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(54) Cleaning process and apparatus.

(57) Brander plates used in the cooking of steaks are cleaned by submerging the plates in a fluidized bed (13), supplying heat to the bed at 7 Kw for a period of two to four hours and then discontinuing heating of the bed, whilst continuing fluidisation by air until the bed is cool.

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Title: "Cleaning Process and Apparatus"

The present invention concerns the cleaning of deposits from surfaces of equipment, and has been devised primarily in connection with the requirement for cleaning from equipment used in cooking deposits derived, at least partly, from food which is cooked.

The process and apparatus of the present invention are especially useful in the cleaning of supports, commonly known as "brander plates", used for supporting steaks during grilling. The deposits which accumulate on these supports during, for example, one evening, are not easily removed but cleaning is necessary before the support is used on a subsequent occasion. The cleaning process which is generally used for these supports comprises the steps of mounting the supports on a conveyor, conveying the supports to a heated, alkaline bath, submerging the supports in the bath for a period, withdrawing the supports, washing the supports, conveying the supports to shot-blasting apparatus and shot-blasting the supports for a further period. Whilst the shot-blasting can remove strongly adherent deposits, it also damages the surface of the supports so that these become roughened and this aggravates the problem of food-derived deposits adhering to the supports when they are subsequently used in a cooking operation. The cleaning procedure renders the supports unusable when cleaning has been repeated approximately twenty times.

Because of the nature of the cleaning process presently used for brander plates, because of the cost and size of the equipment used and because of the nature of the materials used, it is generally impracticable to carry out cleaning at the premises where the plates are used in the cooking of food. It is therefore necessary for the user to have a supply of clean plates, sufficient to last for at least several days, and a collection of used plates, in addition to plates actually in use.

According to a first aspect of the present invention, there is provided a process for cleaning deposits from surfaces of equipment and comprising the steps of fluidising a bed of particles throughout a treatment period, submerging in the bed the surfaces to be cleaned, supplying heat to the bed during an initial part of the treatment period, terminating the supply of heat

to the bed so that the bed cools during a later part of the treatment period and removing the equipment from the bed at the end of the treatment period.

A process in accordance with the invention can be carried out without transferring the equipment to be cleaned from one treatment zone to another treatment zone. Neither supervision, nor intervention by an operator during the treatment period is necessary. The process can conveniently be carried out in apparatus at the premises where the cleaned equipment is to be used and can conveniently be carried out overnight.

We have found that brander plates can be properly cleaned overnight by a process in accordance with the first aspect of the invention without raising the temperature of the bed to a value such that gases leaving the bed give rise to a risk of igniting any combustible material which is likely to be near the apparatus used for carrying out the process. Thus, we preferably avoid a bed temperature in excess of 450°C and more preferably avoid a bed temperature in excess of 430°C.

The superficial velocity of the fluidising gas through the bed is preferably restricted to values which are no greater than 150mm per second. This relatively low velocity further contributes to safety and convenience of the process.

According to a second aspect of the invention, there is provided apparatus defining a treatment chamber containing a bed of particles and comprising fluidising means for causing air to flow through the treatment chamber to fluidise the particles of the bed and heating means for supplying heat to the bed, the fluidising means being adapted to be energised electrically and to maintain an air flow through the bed at a superficial velocity not exceeding 150mm per second when the fluidising means is energised from a domestic mains supply and the heating means being rated at a power not exceeding 10Kw.

An example of apparatus in accordance with the second aspect of the invention and which is used in a method according to the first aspect of the invention, will now be described, with reference to the accompanying drawing, which illustrates the apparatus diagrammatically.

The apparatus comprises a housing 10 provided with feet, on which the apparatus stands on a floor, when in use. The housing includes a hinged lid 11 which is substantially horizontal, when closed.

There is disposed within the housing 10 a treatment zone defined by inner walls 12. The treatment zone contains a bed 13 of particles. At the

bottom of the treatment zone, there is an inlet 14 for admitting a fluidising gas to the bed 13, whilst preventing particles of the bed escaping downwardly from the treatment zone. The inlet may be of a form known for admitting a fluidising gas to a bed of particles. The bed 13 has a weight in excess of 100kg and a volume, when fluidised, in excess of 0.1 cubic metre. The density of the bed is such that it can be fluidised by a gas velocity of less than 100mm per second and, preferably, such that it can be fluidised by a gas velocity substantially less than 90mm per second. Particles known as bubble alumina are suitable for use in the bed. Typically, the bed is rectangular, as viewed in plan, with a length of 675mm and a width of 250mm. The depth of the bed is selected according to the corresponding dimension of the articles which are to be cleaned and is typically 675mm, in the fluidised condition, being slightly less in the slumped condition.

In an upper part of the treatment zone, there is provided a carrier 15 for articles which are to be treated. The carrier includes limbs 16 which extend laterally outwardly over upper ends of the inner walls 12 and a mid-portion 17 which extends across the treatment zone at a level somewhat below that of the limbs 16. The mid-portion 17 is arranged to facilitate suspension in the bed of the articles to be cleaned. Thus, the mid-portion may comprise two rows of hooks 18 which extend into the fluidised bed.

The lid 11 defines an outlet opening through which the fluidising gas can be discharged from the apparatus. The lid incorporates an array of baffles 19 for impeding the carrying of entrained particles out of the apparatus by the fluidising gas. A further baffle 20 is arranged between the array 19 and the mid-portion 17 of the carrier. The baffles 19 and 20 may be perforated and alternative arrangements for retaining the particles in the apparatus may be used.

Fluidising means is provided for supplying the fluidising gas to the bed. The fluidising means comprises an electrically energised blower 21 having an inlet through which ambient air can be drawn into the blower and an outlet connected by a duct 22 with the bed inlet 14. The blower is a single speed blower adapted to blow air into the bed at a rate such that the superficial velocity of the air through the bed is a little above the minimum fluidising velocity of the bed but does not exceed 90mm per second.

Heating means is provided for heating the bed 13. In the example illustrated, the heating means comprises a number of electrical heating elements 23 disposed in the treatment chamber and near to the bed inlet 14,

so that the heating elements occupy a lower part only of the bed. The aggregate rating of the heating elements 23 does not exceed 10Kw and is preferably no greater than 8Kw. A first temeprature sensor 24 is mounted on the inner wall 12 near to the top of the bed 13 and a second temperature sensor is provided either in the bed or in the space above the bed.

When a number of brander plates are to be cleaned, a main switch (not shown) is closed to connect the blower 21 and the heating elements 23 concurrently with a 240V, 50 cycle, single phase electrical supply. Any supply point rated at 30 amps can be used. Thus, the apparatus can be operated from a normal, domestic electricity supply system in the United Kingdom. Where the normal, domestic electricity supply system differs from that available in the U.K., appropriately modified heating elements and blower would be used to avoid an overall power consumption in excess of 10Kw, whilst achieving heat input to the bed at a rate in the region of 7Kw.

Once the blower 21 has been energised to fluidise the bed, the lid 11 is opened, the carrier 15 is removed and the brander plates to be cleaned are suspended on the hooks 18. The carrier is then replaced, the brander plates being lowered into the bed 13 until they are completely submerged. The carrier 15 is arranged to maintain a clearance space between the electrical heating elements 23 and the brander plates which are to be cleaned. When the carrier has been replaced, the lid is closed once more.

Heating of the bed 13 at a power rating in the region of 7Kw is continued until the temperature sensor 24 provides a signal indicating that a selected temperature has been reached. The selected temperature is within the range 400°C to 450°C and is typically 430°C. The time taken for this temperature to be reached depends upon the mass of the brander plates in the bed and is typically within the range two to four hours. The signal provided by the temperature sensor 24 causes the supply of electrical energy to the heating elements 23 to be discontinued. However, energisation of the blower 21 is maintained for a further period. This may be a period of predetermined duration, for example a period within the range three to four hours. Alternatively, a further temperature sensor may be used to provide a signal indicating that the bed 13 has cooled to a selected temperature, typically 200°C, when energisation of the blower can be discontinued.

During that part of the treatment period which follows de-energisation of the heating elements 23, the bed and the brander plates submerged therein are cooled by the flow of ambient air through the bed and by other heat

losses from the bed. The interspace between the housing 10 and inner walls 12 is occupied by thermally insulating material which reduces heat losses from the bed, other than to the air which flows through the bed. The lid 11 also may define an interspace containing thermally insulating material.

Generally, the brander plates to be cleaned are submerged in the fluidised bed for a period of at least six hours. We have found that brander plates are cleaned without suffering surface damage. It is not necessary for the brander plates to be removed from the bed immediately the treatment period ends and the blower 21 is de-energised. The brander plates can easily be withdrawn from the bed subsequently, for example when they are requird for further use.

The second temperature sensor 25 provides a signal if the temperature in the treatment zone rises above a predetermined threshold, for example 500°C, which might happen if the temperature sensor 24 fails. The signal from the temperature sensor 25 causes the apparatus to be isolated from the electrical supply.

The apparatus illustrated in the accompanying drawing may be modified by omission of the electrical heating elements 23 and the provision of a gas burner, through which there can be supplied a gaseous fuel to burn in air supplied by the blower 21 and provide hot products of combustion to the bed 13 through the inlet 14. The burner would be required to supply heat at a rate not exceeding 6000 K.cal per hour.

The features disclosed in the foregoing description, or the following claims, or the accompanying drawings, expressed in their specific forms or in terms of a means for performing the disclosed function, or a method or process for attaining the disclosed result, as appropriate, may, separately or in any combination of such features, be utilised for realising the invention in diverse forms thereof.

CLAIMS:

1. A process for cleaning deposits from surfaces of equipment comprising the steps of fluidising a bed (13) of particles throughout a treatment period, submerging in the bed the surfaces to be cleaned, supplying heat to the bed during an initial part of the treatment period, terminating the supply of heat to the bed so that the bed cools during a later part of the treatment period and removing the equipment from the bed at or after the end of the treatment period.

2. A process for cleaning from the surfaces of cooking equipment food-derived deposits comprising the steps of fluidising a bed (13) of particles throughout a treatment period, submerging in the bed the surfaces to be cleaned, supplying heat to the bed during an initial part of the treatment period, terminating the supply of heat to the bed so that the bed cools during a later part of the treatment period and removing the equipment from the bed at or after the end of the treatment period.

3. A process according to Claim 1 or Claim 2 wherein the temperature of the bed during the treatment period does not substantially exceed 450°C.

4. A process according to any preceding claim wherein said surfaces are submerged in the fluidised bed for at least six hours.

5. A process according to any preceding claim wherein the superficial velocity of the fluidising gas in the bed does not exceed 150mm per second.

6. A process according to any preceding claim wherein heat is supplied to the bed for at least two hours during a single treatment period.

7. Apparatus defining a treatment chamber containing a bed (13) of particles and comprising fluidising means (21) for causing air to flow through the treatment chamber to fluidise the particles and heating means (23) for supplying heat to the bed, said fluidising means being adapted to be energised electrically and to maintain an air flow through the bed at a superficial

velocity not exceeding 150mm per second when the fluidising means is energised from a domestic mains supply and the heating means being rated at a power not exceeding 10Kw.

8. Apparatus according to Claim 7 wherein the weight of the bed exceeds 100kg.

9. Apparatus according to Claim 7 or Claim 8 wherein the volume of the fluidised bed exceeds 0.1 cubic metre.

10. Any novel feature or novel combination of features disclosed herein and/or shown in the accompanying drawing.

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