CLAIMS

1. A process for heating a plurality of articles in a microwave heating system, the process comprising:

(a) generating microwave energy having a predominant wavelength (λ);

(b) loading a plurality of articles into a carrier, in which each of the articles has a length (L) and a width (W) with the width being less than or equal to the length, and in which the width of each article is at least 2.75λ;

(c) passing the loaded carrier through one or more liquid-filled vessels along a convey line, in which the articles are submerged in a liquid medium during at least a portion of the passing;

(d) during at least a portion of the passing, heating the articles in the carrier to provide heated articles, in which at least a portion of the heating is performed using microwave energy discharged into at least one of the vessels via one or more microwave launchers,

in which during the heating, each of the articles has a hottest portion and a coldest portion, and in which the difference between the maximum temperature of the hottest portion of each article and the minimum temperature of its coldest portion during the heating does not exceed 15°C.

2. A process according to Claim 1, in which the heating of step (d) comprises passing the articles in the carrier through a microwave heating chamber followed by a holding chamber, in which during the passing through the holding chamber, the temperature of the coldest portion of each of the articles is maintained at or above a specified minimum temperature for a hold period, in which the holding chamber is at least partially filled with the liquid medium and the articles are submerged in the liquid medium during passage through the holding chamber, in which the difference between the maximum temperature of the hottest portion of each article and the minimum temperature of its coldest portion does not exceed 15°C during the heating.

3. A process according to Claim 1, in which during the heating of step (d) the difference between the maximum temperature of all of the hottest portions of the articles in the carrier and the minimum temperature of all of the coldest portions of the articles in the carrier does not exceed 30°C.

4. A process according to Claim 1, in which the temperature of the hottest portion of each of the articles does not exceed 135°C during the heating of step (d) and in which the difference between the maximum temperature of the hottest portion of each article and the minimum temperature of its coldest portion during the heating of step (d) does not exceed 10°C.

5. A process according to Claim 1, in which the articles are being sterilized, and in which each of the heated articles exhibits have a microbial lethality (F_o) of *C. Botulinum* of at least 1.5 minutes, and in which the ratio of the maximum microbial lethality of all heated articles in the carrier and the minimum microbial lethality of all heated articles in the carrier is not more than 10:1.

6. A process according to Claim 1, in which the heating of step (d) comprises passing the articles in the carrier through a microwave heating chamber, in which the average bulk temperature of the liquid medium in the microwave heating chamber is not more than 130°C, in which the temperature of the liquid medium in the microwave heating chamber is controlled to be within 10°C of a predetermined set point during the heating of step (d).

7. A process according to Claim 1, in which each of the articles has a generally trapezoidal shape and are longer and wider at the top than at the bottom and in which the ratio the length to the width of each article (L:W) is at least 1:1 and not more than 1.35:1.

8. A process according to Claim 1, in which the carrier defines a cargo volume for receiving and holding the articles loaded into the carrier, in which the microwave launcher defines one or more launch openings each having a width and a depth, in which the width of each launch opening is greater than its depth, in which the microwave launcher is configured such that the width of each launch opening is aligned substantially parallel to a direction of travel of the convey line, in which the ratio of the width of the cargo volume to the depth of each launch opening is greater than 2.75:1, and in which the ratio of the width of each article to the depth of each launch opening is greater than 1.25:1.

9. A process according to Claim 1, in which the loading includes arranging the articles within a cargo volume of the carrier, and in which the articles are arranged in at least two spaced apart rows in the cargo volume.

10. A process according to Claim 9, in which the articles are arranged in at least 4 spaced apart rows.

11. A process according to Claim 9, in which the carrier comprises at least one divider for dividing the cargo volume into at least two side-by-side compartments along the width of the carrier, in which each of the compartments is configured to receive one row of the articles, in which each compartment has a compartment width, and in which the ratio of the compartment width to the depth of each launch opening is greater than 1.90:1.

12. A process according to Claim 1, in which the heating includes discharging at least a portion of the microwave energy into the microwave heating chamber via two or more microwave launchers, in which each of the microwave launchers emits microwave energy at a rate of at least 5 and not more than 25 kW.

13. A process according to Claim 1, in which the passing of step (c) includes passing the loaded carrier through a thermalization chamber prior to the heating of the articles with microwave energy, in which the thermalization chamber is at least partially filled with the liquid medium, and in which the heating of step (d) includes preheating the articles in the carrier in the thermalization chamber, in which the average bulk temperature of the liquid medium in the thermalization chamber is in the range of from 50°C to 90°C, and in which the articles comprise packaged foodstuffs, liquids, medical fluids, pharmaceutical fluids, medical instruments, or dental instruments.