

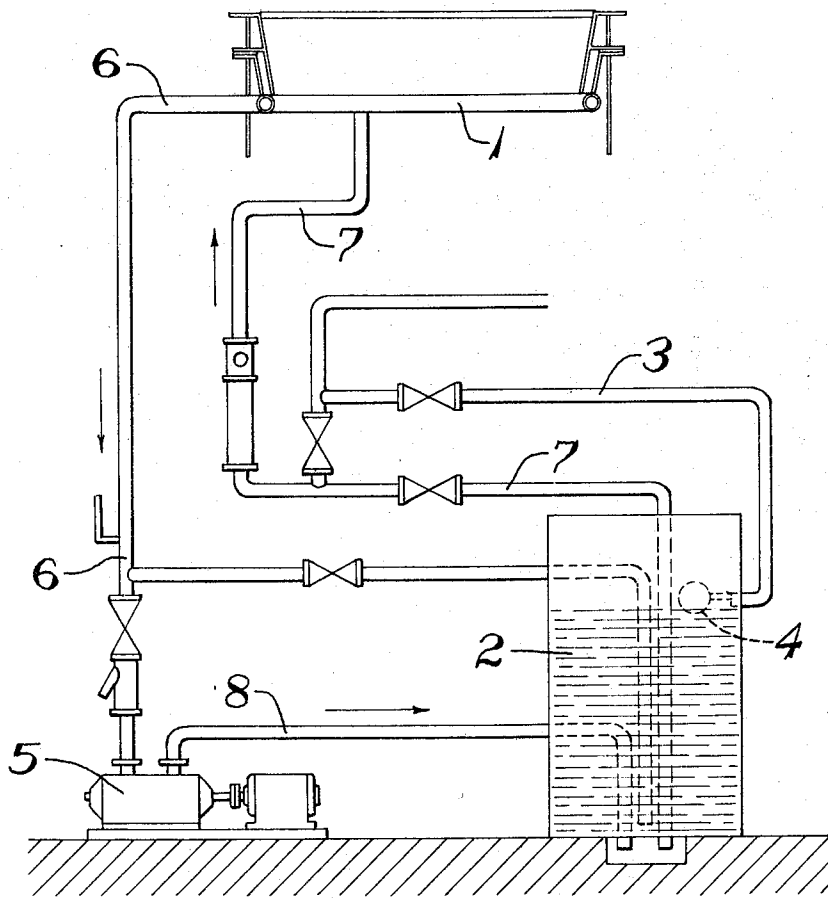
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METHOD AND APPARATUS FOR CIRCULATING COOLANT

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METHOD AND APPARATUS FOR CIRCULATING COOLANT

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5 Claims. (Cl. 165—1)

For the cooling of covers, walls, or bottoms of reaction vessels, or spaces in which reactions take place, a coolant such as water is ordinarily pumped through cooling pipes, coils, or hollow spaces. This kind of cooling system is generally adequate as far as the cooling itself is concerned.

Nevertheless, conventional cooling systems are limited in usefulness in those cases in which hazards would result from introduction of the coolant into the reaction space because of leakage of the cooling elements. This is especially the case in metal melting furnaces and electric arc furnaces.

Heretofore it has often been necessary to avoid cooling systems and instead to rely on high temperature refractory materials. Even then the reactivity of available materials imposes definite limits. For example, graphite cannot be used in any cases in which SiO occurs during the reaction, because of possibility of formation of the carbide. Similarly, such metals as titanium, molybdenum, and tungsten cannot be used in such cases because of formation of the corresponding silicides.

It has now been found that any hazard resulting from presence of coolant in the reaction space, because of leakage of cooling coils or other cooling elements, can be eliminated completely by circulating a liquid or flowable coolant such as water from its source through the coils or other cooling elements by suction. For this purpose the source of the coolant should be located with the liquid level of the coolant below the level of the cooling element, so that the coolant in the cooling element will be at a subatmospheric pressure.

If a leak should then occur in the cooling element, as may result from excessive thermal or mechanical stresses, the coolant will not escape, but instead the column of coolant liquid will be broken and the coolant will flow in one direction by gravity back to its source and in the other direction by the suction of the pump or other suction device. This prevents any penetration of coolant into the reaction space in a completely reliable way.

Resort to expensive materials of construction, which may also be of questionable utility for other reasons, can be avoided. Cheaper and more suitable surface materials can thus be used in high temperature furnaces and the temperatures can be kept in ranges appropriate for the chosen materials by the cooling system of this invention. It is particularly useful for operation of high temperature melting furnaces as well as for electric arc furnaces of all kinds, and also for plasma generators and for all installations which operate with cyanogen or dicyanacetylene flames.

The coolant used in this invention is preferably water where it is suitable, but any other coolant may be used which is liquid or capable of flowing or which may be transformed to a flowable condition. Examples are salt solutions or molten salts or molten metals or alloys.

This invention is especially suited for circulation of coolant through cooling coils. It can also be used with cooling chambers or jackets, cooling pipes, cooling segments and the like, any of which can be placed in the cover of the equipment or in the walls or bottom as may be needed.

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This invention functions with enhanced security as the difference in level between the cooling element and source of coolant increases. Maximum security of operation is assured by keeping the liquid level of the coolant in the supply vessel constant by any of the known means. With free suction of the coolant the limit of difference in level is imposed by the suction capacity of the pump which is used.

It is also generally desirable to recirculate the coolant, returning it to its supply vessel, generally after cooling it.

Naturally, it is possible to operate the cooling system in such a way that the coolant is initially forced through the cooling elements as has been the practice heretofore, and is sucked through after a predetermined temperature level is reached.

A specific embodiment of the practice of the invention is shown schematically in the accompanying drawing. A cooling element 1, which may be a cooling coil, is associated with a cover for a reaction furnace or any other device needing to have its temperature limited. The coolant supply vessel 2 is filled with coolant through the pipe 3. The coolant is maintained at a constant level by a conventional level control 4. The pump 5 sucks the coolant through the cooling element 1 by means of pipes 6 and 7, and then returns the coolant to the supply vessel 2 through pipe 8 or else discharges it to a drain.

If a leak should occur in cooling coil 1, the column of coolant will break and the coolant will flow in one direction through pipe 7 back to the supply vessel 2 and in the other direction through pipe 6 to the suction pump 5.

This invention is especially useful in carrying out processes which operate at temperatures over 1700° C. and in which there is a possibility of formation of water, gas or other explosive gas.

The invention can be used in cooling equipment operating at pressures other than atmospheric, such as vacuum furnaces, so long as the actual pressure in the reaction space is greater than the subatmospheric pressure of the coolant in the cooling element.

We claim:

1. A process for supplying liquid coolant to a cooling element associated with a reaction vessel, comprising sucking the coolant through the cooling element from a source having a free liquid surface at a lower level than the cooling element, and of a capacity sufficient to contain all the liquid in the cooling element.

2. A process for supplying liquid coolant to a cooling element associated with a reaction vessel operating at approximately atmospheric pressure, comprising maintaining a supply of coolant in a partially filled container of a capacity sufficient to contain all the liquid in the cooling element, with its liquid level considerably below any part of the cooling element, and sucking the coolant from the said supply through the cooling element.

3. A process for supplying liquid coolant to a cooling element associated with a reaction vessel operating at approximately atmospheric pressure and a very high temperature, comprising maintaining a supply of coolant in a partially filled container of a capacity sufficient to contain all the liquid in the cooling element, with its liquid surface at a constant level considerably below any part of the cooling element, sucking the coolant from the said supply through the cooling element, and returning the coolant to the supply after cooling.

4. A cooling system for a reaction vessel comprising a cooling element associated with the vessel, a supply for coolant consisting of a container partially filled

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with liquid coolant at a lower level than the cooling element, and of a capacity sufficient to contain all the liquid in the cooling element, a suction pump, and pipes connecting the container to the cooling element and the cooling element to the pump.

5. A cooling system as in claim 4 in which the supply for the coolant is a vessel having a device for maintaining the coolant at a constant level lower than any part of the cooling element.

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