PCT WORLD INTELLECTUAL PROPERTY ORGANIZATION
International Bureau

INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification 5 :		(11) International Publication Number:
B65D 81/34, H05B 6/64	A1	WO 92/19515
		(43) International Publication Date: 12 November 1992 (12.11.92)

(21) International Application Number: PCT/CA92/00189

(22) International Filing Date: 29 April 1992 (29.04.92)

(30) Priority data:
695,920 6 May 1991 (06.05.91) US

(71) Applicant: BECKETT INDUSTRIES INC. [CA/CA]; 610 South Service Road, Oakville, Ontario L6K 2H4 (CA).

(72) Inventor: BECKETT, D., Gregory ; 2132 Nipigon Drive, Oakville, Ontario L6H 4E4 (CA).

(74) Agent: STEWART, Michael, I.; Sim & McBurney, 330 University Avenue, Suite 701, Toronto, Ontario M5G 1R7 (CA).

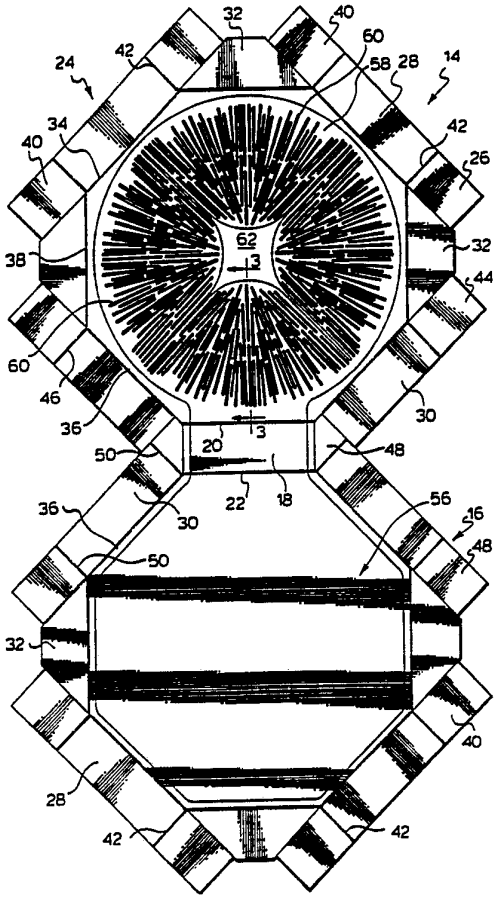
(81) Designated States: AT (European patent), AU, BE (European patent), BR, CH (European patent), DE (European patent), DK (European patent), ES (European patent), FR (European patent), GB (European patent), GR (European patent), IT (European patent), JP, KR, LU (European patent), MC (European patent), NL (European patent), SE (European patent).

Published
With international search report.
Before the expiration of the time limit for amending the claims and to be republished in the event of the receipt of amendments.

(54) Title: PIZZABOX FOR MICROWAVE HEATING

(57) Abstract

A pizza box (10) is described for microwave heating of frozen pizza for consumption. The box includes a lower tray portion (14) which receives the pizza (12), an upper lid portion (16) which encloses the tray and an integral wall portion (18) hingedly joining the upper lid portion and lower tray portion. A continuous electroconductive metal layer (56) having a thickness which is normally microwave opaque is provided extending between the lid portion and the tray portion through the wall portion. A metal layer in the tray portion (14) is provided with an array of slots (60) theretrough, which permits microwave energy conducted from the lid portion to the tray portion by the metal layer, to generate thermal energy to heat the pizza filling and crispen the crust.



FOR THE PURPOSES OF INFORMATION ONLY

Codes used to identify States party to the PCT on the front pages of pamphlets publishing international applications under the PCT.

AT	Austria
AU	Australia
BB	Barbados
BE	Belgium
BF	Burkina Faso
BG	Bulgaria
BJ	Benin
BR	Brazil
CA	Canada
CF	Central African Republic
CG	Congo
CH	Switzerland
CI	Côte d'Ivoire
CM	Cameroon
CS	Czechoslovakia
DE	Germany
DK	Denmark
ES	Spain
FI	Finland
FR	France
GA	Gabon
GB	United Kingdom
GN	Guinea
GR	Greece
HU	Hungary
IT	Italy
JP	Japan
KP	Democratic People's Republic of Korea
KR	Republic of Korea
LI	Liechtenstein
LK	Sri Lanka
LU	Luxembourg
MC	Monaco
MG	Madagascar
ML	Mali
MN	Mongolia
MR	Mauritania
MW	Malawi
NL	Netherlands
NO	Norway
PL	Poland
RO	Romania
RU	Russian Federation
SD	Sudan
SE	Sweden
SN	Senegal
SU	Soviet Union
TD	Chad
TG	Togo
US	United States of America

PIZZA BOX FOR MICROWAVE HEATING

FIELD OF INVENTION

The present invention is directed to box-like structures, particularly adapted for microwave heating of frozen food products, such as frozen pizzas.

BACKGROUND TO THE INVENTION

It is known to heat a variety of foodstuffs for consumptions by the application of microwave energy. Microwave heating occurs by the excitation of water molecules within the body of the foodstuff. This manner of heating is different from conventional oven heating, which involves heating from exterior of the food product. While both methods are effective in heating food products, nevertheless one significant difference exists, in that microwave cooking does not produce browning and crispening of the exterior of the product.

This difference is of no significance with some food products but is of considerable significant with other products, such as those having a pastry shell, for example, a frozen pizza. Frozen pizzas reconstituted in a microwave oven tend to be soggy and lack crispness in the pastry, whereas such crispness is attainable by reconstituting in a conventional oven.

It has been suggested to supplement microwave cooking to achieve crispness of the type found with conventional oven heating by using a thin metal film in contact with the pie crust. The ability to generate thermal energy from such thin metal films is described, for example, in U.S. Patent No. 4,641,005, the disclosure of which is incorporated herein by reference. The thermal energy produced by the thin metal film from the incident microwave energy browns and crispens the pie crust with which it is in contact. The utilization of such thin metal films in box-like structure particularly adapted for pizzas, is described, for

example, in US Patent Nos. 4,592,914, 4,891,482 and 4,940,867, the disclosures of which are incorporated herein by reference.

While some success in achieving a crispened and browned pie crust can be achieved using such thin metal films, the microwave-reconstituted pizza lacks an evenness of heating and, hence, does not match the quality of product which is attained when a conventional oven is employed.

However, reconstitution of frozen foodstuffs, such as frozen pizzas, by the application of microwave energy generally is much quicker than by a conventional oven and hence is highly desirable. The present invention is directed towards the provision of a box structure for a variety of frozen food products which is able to achieve more even heating during microwave reconstitution of such frozen foodstuffs by the application of microwave energy, as well as crispening and browning the crust.

SUMMARY OF INVENTION

In the present invention, there is provided a box-like structure having a lower tray portion and an upper lid portion cooperating with the lower tray portion to define an enclosure for the foodstuff. Preferably, the upper lid portion is hingedly joined to the lower tray portion through an integral hinge line.

The lower tray portion and upper lid portion have microwave-energy controlling elements associated therewith to control the distribution of microwave energy within the enclosure. By controlling the distribution of microwave energy within the enclosure, a foodstuff may be heated by microwave energy in the most desirable manner consistent with its form to provide a uniformly-cooked product for consumption.

The lower tray portion of the structure may incorporate a microwave energy heating structure whereby a portion of incident microwave energy is converted to

thermal energy which is transferred to the foodstuff in contact with the structure. The heating structure may comprise a thin metal film, as described in the aforementioned U.S. Patent No. 4,641,005, a combination of such thin metal film and a grid of electroconductive material, as described in U.S. Patent No. 4,927,991, the disclosure of which is incorporated herein by reference, or a layer of electroconductive material normally opaque to microwave energy and having an array of slots therethrough, as more particularly described in my copending United States patent application Serial No. 535,168 filed June 8, 1990 ("Amaze-Met"), the disclosure of which is incorporated herein by reference, and assigned to the assignee hereof.

Alternatively, the lower tray portion may incorporate an element which is opaque to microwave energy, such as a layer of aluminum foil. The element may have one or more apertures therein to permit a controlled amount of microwave energy to pass therethrough.

The lower tray portion also may incorporate a combination of an element opaque to microwave energy and a microwave energy heating structure to provide a desired combination of thermal energy generation and microwave energy shielding.

The upper lid portion of the structure may incorporate a microwave energy heating structure, an element at least partially opaque to microwave energy or a combination of the two, as in the case of the lower tray portion. The structure incorporated into the upper lid portion of any particular box-like structure may be the same as that incorporated into the lower tray portion of that box-like structure or different from that incorporated into the lower tray portion.

The structure of both the lower tray portion and upper lid portion generally comprises an outer layer of

paperboard of sufficient structural strength to provide the box-like structure, an inner layer of polymeric material coincident with the paperboard layer and the element(s) incorporated into the lower tray portion and the upper lid portion incorporated therein.

In one preferred embodiment of the present invention, there is provided a novel box-like structure particularly adapted for the microwave reconstitution of frozen pizzas for consumption, comprising a lower tray portion and an upper lid portion hingedly joined to the lower tray portion by wall means to define an enclosure for a frozen pizza.

The lower tray portion supports a thermal energy generating layer of electroconductive material on the inner surface thereof dimensioned to receive thereon a pie crust of a frozen pizza to be reconstituted in the box-like structure.

The lid portion supports a continuous layer of microwave-opaque electroconductive material on the inner surface thereof and dimensioned to shield the frozen pizza substantially from microwave energy incident on the lid of the box-like structure.

The wall means supports a continuous layer of microwave-opaque electroconductive material joined to both the microwave heat susceptor layer and the continuous layer of microwave opaque material.

By this arrangement, the proportion of incident microwave energy to which the frozen pizza is directly exposed may be controlled from none at all when the continuous microwave-opaque layer supported by upper lid portion completely covers the frozen pizza to a controlled minor amount when one or more open areas are provided in the continuous microwave-opaque layer, such as adjacent the centre of the lid.

The incident microwave energy instead is conducted by the continuous layer of microwave-opaque

electroconductive material supported by the wall means to the microwave heat susceptor layer, so that the microwave energy is converted into thermal energy by the susceptor in contact with the pizza pie crust to heat the pizza for consumption. The generation of thermal energy in contact with the pie crust ensures that the pie crust is both cooked and browned, while the pie filling also is cooked to a form suitable for consumption.

BRIEF DESCRIPTION OF DRAWINGS

Figure 1 is a perspective view of a pizza box provided in accordance with one embodiment of the invention in a closed position;

Figure 2 is a plan view of a blank from which the pizza box of Figure 1 may be assembled;

Figure 3 is a sectional view of the blank for the pizza box taken along line 3-3 of Figure 2;

Figure 4 is an enlarged form of the sectional view of Figure 3; and

Figure 5 is a perspective view of the pizza box of Figure 1 in an open position.

DESCRIPTION OF PREFERRED EMBODIMENT

Referring to the drawings, there is illustrated therein a pizza box 10 suitable for housing and microwave reconstituting a frozen pizza 12 for consumption. The pizza box 10 usually comprises the structure within which the pizza 12 is marketed, or may be provided separately for receipt therein of a frozen pizza 12 from another source.

The pizza box 10 comprises a lower tray portion 14 and a upper lid portion 16 which is joined to the lower tray portion 14 by a wall portion 18 integrally connected to the lower tray portion 14 and upper lid portion 16 by fold lines 20 and 22.

The pizza box 10 is formed from a unitary blank 24 (see Figure 2) by appropriate folding and gluing of

panels. The lower tray portion 14 and upper lid portion 16 comprise a main panel 26 of octagonal outline. The octagonal nature of the structure of the pizza box 10 is only one of a variety of convenient shapes which may be adapted. For example, the pizza box 10 may be square shaped.

The main panels 26 are joined to side panels 28, 30, 32 along fold lines 34, 36 and 38 respectively. Side panels 28 have wing panels 40 joined thereto along fold lines 42 while side panel 30 connected to the tray main panel 26 has a single wing panel 44 joined thereto along fold line 46 and side panel 30 connected to the lid main panel 26 has wing panels 48 joined thereto along fold lines 50. The latter arrangement may be reversed, if desired.

To assemble the pizza box 10 from the blank 24, the panels 32 first are folded up about their respective fold lines 28 and the panels 28 and 30 are folded up about their respective fold lines 34 and 36. The inner face of the various wing panels 40, 44 and 48 have adhesive applied thereto enable them to be adhered to the outer face of panels 32. Such adhesive may conveniently be provided with pealable covers to be removed when the pizza box 10 is readily to be assembled. The wing panels 40 and 44 are bent inwardly about their respective fold lines 42 and 46 to engage and adhere to the outer surface of panels 32. The wing panels 48 also are bent inwardly about their fold lines 50, in one instance to engage and adhere to the outer surface of adjacent panels 32. The lid portion 16 then is folded about line 22 and the other wing panels 48 are bent inwardly about their fold line 50 to engage and adhere to the outer surface of the wall portion 18.

The blank 24 comprises a lower layer 52 of paperboard or similar stock material having sufficient structural strength to permit a relatively rigid box-

like structure to be assembled from the blank 24 and an upper layer 54 of polymeric material, such as polyester or polyethylene, which extends for the same dimensions as the paperboard layer 52. Sandwiched between the paperboard layer 52 and the upper polymeric film layer 54 is a continuous metal layer 56 which is of sufficient thickness as normally to be microwave opaque.

As may be seen particularly in Figure 2, the portion 58 of the metal layer 56 located in the tray portion 14 of the pizza box 10 is provided with an array of radially-directed slots 60 through the thickness of the metal layer. The metal layer portion 58 has a generally circular shape to conform in shape and dimension to the pizza 12 to be housed in the tray. The central region 62 of the metal layer portion 58 is free from metal.

The array of radially-directed slots 60 allows thermal energy to be generated therefrom when the metal layer portion 58 is exposed to microwave energy, as more particularly described in my aforementioned copending United States patent application Serial No. 475,326 ("Amaze-Met").

The slots or apertures 60 are elongate and each is generally no shorter than about 1.75 cm but may extend to any desirable length. An individual slot or aperture may vary in width from about 1 mm to about 2 cm, provided that the length is greater than the width.

The array of radially-directed slots 60 and the central open region 62 may be provided in any convenient manner. Preferably, this structure is provided by selective demetallization of the metal layer 58 supported by the polymeric film layer 54, using aqueous etchant in one of the procedures described in U.S. Patent Nos. 4,398,994 and 4,552,614, the disclosures of which are incorporated herein by reference.

The metal layer 58 may comprise any

electroconductive metal having a thickness so as to normally be microwave opaque. One convenient metal which may be employed in aluminum, which may have a thickness of about 1 to about 15 microns, typically about 7 microns. Aluminum of that thickness is commercially available and may be laminated to polymeric film. Rolls of such laminate may be selectively demetallized, as discussed above, to provide the required outline shape of the metal layer 58 and the etched out array 60 and central region 62. The polymeric film 54 with etched metal layer 56 supported thereon then may be laminated in any convenient manner using conventional laminating adhesives to the paperboard layer 52 to form the blank 24.

OPERATION

In use, the pizza tray 10, in a closed condition as seen in Figure 1, has a frozen pizza 12 seated on the polymeric film layer 54, which also may have a food-grade release agent applied thereon, in coincidence with the metal layer portion 58. When it is desired to heat the frozen pizza 12 for consumption, the pizza tray 10 is exposed to microwave energy.

The continuous microwave opaque metal layer 56 in the lid portion 16 permits no microwave energy to pass directly to the pizza but rather directs the microwave energy, via the metal layer on the wall portion 18 to the metal layer 58 in the lower tray portion 14.

By virtue of the presence of the array 60 of slots, the microwave energy is converted to thermal energy, which then heats the pizza crust and filling. The open centre region 62 ensures that there is no overheating of the pizza in this region. This arrangement permits an even heating of the pizza filling to be achieved, as well as satisfactory browning and crispening of the crust.

The metal layer 56 in the lid portion 16 need not

be wholly opaque but rather one or more openings therethrough may be provided, for example, a central opening, to permit a controlled amount of the incident microwave energy to pass through the lid directly to the pizza filling.

SUMMARY OF DISCLOSURE

In summary of this disclosure, the present invention provides a novel box structure which is able to achieve a much more uniform heating of a frozen food product for consumption. Modifications are possible within the scope of this invention.

CLAIMS

What I claim is:

1. A box-like structure for the microwave reconstitution of foodstuffs housed in the structure to an edible form, which comprises:

a lower tray portion and an upper lid portion cooperating with said lower tray portion to define an enclosure for the foodstuff,

said lower tray portion and said upper lid portion having microwave-energy controlling elements associated therewith to control the distribution of microwave energy within said enclosure to achieve a desired heating of the foodstuff.

2. The structure of claim 1 wherein said lower tray portion has at least one microwave energy controlling element which is a microwave energy heating element which develops thermal energy from incident microwave energy when in contact with the foodstuff.

3. The structure of claim 1 wherein said lower tray portion has at least one microwave energy controlling element which is at least partially microwave opaque.

4. The structure of claim 1 wherein said lower tray portion has at least one microwave energy controlling element which is a combination of a microwave energy heating element which develops thermal energy from incident microwave energy when in contact with the foodstuff and an element which is at least partially microwave opaque.

5. The structure of claim 1 wherein said upper lid portion has at least one microwave energy controlling element which is a microwave energy heating element which develops thermal energy from incident microwave energy when in contact with the foodstuff.

6. The structure of claim 1 wherein said upper lid portion has at least one microwave energy controlling element which is at least partially microwave opaque.

7. The structure of claim 1 wherein said upper lid portion has at least one microwave energy controlling element which is a combination of a microwave energy heating element which develops thermal energy from incident microwave energy when in contact with the foodstuff and an element which is at least partially microwave opaque.

8. The structure of claim 2, 3, 4, 5, 6 or 7 wherein said lid portion has at least one microwave energy controlling element which is the same as the at least one microwave controlling element of the lower tray portion.

9. The structure of claim 2, 3, 4, 5, 6 or 7 wherein said lid portion has at least one microwave energy controlling element which is different from the at least one microwave controlling element of the lower tray portion.

10. The structure of claim 1 wherein said lower tray portion and said upper lid portion are formed from a laminate of an outer paperboard layer, an inner polymeric film layer and at least one microwave-energy controlling element sandwiched therebetween.

11. The structure of claim 10 wherein said microwave energy controlling element is formed from aluminum.

12. A box-like structure for the microwave reconstitution of frozen pizzas housed in the structure to edible form, comprising:

a lower tray portion and an upper lid portion hingedly joined to said lower tray portion by wall means to define an enclosure for a frozen pizza,

said lower tray portion supporting a thermal energy generating layer of electroconductive material on the inner surface thereof dimensioned to receive thereon a pie crust of a frozen pizza to be reconstituted in said structure,

said upper tray portion supporting a continuous

layer of microwave-opaque electroconductive material on the inner surface thereof and dimensioned to shield the frozen pizza substantially from microwave energy incident on said box-like structure, and

said wall means supporting a continuous layer of microwave-opaque electroconductive material joined to both said microwave heat susceptor layer and said continuous layer of microwave opaque material.

13. The structure of claim 12 wherein said continuous layer of microwave-opaque electroconductive material has an aperture therein to permit a controlled degree of incident thermal energy to pass through said upper lid portion into the enclosure.

14. The structure of claim 12 which is formed from a unitary blank comprising an outer layer of paperboard, an inner layer of polymeric material and said thermal energy generating layer of electroconductive material and said continuous layers of microwave-opaque electroconductive material sandwiched therebetween.

15. The structure of claim 14 wherein said thermal energy generating layer of electroconductive material and said continuous layers of microwave-opaque electroconductive material comprise a single unitary element.

16. The structure of claim 15 wherein said single unitary element is comprised of aluminum foil of thickness of about 1 to about 15 microns.

17. The structure of claim 16 wherein said thermal energy generating layer of electroconductive material comprises an array of generally radially-directed slots through said material dimensioned so as to generate thermal energy in contact with the pizza pie crust when the structure is exposed to microwave energy.

18. The structure of claim 17 wherein each of the slots has a longitudinal dimension of at least about 1.75 cm and a transverse dimension from about 1 mm to about 2

cm.

19. The structure of claim 18 wherein said blank is formed by the steps of:

laminating a layer of aluminum foil to a polymeric material layer,

applying etchant resistant material to the layer of aluminum foil in regions thereof from which aluminum is not to be removed,

applying an etchant for aluminum to said layer of aluminum foil to remove aluminum completely from regions thereof not protected by said etchant resistant material, and

laminating the etched material to paperboard layer.

20. The structure of claim 19 wherein said etchant is aqueous sodium hydroxide solution.

FIG.1.

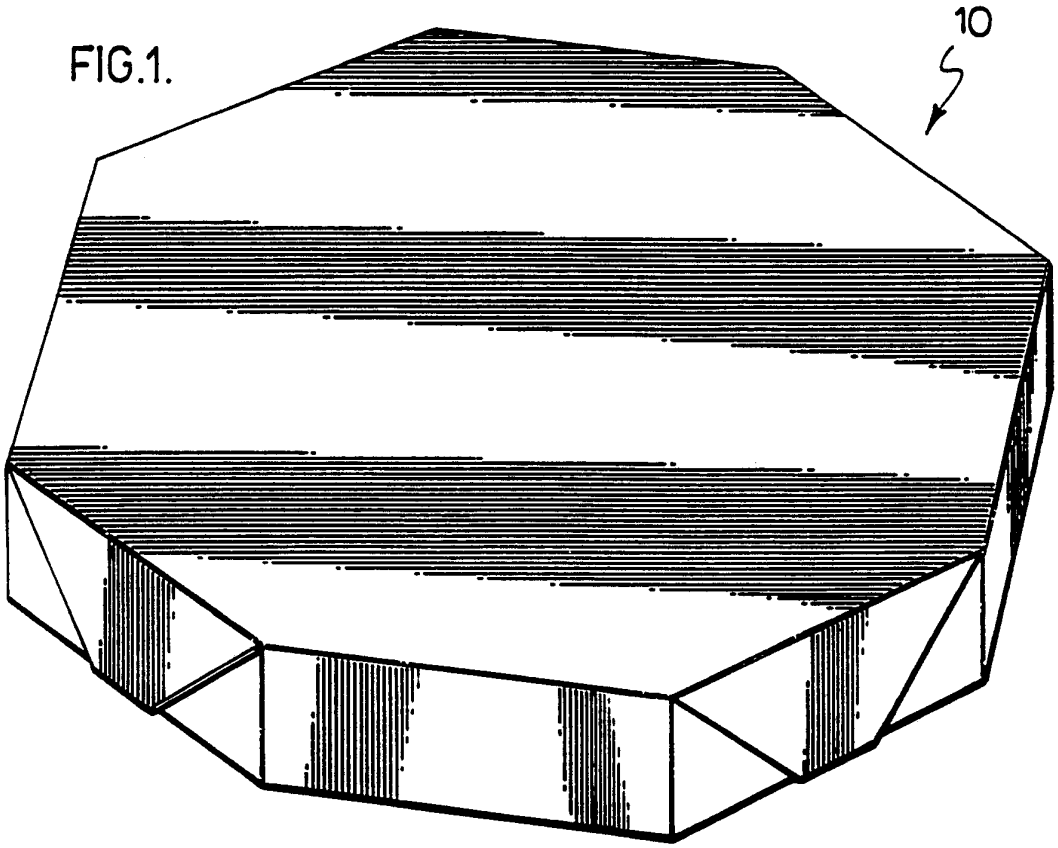


FIG.3.

FIG.4.

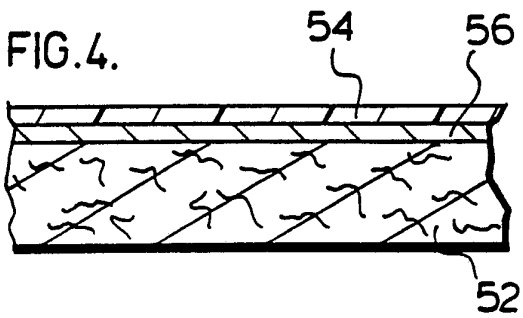
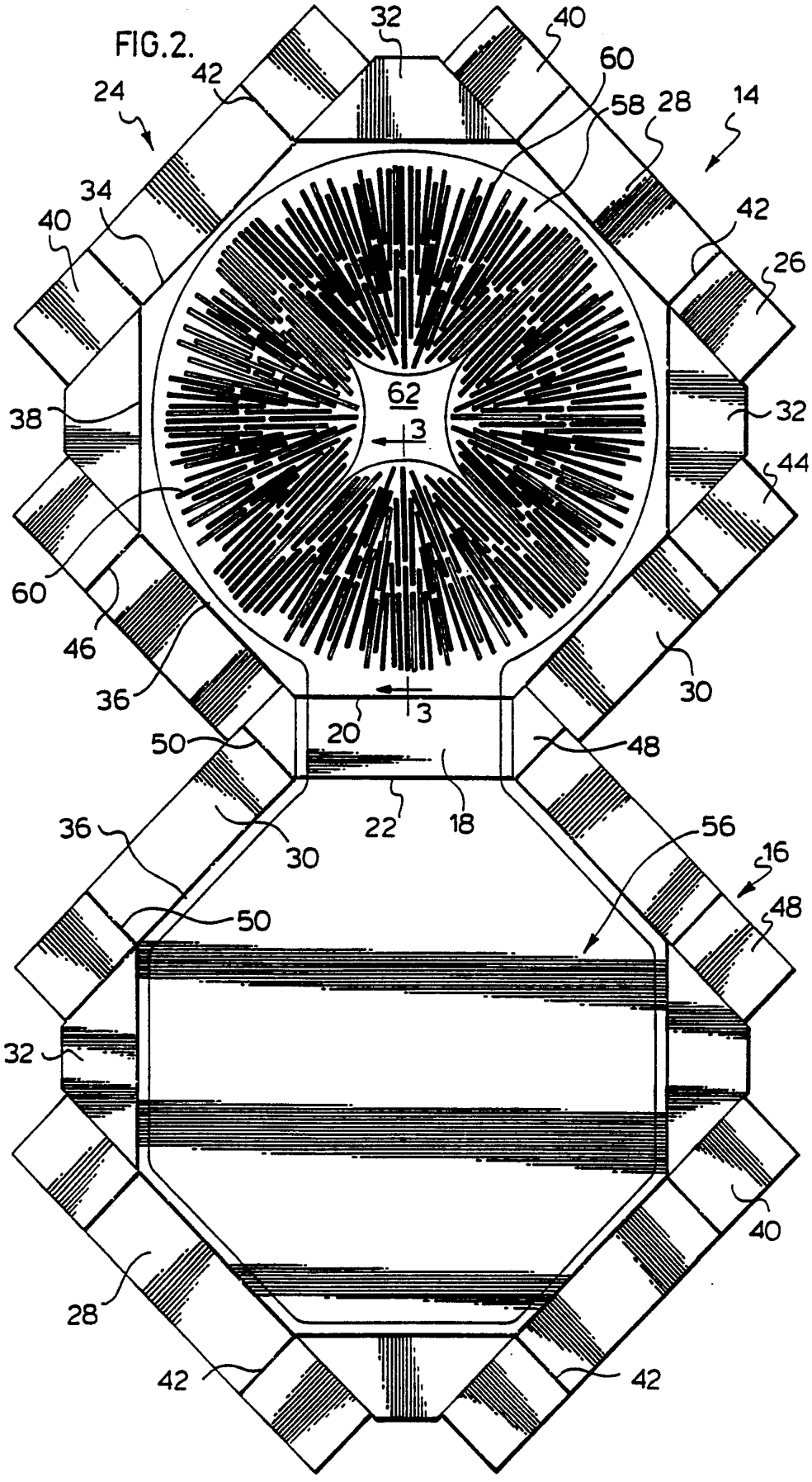


FIG.2.


32
40
60
42
24
58
28
14
34
42
40
26
62
38
3
32
44
60
46
36
30
3
20
50
48
22
18
36
30
56
16
50
48
32
40
28
42
42

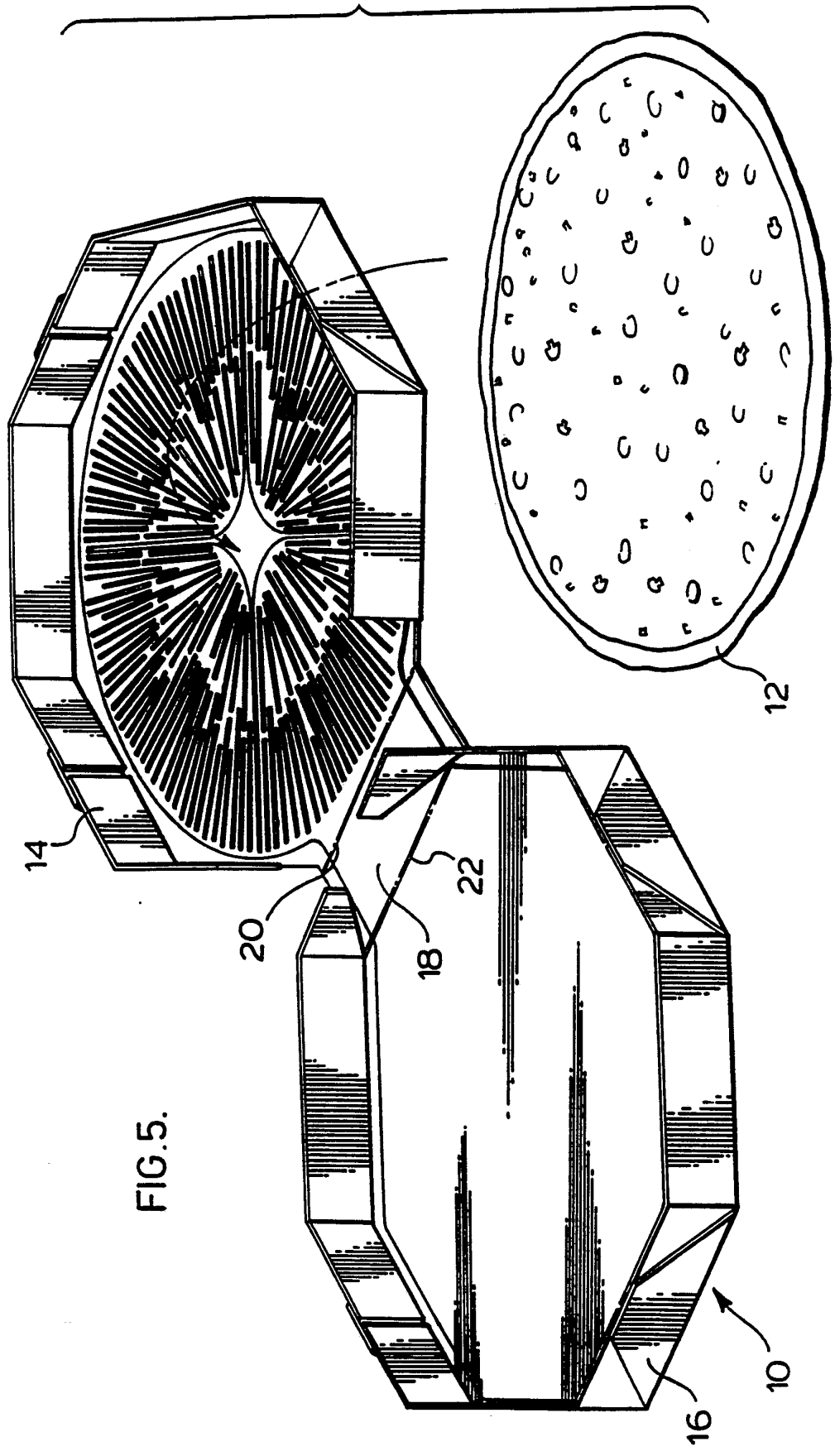


FIG.5.

INTERNATIONAL SEARCH REPORT

International Application N° PCT/CA 92/00189

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all)[6]

According to International Patent Classification (IPC) or to both National Classification and IPC

Int.Cl. 5 B65D81/34; H05B6/64

II. FIELDS SEARCHED

Minimum Documentation Searched[7]

Classification System	Classification Symbols
Int.Cl. 5	B65D ; H05B

Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched[8]

III. DOCUMENTS CONSIDERED TO BE RELEVANT[9]

Category °	Citation of Document,[11] with indication, where appropriate, of the relevant passages[12]	Relevant to Claim No.[13]
X	EP,A,0 336 325 (PACKAGING CORP. OF AMERICA) 11 October 1989 see column 5, line 18 - column 6, line 40	1-12
Y	see column 7, line 7 - line 35; figures 1-3 see column 9, line 9 - line 37	13-20
Y,P	WO,A,9 111 893 (BECKETT INDUSTRIES) 8 August 1991 cited in the application see claims 1-9; figures 1-3	14-18
Y	US,A,4 703 148 (B. MIKULSKI) 27 October 1987 see column 3, line 46 - line 65; figures 2-4	13
X	WO,A,8 805 249 (MARDON & HALL LTD) 14 July 1988 see page 7, line 1 - page 9, line 16	1,2
A	see claims 1, 12; figures 1-7	3-11

-/--

° Special categories of cited documents :[10]

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document 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

"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

IV. CERTIFICATION

Date of the Actual Completion of the International Search	Date of Mailing of this International Search Report
04 AUGUST 1992	11. 09. 92
International Searching Authority	**Signature of Authorized Officer**
EUROPEAN PATENT OFFICE	PERNICE C.

III. DOCUMENTS CONSIDERED TO BE RELEVANT (CONTINUED FROM THE SECOND SHEET)

Category °	Citation of Document, with indication, where appropriate, of the relevant passages	Relevant to Claim No.
A	US,A,4 836 383 (R.L.GORDON) 6 June 1989 see column 2, line 4 - column 3, line 32; figures 1,2	1-6
A	EP,A,0 382 399 (ALCAN INT'L LTD) 16 August 1990 see page 4, line 53 - page 5, line 31 see page 6, line 12 - line 29; figures 1,2,7	12-18
Y	US,A,4 398 994 (D.E. BECKETT) 16 August 1983 cited in the application see the whole document	19,20

ANNEX TO THE INTERNATIONAL SEARCH REPORT ON INTERNATIONAL PATENT APPLICATION NO. CA 9200189 SA 58785

This annex lists the patent family members relating to the patent documents cited in the above-mentioned international search report. The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information. 31/07/92

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP-A-0336325	11-10-89	US-A- 4866232	12-09-89
WO-A-9111893	08-08-91	AU-A- 7150291	21-08-91
		US-A- 5117078	26-05-92
US-A-4703148	27-10-87	CA-A- 1281007	05-03-91
WO-A-8805249	14-07-88	GB-A- 2207589	01-02-89
		AU-A- 1050688	27-07-88
		GB-A- 2220334	04-01-90
US-A-4836383	06-06-89	None	
EP-A-0382399	16-08-90	AU-A- 4917190	16-08-90
		JP-A- 2270294	05-11-90
US-A-4398994	16-08-83	US-A- 4517045	14-05-85