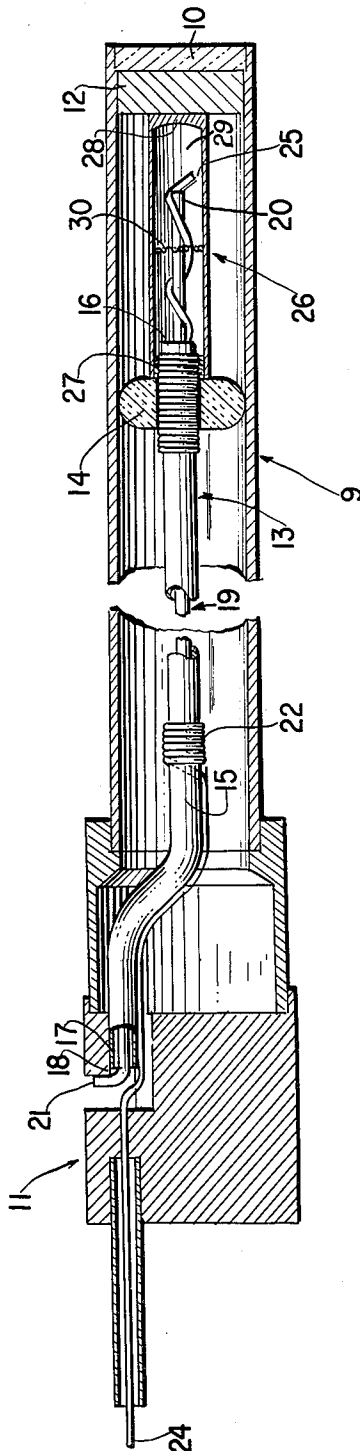


Sept. 25, 1962

D. H. DENNIS
COOLING DEVICE
Filed Dec. 1, 1960

3,055,191



INVENTOR
DAVID H. DENNIS
BY
J. William Carson
ATTORNEY

1

3,055,191

COOLING DEVICE

David H. Dennis, Short Hills, N.J., assignor to Specialties Development Corporation, Belleville, N.J., a corporation of New Jersey

Filed Dec. 1, 1960, Ser. No. 72,929

2 Claims. (Cl. 62-440)

The present invention relates to refrigeration, and, more particularly, to an improved device for maintaining an element such as an infrared cell at a much lower temperature than the ambient temperature wherein a refrigerant such as carbon dioxide or the like is utilized which is capable of solidifying when expanded at low temperatures wherefore provision must be made to thaw out the solid refrigerant to maintain the device in working order.

The primary object of the present invention is to provide an efficient and reliable cooling device of the foregoing type which is extremely simple in construction and can be fabricated in a highly economical manner with a minimum of skilled labor.

Other and further object of the invention will be obvious upon an understanding of the illustrative embodiment about to be described, or will be indicated in the appended claims, and various advantages not referred to herein will occur to one skilled in the art upon employment of the invention in practice.

A preferred embodiment of the invention has been chosen for purposes of illustration and description, and is shown in the accompanying drawing, forming a part of the specification, wherein:

The single FIGURE is a fragmentary longitudinal sectional view of a cooling device in accordance with the present invention.

Referring to the drawing in detail, there is shown a cooling device which generally comprises an envelope 9 adapted to be evacuated having a window 10 at one end, a metallic body 11 on which the other end of the envelope is mounted, an element 12 to be cooled within the envelope adjacent the window, and a cooling assembly 13 supported within the envelope by a spider 14 and mounted on the body.

The cooling assembly 13 comprises an elongate metallic tube 15 having an inner end 16 and having an outer end 17 supported within an outlet 18 in the body 11, a heat conductive wire 19 extending through the tube and having an inner end 20 extending outwardly of the inner end of the tube and having an outer end 21 extending outwardly of the outer end of the tube and being secured in heat conductive relation to the body 11 which serves as a heat source for the wire, metallic capillary tubing 22 coiled about the tube 15 and having an inlet 24 for refrigerant at its outer end and having an outlet 25 at its inner end and being wrapped about the wire 19 at its inner end in heat conductive relation therewith, and a tubular metallic closure 26 having an open end sealed about the inner end of the tube 15 at 27 and having a closed opposite end providing a wall 28 against which the element 12 is mounted.

The closure 26 encloses the inner end of the wire 19 and of the tubing 22 to provide an expansion chamber 29 for refrigerant delivered by the outlet 25 and directed against the wall 28 to thereby cool the same and cause heat to be extracted from the element 12.

In operation, carbon dioxide under pressure, for example, enters the inlet 24 of the capillary tubing 22, flows through the coil of tubing 22, exits at the outlet 25 of the tubing, and is expanded in the chamber 29 to provide refrigeration. Expanded gaseous carbon dioxide enters the inner end 16 of the tube 15, flows through the tube in heat exchange relation with the coil of tubing 22 to

2

cool the incoming carbon dioxide to thereby increase its refrigerating effect, and exits to atmosphere at the outer end 17 of the tube by way of the outlet 18 in the body 11.

As shown herein a screen 30 is positioned in the chamber 29 to prevent solid particles of carbon dioxide from entering the tube 15 and to confine such particles adjacent the wall 28.

In the event carbon dioxide solidifies at or just upstream of the outlet 25 of the capillary tubing 22 and flow of carbon dioxide ceases, the heat conducted by the wire 19 from the source to the portion of the tubing wrapped about the wire is effective to thaw out the solidified carbon dioxide, whereby flow of carbon dioxide is resumed.

In a practical embodiment of the present invention, the cooling assembly may have the following characteristics and approximate dimensions:

Tube 15:

Inner diameter..... 0.047 inch.
Outer diameter..... 0.065 inch.
Material..... Stainless steel.

Wire 19:

Diameter..... 0.025 inch.
Material..... Copper.

Tubing 22:

Inner diameter..... 0.003 inch.
Wall thickness..... .003-.006 inch.

Coil:

Length on tube 15..... 0.875 inch.
Developed length..... 36 inches.
Number of convolutions per inch..... 80.
Outer diameter..... 0.090 inch.
Length of tubing on wire 19 at 20..... 0.35 inch.
Material..... Stainless steel.

Closure 26:

Length..... 0.500 inch.
Inner diameter..... 0.102 inch.
Thickness of wall 28..... 0.015 inch.
Material..... Stainless steel.

Body 11:

Weight..... .038 pound.
Material..... Stainless steel.

Such a cooling assembly operated within a wide range of atmospheric temperatures substantially constantly maintained the element 12 at a temperature of about minus 100° F., rapidly cooled the element to this temperature, and enables a 0.018 pound charge of carbon dioxide to flow about 55 minutes at 70° F. and about 4 minutes at 160° F.

From the foregoing description, it will be seen that the present invention provides a simple, practical and reliable cooling device.

As various changes may be made in the form, construction and arrangement of the parts herein, without departing from the spirit and scope of the invention and without sacrificing any of its advantages, it is to be understood that all matter herein is to be interpreted as illustrative and not in any limiting sense.

I claim:

1. A cooling device comprising a metallic body serving as a heat source, an elongate metallic tube supported by said body having an inner end and having an outer end in communication with the atmosphere, a heat conductive wire extending through said tube having an inner end extending outwardly of the inner end of said tube at its inner end and an outer end extending outwardly of said tube at its outer end and being secured to said body in heat conductive relation therewith, metallic capillary tubing coiled about said tube having an inlet for refrigerant at its outer end and having an outlet at

3

its inner end and being wrapped about the inner end of said wire to establish a heat conductive relation therewith, and a tubular metallic closure having an open end sealed about the inner end of said tube and having a closed opposite end providing a wall adapted to transfer heat from an element to be cooled, said closure enclosing the inner end of said wire and said capillary tubing to provide an expansion chamber for refrigerant delivered by the outlet of said capillary tubing, said tube serving to conduct expanded refrigerant from the chamber to atmosphere and said wire serving to conduct heat to the inner end of said capillary tubing to maintain flow of refrigerant through its outlet.

2. A cooling device comprising a metallic body serving as a heat source, an elongate metallic tube supported by said body having an inner end and having an outer end in communication with the atmosphere, a heat conductive wire extending through said tube having an inner end extending outwardly of the inner end of said tube at its inner end and an outer end extending outwardly of said tube at its outer end and being secured to said body in heat conductive relation therewith, metallic capillary tubing coiled about said tube having an inlet for refrigerant

4

at its outer end and having an outlet at its inner end and being wrapped about the inner end of said wire to establish a heat conductive relation therewith, a tubular metallic closure having an open end sealed about the inner end of said tube and having a closed opposite end providing a wall adapted to transfer heat from an element to be cooled, said closure enclosing the inner end of said wire and said capillary tubing to provide an expansion chamber for refrigerant delivered by the outlet of said capillary tubing, said tube serving to conduct expanded refrigerant from the chamber to atmosphere and said wire serving to conduct heat to the inner end of said capillary tubing to maintain flow of refrigerant through its outlet, and a screen positioned in the chamber between the outlet of said capillary tubing and the inner end of said tube for maintaining solidified refrigerant in the chamber.

References Cited in the file of this patent

UNITED STATES PATENTS

2,951,944	Fong	Sept. 6, 1960
2,952,141	Nelson et al.	Sept. 13, 1960