ROTATING KILN FOR PYROLYSIS OF MSW AND MEDICAL WASTE INTEGRATED WITH ENERGY RECOVERY

Pyrolysis is a thermal degradation process either in the complete absence of oxidising agent, or with such a limited supply that gasification does not occur to an appreciable extent. The products of pyrolysis are: gaseous compounds, liquid compounds and solid residue according to the thermodynamic parameters and speed of process.
The wide spectrum of technologies for treatment of wastes includes pyrolysis technique as an successful method of municipal garbage and hazardous waste destruction.
The Rotary kiln technology proposed in this patent provides better internal mixing of materials and better heat transfer than vertical shaft furnaces. However, this process has a few disadvantages:

- The need for preliminary shredding, adding to handling requirements and cost
- High wear on the refractory lining
- Difficulties in sealing the kiln
- Difficulties in controlling reaction conditions

The difficulties outlined above were overcame with the design of up to date systems of shredding, sealing and recovering the solid and gas products as described in the following with the help of a few images.
The process block scheme is now described when applied to medial waste treatment in figure 1. The same pattern is followed in treatment of municipal solid waste (MSW).
The thermodynamic parameters in the patent described are chosen in view of producing gas and solid residues mainly, still with a high calorific value between 15000 and 20000 kJ/kg.
The basics behind the technology are: the slow indirect heating of shredded waste under continuous mixing due to rotating kiln gives rise to hydrocarbon products that are partly used for the heating and partly, after chemical treatment, offered for chemical or energy use to the market.
In figure 2 are shown the main mechanical and thermal elements in the process from the feeding hopper to the recycling of pyrolysis solid and gas.
In figure 3 are shown the temperature patterns and flow direction both in waste and pyrolysis gas loop.
In figure 4 is described a more conventional treatment chemical plant for fuel gas with heavy load of particles.
Important parts in the design are the hopper/piston/grinder supply described in figure 5, 6, 7 that were constructed taking into account the particular characteristics of waste grindability sometime cause of blockage.
The last two figures 8 and 9 are on the design of burner and combustion chamber where the recycled pyrolysis gas is partly burned in order to give the heating load necessary to maintaining the temperature profile along the rotating kiln. The burner is of the dual fuel model in case diesel oil is needed to supplement the pyrolysis fuel gas.

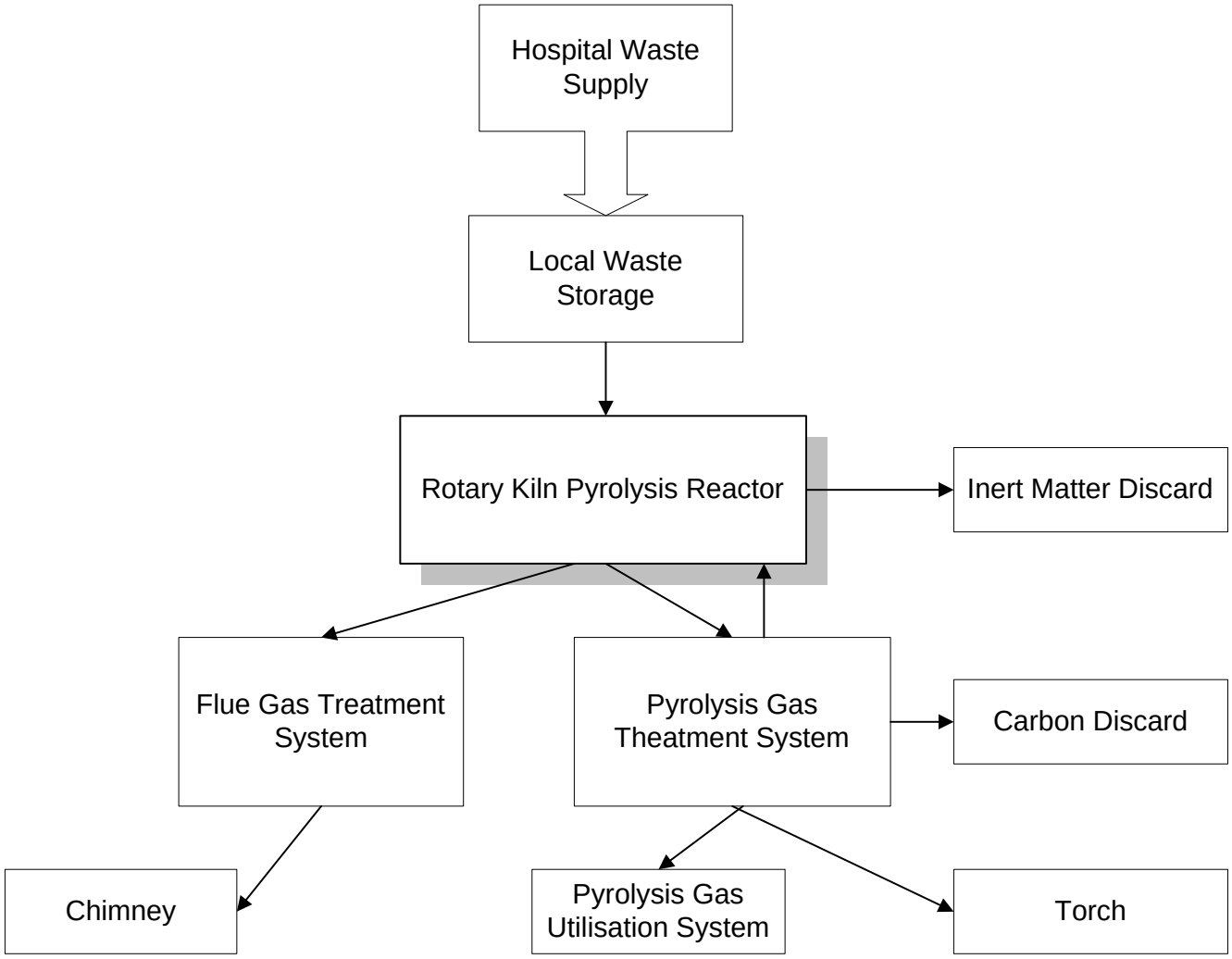

Figure 1. Block scheme

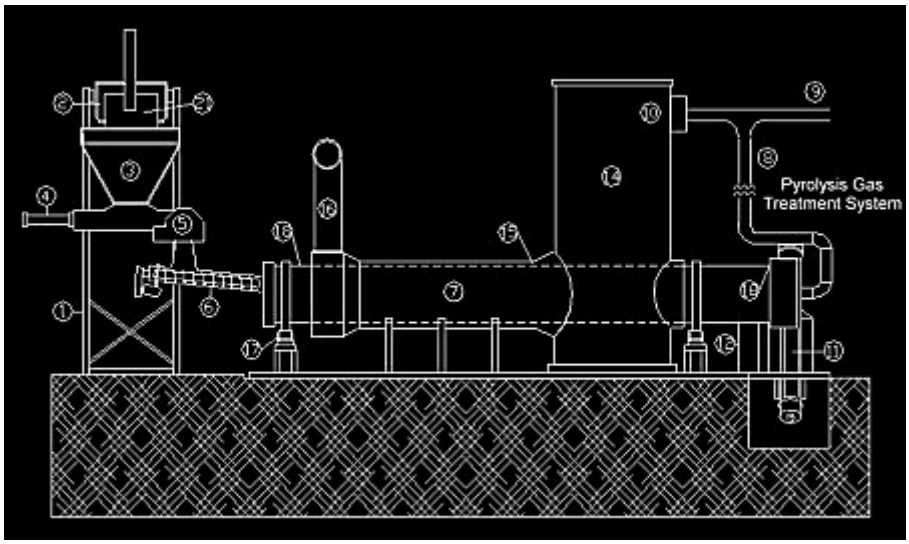

Figure 2. Pyrolysis Reactor. Elements of Design. Are shown: feeding bunker, piston to compress, shredding, rotating kiln inside indirect steady heating chamber, vertical combustion chamber supplied with recycled waste gas, outlet of pyrolisis gas to treatment, solid disposal in hopper

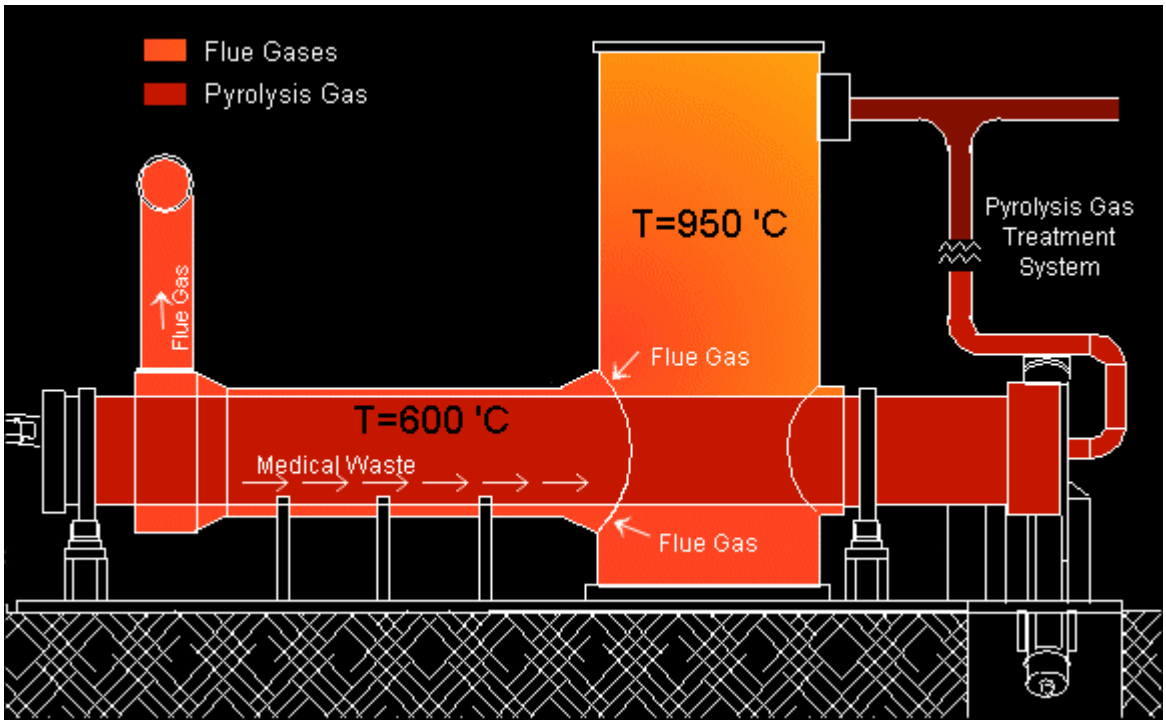

Figure 3. Temperatures & Flows

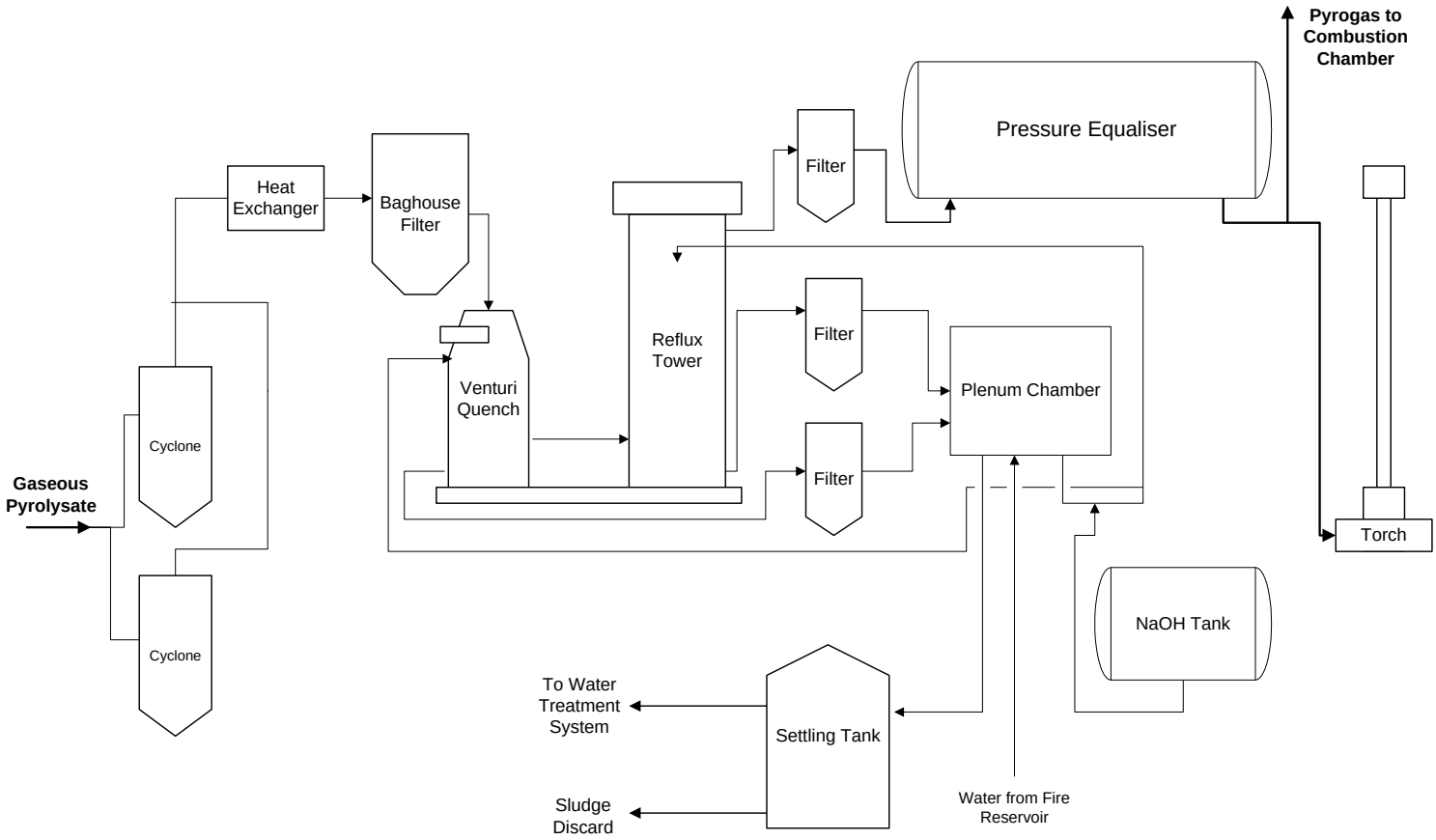

Figure 4. Treatment System for Pyrolysis Gas: Flowsheet

Figure 5. Waste Loading Point: Hopper, Feeder, Grinder

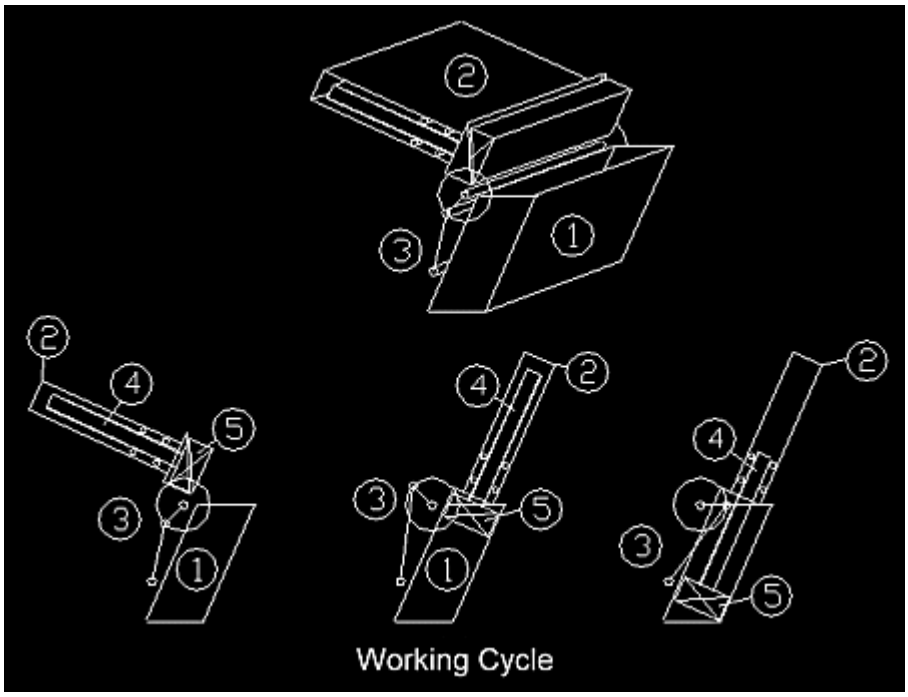

Figure 6. Waste Loading Point: Scheme of Feeder

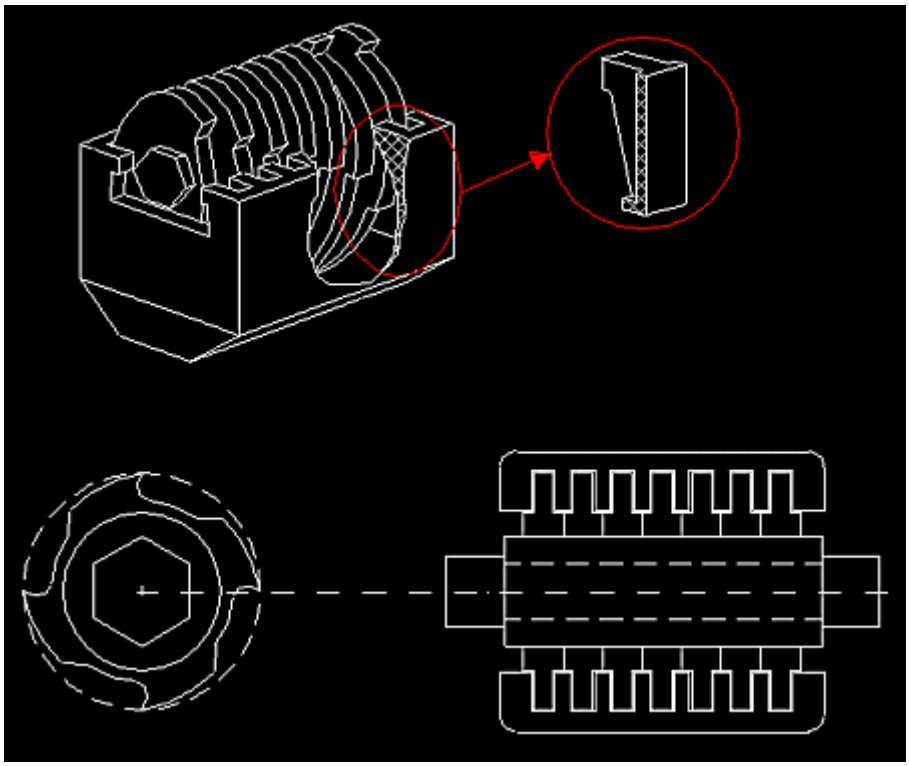

Figure 7. Waste Loading Point: Scheme of Grinder

Figure 8. Combustion Chamber: Burner

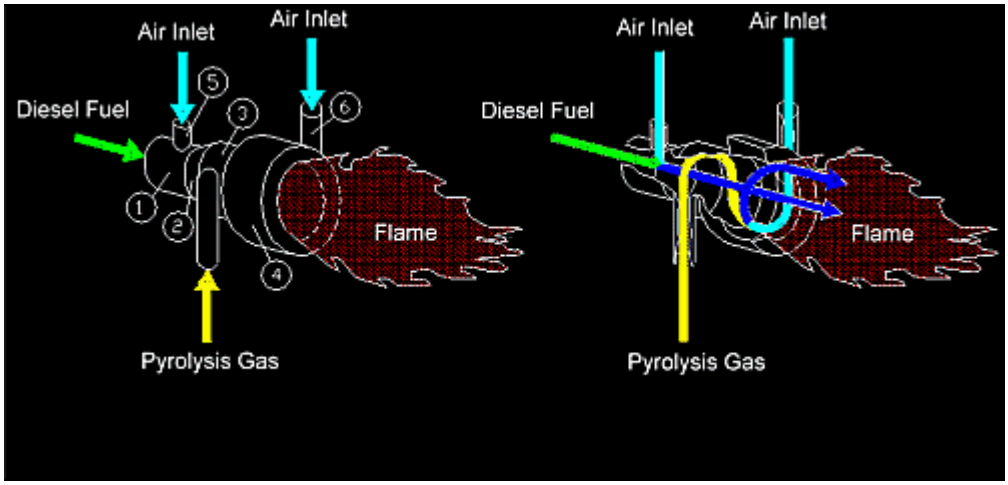

Figure 9. Combustion Chamber: Scheme of Burner