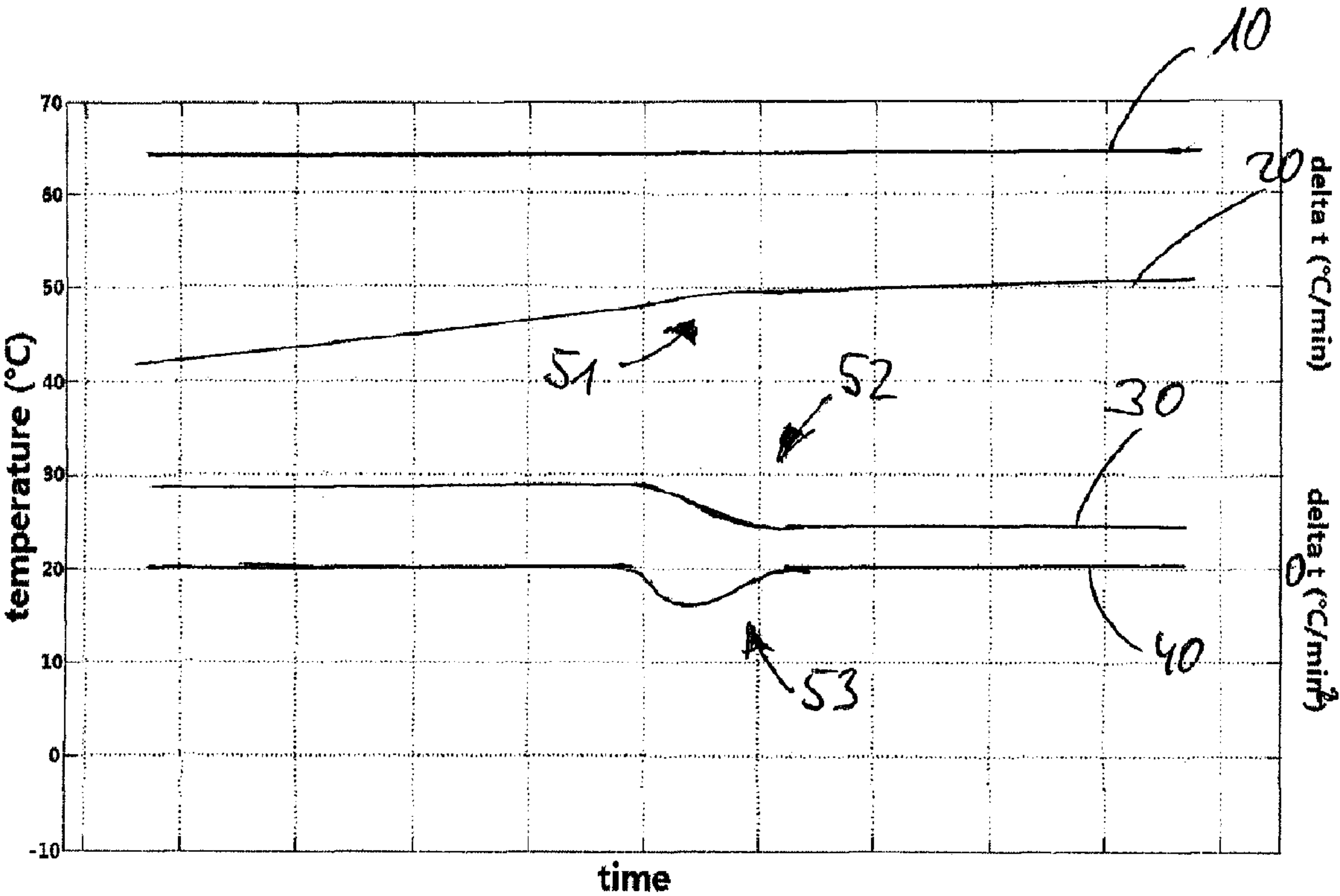




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(54) **Titre :** METHODE ET SYSTEME DE DEGIVRAGE DE PALE DE ROTOR ET PROGRAMME INFORMATIQUE ET INSTALLATION DE PRODUCTION D'ENERGIE EOLIENNE
(54) **Title:** METHOD AND SYSTEM FOR ROTOR BLADE DEICING AS WELL AS COMPUTER PROGRAM AND WIND POWER PLANT



(57) **Abrégé/Abstract:**
The invention relates to a method for deicing a rotor blade of a wind power plant, wherein a deicing procedure is started in the event of icing in an area of the rotor blade to be kept free of or to be freed from ice, in that an air flow is heated to a predetermined

(57) Abrégé(suite)/Abstract(continued):

or predeterminable inflow temperature (10) and is guided from a blade root of the rotor blade through a channel or a channel system in the rotor blade into the area to be kept free of or to be freed from ice and subsequently entirely or partially back to the blade root, wherein the inflow temperature (10) and an outflow temperature (20) of the returned air flow are captured continuously or at certain time intervals. The invention further relates to a computer program, which prompts a control unit of a wind power plant to execute a corresponding method for deicing a rotor blade of a wind power plant, a deicing system of a wind power plant and a wind power plant. According to the invention, a temporal progression of at least one measurement signal containing the outflow temperature (20) is evaluated for a de-icing completion signature (50 - 56) during the deicing procedure, which is caused by a completion of the deicing of the area to be kept free of or to be freed from ice.

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Method and System for Rotor Blade Deicing as well as Computer Program and Wind Power Plant

10

Abstract

(in connection with Fig. 1)

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The invention relates to a method for deicing a rotor blade of a wind power plant, wherein a deicing procedure is started in the event of icing in an area of the rotor blade to be kept free of or to be freed from ice, in that an air flow is heated to a predetermined or predeterminable inflow temperature (10) and is guided from a blade root of the rotor blade through a channel or a channel system in the rotor blade into the area to be kept free of or to be freed from ice and subsequently entirely or partially back to the blade root, wherein the inflow temperature (10) and an outflow temperature (20) of the returned air flow are captured continuously or at certain time intervals. The invention further relates to a computer program, which prompts a control unit of a wind power plant to execute a corresponding method for deicing a rotor blade of a wind power plant, a deicing system of a wind power plant and a wind power plant.

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According to the invention, a temporal progression of at least one measurement signal containing the outflow temperature (20) is evaluated for a deicing completion signature (50 – 56) during the deicing procedure, which is caused by a completion of the deicing of the area to be kept free of or to be freed from ice.

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Method and System for Rotor Blade Deicing as well as Computer Program and Wind Power Plant

Description

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The invention relates to a method for deicing a rotor blade of a wind power plant, wherein a deicing procedure is started in the event of icing in an area of the rotor blade to be kept free of or to be freed from ice, wherein an air flow is heated to a predetermined or predeterminable inflow temperature and is guided from a blade root of the rotor blade through a channel or a channel system in the rotor blade into the area to be kept free of or to be freed from ice and subsequently entirely or partially back to the blade root, wherein the inflow temperature and an outflow temperature of the returned air flow are captured continuously or at certain time intervals. The invention further relates to a computer program, which prompts a control unit of a wind power plant to execute a corresponding method for deicing a rotor blade of a wind power plant, a deicing system of a wind power plant as well as a wind power plant.

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When operating wind power plants, there is the problem at cold locations that the rotor blades ice over, which worsens the aerodynamics and thus, the efficiency of the rotor blades, leads to undesired load problems and

the efficiency of the rotor blades, leads to undesired load problems and bears the risk of falling ice. For this reason, systems have been developed, by means of which the rotor blades can be heated in order to provide de-icing.

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DE 10 2010 030 472 A1 discloses a rotor blade of a wind power plant with a first and a second channel progressing inside the rotor blade for conducting an air flow. Furthermore, a method for deicing a rotor blade of a wind power plant is specified. The rotor blade according to
10 DE 10 2010 030 472 A1 has a separating device, which separates channels from each other so that the first channel on a first side of the separating device is arranged towards the pressure side of the rotor blade and the second channel is arranged on a second side of the separating device towards the suction side of the rotor blade. The described method provides that the
15 flow speed of the air flow provided in the first and in the second channel is specified at least in sections of the rotor blade.

Furthermore, a rotor blade, a deicing system and a method for deicing a rotor blade of a wind power plant are known from DE 10 2013 211 520 A1,
20 in which a heated air flow is guided from a blade root of the rotor blade in the direction of a blade tip in a heat-insulated channel, which is arranged on a web, wherein the web delimits a first area of the rotor blade comprising a rotor blade leading edge to a second area comprising a rotor blade trailing edge, wherein the heated air flow is branched at least partially out of the
25 channel on the way to the blade tip and is guided in the direction of the rotor blade leading edge, and the branched air flow is subsequently guided back to the blade root in a hollow space, which is provided between the rotor blade leading edge and the web as well as the channel. The basic problem of warm air systems is thus solved, namely that a significant portion of the
30 heat energy is lost in the area near the blade root and deicing in the outer blade area, in particular in the blade tip area, is enabled only with a very high energy expenditure and mass flows. By providing a heat-insulated

channel, the warm air can be conveyed very far in the direction of the blade tip without great heat losses. Moreover, an arrangement of the heat-insulated channel on the web, in particular on the web arranged towards the rotor blade leading edge, is required for short paths of the air flow from the channel to the inner wall of the rotor blade leading edge.

In contrast, the object underlying the present invention is to design the deicing of rotor blades in a more efficient manner than has been possible up until now.

This object is solved by a method for deicing a rotor blade of a wind power plant, wherein a deicing procedure is started in the event of icing in an area of the rotor blade to be kept free of or to be freed from ice, wherein an air flow is heated to a predetermined or predeterminable inflow temperature and is guided from a blade root of the rotor blade through a channel or a channel system in the rotor blade into the area to be kept free of or to be freed from ice and subsequently entirely or partially back to the blade root, wherein the inflow temperature and an outflow temperature of the returned air flow are captured continuously or at certain time intervals, which is further developed in that, during the deicing procedure, at least one temporal progression of at least one measurement signal containing the outflow temperature is evaluated for a deicing completion signature, which is caused by a completion of the deicing of the area to be kept free of or to be freed of ice.

The present invention is based on the fundamental idea that, in contrast to what has been conventional up until now, the progression of the deicing procedure is made dependent on the actual deicing occurrence. Since the deicing of the rotor blades of a wind power plant is safety-relevant, it must be completed before the supply of heated air to the area to be deiced is stopped. This means that it must be ensured that the area to be deiced is completely free of ice. Since there have been no external sensors that could

perform this observation simply and reliably up until now, the conventional procedure is such that the duration of the supply of heated air is set long enough that a complete deicing is guaranteed. The set deicing duration is thus independent of the actually needed duration, which can vary individually depending on the outside temperature, air humidity and degree of icing. The quantity of the used warm air is thus in many cases considerably greater than the actually needed quantity, which makes the method used up until now inefficient. If the deicing ends or at least the inflow temperature is reduced up until the end, time and energy are saved and the deicing procedure is made more efficient.

Normally, in deicing systems in the wind energy sector, only the inflow temperature is captured and monitored in order to ensure that the inflow remains below the temperature range critical for the material of the rotor blade.

However, a capturing of the outflow temperature, i.e., the temperature of the air flow fed back out of the rotor blade before it is fed back to the heating device again, is possible with little effort. Specifically, the outflow temperature contains usable information on the progress of the deicing because it depends on the heat quantity actually removed from the heated air flow. In order to be effective, the air channel or respectively the channel system runs through the area to be deiced without separate insulation comparatively close below the blade surface. The heat or respectively heat energy escaping from the heated air flow penetrates the material layer of the rotor blade lying between the air channel and the blade surface as a heat flow and is received by the ice sticking to the blade surface. Aside from the thermal conductivity and the spatial arrangement of the rotor blade material lying in between, the strength of the heat flow depends above all on the temperature difference between the air flow on one hand and the blade surface on the other hand.

As soon as a boundary layer of the ice on the blade surface begins the

phase transition from solid to liquid, the temperature at the blade surface is 0 (zero) °C. This surface temperature is constant as long as the area to be deiced is covered with ice over a large area, especially since ice is a good heat insulator.

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It depends on the degree of icing whether larger ice pieces fall from the rotor blade or smaller "ice drops" melt. The former are not completely thawed, but it is rather sufficient that their layer close to the rotor blade surface is liquid so that they slide off and fall to the ground. Smaller ice drops, which represent a smaller risk for the operation of the wind power plant, will already have melted during the corresponding supply of heat.

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With the freeing of the rotor blade surface of sticking ice, a thin liquid layer first still remains, which is however quickly evaporated due to the heat coming from the rotor blade so that the temperature adjacent to the surface is the air temperature of the ambient air after a short period of time. In many cases, this will be several degrees below 0° C so that the temperature difference between the temperature of the heated air flow on one hand and the temperature at the rotor blade surface increases. In the ideal case that a thermal equilibrium has been reached in the rotor blade and the deicing air flow, the heat flow through the rotor blade material is thereby greater and the outflow temperature drops due to the increase in the removed amount of heat. The development of the outflow temperature of the air flow is thus a good indicator for the completion of the deicing.

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The deicing procedure is preferably ended after the detection of a deicing completion signature. This measure shortens the deicing procedure and saves heating energy. Through the shortening of the deicing procedure, the wind power plant can be restarted earlier than has been possible up until now after an icing event and can thus produce more electrical power. Alternatively, the heated air flow can continue to be used for a predetermined or

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predeterminable rundown period, if applicable with a reduced inflow temperature. A safety reserve for the full deicing is thus also provided in the case of the deicing procedure according to the invention.

5 In the operation of the wind power plant, several effects can overlap that modify the temperature signal. It is possible that thermal equilibrium has not yet been established in the rotor blade material in the area to be deiced before the deicing is complete. In this case, it may be that the ice falls off at a relative early point in time when the rotor blade material is still heating up.
10 This phase involves an at first steep and then leveling increase in the outflow temperature. In such a case, the deicing completion signature is thus not necessarily the reduction in the outflow temperature itself, as described above for the ideal case, but rather a greater reduction in the increase in the outflow temperature.

15 Based on this background, a measurement signal containing the outflow temperature is advantageously the outflow temperature itself, a temperature difference between the inflow temperature and the outflow temperature or a first or a second temporal derivative of the outflow temperature or of the temperature difference between the inflow temperature and the outflow temperature.
20 Within the framework of the invention, several of these measurement signals, which are formed from the outflow temperature and if applicable additionally from the inflow temperature of the heated air flow, can also advantageously be used. It is possible in this manner, due to a greater redundancy in the evaluation, to attain greater reliability of the detection of deicing completion signatures on the one hand and to also detect weaker deicing completion signatures on the other hand.

25 The deicing completion signature is also advantageously an exceeding or a falling below a threshold value or a rapid change in the first and/or second temporal derivative of the outflow temperature or of the temperature differ-
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ence between the inflow temperature and the outflow temperature compared to the slowness of the change in the temperature signal containing the outflow temperature. Within the framework of the present invention, several of these deicing completion signatures can also be used. For example,
5 a greater reduction in the increase in the outflow temperature due to a falling of ice will show itself in the first and/or second temporal derivative of the outflow temperature. The difference between the inflow temperature and the outflow temperature also eliminates effects, which occur above all in the startup phase during the heating of the air flow up until the predetermined
10 inflow temperature has been reached and which can occur as well in the case of fluctuations in the inflow temperature during the further deicing procedure and would feign a deicing completion signature. However, with knowledge of typical deicing procedures and the behavior of outflow temperatures, boundary or threshold values will suffice in many cases, the exceeding or falling below of which suffices as deicing completion signature.
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A further advantageous measure consists in first starting the detection of deicing completion signatures after reaching the predetermined or predeterminable inflow temperature.
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Environmental factors, in particular outside temperature, air humidity, wind speed and/or solar irradiation, are preferably taken into consideration in the determination of threshold values or other indicators for a deicing completion signature. Solar irradiation will, for example, heat the rotor blade surface, which leads to a reduction in the heat flow through the rotor blade.
25 When the rotor blade is dry, the outside temperature is directly responsible for the temperature difference between the rotor blade surface and the air flow; when the rotor blade is wet, indirectly. Air humidity and wind speed will factor, among other things, into the speed, with which the rotor blade dries
30 after having been freed of ice and thus into the temporal "sharpness" or definiteness of the deicing completion signature.

Solar irradiation can be calculated for example from the images of frequently present outside cameras, the image brightness and setting parameters of which, e.g. aperture, magnification factor, etc., are known. The irradiation strength can also be calculated from the known position of the wind power plant as well as the position of the sun in the sky known from the date and time.

Alternatively, the signal can also be evaluated by light intensity sensors arranged on the wind power plant or in the wind park. Such sensors are already comprehensively known in the prior art, in particular for use in controls for preventing shadows from being cast on wind power plants.

It is also advantageous if one or more typical temporal progressions of one or more measurement signals containing the outflow temperature is or will be captured in a deicing test run or several deicing test runs with and/or without icing on the rotor blade and/or are used for generating a reference model, in which in particular environmental factors are furthermore parameterized, and the typical progression(s) and/or the reference model is or are used in subsequent deicing procedures as a comparative reference for determining deicing completion signatures. In order to keep the test data as neutral as possible, they can be taken at night so that solar irradiation does not occur and the temperature is determined only from the air temperature. Factors like solar irradiation are then considered separately through scaling or shifting of the comparative data or the measurement data. These adjustments follow known physical considerations or can be supplemented by daytime test series or those taken under different conditions.

A minimum deicing duration is preferably predetermined or predeterminable, which specifies the minimum duration of the deicing procedure even in the case that a deicing completion signature is detected before the expiry of the minimum deicing duration. Alternatively or additionally, a maximum deicing duration is advantageously predetermined or predeterminable, after

the expiry of which the deicing procedure is also ended without the occurrence of a deicing completion signature.

5 The method according to the invention experiences an advantageous improvement and enhancement when a closed air flow circuit is provided and the heating capacity for achieving the inflow temperature is also monitored. Since the needed heating load depends on the temperature of the outflow, an independent second measurement is thus given, which delivers usable measurement results even in the event of the failure of the temperature sensor for the outflow temperature.
10

The analysis of the temperature progressions is preferably performed allowing for suitable tolerances for the measurement inaccuracies and fluctuations in the temperature measurement so that the deicing is not stopped prematurely due to wrong deicing completion signatures. The time intervals between consecutive temperature measurements are preferably smaller than the length of known or used deicing completion signatures so that the latter do not fall through the measuring grid. The measurement frequency is preferably one measurement per minute or more, in particular one measurement per 10 seconds or more.
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The object underlying the invention is also solved by a deicing system of a wind power plant with at least one rotor blade, which has a channel or a channel system for passing a heated air flow, a heating device for generating a heated air flow, at least one temperature sensor in the inflow of the heated air flow and a temperature sensor in the outflow of the heated air flow, which further comprises a control device, which is designed to control the heating device and is connected with the temperature sensors in the inflow and outflow of the heated air flow and is designed and set up to execute a previously described method according to the invention. Such a control device is normally designed as a data processing system, which is set up by means of a control software for executing the method according to
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the invention. It may be a part of the central controller of a wind power plant.

5 The object underlying the invention is further solved by a computer program, which causes a control device of a wind power plant to execute a previously described method according to the invention for deicing a rotor blade of a wind power plant. This computer program according to the invention is the control software named above.

10 The object underlying the invention is also solved by a wind power plant with a deicing system according to the invention.

The characteristics, advantages and properties described for the method according to the invention are also realized in the deicing system according to the invention and the wind power plant according to the invention.

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Further features of the invention will become apparent from the description of embodiments according to the invention together with the claims and the included drawings. Embodiments according to the invention can fulfill individual characteristics or a combination of several characteristics.

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The invention will be described below without restricting the general inventive idea using exemplary embodiments with reference to the drawings, wherein express reference is made to the drawings for any details according to the invention which are not explained further in the text. They show in:

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Fig. 1 a series of measurements of inflow and outflow temperature as well as a temporal change in the outflow temperature for a typical deicing procedure,

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Fig. 2 a schematic representation of a process with a deicing completion signature and

Fig. 3 a schematic representation of a further process with a deicing completion signature.

In the drawings, the same or similar elements and/or parts are provided with the same reference numbers in order to prevent the item from needing to be reintroduced.

Fig. 1 shows a series of measurements of inflow temperature 10 and outflow temperature 20 as well as a temporal change 30 of the outflow temperature 20 for a typical deicing procedure for an iced rotor blade of a wind power plant. Corresponding deicing systems, rotor blades and heating air channel systems can be found for example in DE 10 2010 030 472 A1 or DE 10 2013 211 520 A1. The time scale on the horizontal axis is ten (10) minutes for each subdivision. The measurement values each determined over ten minutes are also recorded in intervals of ten minutes. The uppermost curve shows the progression of the inflow temperature 10, which achieves its pre-determined inflow temperature of approx. 65° C after the start of the deicing procedure in approximately thirty (30) minutes and then remains constant for approx. fifty (50) minutes up until the completion of the deicing procedure.

The middle curve shows the outflow temperature 20, which first increases sharply with the inflow temperature 10 and flattens out after reaching the maximum inflow temperature 10. However, it continues to increase during the entire deicing procedure. The lower curve with the reference number 30 represents the difference of the consecutive measurement values of the outflow temperature 20, i.e., a measure for the first temporal derivative 30 of the outflow temperature 20. After reaching a maximum shortly before the maximum inflow temperature 10, it falls off, as deicing progresses, down to a few degrees per 10 minutes. A visual inspection at the end of the deicing procedure confirms the complete deicing of the rotor blade tip.

A threshold value 48 determined for example from empirical values, for example the exceeding of the value of 30°C of the outflow temperature 20, the falling below a difference of 35°C between the inflow temperature 10 and the outflow temperature 20 or of a threshold value 48 of 1°C per 10 minutes in the temporal difference of consecutive values, i.e., of the first temporal derivative 30 of the outflow temperature 20, can already be used as the deicing completion criterion 50 in this progression.

Fig. 2 shows an excerpt from a typical deicing procedure, in which the inflow temperature 10 has already reached its maximum value. The unit of the horizontal time axis is arbitrary. The outflow temperature 20 increases comparatively steeply in this system at first, since an area of the rotor blade to be deiced is still covered with the heat retaining ice. After removal of the ice layer, the increase in the outflow temperature 20 flattens out since the heat can now radiate unhindered into the colder environment and thus a higher heat flow takes place through the rotor blade material. The higher outflow temperature 20 compared to the example from Fig. 1 is due to the clarity of the representation and should only be an example. The point at which the steeper increase in the outflow temperature 20 transitions into the flatter increase is called the deicing completion signature 51.

The first derivative 30 and the second derivative 40 of the outflow temperature 20 are plotted in the lower area of Fig. 2. These each have the units $^{\circ}\text{C}/\text{min}$ or respectively $^{\circ}\text{C}/\text{min}^2$, as shown on the vertical axis on the right. The units are arbitrary; only a zero line is shown. The first derivative 30 of the outflow temperature 20 is positive throughout, but drops at the point of the completion of the deicing, resulting in a deicing completion signature 52.

In this exemplary embodiment, the second derivative 40 is constantly zero (0). It only becomes clearly negative at the time of the completion of the deicing, corresponding to the reduction in the value in the first derivative 30. This results in a further deicing completion signature 53.

For the analysis shown in Fig. 2, a closer measurement of temperatures from inflow and outflow is needed than that shown in Fig. 1. Although the deicing system of a wind power plant is a slow system, changes become
5 apparent in the temporal range of a few minutes. In order to be able to capture the changes, a measurement repetition rate of one measurement per minute or more, approximately one measurement per half minute or per ten seconds is expedient. The temporal measurement intervals must be less than the duration of a deicing completion signature 50, 51, 52 or 53.

10 Fig. 3 shows a further exemplary embodiment, in which the inflow temperature 10 in turn has already arrived constantly at its maximum. In contrast to the exemplary embodiment according to Fig. 2, the outflow temperature 20 in Fig. 3 drops after the completion of the deicing. The transition from the
15 increasing to the falling flank of the curve to the outflow temperature 20 forms a deicing completion signature 54. The first derivative 30 changes in this case from positive to negative. In this case, the zero crossing can serve as the deicing completion signature 55. Since the increase in the outflow temperature 20 in the first half of the shown measurement period is not constant but flattens out, the second derivative 40 is first negative, then assumes a minimum (or negative maximum), before arriving at zero (0). The
20 minimum or respectively the negative curve of the second derivative 40 constitutes a deicing completion signature 56.

25 All named characteristics, including those taken from the drawings alone and also individual characteristics which are disclosed in combination with other characteristics are considered alone and in combination as essential for the invention. Embodiments according to the invention can be realized by individual characteristics or a combination of several characteristics. In
30 the scope of the invention, characteristics, which are designated with "in particular" or "preferably" are optional features.

Reference List

	10	Inflow temperature
	20	Outflow temperature
5	30	Temporal change in the outflow temperature (first temporal derivative)
	40	Second temporal derivative of the outflow temperature
	48	Threshold value
10	50 – 56	Deicing completion signature

CLAIMS:

1. A method for deicing a rotor blade of a wind power plant, wherein a deicing procedure is started in the event of icing in an area of the rotor blade to be kept free of or to be freed from ice, wherein an air flow is heated to a predetermined or predeterminable inflow temperature (10) and is guided from a blade root of the rotor blade through a channel or a channel system in the rotor blade into the area to be kept free of or to be freed from ice and subsequently entirely or partially back to the blade root as a returned air flow, wherein the inflow temperature (10) and an outflow temperature (20) are captured continuously or at certain time intervals, characterized in that, during the deicing procedure, at least one temporal progression of at least one measurement signal containing the outflow temperature (20) is evaluated for a deicing completion signature (50 - 56), which is caused by a completion of the deicing of the area to be kept free of or to be freed of ice.
2. The method according to claim 1, characterized in that the deicing procedure is ended after the detection of a deicing completion signature (50 - 56) or the heated air flow is continued to be used for a predetermined or predeterminable rundown period.
3. The method according to claim 2, wherein the heated air flow is continued to be used for a predetermined or predeterminable rundown period with a reduced inflow temperature (10).
4. The method according to one of claims 1 to 3, characterized in that the at least one measurement signal containing the outflow temperature (20) is the outflow temperature (20) itself, a temperature difference between the inflow temperature (10) and the outflow temperature (20) or a first (30) or a second temporal derivative (40) of the outflow temperature (20) or of the temperature difference between the inflow temperature (10) and the outflow temperature (20).
5. The method according to one of claims 1 to 4, characterized in that the deicing completion signature (50 - 56) is an exceeding or a falling below a threshold value (48) of the measurement signal containing the outflow temperature or a rapid change in the first

(30) and/or second temporal derivative (40) of the outflow temperature (20) or of the temperature derivative the inflow temperature (10) and the outflow temperature (20) compared to the slowness of the change in the temperature signal containing the outflow temperature (20).

6. The method according to one of claims 1 to 5, characterized in that the detection of deicing completion signatures (50 - 56) is first started after reaching the predetermined or predeterminable inflow temperature (10).

7. The method according to one of claims 1 to 6, characterized in that environmental factors, , are taken into consideration in the determination of threshold values (48) or other indicators for a deicing completion signature (50 - 56).

8. The method according to claim 7 wherein the environmental factors comprise outside temperature, air humidity, wind speed and/or solar irradiation.

9. The method according to one of claims 1 to 7, characterized in that one or more temporal progressions of one or more measurement signals containing the outflow temperature (20) is or will be captured in a deicing test run or several deicing test runs with and/or without icing on the rotor blade and/or are used for generating a reference model, in which environmental factors are furthermore parameterized, and the typical progression(s) and/or the reference model is or are used in subsequent deicing procedures as a comparative reference for determining deicing completion signatures (50 - 56).

10. The method according to one of claims 1 to 9, characterized in that a minimum deicing duration is predetermined or predeterminable, which specifies a minimum duration of the deicing procedure even in the case that a deicing completion signature (50 - 56) is detected before the expiry of the minimum deicing duration.

11. The method according to one of claims 1 to 10, characterized in that a maximum deicing duration is predetermined or predeterminable, after the expiry of which the deicing procedure is also ended without the occurrence of a deicing completion signature (50 - 56).

12. The method according to one of claims 1 to 11, characterized in that a closed air flow circuit is provided and a heating capacity for achieving the inflow temperature (10) is also monitored.

13. A deicing system of a wind power plant with at least one rotor blade, which has a channel or a channel system for passing a heated air flow, a heating device for generating a heated air flow, at least one temperature sensor in the inflow of the heated air flow and a temperature sensor in the outflow of the heated air flow, further comprising a control device, which is designed to control the heating device and is connected with the temperature sensors in the inflow and outflow of the heated air flow and is designed and set up to execute a method according to one of claims 1 to 12.

14. A computer readable medium having a physical memory which causes a control device of a wind power plant to execute a method according to one of claims 1 to 12 for deicing a rotor blade of a wind power plant.

15. A wind power plant with a deicing system according to claim 13.

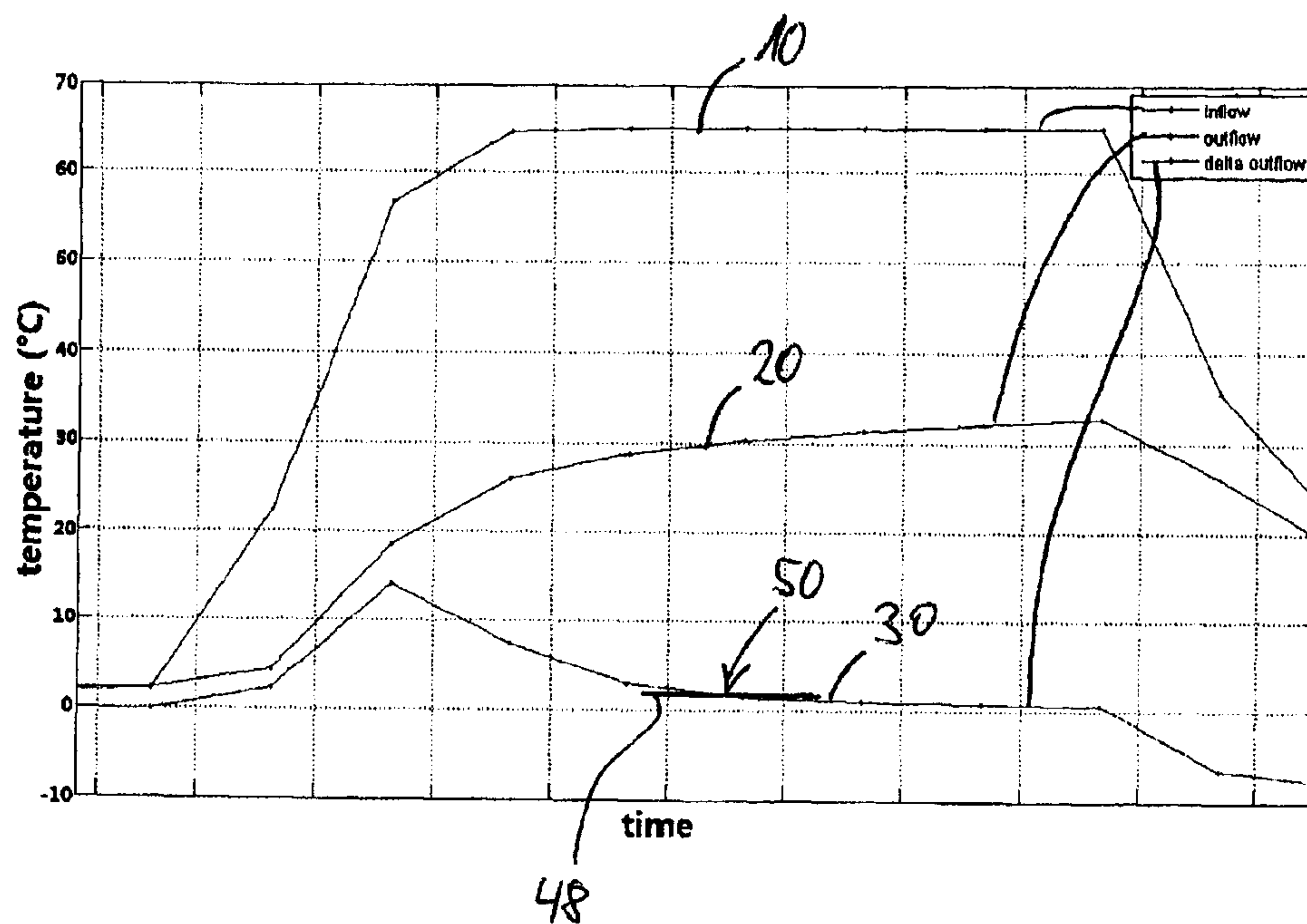


Fig. 1 **Prior Art**

Fig. 2

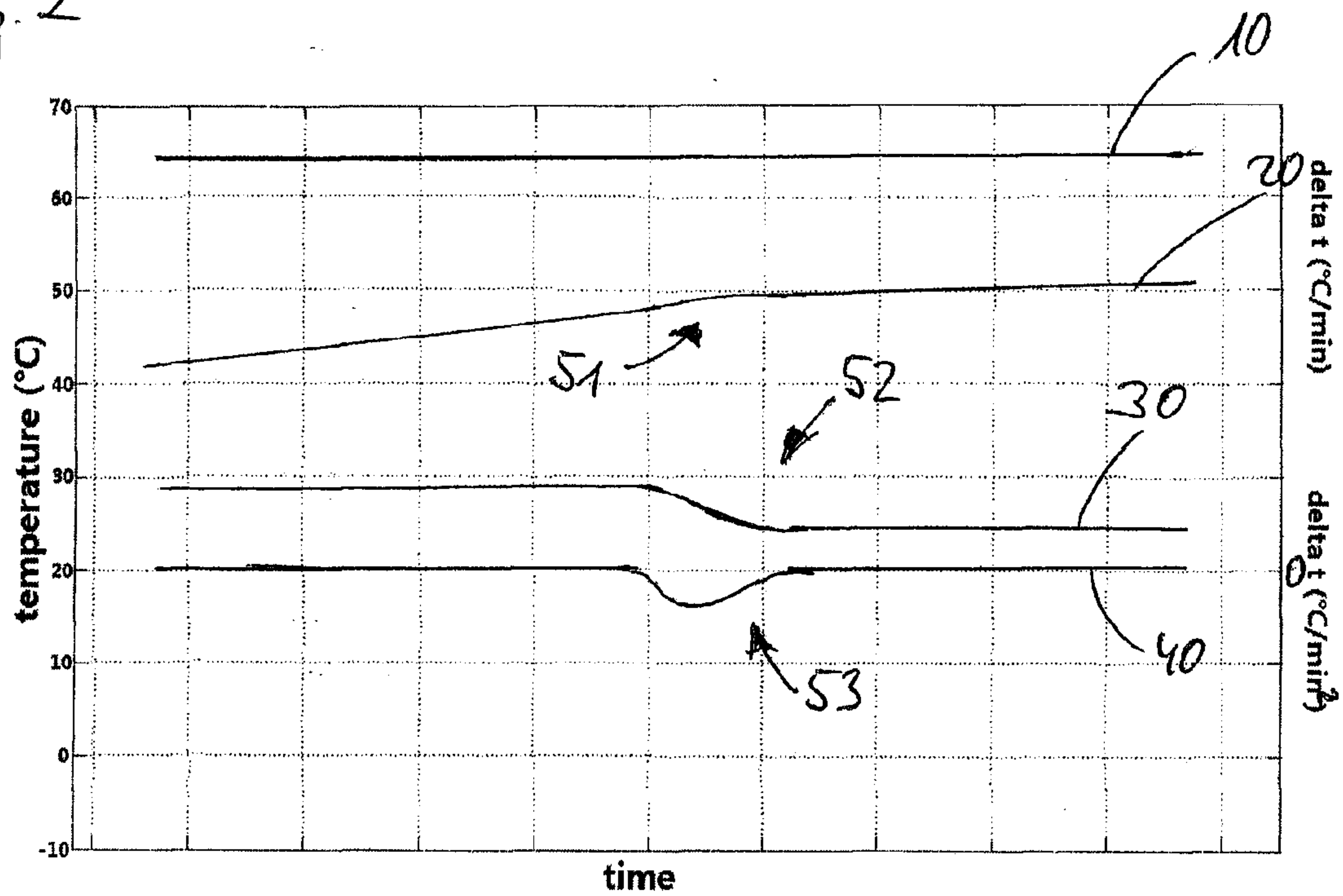


Fig. 3

