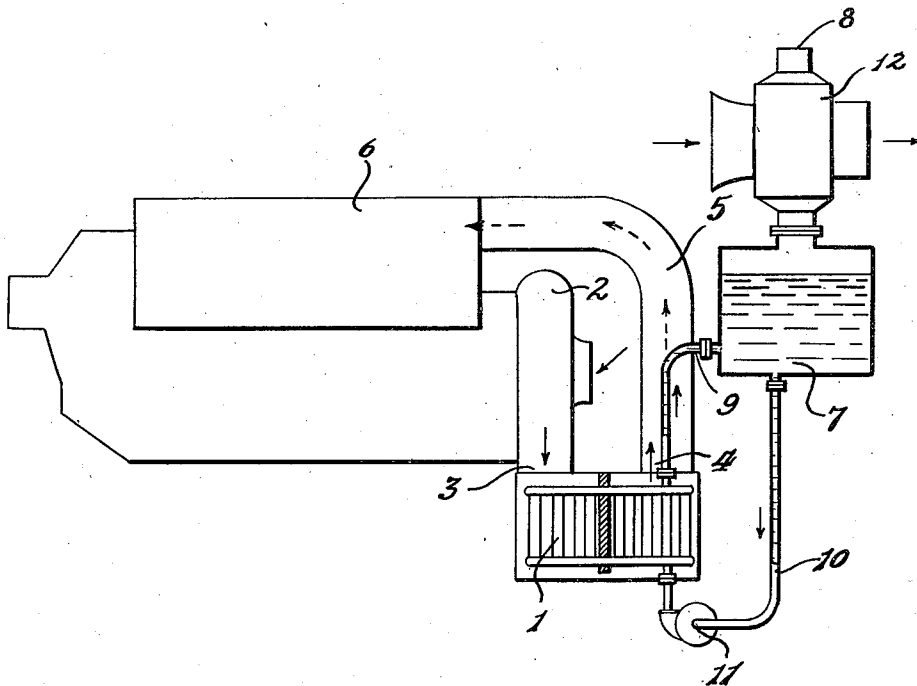


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SYSTEM, IN PARTICULAR TO INTERNAL COMBUSTION
ENGINE, INCLUDING COMPRESSORS
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SYSTEM, IN PARTICULAR TO INTERNAL
COMBUSTION ENGINE, INCLUDING COM-
PRESSORS

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The present invention relates to systems including a compressor, and in particular to internal combustion engines which are fed by means of compressors, adapted to be connected either permanently or temporarily with the engine. The invention is more especially, although not exclusively, concerned, among these engine-compressor systems, with those used on aircrafts.

The object of the present invention is to provide a system of this type which is better adapted to meet the requirements of practice than those used up to the present time, and in particular to improve the cooling of the fluid fed by the compressor to the engine.

According to an essential feature of the invention, in order to cool the fluid fed by the compressor, that is to say fluid which has been heated by being compressed, I make use of a liquid heat interchanger built in such manner that the liquid present therein is kept in communication with the atmosphere, whereby the temperature of said liquid cannot exceed the boiling point corresponding to the atmospheric pressure.

According to another feature of my invention, this heat interchanger includes a radiator through which the liquid in question flows and over the surface of which the compressed fluid to be cooled is caused to pass, a reservoir open to the atmosphere communicating with said radiator, and means for circulating the liquid in a circuit including said radiator and reservoir.

Other features of the present invention will result from the following detailed description of some specific embodiments thereof.

Preferred embodiments of the present invention will be hereinafter described, with reference to the accompanying drawing, given merely by way of example, and in which the figure is a diagrammatical view of a system made according to the invention which includes an internal combustion engine, a compressor for feeding fluid to the engine, and means for cooling the compressed fluid from said compressor.

It will be supposed, in the following description, that such a system is mounted on an airplane and in particular a fighter.

Now it is reminded that, in airplanes such as they are equipped at the present time, the cooling of the compressed fluid from the compressor before it is sent to the engine is obtained by means of a radiator cooled by the atmospheric air or, in a more general manner by means of a device subjected to the cooling action of the atmospheric air.

Experience has taught that it becomes neces-

sary, especially in the case of airplanes intended to fly at high altitudes, to provide radiators of prohibitive dimensions, in view of the fact that, at such altitudes, the density of the atmospheric air is greatly reduced, and causes a corresponding decrease in the efficiency of the radiators per unit of area thereof.

In order to obviate this drawback, according to an essential feature of my invention, the cooling action to be exerted on the compressed fluid is supplied, at least partly, by a heat interchanger containing a liquid in direct communication with the atmospheric air, whereby the temperature of this liquid cannot rise above the boiling point corresponding to the pressure of said air.

It will be readily understood that, with such an arrangement, I obtain, for the heat exchanges, an efficiency which remains constant when the altitude varies, which makes it possible to provide a system occupying the minimum volume.

Furthermore, I obtain a double factor of safety in view of the fact that, on the one hand, the temperature of the liquid, therefore of the fluid to be cooled, is limited by the boiling of the liquid, and on the other hand the boiling temperature becomes lower and lower as the altitude of the airplane increases.

Of course, account must be taken of the fact that the liquid in the interchanger evaporates, so that it is necessary to provide a sufficient volume of said liquid. Preferably, and as it will be hereinafter supposed, this volume is contained on the one hand in this heat interchanger proper and, on the other hand, in a container of suitable volume connected to said interchanger and in communication with the atmosphere.

A specific example of such a system, as illustrated by the drawing, will now be described without involving any possible limitation of the invention.

In this embodiment, the heat interchanger 1 may be of any suitable type, consisting for instance of a conventional radiator in which the liquid is caused to flow and over the surface of which the compressed fluid fed from compressor 2 is caused to pass. According to the arrangement illustrated by the drawing, this compressed fluid is admitted at 3 into the interchanger, and it flows out at 4 through a feed pipe 5 leading to the internal combustion engine 6.

The liquid container 7, which communicates at 8 with the atmosphere, is connected with the radiator through conduits 9 and 10.

Preferably, means are provided for ensuring a sufficiently active circulation of the liquid

through the circuit constituted by heat interchanger 1, container 7, and conduits 8 and 10.

The liquid circulation means may be of the automatic type, the whole constituting a thermosiphon system, but preferably, according to the present invention, the means in question consist of a circulation pump adapted to work at constant or variable speed.

As for the nature of the liquid present in the heat interchanger, I may choose water, or any other liquid having a different boiling point.

Concerning the volume of the liquid container, it is chosen in accordance with the conditions in which the compressor is to work. It will be readily understood that the heating of the fluid in said compressor is relatively considerable only in well determined cases, such for instance as when the airplane is flying at high altitude and with the throttle full opened since, under these conditions, the compressor is called upon to work at maximum rate. On the contrary, when flying at ordinary, or normal, altitude and at a speed which is but a portion of the maximum speed, the heating of the fluid in the compressor is relatively moderate and such that the radiator can then suffice to ensure, without boiling of the liquid therein, the desired cooling.

Supposing that the aircraft on which the system is fitted is a fighter plane, in which case, on the one hand, the full power of the engine is generally required but for a very short time, and, on the other hand, during normal flight is, in all cases, very small, it seems that a volume of some twenty liters, for instance, is wholly sufficient for the liquid tank.

Of course, it should be well understood that, if sufficient space is available, I may adjoin to the container a condenser 12 capable of recuperating at least a portion of the water or other liquid evaporated from the container, the condenser being preferably of the surface type, the cooling fluid used therein being atmospheric air.

Anyway, whatever be the particular embodiment and arrangement that is chosen, I obtain a system the operation of which results from the preceding explanation making it unnecessary to describe it in a more detailed manner.

The system according to the invention has, over other systems of the same kind used up to the present time, many advantages the most important of which are the following:

It is possible to employ a radiator of the minimum dimensions possible, since the thermal efficiency thereof is maximum and is not responsive to variations of the value of the atmospheric pressure in the vicinity of the system.

On the other hand, full safety is obtained provided only that a sufficient reserve of liquid is chosen for each particular case.

In a general manner, while I have, in the above description, disclosed what I deem to be practical and efficient embodiments of the present invention, it should be well understood that I do not wish to be limited thereto as there might be changes made in the arrangement, disposition and form of the parts without departing from the principle of the present invention as comprehended within the scope of the appended claims.

What I claim is:

1. In a system including an internal combustion engine and a supercharger for compressing the fluid to be fed to said engine, a device for cooling said fluid passing from said supercharger to said engine, which comprises, in combination,

a passage for leading the stream of fluid from said supercharger to said engine, a container in direct communication with the atmosphere, a liquid in said container, and a wall forming a partition between said container and said passage and disposed within said passage for the exchange of heat from said fluid to said liquid, the temperature of which cannot exceed its boiling point at the surrounding atmospheric pressure.

2. In a system including an internal combustion engine and a supercharger for compressing the fluid to be fed to said engine, a device for cooling said fluid passing from said supercharger to said engine, which comprises, in combination, a passage for leading the stream of fluid from said supercharger to said engine, a container in direct communication with the atmosphere, water filling said container, and a wall forming a direct partition between said container and said passage and disposed within said passage for the exchange of heat from said fluid to said mass of water, the temperature of which cannot exceed its boiling point at the surrounding atmospheric pressure.

3. In a system including an internal combustion engine and a supercharger for compressing the fluid to be fed to said engine, a device for cooling said fluid passing from said supercharger to said engine, which comprises, in combination, a passage for leading to said engine the stream of fluid from said supercharger, a radiator in said passage, having an aperture opening directly into the atmosphere, and a liquid in said radiator, for the exchange of heat from said fluid to said liquid, the temperature of which cannot exceed its boiling point at the surrounding atmospheric pressure in view of the communication of the inside of said radiator with the atmosphere.

4. In a system including an internal combustion engine and a supercharger for compressing the fluid to be fed to said engine, a device for cooling said fluid passing from said supercharger to said engine, which device comprises, in combination, a passage for leading to said engine the stream of fluid from said supercharger, a radiator in said passage, having an aperture opening directly into the atmosphere, and a liquid in said radiator, for the exchange of heat from said fluid to said liquid, the temperature of which cannot exceed its boiling point at the surrounding atmospheric pressure, in view of the communication of the inside of said radiator with the atmosphere, and condenser means for recuperating at least a portion of the liquid evaporated from said radiator.

5. In a system including an internal combustion engine and a supercharger for compressing the fluid to be fed to said engine, a device for cooling said fluid passing from said supercharger to said engine, which comprises, in combination, a passage for leading to said engine the stream of fluid from said supercharger, a radiator in said passage, a tank communicating with said radiator and having an aperture opening directly into the atmosphere, a liquid filling said radiator and at least a portion of said tank, for taking off, through the wall of said radiator, heat from the fluid on its way toward said engine, the temperature of said liquid being at most equal to its boiling point at the surrounding atmospheric pressure in view of the communication of said tank with the atmosphere, and condenser means for recuperating at least a portion of the liquid evaporated from said radiator.

6. In a system including an internal combustion

tion engine and a supercharger for compressing the fluid to be fed to said engine, a device for cooling said fluid passing from said supercharger to said engine, which comprises, in combination, a passage for leading the stream of fluid from said supercharger to said engine, means forming a circuit including a container in direct communication with the atmosphere, a liquid in said circuit, means for circulating said liquid through said circuit, and a wall forming a direct partition between said passage and a portion of said circuit and disposed within said passage, for the exchange of heat from said fluid to said liquid, the temperature of which cannot exceed its boiling point at the surrounding atmospheric pressure, in view of the direct communication of said container with the atmosphere.

7. In a system including an internal combustion engine and a supercharger for compressing the fluid to be fed to said engine, a device for cooling said fluid passing from said supercharger to said engine, which comprises, in combination, a passage for leading to said engine the stream of fluid from said supercharger, a radiator in said passage, a tank communicating with said radiator, and having an aperture opening directly into the atmosphere, a liquid filling said radiator and at least a portion of said tank, for removing, through the wall of said radiator, heat from the fluid on its way toward said engine, the tempera-

ture of said liquid being at most equal to the boiling point thereof at the surrounding atmospheric pressure in view of the communication of said tank with the surrounding atmosphere, means for constantly circulating said liquid from said radiator to said tank and vice-versa, and condenser means for recuperating at least a portion of the liquid evaporating from said tank.

8. In a system including an internal combustion engine and a supercharger for compressing the air to be fed to said engine, a device for cooling the air passing from said supercharger to said engine, which comprises, in combination, a passage for leading to said engine the stream of fluid from said supercharger, a radiator in said passage, a tank having an aperture communicating directly with the atmosphere, at least two conduits interconnecting said tank with said radiator, so as to form a circuit, a liquid filling said radiator and at least a portion of said tank, for removing, through the wall of said radiator, heat from the fluid on its way toward the engine, the temperature of said liquid being at most equal to the boiling point thereof at the surrounding atmospheric pressure in view of the communication of said tank with the surrounding atmosphere, and a pump for constantly circulating said liquid through said circuit.

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