

REGENERATIVE HEAT EXCHANGERS

Whereas in recuperators, where heat is transferred directly and immediately through a partition wall of some kind, from a hot to a cold fluid, both of which flow simultaneously through the exchanger, the operation of the regenerative heat exchanger involves the temporary storage of the heat transferred in a packing which possesses the necessary thermal capacity. One consequence of this is that in regenerative heat exchangers or thermal regenerators, the hot and cold fluids pass through the same channels in the packing, alternately, both fluids washing the same surface area. In recuperators, the hot and cold fluids pass simultaneously through different but adjacent channels.

In thermal regenerator operation the hot fluid passes through the channels of the packing for a length of time called the "hot period," at the end of which, the hot fluid is switched off. A reversal now takes place when the cold fluid is admitted into the channels of the packing, initially driving out any hot fluid still resident in these channels, thereby purging the regenerator. The cold fluid then flows through the regenerator for a length of time called the "cold period," at the end of which the cold fluid is switched off and another reversal occurs in which, this time, the hot fluid purges the channels of the packing of any remaining cold fluid. A fresh hot period then begins.

During the hot period, heat is transferred from the hot fluid and is stored in the packing of the regenerator. In the subsequent cold period, this heat is regenerated and is transferred to the cold fluid passing through the exchanger.

A cycle of operation consists of a hot followed by a cold period of operation together with the necessary reversals. After many cycles of identical operation, the temperature performance of the thermal regenerator in one cycle is identical to that in the next. When this condition is realized, the heat exchanger is said to have reached "cyclic equilibrium" or "periodic steady state." Should a step change be introduced in one or more of the operating parameters, in particular, the flow rate and entrance temperature of the fluid for either period of operation, or the duration of the hot and cold periods, the regenerator undergoes a number of transient cycles until the new cyclic equilibrium is reached.

In the most common counterflow or contraflow regenerator operation, the hot gas passes through the regenerator in the opposite direction of the cold fluid. In less efficient parallel flow or co-flow the hot and cold fluids pass through the channels of the packing in the same direction(†). (†) In theory, it is possible to imagine a cross-flow regenerator in which the hot and cold fluids flow in directions perpendicular to one another. This is rarely, if ever, realized in practice although cross-flow recuperators are common.

The periodic operation of regenerators can exploit the periodic operation of the system to which the exchanger is attached. For example, in hot climates, day time heat can be stored in a packing by passing the warm atmospheric air through it: this heat can then be recovered by blowing cold night time air through the same packing during the evening to provide at least some supplementary warming of the living space in a building. Hausen (1976) suggests that the throat and nasal passages act as a regenerator packing in cold weather. When an animal breathes in cold air, it is warmed as it passes through the nose and throat before the air reaches the lungs, thereby protecting the lungs from the effects of cold temperatures. As the animal breathes out, the same passages in the nose and throat are warmed by the air leaving the lungs. Clearly, the temperature of the throat and nasal tissue is also regulated by the flow of blood through it.

In general, however, a continuous supply of heated fluid is required so that the discontinuous operation of the regenerator, which is inherent in its design, must be concealed in some way. from

<https://thermopedia.com/content/1087/> ↗ qv for more details of various Stirling systems.

See Also

Boyles Law
Carnot Cycle
Chaos
Charles law
Cold
Compound Vibratory Engine
Continuous Motion
Cycle of Temperature
donkey engine
Dynaspheric Force
Energy from Vacuum
Engineering Scalar Forces
Father-Mother Principle
Figure 13.00 - Keelys Provisional Engine showing oil splatter from rotation
Figure 15.02 - Keelys Hydro-Pneumatic-Pulsating-Vacuo Engine operated with etheric vapor
Figure 19.05 - Globe Motor with Provisional Engine
First Law of Thermodynamics
Gay-Lussac law
heat engine
Heat
Hydro Vacuo Engine Patent
Keely - Electricity from Space
LAW OF THERMODYNAMICS
Law of Thermodynamics
Laws of Thermodynamics
Laws
MAGNETIC ENGINE - Snell
magnetic engine
Neutral Center Dynamics
New Concept - XII - Thermodynamic Misconception
Newton Laws of Motion
Nicolas Leonard Sadi Carnot
Part 18 - Mind as an Engineerable Force
Perpetual Motion
Power vs Energy
regeneration
regenerative
regenerative force
Rhythmic Balanced Interchange
Robert Scragg Solar Reactor Engine
Russells Laws of Thermodynamics
Scalar Potential
Scalar
Second Law of Thermodynamics
Stirling Engine
Tesla - Electricity from Space
Thermoacoustic Effect
thermodynamic equilibrium
thermodynamics
Thermoelectric Effect
thermoelectricity
thermography

thermomagnetic effect

Thermosphere

Third Law of Thermodynamics

Universal Heart Beat

Vacuum Energy

Vacuum

Wavefunction

Zero point energy