United States Patent [19]

Chmiel

[11] **4,107,937**

[45] **Aug. 22, 1978**

[54] **METHOD OF AND APPARATUS FOR THE DEEP FREEZING OF BIOLOGICAL SUBSTANCES**

[75] Inventor: **Horst Chmiel**, Leonberg, Germany

[73] Assignee: **Linde Aktiengesellschaft**, Wiesbaden, Germany

[21] Appl. No.: **752,930**

[22] Filed: **Dec. 21, 1976**

[30] **Foreign Application Priority Data**

Dec. 22, 1975 [DE] Fed. Rep. of Germany 2557870

[51] **Int. Cl.**[2] **F25D 17/02**

[52] **U.S. Cl.** **62/64**; 62/78; 62/373; 165/30; 195/1.8

[58] **Field of Search** 62/64, 78, 373; 195/1.8; 165/30

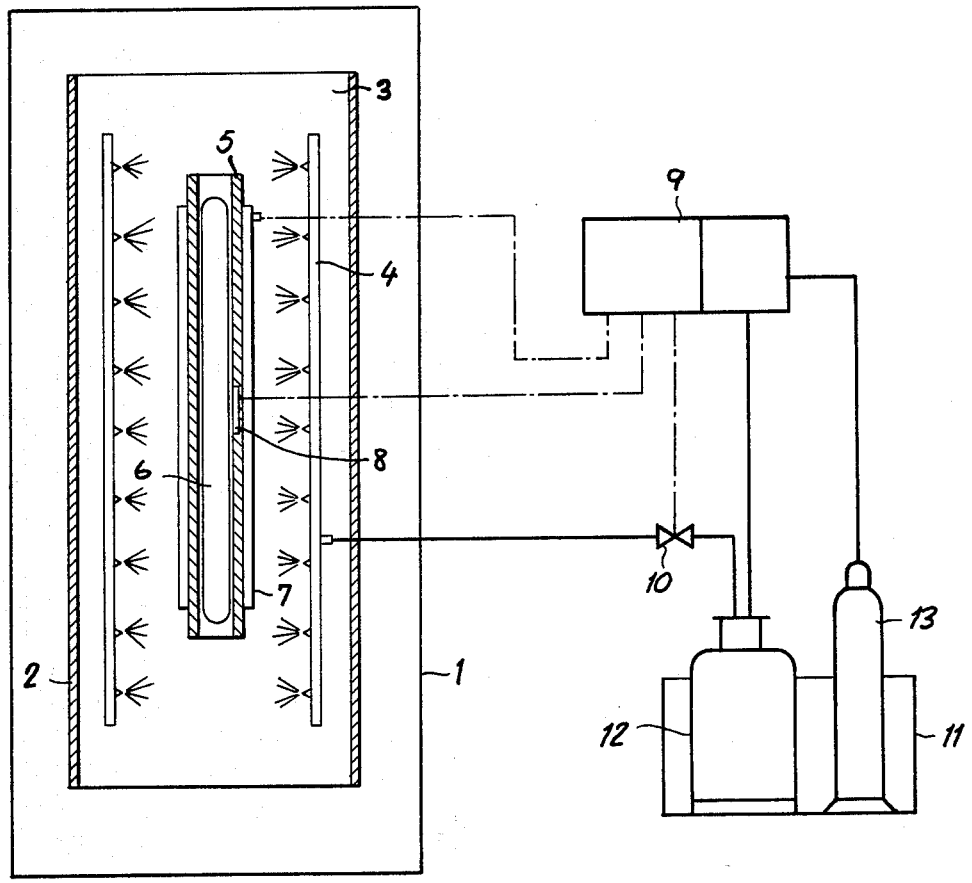
[56] **References Cited**

U.S. PATENT DOCUMENTS

2,508,988	5/1950	Bradley	165/30
2,662,520	12/1953	McMahon	62/64
3,167,812	2/1965	Von Bennigsen	165/30
3,753,357	8/1973	Schwartz	62/64
3,940,943	3/1976	Sikes et al.	62/64
4,033,737	7/1977	Kunioka et al.	62/64

Primary Examiner—Ronald C. Capossela
Attorney, Agent, or Firm—Karl F. Ross

[57] **ABSTRACT**

A system for the deep freezing of biological substances provides an input representing the temperature-time curve required at the outer wall of a receptacle containing biological substances to be deep-frozen while a sensor measures the actual temperatures at this wall and controls the cooling applied to the receptacle to conform the cooling at the receptable wall to the precalculated temperature-time curve. This permits the necessary temperature gradient to be applied to the biological substance for maximum cell survival without any dead time necessitated by the use of sensors within the biological substance itself.

11 Claims, 5 Drawing Figures