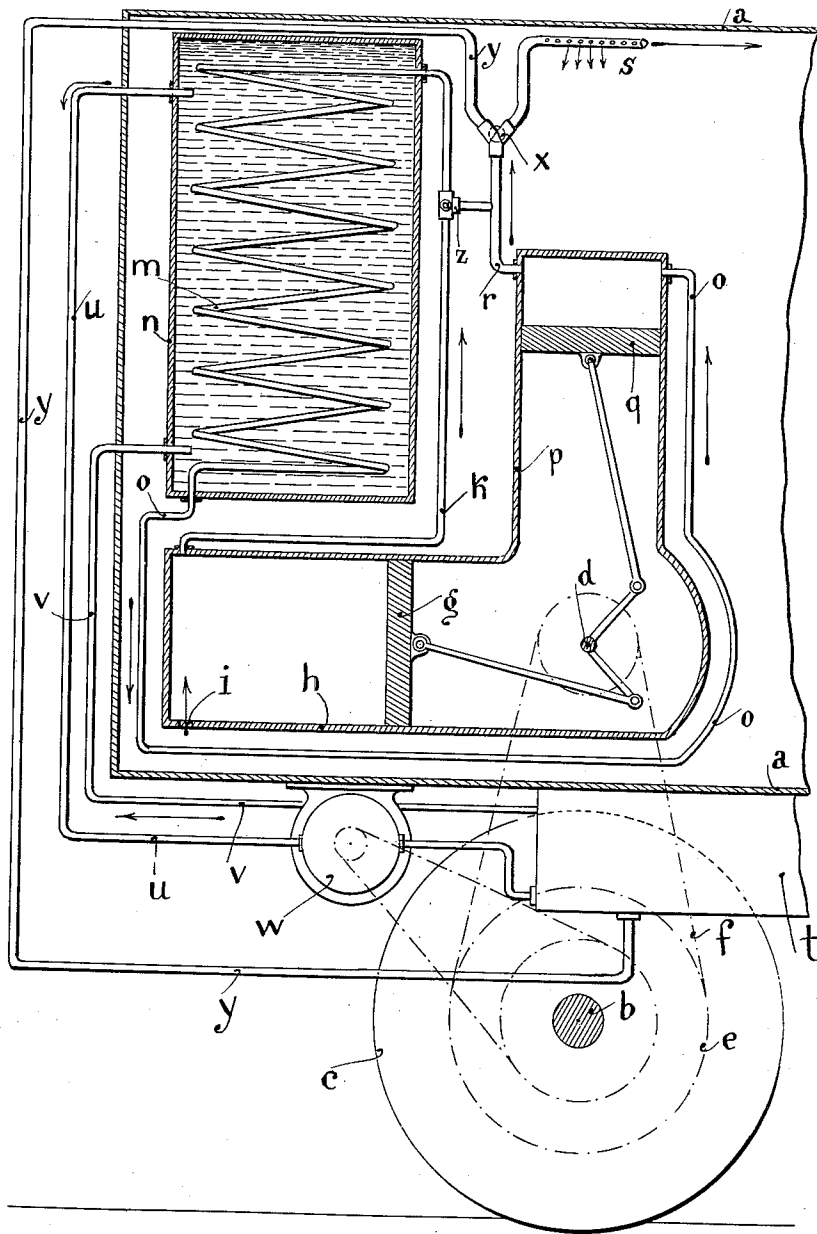


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O. LEVILLY.
SYSTEM OF COOLING ROOMS BY COMPRESSED AIR.
APPLICATION FILED NOV. 14, 1906.



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UNITED STATES PATENT OFFICE.

OLIVIER LEVILLY, OF PARIS, FRANCE.

SYSTEM OF COOLING ROOMS BY COMPRESSED AIR.

No. 879,392.

Specification of Letters Patent.

Patented Feb. 18, 1908.

Application filed November 14, 1906. Serial No. 343,394.

To all whom it may concern:

Be it known that I, OLIVIER LEVILLY, a citizen of the French Republic, and resident of Paris, France, have invented certain new and useful Improvements in a System of Cooling Rooms by Compressed Air, of which the following is a specification.

The methods which are actually used for cooling rooms by means of volatile liquids (ammonia, carbonic acid, ether, etc.,) certainly offer advantages when they are used for stationary arrangements; but when used for cooling railroad cars for example or for the cooling of rooms of ships or the like, the known methods suffer from the great inconvenience that they necessitate special means for storing and supplying the said volatile liquids to make up for the unavoidable loss of such refrigerating material. With railroad cars, for example, it happens that on a long journey the cooling process is suddenly interrupted owing to the loss of a considerable part of the volatile liquids. It has already been proposed to overcome this inconvenience by using common air as carrier for the calories to be removed, but most of the methods which have been proposed with this object in view, suffer also from the hereinbefore mentioned disadvantage as they require either liquid air or, as is the case with certain systems, ice or volatile liquid as source of the means for the refrigeration. The working expenses of such refrigerators are very high and—as already mentioned—the working is uncertain when the car has to travel for a long time.

The object of the present invention is, to provide a system of cooling by air as the only means for producing the low temperature, this system further offering the advantage that it is exceedingly simple and that the working expenses connected with the same are small.

The invention essentially consists in compressing air in a compressor which is operated from the axle of the car; to remove the heat of compression simply by water circulation, comprising a refrigerator and a radiator; to expand the air, which has been thus compressed and heated, in a motor where its temperature is reduced and to finally mix the cooled air intimately with the ambient air of the car.

Figures will better explain the invention. Suppose the inner temperature of the railroad car is 30° above zero and the compressor

compresses the air, whereby the temperature of the air would be raised to about 114°, this heated compressed air will cool in the refrigerator and leave the same at about 20° above zero when it flows into the motor where, in expanding, its temperature is lowered for 40° so that the air, coming out of the motor is 20° below zero. This air—when mixing with the air of the car which is 30°—gradually lowers the temperature of the air of the car in proportion with the dimensions of the car. At a certain moment the cold air from the motor will have no other effect but to compensate the loss of calories by radiation, the temperature in the car having become constant.

To regulate the temperature in the car any suitable thermoelectric device may be provided which, when the desired temperature has been obtained, closes an electric circuit comprising several batteries and a small electric machine for operating a valve in the cold air conduit, the cooled air being thus conducted into one or more water tanks which are preferably arranged along the walls of the car; the water contained in the tanks is thus frozen, the ice serving as an accumulator to give off the cold when the car is not moving. As soon as the temperature of the compartment has risen to a predetermined degree the electric device will operate inversely and the cold air will again be supplied to be mixed with the ambient air of the compartment.

This improved system of cooling offers the very important advantage that in time the entire quantity of air contained in the compartment will pass through the compressor where it is heated to such a degree that it is effectively sterilized and that finally the compartment will only contain perfectly sterilized air. The moisture, admixed with the air, is condensed in the refrigerator wherefrom it can be easily removed; the formation of frost being thus prevented. Another advantage of the system is, that it can be used for heating the car instead of cooling; it being simply necessary, to let escape the air directly from the compressor into the compartment instead of conducting it through the refrigerator.

This invention finally offers the advantage that an intermediate electric operating device can be dispensed with. The systems using volatile liquid require absolute regularity of working of the compressor, as, to

assure the proper working of the apparatus, the pressure difference between aspirator and compression has to remain constantly uniform, while with the new system, where only air is used, the uniform working of the compressor is no longer a necessity so that the compressor can be operated from the axle of the car without any auxiliary electric device.

10 In the accompanying drawings this improved cooling system is illustrated by way of example in its application to a railroad car, in elevation partly in section.

In the body *a* of the car a shaft *d* is revolv-
15 bly mounted parallel to axle *b* of wheel *c* of the car, and which is revolved from said axle through any suitable transmission such as, for example, pulleys *e* and belt *f*. The shaft directly operates piston *g* of the compressor
20 *h* which through the inlet valve *i* draws in the air of the compartment to force the same through pipe *k* into coil *m* of the refrigerator *n* in which it partly gives off the heat of compression. The compressed air, after having
25 thus been conveniently cooled, flows through conduit *o* to the motor *p* the piston *q* of which is connected with shaft *d* by a connecting rod and crank. The air which in expanding in motor *p*, is cooled flows through pipe *r*
30 into the conduit *s* through the perforations of which it escapes into the car where it mixes with the air of the compartment.

The effort of the air expanding in the motor is used to assist the operation of the compressor.
35

The refrigerator *n* is filled with water and communicates through the two conduits *u* and *v* with the radiator *t* arranged under the body of the car; a pump *w* assures the water
40 circulation and maintains the water at uniform temperature.

To simplify the drawings, pump *w* has been shown as arranged under the car and to be directly actuated from axle *b* while in
45 fact it will be operated from shaft *d* so as to make it work in conformity with the motion of the compressor.

It would be advisable, to insert in the driving gear of shaft *d*—between the axle *b* and
50 said shaft—a speed regulator of suitable known construction, for making shaft *d* independent from the axle of the car as regards the speed of revolution. This device, which would be absolutely indispensable with sys-

tems working with volatile liquids, can be 55 dispensed with in the apparatus constructed according to the present invention.

As hereinbefore explained, a valve *x* is provided in conduit *r* which is operated by a thermostatic governor of known construction 60 in such a manner, that the cold air, coming from the motor, is delivered directly to the water tanks through conduit *y* as soon as a temperature is attained which is lower than the predetermined limit. The three-way- 65 cock *z* permits to bring pipe *k* into direct communication with conduit *s* or *y* respectively, if the compartment, instead of being cooled, has to be heated. In this case the hot air from the compressor will pass directly into 70 the conduits *s* or *y* without passing through the refrigerator.

The arrangement, as hereinbefore described, is merely one of the many forms of execution for which this system can be ap- 75 plied, and it is evident, that this system can be adapted for any special purpose without departing from the idea of my invention.

Having now described and ascertained the nature of my said invention, I declare that 80 what I claim and desire to secure by Letters Patent, is:—

In a car to be cooled by compressed air, the combination of a compressor for the air of the car, of a refrigerator adapted to receive 85 the compressed air from the compressor and comprising a water reservoir and a cooling coil, a pipe joining the compressor and cooling coil, a motor, a pipe connecting the motor with the cooling coil, the perforated pipe 90 for supplying the cold air from the motor to the interior of the car, a by-pass joining this supply pipe and the pipe connecting the compressor and the cooling coil, a shaft operated from the axle of the car and connected 95 with the piston of the motor for operating the compressor piston, the car axle, and a three-way cock in the by-pass for delivering the air from the compressor directly to the car for heating the same, substantially as 100 described and shown.

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

OLIVIER LEVILLY.

Witnesses:

CHARLES E. PHENIX,
GEO. LANGE.