CLAIMS

1. Process for thermal cracking of a feedstock of plastic materials, in particular waste materials, comprising the steps of melting the feedstock, conveying melted feedstock in a pyrolysis chamber (2), where said melted feedstock is heated in a substantially oxygen purged environment to convert it into pyrolysis gases, said process further comprising the steps of:

- driving pyrolysis gases from the pyrolysis chamber (2) into a tray reflux column comprising a partial condenser (3a) at its upper extremity and valve trays (16) comprising valves covered with caps (23),
- returning pyrolysis gases condensed in the tray reflux column into the pyrolysis chamber (2),
- distilling pyrolysis gases (4) exiting the partial condenser of the tray reflux column, to provide one or more fuel products.

2. Process according to claim 1 wherein the reflux column comprises a demister pad (14) between the upper tray and the partial condenser.

3. Process according to any of the preceding claims wherein the partial condenser of the reflux column is a tube heat exchanger (13).

4. Process according to any of the preceding claims comprising the step of injecting liquid water or liquid hydrocarbons at the bottom of the tray reflux column.

5. Process according to any of the preceding claims comprising the step of condensing pyrolysis gases (4) exiting the partial condenser (3a) of the reflux column in a condenser (7a) before distilling said gases.

6. Process according to any of the preceding claims wherein distilling pyrolysis gases exiting the partial condenser is done by flash distillation.

7. Process according to claim 6 wherein the flash distillation step comprises condensation of the vapor phase (7b) at the head of the flash distillation column (7) and partial recirculation of condensed light hydrocarbons (10b) in the upper part of the flash distillation column.

8. Process according to claim 6 or 7 wherein the flash distillation step comprises extracting a hydrocarbon fraction in a tray (7d) positioned in the upper medium part of the flash distillation column and recirculating said hydrocarbon fraction in the flash distillation column, preferentially below the extraction level, preferentially by spraying said hydrocarbon fraction.

9. Process according to claim 6 to 8 wherein the flash distillation step comprises partial recirculation of liquid heavy hydrocarbons (7c) obtained at the bottom of the flash column in the lower part of the flash column, preferentially by spraying said heavy fraction.

10. An apparatus for the thermal cracking of a feedstock of plastic materials, in particular waste plastic materials, according to any of claim 1 to 10, comprising:

- a mixing and melting device (1),
- a pyrolysis chamber (2),
- a reflux column connected to the gas exit of the pyrolysis chamber (2),

wherein the reflux column comprises crossflow trays comprising valves covered with caps (23) and a partial condenser (3a) at its upper extremity.

11. Apparatus according to claim 10 wherein crossflow trays comprise down comers (17).

12. Apparatus according to claim 10 or 11 wherein the upper tray of the reflux column is a chimney tray (15).

13. Apparatus according to claim 10 to 12 wherein the partial condenser (3a) of the reflux column is a tube heat exchanger (13).

14. Apparatus according to claim 10 to 13 wherein the reflux column further comprises a liquid injection system (19) at the bottom of the column.

15. Apparatus according to claim 10 to 14, comprising a flash distillation column (7) downstream of the partial condenser of the tray reflux column.

16. Apparatus according to claim 10 to 15 comprising a condenser (7a) positioned between the partial condenser (3a) of the tray reflux column and the flash distillation column (7).

17. Apparatus according to claim 10 to 16 wherein the flash distillation column (7) comprises a condenser (10a) and a reflux drum (10) at its upper extremity, and a recirculation loop for recirculating condensed light hydrocarbons (10b) of the reflux drum in the upper part of the flash distillation column.

18. Apparatus according to claim 10 to 17 wherein the flash distillation column comprises a tray (7d) for extracting liquid hydrocarbon fraction in the upper medium part of the flash distillation column, said tray being connected to a recirculation loop for recirculating said hydrocarbon fraction into the flash distillation column, preferentially below the extraction level, said recirculation loop being preferentially equipped with a spray nozzle (7e) for spraying the liquid in the flash distillation column.

19. Apparatus according to claim 10 to 18 wherein the flash distillation column comprises a recirculation loop for liquid heavy hydrocarbons (7c) obtained at the bottom of the flash distillation column, said recirculation loop

being preferentially equipped with spray nozzles (7e) for spraying the liquid in the flash distillation column.