No. 742,584. PATENTED OCT. 27, 1903.

T. H. BUTLER.

ICE MACHINE.

APPLICATION FILED APR. 7, 1903.

NO MODEL.

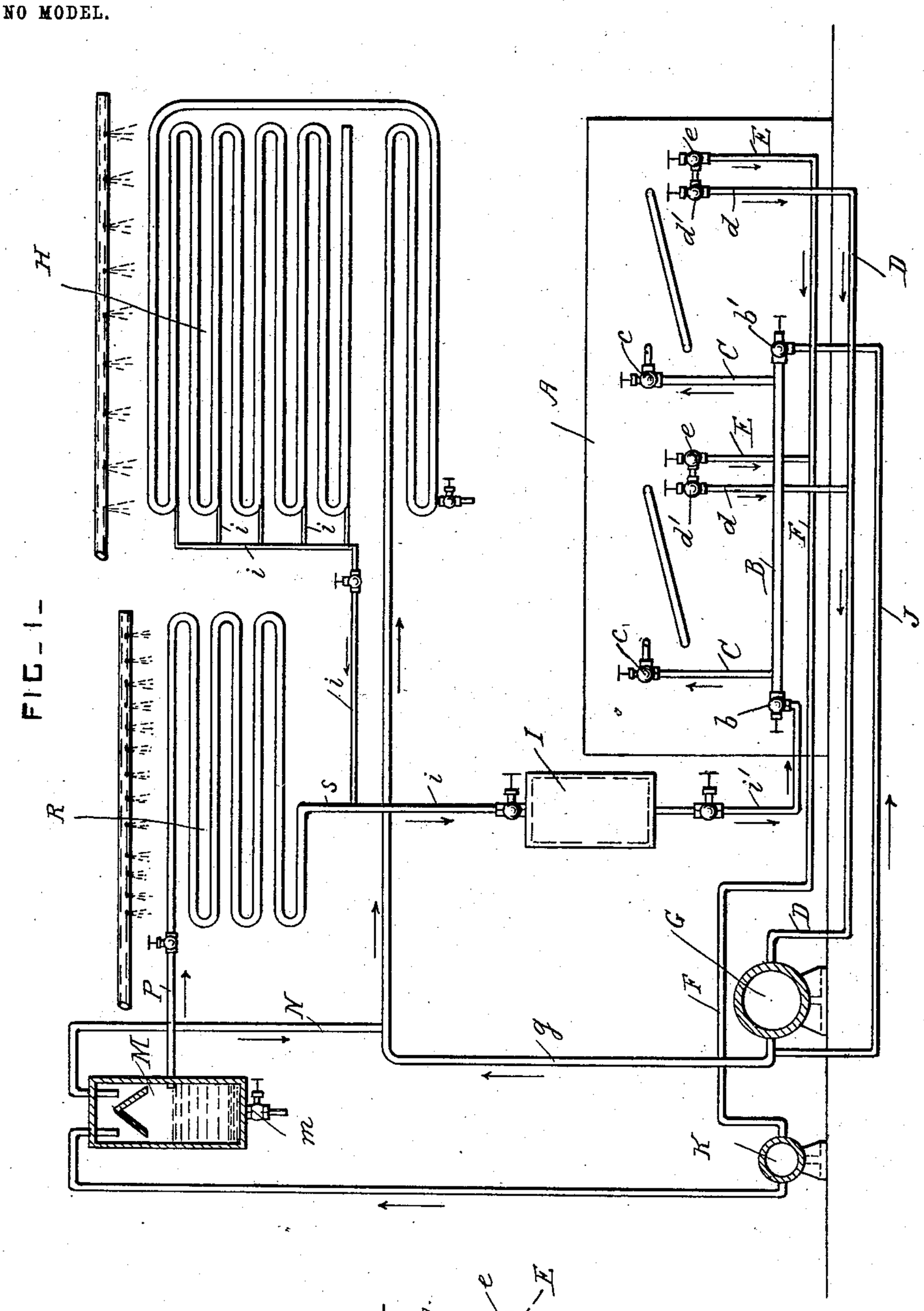

FIG. 1.

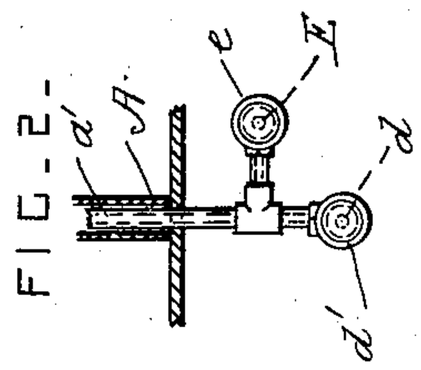

FIG. 2.

WITNESSES

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No. 742,584. Patented October 27, 1903.

UNITED STATES PATENT OFFICE.

THOMAS H. BUTLER, OF BALTIMORE, MARYLAND.

ICE-MACHINE.

SPECIFICATION forming part of Letters Patent No. 742,584, dated October 27, 1903.

Application filed April 7, 1903. Serial No. 151,488. (No model.)

To all whom it may concern:

Be it known that I, THOMAS H. BUTLER, a citizen of the United States, residing at Baltimore, in the State of Maryland, have invented certain new and useful Improvements in Ice-Machines; 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 ice or refrigerating machines; and it consists in the novel construction and combination of the parts hereinafter fully described and claimed whereby the coils of the freezing-tank are supplied with strong and cold liquid ammonia to effect the formation of ice and are subsequently supplied with hot ammonia to thaw the said ice free from the freezing-plates upon which it is formed.

In the drawings, Figure 1 is a diagrammatic view of the apparatus. Fig. 2 is a detail plan view of two of the valves.

A is a freezing-tank provided with freezing coils and plates for forming ice by what is known as the "plate system."

B is a main supply-pipe for ammonia provided with a valve *b* at one end for the admission of cold and strong ammonia to effect the freezing and having a valve *b'* at its other end for the admission of hot ammonia to effect the thawing off.

C represents inlet-pipes provided with valves *c*, which connect the main supply-pipe B with the freezing-coils of the tank A.

D is the main outlet-pipe for the expanded ammonia-gas from the coils of the freezing-tank, and *d* represents branch pipes, and *d'* represents valves which connect the pipe D with the other ends of the said coils from the pipes C.

E represents branch pipes provided with valves *e* and also connected with the same ends of the freezing-coils as the pipes *d*, as shown in Fig. 2, in which *a'* is a portion of one of the freezing-coils.

F is the main outlet-pipe for the warm ammonia, which passes through the pipes E and to which the said pipes E are connected.

The main outlet-pipe D for the expanded ammonia-gas is connected to a main gas-compressor G of any approved construction. A delivery-pipe *g* connects this compressor with the main condenser H, which also is of any approved construction. The compressor G reduces the expanded gas to a hot liquid or to a mixture of hot liquid and gas, the heating being effected by the act of compressing the gas. This hot mixture is cooled in the condenser and is converted into cold and strong liquid ammonia.

I is the receiver for the cold and strong liquid ammonia, and *i* represents the collecting-pipes which connect the coils of the condenser with the receiver I. A pipe *i'* connects the receiver I with the valve *b* of the main supply-pipe B.

When the valves *b* and *d'* are open and the valves *b'* and *e* are closed, the expanded ammonia-gas from the coils of the freezing-tank is drawn into the compressor G and is compressed and is then forced through the coils of the condenser H and is readmitted to the other ends of the coils of the freezing-tank, in which coils it is reëxpanded, and this process is continued until ice of sufficient thickness has formed on the freezing-plates in the freezing-tank.

The inlet-valve *b'* for hot ammonia is connected by a pipe J with the hot-ammonia-delivery pipe *g*, which connects the main compressor G with the main condenser.

K is an auxiliary gas-compressor of any approved construction connected to the main outlet-pipe F for the warm ammonia.

M is a gravity-separator, which has a drain-valve for oil *m* at its lower part. The auxiliary compressor is provided with a discharge-pipe *k*, which is connected to the top of the gas-separator M.

N is a gas-pipe which connects the top of the separator M with the main condenser H.

P is a pipe which connects the middle part of the separator M with an auxiliary condenser R of any approved construction, and *s* is a pipe which connects the auxiliary condenser R with one of the collecting-pipes *i*, which leads into the receiver I.

When the inlet-valve *b* is closed and the valves *b'* and *e* are opened, the hot liquid ammonia or mixture of liquid and gas in the pipe *g* is forced by the main compressor G through the pipes J, B, and C into the coils of the freezing-tank, so that the ice previously

formed on the freezing-plates is thawed off and separated from the said plates, so that it can be removed with facility. The hot ammonia is partially cooled and expanded in the coils of the freezing-tank, and it passes in a warm condition from the coils of the freezing-tank through the pipes E and F to the auxiliary compressor K, in which it is compressed and forced into the gas-separator. The oil and the liquid ammonia separate from each other and from the gas in the separator. The oil is drawn off periodically from the bottom of the separator, and the hot liquid ammonia passes from the middle part of the separator to the auxiliary condenser R, in which it is cooled and from which it is conducted in a liquid condition into the receiver I. The oil which is separated comes from the cylinders of the compressors in which it is used for lubrication, and it is desirable to remove this oil, so that it may be used again and so that it shall not clog the coils of the condensers and impair their efficiency. The gas at the top of the separator is conducted into the main condenser, in which it is liquefied and returned to the receiver I.

What I claim is—

1. The combination, with a freezing-tank provided with an expansion-coil, a main gas-compressor, a main gas-condenser, and pipe connections between the said parts; of a thaw-off pipe connecting the hot-ammonia-delivery pipe of the said main compressor direct with the said expansion-coil, an auxiliary gas-compressor, a suction-pipe connecting the said expansion-coil direct with the said auxiliary gas-compressor, and a delivery-pipe connection between the said auxiliary gas-compressor and the said main gas-condenser.

2. The combination, with a freezing-tank provided with an expansion-coil, a main gas-compressor, suction and delivery pipes between the respective ends of the said coil and the said compressor, and a main condenser and a receiver inserted in the said delivery-pipe; of a branch inlet-pipe for hot ammonia connected to the said coil and to the said delivery-pipe between the said main compressor and the said main condenser, an auxiliary gas-compressor, a suction-pipe between the said coil and the said auxiliary compressor, and a delivery-pipe connection between the said auxiliary compressor and the said main condenser.

3. The combination, with a freezing-tank provided with an expansion-coil, of two valved inlet-pipes connected to one end of the said coil for admitting cold and hot ammonia respectively, two valved outlet-pipes connected to the other end of the said coil for letting out expanded gas and warm ammonia respectively, two compressors connected with the two said outlet-pipes respectively, and a pipe which connects the hot compressed-ammonia-delivery pipe of one of the said compressors with the said hot-ammonia-inlet pipe of the said coil.

4. The combination, with a freezing-tank provided with an expansion-coil, a main gas-compressor, suction and delivery pipes between the respective ends of the said coil and the said compressor, and a main condenser and a receiver for strong cold ammonia inserted in the said delivery-pipe; of a branch inlet-pipe for hot ammonia connected to the said coil and to the said delivery-pipe between the said main compressor and the said main condenser, an auxiliary gas-compressor, a suction-pipe between the said coil and auxiliary compressor, a gas-separator, a delivery-pipe between the said auxiliary compressor and gas-separator, an auxiliary condenser connected to the said gas-separator, and pipe connections between the gas-separator and the said main condenser and between the said auxiliary condenser and the said receiver.

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

THOMAS H. BUTLER.

Witnesses:
TAZEWELL T. THOMAS,
T. BAYARD WILLIAMS.