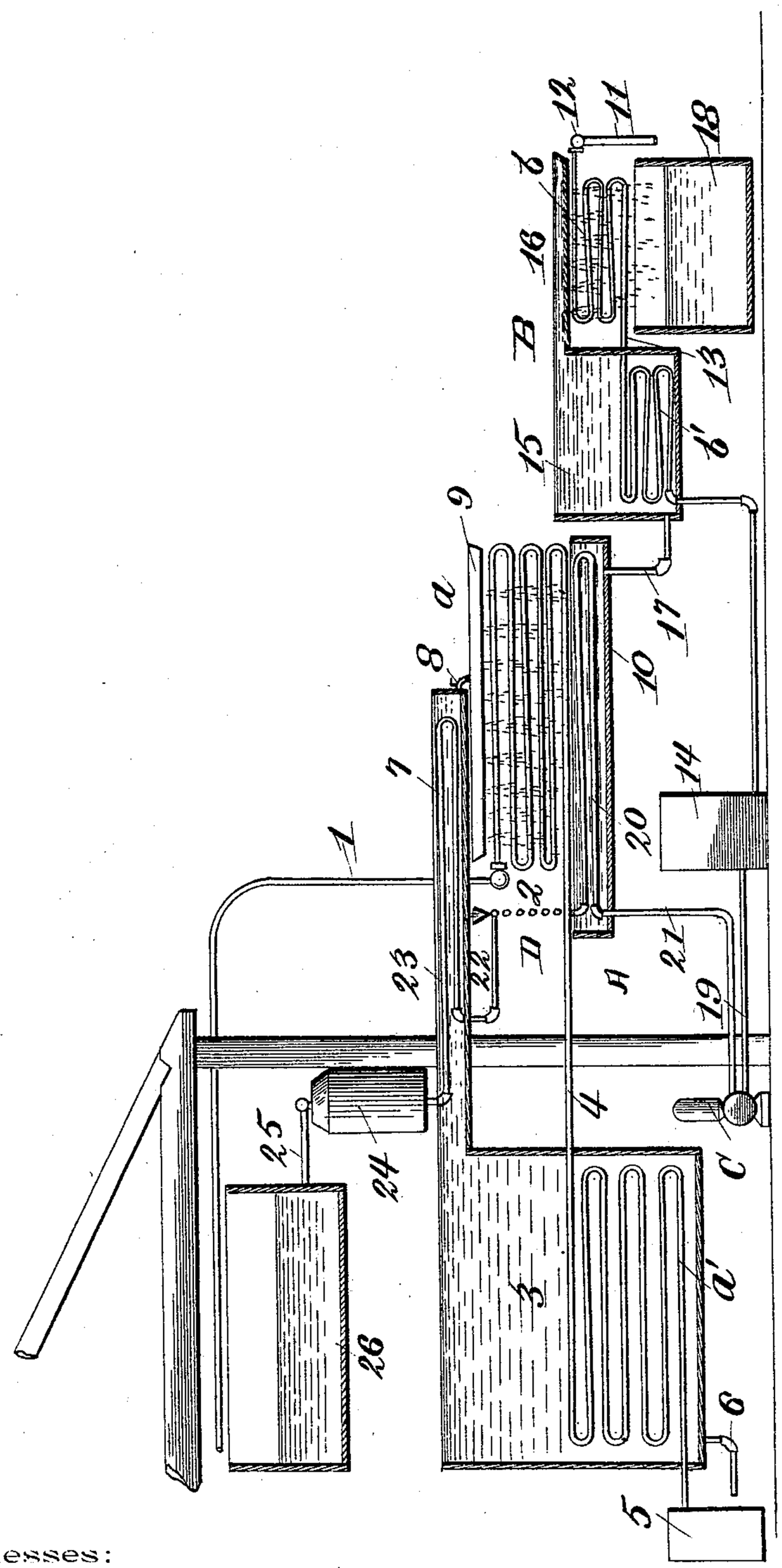
(No Model.)

S. W. JOHNSON.

SURFACE CONDENSER.

No. 521,469. Patented June 19, 1894.



Witnesses:

T. W. Johnson,

E. F. Wells.

Inventor.

Basil W. Johnson

By J. R. Nottingham

Attorney.

THE NATIONAL LITHOGRAPHING COMPANY.
WASHINGTON, D. C.

UNITED STATES PATENT OFFICE.

SAMUEL W. JOHNSON, OF NEWPORT NEWS, VIRGINIA.

SURFACE CONDENSER.

SPECIFICATION forming part of Letters Patent No. 521,469, dated June 19, 1894.

Application filed January 12, 1894. Serial No. 496,653. (No model.)

To all whom it may concern:

Be it known that I, SAMUEL W. JOHNSON, a citizen of the United States, residing at Newport News, in the county of Warwick and State of Virginia, have invented certain new and useful Improvements in Surface Condensers; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

This invention relates to certain improvements in surface condensers; and it consists in the combination and arrangement of devices, whereby complete condensation of gas, under pressure, and steam, may be had and the subsequent cooling of the condensed water provided for, as will be hereinafter more fully described and specifically set forth in the claims.

The principal objects of the invention are, first, to subject the coils of pipes in which the condensation is nearly completed to the action of the water at its coldest, and to use the water, after it has become slightly warmed, on the coils of pipes which contain the gas or steam in a highly heated state; second, to expose the heated gas or steam, first in open-air coils in which the cooling is effected partly by causing water to drip over said coils, partly by the action of the air, and partly by the cooling effect produced by the evaporation of a portion of the condensed water, and subsequently completing the condensation in submerged coils by which the lowest possible temperature is obtained; third, to provide means by which the water, after it has been used on the submerged coils, shall flow by gravity over the open-air coils and, at the same time, the gas or liquid in said open-air coils shall also flow by gravity into the submerged coils, and the water, after being thus used twice on the gas or liquid coils, shall be caused to repeat the same process on the steam coils, thus making four separate times that the whole of the water shall have been used on the coils prior to being fed to the boiler, and, fourth, to provide means by which the temperature of the water after being condensed may be still further reduced. These objects are attained by the devices illustrated in the accompanying drawing, in which the figure represents a side elevation, partly in section, of my improved condenser, as applied to a machine for the manufacture of ice, in which the separate condensation of gas and steam is simultaneously carried on.

For the sake of convenience I shall describe my improved condenser under the following heads, viz:—first, the gas condenser; second, the gas cooling apparatus; third, the steam condenser; fourth, the steam cooling apparatus, and fifth, the means for further utilizing the condensing-water, to cool the condensed water.

The gas condenser.—The letter A indicates the gas or liquid condenser, which comprises the cooling-coils *a* and the condensing-coils *a'*. The cooling-coils are placed in the open air and are connected to a supply-pipe, 1, by a coupling, 2, and with the condensing-coils, which are situated in a water tank, 3, by a pipe 4. The condensing-coils are situated on a lower level than the cooling-coils and are connected with a receiver, 5, into which the liquefied gas is fed, by gravity, as fast as it becomes condensed in said condensing-coils.

The gas cooling apparatus.—The water tank 3, is connected with a suitable water-supply by a pipe, 6, and its walls extend some distance above the cooling-coils. To one side of said tank, at its upper edge, is connected one end of a wide over-flow trough, 7, which extends over the cooling-coils and has its other end provided with a series of short outlet-pipes 8, only one of which is shown. Located above the cooling-coils, and beneath the outlet-pipes, is a series of perforated troughs 9, (only one being shown,) and beneath said coils is a drip-pan, 10, the purpose of which will be hereinafter explained. The operation of these devices is as follows:—The cooling water enters the tank 3 through the pipe 6, and the refrigerating gas enters the cooling-coils through the pipe 1, in a highly heated state. The incoming water rises in the tank and on reaching the overflow trough flows through the same and passing out through the pipes 8 falls into the perforated troughs, from whence it is distributed in small streams over the cooling-coils and subsequently caught in the drip-pan beneath said coils. By extending the walls of the water tank above the cooling-coils I am enabled to cause the water to

flow by gravity, over the cooling-coils, which are placed at such a distance above the condensing-coils that the condensation which is effected in said cooling-coils will flow, by gravity, into said condensing-coils.

The steam condenser.—The letter B indicates the steam condenser, which comprises the open-air steam-condensing coils *b*, and the submerged steam-condensing coils *b'*. The coils *b* are connected with an exhaust-steam pipe 11, by a coupling, 12, and with the coils *b'* by a pipe, 13, through which said coils *b'* receive the drainage from the coils *b*. The coils *b'* are connected with a receiver, 14, into which the condensed water drains by gravity.

The steam cooling apparatus.—The numeral 15 indicates a water tank in which is located the coils *b'*. This tank is provided with an over-flow trough, 16, which extends over the coils *b* and has a perforated bottom. Leading from the tank 15 is a pipe, 17, which, passing upward, enters the bottom of the drip-pan 10. Located beneath the coils *b* is a boiler-feed tank, 18, the purpose of which will presently appear. The operation of these devices is as follows:—Steam is admitted into the coils *b* through the exhaust-steam pipe, and the water which has been caught in the drip-pan 10 is conducted through the pipe 17, into the tank 15. The water rises in said tank and overflowing through the perforated trough 16 is distributed in small streams over the coils *b* and caught in the boiler-feed tank, from which it may be fed to the boiler, not shown.

The means for further utilizing the condensing water to cool the condensed water.—The letter C indicates a pump, which is connected with the condensed-water receiver by a suction-pipe, 19, and with a coil, 20, situated in the drip-pan 10, by a pipe, 21, said coil 20 being in turn connected with a drip-coil, D, the ends of which only are shown. The drip-coil is connected by a pipe, 22, with a coil, 23, which is situated in the over-flow trough 7 and connected with a filter, 24, which is connected by a pipe, 25, with a storage tank 26.

The operation of the device as a whole is as follows:—The refrigerating gas being admitted to the cooling-coils steam admitted to the steam-coils, and water to the water-tank, the water rises to the top of the tank and flowing through the trough 7 and pipes 8 falls into the perforated troughs 9 and is distributed in small streams over the cooling-coils, cooling the liquid in said coils. The said liquid in its cooled state passes into the condensing-coils where it is subjected to the action of the cold water entering the tank. The liquid in passing through the cooling-coils loses considerable of its heat and is cooled nearly to the point of condensation, so that when it reaches the condensing-coils it will be evident that the constant supply of cold water entering the tank will keep the said condensing-coils so thoroughly chilled that the condensation of the gas will be most complete and the lowest possible temperature and pressure obtained. At the same time that condensation of the gas is going on the steam entering the coils *b* through the exhaust-steam pipe is being condensed. The water, which is distributed over the cooling-coils and caught in the drip-pan 10, flows through the pipe 17 into the tank 15 and rising in said tank flows through the perforated bottom of the trough 16 and is distributed in small streams, over the coils *b*, causing a partial condensation of the steam in said coil. As the partly condensed steam passes into the submerged coils *b'* it is further subjected to the cooling action of the constant flow of water from the drip-pan 10, and its condensation is completed. Thus it will be seen that all of the condensing water is used four separate times, first, on the partly cooled gas; second, on the gas more highly heated, as it comes to the condenser; third, on the steam partly cooled, but still hotter than the gas, and fourth on the steam at a still higher temperature, as it enters the condenser, and I thereby secure a greater cooling effect with a smaller quantity of water than is possible by the common practice of using the water once on the gas condenser and once on the steam condenser, and then running it to waste.

The water of condensation passes from the condensing-coils *b'* into the receiving-tank 14. But said water being in a highly heated state it is necessary to cool it as much as possible before it reaches the storage tank 26 and for this purpose, still further utilizes the condensing-water. This is accomplished by means of the pump C, which sucks the condensed water through the pipe 19 and forces it up through the coil 20, which is submerged in the water in the drip-pan 10; thence through drip-coil D, over which water is dripped from a perforated trough, 27, placed cross-wise beneath the bottom of said trough 7, and fed from the same; thence through coil 23, which is submerged in the over-flow trough 7, and thence through the filter to the storage-tank 26. Thus it will be seen that the condensed water is brought in contact at each succeeding stage with condensing-water that is cooler than that used on the preceding coil, thereby insuring the greatest cooling effect.

Having thus fully described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. In a condensing apparatus, the combination, with the condensing-coils and cooling-coils, the latter situated on a plane higher than the former, of a water-tank, in which the condensing-coils are submerged, having its walls so constructed and arranged that the overflow water will be conveyed to and caused to flow over said cooling-coils.

2. In a condensing-apparatus, the combination, with the condensing-coils and the cooling-coils arranged at a higher level than said condensing-coils, of a water-tank, in which the condensing-coils are submerged, provided

with an inlet and with an overflow trough situated on a plane higher than said cooling-coils and having an outlet, whereby the overflow water is caused to flow over the cooling-coils.

3. A condensing-apparatus, comprising gas condensing-coils submerged in a water-tank provided with an overflow as described, a set of gas cooling-coils, connected with and placed on a higher level than said condensing-coils, a set of steam condensing-coils submerged in a water-tank as described, which is fed from the overflow of water from the first mentioned tank and a set of steam cooling-coils connected with the set of steam condensing-coils and placed on a higher level therewith, whereby the condensing-water may be used four separate times in the process of condensation.

4. The combination, with a water-supply tank as described provided with an over-flow, the condensing-coils submerged in said tank and connected with a liquefied-gas receiver, and the cooling-coils placed on a higher level than said condensing-coils and connected therewith, of a drip-pan situated beneath said cooling-coils, a second water-tank connected by a pipe with said drip-pan, a second set of condensing-coils situated in said second tank and connected with a condensed-water receiver, a second set of cooling-coils placed on a higher level than the second set of condensing-coils, and a boiler-feed tank situated beneath said second set of cooling-coils for catching the condensing-water as it is distributed over said coils.

5. The combination, with the steam-condenser, of a condensed-water receiver connected with a pump, a coil situated in the drip-pan beneath the gas cooling-coils and connected with said pump, a set of drip-coils connected with said coil and with a coil situated in the over-flow trough of the water tank, and a filter connected with the coil in said over-flow trough and with a storage tank.

In testimony whereof I affix my signature in the presence of two witnesses.

SAMUEL W. JOHNSON.

Witnesses:
ALICE R. JOHNSON,
CLARA L. JOHNSON.