A Self-Sustaining Device for Power Generation by Sequential Liquefaction, Gasification and "Clean Combustion" of Waste Plastics

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As petroleum resources are finite, it is imperative to use them wisely in energy conversion applications. Plastics, a petroleum-byproduct, are currently widely used in throw-away products and their extent of recycling is limited. Since plastics have a high heating value, their use for power generation is of technological interest. However, whereas waste plastics have found some limited use in incineration, such a conventional direct combustion technique leads to uncontrollable, inefficient energy conversion that produces a considerable amount of soot and health-hazardous hydrocarbons. Thus, an alternative technology is proposed herein to further address our increasing energy needs and at the same time utilize our waste plastics streams. More specifically, a 2rd- generation multistep process/device is proposed to accept plastics, of various types and shapes, and generate an easily-identifiable form of energy as a final product. To achieve low emissions of products of incomplete combustion, the plastics are first liquefied, then gasified, then mixed well with air, then ignited and, finally, burned with pre-mixed low-emission flames. These steps happen in sequential nested chambers. Combustion is indirect, since the solid polymer is not directly burned, instead its gaseous pyrolyzates are burned upon mixing with air. Thereby, combustion is well-controlled and complete. Only a small fraction of the heat released from combustion is used to maintain the high temperature liquefaction/pyrolysis process, leaving the balance of heat available for steam/power generation. After initial startup no external energy input will be needed.

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