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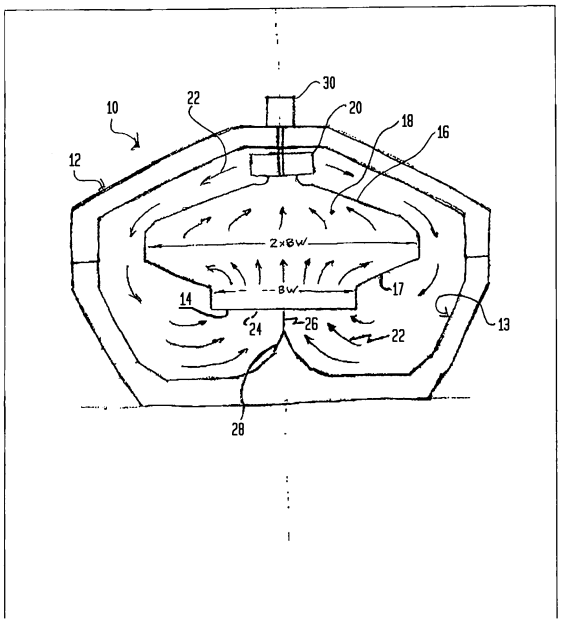
(54) APPARATUS FOR CHILLING AND/OR FREEZING PRODUCTS

(57) In order to overcome the limitations and problems that earlier apparatus and methods have experienced, a cryogenic freezer apparatus (10) is proposed, said apparatus (10) comprising:
- a housing (12);
- a fluidized bed belt (14) movable within the housing (12);
-a shroud (16) positioned within the housing (12) for providing a zone (18) above the belt (14), the shroud (16) angled outward (17) from the belt (14) within the housing (12); and
- a least one blower (20) positioned within the housing (12) in fluid communication with the zone (18) and centrally located above the zone (18) and the shroud (16).

A related method of moving cryogenic gas to a fluidized bed belt (14) in a freezer (10) is also proposed.

FIG. 1



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Description

Technical field of the present invention

[0001] The present invention relates an apparatus for chilling and/or freezing at least one product, in particular at least one food product; more particularly, the present invention relates to a cryogenic freezer apparatus; even more particularly, the present invention relates to a fluidized bed freezer.

[0002] The present invention further relates a corresponding method.

Technological background of the present invention

[0003] Known cryogenic fluidized bed freezers utilize blowers to pressurize a bed of the freezer, and to provide gas flow to drive heat transfer from the product to the gas. The known blowers are offset to a side of the fluidized bed zone of the freezer.

[0004] The blowers force the gas downward, where the gas impacts and is driven across the floor of the freezer whereupon the gas then impacts a sidewall of the freezer to then be turned upward and through the fluid bed belt transporting the product.

[0005] Unfortunately, the plurality of turns that the gas is required to make causes the gas flow and therefore the gas velocity to vary dramatically throughout the fluid bed belt length and width. In order to reduce this variation, baffles are positioned below the bed, but this baffle placement causes pressure drop in the freezer and therefore, more power is required to drive the blowers to maintain acceptable heat transfer rates.

[0006] An additional problem is that fluidization velocity is limited to no more than approximately 1000 feet per minute (being approximately 5.08 meter per second) in order to prevent and at least minimize product carry-over into the blower zone when peak velocities are used.

Disclosure of the present invention: object, solution, advantages

[0007] Starting from the disadvantages and shortcomings as described above as well as taking the prior art as discussed into account, an object of the present invention is to overcome the limitations and problems that earlier apparatus and methods have experienced.

[0008] This object is accomplished by an apparatus comprising the features of claim 1 as well as by a method comprising the features of claim 9. Advantageous embodiments, expedient improvements and other optional features of the present invention are set forth herein and disclosed in the respective dependent claims.

[0009] There is provided herein a cryogenic fluidized bed freezer with gas flow path, namely a cryogenic freezer apparatus embodiment which includes a housing; a fluidized bed belt movable within the housing; a shroud positioned within the housing for providing a zone above the belt, the shroud angled outward from the belt within the housing; and a least one blower positioned within the housing in fluid communication with the zone and centrally located above the zone and the shroud.

[0010] Another advantageous embodiment of the apparatus may include the belt comprising a first width within the housing, and the zone may comprise a second width within the housing greater than the first width.

[0011] Another expedient embodiment of the apparatus may include the second width being twice as wide as the first width.

[0012] Another favoured embodiment of the apparatus may include the shroud angled outward fifteen degrees from the belt.

[0013] Another preferred embodiment of the apparatus may further include a divider, in particular a belt divider, positioned below the belt for guiding gas flow to the belt.

[0014] Another advantageous embodiment of the apparatus may include the housing comprising an inner surface having a construction which may direct gas flow within the housing to an underside of the belt.

[0015] There is also provided herein a method embodiment of moving cryogenic gas to a fluidized bed belt in a freezer which includes shrouding a zone within the freezer having a first pressure above the belt; positioning at least one blower centrally located above the zone and the belt; directing a flow of cryogenic gas from the at least one blower to an underside of the belt at a second pressure greater than the first pressure; and moving the flow of cryogenic gas through the belt into the zone.

[0016] Another expedient embodiment of the method may further include reducing a velocity of the flow upon the flow entering into the zone from the belt.

[0017] Another favoured embodiment of the method may further include comprising angling outward the flow upon entry into the zone for the reducing of the velocity of the flow.

[0018] Another preferred embodiment of the method further may include directing the flow of cryogenic gas with an interior surface of the freezer toward the underside of the belt.

[0019] Another advantageous embodiment of the method further may include dividing the flow of the cryogenic gas at the underside of the belt before moving the flow through the belt.

[0020] Another expedient embodiment of the method may include the moving the flow of the cryogenic gas through the belt being at a substantially constant velocity throughout a length and width of the belt.

[0021] The apparatus according to the present invention as well as the method according to the present invention may be used to chill and/or to freeze at least one product, in particular at least one food product.

Brief description of the drawings

[0022] For a more complete understanding of the present embodiment disclosures and as already dis-

cussed above, there are several options to embody as well as to improve the teaching of the present invention in an advantageous manner. To this aim, reference may be made to the claims dependent on claim 1 as well as on claim 9; further improvements, features and advantages of the present invention are explained below in more detail with reference to a particular and preferred embodiment by way of non-limiting example and to the appended drawing figure taken in conjunction with the following description of exemplary embodiments, of which:

FIG. 1 shows a cryogenic fluidized bed freezer with gas flow path embodiment of the present invention, said embodiment working according to the method of the present invention.

[0023] The accompanying drawing is included to provide a further understanding of the apparatus and method(s) provided herein and is incorporated in and constitutes a part of this specification. The drawing illustrates an embodiment of the apparatus and method(s) provided herein and, together with the description, serves to explain the principles described herein but is not intended to limit the specification or any of the claims.

Detailed description of the drawings;

best way of embodying the present invention

[0024] Before explaining the present inventive embodiment in detail, it is to be understood that the embodiment is not limited in its application to the details of construction and arrangement of parts illustrated in the accompanying drawing, since the present invention is capable of other embodiments and of being practiced or carried out in various ways. Also, it is to be understood that the phraseology or terminology employed herein is for the purpose of description and not of limitation.

[0025] In the following description, terms such a horizontal, upright, vertical, above, below, beneath and the like, are used solely for the purpose of clarity illustrating the present invention and should not be taken as words of limitation. The drawings are for the purpose of illustrating the present invention and are not intended to be to scale.

[0026] An improved flow pattern can be seen in the attached schematic of FIG. 1 for the present cryogenic fluidized bed freezer apparatus embodiment 10 that will provide a more even and uniform gas flow and velocity to the bed by placing the blowers centered and directly above the fluid bed zone.

[0027] Such an arrangement provides higher fluid bed velocities in the bed by doubling cross-sectional area above the fluid bed zone and therefore, reducing by one half a velocity in the zone which will prevent product carry-over, prevent lower pressure drop throughout the system and thereby reduce specific blower power and improving system efficiency.

[0028] The cryogenic fluidized bed freezer 10 of the present embodiments includes a housing 12, a fluidized bed belt 14 with a width BW, and a shroud 16 attached above the belt 14 that angles outward 17 at fifteen degrees on both sides of the belt 14 to a width of 2 x BW in order to provide a zone 18 above the belt 14 wherein a velocity of one-half that of the velocity through the fluidized bed belt 14 in order to prevent carry-over of a product, in particular of a food product, into the blower area.

[0029] Blowers 20 are mounted centrally above the fluidized bed shroud 16, so that half of the flow generated is sent to each side of the fluidized bed providing a substantially constant velocity throughout the bed length and width. An inner surface 13 of the housing 12 also directs the gas flow 22 to an underside 24 of the belt 14.

[0030] A belt divider 26 and gas flow guide 28 are mounted below the fluid bed belt 14 to provide uniform and constant gas flow and velocity across the fluid bed zone.

[0031] It will be understood that the embodiments described herein are merely exemplary, and that one skilled in the art may make variations and modifications without departing from the spirit and scope of the present invention. All such variations and modifications are intended to be included within the scope of the present invention as described and claimed herein. Further, all embodiments disclosed are not necessarily in the alternative, as various embodiments of the present invention may be combined to provide the desired result.

List of reference signs

[0032]

10	apparatus, in particular freezer apparatus, for example cryogenic freezer apparatus
12	housing
13	inner surface of housing 12
14	belt, in particular bed belt, for example fluidized bed belt
16	shroud
17	outward angle of belt 14
18	zone above belt 14
20	blower
22	gas flow, in particular flow of cryogenic gas
24	underside of belt 14
26	divider, in particular belt divider
28	gas flow guide
30	motor
BW	first width, in particular first width within housing 12, for example width of belt 14

Claims

1. A cryogenic freezer apparatus (10), comprising:

- a housing (12);
- a fluidized bed belt (14) movable within the housing (12);
- a shroud (16) positioned within the housing (12) for providing a zone (18) above the belt (14), the shroud (16) angled outward (17) from the belt (14) within the housing (12); and
- a least one blower (20) positioned within the housing (12) in fluid communication with the zone (18) and centrally located above the zone (18) and the shroud (16).

2. The apparatus according to claim 1, wherein the belt (14) comprises a first width (BW) within the housing (12), and the zone (18) comprises a second width within the housing (12) greater than the first width (BW).

3. The apparatus according to claim 2, wherein the second width is about twice as wide as the first width (BW).

4. The apparatus according to at least one of claims 1 to 3, wherein the shroud (16) is angled outward (17) about fifteen degrees from the belt (14).

5. The apparatus according to at least one of claims 1 to 4, further comprising a divider (26) positioned below the belt (14) for guiding (28) gas flow (22) to the belt (14).

6. The apparatus according to claim 5, wherein the divider (26) is a belt divider.

7. The apparatus according to at least one of claims 1 to 6, wherein the housing (12) comprises an inner surface (13) having a construction which directs gas flow (22) within the housing (12) to an underside (24) of the belt (14).

8. The apparatus according to at least one of claims 1 to 7, wherein at least one food product is chilled and/or frozen.

9. A method of moving cryogenic gas to a fluidized bed belt (14) in a freezer (10), comprising:

- shrouding (16) a zone (18) within the freezer (10) having a first pressure above the belt (14);
- positioning at least one blower (20) centrally located above the zone (18) and the belt (14);
- directing a flow (22) of the cryogenic gas from the at least one blower (20) to an underside (24) of the belt (14) at a second pressure greater than the first pressure; and
- moving the flow (22) of cryogenic gas through the belt (14) into the zone (18).

10. The method according to claim 9, further comprising reducing a velocity of the flow (22) upon the flow (22) entering into the zone (18) from the belt (14).

11. The method according to claim 10, further comprising angling outward (17) the flow (22) upon entry into the zone (18) for the reducing of the velocity of the flow (22).

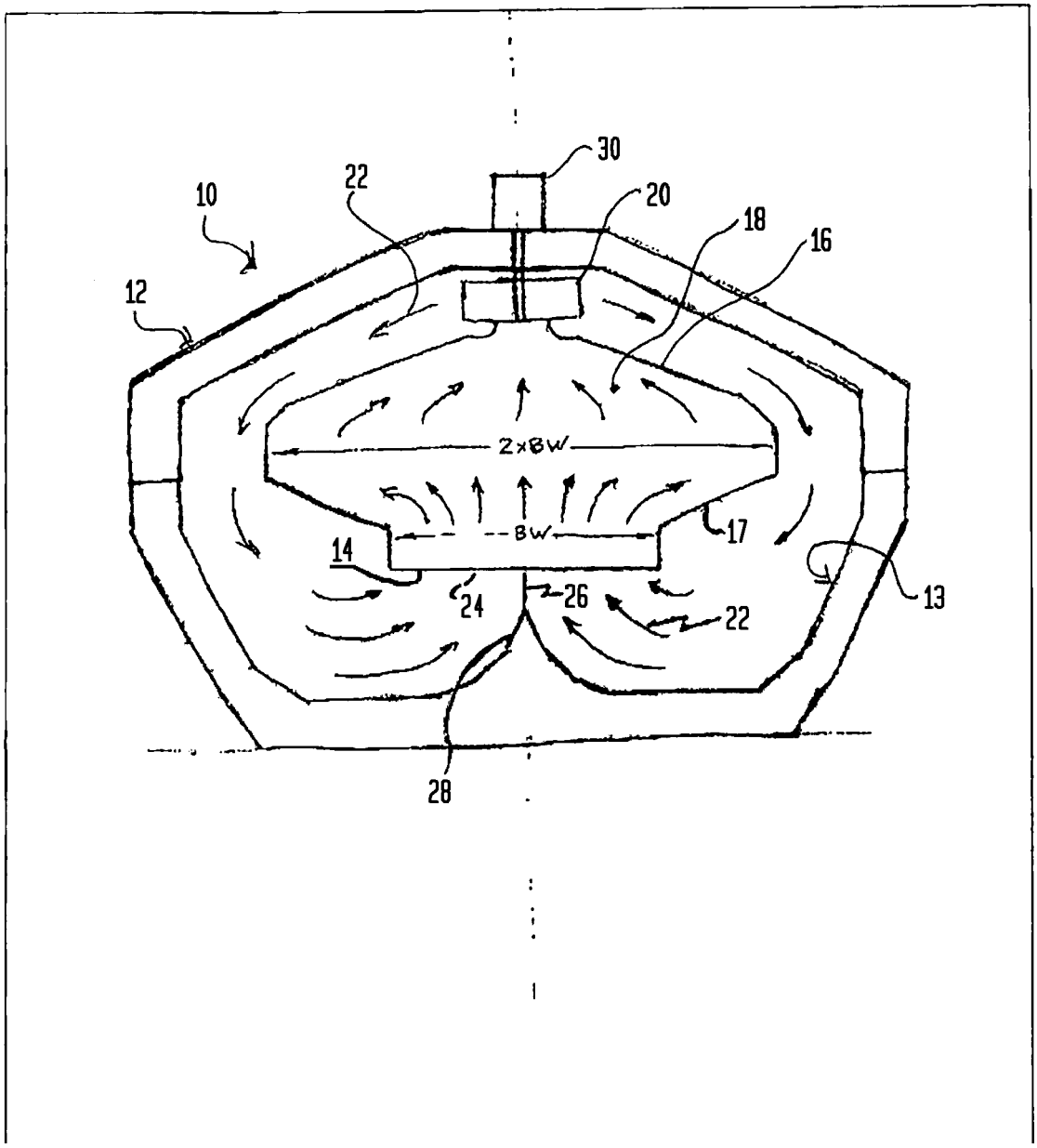
12. The method according to at least one of claims 9 to 11, further comprising directing the flow (22) of the cryogenic gas with an interior surface (13) of the freezer (10) toward the underside (24) of the belt (14).

13. The method according to at least one of claims 9 to 12 further comprising dividing (26) the flow (22) of the cryogenic gas at the underside (24) of the belt (14) before moving the flow (22) through the belt (14).

14. The method according to at least one of claims 9 to 13, wherein the moving the flow (22) of the cryogenic gas through the belt (14) is at a substantially constant velocity throughout a length and width (BW) of the belt (14).

15. The method according to at least one of claims 9 to 14, wherein at least one food product is chilled and/or frozen.

FIG. 1



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EUROPEAN SEARCH REPORT

Application Number
EP 17 17 3701

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	EP 2 269 474 A2 (LINDE AG [DE]) 5 January 2011 (2011-01-05) * paragraphs [0017] - [0030]; figures 1-3 * -----	1-4, 7-12,14, 15	INV. F25D13/06
X	FR 2 979 421 A1 (AIR LIQUIDE [FR]) 1 March 2013 (2013-03-01) * page 7, line 24 - page 9, line 30; figures 1-6 * -----	1,7,8	
X	GB 1 515 509 A (JOWITT R) 28 June 1978 (1978-06-28) * page 3, line 52 - page 4, line 80 * -----	1,7,8	

TECHNICAL FIELDS SEARCHED (IPC)

F25D

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	8 November 2017	Kolev, Ivelin

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 17 17 3701

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
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08-11-2017

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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82