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THE ENGINEERING OF INTERMOLECULAR ATTRACTIVE FORCES TO IMPROVE THE THERMODYNAMIC EFFICIENCY OF A STIRLING CYCLE HEAT ENGINE

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On the assumption that experimentally validated tabulated thermodynamic properties of saturated fluids published by the National Institute of Standards and Technology are accurate, a theoretical thermodynamic cycle can be demonstrated that produces a net negative entropy generation to the universe. The experimental data on the internal energy can also be used to obtain a simple, empirical equation for the change in internal energy of a real fluid undergoing isothermal expansion and compression. This demonstration provides experimental evidence to the theory that temperature dependent intermolecular attractive forces can be an entropic force that can enhance the thermodynamic efficiency of a real-fluid macroscopic heat engine to exceed that of the Carnot efficiency. A heat engine design, a modification of the Stirling thermodynamic heat engine cycle will be presented. This cycle uses super critical argon gas to take advantage of the attractive intermolecular forces of the working fluid to assist in compressing the working fluid, reducing the input compression work and the heat output during isothermal compression, as well as reducing the heat input during isothermal expansion and increasing the overall heat engine efficiency. This cycle utilizes accumulators to ensure the working fluid is heated and cooled isochorically and a proximate piston cylinder filled with ideal-gas helium is used in lieu of a regenerator during the isochoric heating and cooling. All of these modifications serve to increase the overall thermodynamic efficiency of the heat engine cycle.

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