon.

Before giving a description of my invention I will describe a vacuum condensing-pan of the ordinary mode of construction.

The common vacuum-pan is generally built of copper, and is in shape very much like a hen's egg, that being a form well adapted for giving strength to resist the pressure of the atmosphere and for giving space inside for the evaporation and condensation of fluid substances. A pipe of considerable size—about eight inches for a pan five feet in its longitudinal diameter—connects with this pan in the middle of its upper surface, and connects indirectly with an air-pump. This pipe is for exhausting the air from the vacuum-pan, and also for drawing off the vapor given up by evaporation inside the pan. The pipe, however, first connects with a condenser and the condenser with the pump. The condenser is generally a vessel in which water falls in jets or spurts, and is used for condensing the vapor before it goes to the pump. The lower part of the vacuum-pan is built with a jacket, or, as I may call it, a "double bottom." Steam is admitted inside of this jacket or double bottom for the purpose of heating the substance which may be inside of the pan. Beside the jacket or double bottom for heating, there is usually a pipe coiled two or three times around the interior surface of the pan down well under the fluid and near the jacket. This pipe is heated with steam and aids the jacket to bring about evaporation. In the process of evaporation the air-pump is started to form a vacuum inside the pan. The substance to be evaporated is then drawn into the pan and the steam let into the jacket and the coil. As soon as the fluid is sufficiently heated it will begin to evaporate. Most of the vacuum-pans now in use are made as I have described. For the past twenty years there have been few improvements made in the construction of the vacuum-pans.

By the plan I propose the principle of heating and evaporating liquids *in vacuo* will be very different. I will first give a description of my improved mode of constructing vacuum condensing-pans and then show how they differ from those in common use and wherein they are better.

To enable others skilled in the art to make and use my improved vacuum condensing-pans, I will proceed to describe its construction and operation, reference being had to the accompanying drawing, and to the letters of reference marked thereon.

The exterior or shell of my improved vacuum-pan is made as they now make them, except that no jacket or double bottom is needed. This shell may be made of any shape to resist the pressure of the air. The best shape, however, has been found to be oval.

A in the accompanying drawing represents the shell of the vacuum condensing-pan.

a represents a simple ring of pipe, perforated with holes upon its under surface, and is used for feeding the substance to be condensed into the vacuum-pan. In the accompanying drawing this feeder *a* has a piece of metal with a serrated edge fastened to the middle of its under surface. This is for the purpose of more evenly distributing the fluid upon the pipe below. This piece of serrated metal is lettered *b*. When it is attached to the feeder, as represented in the accompanying drawing, the holes in the feeder are just at the sides of the metal.

c is a pipe, which connects with a reservoir and supplies the feeder *b* with the fluid to be condensed. *d* is a stop-cock in the pipe *c*.

The feeder, instead of being a pipe with perforated holes on its under surface, may be constructed in the form of a trough with a continuous opening for the discharge of fluid substances, or it may have slits or holes, or both. Instead of a trough a box with openings on its under surface may be used. The object is to have the substance flow in thin sheets or fall in drops upon the heated pipes or surface below. Directly underneath the feeder *a* is a series of pipes, (represented by *f*.) This series of pipes lettered *f* should be directly underneath the feeder, and may be of more or less number to suit the builder. They should be large enough to admit hot liquids

or steam to course through them, pipes of about two inches in diameter being the best size, as they can be readily heated and present a good surface for evaporation. There should be about four to every upright foot, and four or five feet is the best height. The pipes *f* also have pieces of metal with a serrated edge upon their under surface, and are lettered *m*. These may be discarded in many instances, and at no time are they indispensable. The pipes *f* are connected together by short pipes, (lettered *g*) to allow the steam or heated fluid to pass from one pipe to another through the series.

h represents a pipe for supplying the pipes lettered *f* with steam or heated fluid. *j* is a stop-cock in the pipe *h*. *k* is a pipe connecting with the lowest of the series of rings or pipes *f*, and is a discharge-pipe for steam or heated fluids.

In a large vacuum-pan it may be necessary to have the series of pipes *f* fed by more than one supply-pipe, and consequently have more than one discharge-pipe. Every three or four rings may have a supply and a discharge pipe.

My process for condensation is this: I first make a vacuum in my vacuum condensing-pan by setting the air-pump to work. I then turn on steam or heated fluids (the heated fluid, such as hot water, may in many instances answer a better purpose than steam) into the pipes *f* through the pipe *h*, and leave it to course through the pipes *f* and connecting-pipes *g*, and discharge itself through pipe *k*, until the pipes *f* are sufficiently heated to cause evaporation to the fluid passing over their surface. I keep them up at the proper point for evaporation by continuing to let the steam or heated fluid pass through them. When the pipes are sufficiently heated to cause evaporation I turn the fluid which is to be condensed into the feeder *a* through the pipe *c*. The fluid fills the feeder, and then runs or trickles from it and falls upon the heated pipe below, and, running over this pipe, falls upon the next one below, and so on over the whole series of pipes represented by *f*, and falls from the last one into the bottom of the vacuum-pan or any vessel placed therein for its reception. There might be a vessel upon the bottom of the vacuum-pan to receive the condensed product, but it is not necessary. The operator, by examining the fluid which has thus dropped into the bottom of the pan by means of a "test-stick," can at once regulate the degree of condensation. If he wishes the substance to be more condensed, he should let the fluid more slowly into the feeder and heat his evaporating surface to a higher degree. Of course the more fluid there is trickling over the heated pipes the less it will be condensed.

The test-stick mentioned above is in quite common use, and is a short tube running through the shell of the vacuum-pan. When it is withdrawn the hole is closed by giving it a turn. The tube brings with it some of the material inside the pan. After the fluid has been condensed to the required consistence, or any time that the vacuum-pan gets too full, the condensed substance is discharged from the bottom of the vacuum-pan into any receptacle placed below. This may be done without breaking the vacuum in the pan by a mode very simple in its operation.

The vessel below may be attached to the vacuum-pan by a pipe. The air may be exhausted from the vessel below, and the discharged substance from the vacuum-pan will then fall into a vacuo.

The plan that I have adopted above for constructing my improved vacuum-pan is by no means the only one that can be used. The pipes, instead of being constructed in coils, may be made straight and run in parallels back and forward in the pan, or they may run transversely, or be fashioned into any device to suit the builder. Instead of pipes a corrugated surface of metal may be used; or the pipes, instead of having a piece of metal with serrated edge upon the lower surface, may have a plain metal attachment, or they may be placed near enough together so that no metal will be needed. The pipes might be placed close together, so that they would touch. The series of pipes might be formed in the shape of a cornucopia, the substance to be condensed running or trickling over the surface. Smooth, roughened, or corrugated metal might also be made in the shape of a cornucopia. The pipes or the smooth, roughened, or corrugated metal might be inclined at an angle for the fluid to run over them, or the fluid might be made to run along the pipes by some device, or along the roughened or corrugated metal.

I do not claim as new any particular mode of constructing my feeding-pipe for introducing the fluid to be condensed into the pan. Nor do I claim as new any device or mode of constructing pipes for heating, or of any metal surface for the substance to run or trickle over while condensing. The plan which I have made in my drawing hereto annexed of pipes and feeder is from one in common use among brewers for cooling ale and malt liquors. I do not claim as new any particular form of constructing the exterior surface or shell of my vacuum-pan.

I do not claim in my application the mode of heating the vacuum-pan by radiating heat, as adopted by J. J. Miller in Letters Patent issued December 23, 1862, and November 17, 1863. By his process substances to be condensed run over heated surfaces heated by radiation, or are caused to evaporate or condense by heat around the interior surface of the vacuum-pan. It thus forms a chamber and this chamber is heated by radiated heat.

By my process the substance to be condensed or evaporated runs or trickles over a surface of pipes or metals heated by hot air, steam, or hot fluids passing within the pipes over which the fluid trickles or runs, or ap-

plied next to the surface of the metal over which the substance to be condensed or evaporated trickles or runs within a vacuum.

I will now mention some of the advantages that my method of evaporating and condensing *in vacuo* possesses over the method in common use.

First, with the vacuum-pan now in use the whole body of the fluid within the pan has to be heated up to the boiling-point of fluids *in vacuo* before it commences to evaporate or condense, and to evaporate fast it has to be kept above that point of heat. It thus requires a higher degree of heat to the substance to be evaporated or condensed than the point at which it will evaporate or condense. Moreover, this degree must be kept up during the entire operation. The fluid is thus kept in a state of continued commotion and violent ebullition, which in many cases is highly injurious to the substance. Portions already condensed are in danger from the continued heat of being burned or deprived of their essential properties. By my process only those portions of the fluid are heated which are actually undergoing evaporation or condensation, and on account of the separation of the particles but a very little greater degree of heat is required than the degree at which evaporation or condensation actually takes place. Moreover, there is no violent commotion of particles, and condensed portions are received in the bottom of the pan, where no further heat is applied to them. I thus obviate by my process, (*a*) an unnecessary degree of heat; (*b*) commotion and breakage of particles; (*c*) injurious heating of portions already condensed.

Second advantage: The far greater area of evaporating and condensing surface afforded by my improvement. In the old pan the evaporating or condensing surface is limited by the superficial surface of the substance undergoing evaporation or condensation. In my pan it is only limited by the superficies of the pipes or other appliances over which the substance to be evaporated or condensed is caused to percolate or trickle. For instance, the series of pipes, as represented in my drawing, would afford a superficial surface of about eighty square feet, the pipes in that case being about two inches in diameter, the coils or rings three feet in diameter, and the height of the pipes about four feet, or over. In the old pan the superficial surface of one four feet in diameter would only be twelve square feet. A pan constructed according to my method of the same size would give about six times the amount of evaporating and condensing surface.

Third advantage: By the old plan only steam can be used for heating purposes, while with my plan hot water or other heated fluids may be used. Steam will often cause things to burn while condensing, but with hot water there is no danger of burning.

Fourth advantage: My process very materially differs from the old plan in this, that, instead of heating a body of fluid up to an evaporating-point with the heat applied to its bottom or sides, the substance runs or trickles over the heating surface.

Fifth advantage: That my method may be introduced into most of the pans now in use, if desired. The feeder, coils, pipes, corrugations, or heated surface may be introduced into most of the pans now used without much expense.

Having thus described the manner of constructing and using my improved vacuum condensing-pan, I claim as new and desire to secure by Letters Patent—

1. The combination of the shell A with the series of pipes *f f*, the feeder *a*, the connecting-tubes *g*, substantially as described, *in vacuo*.

2. The combination of the feeder *a* with the shell A, whether with or without the pipes *f f*, when used *in vacuo*.

3. The combination of the ordinary vacuum condensing-pan with the percolating, trickling, and heating apparatus, as above described.

4. The introduction into a vacuum-pan of liquids in drops, small particles, or thin sheets, when for the purpose of evaporation or condensation *in vacuo*, and when used in combination with a direct heating-surface, and not one formed by radiation, and the liquor to be condensed or evaporated running or trickling over such heated surface.

5. The method or mode, as above described, of evaporating and condensing in vacuum at low temperatures.

6. The percolating, separating, disruption, and disintegration of substances *in vacuo*, as above described.

7. The production and application of a uniform rate of temperature in and to substances while undergoing evaporation and condensation *in vacuo* by means of their running or trickling over a surface of pipes or metals heated by the direct application of steam, hot air, or hot fluids to said pipes or metals, as above described.

In testimony whereof I have hereunto subscribed my name.

GEORGE R. PERCY.

Witnesses:

GEO. T. HOUGH,

SAML. A. PERCY.