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(54) **METHOD AND APPARATUS FOR ACHIEVING HIGHER THERMAL EFFICIENCY IN A STEAM ENGINE OR STEAM EXPANDER**

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USPC ..... **60/712; 60/670; 60/597; 60/643; 60/676; 60/618; 60/616; 60/614; 91/22; 123/50 R; 123/520**

(58) **Field of Classification Search**

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See application file for complete search history.

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(57) **ABSTRACT**

A high order of thermal efficiency is achieved in a steam engine or steam expander having a piston clearance that approximates zero together with a negligible amount of compression, such that pressure in the clearance volume approximates ambient pressure, i.e. atmospheric or condenser pressure as the case may be at the end of the piston return stroke when the clearance is essentially zero and constitutes a new engine apparatus and Rankine operating cycle that can be referred to as "zero clearance with zero compression". The steam admission valve assembly can be operated either automatically responsive to piston contact or by means of a cam shaft or electrically by means of a solenoid. A normally open exhaust valve permits residual steam to be exhausted through the piston return stroke, closed by the piston or cam then held closed by a fresh charge of steam.

**65 Claims, 9 Drawing Sheets**



