CLAIMS

1. A~~n apparatus for controlling a~~ Baumkuchen baking machine ~~including~~ comprising:

an oven~~,~~;

a batter container~~,~~; ~~and~~

a roller capable of moving between a baking position for the oven and the batter container~~,~~;

a camera adapted to photograph a portion of an outer peripheral surface of layered batter of a Baumkuchen on the roller; and

~~the~~ a control apparatus comprising:

a computer adapted to control movement of~~–~~ the roller having layered batter of a Baumkuchen thereon from a batter application position for applying batter in the batter container to batter on the roller to the baking position for the oven and movement of the roller from the baking position for the oven to the batter application position,

the computer being configured to perform:

an image acquisition process for acquiring, from ~~a~~ the camera ~~photographing a portion of an outer peripheral surface of the layered batter of a Baumkuchen on the roller~~, a group of images of the outer peripheral surface of the batter rotating together with the roller at the baking position for the oven, characterized by the group of images covering at least one entire turn; and

a decision process for deciding on a point of time at which the roller is to be moved from the baking position for the oven to the batter application position based on a baked color of the outer peripheral surface of the batter indicated by the group of images of the outer peripheral surface of the batter at the baking position for the oven covering at least one entire turn;

wherein the group of images contain information about the entire circumference of the outer peripheral surface of the batter of the Baumkuchen baked in the oven.

2. The ~~apparatus for controlling a~~ Baumkuchen baking machine according to claim 1, wherein the computer is configured to further perform:

a determination estimation process for estimating a result of a

determination by an operator regarding a doneness of the batter of a Baumkuchen based on an operation of the Baumkuchen baking machine by the operator; and

a learning process for generating a learning-enhanced model to be used in the decision process by means of machine learning using, as teaching data, the estimated result of the determination by the operator and a group of images of the outer peripheral surface of the batter at the baking position for the oven covering at least one entire turn in a period of time including a time of the determination.

3. The ~~apparatus for controlling a~~ Baumkuchen baking machine according to claim 1 or 2, wherein, when acquiring the images, the computer further acquires at least one of a rotational speed of the layered batter of a Baumkuchen on the roller, a baking time for the outer surface of the batter of a Baumkuchen, and a temperature in the oven, and,

in the decision process, the computer performs the decision based on at least one of the acquired rotational speed, the acquired baking time for the outer surface of the batter of a Baumkuchen, and the acquired temperature in the oven, in addition to the baked color of the outer peripheral surface of the batter indicated by the group of images.

4. The ~~apparatus for controlling a~~ Baumkuchen baking machine according to claim 2, wherein, in the learning process, the computer generates the learning-enhanced model further using at least one of the rotational speed of the layered batter of a Baumkuchen on the roller, the baking time for the outer surface of the batter of a Baumkuchen, and the temperature in the oven in the period of time including the time of the determination based on the operation by the operator.

5. The ~~apparatus for controlling a~~ Baumkuchen baking machine according to any one of claims 1 to 4, wherein, in the decision process, the computer acquires at least one of a speed of circumferential movement of the outer peripheral surface of the layered batter of a Baumkuchen on the roller, and a diameter of the outer periphery of the layered batter of a Baumkuchen on the roller, and,

in the decision process, the computer performs the decision based on

at least one of the acquired speed of circumferential movement and the acquired diameter in addition to the baked color of the outer peripheral surface of the batter indicated by the group of images.

6. The ~~apparatus for controlling a~~ Baumkuchen baking machine according to claim 2 or 4, wherein, in the learning process, the computer generates the learning-enhanced model further using at least one of a speed of circumferential movement of the outer peripheral surface of the layered batter of a Baumkuchen on the roller, and a diameter of the outer periphery of the batter of a Baumkuchen in the period of time including the time of the determination by the operator regarding the doneness.

~~7. A Baumkuchen baking machine comprising:~~

~~an oven;~~

~~a batter container;~~

~~a roller capable of moving between a baking position for the oven and the batter container;~~

~~a camera adapted to photograph a portion of an outer peripheral surface of layered batter of a Baumkuchen on the roller; and~~

~~a control apparatus including a computer,~~

~~wherein the computer is adapted to control movement of the roller having the layered batter of a Baumkuchen thereon from a batter application position for applying batter in the batter container to batter on the roller to the baking position for the oven and movement of the roller from the baking position for the oven to the batter application position,~~

~~the computer is configured to perform:~~

~~an image acquisition process for acquiring, from the camera, a group of images of the outer peripheral surface of the batter rotating together with the roller at the baking position for the oven, the group of images covering at least one entire turn; and~~

~~a decision process for deciding on a point of time at which the roller is to be moved from the baking position for the oven to the batter application position based on a baked color of the outer peripheral surface of the batter indicated by the group of images of the outer peripheral surface of the batter at the baking position for the oven covering at least one entire turn.~~

~~8~~7. A method for controlling a Baumkuchen baking machine including an oven, a batter container, and a roller capable of moving between a baking position for the oven and the batter container, comprising:

a control step in which the computer controls movement of the roller having layered batter of a Baumkuchen thereon from a batter application position for applying batter in the batter container to batter on the roller to a baking position for the oven, and movement of the roller from the baking position for the oven to the batter application position,

wherein, in the control step, the computer performs:

an image acquisition process for acquiring, from a camera photographing a portion of an outer peripheral surface of the layered batter of a Baumkuchen on the roller, a group of images of the outer peripheral surface of the batter rotating together with the roller at the baking position for the oven, characterized in that the group of images covering at least one entire turn; and

a decision process for deciding on a point of time at which the roller is to be moved from the baking position for the oven to the batter application position based on a baked color of the outer peripheral surface of the batter indicated by the group of images of the outer peripheral surface of the batter at the baking position for the oven covering at least one entire turn;

wherein the group of images contain information about the entire circumference of the outer peripheral surface of the batter of the Baumkuchen baked in the oven.

~~9~~8. A method for controlling a Baumkuchen baking machine ~~including an oven, a batter container, and a roller capable of moving between a baking position for the oven and the batter container~~according to claim 7~~,~~ comprising:

a determination estimation step in which a computer estimates a result of a determination by an operator regarding a doneness of batter of a Baumkuchen based on an operation by the operator of the Baumkuchen baking machine; and

a learning step in which the computer generates a learning-enhanced model to be used in ~~a~~ the decision process by means of machine learning

using, as teaching data, the estimated result of the determination by the operator and a group of images of an outer peripheral surface of the batter at the baking position for the oven, the group of images covering at least one entire turn in a period of time including a time of the determination~~,~~

~~wherein the learning-enhanced model is data to be used in the decision process in which the computer decides on a point of time at which the roller is to be moved from the baking position for the oven to the batter application position based on a baked color of the outer peripheral surface of the batter indicated by the group of images of the outer peripheral surface of the batter at the baking position for the oven covering at least one entire turn~~.

~~10. A program for controlling a Baumkuchen baking machine including an oven, a batter container, and a roller capable of moving between a baking position for the oven and the batter container, the control program causing a computer to perform:~~

~~a control process in which the computer controls an operation of moving the roller having layered batter of a Baumkuchen thereon from a batter application position for applying batter in the batter container to the roller to a baking position for the oven, and an operation of moving the roller from the baking position for the oven to the batter application position,~~

~~wherein the control process includes:~~

~~an image acquisition sub-process for acquiring, from a camera photographing a portion of an outer peripheral surface of the layered batter of a Baumkuchen on the roller, a group of images of the outer peripheral surface of the batter rotating together with the roller at the baking position for the oven, the group of images covering at least one entire turn; and~~

~~a decision sub-process for deciding on a point of time at which the roller is to be moved from the baking position for the oven to the batter application position based on a baked color of the outer peripheral surface of the batter indicated by the group of images of the outer peripheral surface of the batter at the baking position for the oven covering at least one entire turn.~~

~~11. A program for controlling a Baumkuchen baking machine including an oven, a batter container, and a roller capable of moving between~~

~~a baking position for the oven and the batter container, the control program causing a computer to perform:~~

~~a determination estimation process for estimating a result of a determination by an operator regarding a doneness of batter of a Baumkuchen based on an operation by the operator of the Baumkuchen baking machine; and~~

~~a learning process for generating a learning-enhanced model to be used in a decision process by means of machine learning using, as teaching data, the estimated result of the determination by the operator and a group of images of an outer peripheral surface of the batter at the baking position for the oven, the group of images covering at least one entire turn in a period of time including a time of the determination,~~

~~wherein the learning-enhanced model is data to be used in the decision process in which the computer decides on a point of time at which the roller is to be moved from the baking position for the oven to the batter application position based on a baked color of the outer peripheral surface of the batter indicated by the group of images of the outer peripheral surface of the batter at the baking position for the oven covering at least one entire turn.~~