United States Patent

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[54] **APPARATUS FOR COOLING REFLECTOR WALLS**
7 Claims, 3 Drawing Figs.

[52] **U.S. Cl.** **165/47,** 165/123, 165/169, 240/47, 250/89, 352/202, 353/54, 353/61
[51] **Int. Cl.** **F21v 29/00**
[50] **Field of Search** 165/47, 121, 123, 169; 240/47; 353/57, 61, 54; 352/202; 250/88, 89

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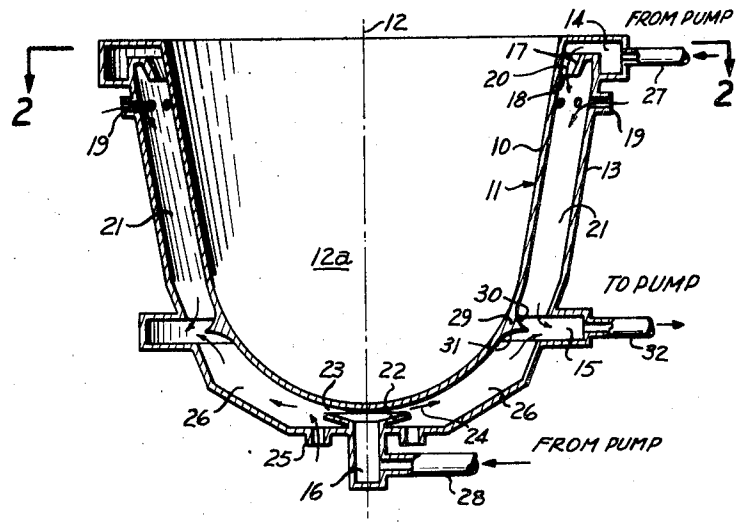
ABSTRACT: Apparatus in accordance with the present disclosure comprises housing defining a wall supporting a reflector also having a wall. A region is defined between the walls and manifolds are located at each end of the region. Nozzle means is in fluid communication with at least one of the manifolds for directing a jet stream of coolant into the region between the walls and tangentially to the wall being cooled to thereby cool the wall. The jet stream is collected and dispelled through a second manifold at the opposite end of the region. Vent apparatus may be provided adjacent the nozzles so that as the jet streams are emitted from the nozzles, air or coolant is drawn into the region to further cool the walls.



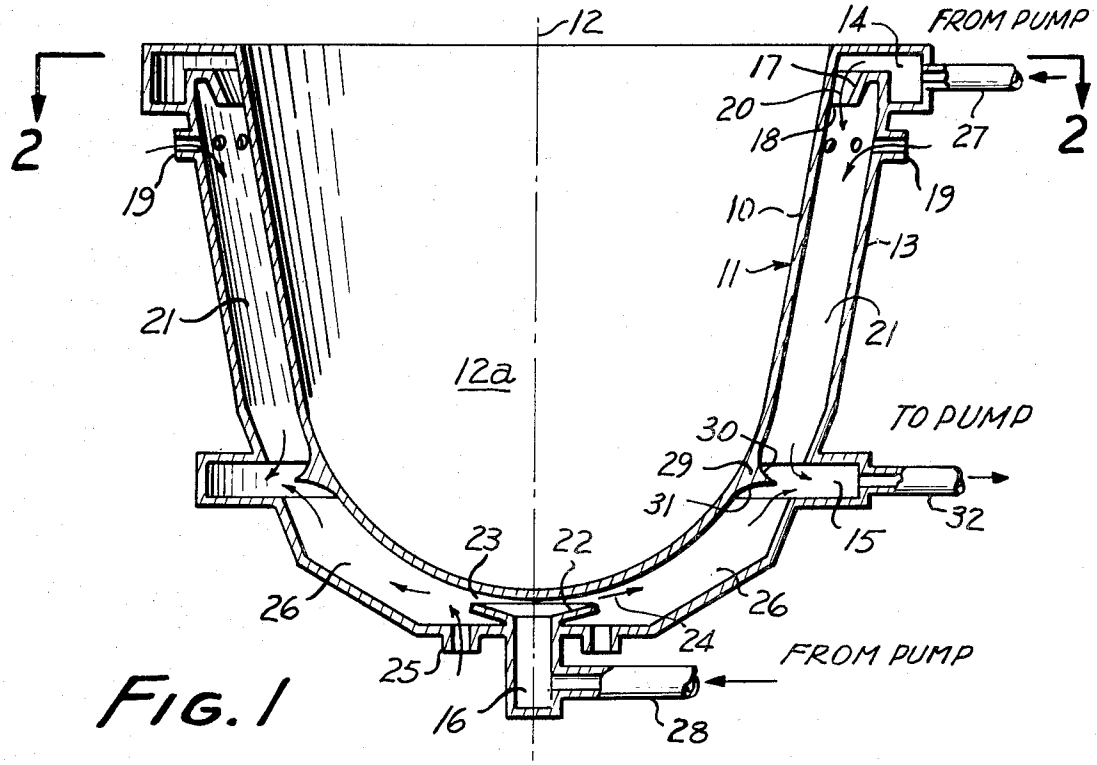


FIG. 1

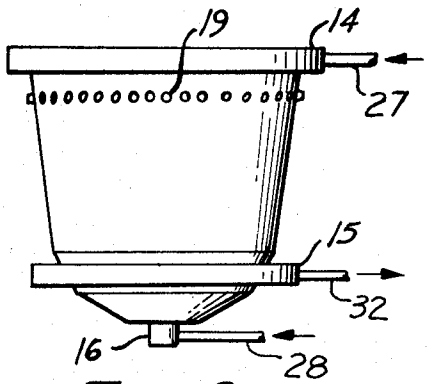


FIG. 3

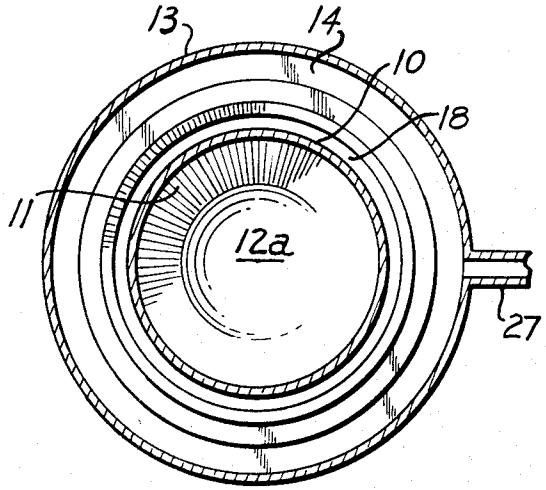


FIG. 2

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APPARATUS FOR COOLING REFLECTOR WALLS

This invention relates to apparatus for cooling a wall, and particularly for cooling a reflector wall by means of fluid jets.

Heretofore, heated walls, such as radiation reflectors, high-power lamp reflectors, and the like, have been cooled by convection techniques whereby air or coolant was directed at the wall to be cooled in a direction generally normal to the surface thereof. However, such forced ventilation systems for cooling radiation reflectors was relatively inefficient because large volumes of coolant was required to effectuate minimum cooling. Furthermore, forced ventilation cooling of reflector walls was not always possible for all orientations of a reflector.

It is common practice to illuminate a region by means of high-power lamps, such as Xenon lamps. Such lamps dispel large quantities of heat which must be dispelled or carried away to prevent damage to the lamp and its associated reflector and electrical wiring. Heretofore, large flood lamp installations have been cooled by forced ventilation or by merely exposing the lamp to the atmosphere, neither method proving to be very reliable. Also, relatively large pumps were required for forced ventilation cooling of reflector, such pumps generally rendering such cooling systems prohibitively expensive.

It is an object of the present invention to provide a cooling system for lamps, reflectors, radiant heater walls, and the like, which is more economical than prior systems and which can be operated by more simple pumps, blowers and the like, than prior systems.

Another object of the present invention is to provide a cooling system for cooling walls which is more efficient than prior cooling systems.

Another object of the present invention is to provide an improved cooling technique for cooling radiation reflectors.

Another object of the present invention is to provide a cooling system for a reflector wall which is capable of effective operation in any orientation of the reflector.

In accordance with the present invention, jet streams of coolant, such as cool air, are directed tangentially to the surface of the wall to be cooled. The fluid adheres to the wall and carries away heat therefrom.

According to one feature of the present invention, manifolds are provided for delivering the coolant to nozzles for forming the jet streams, and for collecting the jet streams of coolant after they have acquire heat from the wall being cooled.

In accordance with another feature of the present invention, vents are provided so that air is drawn into the jet streams as they pass the vents.

One feature of the present invention resides in the fact that the fluid is directed along the surface of the wall so as to adhere to the wall to form a thin film of coolant thereon. The adherence of the fluid is by the Coanda effect, an effect known in fluidic science whereby a stream of fluid will adhere to a wall surface and flow along the wall in a nonturbulent stream. The Coanda effect is often referred to as the tendency of a fluid to attach to a wall.

The above and other features of this invention will be more fully understood from the following detailed description and the accompanying drawings, in which:

FIG. 1 is a side view elevation in cutaway cross section of a reflector having a cooling system in accordance with the presently preferred embodiment of the present invention;

FIG. 2 is an end view of the reflector taken at line 2—2 in FIG. 1; and

FIG. 3 is a side view elevation of the reflector illustrated in FIGS. 1 and 2.

Referring to the drawings, there is illustrated a reflector having a cooling system in accordance with the presently preferred embodiment of the present invention. The apparatus comprises a reflector wall **10** having a reflector surface **11** on one side thereof. Reflector wall **10** is ordinarily symmetrical about axis **12** so that radiation from a source (not shown) in the region **12***a* defined by the reflector is directed forwardly along axis **12**. Alternatively, reflector wall **10** may

be cylindrical in shape to form an elongated reflector. Reflector wall **10** is mounted to housing **13** which includes manifolds **14**, **15**, and **16**. Housing **13** provides structural support for reflector **10**, and additional structural mounts (not shown) may be provided for this function. By way of example, if wall **10** is deformable, such additional supports may be adjustable mounting means as disclosed in our copending application Ser. No. 21,590 filed of even date herewith for "Adjustably Positionable Reflectors" and assigned to the same assignee as the present invention. Wall **10** may be integral with housing **13** or may be fabricated in several stages and mounted together by fastener means (not shown) such as suitable threaded fasteners or adhesive bonding.

Nozzle **17** cooperates with reflector wall to form throat **18** through which fluid in manifold **14** is emitted in a jet stream into region **21**. Preferably nozzle **17** forms a substantially ring-shaped throat **18** about the outer surface of reflector **10**. Vent apertures **19** are arranged about the periphery of housing **13** adjacent throat **18** so that as the jet stream is emitted through throat **18** in the direction of arrow **20**, air may be drawn into region **21** through apertures **19**.

Likewise, nozzle **22** forms a substantially ring-shaped throat **23** at the lowermost region of the reflector so that coolant is emitted in a jet stream, indicated by arrows **24** into region **26**. As the jet stream is emitted from nozzle **22**, air may be drawn through vent apertures **25** adjacent nozzle **22**.

Manifolds **14** and **16** are connected via suitable conduits **27** and **28**, respectively, to a pump (not shown) to force coolant, such as cooled air, under pressure into nozzles **17** and **22**. The jet streams emitted from the nozzles are directed tangentially to the surface of wall **10** being cooled until deflected by deflector **29** whose deflector surfaces **30** and **31**, respectively, deflect the jet streams into manifold **15** and to prevent turbulence in the respective jet streams by virtue of directing the jet streams into manifold **15**. The expanded coolant and air collected by manifold **15** is carried out through conduit **32** preferably by means of a vacuum pump (not shown) to further reduce turbulent flow in the jet streams. If desired, the air or coolant carried out through conduit **32** may be pumped through a suitable radiator or other heat sink and recirculated back through conduits **27** and **28** to further cool the reflector.

In operation of the cooling system, a source of radiant heat, such as a high-voltage Xenon light bulb is positioned on axis **12** to direct heat or light forwardly along the direction of axis **12**. The reflector is heated by the source, and coolant, such as cool air is forced under pressure into manifolds **14** and **16**. Jet streams of coolant are emitted tangentially along the surface of the reflector through nozzles **17** and **22**. The fluid adheres to the wall surface of the reflector by the Coanda effect to thereby form a thin film of coolant thereon to which heat is transferred in a nonturbulent manner. Additional cooled air is drawn in through the atmosphere through vent apertures **19** and **25** and is carried with the jet streams to cool wall **10**. The jet streams being directed tangentially to the wall surface adhere to the wall so that heat in the wall is transferred to the air by induction. The streams are thereafter removed from the walls by deflector **29** to carry the heat away. Since the coolant is in contact with the wall surface for a substantial area, the coolant is heated to a temperature close to the temperature of the wall surface before being carried away through manifold **15** and conduit **32**. It should be understood that since the fluid stream attaches to wall **10** by means of the Coanda effect, the housing **13** is not required to direct or hold the jet streams.

The present invention thus provides a cooling system for a reflector or radiator surface which is capable of efficiently cooling the surface. With the present invention, high-power lamp reflectors and the like may be cooled with a smaller volume of air need to be moved, thereby requiring less power to cool the reflector surface than heretofore required with forced ventilation systems. With the present invention, efficient use of the coolant, such as cooled air, is utilized because the air is in contact with the surface over a substantial area of the surface before being ejected from the cooling system.

This invention is not to be limited by the embodiment shown in the drawings and described in the description, which is given by way of example and not of limitation, but only in accordance with the scope of the appended claims.

What is claimed is:

1. Apparatus for cooling a reflector wall, said wall having a generally concave cross section defining an axis and having an open forward end, said apparatus comprising: first manifold means positioned adjacent said wall at the intersection of said wall and said axis; first nozzle means supported by said first manifold means in fluid communication with said first manifold means for directing a first jet stream of fluid substantially tangential to said wall; second manifold means positioned adjacent said forward end of said wall; second nozzle means supported by said second manifold means and in fluid communication with said second manifold means for directing a second jet stream substantially tangential to said wall; first connector means mounted to said first manifold means for connecting said first manifold means to a source of coolant under pressure; second connector means mounted to said second manifold means for connecting said second manifold means to a source of coolant under pressure; third manifold means positioned between said first and second manifold means; and collector means for directing said first and second jet streams into said third manifold means.

2. Apparatus according to claim 1 wherein said collector means provides a turbulence reducing barrier between said first and second jet streams.

3. Apparatus according to claim 1 further including aperture means adjacent said first and second nozzle means for admitting fluid into said first and second jet streams.

4. Apparatus according to claim 5 wherein said collector means provides a turbulence reducing barrier between said first and second jet streams.

5. In combination: a housing; reflector means supported by said housing, said reflector means having a wall; first, second and third manifold means supported by said housing; first nozzle means supported by said first manifold means and in fluid communication with said first manifold means for directing a first jet stream of fluid substantially tangential to said wall; second nozzle means supported by said second manifold means and in fluid communication with said second manifold means for directing a second jet stream of fluid substantially tangential to said wall; collector means for directing said first and second jet streams into said third manifold means; first connector means for connecting said first manifold means to a source of coolant under pressure; and second connector means for connecting said second manifold to a source of coolant under pressure, said collector means providing a turbulence reducing barrier between said first and second jet streams.

6. In combination: a housing, reflector means supported by said housing, said reflector means having a wall; first, second and third manifold means supported by said housing; said third manifold means being positioned between said first and second manifold means; first nozzle means supported by said first manifold means and in fluid communication with said first manifold means for directing a first jet stream of fluid substantially tangential to said wall; second nozzle means supported by said second manifold means and in fluid communication with said second manifold means for directing a second jet stream of fluid substantially tangential to said wall; collector means for directing said first and second jet streams into said third manifold means; first connector means for connecting said first manifold means to a source of coolant under pressure; second connector means for connecting said second manifold to a source of coolant under pressure; and aperture means in said housing adjacent said first and second nozzle means for admitting fluid into said first and second jet streams.

7. A combination according to claim 6 wherein said collector means provides a turbulence reducing barrier between said first and second jet streams.

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UNITED STATES PATENT OFFICE

CERTIFICATE OF CORRECTION

Patent No. 3,628,601 Dated December 21, 1971

Inventor(s) ALVIN A.SNAPER, ET AL

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Col. 2, line 44	insert --,-- after "bulb"
line 47	insert --,-- after "air"
Col. 3, line 32 Claim 4, line 1	"5" should read --3--
Col. 3, line 37 Claim 5, line 3	after "housing;" insert --said third manifol means being positioned between said first a second manifold means;--

Signed and sealed this 6th day of August 1974.

(SEAL)
Attest:

McCOY M. GIBSON, JR.
Attesting Officer

C. MARSHALL DANN
Commissioner of Patents

UNITED STATES PATENT OFFICE

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