UNITED STATES PATENT

[54] WATER COOLING OF WALL SURFACES

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[56] References Cited
UNITED STATES PATENTS
349,513 9/1986 McMichael........................ 266/32
2,776,168 1/1957 Schweda.................................. 239/587
3,030,095 4/1962 Desfossez.......................... 266/32
3,157,228 11/1964 Keller.............................. 239/587 X
3,586,304 6/1971 Greaves et al...................... 266/32

ABSTRACT

The outer surface of a conical wall of a cyclone separator is cooled by collecting a supply of cooling water at a regulated constant pressure, delivering the water under this pressure in a series of water jets to the wall surface by an annular array of springing nozzles circling the surface, the distance of the nozzle outlets from the wall surface being so adjusted that the jets impinge upon the wall and spread out thereon to form an adherent sheet of water, and adjacent water jets being so spaced that the sheets of water are joined into a single, uninterrupted water curtain is permitted to flow down along the wall surface and the spent and warm water is collected at a level of the wall surface where the water temperature becomes too high for cooling the wall. The collected warm water is then removed.

4 Claims, 2 Drawing Figures
WATER COOLING OF WALL SURFACES

The present invention relates to an improved process and apparatus for cooling the conical walls of a cyclone separator, such as used, for instance, in the manufacture of cement.

In known apparatus of this type, a series of superposed cooling jackets are mounted on the conical separator wall and surround the same, a container of cold water is mounted to feed water to the lowest one of the jackets at the bottom thereof, the water fed into the chamber defined by the lowest jacket rises upwards in the chamber and is fed therefrom through a connecting conduit into the next higher jacket where within it rises again to be finally removed therefrom into a water collecting vessel, wherein it is evacuated.

This cooling system has various disadvantages among which are the formation of foul puddles of water in the pockets of the jackets at the bottom thereof and scale deposits on the walls of the chambers defined by the jackets. Another disadvantage is the poor distribution of the cooling water over the wall surface to be cooled. In effect, water currents are formed between the inlet and the outlet of the water into the jacket chambers.

Therefore, relatively warm zones separate adjacent cool zones of water currents in these chambers. This reduces the cooling efficiency.

Furthermore, the interior walls of the cooling jackets and the exterior wall of the separator, which they cover, are inaccessible, which makes cleaning of these walls impossible.

Finally and not least importantly, the jacket walls are subjected to considerable water pressure in view of the height of the water column produced in such a cooling system. This static pressure may cause the walls to be deformed or even to break. When such a breakage occurs in a cyclone separator wherein cement is treated, for instance, large amounts of cement would be lost.

This invention has the primary object to overcome these and other disadvantages and to provide a new and useful process and apparatus for cooling the conical walls of cyclone separators.

The above and other objects and advantages are accomplished in accordance with the invention by collecting cooling water in a water supply container and regulating the water pressure in the container. The water is delivered from the container under regulated, constant pressure through a series of sprinkling nozzles disposed at an adjustable distance from the conical separator wall to be cooled, the distance being adjusted so that the resultant water jets from the nozzles impinge upon the wall and spread out thereon to form a sheet of water, and the spacing of adjacent nozzles being regulated so that the sheets of water produced by each of the nozzles are joined into a single, uninterrupted sheet on the wall, and the uninterrupted sheet of water thus formed is permitted to flow down along the wall. The water running down the wall is then collected at a level at which its temperature becomes too high for cooling the wall, and the collected warm water is removed.

The above and other features will be better understood by reference to the following detailed description of prior art apparatus and a preferred embodiment of the present invention, taken in conjunction with the accompanying drawing wherein

FIG. 1 illustrates a conventional cooling system for a conical wall of a cyclone separator, and

FIG. 2 is a similar side elevational view of such a system according to this invention.

Referring first to the conventional apparatus of FIG. 1, the cyclone separator is illustrated by conical wall 1 whose outer surface is to be cooled. As will be seen, a series of jackets 2,2' are mounted on wall 1 to surround the outer surface thereof. A toroidal container 3 is mounted concentrically around the conical separator wall and receives cold water under pressure, the container 3 being mounted adjacent the base or bottom of the lowest jacket 2 and cooling water being fed from container 3 into the cooling chamber defined by jacket 2 through a connecting conduit. Under its pressure of delivery, the water rises in the cooling chamber in contact with wall 1 until it fills the chamber and then flows through connecting conduit 4 into the next higher jacket 2' where within it again rises, to be finally removed through an outlet pipe at the top of jacket 2' into a water collecting container 5 concentrically surrounding the jacket. The warm water is removed from container 5 through water evacuating pipe 6.

In this system, foul puddles of water gather in the pockets 7,7' of the jackets, various other disadvantages being inherent therein, as hereinabove described.

Referring now to FIG. 2 showing a preferred embodiment of the invention, a toroidal container 9 is mounted concentrically around the upper edge of conical separator wall 1 to be cooled and receives cooling water through conduit 10. The water pressure in container 9 is regulated so that it remains at a predetermined, constant level by control valve 11 in conduit 10. A like container 9' is similarly mounted around the middle of wall 1 for cooling the lower half thereof. Container 9 receives cooling water through conduit 10 and the water pressure in container 9' is similarly controlled by valve 11'. The cooling water for both containers comes from a common supply 18.

The water containers 9, 9' carry a series of sprinkling nozzles 12 arrayed annularly around the wall 1. The nozzles comprise telescoped mounted sleeves 13 so that the distance 14 between the outlets of sleeves 13, i.e., of the nozzles, and wall 1 may be adjusted. This adjustment is so selected that the resultant water jets from the nozzles impinge upon the outer surface of wall 1 and spread out thereon to form a sheet of water. The spacing between adjacent nozzles in the annular array is so regulated that the sheets of water produced by the nozzles are joined into a single, uninterrupted sheet on the wall. The uninterrupted sheet of water thus formed will flow down along the wall as a cooling curtain of water.

At the bottom of the wall section to be cooled by the curtain of cooling water, an annular trough 15,15' is mounted to surround the wall at a level at which the water temperature becomes too high for cooling the wall. The warm water is collected in these troughs, a removable annular shield 17,17' being mounted on a respective one of the troughs.

An overflow pipe 16 is mounted on top of the toroidal water containers whence the cooling water is fed under constant pressure to nozzles 12.

The above-described cooling system operates as follows:

Cooling water is delivered from main 18 through conduits 10,10' into containers 9,9', the water pressure being so adjusted by valves 11, 11' that the overflow pipes 16 on the containers permit a small amount of
water to escape. In this manner, a relatively low water pressure is established in containers 9, 9'. Under this low, constant pressure, the cooling water is delivered through nozzles 12 and nozzle sleeves 13 as water jets impinging upon the outer surface of wall 1. The distance 14 between the nozzle outlets and the wall surface is regulated so that the ejected water will cling to the wall surface and spread out thereon in a sheet. The lateral distances between the nozzles surrounding the wall in an annular array are so selected that the sheets of water produced by each jet will join into an uninterrupted curtain of water flowing down the wall surface and cooling it. The water is received in troughs 15, 15' at a point where its temperature becomes too high to operate as an effective cooling medium. The warm water collected in the troughs is removed therefrom through evacuating pipes 19 and 20, the water from pipe 19 flowing into trough 15' at the bottom of the conical wall whence the entire spent water is removed through pipe 20.

Preferably and to obtain a satisfactory downward flow of the water curtain and its adherence to the surface of wall 1, the pressure conditions in the water containers 9, 9' are so controlled that a laminar flow of water will emanate from nozzle sleeves 13.

Clearly, a cooling system of the type illustrated in FIG. 2 will eliminate the disadvantages described in connection with the convention system of FIG. 1, the collection of foul puddles of water in troughs 15, 15' and of scald on wall 1 being considerably reduced and, when formed, being readily removable by removing the shields 17 to have access to the fouled areas. Furthermore, the distribution of the cooling water over the surface of wall 1 is greatly improved since the water forms an uninterrupted curtain running down the wall surface. Finally, there is no static pressure exerted upon the separator wall by the cooling water.

While the present invention has been described in connection with a now preferred embodiment thereof, it will be clearly understood that structural modifications and variations may occur to those skilled in the art, particularly after benefiting from the present teaching, without departing from the spirit and scope of this invention as defined by the appended claims.

I claim:

1. An apparatus for cooling the outer surface of a conical wall of a cyclone separator, the wall having an upper edge, comprising
   1. a supply container of cooling water mounted adjacent the upper wall edge and laterally spaced therefrom,
   2. means for regulating the pressure of the cooling water supplied to the supply container,
   3. an overflow pipe mounted on top of the supply container, (4) an array of sprinkling nozzles oriented towards the wall surface and mounted to deliver the water from the supply container under a constant pressure through nozzle outlets in a series of water jets to the wall surface, the water pressure at the level of the sprinkling nozzles being determined by the height of the water column between said level and the level of the overflow pipe,
   5. means for adjusting the distance of the nozzle outlets from the wall surface, and
   6. means downwardly spaced from the array of nozzles adjacent the wall surface for collecting the water, and for removing the collected water.

2. The apparatus of claim 1, wherein the means for adjusting the distance of the nozzle outlets from the wall surface comprises an outlet sleeve telescopingly mounted on each of the nozzles.

3. The apparatus of claim 1, wherein the array of sprinkling nozzles comprises an annularly arranged series of said nozzles spaced apart a distance regulated to form the water jets into an uninterrupted curtain of water on the wall surface, the means for collecting the water comprises an annular trough circling the wall surface, and further comprising a removable shield mounted between the trough and the supply container.

4. The apparatus of claim 1, wherein the sprinkling nozzles are fixedly mounted in respect to the wall surface. * * * * *