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APPARATUS FOR REDUCING HEAT TRANSFER

Filed Aug. 20, 1964

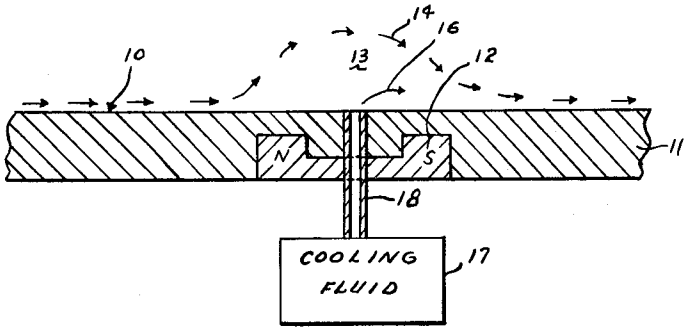


Fig. 1

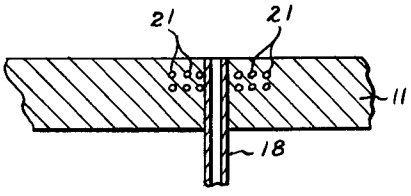


Fig. 2

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APPARATUS FOR REDUCING HEAT TRANSFER

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1 Claim. (Cl. 165—134)

This invention relates to an apparatus for reducing the heat transfer from a hot electrically conducting fluid, such as an ionized gas, to a solid surface.

One object of the invention is to provide a device for reducing the heat transfer to a solid surface such as the outer surface of a high velocity vehicle from the ionized gas through which the vehicle passes in flight.

Another object of the invention is to provide a method for reducing the heat transfer to a surface from an electrically conducting fluid by the use of a magnetic field to separate the conducting fluid from the surface and by introducing a coolant such as a gas or liquid into the separated region.

These and other objects will be more fully understood from the following description taken with the drawing, wherein:

FIG. 1 shows a sectional view of a device for reducing the heat transfer to a surface according to one embodiment of the invention; and

FIG. 2 shows a modification of the device of FIG. 1 according to another embodiment of the invention.

When an electrically conducting fluid is passing a wall or surface such as the ionized layer around a spacecraft on re-entry or an ionized stream in a nozzle, it is possible, according to this invention, to reduce the heat transfer to the surface by providing a localized magnetic field adjacent the surface to cause separation of the conducting gas from the surface and by injecting a cooling fluid into the separated region. The separation of the conducting fluid from the surface and the injection of cooling fluid into the separation co-operate to reduce the heat transfer to the surface.

Referring more particularly to FIG. 1 of the drawing there is shown a surface **10** of a portion of a wall **11**, of non-magnetic material, such as the wall of a space vehicle. A permanent magnet **12** is located in the wall **11** and has its poles projecting toward the surface **10** and has the south pole located in the direction of travel of the conducting fluid with respect to the north pole. The charged particles in the conducting fluid will tend to follow the magnetic lines of force to provide a separation region **13** between the conducting fluid and the surface **10**. A cooling fluid such as super-cooled air, indicated by the

arrow **16** is injected into the region **13** from a cooling fluid supply **17** through tube **18**.

While only one magnet and cooling fluid supply tube is shown it is obvious that many such systems would be needed over the surface of a space vehicle. Also it is obvious that certain areas of a space vehicle might not require such a system in which case they would be omitted from these regions. This invention however relates to the particular system for reducing heat transfer and not to the particular location or use of the system.

While a permanent magnet is shown, it is to be understood that the magnetic field could also be provided by the use of conductors located within the wall as shown in FIG. 2 wherein a plurality of wires **21** are imbedded within the wall **11**. The cooling fluid would be supplied through cooling tube **18** in the same manner as in FIG. 1.

There is thus provided a device for reducing heat transfer to a surface from an electrically conducting fluid passing the surface.

While certain specific embodiments have been described it is obvious that numerous changes may be made without departing from the general principles and scope of the invention.

I claim:

Apparatus for use in a flight vehicle adapted to travel through space at a sufficiently high velocity that a hot electrically conducting fluid flowing past the outer surface of said vehicle is produced, the combination of means adapted to be carried by said vehicle for producing a magnetic field having flux lines that project from said surface and extend substantially in the direction of the flow of said fluid in at least one discrete location along said surface to thereby provide a separation region at said location between said conducting fluid and said surface, said separation region being located rearward of a non-separated region whereat said fluid and said surface are in relatively close relationship, and means positioned at said separation region only for injecting a cooling fluid into said separation region between said conducting fluid and said surface, whereby the heat transfer between said conducting fluid and said surface at said separation region is reduced to a minimum.

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