Steam From Cavitation

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Abstract: In 1973 Carl Schaeffer applies for a patent and one year later he gets it for a new steam generator. The effect seems not to be spectacular but the method is brand new. The applications consist in home heating, chemical reactions, mining, mixing unmixing natural liquids. The working principle requests a spinning rotor with radial holes inside a cylinder. Water is introduced in the space between them. The rotor being externally spinned, the steam results.

Introduction

Cavitation has been a familiar phenomenon for a long time particularly in shipping. In 1917, the British physicist Lord Rayleigh was asked to investigate what caused fast-rotating ship propellers to erode so quickly. He discovered that the effect of cavitation, already proved in experiments by Reynolds in 1894, was the source of the problem. Despite numerous investigations into the subject of cavitation in the years that followed, many of the accompanying effects have still not yet been completely explained. This is no wonder considering the complexity of the process involving the areas of acoustics, hydrodynamics, thermodynamics, optics, plasma physics and chemistry. Cavitation can be caused in a fluid by energy input. Technically cavitation heaters are simply devices that transfer mechanical energy into thermal energy in a working fluid. The common design amounts to a very inefficient centrifugal pump. The energy conversion in a cavitation heater has well known advantages in industrial applications where the working fluid can be damaged by contact with heating elements with a significant temperature differential. Cavitation shall be generally understood as the dynamic process of the formation and implosion of cavities in fluids. Cavitation occurs, for instance, when high flow velocities cause the local hydrostatic pressure to drop to a critical value which roughly corresponds to the vapor pressure of the fluid. This causes small bubbles filled with steam and gases to form. These bubbles finally collapse when they reach the high-pressure areas as they are carried along by the liquid flow. In the final phase of bubble implosion, high pressure peaks are generated inside the bubbles and in their immediate surroundings. These pressure peaks lead to mechanical vibrations, noise and material erosion of surfaces in walled areas. If cavitation is severe, the hydraulic valve coefficients as well as the fluid properties change.
Un homogeneities (disturbances) in the quasi-crystalline structure of water, however, reduce the possible tensile strengths by minimum one order of magnitude. In all probability, submicroscopic accumulations of steam or gas molecules are created at these disturbances with the molecules being in an unstable equilibrium with the fluid. In the case of external tensile strengths (negative pressure), these nuclei can exceed a critical diameter and then grow spontaneously as steam is formed.

The discrepancy between the theoretically and experimentally (under ideal conditions) determined strength values shows that the microscopic bubbles filled with gas and steam (cavitation nuclei), which exist in the fluid and whose existence in water can be explained according to the model. As a result, the critical pressure at which cavitation stops is higher than the critical pressure at incipient cavitation. Lehmann and Young examined the phenomenon of cavitation hysteresis in depth and found that the end of cavitation can be more easily reproduced than incipient cavitation. In particular cases, it therefore depends on the state of the liquid, especially the temperature, spectrum of nuclei, the content of dissolved gases and the surface tension, at which static pressure cavitation begins. Generally, this is just below the vapor pressure. In practice, it is impossible to determine a liquid’s spectrum of nuclei in advance for most applications. Therefore, it is common practice in control valve sizing to describe the critical state of the cavitation nuclei at incipient cavitation by means of the vapor pressure of the liquid.
Case study

For example some food processing and chemical processing applications where there some constituents of the fluid may come out of solution on a heat transfer surface (as in mineralization in water heaters and boilers) or where on-demand heating is needed (as in water for residential or commercial uses). Established commercial vendors serve these industrial markets. There are a few companies who have developed cavitation devices. However there is a more efficient use of cavitation technology possible. Specifically by using the rotation of a rotor with holes that creates hot water or steam nearly instantaneously. As a result this process is producing 70% more energy than was put into the system.

![Cavitation pump](image)

In Rome, Georgia Jim Griggs of Hydrodynamics, Inc demonstrated the assembly and operation of a "hydro sonic water pump" which operated over-unity by producing hot water or steam with energy in excess of the electrical energy input to the pump motor. "Over-unity" was confirmed by satisfied customers, including the Albany Fire Station, where engineers from the "local university" and the "local power company" had been called in to verify the over-100% efficiency. In 2002 the Akoils heat generator (VHG) has been shown to be able to generate cheap thermal energy and hot water. Heat generators have the coefficient of energy conversion (electrical – mechanical – thermal), which is much more than 100%. They produce universal, non-polluting plants with very low electricity consumption and a high thermal energy output (transformation coefficient of electrical energy into thermal one is over 100 %), working without heating devices, are intended for heating systems of the industrial factories, housing and communal services and private dwellings. This available prototype proves that a vortex heat generator (VHG) can produce more thermal energy out than it electrical energy input in. Despite these individuals having a working available device, this scientific find has no faculty recognition, and they are further unable to get faculties to present and accept these findings. As an impeller's (in a pump) or propeller's (as in the case of a ship or submarine) blades move through a fluid, low-pressure areas are formed as the fluid accelerates around and moves past the blades. The faster the blades move, the lower the pressure around it can become. As it reaches vapory pressure, the fluid vaporizes and forms small bubbles of gas. This is cavitation. When the bubbles collapse later, they typically cause very strong local shock waves in the fluid, which may be audible and may even damage the blades. Cavitation in pumps may occur in two different forms: Suction cavitation and Discharge cavitation.
Conclusions

- Steam generator solution was unfairly regarded with skepticism for a long time.
- The steam generator is suitable for an urban implementations involving a limited space, this water and the possibility of electric drive of the rotor.
- Steam generator reliability and performance are serious concerns in the operation of pressurized water reactors.
- The plant evaluations using the newly developed fission product retention models described here, serves in a combination with the plant calculation for rough estimation of the effect of aerosol deposition on the primary side and the near-field tube bundle secondary side during a severe accident with horizontal SG tube rupture.

Bibliography

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