

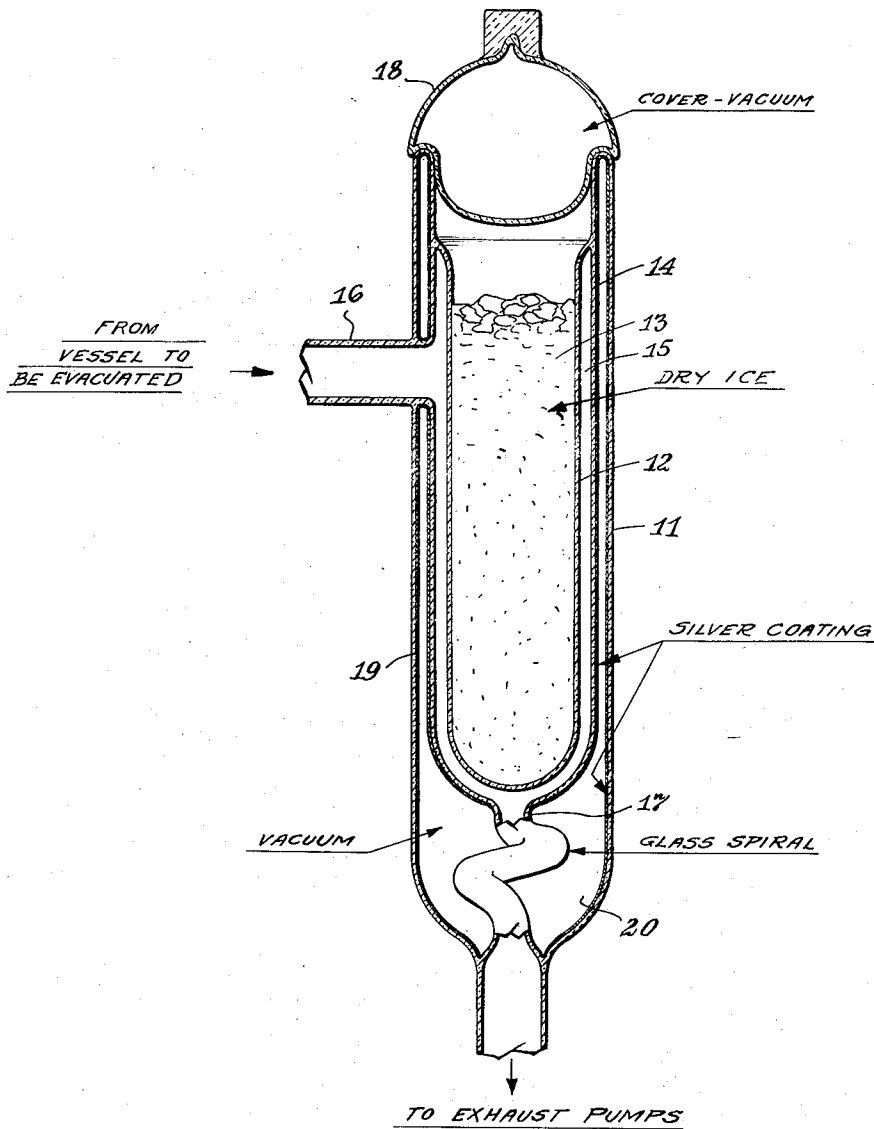
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COOLING DEVICE

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COOLING DEVICE

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This invention relates to a cooling device as an improvement in the Dewar flask trap which is used as a combination refrigerant-holding bottle and trap in connection with a mass spectrometer.

The principal object of our invention, generally considered, is to provide a cooling device for use in connection with an evacuating system for condensing vapor, such as that of mercury, and preventing it from traveling further into the system, as from a mercury pump.

Another object of our invention is to provide a Dewar flask with tubulations, one at a side and one at the bottom, and one more outer wall added, silvered, and the enclosure provided by said outer wall evacuated in order to economize on the use of refrigerant.

A further object of our invention is to provide, in a device of the character described, a glass spiral in the lower tubulation between the outside wall and the bottom of the Dewar flask, to relieve strains caused by unequal expansions and contractions.

Other objects and advantages of the invention, relating to the particular arrangement and construction of various parts, will become apparent as the description proceeds.

In the drawing, the single figure is a longitudinal sectional view of a cooling device embodying our invention, shown approximately to scale and about one third size.

The cooling device embodying our invention, one embodiment of which is illustrated in the drawing and designated 11, is an improvement over that which has been used in connection with a mass spectrometer, for the condensation of mercury vapor from a mercury pump used for evacuating purposes, or the freezing down of any condensable vapor which may be present in the high vacuum side of the system, to thereby prevent the same from traveling further in the vacuum system. Due to the compact design of the equipment, some parts had to be made special in order to fit into the limited space. These parts included the cold trap, which in the equipment referred to was designed to use liquid air as the refrigerant.

In order to keep the high speed pumping, and also to fit into the space available, a double-walled receptacle, in the nature of a Dewar flask, was used, but tubulated at the side and bottom, and not permanently evacuated. The receptacle or flask employed consisted of, as shown in the drawing, an inner generally hollow cylindrical container or bottle 12, with a generally hemi-

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spherical closed bottom portion, for holding refrigerant 13, such as liquid air or Dry Ice. Enclosing said inner wall was a correspondingly shaped outer wall, designated 14, spaced therefrom, connected thereto at the upper edge of the inner wall, and forming a refrigerating enclosure 15 through which fluid may pass, a side tubulation 16 and a bottom tubulation 17 being provided on the wall 14.

Such an arrangement used the space between the walls as the vacuum insulation, vacuum system itself, and also as a condensing chamber, permitting the bottle to be filled from the top without having to move it in the limited space. A vacuum cover 18 of conforming shape was provided for said bottle, as illustrated, the inner surface being silvered. The tubulation 16 connects with the vessel to be evacuated, while the tubulation 17 extends to the exhaust pumps. Any mercury vapor or the like from said pumps is condensed on the flask 12 and drops back into the tubulation 17.

The disadvantages of the original design are that the outer surface of the refrigerant-containing portion 12, and the inner surface of the spaced wall 14 if silvered would become amalgamated by the mercury and its efficiency considerably decreased. Without silvering, the bottle is very wasteful in the use of refrigerant. The use of Dry Ice, instead of liquid air, in order to economize, involves considerable expense in connection with such use, as will be noted from the following statistics.

At present such a device must be filled with Dry Ice at least once every eight hours, and considerably more often if liquid air is used. It has been necessary to secure approximately fifty pounds of Dry Ice every twenty four hours, for supplying such a device, requiring attention during nights, week-ends and holidays when the equipment is in continuous operation, which is the case in most installations.

In accordance with our invention, we have improved on such design by adding one more wall, as an outside wall 19, of a size and shape corresponding with the outer wall of the Dewar flask and with its upper edge connected to the upper edge of the intermediate wall 14 extended beyond the top of the inner wall 12, and forming a curved seat for the cover 18. The length of this outer wall 19 was increased over the length of the original modified Dewar flask to include the glass spiral illustrated, so that it is about 19 inches in the embodiment under consideration. The inner surface of the outside wall 19 is

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silvered, or coated with specular material, desirably metal, suitable for efficiently reflecting radiant energy, especially heat, as well as the outer surface of the spaced wall 14, the space 20 between said walls being evacuated. The distance at the side between the outer wall 19 and the spaced wall 14 being very small in the illustrated embodiment, the tubulation 16 may go straight therethrough, as illustrated. But the tubulation 17 desirably continues between the bottom of the spaced wall 14 and the bottom of outside wall 19 as a helix or spiral to its point of connection with the bottom of the outside wall 19, from whence it may extend without spiraling to the exhaust pumps. This curvature to helical form relieves thermal strains due to the difference in operating temperatures between the middle and outer walls, which are sealed together by ring seals. The outer cylindrical wall of the bottle has to conform to shape and diameter of existing equipment, which required a decrease in the diameter of the inner container 12, thereby decreasing its volume.

In spite of the smaller volume, we have found that such an improved bottle, as illustrated in the drawing, will operate four days with one filling consisting of three pounds of Dry Ice. We have therefore decreased the consumption from about fifty pounds per day to about six pounds per week, and eliminated the necessity of attention during periods when the operator is not with the equipment.

Although a preferred embodiment of our invention has been disclosed, it will be understood that modifications may be made within the spirit and scope of the appended claims.

We claim:

1. A cold trap comprising a double-walled receptacle in the nature of a Dewar flask, an evacuated cover therefor, a wall outside of and spaced from the outer wall, and to which the upper edge of said flask is connected to form an enclosure therebetween, a tubulation extending from a side of the outer wall of, and communicating with the space between the walls of, said flask and connected to and passing through said outside wall, another tubulation passing through the bottom of said outside wall and also communicating with the space between the walls of said

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flask, and the enclosure formed between the outer wall of said flask, its tubulations, and said outside wall, being evacuated.

2. A combination refrigerant bottle and cold trap comprising a flask for holding refrigerant, an evacuated cover therefore, a wall spaced from the outer surface of said flask and forming a refrigeration enclosure through which fluid may pass, an outside wall spaced from said first-mentioned wall and forming an evacuated enclosure therewith and a tubulation passing through a side of said outside wall and communicating with said refrigeration enclosure, and another tubulation passing through the bottom of said outside wall and also communicating with said refrigeration enclosure.

3. A combined refrigerant bottle and cold trap comprising a flask for holding refrigerant, an evacuated cover for said flask, a wall spaced from the outer surface of said flask and forming a refrigeration enclosure through which fluid may pass, an outside wall spaced from said first-mentioned wall and forming an evacuated enclosure therewith, the inner surface of said outside wall being silvered, a tubulation passing through a side of said outside wall and communicating with said refrigeration enclosure, and another tubulation passing through the bottom of said outside wall and also communicating with said refrigeration enclosure, a part of said tubulation between the bottom of said refrigeration enclosure and the point of union with said outside wall being helically curved to relieve strains caused by thermal changes.

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