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(54) **Method for reducing differences in heat transfer in the vaporizer of cooling systems with cooling agent circulation as far as is possible by means of utilizing flashgas and means for the implementation of the method.**

(57) Method for the operation of a cooling system with cooling agent circulation whereby the heat transfer over the entire vaporizer surface is uniform.

As a result of this a considerable energy saving is obtained. This is achieved by fully or partially passing the throttled cooling agent or vapor-gas mixtures into the vaporizer in particular by guiding it via a separate pipe from the throttle mechanism to the pipe between the circulation pump or separator and the vaporizer.

The invention also includes cooling systems which work according to the above mentioned principle.

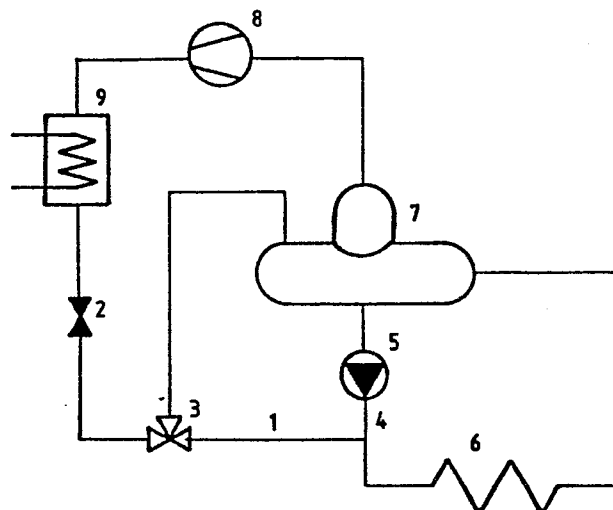


Fig. 1

Method for reducing differences in heat transfer in the vaporizer of cooling systems with cooling agent circulation as far as is possible by means of utilizing flashgas and means for the implementation of the method.

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The invention relates to cooling systems with cooling agent circulation, hereinafter referred to as circulation systems.

Circulation systems can be divided into pump circulation and gravity circulation systems. With these kinds of systems there is a complete
10 destruction of pressure and speed energy of the condensed cooling agent which comes into the separator via the throttle mechanism.

With circulation systems several times more cooling agent is consciously circulated than the quantity which is necessary for the evaporation, so that there can still be a completely "moistened"
15 surface at the end of the vaporizer. The overheating of the cooling agent is therefore nihil with these kinds of systems, which results in energy advantages alongside all sorts of technical control advantages. Furthermore it is a fact that with circulation of cooling agent, compared to systems with dry evaporation, the temperature
20 distribution and the cooling capacity is more uniform over the vaporizer surface, particularly at the end of the vaporizer.

Circulation systems can, however, have the disadvantage that the beginning of the vaporizer functions badly. This is because 100% of the fluid is present at the vaporizer entrance. As a result of the
25 large difference in the volume of vapor and fluid the speed at the beginning of the vaporizer compared to the speed at the end will be very low at constant vaporizer diameter. As a result of this large differences in heat transfer can arise, whereby the beginning of the

vaporizer functions worst in this respect. This disadvantage of circulation systems can be removed by entering the vaporizer with a particular vapor fraction, such that while this vapor fraction will vary across the vaporizer, the heat transfer coefficient will remain reasonably constant. Even with slight vapor fractions at the beginning a considerable improvement can occur. Particularly for application in artificial skating rinks, where a uniform heat withdrawal by the vaporizer is essential for obtaining a uniform ice quality and a limited energy consumption, a certain vapor fraction at the beginning would be desirable. For other applications, for example for the preservation of food products for which dehydration plays a role, a uniform vaporizer temperature which is as high as possible is important. The invention has the following specific characteristics. In the case of pump circulation systems the condensed cooling agent, which usually ends up in the separator via a throttle mechanism, is, according to the invention, led according to figure 1 in whole or in part by means of control valve 3 via a separate pipe 1 from the throttle mechanism 2 to pipe 4 between circulation pump 5 and vaporizer 6.

In the case of gravity circulation systems the condensed cooling agent is, according to the invention, led according to figure 2 in whole or in part by means of control valve 3 via a separate pipe 1 from the throttle mechanism 2 to pipe 4 between the separator 7 and the vaporizer 6.

In both circulation systems the cooling agent is led as a liquid/vapor mixture back to the separator 7 and the cooling agent vapor is compressed by means of compressor 8 and condensed in condensor 9. The effects which arise as a result of this are: The

condensed cooling agent will now expand via the throttle mechanism 2 to a higher pressure compared with the pressure in the separator 7. As a result of this a little less cooling agent, hereinafter referred to as "flashgas", arises during the throttling, which in itself already provides an energy saving. More important, however, is the increased cooling agent speed which is attained at the entrance of the vaporizer 6 as a result of the presence of "flashgas". As a result of this the heat transfer at that place is improved and the same cooling capacity can be produced at a higher evaporation temperature, as a result of which energy saving is obtained as an advantage. For application of this invention in artificial skating rinks a more uniform ice surface temperature is an extra advantage. For application of this invention in the preservation of food products a slighter dehumidification of the air, as a result of which less dehydration of the product occurs, is an extra advantage. Furthermore, in pump circulation systems the circulation pump 5 needs to produce less work, because the delivery by the circulation pump 5 has decreased by the delivery which is now brought into the vaporizer 6 directly from the throttle mechanism 2. It comes down to the fact that only the extra fluid which is to be pumped around is displaced by the circulation pump 5. A saving of driving energy for circulation pump 5 therefore also arises.

In a particular design several vaporizers 6, throttle mechanisms 2 and circulation pumps 5 can be applied.

1 1. Method for reducing the differences in heat transfer in the
vaporizer of cooling systems with cooling agent circulation as far as
possible by means of utilizing throttled cooling agent, or flashgas,
characterized in that that the throttled cooling agent is passed in
5 whole or in part as a vapor/liquid mixture in the vaporizer.

 2. Method according to claim 1 characterized in that in pump
circulation systems the throttled cooling agent is led via a separate
pipe from the throttle mechanism by means of a control mechanism in
whole or in part to the pipe between the circulation pump and the
10 vaporizer.

 3. Method according to claim 1 characterized in that in gravity
circulation systems the throttled cooling agent is led via a separate
pipe from the throttle mechanism in whole or in part by means of a
control mechanism to the pipe between the separator and the
15 vaporizer.

 4. Cooling systems according to claim 2 characterized in that
several circulation pumps and/or throttle mechanisms and/or
vaporizers are applied.

 5. Cooling systems according to claim 3 characterized in that
20 several throttle mechanisms and/or vaporizers are applied.

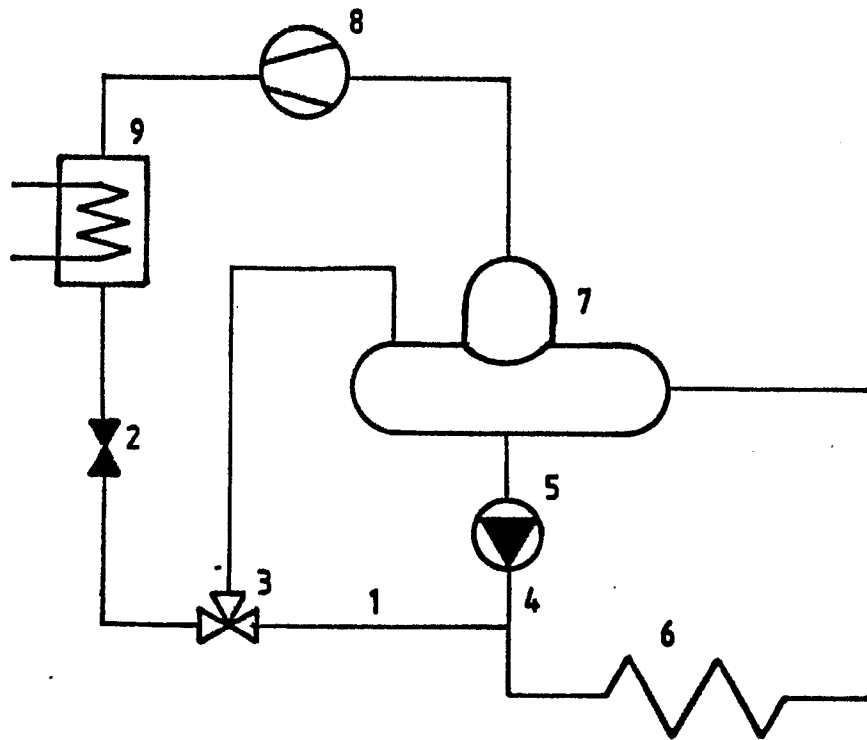


Fig. 1

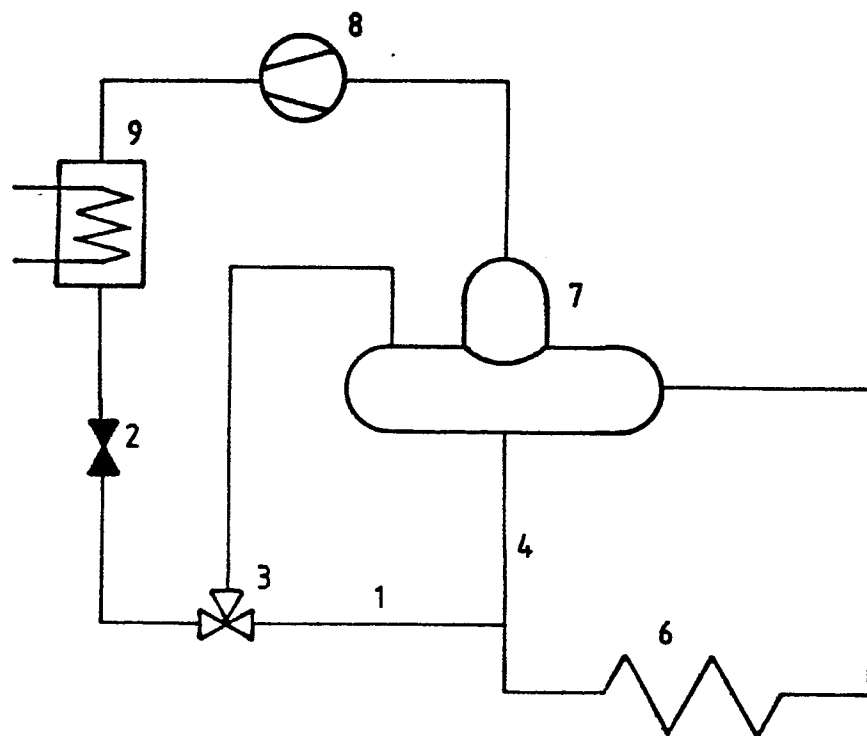


Fig. 2