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Review

A review of magnetic refrigerator and heat pump prototypes built before the year 2010

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ARTICLE INFO

Article history:
Received 21 November 2009
Received in revised form
4 February 2010
Accepted 4 April 2010
Available online 14 April 2010

Keywords:
Magnetic refrigerator
Heat pump
Review
History

ABSTRACT

Magnetic refrigeration, heating and power conversion technologies are interesting alternatives to the conventional refrigeration, heat pumping and different conventional energy conversion technologies. At present they all show a realistic potential to enter conventional markets, respectively to be applied in a few years. In this review paper, mainly magnetic refrigeration and magnetic heating are addressed and from these two technologies the main part is dedicated to magnetic refrigeration at room temperature. This article covers the demand of giving a complete list and description of existing magnetic heating and cooling prototypes up to the year 2010. Forty-one machines, their components and operation principles are presented in detail.

Prototypes de réfrigérateurs et de pompes à chaleur magnétiques réalisés avant l'an 2010

Mots clés : Réfrigérateur magnétique ; Pompe à chaleur ; Synthèse ; Historique

1. Introduction

1.1. *Prospects of magnetic refrigeration*

Magnetic refrigeration, heating and energy conversion are environmentally benign technologies with a realistic potential to enter large existing markets (see e.g. magnetic refrigeration (Kitanovski et al., 2008a), magnetic heating (Egolf et al., 2006a) and magnetic energy conversion (Kitanovski et al., 2008b)). Contrary to conventional vapor compression/expansion systems, magnetic refrigeration requires a solid magnetic material as working fluid (refrigerant). As these materials are neither gaseous nor in vapor

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doi:10.1016/j.ijrefrig.2010.04.002

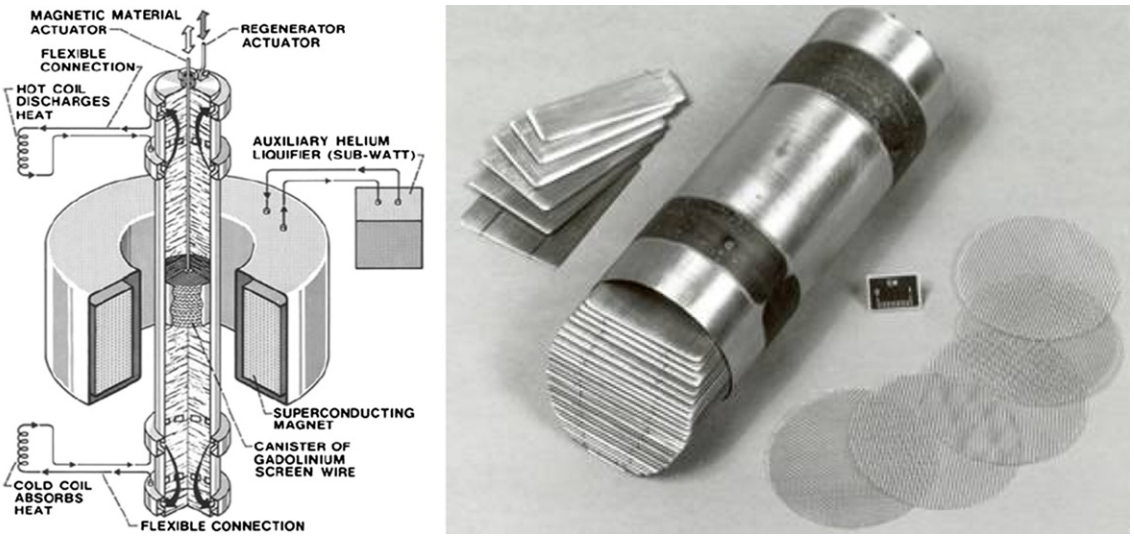

Fig. 1 – First room-temperature magnetic heat pump designed in 1976 by G. V. Brown (Brown, 1976; Gschneidner and Pecharsky, 2008).

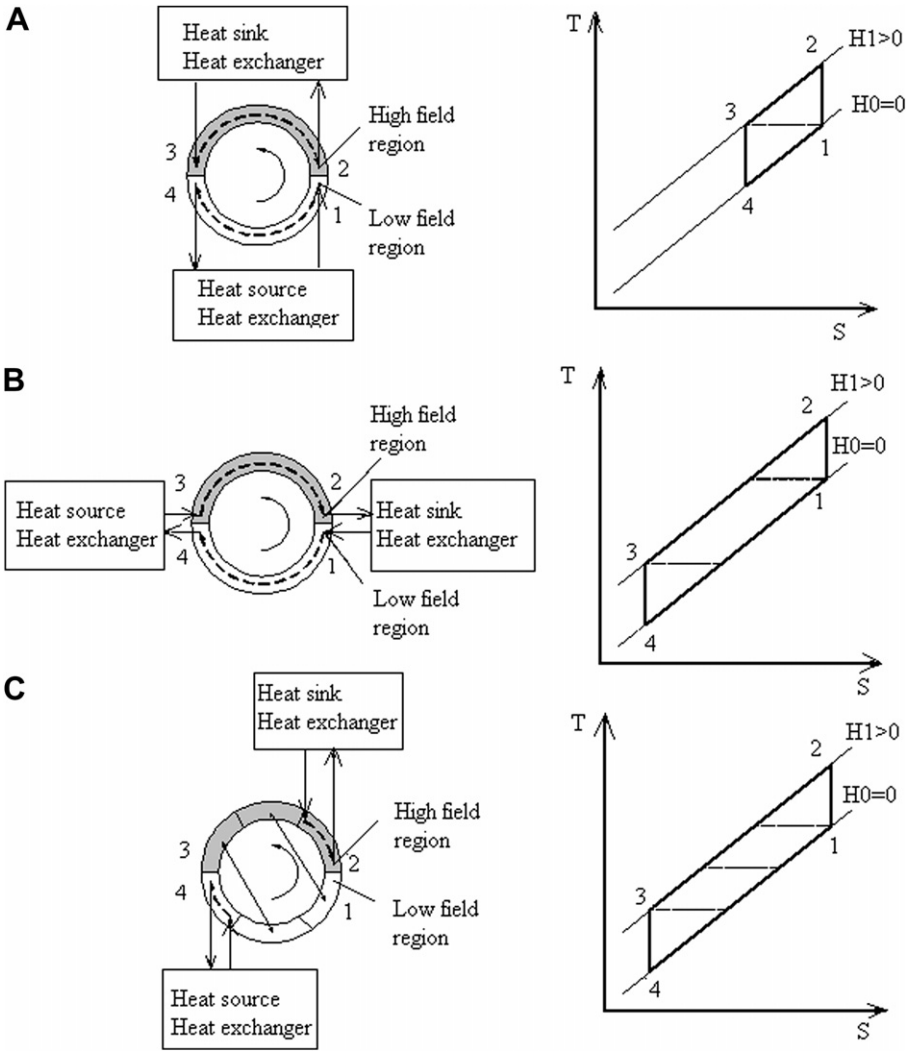

Fig. 2 – Different regenerative Brayton cycles are presented.