2 Sheets—Sheet 1

O. P. LEWIS.

Beer Cooler.

No. 108,606. Patented Oct. 25, 1870.

Fig. 1,

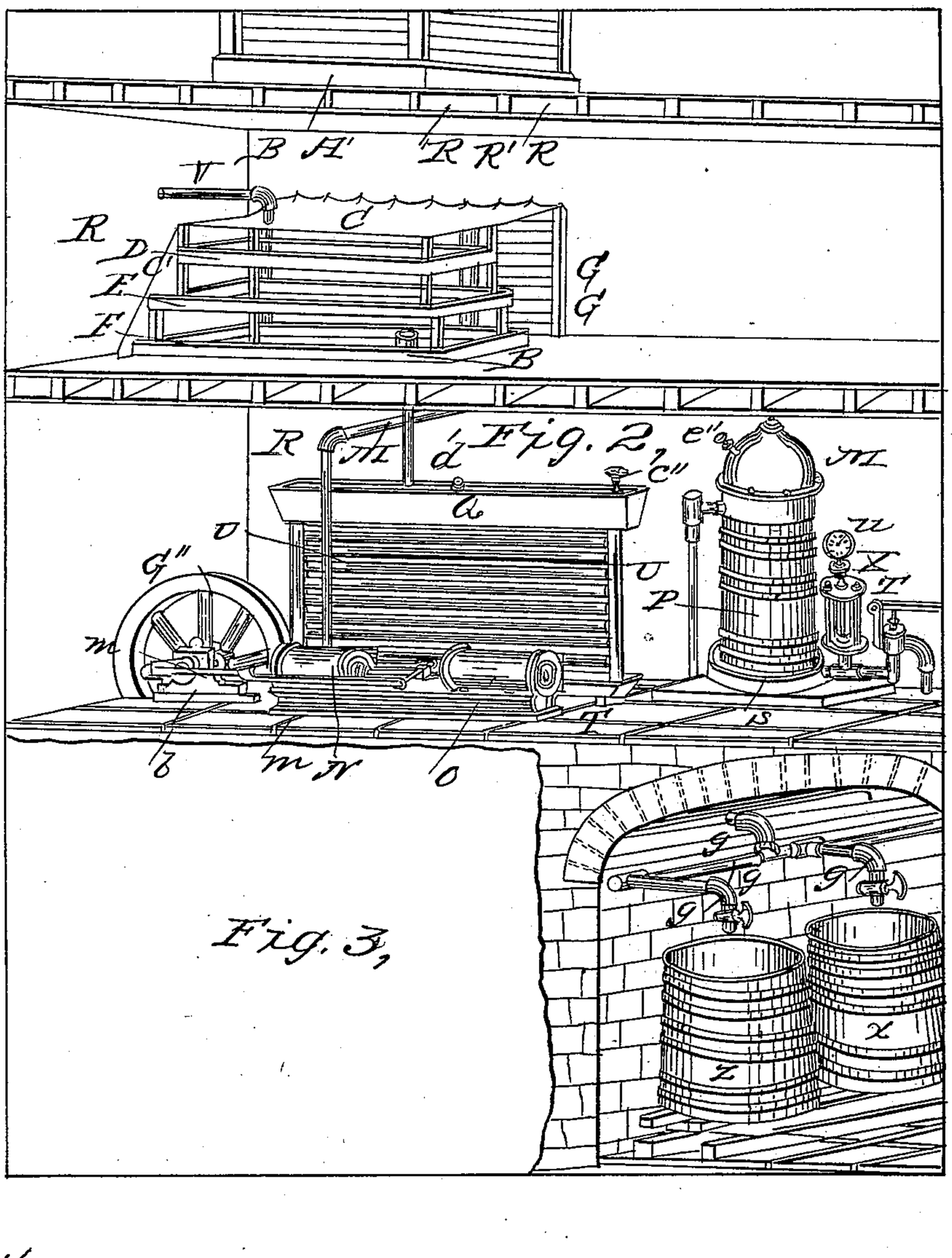


Fig. 3,

Witnesses:
E. Boyd
H. R. Wood.

Inventor.
Oscar P. Lewis

2 Sheets—Sheet 2.

O. P. LEWIS.

Beer Cooler.

No. 108,606. Patented Oct. 25, 1870.

Fig. 4.

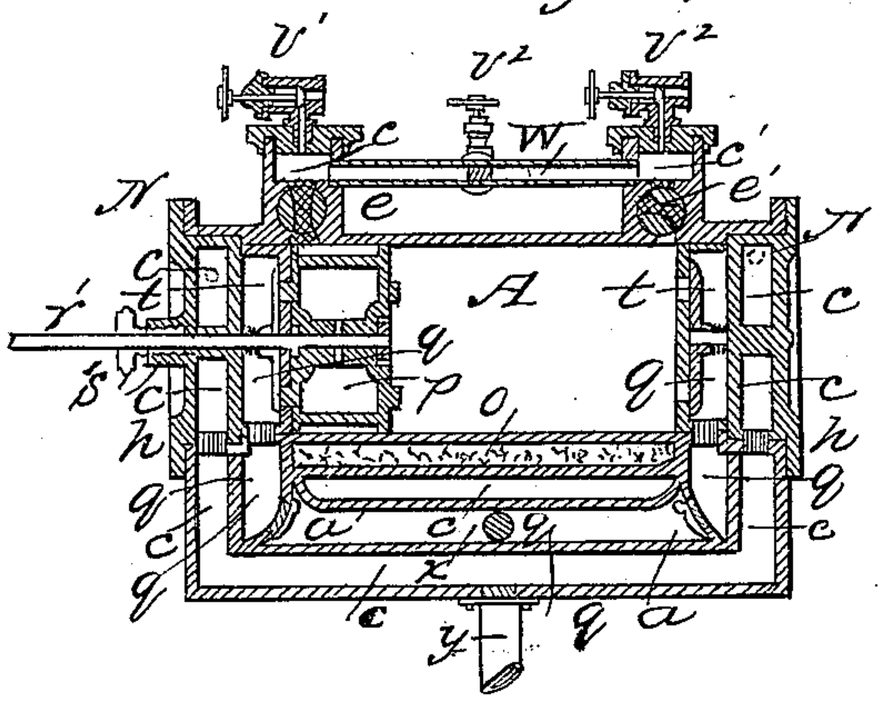


Fig. 5.

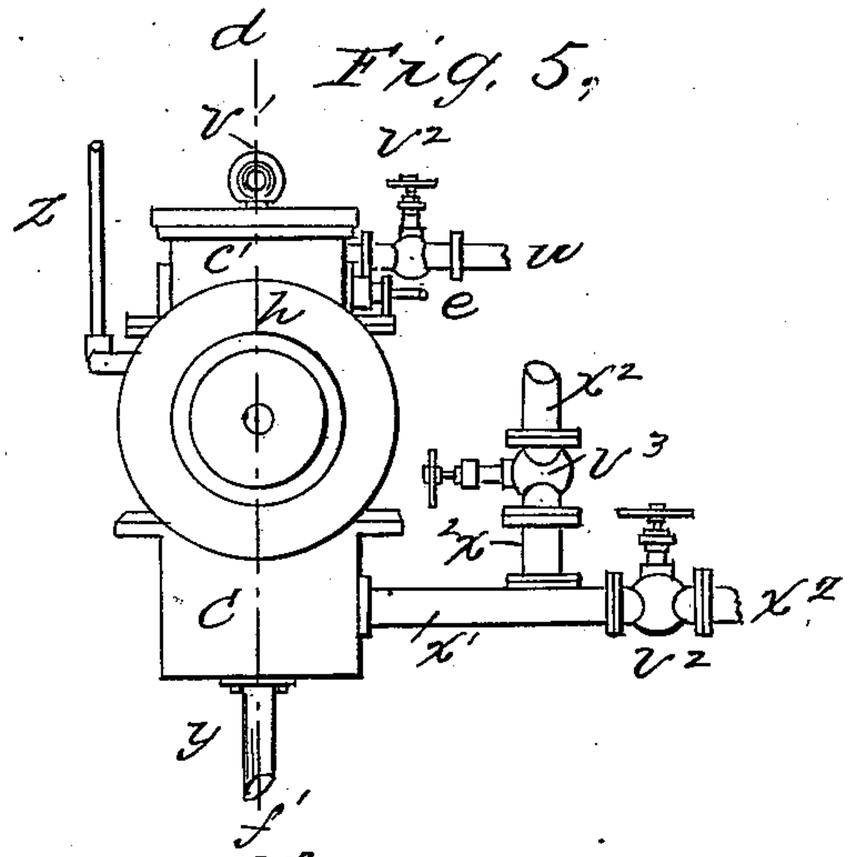


Fig. 6.

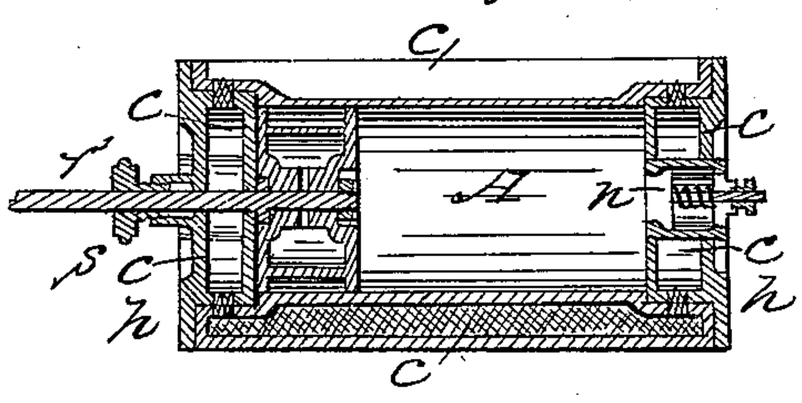
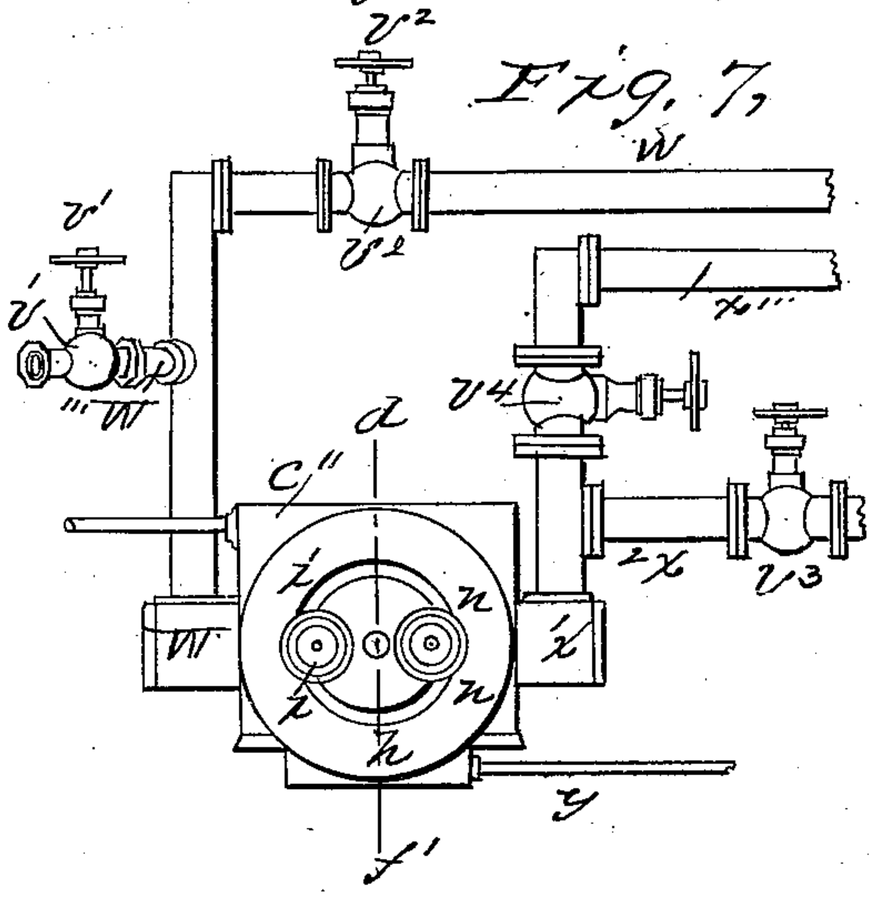


Fig. 7.



Witnesses:
Jno Wood
S Boyd

Inventor
Oscar P Lewis

UNITED STATES PATENT OFFICE.

OSCAR P. LEWIS, OF CINCINNATI, OHIO.

IMPROVEMENT IN THE METHOD OF COOLING BEER-WORTS, &c.

Specification forming part of Letters Patent No. **108,606,** dated October 25, 1870.

I, OSCAR P. LEWIS, of Cincinnati, Hamilton county, Ohio, have discovered and invented new and useful Processes for Effecting all the Cooling Required in the Art of Brewing, which will enable the brewer to do what he has hitherto been unable to do in warm seasons or warm climates—namely, to dispense entirely with the use of ice; and the following is a specification of said processes.

Specification.

My discovery and invention consists in the direct application of natural laws and mechanical effort, through appropriate devices, to the cooling of beer and beer-worts, and the filling of beer-cellars with cool, dry, pure air, displacing the air formerly therein without the production or use of ice in any part of the processes.

In the practical application of this discovery and invention the means and apparatus may consist of the following devices, namely: A cool ship-stack, so arranged with other devices shown as to readily cool the beer or worts to the temperature of the normal air; a steam-engine or other appropriate motor; a double-acting pump, so constructed as to be capable of compressing air each stroke efficiently, or of condensing vapor each stroke efficiently, and to do either separately, at the will of the operator; bisulphide of carbon, deodorized and rendered non-corrosive, or any other suitable volatile fluid, for absorbing the heat in the beer and beer-worts by being vaporized thereby in a partial vacuum; an abundant supply of normally-cool running water, to absorb and carry off the heat in the vapor and air when condensed or compressed; vessels, chambers, or pipes surrounded by normally-cool running water, in which the vapor of said volatile fluid is to be condensed, under pressure, by means of the pump aforesaid, driven by the engine aforesaid, and through which it is to be returned in liquid form to the vessel wherein it was vaporized; vessels, chambers, or pipes in which the volatile liquid is vaporized in a partial vacuum, caused by said pump and engine, by being surrounded by the beer or beer-worts to be cooled; vessels, chambers, or pipes surrounded by normally-cool running water, in which the air is compressed by means of said engine and pump under a loaded valve, which regulates the degree of compression, and hence the temperature at which the air will arrive after passing the loaded valve and expanding to its normal density, the heat evolved by compression being carried off by the water aforesaid; pipes or chambers to conduct the said air to the bottom of the cellar to be cooled; the whole of the above to be appropriately combined, connected, and arranged for the purposes specified.

Any known appropriate mechanical devices may be employed to perform the processes I have discovered, invented, and applied; but I prefer such special mechanical devices as are illustrated by the drawing accompanying this specification.

Either in compressing air or condensing vapors under pressure in the manner herein described, if there is much clearance to the piston of the pump performing the work, or much space between the faces of the valves set facing the pistons, the compressed air or vapor will fill those spaces without being ejected from the pump-chamber, and on the return-stroke of the piston they will expand in the pump-chamber, and prevent, in some considerable degree, the inflow of fresh air or vapor again.

If there is no provision made for carrying away the heat evolved by compression, as well as the artificial heat in the air and the vapor, the pump-cylinder will get hot, and the inflowing fresh air will absorb some of said heat and expand in the pump-chamber, diminishing the volume of normal air thrown by said pump, and rendering it more difficult to condense vapor.

I am aware that various devices have been used to obviate these difficulties, among them, surrounding the cylinder with a jacket, so that running water might occupy the space between the cylinder and the jacket; ejecting cool water in jets or spray into the pump-chamber; wrapping the pump with fibrous materials wet with water or volatile liquids; but the device marked Figs. 4 and 5 on Sheet No. 2 of the accompanying drawing, which is substantially a copy of drawings of a compound engine and pump, (so far as the pump part is concerned, namely, the cylinder-head with

ports, chambers, or passages, and the condensing-chamber beneath, so combined and arranged with disk-valves, as represented, for which I applied for Letters Patent to the Hon. Commissioner of Patent of the United States of America on even date herewith,) is well adapted to my purposes, herein set forth, for the reason that the disk-valves *t t*, having a greater surface on that side opposite to the pump-chamber than is exposed to the pressure within said pump-chamber, which disparity of surface may, by said construction, be carried to a considerable degree, so by that means the compression within the pump-chamber may be carried to a degree greatly exceeding the pressure in the chamber *q*, and hence the heat due to compression be concentrated at the valve-openings before the valves *t t* open, and when they do open, by the peculiar construction of the piston, (it having projections which fit in and fill the valve-openings,) all the contents of the pump-chamber are ejected into *q*, and against the copper wall or diaphragm dividing *q* from *c*, *c* being filled with normally cool running water.

Thus, the heat due to compression is concentrated on the copper wall or diaphragm aforesaid, so cooled, as aforesaid, and the contents of the pump-chamber are still further cooled while passing the check-valves *a a'* in the lower channel-way *q* to the outlet-pipe *x*.

The pump-chamber in this device might be set in a tank of water, in same manner as is shown in Figs. 6 and 7.

I also illustrate another device by drawing on Sheet 2, Figs. 6 and 7, which embodies the same principle, but in different mechanical arrangement, and is well adapted to my purposes, herein set forth, and which obviates, in a great degree, the difficulties aforesaid.

Such a pump, constructed in accordance with said drawing, (marked Figs. 6 and 7,) might be driven by any known motive power, communicated to it by any known method; but I should prefer to use such a pump connected appropriately and directly to a steam-engine and balance-wheel, as shown on the drawing on Sheet No. 1, Fig. 2; or in lieu thereof I might prefer to use sometimes the compound engine and pump aforesaid, because it might be worked at a much lower pressure than an ordinary steam-engine, for the reason that there would be always two surfaces for steam to act on instead of one, and hence it could be worked in some situations and under some conditions more safely than the ordinary steam-engine.

I prefer to connect any pump which I may choose to use to perform the process herein set forth directly and appropriately to a motor, as herein suggested and shown, for the reason that scarcely any brewer who might choose to adopt my method of cooling would find the motive power in his brewery sufficient for the purpose, and, if he were furnished a pump of suitable size to perform the work of cooling usually performed by ice, would be compelled to replace his motor with a larger and more powerful one; hence, it would be cheaper for the brewer to be furnished at once with motor and pump, in which case he could continue to use the motor and machinery he had for all purposes but cooling, and no interference or suspension of his business would be necessary while the work of fitting his brewery up to perform the processes herein set forth was going on. Most every brewer who bought an ice-machine would also find his motor in use inadequate to drive it. It is very doubtful if any brewer has surplus power enough, or even one-fourth enough, to make what ice he must necessarily consume in the present method of carrying on the cooling processes of a brewery. I would, therefore, prefer a pump and motor combined, so as to cause the brewer the least inconvenience and expense in adopting my method, system, or process for cooling in breweries.

Although the process of filling cellars with cool, dry, pure air herein set forth can be performed without a reservoir to receive the compressed air, as shown in Fig. 2 by letters P, S, and M', I should sometimes prefer to use one or more of such reservoirs, because the metal surfaces at top and bottom serve to convey away a portion of the heat evolved in the air by compression; and if they are of sufficient size and proper shape, as shown by said letters in said Fig. 2 on Sheet No. 1, there is quite a little interval in which each increment of air furnished to the reservoir by each stroke of the pump may give off its heat through the metal cover to the surrounding air, thus lessening the quantity of water needed to cool the air; besides, during stoppage of pump the compressed air in the reservoir will speedily acquire the temperature of the surrounding air at least by conduction through and radiation from the cover aforesaid.

I am aware that various processes of cooling have been before devised, among which may be enumerated, first, cooling the air before compressing it, and then compressing it by falling weighted pistons in cylinders buried in the earth; second, circulating the same volume of air through a machine continually, compressing it on one side of a piston, and allowing it to expand on the other side of the same piston, or operating on different volumes of air in the same way, the pump in such case taking air only on each alternate stroke; third, combining the refrigerating effects of compressed air cooled and expanded with the vapors of volatile fluids, at the same time forcing the said air to bubble up or rise through volatile fluids, and also passing it over surfaces cooled with running water; fourth, by devices called "expansion-chambers," in which the expansion of the air and its consequent cooling takes place; fifth, by allowing compressed air to expand gradually in an engine, thus rendering available for pur-

poses of power the mechanical force with which the air tends to dilate; sixth, by forcing the normal air, by means of fan-blowers or blowing-engines, through small pipes surrounded by methylic ether or other volatile fluids, the air giving off its heat to the said fluids and becoming cooled thereby; seventh, by forcing the normal air through pipes buried from ten to forty feet under the surface of earth.

But these processes do not resemble mine. I employ no expansion-chamber except the cellar to be cooled. I abstract the heat evolved from the compressed air in and about the pump-chamber, and in the coiled pipe between the pump and loaded valve. I do not use any vapor for the purpose of cooling air. I arrange my pump for the double purpose of compressing air for cooling cellars and for condensing vapor by pressure for cooling beer-worts. I regulate the degree of compression to be given to the air, and, by consequence, the temperature to be produced, by a loaded valve, which is simple, efficient, and automatic, and requires no constant attendant.

A full description of the receivers, loaded valve, and pipes used for cooling cellars may be found in my application for Letters Patent thereon made on even date herewith.

In connection with the volatile fluid-evaporator I arrange and use a cool ship-stack, with screens on top and two sides, combined with a tube or shaft, for carrying off the air heated by the hot worts, and with apertures through the outer partition or wall to admit fresh cool air to supply the place of the hot air rising naturally through the tube, these apertures to be made between the floor and the screens.

This is an application of the natural law that heated air will rise through a tube with a velocity dependent upon its height, and cool air will come in and supply its place through proper apertures.

This process, by being performed before the worts are further cooled by means of the volatile fluid-evaporator and the pump and engine aforesaid, saves the work of the pump in that proportion which the amount of cooling so performed by this process bears to the whole amount of cooling to be performed in the worts. The balance of which work of cooling after the worts have been brought to the temperature of the normal air must be performed by the said pump and appurtenances aforesaid, for there is nothing more certain than that all the heat in the worts in excess of its proper fermenting temperature must be absorbed and carried off in some way, and the mechanism aforesaid performs that work, transferring the heat in the worts to the water aforesaid.

I am aware that various processes and devices for doing the work performed by cool ship-stack, screens, tube, and apertures, as aforesaid, have before been devised, among which may be named, first, the ordinary method now in use in breweries, of exposing the hot worts in one cool ship without screens to currents of air coming in through apertures in the outer partitions or walls, the cooler air coming in at the bottom of the aperture and issuing, after being heated, at the top thereof, or exposing said worts in some way to currents of air entering and issuing in same manner, but driven over the surface of the worts by fan-blowers; second, of the same method as the first, in combination with a short tube or shaft; third, of leading the air heated by the worts to a chimney or flue artificially heated by gas-jets or fire, though the chimney or flue was not combined with any cool ship or cool ship-stack or screens.

The full description of the cool ship-stack and appurtenances aforesaid may be found in my application for Letters Patent for improvement in cooling beer-worts, &c., made on even date herewith.

I am also aware that various processes for cooling liquids have been before devised, among which may be named, first, surrounding the vessel containing a volatile fluid with some other liquid not easily frozen, such as glycerine, alcohol, rum, whisky, solutions of chloride, such as soda, calcium, &c., salt water or brine, and dipping or setting therein vessels containing the liquids to be cooled, causing a circulation of these slow-congealing liquids by means of a pump, and removing the vapor of the volatile fluid from its chamber or vessel by means of a pump, condensing and returning it, by means of the same pump, to the vessel from whence it came, thus transferring the heat in the vapor to cool running water; second, by passing the fluids to be cooled through pipes or channels surrounded by cool air; third, by causing an unfreezable liquid to circulate around vessels containing the liquids to be cooled, absorbing the heat thereof, and giving it off again, through suitably-arranged mechanism, to cool expanding air; fourth, by passing the liquid to be cooled over a surface impinged on by cool air, or by allowing the liquid to be cooled to stand in a vessel, or run through channels in a vessel, whose bottom was impinged on by a current of cool air on its under side; fifth, by surrounding, or nearly surrounding, the vessel containing the liquid to be cooled with the combined refrigerating effects of compressed air cooled and expanded, and the vapors of volatile fluids; sixth, by forcing the liquids to be cooled through pipes buried from ten to forty feet under the surface of the earth; seventh, by burying the vessel containing the liquid to be cooled in the earth; eighth, by surrounding the vessel containing the liquid to be cooled with a refrigerific mixture; ninth, by producing and maintaining a partial vacuum over the surface of the liquid to be cooled; tenth, by first boiling the liquids to be cooled, and allowing them to stand and cool down to the temperature of the normal air and earth in the shade, then placing them at sunset in shallow un-

glazed earthen pans resting on straw in pit-holes; but these processes do not resemble mine.

I first allow the normal air separately to cool the hot worts by a natural draft, induced by such mechanical means as I have described in combination with the cool ship-stack and screens. I then further cool them mechanically by means of a volatile-fluid evaporator, in combination with a pump, a condensing-coil, normally cool running water, and a loaded valve.

I evaporate my volatile fluid in the upper chamber of my evaporator, the beer or worts to be cooled directly surrounding it, and, as they cool, they follow the law of gravity in liquids, which assigns the coolest and most dense portions the lowest strata, coming in contact as they descend with still cooler surfaces, and becoming cooler themselves.

I use a volatile liquid, to deodorize which and make non-corrosive I take especial pains to better adapt it to the purposes herein described—viz., bisulphide of carbon—which, by the process of deodorizing and rendering non-corrosive, is made more volatile.

In my process of cooling beer and beer-worts its rapidity depends upon the speed of the pump and its capacity.

I regulate the pressure under which the volatile fluid shall be compressed by a loaded valve.

I regulate the speed or flow of the worts or beer to be cooled over the surfaces of the evaporator and the vapor-chamber thereof by valves.

The beer and worts to be cooled are in motion during the process of cooling, and not stationary.

The full description of the volatile-fluid evaporator and appurtenances may be found in my application for Letters Patent for improvement in cooling beer-worts, &c., before referred to.

Description of the Accompanying Drawing.

Figure 1 shows one story or floor in a brewery, suitable for the location of the cool ship-stack D E F, the screens C C′ (one screen similar to C′ being left off of the right-hand end of said cool ship-stack, and not shown in the drawing,) the pipe I, strainer H, communicating with pipe I, well-hole B of tube or shaft A″, situated on the roof formed by joists K K, the sides of the room R R′, the apertures G G, the whole combined and arranged substantially as herein set forth.

Fig. 2 shows another story or floor in a brewery, suitable for the location of the engine N, pump O, bed Y, pillow-blocks *b*, balance-wheel G″, steam-pipe M, volatile-fluid evaporator and cooler, consisting of parts *d′* Q C″ U V W″ T, worts-pipe I, reservoir for compressing the air, consisting of parts M′ P S *e″*, walls of room R R′, pitman *m*, pressure and temperature regulator, consisting of parts *u x′ q′ r t′*, pipe *x″* for compressing air leading from pump O to top of reservoir M′.

Fig. 3 shows another story or floor of a brewery, suitable to receive the worts after it is cooled to fermenting-temperature, and requiring the air therein to be gradually supplied at the proper temperature, pure and dry, and to displace and drive out the air before therein contained. In this room are the ferment-tuns Z′ Z′, the worts-pipe *g g*, with suitable cocks, &c.

Fig. 4 is a sectional elevation of the pump part of my compound engine and pump aforesaid through the line *d f*. Fig. 5 is an end view of the same. Fig. 6 is a sectional elevation of another form of pump, adapted to the purposes herein set forth, through the line *d f*. Fig. 7 is an elevation of the same, in which the valve-chambers are set in a double cylinder-head, and surrounded by water, the valves acting automatically, and being kept to their seats by springs of light tension, the whole pump-cylinder being set in a tank of water.

General Description, in which Like Letters refer to Like Parts.

A A are the pump chambers or cylinders. *p* is the piston, and *r′* the piston-rod. *s* is the stuffing-box, with its follower. *h h* are cylinder-heads. v^1 v^2 v^3 v^4 are ordinary valves. *c′* *c′* in Figs. 4 and 5 are chambers or chests for the induction of air or vapor. *e e′* in Figs. 4 and 5 are valves moved by cams or dogs, for the induction of air or vapor. *a a′* in Fig. 4 are automatic clack or check valves, to prevent the return of air or vapor after it has been forced by the piston into the chamber *q* between them. *o* in Fig. 4 is a filling of wood or other non-conducting material. *t t* in Fig. 4 are such disk-valves as are herein described, acting automatically, as described, and for the purposes set forth. *q q* in Fig. 4 are channels or passages for air or vapor. *i i* in Fig. 7 are automatic puppet inlet-valves, kept to their seats by springs of light tension. *n n* in Figs. 6 and 7 are automatic puppet outlet-valves, kept to their seats by springs of light tension. *c c* are water chambers or passages. *c″* *c″* are water-tanks. *w w* are pipes supplying the water with either air or vapor, at the will of the operator. *x′* is the discharge pipe or chamber for both air and vapor. *x″* is the discharge-pipe for air. *x‴* is the discharge-pipe for vapor. *y y* are pipes conducting, normally, cool running water into *c″*. *z z* are pipes discharging water from *c″* after it has passed through *c c*.

To compress the normal air, close valves v^2, open valves v^1 in pipe *w*, chest *c′*, and pipe *w‴*, and open valves v^3 in pipes *x″*, closing valves v^4 in pipes *x‴*.

To exhaust the volatile-fluid evaporator, or nearly exhaust it, of vapor, condense it by pressure, and return it in liquid form to the said evaporator. Reverse the process for compressing normal air.

It is obvious that this discovery can be ap-

plied to the cooling of whisky-mashes, and anything requiring a speedy reduction of temperature, or the maintenance of a temperature lower than that of the normal air, and I intend to so apply it.

Claims.

Having described the nature of my discovery and invention, as well as the means whereby the processes discovered and invented can be performed, what I claim as my discovery and invention is—

1. The process of cooling beer and beer-worts, in the manner herein described, by means of the cool ship-stack D E F, tube or shaft A B, apertures G G′, and screens C C′.

2. The process of cooling beer and beer-worts, in the manner herein described, by means of a volatile-liquid evaporator, with vapor chambers or pipes beneath the fluid-chamber, connected with a pump, N, condensing-coil motor O, and loaded valve and connecting-pipes, arranged as herein described.

3. The process of cooling the normal air by compressing it in a receiver under the pressure of a loaded valve, said receiver being set upon a cooling-chamber, forming the base, and containing pipes surrounded by normally-cool running water, and allowing the air so compressed to expand after it passes said loaded valve in the pipe or room to be cooled.

OSCAR P. LEWIS.

Witnesses:
GEO. S. RICHARDSON,
HENRY C. BARNETT.