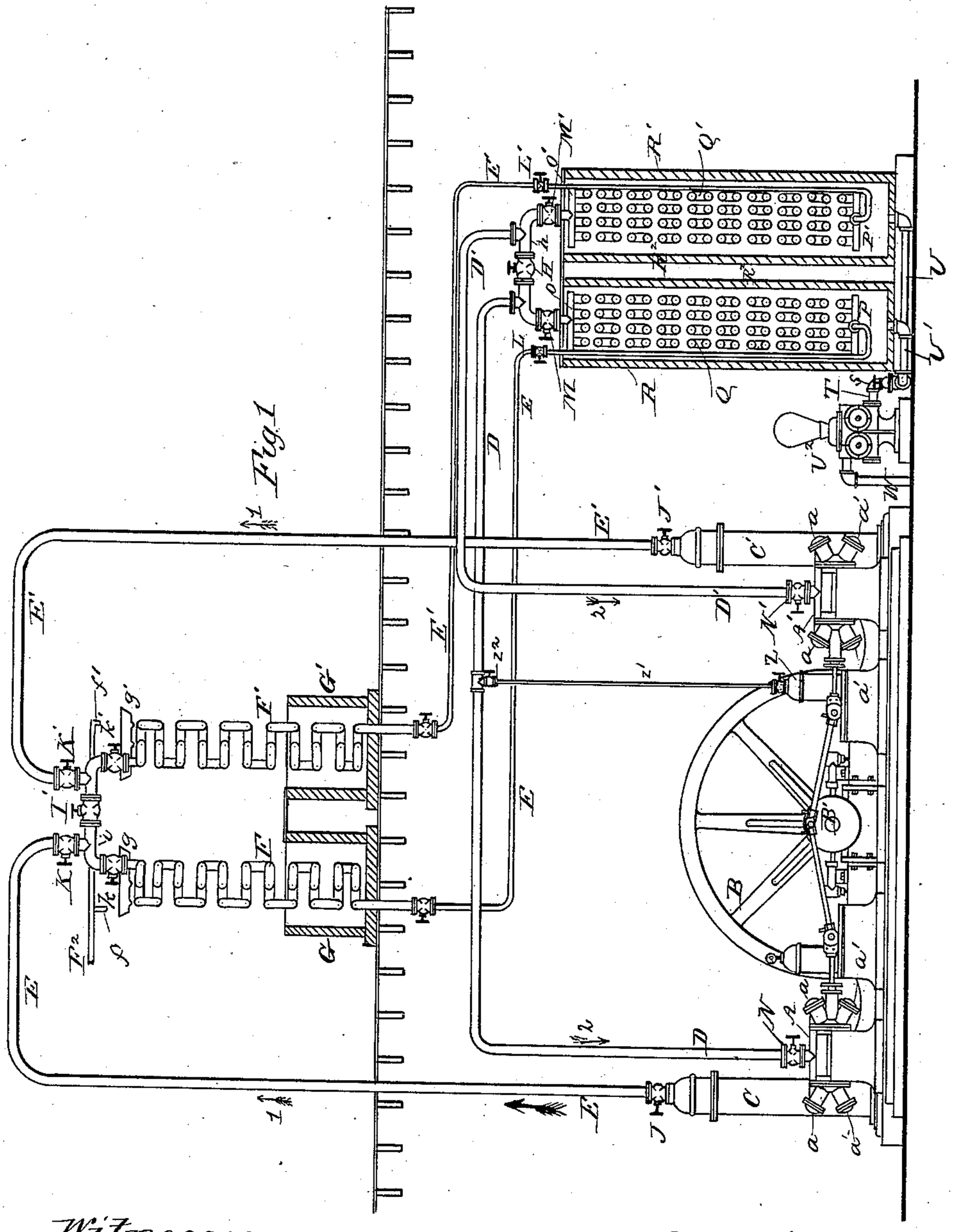
(No Model.) 2 Sheets—Sheet 1.

A. SNYDER.

SYSTEM OF AND APPARATUS FOR REFRIGERATING.

No. 373,319. Patented Nov. 15, 1887.



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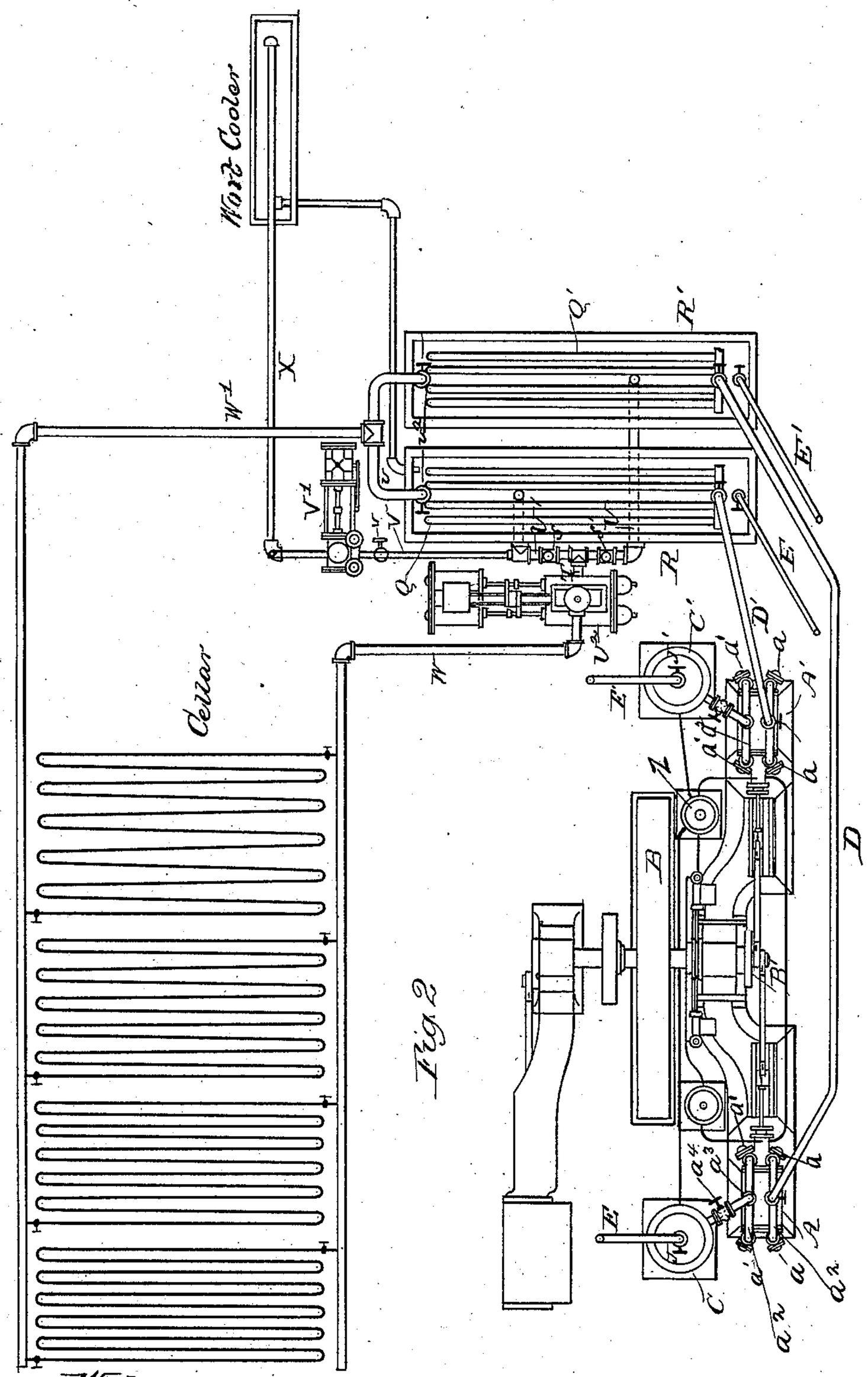

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UNITED STATES PATENT OFFICE.

AUGUST SNYDER, OF PITTSBURG, PENNSYLVANIA.

SYSTEM OF AND APPARATUS FOR REFRIGERATING.

SPECIFICATION forming part of Letters Patent No. 373,319, dated November 15, 1887.

Application filed April 26, 1887. Serial No. 236,221. (No model.)

To all whom it may concern:

Be it known that I, AUGUST SNYDER, a citizen of the United States, residing at Pittsburg, in the county of Allegheny and State of Pennsylvania, have invented certain new and useful Improvements in Systems and Apparatus for Refrigerating; and I do hereby declare the following to be a full, clear, and exact description of the invention, reference being had to the accompanying drawings, which form part of this specification.

My present invention has relation to a system and apparatus for cooling and refrigerating of that class wherein the reduction of the temperature is produced by the alternate contraction and expansion of gas or vapor through the medium of compression-cylinders, reservoir-pipes, coils, &c.

In the class of apparatus referred to it is customary to employ a single compression apparatus, reservoir, &c., with a single line of pipe leading to and from a coil of pipe within a tank filled with salt or briny water, called the "brine-tank," the gas or vapor being drawn back to the compression apparatus and reservoir after it has been allowed to expand in the brine-tank and used over and over again, and the salt water being pumped from the brine-tank through coils of pipe arranged in the building or apparatus to be cooled. When but a single compression-cylinder, reservoir, expansion-coil, &c., are employed, there is always danger that by reason of some accident to some portion the working of the apparatus may be interrupted for a time and great loss of stock or material which should be kept cool result. In addition to the inconveniences which are sure to result from a stoppage of the refrigerating apparatus, the gas constituting the charge of the same is necessarily allowed to go to waste whenever for any reason it becomes necessary to disconnect any of the pipes of the system or open the compression-cylinder.

My invention has for its object the provision of means whereby in a system of refrigerating any of the parts of the apparatus employed may be disconnected or removed, if necessary, without discontinuing or interrupting the refrigerating process and without wasting any of the gas or vapor with which the apparatus is charged.

In carrying my invention into effect I propose to employ two complete sets of refrigerating apparatus which, while working together under ordinary circumstances and in communication with one another, may either of them be operated while the other one is idle or being taken apart or repaired, the gas from the idle compressor, reservoir, and connections being drawn or pumped into the one which is being operated, and all loss of gas thereby avoided.

My invention has for its further object the provision of means whereby, in a refrigerating apparatus employing two brine-tanks, the brine from both tanks may be conveyed through a single line of cooling pipes or coils, or the brine from each tank may be separately conveyed to a different line of pipe or coils, the one being employed to cool wort in the brewing process while the other may be employed in cooling chambers, cellars, apartments, or, in fact, for any purpose whatsoever.

A still further object of my invention is to provide means whereby any ammonia which may be absorbed by the oil which is employed in lubricating the compression-cylinders may be regained and restored from the oil-tank to the reservoir and pipes comprising the ammonia system.

My invention consists in the novel construction, combination, and arrangement of parts, as hereinafter described and claimed.

Referring to the accompanying drawings, Figure 1 is an elevation, partly in section, and Fig. 2 a plan view, of the refrigerating system showing my improvements.

A A′ designate two compression-cylinders, whose piston-rods are both connected with and receive motion from a crank-wheel, B, on the shaft B′ of a steam-engine. The construction of these compression-cylinders and their connection with the driving-engine have been fully described and illustrated in Letters Patent issued to me October 26, 1886, No. 351,665, and in application for Letters Patent filed by me August 22, 1885, No. 175,574, and need not, therefore, be now particularly described, it being sufficient to remark that the compression-cylinders are of the double-acting type and are provided at each end with an ingress-valve communicating with a pipe leading to the refrigerating system.

C C′ designate the two reservoirs with which the egress-valves *a′ a′ a′ a′* of the two compression-cylinders A A′ communicate by branch pipes a^2 a^2, which join at a^3, where a cock, a^4, is placed. From the top of the reservoirs C C′ proceed pipes E E′, leading off in any desired direction to the point where the compressed gas is cooled.

In the drawings I have illustrated a convenient arrangement of the several necessary parts of the complete apparatus, the compressors, with their driving-engine and the brine-pumps, being located alongside the brine-tank, while the ammonia-cooling coils and tanks are arranged above the same; but I wish it to be understood that the relative positions of these parts may be varied according to circumstances.

Just above the reservoirs C C′ the pipes E E′ are provided with stop-cocks J J, and from thence the pipes E E′ proceed uninterruptedly toward the ammonia-cooling coils, being provided with stop-cocks K K′ and *k k′* before merging into said cooling-coils. Between the cocks K K′ and *k k′* the pipes E E′ are joined by a branch pipe, *i*, provided with a stop-cock, I.

F F′ designate the ammonia-cooling coils, which consist of a series of sinuous pipes arranged in any desired or convenient manner in and above water-troughs G G′. Water is supplied to and flows over the coils from the water-pipe F^2, which has outlets at *f f′*, delivering the water into pans *g g′*, whence it flows down over the coils F F′ and into the troughs G G′, which are thus kept full of changing water.

The coil F, it should be understood, is continuous with the pipe E, while the coil F′ is continuous with the pipe E′. After leaving the water troughs G G′ the pipes E E′ are diminished to about one-half the size of the preceding portion thereof, and proceed to and enter the top of the brine-tank, being provided with cocks L L′ before entering said tank.

The brine-tank consists of two separate compartments, R R′, being centrally divided by a vertical partition, R^2, and each of the two compartments contains two manifold casings, one at the top and the other at or near the bottom, these manifolds being lettered O O′ and P P′, respectively, and the two manifolds at the top and bottom of each compartment being connected by several lines of sinuously-formed vertical pipes, Q Q Q and Q′ Q′ Q′.

The pipes E E′ pass down vertically through the respective compartments R R′, and finally connect with the centers of the manifolds P P′. The manifolds O O′ at the top of the compartments R R′ connect with the return-pipes and return the expanded gas to the compression-cylinders. Said return-pipes are lettered D D′, respectively, and they are connected, as before said, with the manifolds O O′, from which they pass out through the top of the brine-tank, and are provided above the top of the latter with a connecting-pipe, *h*, provided with a stop-cock, H, and below the pipe *h* with stop-cocks M M′, and from this point they proceed to the compression-cylinders A A′, being provided with stop-cocks N N′, just previous to their connection with the ingress-valves *a a* of said cylinders.

In the drawings the arrows 1 1 show the course of the ammonia from the compression-cylinders to the brine-tank and the arrows 2 2 the course of the returning ammonia from the brine-tanks to the cylinders.

The operation of so much of the device as has been described is as follows: It being premised that the reservoirs, cylinders, coils, and connecting-pipes have been filled with ammonia under pressure and that the brine-tanks have been filled with brine by the operation of the compression-cylinders A A′, the ammonia is drawn from the pipes D D′ and forced into the reservoirs C C′, whence it proceeds by way of the pipes E E′ to the cooling-coils F F′, where it is deprived of its heat by the water from pipe F^2. Leaving the cooling-coils F F′, the ammonia passes through the now diminished pipes E E′, through the cocks L L′ to the lower manifolds, P P′. Expanding at this point and in its passage upwardly to the manifolds O O′, through the pipes Q Q, the ammonia absorbs heat from the brine surrounding the said manifolds and connecting-pipes, the temperature of the brine being thereby reduced to the requisite degree. From the manifolds O O′ the gas is drawn through the pipes D D′ to the ingress-valves of the compression-cylinders and again compressed; and the continuous operation is carried out indefinitely or as long as the apparatus remains in good working order. We will now suppose that one of the compression-cylinders—say, for instance, the compressor A′—needs repairs, or for any reason it is desired to dismantle the same. The cock at the back of the cylinder on the pipe connecting the reservoir C′ therewith is closed, as is also the cock K′. The engine is stopped, and the pitman of the compression-cylinder A′ is now disconnected from the crank B′. The engine is again started and the compressor A, being continued in operation, draws off all the ammonia from the cylinder A′ and the pipe D′ through the pipe *h* and cock H. The cock N′ on pipe D′ is then closed, and the cylinder A′ may be dismantled or opened and inspected or repaired at leisure.

It will be noticed that under the above-described condition of affairs the cylinder A is operating the entire system, the gas passing from reservoir C through pipe E to the cooling-coils F F′, having access to the latter through the branch *i* and cock I, and, after passing through the compartment R′, returning to the pipe D through the branch *h* and cock H, and by way of said pipe D to the compression-cylinder A.

If the cylinder A should need repairs, it will be readily understood that the above operation may be reversed and the cylinder A′ made to operate the entire system. As a further

illustration of the adaptability of my apparatus to the interchangeable operation of the duplicate cylinders, let it be supposed that one of the cooling-coils F F′ is discovered to be leaking, and that consequently some of the joints or connections must be disconnected. For instance, if it is the coil F that is to be repaired, the cock *k* is closed and the cock H opened, as is also the cock I. The compressors are continued in operation until a vacuum is formed in the coil F, the manifold P, the pipes Q, and the manifold O. The cocks L and M are then closed and the coil F may be taken apart and repaired.

The brine system.—I will now, having described the construction and operation of the ammonia system, proceed to describe the system of distributing the cooled brine throughout the apartments which are to be kept cooled. In this connection it may be well to mention that the class of machines of which my invention is a type are principally employed in breweries, and that in the process of brewing malt liquors the freshly-boiled liquid called "wort" is cooled by pouring it over coils or lines of pipe through which cold water is run. This cold water is usually produced by melting a large quantity of ice in a tank of water, and hence the cooling of the wort forms a not inconsiderable portion of the expense of brewing. I propose to cool the wort by substituting for the ice-water ordinarily employed the brine from one of the compartments of my double brine box or tank, the brine from the other tank, meanwhile, being used solely for the purpose of cooling the cellars and storage-rooms of the brewery. This end I accomplish as follows: On the left-hand side of the brine-tank (see Fig. 1 of the drawings) I have arranged a pump, U^2, of the ordinary or any desired form. T designates the inlet-pipe of said pump divided into two branches, U U′, which communicate, respectively, with the two compartments R R′ of the brine-tank, and are provided with cocks *s s′*. When pumping to the cellar, both the cocks *s s′* are opened and the brine passes off to the cellar (or to whatever apartments are to be kept cool) from the pump U^2 by a pipe, W, and returns to the compartment R′ of the brine-tank by a pipe, W′, and to the compartment R by a branch, *u*, from the pipe W′, said branch being provided with a cock, u^2, as shown. A branch, V, having a cock, *v*, leads from the pipe U′ to a pump, V′, from which leads a pipe, X, conveying the brine to the wort-cooling apparatus and back again to the compartment R of the brine-tank. When it is desired to cool the wort and at the same time maintain a low temperature in the cellars, the stop-cocks *s* and u^2 are closed and the stop-cock *v* is opened. The pump V′ is then put in operation and the brine for supplying the wort-cooling apparatus is pumped solely from and back into the compartment R, while the brine from compartment R′ goes constantly to the cellar, as before.

It will be observed that by means of the above-described arrangement of parts I am enabled to cool wort rapidly and without additional expense, and at the same time maintain at the proper temperature the air in the cellars or other storage-apartments.

The above-described method of separately distributing the brine from one compartment of the brine-tank to the wort-cooling apparatus while the brine from the other compartment is led solely to the cooling-coils in the cellars or storage-rooms is of great advantage, for if the brine after passing through the wort-cooling apparatus were to be mixed in with the brine which is employed in cooling the storage-rooms the consequence would be that the temperature of the entire contents of the brine-tank would be raised to such a degree as would allow the temperature in the storage rooms or cellars to rise considerably above the minimum necessary to the proper preservation of their contents.

The oil regaining device.—In the apparatus above described, and as shown and described in my before-mentioned application for Letters Patent, the piston-rods of the duplicate compression-cylinders are lubricated by means of a fluid packing, (oil,) which is pumped to and from the stuffing-boxes from an oil-reservoir common to both. The arrangement of oil-pipes which convey the oil to and from the stuffing-boxes forms no part of my present invention, and hence will not be particularly described. Suffice it to say that the oil is all led into and out of a reservoir, lettered Z in the drawings. The oil which is thus pumped to and from the stuffing-boxes of the duplicate compression-cylinders eventually absorbs a small quantity of the ammoniacal gas, which, being of less specific gravity than the oil, collects in the upper portion of the oil-reservoir Z. A pipe, *z′*, having a cock, z^2, connects the said oil-reservoir with the return-pipe D′, and when a quantity of the gas has collected in the oil-reservoir the cock *z′* is opened and the gas is drawn into the ammonia system.

I claim—

1. The combination of two complete refrigerating systems operating independently, having their several lines of pipe provided with suitable stop-cocks and being connected at one or more points by a pipe or pipes provided with stop-cocks, whereby, if desired, the vaporized charge from one system may be transferred to the other, substantially as described.

2. The combination, with the duplicate compression-cylinders, cooling-coils, and expansion-pipes, designed and adapted to be independently operated, and connections between these parts, of a brine-tank divided into compartments, the contents of each compartment being cooled by one of the sets of refrigerating apparatus and both compartments supplying brine to a common pump and cooling system connected therewith, substantially as described.

3. The combination, with a brine-tank di-

vided into separate compartments, and a pump communicating with both the compartments of the tank and conveying their contents to a common system of cooling-pipes, of a second pump connected to the pipes between the first pump and one compartment of the brine-tank and conveying the brine to a wort-cooling apparatus and thence back to the compartment from which it was first taken, substantially as described, suitable cocks being placed on the connecting-pipes, whereby when the brine from one compartment is conveyed to the wort-cooling apparatus the connection with the other compartment may be cut off, as set forth.

4. In a refrigerating apparatus, the combination, with duplicate refrigerating systems comprising compression-cylinders, cooling-coils, and expansion-pipes, of a brine-tank divided into separate compartments and suitable cocks and connecting-pipes connecting the duplicate systems, whereby the brine in each compartment may be cooled by the operation of the compression-cylinder pertaining thereto or the brine in both compartments cooled by the operation of either cylinder alone.

5. In a refrigerating apparatus, the combination, with duplicate compression-cylinders receiving motion from a single engine, of a brine-tank connecting with both compression-cylinders and means, substantially as described, whereby its liquid contents may be cooled by the operation of either cylinder separately or the conjoint action of both, such means consisting, essentially, of connections between the pipes leading from the compression-cylinders and suitable stop cocks, as set forth.

6. In an ammonia plant for cooling and refrigerating, the combination of the following elements, to wit: duplicate compression-cylinders, an engine for operating the same, duplicate ammonia-cooling coils, duplicate expansion-coils, a brine-tank divided into separate compartments, each compartment containing an expansion-coil, a pump communicating with both compartments, a system of cooling-pipes connected to said pump, and a return therefrom divided into branches leading to both said compartments, substantially as described.

7. In an ammonia plant for cooling and refrigerating, the combination of the following elements, to wit: duplicate compression-cylinders, an engine for operating the same, duplicate ammonia-cooling coils, duplicate expansion-coils, a brine-tank divided into separate compartments, each compartment containing an expansion-coil, a pump communicating with both compartments, a system of cooling-pipes connected to said pump, and a return therefrom divided into branches leading to both said compartments, one of said branches being provided with a valve or cock, and a second pump being arranged so as to take the brine from one compartment to a wort-cooling apparatus and return it to the same compartment, all as set forth.

In testimony that I claim the foregoing I have hereunto set my hand this 21st day of April, 1887.

AUGUST SNYDER.

Witnesses:
JOS. B. CONNOLLY,
JOHN F. ATCHESON.