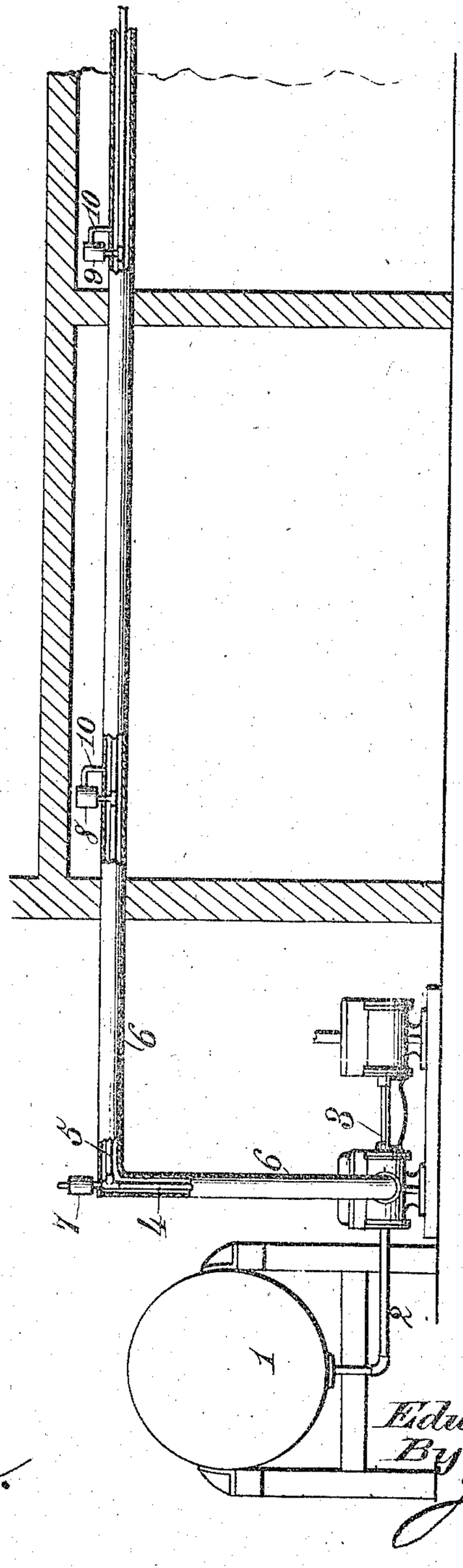
No. 625,759. Patented May 30, 1899.

E. C. HARGRAVE.

LIQUEFIED AIR CONVEYING CONDUIT.

(Application filed July 25, 1898.)

(No Model.)



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UNITED STATES PATENT OFFICE.

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LIQUEFIED-AIR-CONVEYING CONDUIT.

SPECIFICATION forming part of Letters Patent No. 625,759, dated May 30, 1899.

Application filed July 25, 1898. Serial No. 686,832. (No model.)

To all whom it may concern:

Be it known that I, EDWARD C. HARGRAVE, a citizen of the United States, residing at Bay City, in the county of Bay and State of Michigan, have invented new and useful Improvements in Liquefied-Air-Conveying Conduits, of which the following is a specification.

This invention relates to the art of utilizing liquefied air or gas for cooling or refrigerating apartments, chambers, refrigerators, rooms, or other spaces where a low temperature is desired for preserving perishable articles or for refrigerating purposes in general.

The invention consists of the process and apparatus hereinafter described, and set forth in the claims.

In the drawing, the figure represents in sectional elevation the structural embodiment of my invention which seems at this time to be the preferable one.

In order to enable those skilled in the art to make and use my invention, I will now describe the same in detail, reference being made to the accompanying drawing, wherein the numeral 1 indicates a reservoir or tank containing liquefied air or gas obtained, as is known, by reducing air or gas to a liquid state through the medium of high pressure and reduction of temperature. The reservoir or tank connects by a pipe 2 with a liquid-forcing steam-pump 3 or any other pump which will serve to force the liquefied air through the piping, hereinafter explained, if the liquid requires to be elevated. The piping for conveying the liquefied air from the pump to a more or less distant point or from one apartment or room of a building to another apartment or room is represented as first rising vertically, as at 4, from the pump-cylinder, and thence extending horizontally, as at 5, through the apartments or rooms of the building to the place or point where the liquefied air is to be utilized for refrigerating or other purposes. The piping 4 5 may be composed of ordinary metal tubes, and it is completely enveloped or surrounded by a non-conducting casing 6, preferably so applied relatively to the exterior of the piping as to create or provide a surrounding space between its inner side and the exterior of the piping for a purpose which will hereinafter appear. The casing is preferably composed of felt or rock-wool; but it may be made of any other suitable non-conducting material or substance. This casing excludes the outside or surrounding atmosphere from contact with the piping through which the liquefied air passes or is forced to the point where it is to be used or utilized for refrigerating or other purposes. As the liquefied air or gas flows through the piping portions thereof will evaporate, and this evaporating liquefied air escapes through safety-valves, as at 7, 8, and 9. The escape of the evaporating liquefied air passing or forced through the piping avoids bursting of the latter, while the non-conducting casing excludes the heated atmosphere from the surface of the piping, reduces the temperature of the latter, and maintains the liquefied air in the piping in a liquid state, except as to the portions which naturally evaporate. The evaporated liquefied gas in the form of a vapor is preferably conducted by short tubes 10 from the safety-valves into the space between the inner side of the non-conducting casing and the exterior of the piping for the purpose of cooling the latter and aiding in maintaining the liquefied gas flowing or passing through such piping in a liquefied state. I do not wish to be understood, however, as confining myself to conducting the evaporated liquefied gas from the safety-valves to a space between the non-conducting casing and the exterior of the piping; nor do I confine myself to so arranging the non-conducting casing relatively to the surface of the piping that there is a surrounding space between the same. The non-conducting casing may be placed in direct contact with the piping, and the evaporating liquefied air may pass away after escaping from the safety-valves or be utilized for cooling purposes.

By the construction described it will be observed that the evaporating air or gas in the pipe 4 5 is allowed to escape therefrom in sufficient quantities and is utilized to maintain the remaining air or gas therein in a liquefied state, and thereby prevent undue pressure within said pipe.

The pump for forcing the liquefied air or gas through the conduit to the place or point desired may be dispensed with if the lique-

fied-air reservoir or tank is placed in an elevated position or above the level of the conduit, as will be obvious.

Having thus described my invention, what I claim is—

1. The process of conducting liquefied air or gas from one point to another, which consists in piping the same, allowing a portion thereof to evaporate, in quantities sufficient to maintain the main body of the air or gas in a liquefied state and thereby prevent undue pressure therefrom.

2. The process of conducting liquened air or gas from one point to another, which consists in piping the same, allowing a portion thereof to evaporate, and conveying the evaporated portion through an annular space around the main body of the air or gas in quantities sufficient to maintain said body in a liquefied state and thereby prevent undue pressure therefrom.

3. A conduit for liquefied air or gas, provided with means for permitting the escape of evaporating air or gas from the interior thereof, in sufficient quantity to maintain the air or gas liquid in said conduit and thereby preventing undue strain thereof.

4. A conduit for liquefied air or gas comprising piping, a non-conducting surrounding casing therefor, and means for permitting the escape of evaporating air or gas from said piping, in sufficient quantity to maintain the air or gas liquid in said piping and thereby prevent undue strain thereof.

5. A conduit for liquefied air or gas comprising piping, a non-conducting surrounding casing therefor, and safety-valves connected with the piping at different points for permitting the escape of the evaporating air or gas from said piping in sufficient quantity to maintain the air or gas liquid in said piping and thereby prevent undue strain thereof

6. The combination with piping for conveying liquefied air or gas from one place to another, of a casing relatively arranged to the external surface of the piping to provide a continuous intervening space, regulating-valves connected with the piping at different points for permitting the escape of the evaporating air or gas from the interior of the piping to the intervening space in sufficient quantity to maintain the air or gas liquid in said piping and thereby prevent undue strain thereof.

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

EDWARD C. HARGRAVE.

Witnesses:
ALBERT H. NORRIS,
F. B. KEEFER.