



(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
01.08.2012 Bulletin 2012/31

(51) Int Cl.:
A24B 3/04 (2006.01)

(21) Application number: **11186721.4**

(22) Date of filing: **26.10.2011**

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA ME

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(30) Priority: **27.01.2011 IT TV20110009**

(54) **Tobacco cooling device, particularly for a tobacco drying system**

(57) A tobacco cooling device (7), particularly for a tobacco drying system comprising means for the circulation of a process gas at high temperature in a circuit provided with a tobacco drying column and with a device

for separating the process gas from the tobacco.

The device is adapted to utilize the enthalpy content of the tobacco available downstream of the discharge point of the separation device.

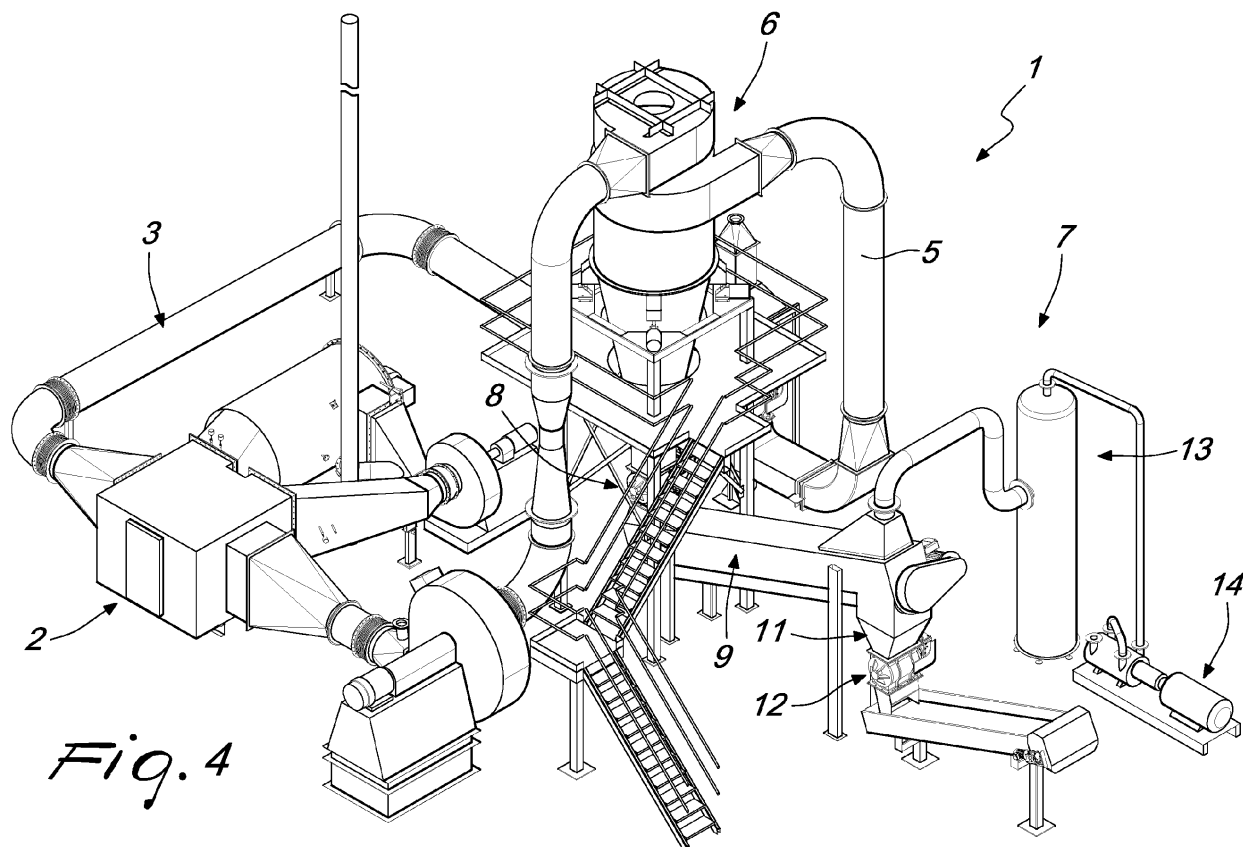


Fig. 4

Description

[0001] The present invention relates to a tobacco cooling device, particularly for a tobacco drying system.

[0002] Currently, among the various tobacco drying methods, the systems commonly known as flash (tower) dryers or air dryers are known.

[0003] These are systems that circulate a gas (process gas) at high temperature through a closed or open circuit.

[0004] The process gas is moved by a fan, typically of the centrifugal type and provided with all the solutions required for operation at high temperature.

[0005] The fan produces a mass and volume flow-rate of process gas that is adapted to provide the desired drying effect, which is obtained essentially by thermal convection, and convey the product from the loading point to the discharge point.

[0006] The systems for heating the process gas based on the combustion of hydrocarbons can be of the direct fire or indirect fire type.

[0007] In the first case, the combustion products are introduced directly into the drying circuit (typically of the open type).

[0008] In the second case, the process gas is made to pass through a heat exchanger, inside the hot section of which the combustion products are circulated, while the process gas passes through the cold section. Typically, the indirect heating technique is applied to closed circuit systems.

[0009] As an alternative, electric coil heaters are inserted in the process gas circuit for the direct heating thereof, although this application is preferred for low-capacity dryers.

[0010] The process gas is then made to pass through a vertical pipe known typically as a drying tower or drying column, where the product, propelled by the process gas, proceeds typically upward from below in suspension in the process gas.

[0011] The adjustment of the speed of the process gas and the geometry of the drying column can be set in various ways so as to induce a greater or smaller speed gradient between the product and the process gas.

[0012] The gas mixed with the product then enters the device that is adapted to perform the gas/product separation.

[0013] For this purpose, in most cases cyclone separators are used by virtue of their superior separation efficiency.

[0014] Other separation systems, which are well-known in the technology of conveying solid materials by means of gases, such as for example so-called "tangential separators" or duct expansion separators (known in the tobacco sector as APS), can be applied.

[0015] However, these two last types are the least preferred, due to the lower efficiency of separation and the higher load loss that they induce.

[0016] The product is introduced typically by means of a star valve (i.e. an airlock) at the height of the horizontal

portion of the duct that precedes the drying column or alternatively directly into the drying column.

[0017] The product is extracted at the base of the cyclone separator (or other separation system) typically by means of a star valve.

[0018] The process gas, after the separation of the product, is sent to the stack (after energy recovery, if any) in an arrangement with an open circuit, or alternatively it is recycled and resent to the propulsion fan in a closed-circuit system.

[0019] In closed-circuit circulation, part of the process gas is bled (in a natural or forced manner) in order to eliminate the steam generated in the drying process.

[0020] Various instruments are arranged to measure the temperatures, speed and flow rate of the gas, the pressure inside the dryer, et cetera.

[0021] It is common practice to use superheated steam as a process gas; in addition to avoiding dangers of fire, in view of the substantial elimination of the residual oxygen in the circulated gas, it allows higher thermal efficiency than operation with air, in view of the higher specific heat of steam.

[0022] Typically, the product is discharged at 100°C, a temperature which of course corresponds to the boiling point of water at atmospheric pressure at sea level.

[0023] After the drying process, the product is typically cooled with various means, all of which, albeit according to various different application schemes, provide for the removal of the heat by thermal convection from the product to the ambient air, which may or may not be pre-cooled.

[0024] According to the most widespread application, the product is conveyed through an open-circuit pneumatic conveyance system, drawing air directly from the environment.

[0025] By virtue of the high temperatures of the process gas and the rapid transmission of the heat of the gas to the product, in flash dryers a sudden evaporation of the water inside the product (boiling) is induced, causing the bursting of the cells thereof, thus causing the expansion or, more precisely, the increase in specific volume (cm³/g) thereof.

[0026] Also widespread is the technical trend aimed at assigning to the subsequent cooling process the function of "freezing" the expansion at the best obtainable result, since it has been observed that a slow cooling is accompanied by a reduced yield in terms of increase in specific volume.

[0027] Therefore, according to the widespread process schemes, cooling is induced with means adapted to maximize its efficiency, since the swiftness of the cooling has been found to be functional to optimizing the process.

[0028] Specific volume is measured typically by means of standard procedures that consist in subjecting, inside a vessel having a calibrated volume, a sample of product of predetermined mass to compression by a known weight, for a preset time.

[0029] Appropriate formulations are established in or-

der to introduce the correction of the reading in relation to the current humidity of the sample.

[0030] It has been demonstrated that the increase in specific volume of the product in turn corresponds to the increase in cigarette filling power, which means a reduction in the quantity of tobacco required to fill the tubular volume of the cigarette, but without altering its firmness.

[0031] However, the conclusive test adapted to determine the filling power remains that of proceeding with the packaging of a significant number of cigarettes (thousands) and measuring, for equal packaging conditions, the actual content of product in relation to the actual consistency of the cigarettes, which in turn is determined on the basis of standard transverse compression tests.

[0032] Although this is a technology that is now well-established and widely applied industrially, some limitations on a technical/economic level have been found, of which we draw attention to the fact that since the preferred system for separating the product from the gas is the cyclone separator, the gas flow rates involved by the process for production on an industrial scale entail the use of cyclone separators that are several meters tall.

[0033] Furthermore, the drying column, inside which most of the process occurs, by being extended in a vertical direction, also requires a useful height of several meters.

[0034] This entails that often the roof of the factory where the dryer is installed must undergo structural modifications of such importance and cost as to make the investment less attractive from an economic standpoint.

[0035] Another drawback that can be ascribed to the cited background art is the high energy consumption that has been observed.

[0036] The actual energy consumption is variable in relation to the technical layout used; for example, it depends greatly on whether a closed circuit is applied instead of an open one, on the extent to which the gas is bled, on the quality of the thermal insulation of the circuit, on the efficiency of the assemblies for heating the process gas (burner and heat exchanger), etc.

[0037] However, the extent of the energy consumption that has been observed for typical industrial applications remains considerable, thus penalizing Return On Investment (ROI), which is less attractive.

[0038] Furthermore, the cooling process that is necessary after drying in order to optimize the specific volume introduces an additional and significant increase in the energy cost.

[0039] Another drawback that can be ascribed to the cited background art is the limited specific volume of the product that is the result of the process; this volume typically can be improved in two ways: by increasing the temperature of the process gas (so as to accelerate the transmission of the heat to the product and therefore the evaporation of the water by increasing the thermal gradient) or by increasing the humidity at the entry of the product (in order to increase the quantity of water available for evaporation).

[0040] However, these known solutions are limited in that both the increased temperature of the process gas and the increase in humidity tend to alter the organoleptic characteristics of the final product, which by contrast must be reproduced with highest possible uniformity and repetitiveness, to the point that in the majority of known industrial applications these solutions are not utilized fully.

[0041] Therefore, the increase in specific volume available in principle is used only partially, and once again this slows down the Return On Investment.

[0042] Another drawback that can be ascribed to the cited background art is that the process is not controllable and reproducible.

[0043] Indeed, the cooling process after drying typically uses ambient air for the convective extraction of the heat.

[0044] The temperature of the ambient air is of course variable depending on the season and on the current conditions inside the factory.

[0045] Furthermore, since the cooling process produces a further, albeit limited, drying effect, which in turn is sensitive to the current temperature of the ambient air, in practice a certain difficulty must be dealt with in controlling the overall process for the purposes of achieving the final humidity and temperature targets, which is due to the variability of the temperature of the ambient air.

[0046] Another drawback that can be ascribed to the cited background art is an observed degradation of the product (tobacco).

[0047] In tobacco processing, degradation is defined as the fragmentation of the product which results from the process and which, by reducing the size of the particles of product, has a negative effect on its specific volume and filling power.

[0048] Of course, degradation is a price to be paid which is inherent in the handling of the product, but it must still be resolutely minimized.

[0049] The known use of pneumatic conveyance systems, by which is meant means for conveyance between two points, is typically limited to the minimum indispensable, since they are found to be responsible for degradation which can be traced back mainly to the dynamic impact of the product, especially if it is in the dried state, against the walls of the conveyance duct, especially where the latter has a winding shape.

[0050] Therefore, the adoption of pneumatic conveyance systems adapted to induce cooling is scarcely efficient in the balance between recovered expansion and induced degradation in terms of the overall increase in filling power.

[0051] The aim of the present invention is therefore to solve the drawbacks cited above and therefore solve the described technical problems by providing a device that can be used in tobacco drying systems and which makes it possible to reduce the quantity of energy to be transferred by convection from the hot process gas, this allowing a reduced sizing of the tobacco drying means and

therefore, among other things, a reduced overall height of the system.

[0052] Within the scope of this aim, an object is also to make it possible to achieve an energy saving.

[0053] Another object of the present invention is to provide a device that combines the preceding characteristics with that of achieving an increase in the specific volume of the product resulting from the drying process.

[0054] Another object of the present invention is to provide a device that makes it possible to achieve controllability and reproducibility of the drying process.

[0055] Another object of the present invention is to obtain a device that can be used in tobacco drying systems and makes it possible to achieve a limited degradation of the dried product.

[0056] This aim and these and other objects that will become better apparent from the description that follows are achieved by a tobacco cooling device, particularly for a tobacco drying system comprising means for the circulation of a process gas at high temperature in a circuit provided with a tobacco drying column and with a device for separating said process gas from said tobacco, characterized in that it is adapted to utilize the enthalpy content of the tobacco available downstream of the discharge point of said separation device.

[0057] Further characteristics and advantages of the invention will become better apparent from the detailed description of a particular but not exclusive embodiment, illustrated by way of non-limiting example in the accompanying drawings, wherein:

Figure 1 is a side view of a tobacco drying system with the energy recovery device according to the present invention;

Figure 2 is a further side view of a tobacco drying system with the energy recovery device;

Figure 3 is a still further side view of a tobacco drying system with the energy recovery device;

Figure 4 is a perspective view of a tobacco drying system with the energy recovery device;

Figure 5 is a plan view of a tobacco drying system with the energy recovery device;

Figure 6 is a further perspective view of a tobacco drying system with the energy recovery device;

Figures 7 and 8 are views of a circuit diagram of the energy recovery device.

[0058] In the exemplary embodiments that follow, individual characteristics, given in relation to specific examples, may in reality be interchanged with other, different characteristics that exist in other exemplary embodiments.

[0059] With reference to the cited figures, and considering that they exemplify some particular embodiments and are in variable scale and that individual reference numerals therein correspond to identical or equivalent elements, the reference numeral 1 designates a system for drying tobacco (also referred to as "product"), comprising

a known type of superheater 2 for a process gas, which is raised to a high temperature.

[0060] A circuit 3 is defined into which the product is introduced for example at a first star valve 4, located downstream of the superheater 2; the product is then conveyed to the base of a vertical drying column 5.

[0061] The vertical drying column 5 conveys the product into a subsequent separation device 6, such as a cyclone separator, of a known type.

[0062] The energy recovery device, generally designated by the reference numeral 7, is adapted to generate the conditions suitable for utilizing, instead of dissipating, the enthalpy content comprised between the pre- and post-cooling temperatures of the tobacco at the point 8 of discharge thereof from the separation device 6.

[0063] As already noted, in the background art the product is currently discharged from the drying system at the temperature of 100°C and the "available" enthalpy with respect to the target temperature level downstream of the subsequent cooling process (typically 40°C) is currently dispersed completely by convection of the heat toward the cooling gas (typically ambient air) for a marginal residual drying effect.

[0064] With reference to the values involved on an industrial scale, the enthalpy gradient (which is currently dissipated) comprised between the pre- and post-cooling temperatures is unquestionably considerable.

[0065] This is, moreover, an enthalpy content that is already present in the mass of product which, as such, is "immediately" available to produce rapid drying and therefore expansion, since the process is not negatively affected in its suddenness by the heat transfer time and the efficiency that are typical of every convective heat transfer.

[0066] The tobacco cooling device 7 therefore has first means for introducing an evaporation stage at subatmospheric pressure, which is arranged downstream of a first point 8 of discharge of the tobacco from the separator or separation device 6, so as to generate the psychrometric conditions adapted to restart the evaporation, which is supported, from the energy standpoint, by the "available" enthalpy cited above.

[0067] The tobacco cooling device 7 therefore has the function of adjusting the pressure conditions of the environment so that the sensible heat contained in the dry mass of the product, as well as the sensible heat of the water contained therein, is converted into latent heat in order to induce the change of state of the water (boiling).

[0068] In the particular but not exclusive embodiment described, the tobacco cooling device 7 therefore comprises a vessel 9 in partial vacuum, provided with internal conveyance means 10, which are adapted to transfer the product from the loading point, arranged downstream of the first discharge point 8, to the second discharge point 11.

[0069] The vessel 9 is arranged in direct connection to the first discharge point 8 of the tobacco and is provided with adapted means for insulation with respect to the out-

side environment; inside the vessel 9 it is possible, by means of the forced extraction of the air and steam generated therein, to maintain a perceptibly subatmospheric pressure, so that it is possible to induce a rapid evaporation of water by transformation of the sensible heat into latent heat and achieve the simultaneous cooling of the product to the target delivery temperature thereof (drying by cooling).

[0070] The internal conveyance means 10 are constituted, in the particular embodiment, for example by a screw feeder, but they can be constituted by another conveyance system that is commonly available in the background art.

[0071] As an alternative to the vessel 9 and to the screw feeder 10 it is also possible to use other conveyance means, such as for example a gravity hopper.

[0072] The vessel 9 is provided with a second discharge star valve 12, which is provided for the evacuation of the product, maintaining at the same time and in the best possible terms of efficiency the pressure insulation from the external atmospheric environment.

[0073] The tobacco cooling device 7 comprises a system for the forced extraction of the gas that consists of a mixture of water vapor (which is a result of the inherent evaporation and of the draft related to the efficiency and to the clearance volume of the loading valve) and air (which, in the steady state, is a result of the draft related to the efficiency and to the clearance volume of the discharge valve) connected to the vessel 9.

[0074] These two gas fractions are referenced herein-after as "condensable" gases, i.e., water vapor, which, at the pressure levels involved, is indeed again condensable merely by cooling, as opposed to "non-condensable" gases, i.e., air.

[0075] The extraction system is of the two-stage type and is composed of a condenser 13 (first stage) which is adapted to condense the "condensable" gases and a compressor 14 (second stage), which is adapted to recompress the "non-condensable" gases to atmospheric pressure for final return into the environment (after optional treatment for neutralization of the environmental impact, if necessary).

[0076] The condenser 13 can be of the direct type - by contact (by transit of the gases through a cooling water screen) or indirect, by means of a tube nest exchanger provided according to the common known technical options.

[0077] In both cases, water is used inside the condenser 13 as a cooling fluid and can be conveyed in an open or closed circuit, wherein, in the latter case, an evaporation tower 15 is provided in order to cool water before recycling it.

[0078] The invention has thus achieved the aim and objects cited above, a device having been obtained in which, for an equal capacity of the drying system and an equal increase in the obtained specific volume, by virtue of the reuse of the enthalpy that is inherent in the product at the discharge of the dryer (which in the background

art is dissipated), the energy to be transferred by convection from the hot process gas is lower.

[0079] Therefore, the exposure time of the product, or the flow of process gases, required to achieve the aim are reduced significantly.

[0080] All this leads to a more reduced size of the dryer and therefore, among other things, to a reduced overall height thereof.

[0081] Furthermore, the recovery of the enthalpy content that is inherent in the product at the discharge of the dryer, for the purposes of the drying process, leads to a corresponding net energy saving.

[0082] The consumption related to maintaining the subatmospheric pressure inside the vessel for "drying by cooling" is in fact comparable, in terms of dimensional order, to the consumption currently used for cooling devices.

[0083] An increase in specific volume is furthermore observed.

[0084] The evaporation induced by alteration of the pressure conditions that induces the sudden transformation of the inherent sensible heat into latent heat has, with respect to the cell walls of the product, a character of "explosiveness" that is much greater than any evaporation process produced by convective heat transfer.

[0085] Therefore, the increase in specific volume for an equal process temperature and humidity of the product at entry is greatly improved, without however introducing any alteration to the organoleptic characteristics of the product.

[0086] The device furthermore makes it possible to achieve controllability and reproducibility of the drying process.

[0087] Cooling of the product is in fact obtained by virtue of the evaporation induced in subatmospheric pressure conditions.

[0088] Therefore, the control and repeatability of the target delivery temperature and humidity of the finished product must be ascribed exclusively to the pressure level established within the vessel for "drying by cooling".

[0089] From the technical standpoint, this value is very easy to control, since it is simply a matter of acting on the temperature of the fluid that is condensing inside the condenser in order to adjust the extent of the suppression of the "condensable" gases and acting on the flow rate of the compressor in order to adjust the extraction of the "non-condensable" gases.

[0090] The process is therefore far more controllable and reproducible.

[0091] Finally, a limited degradation of the product is observed and is reduced significantly, since no pneumatic conveyance system is required in order to achieve the cooling of the finished product.

[0092] The invention is of course susceptible of numerous modifications and variations, all of which are within the scope of the appended claims.

[0093] The materials used, as well as the dimensions that constitute the individual components of the invention,

may of course also be more pertinent according to the specific requirements.

[0094] The various means for performing certain different functions certainly need not coexist only in the illustrated embodiment but can be present per se in many embodiments, including ones that are not illustrated.

[0095] The characteristics indicated as advantageous, convenient or the like may also be omitted or be replaced with equivalent characteristics.

[0096] The disclosures in Italian Patent Application No. TV2011A000009 from which this application claims priority are incorporated herein by reference.

[0097] Where technical features mentioned in any claim are followed by reference signs, those reference signs have been included for the sole purpose of increasing the intelligibility of the claims and accordingly, such reference signs do not have any limiting effect on the interpretation of each element identified by way of example by such reference signs.

Claims

1. A tobacco cooling device (7), particularly for a tobacco drying system comprising means for the circulation of a process gas at high temperature in a circuit provided with a tobacco drying column and with a device for separating said process gas from said tobacco, **characterized in that** it is adapted to utilize the enthalpy content of the tobacco available downstream of the discharge point of said separation device.
2. The device (7) according to claim 1, particularly for a tobacco drying system comprising a superheater (2) of a process gas, brought to a high temperature, and a circuit (3) into which the tobacco or product is inserted at a first star valve (4), arranged downstream of said superheater (2), and then conveyed to the base of a vertical drying column (5), which in turn is adapted to convey the tobacco into a subsequent separation device (6), **characterized in that** it generates the conditions adapted to utilize the enthalpy content comprised between the pre- and post-cooling temperatures of the tobacco at a first point (8) for discharging said tobacco from the separation device (6).
3. The device (7) according to claims 1 and 2, **characterized in that** it comprises first means for introducing a stage for evaporation at subatmospheric pressure which is located downstream of said first point (8) of discharge of the tobacco from said separator or separation device (6), so as to generate the psychrometric conditions adapted to restart the evaporation which is supported, from the energy standpoint, by the "available" enthalpy.
4. The device (7) according to claims 1 and 3, **characterized in that** the pressure conditions of the environment are adjusted so that the sensible heat contained in the dry mass of the product, as well as the sensible heat of the water contained therein, is converted into latent heat in order to induce the change of state of the water (boiling).
5. The device (7) according to claims 1 and 4, **characterized in that** it comprises a gravity hopper in partial vacuum or a vessel (9) in partial vacuum, provided with internal conveyance means (10), said hopper or said internal conveyance means (10) being adapted to transfer the product from the loading point, located downstream of the first discharge point (8), to the second discharge point (11).
6. The device (7) according to claims 1 and 5, **characterized in that** said internal conveyance means (10) are constituted by a conveyor.
7. The device (7) according to claims 1 and 6, **characterized in that** said vessel (9) is provided with a second discharge star valve (12) which is provided for the evacuation of the product while at the same time maintaining, in the best possible terms of efficiency, the pressure insulation from the external atmospheric environment.
8. The device (7) according to claims 1 and 7, **characterized in that** it comprises a system for the forced extraction of the gas, which consists of a mixture of water vapor, which is the result of the inherent evaporation and of the draught linked to the efficiency and to the clearance volume of the loading valve, and air, which is the result, under steady-state conditions, of the draught linked to the efficiency and to the clearance volume of the discharge valve, connected to said vessel (9), said two gas fractions being also identifiable as "condensable" gases, i.e., water vapor, as opposed to "non-condensable" gases, i.e., air.
9. The device (7) according to claims 1 and 8, **characterized in that** it uses means for obtaining an extraction system of the two-stage type, said means comprising a condenser (13), or first stage, which is adapted to condense the "condensable" gases, and a compressor (14), or second stage, which is adapted to recompress the "non-condensable" gases at atmospheric pressure for final return to the environment.
10. The device (7) according to claims 1 and 9, **characterized in that** said condenser (13) is of the direct type - by contact, by transit of the gases through a cooling water screen, or of the indirect type, by means of a tube nest exchanger, in both cases the

water being used inside said condenser (13) as a coolant fluid, said water being conveyed in an open or closed circuit, where, in the latter case, an evaporation tower (15) is provided to cool the water before recycling it.

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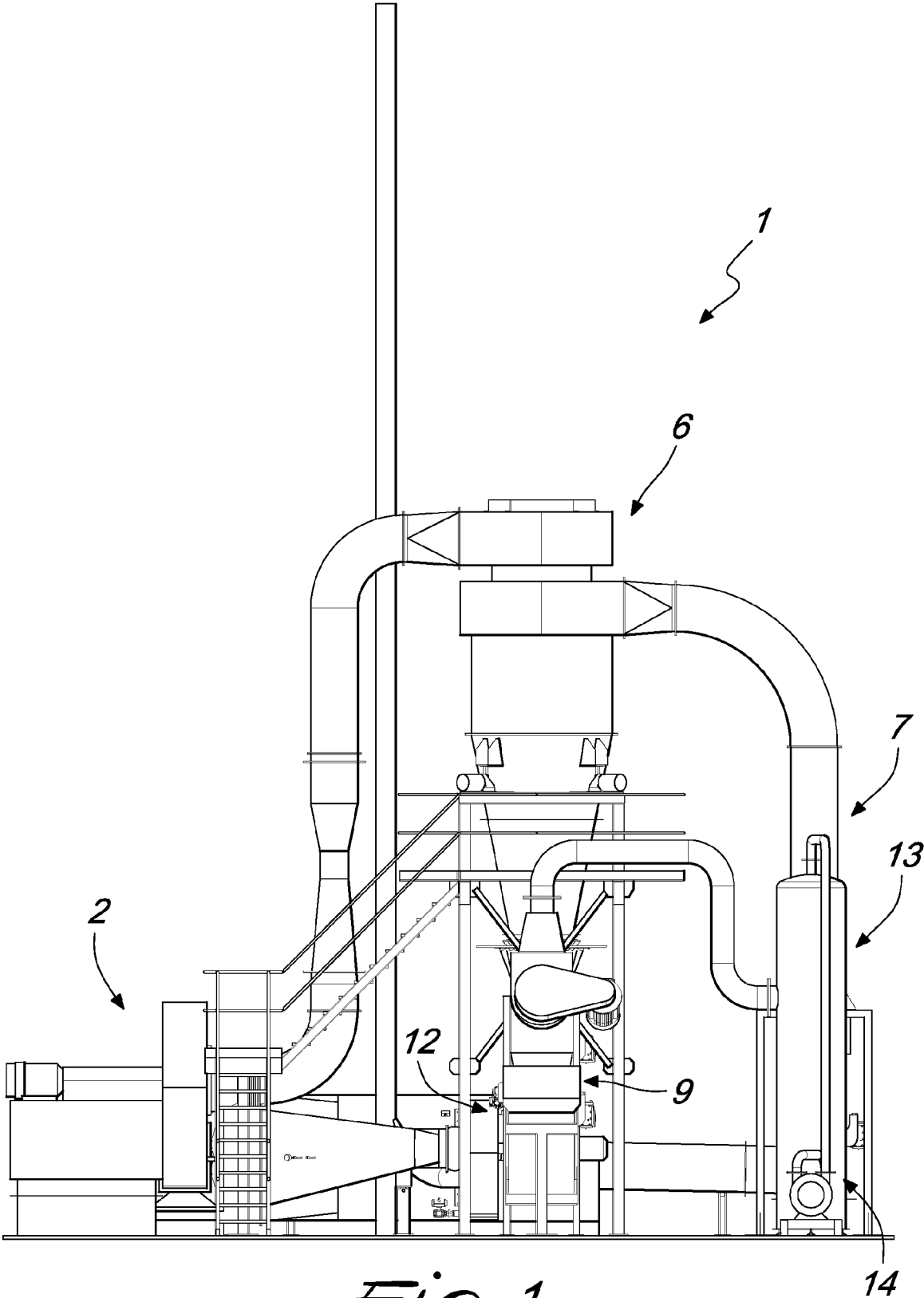
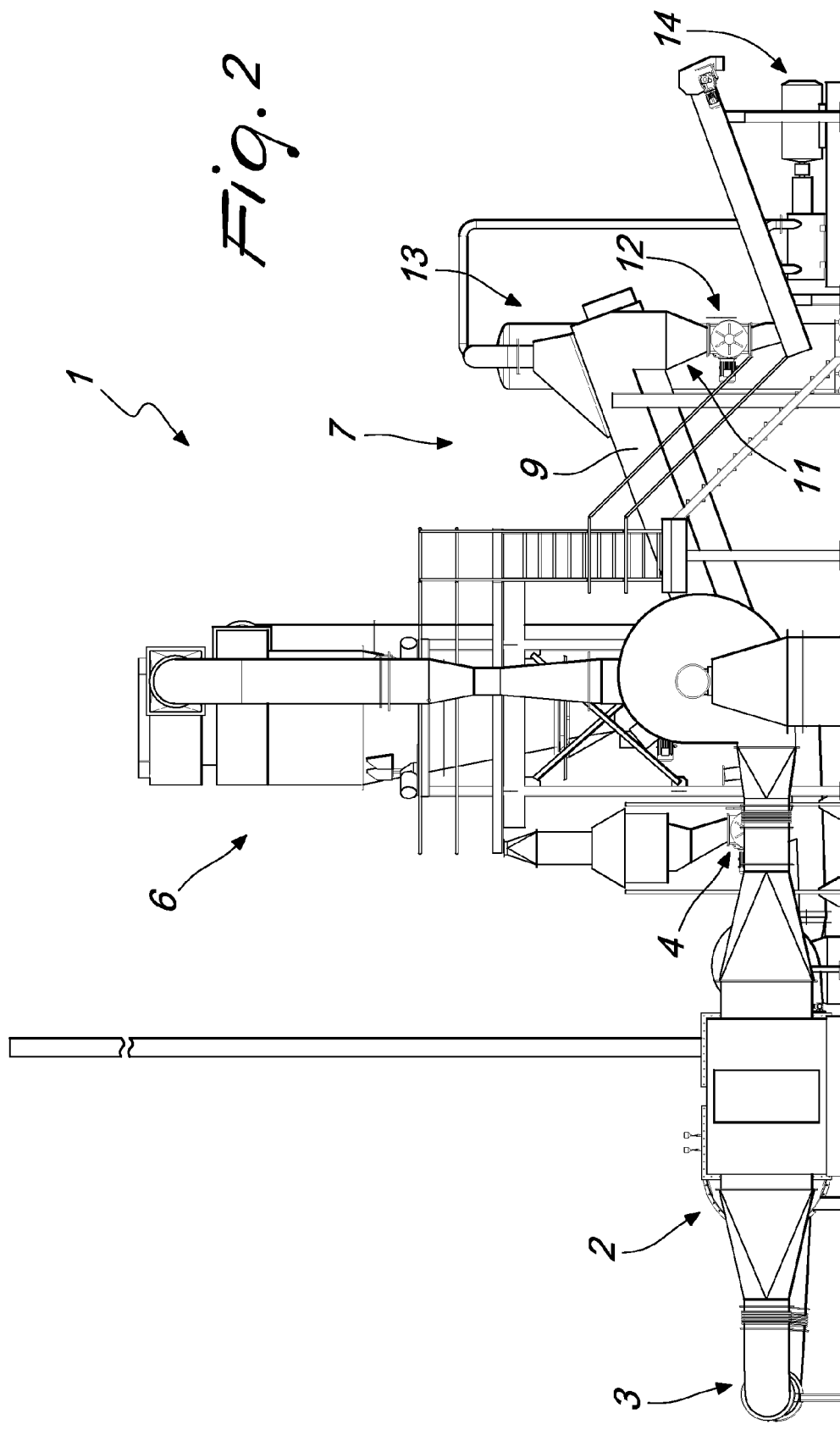
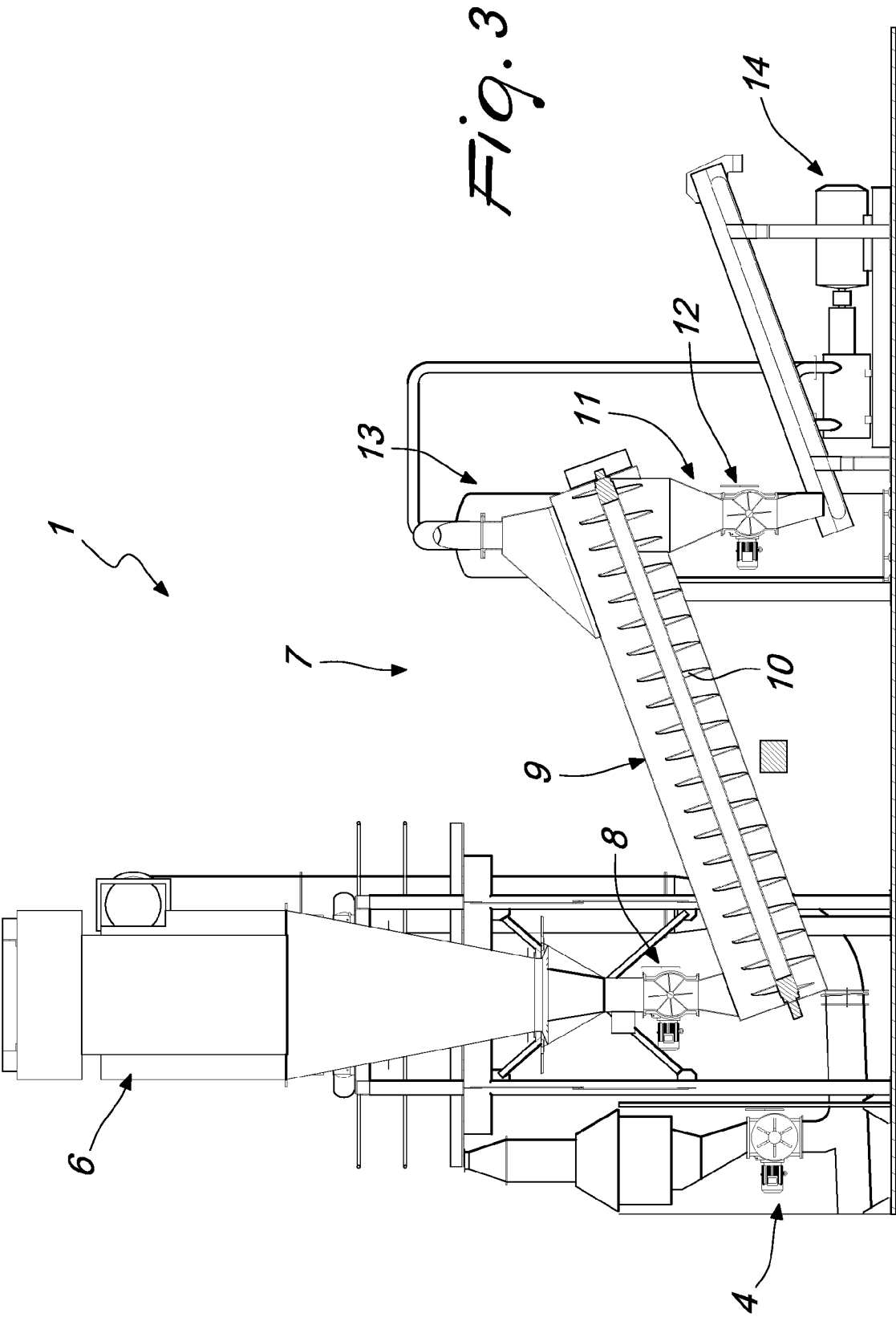


Fig. 1





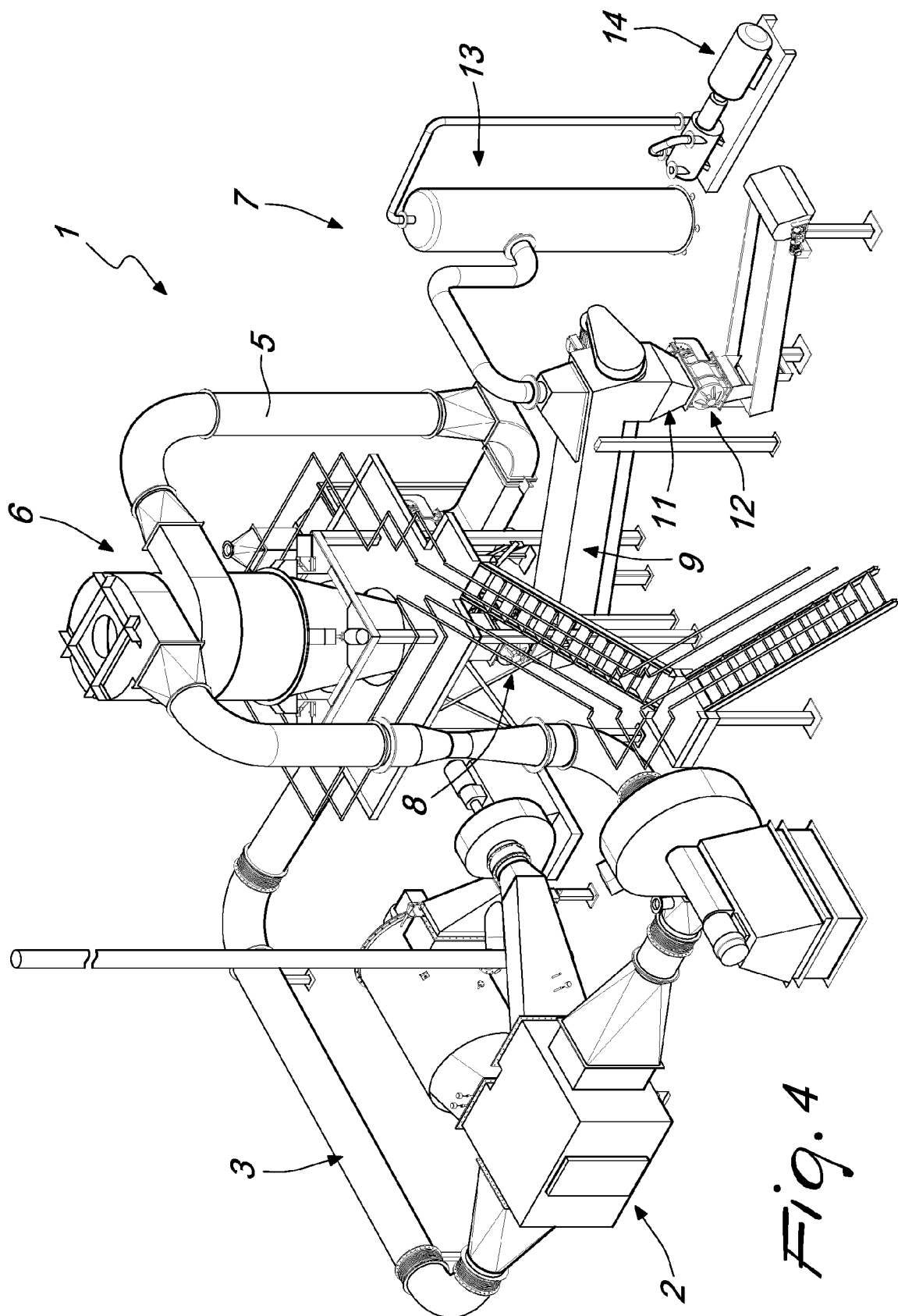
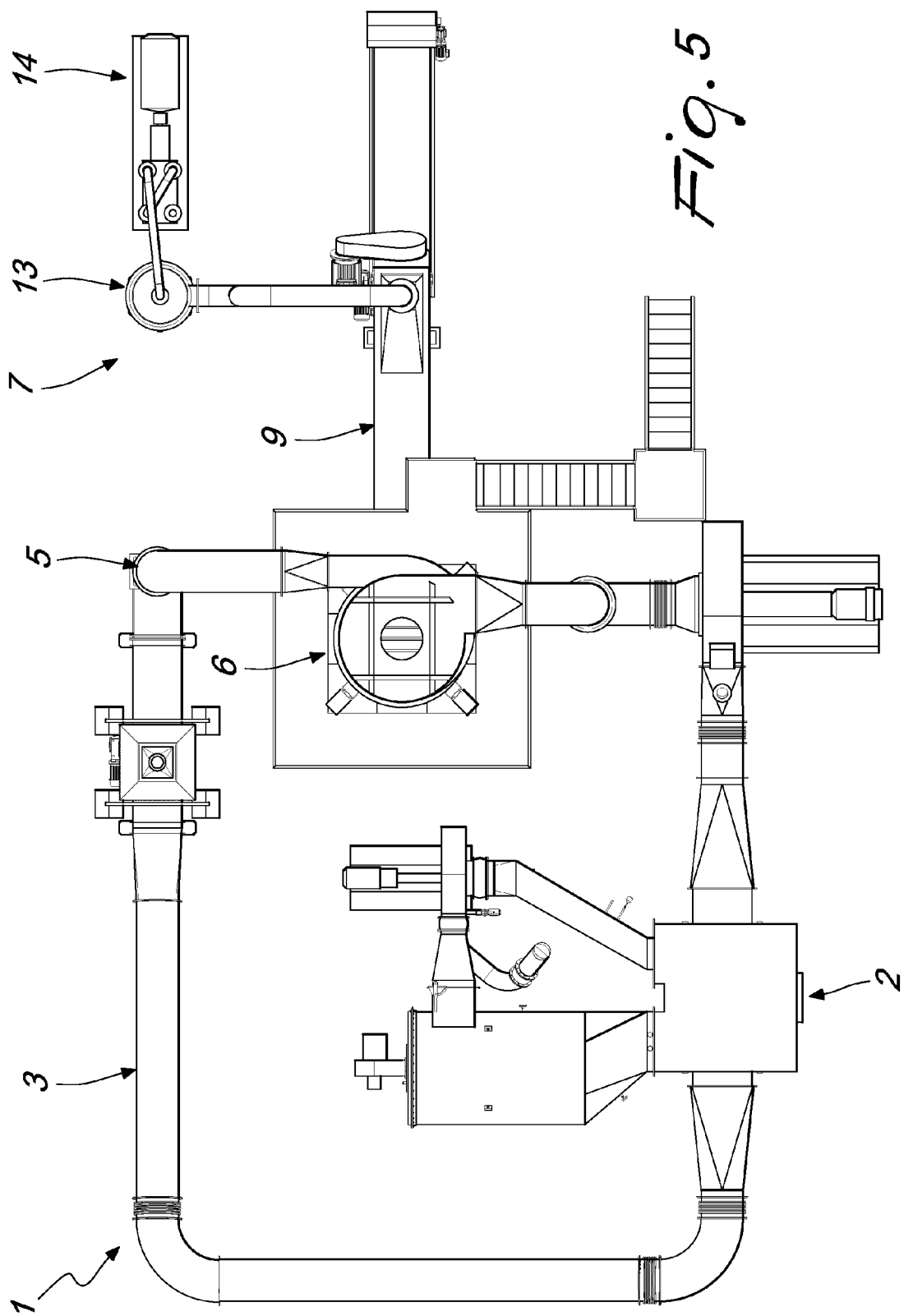
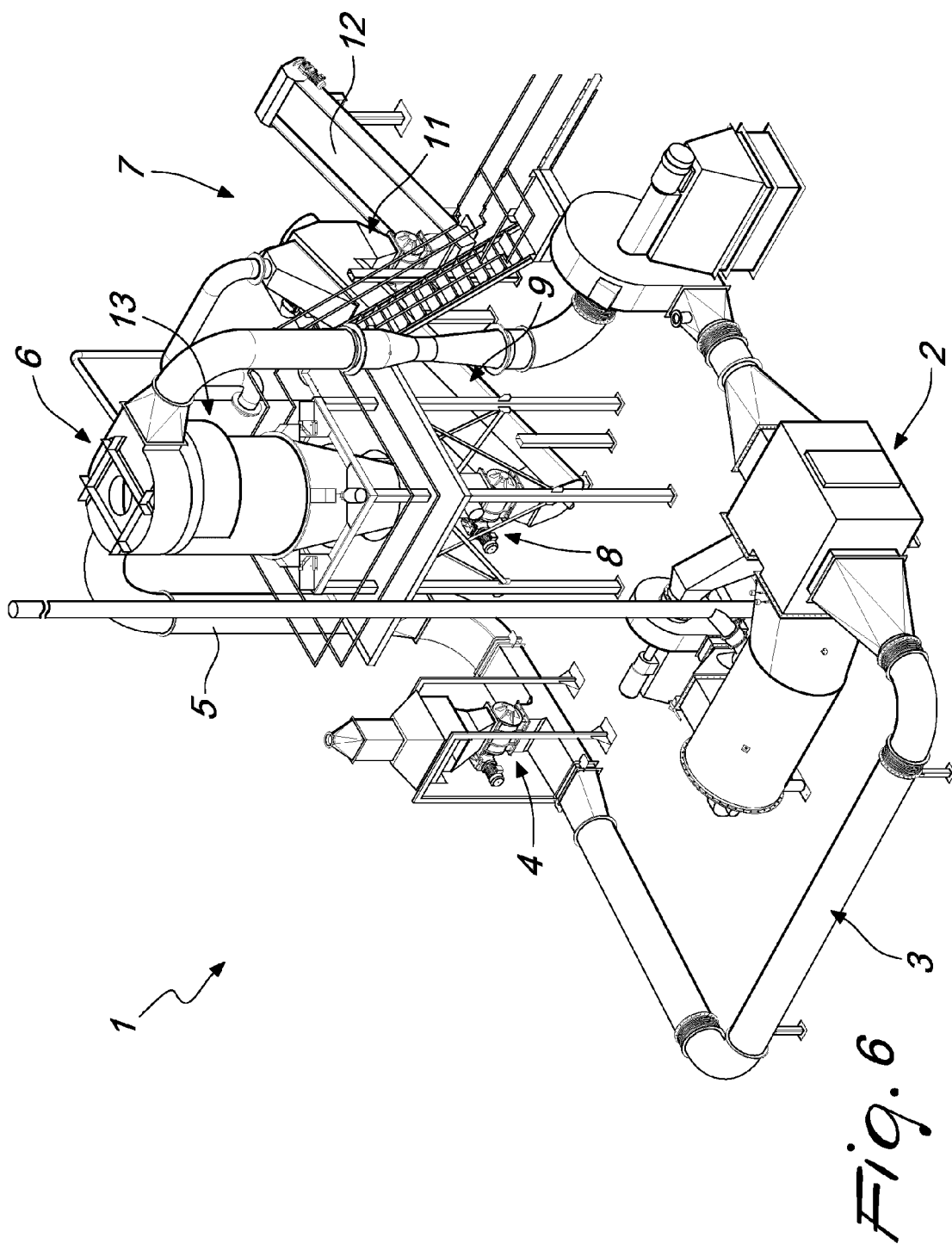
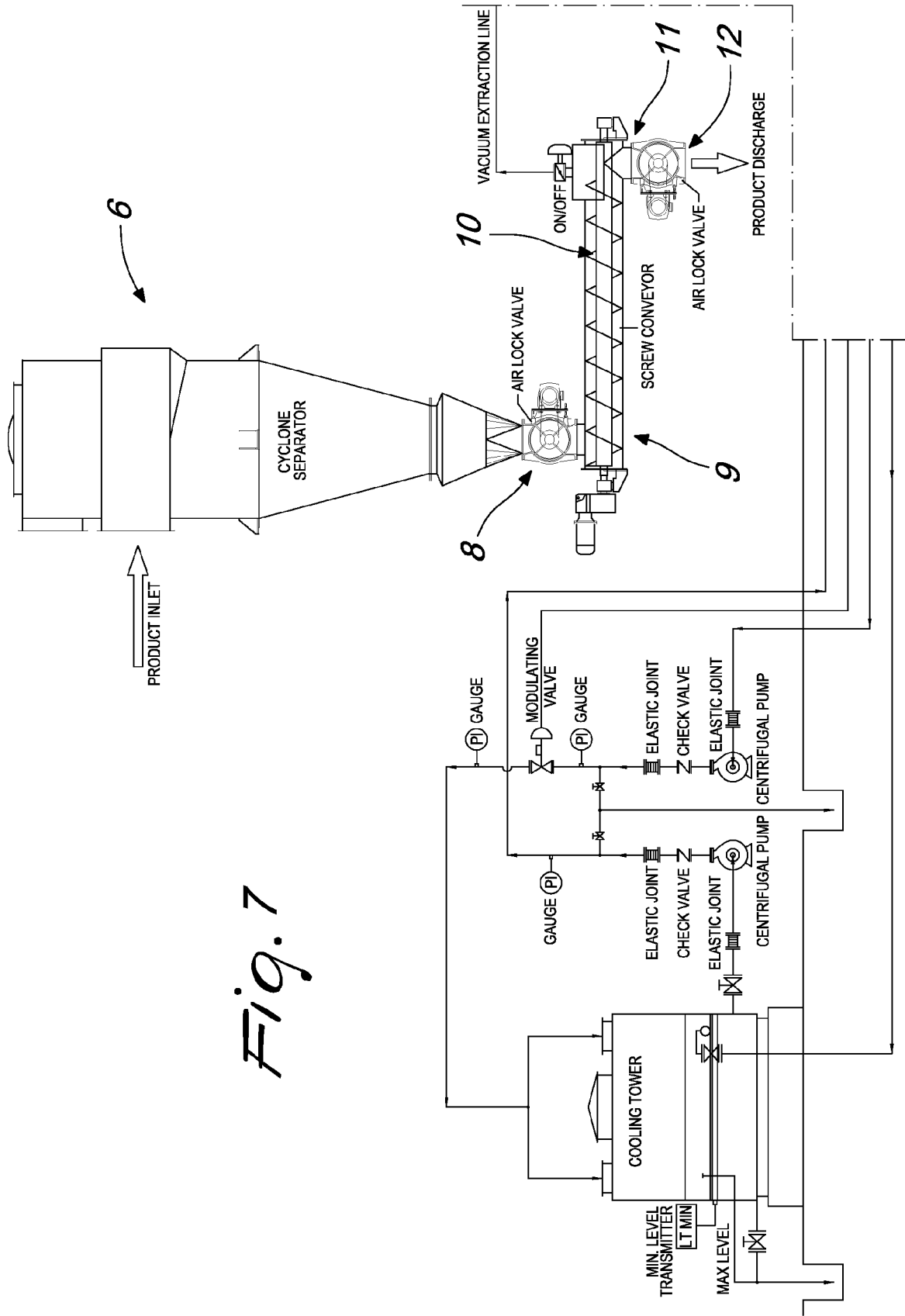


Fig. 4







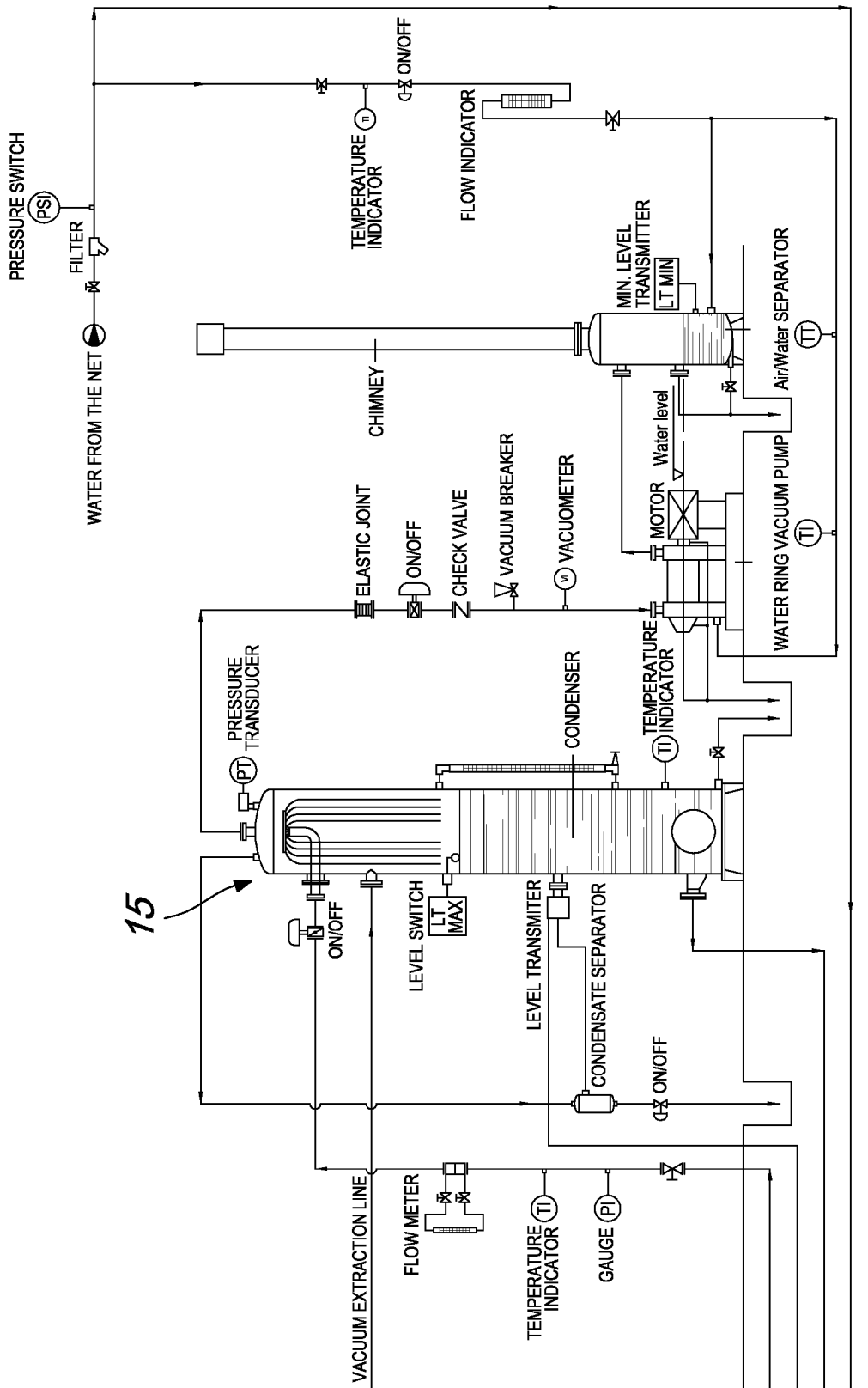


Fig. 8



EUROPEAN SEARCH REPORT

Application Number
EP 11 18 6721

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
A	GB 2 426 566 A (HAUNI MASCHINENBAU AG [DE]) 29 November 2006 (2006-11-29) * page 3, line 31 - page 4, line 12; figures *	1-10	INV. A24B3/04
A	EP 2 042 045 A1 (INT TOBACCO MACHINERY POLAND [PL]) 1 April 2009 (2009-04-01) * the whole document *	1-10	
A	DE 33 23 000 A1 (HAUNI WERKE KOERBER & CO KG [DE]) 19 January 1984 (1984-01-19) * the whole document *	1-10	
A	DE 32 21 602 A1 (HAUNI WERKE KOERBER & CO KG [DE]) 13 January 1983 (1983-01-13) * the whole document *	1-10	
A	GB 2 264 354 A (KOERBER AG [DE] KOERBER AG [DE]; HAUNI MASCHINENBAU AG) 25 August 1993 (1993-08-25) * abstract; figures *	1-10	
			TECHNICAL FIELDS SEARCHED (IPC)
			A24B
The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 26 April 2012	Examiner Marzano Monterosso
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EPO FORM 1503 03.82 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 11 18 6721

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26-04-2012

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
GB 2426566	A	29-11-2006	CN 1868345 A	29-11-2006
			DE 102005024975 A1	30-11-2006
			GB 2426566 A	29-11-2006

EP 2042045	A1	01-04-2009	CN 101396168 A	01-04-2009
			EP 2042045 A1	01-04-2009
			JP 2009159944 A	23-07-2009
			US 2009090374 A1	09-04-2009

DE 3323000	A1	19-01-1984	NONE	

DE 3221602	A1	13-01-1983	NONE	

GB 2264354	A	25-08-1993	DE 4204771 A1	19-08-1993
			GB 2264354 A	25-08-1993
			IT 1263901 B	05-09-1996

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Patent documents cited in the description

- IT TV20110009 A [0096]