generate, and controls water contained in the food.

[0049] FIG. 1 is a side view schematically showing a fryer 100 according to an embodiment. The fryer 100 essentially includes an oil reservoir 101, a pair of opposed plate antennas 102, a drive portion 103, and a heating portion 104.

[0050] The oil reservoir 101 is provided for the purpose of storing food oil therein and cooking food therein. In other words, food is fried by putting the food into the heated food oil in the oil reservoir 101. The oil reservoir 101 is where food is to be put in and the internal surface of the oil reservoir 101 thus comes into contact with hot oil. Therefore, the oil reservoir 101 is preferably made of a material harmless to humans and less degradable even after a long period of use at high temperatures, for example, stainless steel. The volume and shape of the oil reservoir 101 are arbitrarily selected depending on where the fryer 100 is to be placed, how much food is to be cooked at once by the fryer 100, and/or other requirements.

[0051] The pair of opposed plate antennas 102 are placed oppositely and upright in the oil reservoir 101. While electromagnetic waves in a predetermined frequency range are generated between the opposed plate antennas 102, food is cooked in the space where the electromagnetic waves generate. The surfaces of the opposed plate antennas 102 are preferably coated with an insulating material. Through the use of this structure, for example, it can be prevented that an AC voltage supplied to the opposed plate antennas 102 is transmitted to the oil reservoir 101 to shock the user of the fryer 100 and cause failures or the like of devices around the fryer 100.

[0052] For example, the opposed plate antennas 102 may

[0128] The "first controller" (0107) is configured to control alternating current output from the first circuit portion, and the "second controller" (0108) is configured to control alternating current output from the second circuit portion.

[0129] FIG. 22 is a diagram showing an example of the functional blocks of the food composition control device in the present embodiment. The first controller and the second controller may include a first frequency controller (4013) and a second frequency controller (0414), respectively, which control the frequency of the output alternating current. It is preferable that the first frequency and the second frequency are controlled to different frequencies by the first controller and the second controller, respectively. However, the first frequency and the second frequency may be the same. The first controller and the second controller may include a first phase controller (0415) and a second phase controller (0416), respectively, which control the phase of output alternating current. The first controller and the second controller may further include a first timing controller (0417) and a second timing controller (0418), respectively, which control the timing of stopping and outputting alternating current output.

(Control of Frequency)

<Example of Electromagnetic Fields Formed with Electromagnetic Waves of Different Frequencies (50 kHz and 47 kHz)>

[0130] FIG. 23 is a circuit diagram showing an example of the food composition control device in the present embodiment and shows an example of waveforms of electromagnetic fields. The food composition control device shown in the circuit diagram in FIG. 23A has a pair

CLAIMS

1. An ingredient control device (100, 0100, 0400, 10, 4001, 4010) comprising at least one vibration generating portion (102, 0101, 0102, 0401, 0402, 3, 4) configured to generate vibrations, wherein vibration is generated by the vibration generating portion to control an ingredient in an object disposed to face the vibration generating portion to decrease an interfacial tension between the water phase and the other phase.

2. The ingredient control device (100, 0100, 0400, 10, 4001, 4010) according to claim 1, wherein

the vibration generating portion (102, 0101, 0102, 0401, 0402, 3, 4) includes an electrode configured to generate electromagnetic waves, and

a water activity of the object is controlled by generating electromagnetic waves by the electrode.

3. The ingredient control device (100, 0100, 0400, 10, 4001, 4010) according to claim 2, wherein electromagnetic waves are generated by the electrode to increase interfacial polarization between a water phase and another phase of the object and thus decrease an interfacial tension between the water phase and the other phase and bind water in the object into a pearl-chain structure.

4. The ingredient control device (0100, 0400) according to claim 1, 2, or 3, wherein

the vibration generating portion (102, 0101, 0102, 0401, 0402, 3, 4) includes a pair of vibration generating portions,

the ingredient control device (0100, 0400) further comprising:

a first circuit portion (0105, 0405) configured to apply alternating current of a first frequency to a first vibration generating portion (0101, 0401) of the pair of vibration generating portions; and

a second circuit portion (0106, 0406) configured to apply alternating current of a second frequency to a second vibration generating portion (0102, 0402) of the pair of vibration generating portions.

5. The ingredient control device (0400) according to claim 4, further comprising a frequency controller (0413, 0414) configured to control the first frequency and the second frequency to different frequencies.

6. The ingredient control device (0400) according to claim 4 or 5, wherein the first frequency and the second frequency are at least 10 kilohertz to at most 150 kilohertz.

7. The ingredient control device (0400) according to claim 4, 5, or 6, further comprising a phase controller (0415, 0416) configured to control a phase of the alternating current of the first frequency and the alternating current of the second frequency.

8. The ingredient control device (0100, 0400) according to any one of claims 4 to 7, further comprising:

a frying tank (1541); and

a heating portion (1542) configured to heat the frying tank, wherein

the vibration generating portions (1501, 1502) generate electromagnetic waves, and

the pair of vibration generating portions are disposed

to form an electromagnetic field in the frying tank.

9. The ingredient control device (0100, 0400) according to any one of claims 4 to 7, further comprising a food soaking tank (1643) capable of storing edible liquid for soaking food (1661) to allow the edible liquid (1662) to soak into the food and/or to extract an ingredient from the food into the edible liquid, wherein

the vibration generating portions (1601, 1602) generate electromagnetic waves, and

the pair of vibration generating portions (1601, 1602) are disposed to form an electromagnetic field in the food soaking tank.

10. The ingredient control device (0100, 0400) according to any one of claims 4 to 7, further comprising a high-temperature food cooking portion (1744) configured to heat food (1761a, 1761b, 1761c) as the object at high temperature, wherein

the vibration generating portions (1701, 1702) generate electromagnetic waves, and

the pair of vibration generating portions are disposed to form an electromagnetic field in the high-temperature food cooking portion.

11. The ingredient control device (0100, 0400) according to any one of claims 4 to 7, further comprising a room-temperature food cooking portion (1845) in which food (1861) as the object is placed at room temperature, wherein

the vibration generating portions (1801, 1802) generate electromagnetic waves, and

the pair of vibration generating portions are disposed to form an electromagnetic field in the room-temperature

food cooking portion.

12. The ingredient control device (0100, 0400) according to any one of claims 4 to 7, further comprising a refrigerated food cooking portion (1946) configured to refrigerate food (1961) as the object, wherein

the vibration generating portions (1901, 1902) generate electromagnetic waves, and

the pair of vibration generating portions are disposed to form an electromagnetic field in the refrigerated food cooking portion.

13. The ingredient control device (0100, 0400) according to any one of claims 4 to 7, further comprising a low-temperature refrigerated food cooking portion (2048) configured to store food (2061) as the object by low-temperature refrigeration, wherein

the vibration generating portions (2001, 2002) generate electromagnetic waves, and

the pair of vibration generating portions are disposed to form an electromagnetic field in the low-temperature refrigerated food cooking portion.

14. The ingredient control device (0100, 0400) according to any one of claims 4 to 7, further comprising a food defrost cooking portion (2149) for defrosting frozen food, wherein

the vibration generating portions (2101, 2102) generate electromagnetic waves, and

the pair of vibration generating portions are disposed to form an electromagnetic field in the food defrost cooking portion.

15. The ingredient control device (0100, 0400) according to any one of claims 10 to 14, further comprising a vapor supply portion (2250) configured to supply water vapor and/or water spray.

16. The ingredient control device (0100, 0400) according to any one of claims 4 to 7, further comprising a frozen food storing portion (2351) configured to store food as the object by freezing, wherein

the vibration generating portions (2301, 2302) generate electromagnetic waves, and

the pair of vibration generating portions are disposed to form an electromagnetic field in the frozen food storing portion.

17. The ingredient control device (10, 4001, 4010) according to claim 1, wherein the vibration generating portion (102, 0101, 0102, 0401, 0402, 3, 4) includes a pair of vibration generating portions,

the ingredient control device (10, 4001, 4010) further comprising a power source (10) configured to generate alternating current, wherein

a first vibration generating portion (3) of the pair of vibration generating portions is coupled to one electrode of the power source, and

a second vibration generating portion (4) of the pair of vibration generating portions is coupled to another electrode of the power source.

18. The ingredient control device (10, 4001, 4010) according to claim 17, wherein the vibration generating portions (3, 4) are sheet-like members.

19. The ingredient control device (10) according to claim 17 or 18, further comprising a temperature controller (6) configured to control ambient temperature.

20. The ingredient control device (10) according to claim 17, 18, or 19, further comprising a container (11) in which the object is disposed, wherein

the vibration generating portions (3, 4) are electrodes configured to generate electromagnetic waves,

the container has a part serving as one electrode of a pair of the electrodes and another part serving as another electrode of the pair of the electrodes, and

an insulating member (7) is installed between the pair of the electrodes to separate the pair of the electrodes from each other.

21. An ingredient control method using an ingredient control device (100, 0100, 0400, 10, 4001, 4010) including at least one vibration generating portion (102, 0101, 0102, 0401, 0402, 3, 4) configured to generate vibrations,

the method comprising generating vibrations by the vibration generating portion to control an ingredient in an object disposed to face the vibration generating portion to decrease an interfacial tension between the water phase and the other phase.

22. The ingredient control method according to claim 21, wherein

the vibration generating portion (102, 0101, 0102, 0401, 0402, 3, 4) includes an electrode configured to generate electromagnetic waves, and

a water activity of the object is controlled by generating electromagnetic waves by the electrode.

23. The ingredient control method according to claim 21 or 22, wherein electromagnetic waves are generated by the electrode to increase interfacial polarization between a water phase and another phase of the object to decrease an interfacial tension between the water phase and the other phase and bind water in the object into a pearl-chain structure.

24. The ingredient control method according to claim 22, wherein a DC electric field is applied as an offset electric field to an AC electric field to increase interfacial polarization between a water phase and another phase of the object to decrease an interfacial tension between the water phase and the other phase and bind water in the object into a pearl-chain structure.

25. The ingredient control method according to claim 24, wherein the DC electric field of approximately +100 V is applied as an offset electric field on the water phase side relative to the other phase in the AC electric field to increase interfacial polarization between the water phase and the other phase of the object and thus decrease the interfacial tension between the water phase and the other phase and bind water in the object into a pearl-chain structure.

26. The ingredient control method according to any one of claims 22 to 25, wherein the electromagnetic waves are low-frequency waves.

27. The ingredient control method according to any one of claims 22 to 25, wherein the electromagnetic waves have a

frequency of 10 kHz to 500 kHz.

28. The ingredient control method according to any one of claims 22 to 27, wherein

the water in the object is divided into bound water and free water, and

the free water in the object is bound in a pearl-chain structure.

29. The ingredient control method according to claim 21, wherein

the vibration generating portion (102, 0101, 0102, 0401, 0402, 3, 4) includes a pair of vibration generating portions,

the vibration generating portions generate electromagnetic waves,

one (0101, 0401) of the pair of vibration generating portions applies an electromagnetic field of a first frequency to the object, and

the other (0102, 0402) of the pair of vibration generating portions applies an electromagnetic field of a second frequency different from the first frequency to the object.

30. A transportation method using an ingredient control device (10) including at least one vibration generating portion (3, 4) configured to generate vibrations, the method comprising:

installing an object disposed to face the vibration generating portion; and

transporting the object while generating vibrations by the vibration generating portion to control an ingredient in the object to decrease an interfacial tension between

the water phase and the other phase.

31. A transportation method using an ingredient control device (10) including at least one vibration generating portion (3, 4) configured to generate vibrations, the method comprising:

installing an object disposed to face the vibration generating portion;

generating vibrations by the vibration generating portion to control an ingredient in the object to decrease an interfacial tension between the water phase and the other phase;

removing the object from the ingredient control device after elapse of a predetermined period of time; and

thereafter transporting the object.

32. A cooking method using an ingredient control device (4001, 4010) including at least one vibration generating portion (3, 4) configured to generate vibrations and an oil reservoir (4006, 4011) in which the vibration generating portions are installed, the method comprising:

storing oil in the oil reservoir;

frying an ingredient in oil in the oil reservoir in which the vibration generating portion generates vibrations to control an ingredient in the object to decrease an interfacial tension between the water phase and the other phase; and

thereafter washing the ingredient with water.

33. The cooking method according to claim 32, wherein after the ingredient is washed with water, the ingredient is baked.

34. The cooking method according to claim 32, wherein after the ingredient is washed with water, the ingredient is boiled.

35. The cooking method according to claim 32, wherein after the ingredient is washed with water, the ingredient is steamed.

36. The cooking method according to any one of claims 32 to 35, wherein the vibration generating portions (3, 4) generate electromagnetic waves.

37. The cooking method according to any one of claims 32 to 36, wherein

the vibration generating portion (3, 4) includes electrodes configured to generate electromagnetic waves,

the oil reservoir has a part serving as one electrode of the electrodes and another part serving as the other electrode of a pair of the electrodes, and

an insulating member (12) is installed between the pair of the electrodes to separate the pair of the electrodes from each other.

38. A program for a computer of an ingredient control device (0100, 0400) including a pair of vibration generating portions configured to generate electromagnetic waves to control an ingredient in the object to decrease an interfacial tension between the water phase and the other phase, the program causing the computer to perform:

applying an electromagnetic field of a first frequency by one (0101, 0401) of the pair of vibration generating portions to an object installed between the pair of vibration generating portions; and

applying an electromagnetic field of a second frequency different from the first frequency by the other (0102, 0402) of the pair of vibration generating portions to the object installed between the pair of vibration generating portions.