THE HEATING OF CONVEYED FOODS

An apparatus (10) for heating conveyed foods includes a carrier (12) that is displaceable with respect to a substructure. A plurality of support structures (22) are arranged on the carrier (12) each support structure (22) being configured to support a food receptacle above the carrier (12). A plurality of fuel-burning heating devices (40) are operatively arranged with respect to the support structures (22) so that heat generated by the heating devices (40) is directed on to respective food receptacles.
Published:  
— of inventorship (Rule 4.17(iv)) for US only  
— with international search report  

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.
TITLE
The Heating of Conveyed Foods

FIELD OF THE INVENTION
This invention relates to the heating of foods. More particularly, this invention relates to an apparatus for heating conveyed foods and to a method of heating conveyed foods.

BACKGROUND TO THE INVENTION
The automated conveying of prepared foods is well known. This is particularly so with prepared Asian foods. For example, it is common practice in sushi restaurants to convey foods to patrons on a moving carrier that traverses a path along a self-serving area in the restaurant. At present, such conveying of prepared foods is suitable for foods that are served at room temperature.

A problem arises where the food is to be served warm. In this case, the food must be re-heated occasionally. Thus, the food must be removed regularly from the carrier, heated up and replaced on the carrier. This is both inefficient and labour-intensive.

SUMMARY OF THE INVENTION
According to a first aspect of the invention, there is provided an apparatus for heating conveyed foods, the apparatus comprising

a carrier that is displaceable with respect to a substructure;

a plurality of support structures that are arranged on the carrier, each support structure being configured to support a food receptacle above the carrier; and

a plurality of fuel-burning heating devices that are operatively arranged with respect to the support structures so that heat generated by the heating devices is directed onto respective food receptacles.
The carrier may be in the form of an elongate, articulated arrangement that defines a closed loop and is capable of being driven along a closed, curved path defined by the substructure.

Each support structure may include a generally planar support member, the support members being mounted on the carrier in a nested configuration.

Each support structure may further include a plurality of holders, each holder being mounted on a respective support member and each holder having a floor and a wall, the floor being engageable with the respective support member and the wall being engageable with said food receptacle to support the food receptacle above the floor.

Each fuel-burning heating device may include a gas burner assembly that is fastened to the carrier and is connectable to a flammable gas supply, the gas burner assembly including a burner that extends through a respective support structure and through an opening defined in the floor of the holder to be directed towards the food receptacle.

The apparatus may include a plurality of valve assemblies that are fastened to the carrier, the gas supply being in the form of a plurality of gas cylinders that are fastenable to the valve assemblies, each valve assembly being in fluid communication with a respective gas burner assembly to supply the gas burner assembly with fuel.

The apparatus may include a plurality of valve control arms, each valve control arm extending through the carrier and a respective support structure to engage a respective valve assembly, the valve control arms being configured to open or close the valve assembly on manipulation of the valve control arm.

Each valve control arm may extend through an opening defined in the floor of a respective holder so that the valve control arm can be manipulated from above the floor of the holder.

Each valve assembly may have an outlet that is in fluid communication with a respective gas burner assembly, a safety valve assembly being interposed between said outlet and the gas burner assembly, the safety valve assembly being
configured to shut off gas to the gas burner in the event that the gas burner ceases to operate.

The safety valve assembly may include a safety valve and a thermocouple operatively positioned with respect to the gas burner assembly, the safety valve being operable to shut off the gas supply to the burner assembly upon the thermocouple registering a temperature below a predetermined value in the region of the burner assembly.

The apparatus may include an igniting mechanism that is operable by a user to ignite the burner assembly. The igniting mechanism may include a pushrod and a piezo-electric device, the pushrod extending through the floor of the holder to be accessible from above the floor and being engageable with the piezo-electric device so that a user can ignite the gas burner assembly by depressing the pushrod.

The safety valve may be in a normally closed condition and may be configured to assume a closed condition on receipt of a suitable signal from the thermocouple, the safety valve including an over-ride mechanism that is engaged with the pushrod, so that depression of the pushrod results in the safety valve being over-ridden into an open condition, thus releasing gas to the gas burner assembly so that ignition can take place.

The support members may be spaced from the carrier so that a region is defined between the carrier and the support members.

Each support member may have a base member and a heating member. The heating member may be mounted on the base member. The heating member may be spaced from the base member so that a heating area is defined between each base member and its associated heating member. The heating member may be of a heat conductive material. Further, the heating member may be configured so that the food receptacle can be placed on the heating member.

Each heating device may be in the form of a gas burner. Each gas burner may include a gas regulator which is positioned in each region between the carrier and the support members. The gas burner may further include at least one gas
burning nozzle which extends into the heating zone, so that heat from a gas flame emitted by the, or each, nozzle impinges on an underneath surface of the heating member.

The gas regulator may include a connection piece that permits a gas canister or cartridge to be fixed to the regulator. The connection piece may be a conventional connecting piece for a gas cartridge of the type used for such activities as camping, and other activities where a compact and lightweight cartridge is necessary. If follows that the device may include a mounting means positioned in the region to mount the cartridge in position.

The mounting means may be in the form of a plurality of holders mounted on the carrier. The holders may be configured to accommodate a replaceable gas canister. Each regulator may thus be configured to be able to connect to the gas canister.

Each gas burner may further include an ignition switch to allow a user to ignite the burner when heating is required.

Each regulator may also include a valve for heat adjustment. The valve may be manually adjustable. It is, however, to be appreciated that the valve may also be remotely adjustable.

In an alternative embodiment, the heating apparatus may include a single regulator which is configured to be rotatably mountable on the gas cylinder. The single regulator may be connected directly to each gas burner via a suitable conduit. Instead, the single regulator may be connected to each of the regulators of the previous embodiment via the conduit. It follows that, as the carrier is displaced relative to the substructure, the single regulator is capable of rotating to accommodate movement of the carrier.

It is to be appreciated that it may be inconvenient to provide a separate gas canister for each burner. In this case the heating apparatus may include a number of holders, each holder being connected to the carrier to hold a gas cylinder in position operatively beneath the carrier. A multi-way regulator may be positioned with respect to the holder. The multi-way regulator may include two or more outlet
conduits. Each outlet conduit may be connected to a respective burner. The inlet conduit may be connectable to the gas cylinder.

The holder may be configured to hold a conventional lpg cylinder in position. It follows that the inlet conduit may be configured to connect to an outlet valve of such a cylinder.

Another embodiment of the invention is particularly suited to the use of gas which is supplied from a location remote from the carrier. This can include gas supplied from one or more high capacity cylinders positioned outside a structure in which the carrier is located. This can also include gas piped to the structure as a utility.

Applicant has recognised that there is a difficulty in providing gas to the burners from such a supply, due to the fact that the carrier must, of necessity, be in motion during use. Applicant has therefore devised the following embodiment which caters for such continuous movement.

This embodiment may include a gas feed mechanism which may be connected to the gas supply. The gas feed mechanism may include a feed nozzle head from which gas is fed.

A number of gas storage vessels may be positioned on the carrier. Each gas storage vessel may be connected to a refilling conduit. The refilling conduits may include secondary refilling conduits and a primary refilling conduit.

The gas feed mechanism may include a refilling nozzle head which is in fluid communication with the primary refilling conduit. The feed nozzle head may be configured operatively to engage the refilling nozzle head and to direct gas into the primary refilling conduit via the refilling nozzle head. The refilling conduits and the storage tanks may be configured so that, when the feed nozzle head is in fluid communication with the refilling nozzle head, gas is fed into the storage vessels. A suitable valve arrangement may be provided to ensure that the gas is retained in the storage tanks.

In this embodiment, a drive mechanism for the carrier may be configured to slow or stop the carrier intermittently to allow refilling of the storage tanks. In
particular, the drive mechanism may be configured to slow or stop at a particular position to allow sufficient time for filling of the storage tanks.

Each of the storage tanks may be connected to at least one respective burner. As with the previous embodiments, the storage tanks may be connected to the respective burners via suitable regulators.

Also, as before, this embodiment may include ignition switches and valves for regulating the heat.

According to a second aspect of the invention, there is provided a method of heating conveyed foods, the method including the steps of:

10 Positioning a food receptacle on a support structure which is arranged on a carrier that is displaceable with respect to a substructure; and

Heat the food receptacle with a fuel burning device, which is operatively arranged with respect to the support structure so that heat generated by the heating device is directed on to the food receptacle.

The invention will now be described, by way of example, with reference to the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

In the drawings:

Figure 1 shows a schematic view of a first embodiment of an apparatus, in accordance with the invention, for heating conveyed foods.

Figure 2 shows a side schematic view of a second embodiment of a heating apparatus, in accordance with the invention, for heating conveyed foods.

Figure 3 shows a side schematic view of a third embodiment of a heating apparatus, in accordance with the invention, for heating conveyed foods.

Figure 4 shows a side schematic view of a fourth embodiment of a heating apparatus, in accordance with the invention, for heating conveyed foods.
Figure 5 shows a side schematic view of a fifth embodiment of a heating apparatus, in accordance with the invention, for heating conveyed foods.

Figure 6 shows a schematic view of a timing arrangement of a food conveying apparatus which includes the heating apparatus of figure 5.

Figure 7 shows a side view of a sixth embodiment of a heating apparatus, in accordance with the invention, for heating conveyed foods.

Figure 8 shows a three-dimensional view of the heating apparatus of Figure 7.

Figure 9 shows a plan view of a heating enclosure of the heating apparatus of figure 7.

DETAILED DESCRIPTION OF THE DRAWINGS

In figure 1, reference numeral 10 generally indicates a first embodiment of an apparatus, in accordance with the invention, for heating conveyed food.

The apparatus 10 includes a carrier 12 which is displaceable with respect to a substructure (not shown). The carrier 12 is in the form of an elongate, articulated arrangement 14.

The arrangement 14 includes a plurality of link members or links 16 that are pivotally connected together, end-to-end, via pivot shafts 18 and rollers 20. The carrier 12 is a conventional carrier that is presently used for conveying prepared foods. These can be found in many so-called “sushi bars”.

The conveying system 10 includes a plurality of support structures 22. Each support structure 22 is mounted on a respective link 16 to be positioned above the link 16. In particular, the support structures 22 are configured so that a region 24 is defined between each link 16 and its respective support structure 22.

Each support structure 22 includes a support member 26. The support members 26 each have a pair of opposed, substantially planar surfaces 28. Each end 30 of each support member 26 is shaped so that consecutive and adjacent support members 26 are in a nesting configuration with respect to each other to
allow the support members 26 to move continuously along a curved path without significant separation from each other.

Each support structure includes a heating member 31 which is mounted above a respective support member 26 so that a heating zone 32 is defined between each support member 26 and its respective heating member 31.

The apparatus 10 includes a plurality of fuel burning heating devices 34. Each device 34 includes a fuel gas regulator 36 which is mounted in the region 24. A nozzle arrangement 38 extends from each regulator 36. Each nozzle arrangement 38 includes a number of gas nozzles 40 that extend through each support member 26 into the heating zone 32. The gas nozzles 40 are positioned so that a gas flame emitted from the nozzles 40 will impinge on a lower surface 42 of the heating members 31. The heating member 31 is of a suitable conductive material, such as steel. Thus, the gas flames serve to heat the heating member 31. A food receptacle can be placed on the heating member 31 to keep food in the receptacle warm.

In the embodiment indicated by reference numeral 10, the regulators 36 are each connectable to an independently mounted gas cartridge 44. Each gas cartridge 44 is mounted beneath a respective support member 26 to be operatively engaged with a respective regulator 36. It follows that the apparatus 10 includes a plurality of mounting means in the form of a pair of retaining members 48. Each pair of retaining members 48 is configured to retain a respective gas cartridge 44 in position within the region 24.

The gas cartridges 44 are in the form of conventional, small-size gas cartridges of the type which are used, for example, in camping and in other applications where lightweight and disposability are essential. It follows that each gas regulator 36 is configured to engage operatively such a gas cartridge 44.

Each regulator 36 has a manually adjustable valve 46 to permit a rate of gas flow from the cartridges 44 to the respective nozzle arrangements 38 to be adjusted, as desired.
In figure 2, reference numeral 50 generally indicates a second embodiment of an apparatus, in accordance with the invention, for heating food. With reference to figure 1, like reference numerals refer to like parts, unless otherwise specified.

The apparatus 50 does not include the mounting arrangement 48. Instead, a single pivotal regulator 52 is provided which is pivotally mounted on a gas cylinder or operatively with respect to a number of gas cylinders, indicated by reference 54. A number of conduits or gas lines 56 are connected to the regulator 52 at one end, and at an opposed end, to each regulator 36. Thus, as the carrier 12 is displaced relative to the substructure, the regulator 52 can pivot to accommodate this movement. The gas regulator 52 also includes a manually adjustable valve 58 so that a gas supply can be completely shut off, if desired.

In figure 3, reference numeral 60 generally indicates a third embodiment of an apparatus, in accordance with the invention, for heating conveyed foods. With reference to figures 1 and 2, like reference numerals refer to like parts, unless otherwise specified.

The apparatus 60 is substantially the same as the apparatus 10, with the exception that the gas cartridge 44 is replaced with a gas canister 62. The canister 62 is positioned within a canister holder 64. The canister holder 64 is oriented so that the canister 62 is in an upright position in use.

An adjustment arm 46 extends from the regulator 36 through the links 16 and the support member 26 so that a user can adjust gas flow from the regulator 36.

The apparatus 60 is particularly suited for steaming food, a popular way of keeping food warm and moist with oriental cooking. Thus, the apparatus 60 includes a number of steamers 66, which are positioned on respective support members 26.

Each steamer 66 includes a water container 68, the heating member 31 defining a floor of the water container 68. A foraminous plate 70 is positioned on the container 68 to allow the passage of steam through the plate 70. A traditional steamer basket 72 can be positioned on the plate 70.
A stainless steel shroud 74 is positioned about the container 68 for safety. The apparatus 60 includes a temperature gauge 76, which extends into the container 68 to maintain the correct temperature. The apparatus 60 also includes a water level indicator 82 to permit a user to ensure that the water in the container 68 does not evaporate entirely.

The apparatus 60 also includes an ignition device 78 to permit a user to ignite the gas.

Breather holes 80 are defined in the shroud 74 to permit the flames from the nozzle arrangement to burn correctly.

In figure 4, reference numeral 90 generally indicates a fourth embodiment of an apparatus, in accordance with the invention, for the heating of conveyed foods. With reference to figures 1 to 3, like reference numerals refer to like parts, unless otherwise specified.

It is to be appreciated that it may not always be convenient to have a separate canister for each nozzle arrangement 38. Thus, this embodiment is configured to be used with a number of gas containers in the form of standard liquid petroleum gas (LPG) cylinders, indicated at 92.

The apparatus 90 thus includes a number of LPG cylinder holders, one of which is shown at 94. Each holder 94 includes a hanger 96, which is configured to engage the LPG cylinder 92 at a position beneath a valve assembly 98 of the cylinder 92.

A multi-way regulator 100 is mounted on the hanger 96 and is bolted to its respective link 16. A primary gas conduit 102 is connected between the valve assembly 98 and an inlet of the regulator 100. A plurality of secondary gas conduits 104 are connected between outlets of the regulator and respective nozzle arrangements 38.

Instead of the steamer 66, the apparatus 90 includes a cast iron heating plate 106 that is positioned on the shroud 74 to define a hot plate. An internal cast iron heating plate 108 is positioned above the nozzle arrangement 38.
In figure 5, reference numeral 110 generally indicates a fifth embodiment of an apparatus, in accordance with the invention, for heating conveyed foods. With reference to figures 1 to 4, like reference numerals refer to like parts, unless otherwise specified.

The embodiment of figure 5 is especially suited for the supply of gas from a position remote from the carrier 12. This can include gas supplied from a bank of gas cylinders positioned outside a structure in which the carrier 12 is located. Instead, this can include gas piped to the structure as a utility. This is often referred to as “town gas”.

The apparatus 110 includes a gas feed mechanism 112 which is connected to the gas supply. The gas feed mechanism 112 includes a feed nozzle head 114 from which gas is fed.

A number of gas storage vessels or tanks 116 are positioned on the carrier 12. Each gas tank 116 is connected to a refilling conduit 118. The refilling conduits 118 include a primary refilling conduit 118.1 and a plurality of secondary refilling conduits 118.2.

The gas feed mechanism 112 includes a refilling nozzle head 120 that is in fluid communication with the primary refilling conduit 118.1. The feed nozzle head 114 is configured operatively to engage the refilling nozzle head 120 and to direct gas into the primary refilling conduit 118.1, via the refilling nozzle head 120. The refilling conduits 118 and the storage tanks 116 are configured so that, when the feed nozzle head 114 is in fluid communication with the refilling nozzle head 120, gas is fed into the tanks 116. A suitable valve arrangement is provided to ensure that the gas is retained in the storage tanks 116.

The feed nozzle head 114 is positioned within a sleeve 122, which is connected to a pneumatic drive mechanism 124. The pneumatic drive mechanism 124 is configured to inject air into the sleeve 122 to drive the feed nozzle head 114 into fluid engagement with the refilling nozzle head 120.

A drive mechanism 126 for the carrier 12 is shown in figure 6. The mechanism 126 is configured to stop the carrier 12 intermittently to allow refilling of
the storage tanks 116. It will be appreciated that the drive mechanism 126 should be configured to stop the carrier 12 when the feed nozzle head 114 is aligned with the refilling nozzle head 120. At this point, the pneumatic drive mechanism 124 is activated.

The drive mechanism 126 includes a motor 128 that drives a gearbox 130. The gearbox 130, in turn, is connected via a suitable geared arrangement 132 to a sprocket wheel 134 that is operatively engaged with the carrier 12.

In order to permit the intermittent stopping of the drive mechanism 126, a power supply 136 is connected to the motor 128 via a timing mechanism 138. The timing mechanism 138 includes a sensor 139 to record the position of the carrier 12, a manually adjustable setting device 140 and a time-indicating device 142 to permit a user to set the timing mechanism 138. Thus, the timing mechanism can be set according to the operation of the pneumatic drive mechanism 124 so that the refilling nozzle head 120 is correctly positioned to provide engagement of the feed nozzle head 114 with the refilling nozzle head 120.

In figures 7 and 8, reference numeral 150 generally indicates a sixth embodiment of an apparatus, in accordance with the invention, for heating conveyed foods. With reference to figures 1 to 6, like reference numerals refer to like parts, unless otherwise specified.

In the following description, for the sake of convenience, a single heating station 156 is described. It will be appreciated that the apparatus 150 includes a plurality of the heating stations 156.

As can be seen in the drawing, each link member 16 includes an upper link plate 158 and a lower link plate 160 spaced from the upper link plate 158. Each link plate 158, 160 has a first end portion 162, an intermediate portion 164 and a second end portion 166. The link members 16 are assembled so that the respective portions 162, 164 and 166 of the upper and lower link plates 158, 160 are aligned with each other. The intermediate portions 164 are angled with respect to the first and second end portions 162, 166 so that the second end portions 166
of a preceding link member 16 are interposed between the first end portions 162 of a succeeding link member 16.

The apparatus 150 includes a valve assembly 152 that is fast with the carrier 12. The valve assembly 152 includes a control arm assembly 154 that extends through the first end portions 162 of the succeeding link member 16 and through the second end portions 166 of overlapping consecutive link members 16 and through the roller 20 positioned between the second end portions 166 of the preceding link member 16. Thus, the link members 16 pivot relative to each other about the control arm assembly 154.

The control arm assembly 154 includes a spindle 168 that extends from an upper end 170 that is positioned above the support member 26 to terminate in a valve closure 172 at an opposed end.

The spindle 168 has an upper threaded formation 174 that engages a nut and lock nut combination 176 that is positioned on the support member 26.

A nylon spacer 178 is positioned between the first and second end portions 162, 166 of the upper link plates 158 of the link members 16 and between the first and second end portions 162, 166 of the lower link plates 160 of the link members 16. The nylon spacers 178 define a passage that accommodates the spindle 168.

A collar 180 is positioned in the roller 20 to extend between the second end portions 166 so that the spindle 168 extends through the collar 180.

An O-ring groove 182 is machined about that part of the spindle 168 that is positioned in the collar 180. An O-ring is received in the groove 182 to bear against an inner surface of the collar 180 in a gas-tight manner.

An end collar 184 is fast with the spindle 168 proximate the valve closure 172 with the valve closure 172 extending out of the collar 184. The end collar 184 is threadedly engaged with a valve body 186 such that the valve closure 172 extends into the valve body of the preceding link member 16. A brass spacer 185 is interposed between the first end portion 162 of the lower link plate 160 of the succeeding link member 16 and the end collar 184.
The spindle 168 defines a further O-ring groove 188 that is positioned in the valve body 186. An O-ring 188 is received in the groove 188 to bear against the valve body 186 in a gas-tight manner.

The valve body 186 defines a valve seat 190 at an inlet 192 of the valve body 186. The valve body 186 is fastened to a gas bottle or cylinder 194. The valve closure 172 is positioned so that on suitable rotation of the spindle 168, the valve closure 172 can bear against the valve seat 190 to close the inlet 192 or can be displaced from the valve seat 190 to open the inlet 192. Thus, by manipulating the spindle 168 a user can control the flow of gas from the cylinder 194 into the valve body 186. For this purpose, the control arm assembly 154 includes a lever arm 196 that is connected to the upper end 170 of the spindle 168 to permit a user to rotate the spindle 168.

The gas cylinder 194 can contain a suitable flammable gas such as lpg. The valve body 186 includes a suitable mounting formation 198 to permit a refill adapter to be positioned on the valve body 186 so that the cylinder 194 can be refilled.

The valve body 186 defines an outlet, an outlet conduit 200 being fast with the valve body 186 at the outlet.

The outlet conduit 200 is fast with a safety valve 202 at an inlet of the safety valve 202. The safety valve 202 is normally closed and includes a solenoid 204 to open the valve 202.

An outlet conduit 206 is fast with the safety valve 202 at an outlet of the safety valve 202. The outlet conduit 206 is connected to a burner assembly 208.

The burner assembly 208 includes a jet enclosure 210 that is fastened to the first end portion 162 of the lower link plate 160 of the preceding link member 16. The outlet conduit 206 is connected to a replaceable gas jet 212 positioned in the jet enclosure 210. The gas jet 212 provides a suitable supply of gas to a burner nozzle 214 that extends through and above the support member 26.

The solenoid 204 is actuable on receipt of a signal from a thermocouple indicated schematically at 216. In particular, the solenoid 204 is configured to maintain the safety valve 202 in the open condition while the thermocouple 216
senses a temperature above a predetermined value. For this purpose, the thermocouple 216 has a sensing tube 218 that extends from the safety valve 202 to a sensor 220 positioned proximate the burner nozzle 214. Thus, if a flame at the burner nozzle 214 is extinguished, the thermocouple no longer senses said temperature at the predetermined value and the safety valve 202 shuts off the gas supply.

An over-ride pushrod 222 extends through the support member 26 and the second end portions 106 of the preceding link 16. The pushrod 222 is engaged with the solenoid 204 to over-ride the solenoid 204 to open the safety valve 202, thereby releasing gas to the burner assembly 208.

An igniting mechanism in the form of a battery-powered piezo-electric lighter 224 is fast with the first end portion 162 of the lower link plate 160 of the succeeding link member 16. A starter button 226 of the piezo-electric lighter 224 extends through the second end portion 166 of the lower link plate 160 of the preceding link member 16.

A sparking lead 230 of the lighter 224 extends to a position proximate the burner nozzle 214 so that a spark generated by the sparking lead 230 can ignite the gas. The lighter 224 is of the type that generates a repetitive spark.

A lug 228 is fast with the pushrod 222 and makes contact with the starter button 226 of the piezo-electric lighter 224. Thus, when the pushrod 222 is depressed, the safety valve 202 is opened and gas is fed to the burner assembly 208. At the same time, the lighter 224 generates a repetitive spark at the burner nozzle 214 to ignite the gas.

It will readily be appreciated that the gas cylinder can be replaced by a town gas supply with an appropriate fitting or adapter.

A further outlet conduit 232 is connected to the valve body 186 to permit the gas cylinder 194 to be connected to a safety valve of a preceding heating station 156. The conduit 232 includes a length of flexible piping 234 to accommodate relative movement of the heating stations 156.
A burner enclosure 236 is mounted on the support member 26. The burner enclosure includes a floor 238 and a sidewall 240. The burner enclosure 236 is of stainless steel.

The floor 238 defines a pushrod opening 242 to accommodate the pushrod 222. Thus, a user can access the pushrod 222 from within the enclosure 236.

The floor 238 defines a burner nozzle and thermocouple sensor opening 244 to accommodate the burner nozzle 214 and the thermocouple sensor 220.

The floor 238 further defines a spindle opening 246 to accommodate the spindle 168.

The sidewall 240 defines a slot 249 to accommodate the lever arm 196 that extends through the slot 249. Thus, a user can adjust the gas flow to the burner nozzle 214 from a position outside of the burner enclosure 236.

The sidewall 240 is shaped to receive a stainless steel steam bowl 247. The sidewall 240 defines three spaced holding formations 248 on which the steam bowl 247 rests, in use. The steam bowl 247 has a stainless steel mesh 250 that spans the bowl 247 and defines a support surface for foods to be steam-heated.

Each formation 248 defines an airflow opening 252 to permit airflow to the gas burner nozzle 214.

The Applicant believes that the embodiments of the apparatus described above provide an efficient means for keeping conveyed food heated. This is particularly desirable in "food-train" - type restaurants which are becoming increasingly popular for such dishes as yum cha.
CLAIMS

1. An apparatus for heating conveyed foods, the apparatus comprising
   a carrier that is displaceable with respect to a substructure;
   a plurality of support structures that are arranged on the carrier, each
   support structure being configured to support a food receptacle above the carrier;
   and
   a plurality of fuel-burning heating devices that are operatively arranged with
   respect to the support structures so that heat generated by the heating devices is
   directed on to respective food receptacles.

2. An apparatus as claimed in claim 1, in which the carrier is in the form of an
   elongate, articulated arrangement that defines a closed loop and is capable of
   being driven along a closed, curved path defined by the substructure.

3. An apparatus as claimed in claim 1 or 2, in which each support structure
   includes a generally planar support member, the support members being mounted
   on the carrier in a nested configuration.

4. An apparatus as claimed in claim 3, in which each support structure further
   includes a plurality of holders, each holder being mounted on a respective support
   member and each holder having a floor and a wall, the floor being engageable with
   the respective support member and the wall being engageable with said food
   receptacle to support the food receptacle above the floor.

5. An apparatus as claimed in claim 4, in which each fuel-burning heating
   device includes a gas burner assembly that is fastened to the carrier and is
   connectable to a flammable gas supply, the gas burner assembly including a
   burner that extends through a respective support structure and through an opening
   defined in the floor of the holder to be directed towards the food receptacle.
6. An apparatus as claimed in claim 5, which includes a plurality of valve assemblies that are fastened to the carrier, the gas supply being in the form of a plurality of gas cylinders that are fastenable to the valve assemblies, each valve assembly being in fluid communication with a respective gas burner assembly to supply the gas burner assembly with fuel.

7. An apparatus as claimed in claim 6, which includes a plurality of valve control arms, each valve control arm extending through the carrier and a respective support structure to engage a respective valve assembly, the valve control arms being configured to open or close the valve assembly on manipulation of the valve control arm.

8. An apparatus as claimed in claim 7, in which each valve control arm extends through an opening defined in the floor of a respective holder so that the valve control arm can be manipulated from above the floor of the holder.

9. An apparatus as claimed in any one of claims 6 to 8, in which each valve assembly has an outlet that is in fluid communication with a respective gas burner assembly, a safety valve assembly being interposed between said outlet and the gas burner assembly, the safety valve assembly being configured to shut off gas to the gas burner in the event that the gas burner ceases to operate.

10. An apparatus as claimed in claim 9, in which the safety valve assembly includes a safety valve and a thermocouple operatively positioned with respect to the gas burner assembly, the safety valve being operable to shut off the gas supply to the burner assembly upon the thermocouple registering a temperature below a predetermined value in the region of the burner assembly.
11. An apparatus as claimed in claim 10, which includes an igniting mechanism that is operable by a user to ignite the burner assembly.

12. An apparatus as claimed in claim 11, in which the igniting mechanism includes a push rod and a piezo-electric device, the push rod extending through the floor of the holder to be accessible from above the floor and being engageable with the piezo-electric device so that a user can ignite the gas burner assembly by depressing the push rod.

13. An apparatus as claimed in claim 12, in which the safety valve is in a normally closed condition and is configured to assume a closed condition on receipt of a suitable signal from the thermocouple, the safety valve including an over-ride mechanism that is engaged with the push rod, so that depression of the push rod results in the safety valve being over-ridden into an open condition, thus releasing gas to the gas burner assembly so that ignition can take place.

14. An apparatus for the heating of conveyed foods that are carried on a support structure that is arranged on a carrier that is displaceable with respect to a substructure, the support structure being configured to support a food receptacle, wherein the heating apparatus comprises

   a fuel-burning heating device that is fastenable to the carrier to direct heat on to the receptacle.

14. A new apparatus for heating conveyed foods, substantially as described herein, with reference to the accompanying drawings.
### INTERNATIONAL SEARCH REPORT

**International application No.**

**PCT/AU/03/00513**

---

**A. CLASSIFICATION OF SUBJECT MATTER**

Int. Cl. 7: A47J 27/14, 37/00, B65G 49/00.

According to International Patent Classification (IPC) or to both national classification and IPC

---

**B. FIELDS SEARCHED**

Minimum documentation searched (classification system followed by classification symbols)

IPC A47J 27/14, 37/00, B65G 49/00.

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

AU IPC A47J 27/14, 37/00, B65G 49/00.

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

DWPI (B65G/IC OR A47J/IC) AND (SUSHI), (A47J 27/14, 37/IC, B65G 49/00) AND (CONVEY+), AND (HEAT+, WARM+, FOOD+, COOK+)

---

**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

<table>
<thead>
<tr>
<th>Category*</th>
<th>Citation of document, with indication, where appropriate, of the relevant passages</th>
<th>Relevant to claim No.</th>
</tr>
</thead>
</table>

[X] Further documents are listed in the continuation of Box C

See patent family annex

---

* Special categories of cited documents:

  - "A" document defining the general state of the art which is not considered to be of particular relevance
  - "E" earlier application or patent but published on or after the international filing date
  - "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
  - "O" document referring to an oral disclosure, use, exhibition or other means
  - "P" document published prior to the international filing date but later than the priority date claimed

  "T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

  "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

  "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

  "&" document member of the same patent family

---

Date of the actual completion of the international search: 16 July 2003

Date of mailing of the international search report: 28 JUL 2003

Name and mailing address of the ISA/AU

AUSTRALIAN PATENT OFFICE
PO BOX 200, WODEN ACT 2606, AUSTRALIA
E-mail address: pct@ipaustralia.gov.au
Facsimile No. (02) 6285 3929

Authorized officer

R. WEBER

Telephone No.: (02) 6283 2546

Form PCT/ISA/210 (second sheet) (July 1998)
<table>
<thead>
<tr>
<th>Category</th>
<th>Citation of document, with indication, where appropriate, of the relevant passages</th>
<th>Relevant to claim No.</th>
</tr>
</thead>
</table>