(No Model.)

2 Sheets—Sheet 1.

J. J. SUCKERT.

PROCESS OF SEPARATING AND COOLING A SEALING OR LUBRICATING LIQUID IN APPARATUS FOR PRODUCING REFRIGERATION.

No. 320,308. Patented June 16, 1885.

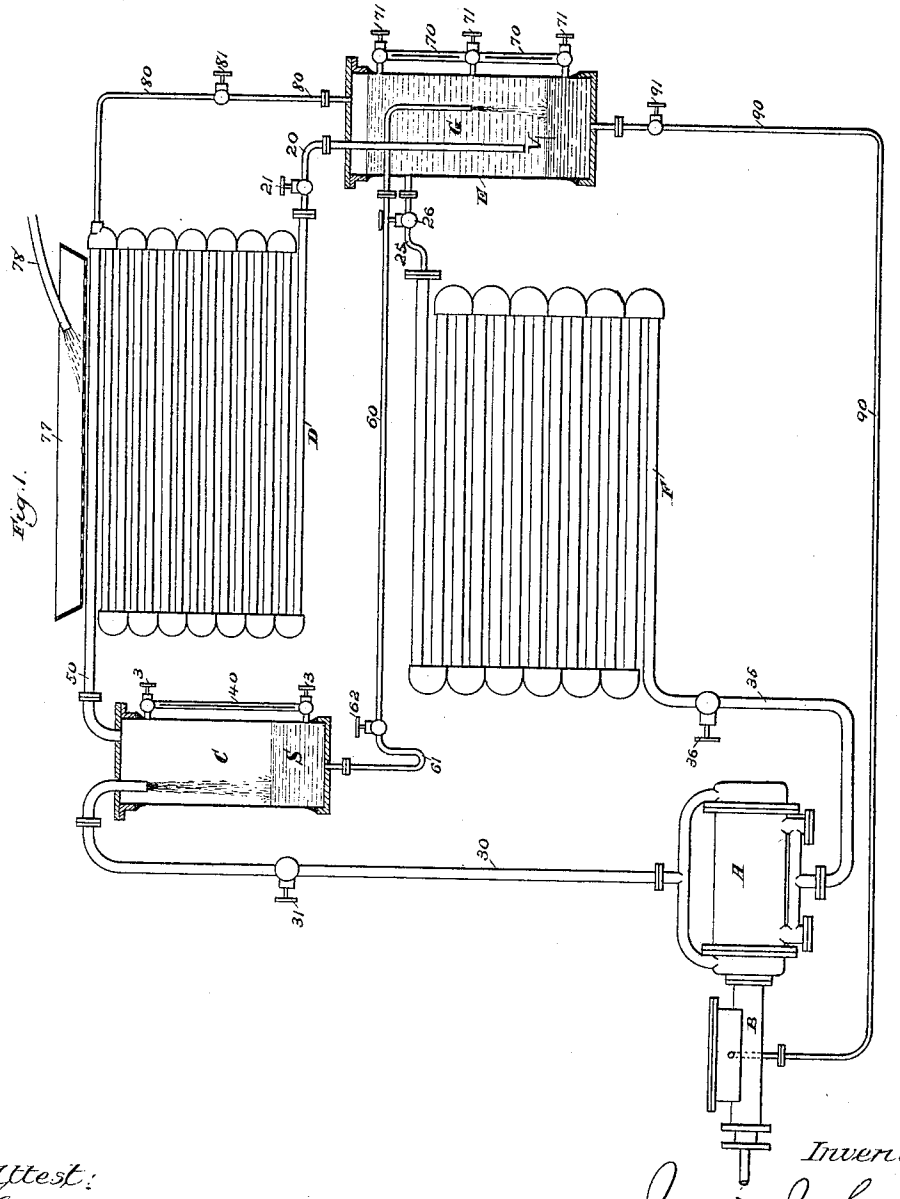

Fig. 1.

Attest:
Geo. H. Bott.
Geo. H. Graham

Inventor:
Julius J. Suckert,
by Munson & Philipp,
Attys

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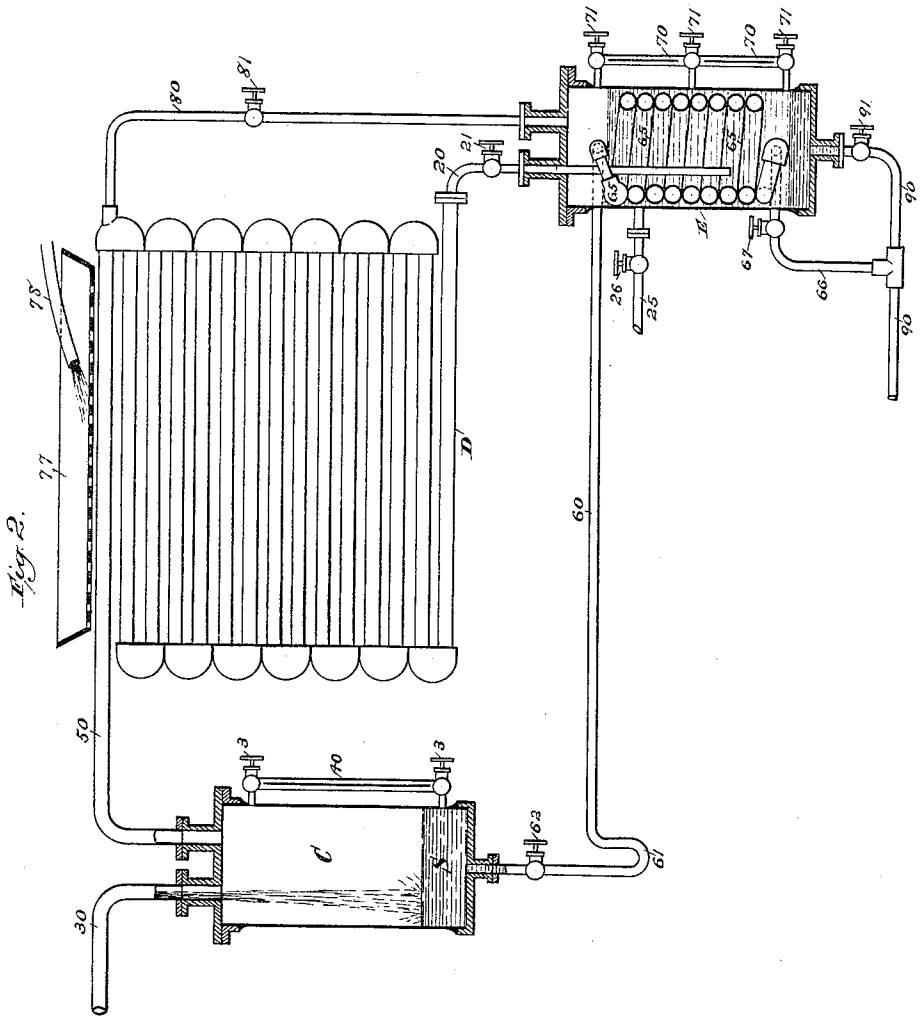

Fig. 2.

Attest:
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UNITED STATES PATENT OFFICE.

JULIUS J. SUCKERT, OF RIDGEWOOD, NEW JERSEY.

PROCESS OF SEPARATING AND COOLING A SEALING OR LUBRICATING LIQUID IN APPARATUS FOR PRODUCING REFRIGERATION.

SPECIFICATION forming part of Letters Patent No. 320,308, dated June 16, 1885.

Application filed April 23, 1885. (No model.)

To all whom it may concern:

Be it known that I, JULIUS J. SUCKERT, a citizen of the United States, residing at Ridgewood, county of Bergen, and State of New Jersey, have invented certain new and useful Improvements in Process of Separating and Cooling a Sealing or Lubricating Liquid in Apparatus for Producing Refrigeration, fully described and represented in the following specification and the accompanying drawings, forming a part of the same.

This process relates to a new and improved system of separating and cooling the sealing or lubricating liquid used for sealing the valves, piston, and piston-rod, and for lubricating the working parts of a gas-compressor used in refrigerating apparatus. Hitherto to avoid waste of the sealing or lubricating liquid, and the gas with which such liquid is charged, the liquid has been circulated without exposure to the atmosphere and cooled by passing it through a coil of exposed pipe having cold water in contact with the outside surface of the coil, and then reintroduced to the compressors. To effect this the lubricant has been discharged from the compressor into a tank or receptacle placed on a level with or below the discharge-outlet of the compressor between the compressor and the condenser, and all of the lubricant in the form of a liquid, or that portion of it not converted into froth, foam, or vapor and carried mechanically with the compressed gas to the condenser, has separated in this tank from the compressed gas, and has then been forced by the working pressure of the apparatus into a coil of pipe usually placed on the condenser-floor and cooled by passing water over the lubricant-cooling coil. It has been possible to force the lubricant to the condenser floor by the working pressure of the apparatus in consequence of the cooling-coil being connected at one end with another tank communicating with the return or suction side of the apparatus, and must therefore be under a reduced pressure or at the same pressure as the vaporized liquefied gas returning from the heat-absorbing coils to the compressors for recompression. Its flow from the cooling-coil is regulated or controlled by a stop-cock on the communicating pipe and requires constant attention and regulation. That part of the lubricant not separated from the compressed gas and carried with it mechanically to the condensers is therein condensed and discharged into a tank or reservoir placed between the condenser and the heat-absorbing coil, and in some cases designated as the "separating-tank," into which the compressed gas when liquefied is also introduced. The lubricant having the greatest specific gravity settles to the bottom of the tank, and when gathered in quantity is returned to the first tank into which it was discharged from the compressor. It has been necessary to return this liquefied vapor of the lubricant in the manner described, in some instances at least once an hour. Again, it has been necessary for the attendant in charge of the engines and compressors to watch the supply of water applied to the coil for cooling the lubricant. Thus it will be seen that there are three different things to watch and three stop-cocks to regulate to insure a satisfactory working of the apparatus. If the supply of water is scanty, the pumps become heated and the friction is increased. If the lubricant fails to be supplied in proper quantities, the valves pound, the pumps become heated, and the gas slips past the piston and piston-rod. In any event, the apparatus as formerly constructed, requires the close attention of a careful engineer.

The object of this invention is to obviate these difficulties and to make the apparatus automatic with the exception of turning on steam.

To this end the invention consists, first, of the process of cooling a sealing or lubricating liquid expelled from a compressing-cylinder of a gas-compressor, which process consists in first separating the sealing or lubricating liquid, which is in liquid form, from the compressed gas in a receptacle interposed between the compressing-chamber and the condenser, and then reducing the temperature of such sealing or lubricating liquid by the vaporization of a quantity of liquefied gas, either in direct or indirect contact with such sealing or lubricating liquid, in a tank receiving the

liquefied compressed gas from the condenser, and then liquefying the gas vaporized by the cooling of the lubricant and returning the same to the receptacle in which it was vaporized, as will hereinafter appear.

Second. The invention further consists of the process of cooling a sealing or lubricating liquid expelled from a compressing-cylinder of a gas-compressor, which process consists in first separating the sealing or lubricating liquid, which is in liquid form, from the compressed gas in a receptacle interposed between the compressing-chamber and the condenser, and then reducing the temperature of such sealing or lubricating liquid by the vaporization of a liquefied gas either in contact with or in indirect contact with such sealing or lubricating liquid, as will hereinafter appear.

Third. The invention further consists of the process of cooling a liquid, which process consists in introducing the liquid to be cooled into pipes or a coil of pipe in a tank or receptacle holding a body of liquefied gas, then cooling such liquid by the vaporization of a part of the liquefied gas and returning it or its equivalent to the receptacle in which the gas was vaporized, as will hereinafter appear.

Fourth. The invention further consists in combining with a gas compressor and condenser, a tank or receptacle interposed between the compressor and condenser operating as a separating-tank, and separating a liquid from a compressed gas, a tank or receptacle connected with the condenser and arranged to receive a gas liquefied in the condenser and connecting-pipes, when the separating-tank is constructed, arranged, and operates to discharge a liquid contained therein into the tank or receptacle receiving the liquefied gas from the condenser, as will hereinafter appear.

Fifth. The invention also consists in the combination of parts as shown and described.

Figure 1 is an illustration of one embodiment of the invention, the same showing an apparatus in elevation and partly in section, the method of cooling the sealing or lubricating liquid being by direct contact with a liquefied gas. Fig. 2 is another illustration of the invention, showing an apparatus in elevation and partly in section, the method of cooling the sealing or lubricating liquid being by indirect contact with a liquefied gas.

The principal parts of the apparatus illustrated as a means for carrying this invention into practical effect are a double-acting compresser, A, an auxiliary-pump, B, for introducing a sealing or lubricating liquid into the compression-chambers of the compressor, a condenser, D, a tank or reservoir, C, interposed between the compressor A, and the condenser D to operate as a separating-tank to separate that portion of the sealing or lubricating liquid which is in liquid form from the compressed gas in its passage from the compressor to the condenser, a tank or reservoir, E, for liquefied gas, and an expansion-coil or heat-absorbing coil, F. The discharge-pipe 30 of the gas-compressor has a cock, 31, that connects with and empties into the liquid-separating tank or receptacle C, so that all liquids, gases, and vapors discharged from the compressor pass through this pipe into said tank, which has a glass gage, 40, connected with it by valves 3. This tank communicates with the top of the condenser by means of a pipe, 50, through which the compressed gas, having separated from the sealing or lubricating liquid in liquid form, passes to the condenser. The sealing or lubricating liquid which has separated from the compressed gas in the separating-tank C is indicated by the dark shading, and is marked S, and the sealing or lubricating liquid is conveyed from said tank by a pipe, 60, to the liquefied gas-tank to be cooled, which pipe is bent to form a trap, 61, has a controlling stop-cock, 62, and inside of the tank E is bent downward, so as to be submerged in the liquefied gas therein, indicated by the light shading marked G, which is received from the condenser D through the pipe 20 when the cock 21 is appropriately turned.

The dark shading marked V in the tank E represents the liquefied lubricant which has passed over from the tank C, also the vapor, froth, or foam of the sealing or lubricating liquid, (in liquefied form,) which was carried by the compressed gas from the separating-tank C to the condenser D and there condensed, and which, flowing with the liquefied gas to the tank E, has settled to the bottom of the tank, owing to its greater specific gravity. In this tank E the height of the liquefied gas and sealing or lubricating liquid is indicated by means of a glass gage, 70, made in two sections and connected with the tank through stop-cocks 71. This tank communicates with the condenser by means of a pipe, 80, having cock 81, which connects its top with the upper part of the condenser, and acts not only as an equalizer, but permits the gas vaporized in the tank E, by the introduction therein of warm sealing and lubricating liquid from the separating-tank C, to escape to the condenser D, where it is condensed and then returned to the tank E through pipe 20. The lower part of the tank E connects by a pipe, 90, having stop-cock 91, with the auxiliary pump B, which pipe conveys the cooled, sealing, and lubricating liquid charged with gas or liquefied gas under the working pressure, from said tank to the pump, preparatory to its reintroduction to the compressor A. The heat-absorbing coil F connects with the tank G, from which it receives its supply of the liquefied gas by a pipe, 25, having cock 26, and the lower pipe of the coil is connected with the suction or return-pipe 35 having cock 36, which conveys the vaporized gas from the coil F back to the compressor for recompression. The condenser D is surmounted by a perforated trough or gutter, 77, which is

supplied with water from a pipe, 78, whereby the said condenser is kept cool.

Having described the various parts, the operation is as follows: The air having been removed from the system or the various tanks and connecting-pipes, the water is turned on at pipe 78 to the gutter 77, which operates, in consequence of its bottom being perforated, to sprinkle the water over the pipes forming the condenser D. Steam is now turned on, and while the apparatus is running slowly the necessary gas and the sealing and lubricating liquid is introduced, or a part may be introduced before starting. The gas is drawn into the compression-chamber of the compressor, and when fully charged, and during the act of compression, the sealing and lubricating liquid is introduced under the working pressure to seal the valves and moving parts as well as for purposes of lubrication. The gas, having been compressed, is discharged from the compressor through the discharge-pipe, 30, intermingled with the sealing or lubricating liquid either in the form of liquid, froth, foam, or vapor, and is introduced into the separating-tank C. Here all of the sealing or lubricating liquid, in liquid form, settles to the bottom of the tank, as indicated by S. The compressed gas and the froth, foam, or vapor of the sealing or lubricating liquid carried with the gas, mechanically passes out through the pipe 50 to the condenser D, where the heat of compression and liquefaction is removed by the cold water passing over it. Liquefaction then ensues and the lubricant and liquefied gas both flow through the pipe 20 into the liquefied-gas tank E, where they separate, owing to their difference in specific gravity, the lubricant falling to the bottom, as indicated by V. The warm liquefied gas S in the liquid separating-tank C flows through the pipe 60 and is emptied into the midst of or in direct contact with a body of liquefied gas, G, in the liquefied-gas tank E. The warm sealing or lubricating liquid imparts its heat to the liquefied gas and is cooled by the vaporization of a portion of the liquefied gas, which passes through the pipe 80 to the condenser D, is there liquefied in the same manner as the compressed gas, and returns again through the pipe 20 to the tank or receptacle E. The proper proportions of liquefied gas and sealing or lubricating liquid having been introduced into the system at the beginning, the quantity of each will vary but little in any of the several parts. In any event the gages will show the height of the liquids in both tanks. If they are drawn from one receptacle with rapidity they are supplied to another with equal rapidity; and if the liquefied gas is not supplied to the heat-absorbing coils faster than necessity calls for, the entire plant will need no regulation whatever. The lubricant is drawn from the tank E through pipe 90 to the pump B for reintroduction to the compressors. The liquefied gas is drawn from tank E through the pipe 25 to the heat-absorbing coil F, where it is introduced under a reduced pressure operating to absorb heat in contact with such coils, the vaporized gas then returning to the compressor for recompression through the suction or return pipe 35. It will be observed that the separating-tank in these illustrations is placed sufficiently high to permit the sealing and lubricating liquid to flow from the tank C to the tank E by gravity.

If it be deemed advisable to employ the indirect system of cooling the lubricant, the pipe 60 (see Fig. 2) may be introduced into the tank E in the form of a coil, 65, the lower end of which will connect with the pipe 90 by a pipe, 66, and cock 67, which pipe 90 leads to the auxiliary pump. In this arrangement the branch of 90 that connects with the bottom of tank E is to release the lubricant liquefied in the condenser.

The parts in Fig. 2 are intended to be connected with the gas-compressor and heat-absorbing coil in the same manner as shown in Fig. 1, as the broken pipes indicate.

Having fully explained my invention, what I claim as new, and desire to secure by Letters Patent of the United States, is—

1. The process of cooling a sealing or lubricating liquid expelled from a compressing-cylinder of a gas-compressor, which process consists in first separating the sealing or lubricating liquid, which is in liquid form, from the compressed gas in a receptacle interposed between the compressing-chamber and the condenser, and then reducing the temperature of such sealing or lubricating liquid by the vaporization of a quantity of liquefied gas, in direct or in indirect contact with such sealing or lubricating liquid, in a tank receiving the liquefied compressed gas from the condenser and then liquefying the gas vaporized by the cooling of the lubricant and returning the same to the receptacle in which it was vaporized, substantially as described.

2. The process of cooling a sealing or lubricating liquid expelled from a compressing-cylinder of a gas-compressor, which process consists in first separating the sealing or lubricating liquid, which is in liquid form, from the compressed gas in a tank or receptacle interposed between the compressing-chamber and the condenser, and then reducing the temperature of such sealing or lubricating liquid by the vaporization of a liquefied gas, either in direct or indirect contact with such sealing or lubricating liquid, and while said liquefied gas is under a pressure in excess of the pressure of the gas entering the compressor to be compressed, substantially as described.

3. The process of cooling a liquid, which process consists in introducing the liquid to be cooled into pipes or a coil of pipe inclosed in a tank or receptacle holding a body of liquefied gas, then cooling such liquid by the vaporization of a part of the liquefied gas, and then condensing or reliquefying the gas so vaporized and returning it to the receptacle

in which the gas was vaporized, substantially as described.

4. The combination, with a gas compressor and condenser, of a tank or receptacle interposed between the compressor and condenser operating as a separating-tank and separating a liquid from a compressed gas, a tank or receptacle connected with the condenser and arranged to receive a gas liquefied in the condenser, and connecting-pipes, when the separating-tank is constructed, arranged and operates to discharge a liquid contained therein into the tank or receptacle receiving the liquefied gas from the condenser, substantially as described.

5. The combination of a gas compressor and condenser, of a separating tank or receptacle operating to separate a liquid from compressed gas passing to the condenser, a liquefied-gas tank or receptacle connected with the condenser and receiving liquefied gas from the condenser, when the said separating-tank is constructed and arranged to discharge a sealing or lubricating liquid into a tank or receptacle cooled by the vaporization of a liquefied gas, and the liquefied-gas tank also communicates with the condenser by a conduit through which the gas vaporized in the liquefied-gas tank passes to the condenser for reliquefaction, substantially as described.

In testimony whereof I have hereunto set my hand in the presence of two subscribing witnesses.

JULIUS J. SUCKERT.

Witnesses:
H. T. MUNSON,
GEO. H. GRAHAM.