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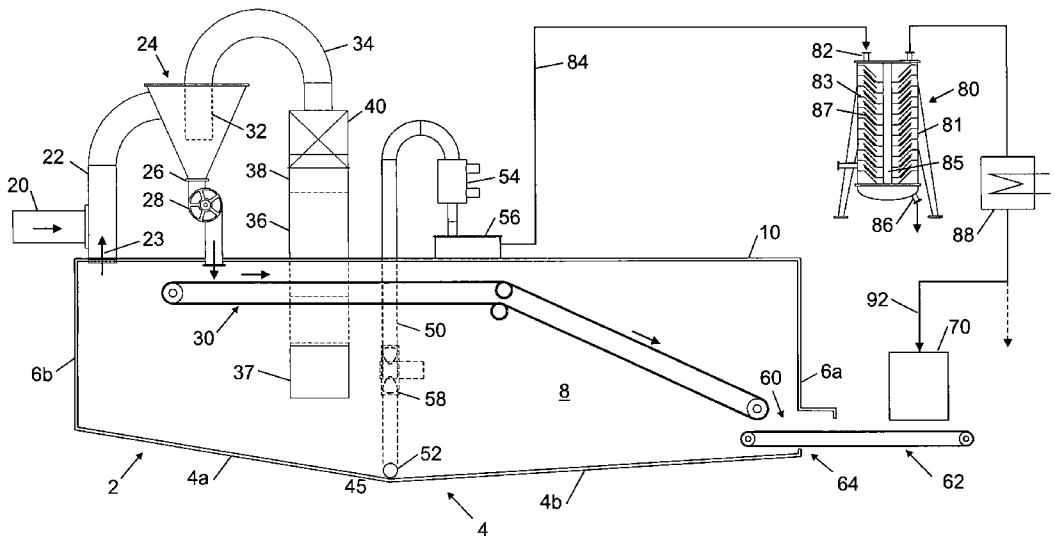
(54) **Title:** METHOD AND APPARATUS FOR DRYING AN EXTRUDED MATERIAL

Fig. 1



(57) **Abstract:** The invention relates to a method of drying an extruded material, comprising the steps of: providing a gaseous atmosphere with superheated steam in a housing, extruding a material in the housing, drying the material in the gaseous atmosphere, and moving the dried material out of the housing as well as apparatus for drying the extruded material.

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"Method and apparatus for drying an extruded material"

The invention relates to a method and an apparatus for drying an extruded material.

In order for the extrusion process to be performed effectively, extruded materials often need to include a not inconsiderable water content, so that, after emerging from the extruder, they in many cases first have to be dried before being packed or used in some other way. Especially if the material is a food product, the drying process must as far as possible be performed in such a way that any contact between the material to be dried and germs or other micro-organisms can be ruled out. With conventional drying methods, in which there is contact between the material and dry air, it is, however, difficult to achieve general sterility.

The problem of the invention therefore consists in providing a method and an apparatus which make it possible to dry an extruded material efficiently without this entailing any contamination with undesirable germs.

From the point of view of process engineering, this problem is solved by a method of drying an extruded material, comprising the steps of: providing a gaseous atmosphere with superheated steam in a housing, extruding a material in the housing, drying the material in the gaseous atmosphere, and moving the dried material out of the housing.

A particularly low level of germ content or even total sterility can be achieved if the temperature of the material when it emerges from the extruder or enters the housing is more than 100° C, especially more than 110° C, 120° C, 130° C or 140° C.

It can be provided for the material to be dried to a water content of less than 50 % by weight, 40 % by weight, 30 % by weight, 20 % by weight or 10 % by weight.

It can be provided for the material to be dried to a water content of less than 50 % by weight, 40 % by weight, 30 % by weight, 20 % by weight or 10 % by weight. AW (Activity of Water) is defined as the quotient of water vapour pressure over the material (p) to the water vapour pressure over pure water (p_0) at a defined temperature: $AW = p/p_0$.

It can be provided for the gaseous atmosphere to be at a temperature of more than 100° C, 120° C, 140° C, 160° C, 180° C or 220° C.

The gaseous atmosphere may be at ambient pressure or at an elevated or reduced pressure.

It is preferably provided that the gaseous atmosphere is a mixture of a first component, consisting of air and/ or another gas, such as CO_2, nitrogen or another inert gas, and water vapour as a second component, and has a steam content of at least 50 % by weight, 60 % by weight, 70 % by weight, 80 % by weight, 90 % by weight, 95 % by weight, 98 % by weight or 99 % by weight. The gaseous atmosphere may also consist of pure water vapour.

In a convenient variant, it is provided that volatile substances which escape from the material into the gaseous atmosphere, especially flavours, are extracted from the gaseous atmosphere. After extraction, the substances can be added to the material again, either directly or in the form of a carrier material, e.g. a coating or filling, to which the extracted substances are first of all added.

The material can be packed after being moved out of the housing. In this context, it can be provided that substances extracted from the gaseous atmosphere are introduced into a packing container during the packing process.

From the apparatus point of view, the problem of the invention is solved by an apparatus for drying an extruded material, comprising a housing for holding a gaseous atmosphere with superheated steam, the housing having an inlet port and an outlet port, a means for generating a gase-

ous atmosphere with superheated steam inside the housing, an extruder connected to the inlet port, a transport means for receiving material from the extruder and moving the material through the outlet port out of the housing.

It is appropriate for the outlet port to be placed lower down than the inlet port.

The outlet port can be disposed at a free end of an outlet duct. The outlet duct can extend downwards from the housing.

It can be provided that a ventilation line communicates with the housing and has an exit aperture at a height below the housing and above the outlet port and leading to the outside.

Alternatively or in addition, it is possible for an extraction line to communicate with the housing and to be conducted via a fan to a condenser.

The transport means may have a perforated conveyor belt.

A conduit subjected to elevated or reduced pressure can be disposed along a part-section of the transport means, communicating with the housing, especially with the lower portion thereof.

A flow guide or sealing means may be disposed between the conduit and the partial section of the transport means in order to ensure that there is an intensive flow round or through the transport means through the gaseous atmosphere.

The apparatus is preferably equipped with an extraction unit for extracting volatile substances from the gaseous atmosphere.

It is also contemplated that there may be a packing station associated with the apparatus for packing the dried material.

It is convenient for the transport means to extend as far as the packing station.

Further advantages and features of the invention will become clear from the following description of a preferred embodiment, reference being made to a drawing in which

Fig. 1 shows a schematic side view of an apparatus in accordance with the invention, with which the method of the invention can be carried out,

Fig. 2 shows a side view of a variant of the apparatus according to Fig. 1;

Fig. 3 shows a variant of the apparatus according to Fig. 1, and

Fig. 4 shows density values of steam and dry and moist air at different temperatures and relative humidity values (rh).

The apparatus consists first of a housing 2 with a bottom wall 4, a right-hand side wall 6a, a left-hand side wall 6b, a rear wall 8, a corresponding front wall, not shown, and an upper wall 10. The bottom wall 4 is arranged substantially horizontally and consists, in the embodiment shown, of two bottom wall parts 4a, 4b inclined towards one another in a slight V shape. The purpose of this arrangement is to allow condensate to flow to a connecting or transition area between the two bottom wall parts 4a, 4b, which forms the lowest point of the interior space of the housing.

The front wall, not shown, is substantially parallel to the rear wall 8 and abuts the lateral edges of the upper wall, the side walls and the bottom wall in such a manner as to create a seal, so that,

apart from the apertures, which will be explained below, the housing 2 surrounds an interior space which is enclosed on all sides.

An extruder 20, which is preferably a boiling extruder in which a temperature of at least 100° C prevails, has an outlet port leading into a transport duct 22, which is connected to a centrifugal cyclone separator 24. An outlet port 26 from the centrifugal cyclone separator is connected to an inlet to a cellular wheel sluice 28, the outlet form which is guided through the upper wall 10 of the housing 2 and terminates over a transport means 30.

A submerged tube 32 of the centrifugal cyclone separator 24 is connected to a suction pipe 34, which is joined to a conduit 36. Inside the conduit, there is a fan 38 and a heating means in the form of a heat exchanger 40. At a certain height above the bottom wall 4, beneath the upper wall 10, the conduit 36 leads into an opening 37 in the rear wall 8, where the medium drawn in is returned into the housing.

In order to intensify the contact between the medium to be dried and the superheated steam inside the upper portion of the interior of the housing, a further conduit 36 can be provided, as is indicated in Fig. 2 by way of example. In its course, the conduit likewise has a fan 38 and optionally a heating means 40. The conduit 36 leads firstly into the upper wall of the housing 10 in a region above the transport means 30 and secondly into an opening 37′ in the rear wall 8. With such an arrangement, it is possible to extract hot, superheated steam from the region above the transport means 30, so that the steam flowing in flows intensively round the material located there. In a different embodiment, it could be provided that the opening 37′ is located on the level of the transport means 30 and that the flow is in the opposite direction, so that hot steam is drawn in through the opening 37′ and blown out through the opening in the upper wall 10 onto the transport means 30 from above, in order to bring the product located on it into intensive contact with the steam. As a further alternative, fans are possible, which are mounted above the transport means 30, and apply superheated steam intensively to the product to be dried.

In a lower portion of the housing, preferably in the region of a lowest point of the housing directly above the bottom wall 4, an extraction line 50 leads into an extraction port 52 in the rear wall 8 and leads to a condenser 54, from where condensate is directed into a container 56. Inside the extraction line 50, there is a controlled fan 58, which is controlled by temperature and/or moisture or steam content information. For this purpose, at least one temperature sensor and at least one steam content sensor are disposed inside the housing to determine the condition of the steam (relative humidity and/or degree of saturation, or steam content). It is advantageous to have one temperature sensor and one moisture or steam content sensor each in the upper region of the housing near the upper wall 10 and in the lower region near the bottom wall 14 or in the vicinity of the extraction port 52. If there is any superheated steam present, it is possible in this way to determine the degree of superheating or the temperature difference relative to the saturation state. By means of an enhanced extraction of relatively moist steam from the lower region of the housing, while at the same time supplying heat, the gaseous atmosphere inside the housing can be shifted in the direction of a higher content of superheated steam at a higher temperature.

In the example illustrated, the transport means 30 takes the form of a conveyor belt with a perforated transport belt, which first extends horizontally and then at a downward slope. Beneath one discharge end 60 of the transport means, there is a further transport belt 62, which runs horizontally through an outlet port 64 of the housing 2 to the outside.

A packing station 70 can be provided in the region of the further transport means 62, where the dried material is packed into individual packing containers, such as tins, screw-topped jars, containers with screw-on lids or vacuum press-on lids, or film bags.

An extraction unit 80 for recovering volatile substances, such as flavours, preferably takes the form of a spinning cone column or spinning table column. This is a vertical cylinder 81, in which an inert separating gas such as steam at normal or reduced pressure separates a vaporous stream of volatile components from a fluid input or a slurry. From top to bottom, there is an alternating arrangement of fixed conical sheets of metal 83 attached to the interior wall of the cylinder, and conical sheets of metal 87 attached to a rotating shaft 85.

The fluid input to be extracted, in this case the condensate forming in the housing 2, is introduced into a product input 82 at the top of the column via an extraction line 84. Under the force of gravity, the liquid flows down on the upper surface of the first fixed cone 83 and reaches the inside of the first rotating cone 87, on which the liquid is distributed into a thin, turbulent film because of the centrifugal forces acting on it, and then flows upwards and outwards and passes from the outer edge of the rotating cone onto the next-lower stationary cone until, having passed through all the cones, it reaches an outlet 86 at the foot of the column, where there is only a small content of volatile substances left in it.

The inert separating gas, steam in this case, which is fed in counterflow, flows through the column from bottom to top and absorbs volatile components. When the steam enriched with volatile substances reaches the head of the column, it is condensed in a condenser 88, so that the volatile substances are available in a concentrated form, dissolved in water, and can be delivered in the manner described to the dried material and/or a packing container.

The method of the invention provides that the material to be dried in the housing 2 is first extruded in the extruder 20, a temperature of more than 100° C being appropriate in the process, with a view to ensuring that the material is already largely or completely free of germs when it emerges from the extruder. After emerging from the extruder, the material enters the transport duct 22 directly, without the possibility of any contamination occurring, and is immediately entrained in the direction of flow 23 by the current prevailing in the transport duct 22 and reaches the centrifugal cyclone separator 24. A mixture of gas/steam which is virtually free of particles flows into the conduit 36 via the suction pipe 34, while the separated material passes through the cellular wheel sluice 28 and reaches the transport means 30.

In order to generate the desired gaseous atmosphere with superheated steam or an atmosphere of pure superheated steam inside the housing 2, such as is described in US 5 711 086, there is a heating means 40 inside the conduit 36, which can take the form of an electric heating element, heat exchanger, condenser or the like. The gas/steam atmosphere conducted in a closed circuit via the transport duct 22, the centrifugal cyclone separator 24, the suction pipe 34, the conduit 36 and the housing 2 can be heated to a desired temperature in this way. The material entering the

housing 2 via the extruder causes an input of water or steam in the housing, so that the steam content inside the housing increases. By means of an appropriate open or closed-loop control of the steam extracted via the extraction line 50 and condensed in the condenser 54, the steam content in the housing 2 can be adjusted. If there is no extraction, surplus steam is released to the outside through the outlet port 64. The housing can be equipped with an outlet duct extending downwards and a ventilation line, as is illustrated in Fig. 2.

In order to accelerate or intensify the generation of the desired gaseous atmosphere, a steam feed line, not shown, can be used to introduce superheated steam directly into the housing 2. Alternatively, it can be provided that a steam or water feed line, such as a water atomiser, leads into the conduit 36 upstream of the heating means 40, so that by heating the steam or evaporating the water, a superheated steam atmosphere can be introduced in the region of the opening 37.

Because of the different densities of steam at different temperatures and because of the influence of any air that might be mixed in, as is shown in Fig. 4, vertical layers form inside the housing, with superheated steam collecting at the top and moister steam and/or a steam-air mixture collecting at the bottom. For this reason, after the material to be dried has been delivered, the transport means 30 first runs in a first section in an upper region of the housing near the upper wall 10, i.e. inside a zone of superheated steam, after which the material is then conveyed towards the outlet port 64 lower down. The low position of the outlet port 64 makes it difficult for superheated steam to escape directly from the housing, which would be an undesirable loss. Alternatively, the conveyor belt 30 could run completely horizontally, as is shown in Fig. 2.

Fig. 2 illustrates a variant of the apparatus according to Fig. 1, in which first of all saturated steam and thus the surplus moisture can be conducted out of the housing by extraction via the extraction port 52 or alternatively via a ventilation line 41. The ventilation line 41 is connected to a three-way valve 42, which is also connected, via a connection line 43, to the extraction line 50 and, via a further connection line 44, to an opening 45 in the bottom wall 4. The ventilation line has a ventilation aperture 46 leading to the outside

The three-way valve 42 can be placed in a first position, in which the lines 43 and 44 communicate, while the line 41 is sealed off, so that extraction takes place via the ports 45 and 52. If desired, a check valve may be provided in the line 43 in order to be able to ensure that in the first position of the three-way valve, extraction occurs exclusively via the port 52.

The three-way valve 42 can be placed in a second position, in which the vent line 44 communicates with the conduit 44, while the conduit 43 is sealed off and the fan 58 is switched off, so that the steam atmosphere within the housing communicates with the environment via the port 45 and the conduits 44 and 41.

In contrast to the apparatus according to Fig. 1, the apparatus illustrated in Fig. 2 includes a guide duct 47, which, in the region of the outlet port 64, extends the housing downwards and terminates openly. A chute 48 conducts the material from the discharge end 60 of the transport means 30 onto the further transport belt 62. Together with the ventilation line 41, which terminates on a higher level, the guide duct ensures that surplus steam is released from the interior of the housing 2 via the ventilation line 41, in the second position of the three-way valve 42. The steam located inside the housing has a tendency to flow downwards through the guide duct, but encounters relatively cold ambient air in the process, so that a substantially horizontal boundary layer forms in the guide duct at the level of the ventilation aperture 46. The height h0 at which the vent aperture 46 is located above the height of the free end of the guide channels may, for example, 10 %, 20 %, 30 % or 50 % of the height H of the housing, H indicating the vertical distance between the highest and lowest points of the interior of the housing. In addition, the height h0 is preferably between about 30 % and 70 %, e.g. 50 %, of the vertical extent hb of the guide duct, beginning at the lower wall 4 or the lowest point of the housing.

In all embodiments, a height hs of the extraction port 52 above the lower wall 4 of the housing or the lowest point of the housing may be virtually zero in effect, or it may be about 5 %, 10 %, 15 %, 20 % or 30 % of H. A height ht at which the actual drying process mainly takes place and at which or above which the horizontal partial layer is preferably located, in which the gaseous atmosphere is of the desired high temperature and exhibits low oxygen values, may be about 50

%, 60 %, 70 %, 80 %, 90 % or 95 % of the height H of the housing, measured in each case from the lower wall of the housing 4 or the lowest point of the housing.

Fig. 3 illustrates a variant of the invention in which - unlike the embodiments illustrated in Figs. 1 and 2 - the aim is not to have a distinct horizontal succession of layers with a steam atmosphere that, moving from bottom to top, becomes increasingly warmer, poorer in air and oxygen and increasingly contains only superheated steam, but rather a steam atmosphere which is mixed as thoroughly as possible and homogenised within the entire housing. This is achieved in that the interior of the housing is evenly mixed with the aid of at least one circulation fan 90 (Fig. 3 shows two of them), so that virtually no stratification or uneven mixing can become established in the vertical direction.

In addition, the contact between the material to be dried and the steam atmosphere is improved with a forced circulation system consisting of a cyclone 92, a fan 94, a heat exchanger 96, fans 98a, b, c and, connected to them, steam guide boxes 100a, b, c. Depending on what is more appropriate, the cyclone 92, fan 94, heat exchanger 96 and fans 98 may be disposed inside or outside the housing 2. Depending on the flow conditions, either the fan 94 or the fans 98 may be dispensed with. The fan 94
sucks in the steam atmosphere across the cyclone 92 upstream, in which particles originating from the material to be dried are deposited. The cyclone for its part sucks in the steam atmosphere at any suitable point or area within the housing. Downstream of the fan 94, the steam atmosphere flows through the heat exchanger 96, having optionally been enriched with steam beforehand by means of a steam generator 95. In the heat exchanger 96, heat may be supplied or removed as required, whereupon the steam atmosphere then enters the steam guide boxes 100a, b, c via the fans 98a, b, c. The steam guide boxes guide the steam atmosphere through a preferably perforated conveyor belt of the transport means 30, so that the material on it is brought into intimate contact with the steam atmosphere.

List of reference numerals

2	Housing
4	Bottom wall
4a, b	Bottom wall part
6a, b	Right-hand, left-hand side wall
8	Rear wall
10	Upper wall
20	Extruder
22	Transport duct
23	Direction of flow
24	Centrifugal cyclone separator
26	Outlet port
28	Cellular wheel sluice
30	Transport means
32	Submerged tube
34	Suction pipe
36, 36	Conduit
37′, 37′	Opening
38, 38′	Fan
40, 40′	Heat exchanger
41	Ventilation line
42	Three-way valve
43, 44	Connection line
45	Opening
46	Ventilation aperture
47	Guide duct
48	Chute
50	Extraction line
52	Extraction port
54	Condenser
56	Container
60	Discharge end (of 30)
62	Further transport belt
64	Outlet port
70	Packing station
80	Extraction unit
81	Cylinder
82	Product input
83	Fixed cone
84	Extraction line
85	Rotating shaft
86	Outlet
87	Rotating cone
88	Condenser
90	Circulation fan
92	Cyclone

94	Fan
95	Steam generator
96	Heat exchanger
98a, b, c	Fan
100a, b, c	Steam guide box

Claims

1. A method of drying an extruded material, comprising the steps of:

   - providing a gaseous atmosphere with superheated steam in a housing (2),
   - extruding a material in the housing (2),
   - drying the material in the gaseous atmosphere, and
   - moving the dried material out of the housing (2).

2. The method as claimed in claim 1, characterised in that the temperature of the material when it enters the housing (2) is more than 100° C, 110° C, 120° C, 130° C or 140° C.

3. The method as claimed in either of claims 1 or 2, characterised in that the material is dried to a water content of less than 50 % by weight, 40 % by weight, 30 % by weight, 20 % by weight or 10 % by weight.

4. The method as claimed in any of the preceding claims, characterised in that the material is dried to an AW value of less than 0.6, 0.5, 0.4, 0.3, 0.2 or 0.1.

5. The method as claimed in any of the preceding claims, characterised in that the gaseous atmosphere is at a temperature of more than 100° C, 120° C, 140° C, 160° C, 180° C or 220° C.

6. The method as claimed in any of the preceding claims, characterised in that the gaseous atmosphere is at ambient pressure, at an elevated or at a reduced pressure.

7. The method as claimed in any of the preceding claims, characterised in that the gaseous atmosphere is a mixture of a first component, consisting of air and/ or another gas, such as CO_2, nitrogen or another inert gas, and water vapour as a second component, and has a

steam content of at least 50 % by weight, 60 % by weight, 70 % by weight, 80 % by weight, 90 % by weight, 95 % by weight, 98 % by weight or 99 % by weight.

8. The method as claimed in any of the preceding claims, characterised in that volatile substances which escape from the material into the gaseous atmosphere, especially flavours, are extracted from the gaseous atmosphere.

9. The method as claimed in claim 8, characterised in that, after extraction, the substances are added to the material again.

10. The method as claimed in claim 9, characterised in that the substances are added to the material directly or in the form of a carrier material, such as a coating or filling.

11. The method as claimed in any of the preceding claims, characterised in that the material is packed after being moved out of the housing (2).

12. The method as claimed in claim 11, characterised in that substances extracted from the gaseous atmosphere are introduced into a packing container during the packing process.

13. The method as claimed in any of the preceding claims, characterised in that the gaseous atmosphere inside the housing is thoroughly mixed and vertical stratification is avoided.

14. An apparatus for drying an extruded material, comprising:

- a housing (2) for holding a gaseous atmosphere with superheated steam, the housing having an inlet port and an outlet port (64),
- a means for generating a gaseous atmosphere with superheated steam inside the housing,
- an extruder (20) connected to the inlet port,

- a transport means (30) for receiving material from the extruder (20) and moving the material through the outlet port (64) out of the housing (2).

15. The apparatus as claimed in claim 14, characterised in that the outlet port (64) is placed lower down than the inlet port.

16. The apparatus as claimed in either of claims 14 or 15, characterised in that the outlet port is disposed at a free end of an outlet duct.

17. The apparatus as claimed in claim 16, characterised in that the outlet duct extends downwards from the housing (2).

18. The apparatus as claimed in any of claims 14 to 17, characterised in that a ventilation line communicates with the housing (2) and has an exit aperture at a height below the housing (2) and above the outlet port and leading to the outside.

19. The apparatus as claimed in either of claims 14 to 18, characterised in that the transport means (30) has a perforated conveyor belt.

20. The apparatus as claimed in any of claims 14 to 19, characterised in that a conduit subjected to elevated or reduced pressure is disposed along a part-section of the transport means (30), communicating with the housing, especially with the lower portion thereof.

21. The apparatus as claimed in claim 20, characterised in that a flow guide or sealing means is disposed between the conduit and the partial section of the transport means (30) in order to ensure that there is an intensive flow round or through the transport means through the gaseous atmosphere.

22. The apparatus as claimed in any of claims 14 to 21, characterised in that an extraction unit (80) is provided for extracting volatile substances from the gaseous atmosphere.

23. The apparatus as claimed in any of claims 14 to 22, characterised in that a packing station is provided for packing the dried material.

24. The apparatus as claimed in claim 22, characterised in that the transport means (30) extends as far as the packing station.

25. The apparatus as claimed in any of claims 14 to 24, characterised in that the extruder (20) leads into a transport duct (22), which is connected to a centrifugal cyclone separator (24).

26. The apparatus as claimed in claim 25, characterised in that the transport duct (22) is connected to the housing (2) in the region of the upper wall (10).

27. The apparatus as claimed in either of claims 25 or 26, characterised in that an outlet from the centrifugal cyclone separator terminates above the transport means (30).

28. The apparatus as claimed in any of claims 25 to 27, characterised in that a submerged tube (32) of the centrifugal cyclone separator (24) is connected to a suction means such as a fan or a jet nozzle.

29. The apparatus as claimed in any of claims 14 to 28, characterised in that a circulation fan (90) is disposed in the housing (2).

30. The apparatus as claimed in any of claims 14 to 29, characterised in that a cyclone separator (92), which purifies the gaseous atmosphere, with a fan (94) is disposed in the housing (2).

31. The apparatus as claimed in claim 30, characterised in that the cyclone separator (92) is disposed in series with a flow guide or steam guide means (100a, b, c) and optionally one or more fans (98a, b, c).

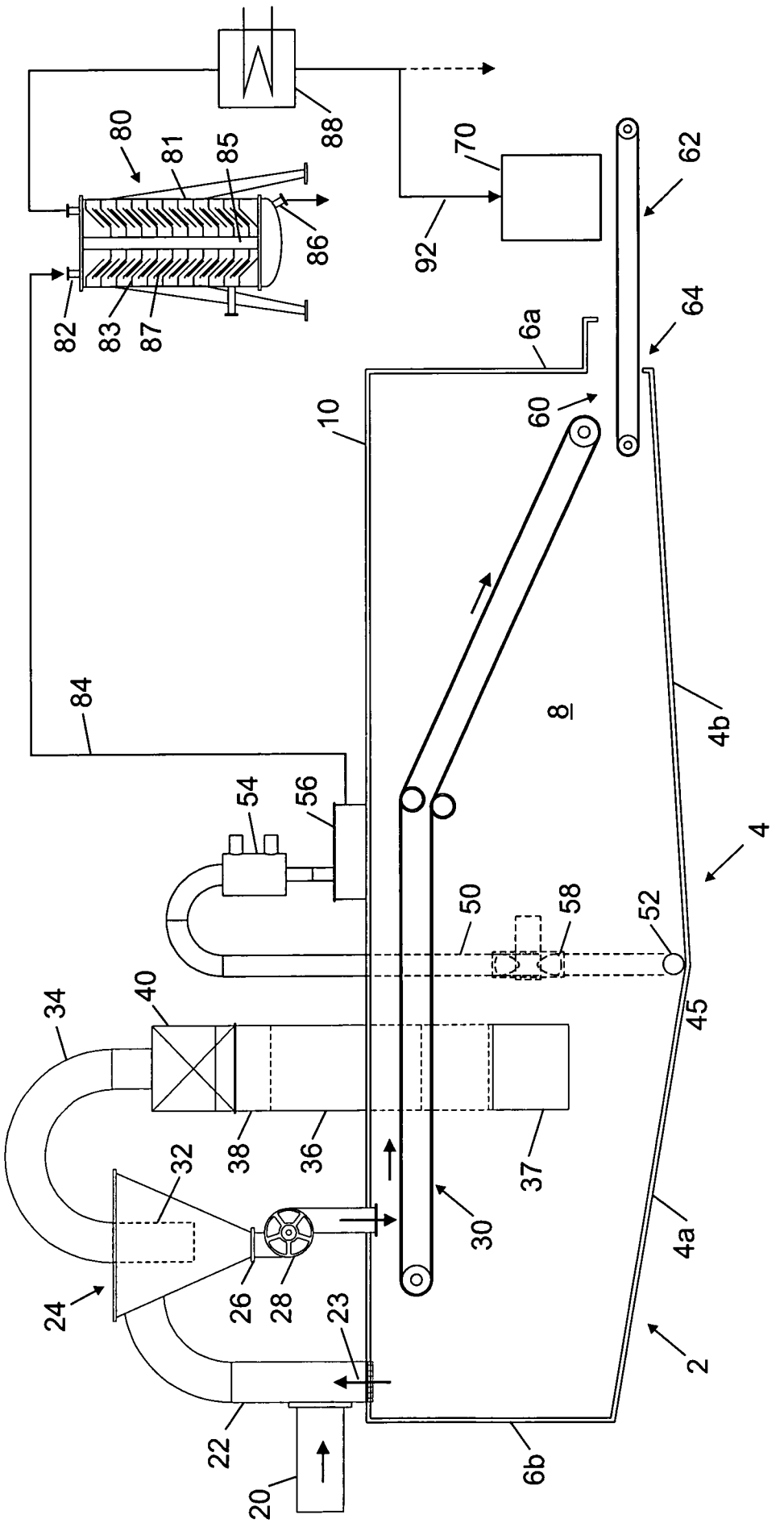
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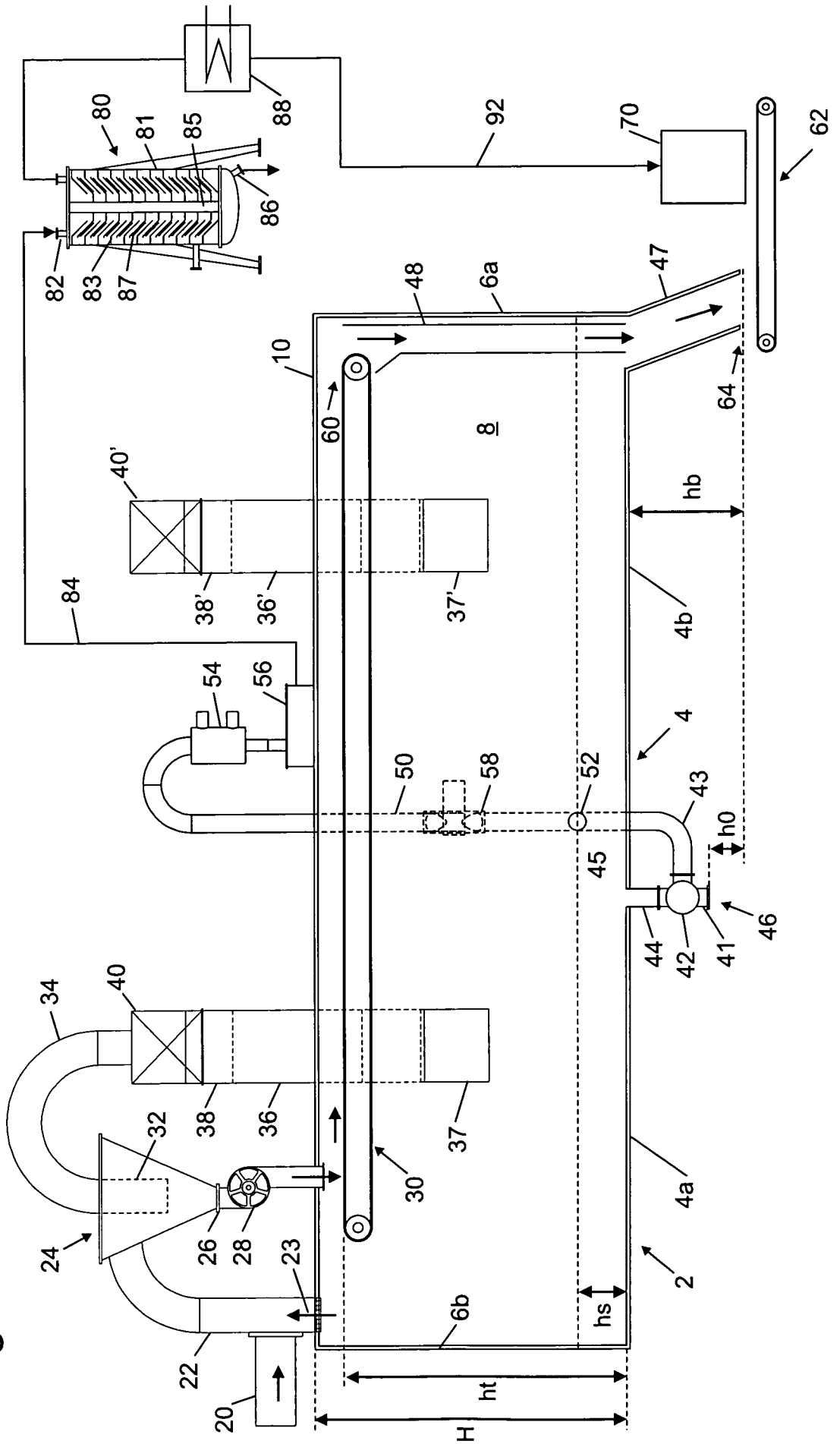
Fig. 1

Fig. 2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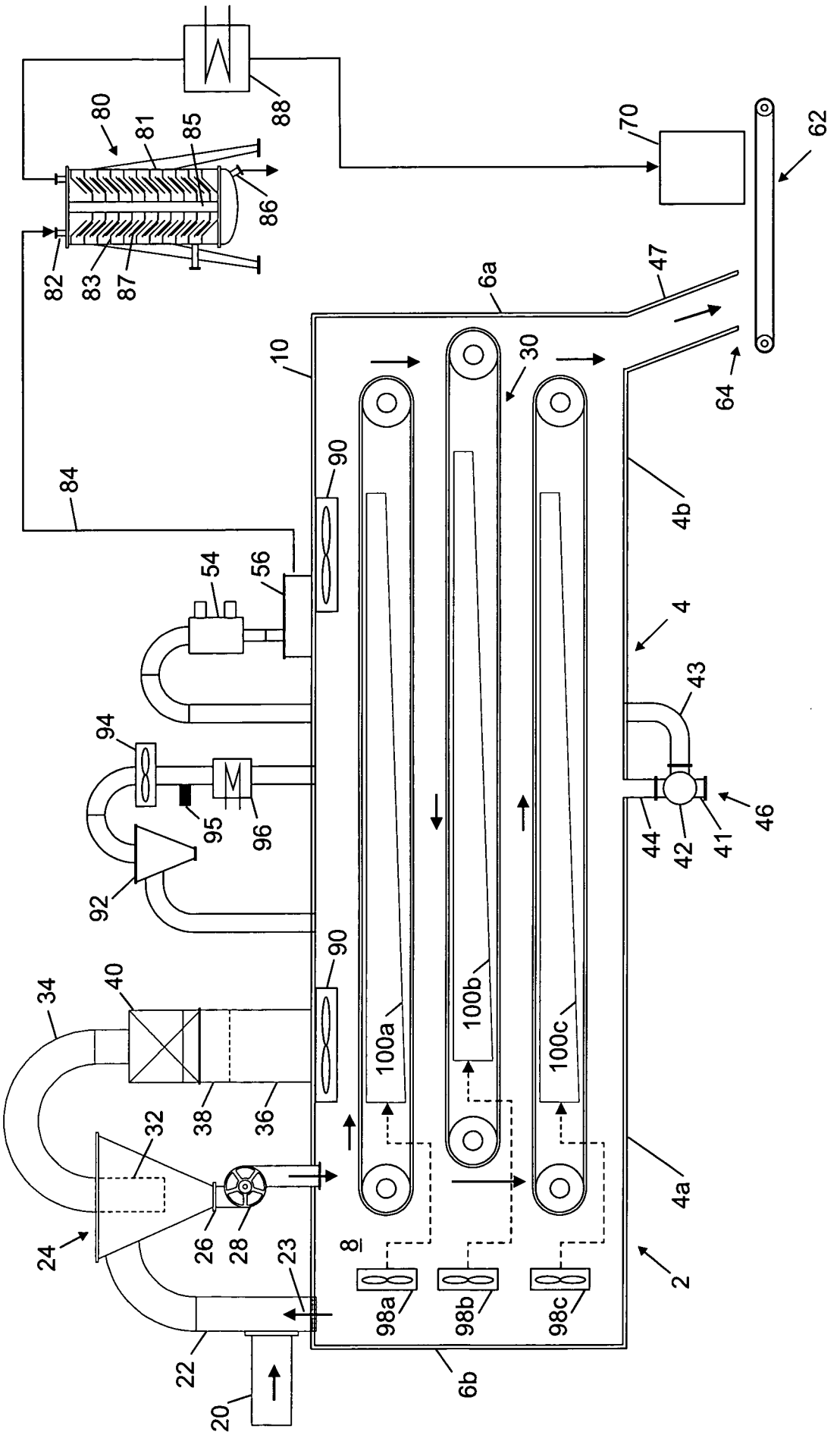
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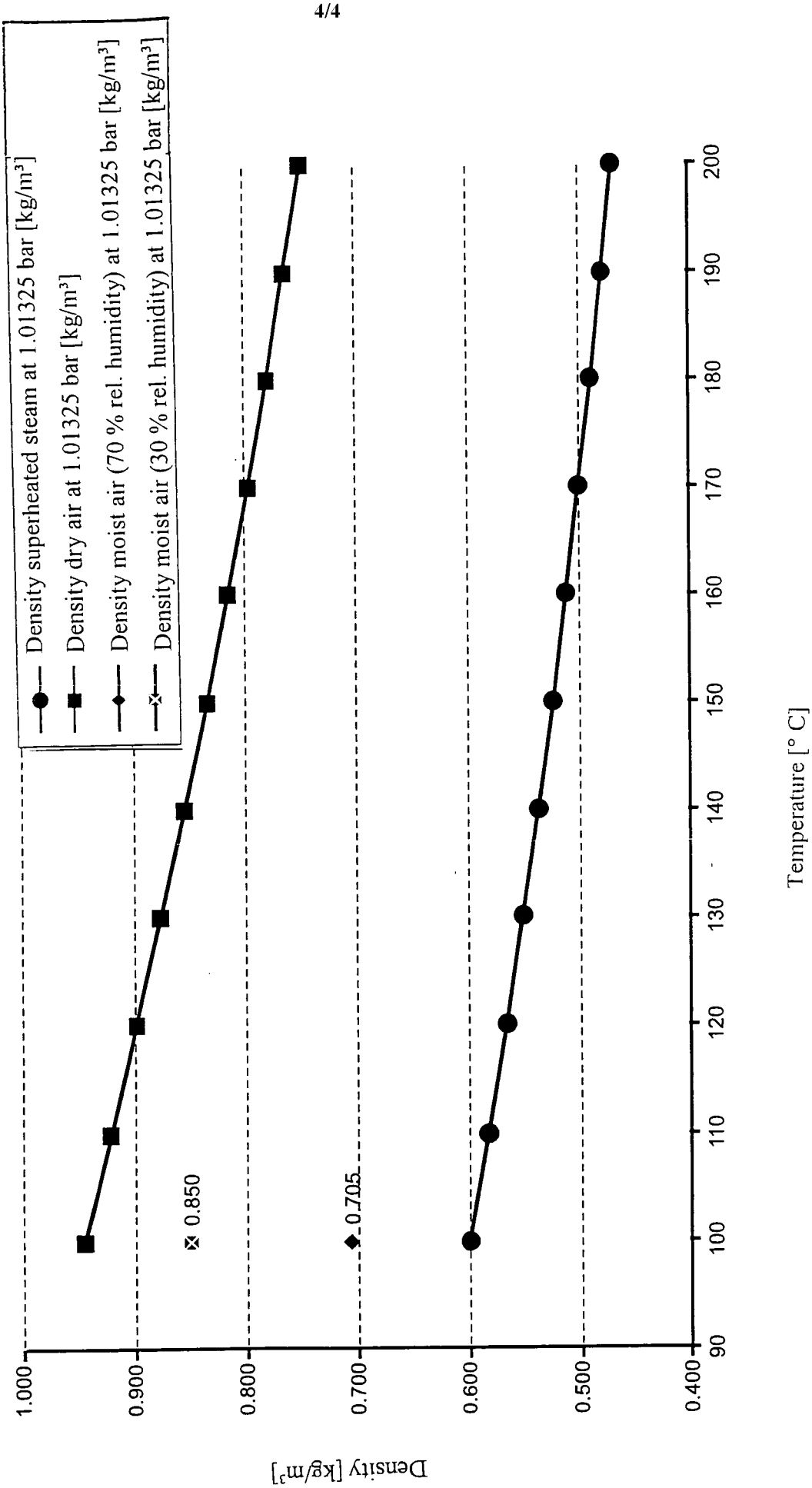
95
96
92
44
42
41
46
34
40
100a
100b
100c
38
36
32
4a
24
26
28
23
8
98a
98b
98c
2
22
20
6b

Fig. 3

Fig. 4


Density superheated steam at 1.01325 bar [kg/m³]
Density dry air at 1.01325 bar [kg/m³]
Density moist air (70 % rel. humidity) at 1.01325 bar [kg/m³]
Density moist air (30 % rel. humidity) at 1.01325 bar [kg/m³]
0.850
0.705
1.000
0.900
0.800
0.700
0.600
0.500
0.400
90
100
110
120
130
140
150
160
170
180
190
200
Density [kg/m³]
Temperature [° C]

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2008/006429

A. CLASSIFICATION OF SUBJECT MATTER
INV. A23P1/12 A23L1/00 F26B21/08 F26B17/04 F26B23/00
B01D5/00

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)
A23P F26B B01D A23L A23N

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

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 5 505 567 A (SCOTT NICHOLAS B [US]) 9 April 1996 (1996-04-09) column 1, line 48 - column 2, line 36 column 3, line 7 - column 4, line 29; figures	1-9,11, 13,14, 20,21, 23-26, 28-31
X	FR 2 607 230 A (BERTIN & CIE [FR]) 27 May 1988 (1988-05-27) page 4, line 21 - page 5, line 19 page 6, line 13 - page 7, line 6; figures	1-31

-/--

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

[X] See patent family annex.

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Date of the actual completion of the international search	Date of mailing of the international search report
31 October 2008	07/11/2008

Name and mailing address of the ISA/	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL – 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Cametz, Cécile

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2008/006429

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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X	US 5 711 086 A (STUBBING THOMAS JOHN [GB]) 27 January 1998 (1998-01-27) cited in the application column 8, line 8 - line 46; figures	1-31

INTERNATIONAL SEARCH REPORT

Information on patent family members

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