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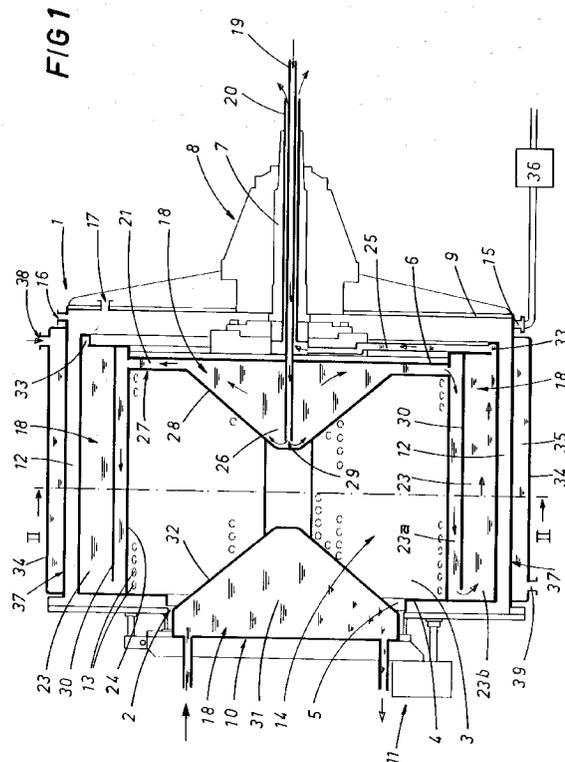
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A method for drying under vacuum and in a non-inert atmosphere products in general that have been washed with flammable solvents and the relative system for implementation of the method.

A method for drying in a non-inert atmosphere products in general, such as clothing or metal, plastic or similar parts, which have been washed in a drum (3) using flammable hydrocarbon solvents, in which the drying stage is effected by creating a vacuum within the drum (3) to obtain a residual pressure which prevents the spread of air flows within the drum (3) and corresponds to a boiling temperature for the said solvent which is well below its flash point; the heat necessary to dry the said products is transmitted by contact of the products with one or more sections (18) of the drum (3), heated by means which do not interact with the said atmosphere.



The present invention relates to a method able to guarantee the drying under vacuum and in a non-inert atmosphere of products in general, such as clothing or metal, plastic or similar parts, which have been washed using flammable solvents, and the relative system which effects the washing and drying using flammable solvents and is able to implement the said method during drying of the said products.

As is known, the industrial washing of products such as metal or plastic parts, components or machine parts which must be thoroughly degreased, or the so-called "dry cleaning" of clothing, has for some time been carried out with machinery or systems which use a solvent as the washing agent.

These machines or systems usually operate with a closed circuit, to allow maximum recovery of the solvents used, which normally belong to the chloro-fluoro-carbons (CFC) family, such as freon 113, or are chlorinated solvents, such as perchloroethylene.

Recently, to avoid the use of these solvents which, as is known, have damaging effects when spread into the external environment, special machines or systems, of the type mentioned above, have been designed which use flammable substances such as hydrocarbons as solvents. In these machines, to avoid the risks linked to the high flammability of the type of solvent currently used, the closed washing circuit, and in particular the drying circuit, are maintained in an inert atmosphere. That is to say, an atmosphere is created which does not react with the type of solvent used, an atmosphere consisting of inert gases, such as nitrogen, which prevent the combustion of the solvent.

Normally, the drying cycle is implemented by inducing evaporation of the solvent by means of a heated air flow, which is forced to circulate inside the chamber or drum in which the products are washed, and from which the solvent used for washing has been drained into a special collection tank.

During the drying cycle, wherever an inert atmosphere is not envisaged, there is a tendency to maintain a safe temperature within the drying circuit, envisaged as several degrees lower than the solvent's flash point.

Obviously, by "flash point", we refer to the minimum temperature of the solvent and the atmosphere in which it operates, consisting of gases which support combustion, at which the solvent ignites spontaneously. It must be noted that, to induce ignition of the solvent, not only must the flash point be reached, but the particles of solvent and air flow must also arrive at a given ratio, called the stoichiometric ratio, below which the temperature alone is not sufficient to provoke spontaneous ignition of the solvent. In other words, an excess of air is always required.

On the basis of the latter, that is to say, the fact that if the particles of solvent and the air flow are not present in the correct stoichiometric ratio the prob-

lems of solvent ignition are avoided, the techniques currently employed envisage that the washing and subsequent drying of products be carried out in an atmosphere which is not inert, that is to say, an atmosphere in which air, and therefore oxygen, is present, and envisages that drying of the products washed be effected by the generation of a significant air flow for ventilation and drying purposes.

A low temperature air flow is supplied and the action and mechanical energy of the air is exploited to remove particles of solvent from the products washed. At the same time, the said air flow causes some of the solvent to evaporate, even if the temperature of the air supplied is lower than both the boiling point and flash point of the solvent.

Moreover, during the drying stage, constant control of certain parameters is envisaged, parameters which affect the spontaneous ignition of the solvent, such as its concentration in the air and the temperature of the air flow. This type of control allows correct, safe operation, even if the drying process is accelerated by gradually heating the air as the solvent concentration falls, always remaining well below the flash point and stoichiometric ratio which would induce spontaneous ignition of the solvent.

In contrast to the above, these types of solvents are used, particularly during the drying stage, in an atmosphere with low oxygen content and are kept at a low temperature, or special devices are used, which are able to generate a vacuum in the areas of the machine or system containing the solvent, thus avoiding environments and situations in which the solvent and gases which support combustion (air) react.

As regards the research and set of principles which allow the use of such flammable solvents under vacuum, it is a good idea to specify that the so-called vacuum, in this particular case, is not a term indicating the absolute absence of air, but a synonym for a vacuum whose value may vary, from one case to another, within a range of values.

To this regard, other types of systems are known, which operate with flammable solvents and under vacuum, in which the relative vacuum reached, at least during the drying stage, still allows for the passage of a hot air flow, without which complete drying of the products washed could not be achieved in their particular case.

However, operating with this vacuum, it becomes necessary to heat and supply the air flow at a temperature which could induce an explosion, being too close to the solvent's flash point. The limits of such systems are, therefore, evident, given that operation with a certain relative vacuum, to effect correct and complete drying, requires an air flow with a high temperature and, therefore, critical conditions.

In fact, to quote some values which are only indicative, in traditional drying processes under vacuum in which the operating value is approximately 350

mmHg, it is extremely difficult to supply heat for drying, and temperatures which are critical with regard to the "flash point" must be approached.

The object of the present invention is to provide a method and relative system, able to dry under vacuum products washed with flammable solvents used in a non-inert atmosphere, allowing the maintenance within the drying circuit of a relatively low temperature, envisaged as many degrees below the solvent's flash point, in maximum safety from the point of view of possible explosion of the solvent, so as to eliminate the disadvantages mentioned above.

The present invention, and its technical specifications, in accordance with the said objects, are clearly described in the claims herein and the advantages of the present invention are made more evident in the detailed description, by way of example, with the aid of the accompanying drawings, which illustrate an example of an embodiment, in which:

- figure 1 is a schematic longitudinal section of a washer cylinder which is part of the system according to the present invention;
- figure 2 illustrates section II - II of figure 1, and
- figure 3 illustrates, with reference to figure 1 and according to a perspective-schematic view with some parts transparent to better view others, the cylinder which forms part of the system according to the present invention.

Before describing the advantages of the present invention, it is a good idea to define some basic concepts known to the technical staff of the sector, and to which reference is subsequently made. By "boiling" we refer to the passage of a liquid mass from the liquid state to the gaseous state, characterized by the fact that such a transformation occurs not only at the surface, as happens with evaporation, but within the entire mass of the liquid. The "boiling point" or "normal boiling temperature" is the temperature at which the liquid boils under a pressure of 1 atm (atmosphere). By "evaporation" we refer to the passage of a liquid mass from the liquid state to the gaseous state, such transformation occurring only at the surface of the liquid mass. The opposite phenomenon to evaporation is condensation. At a suitable temperature, this transformation may occur naturally at normal atmospheric pressure, or it may be artificially induced under high vacuum. By "flammability" we refer to the property of a substance to ignite and burn with a flame when heated to a suitable temperature in the presence of air or oxygen.

By "flash point" we refer to the minimum temperature of a substance and its surrounding environment for the substance to catch fire, that is to say, burn with a flame. With reference to an environment or recipient, the term "create a vacuum" is used each time a residual gaseous pressure lower than normal atmospheric pressure is created within it. The lower the value of the residual pressure, the higher the degree

of vacuum, or, more simply, the vacuum. The degree of vacuum may be distinguished as low, average, high and very high on the basis of the value of the residual pressure according to the classification which envisages that a low vacuum corresponds to a residual pressure of between 760 and 1 mmHg, a medium vacuum between 1 and 10^{-3} , a high vacuum between 10^{-3} and 10^{-6} and a very high or ultravacuum corresponds to a residual pressure lower than 10^{-6} . It is, therefore, evident that the term "create a vacuum" indicates a relative condition rather than an absolute one, unless the value of the residual pressure is specified.

This being said, the method according to the present invention for drying under vacuum and in a non-inert atmosphere products in general such as clothing, metal plastic or similar parts which have been washed in one or more cylinders using flammable solvents, such as hydrocarbons, envisages that the drying stage be effected by creating a low vacuum in the said environment. The value of the residual pressure in the said environment must be such as to prevent the generation and spread of air flows within the environment. This residual pressure value must correspond to a boiling temperature of the solvent used which is well below the solvent's flash point. The present method envisages that the products be heated and receive heat by making contact with one or more walls of a heated body, which is arranged and operates inside the vacuum environment and is heated by means 18 which do not interact with the atmosphere of the said environment.

It is true that even now, as has been said, a vacuum is created so that the boiling temperature is lower than the flash point, but it is also true that the difference between these temperatures is only a few degrees centigrade, and they force the drying air temperature to be raised to dangerous levels, or oblige the use of large air flows. In fact, in the cases encountered until now, given that the method used for drying products envisages, in any case, the circulation of more or less significant air flows, which make direct contact with the products, the operating pressure in such a stage cannot assume vacuum values high enough to prevent the circulation of such flows. It is also evident that vacuum values which are not high do not allow a drastic reduction of both the boiling temperature, and, therefore, the operating temperature, during washing, or the temperature of the drying air flows. Thus, in the past, the fact that an air flow always had to be generated in order to carry out the drying stage meant that the degree of vacuum could not be increased and, consequently, the effects which are the object of the present invention could not be obtained.

The method according to the present invention which does not, therefore, use air flows as the main vehicle for the removal of the solvent and its vapours

during the drying stage, envisages and allows a significant increase in the degree of vacuum in the parts of the system which contain the solvent, allowing two advantages to be obtained simultaneously.

The first of these advantages is the drastic reduction of the boiling temperature, so that the flammable solvent can be evaporated even with small increases in the temperature of the environment.

The second advantage is the generation of a non-inert atmosphere, not by the introduction of inert gases, but by an almost complete removal of the gases which support combustion, that is to say, of air and the oxygen which it contains.

Again considering the method according to the present invention, the transmission of heat to the products to be dried is obtained by their contact with one or more sections of the drum 3, heated by means 18 which do not interact with the environment inside the drum 3 itself.

The use of means of heating 18 is made necessary by the fact that a liquid, when it evaporates, yields heat and cools, and it can only continue to evaporate if supplied with at least the amount of heat that it loses during the said evaporation.

To provide a scale of the degree of vacuum to be obtained, the method envisages that the residual pressure value reached within the environment passed through or containing the solvent corresponds to a boiling temperature for the solvent used which is several tens of degrees lower than its spontaneous ignition and/or flash point temperature. More precisely, it is envisaged that the difference between these temperatures shall be approximately 30 - 45°C. Considering that the flash point of a hydrocarbon solvent is around 95°C, the residual pressure must, obviously, correspond to an easily reached boiling temperature of approximately 50-60°C.

The present method is implemented in a washing system with flammable solvents, such as hydrocarbons, the system being equipped, as shown in the accompanying drawings, with a fixed washer cylinder 1, which is substantially cylindrical, its axis of rotation lying horizontal, and having a sealable loading/unloading opening 2. The presence of a drum 3 to receive the products to be washed is envisaged inside the washer cylinder 1. The drum 3 is also substantially cylindrical, supported coaxially by the washer cylinder 1, and can rotate about its axis of rotation, powered by known drive means which are not illustrated.

Observation of figure 1 shows that the front wall 4 of the drum 3, that is to say, the wall facing the loading/unloading opening 2, has a loading/unloading opening 5 which substantially coincides with the loading/unloading opening 2. The back wall or base 6 of the drum 3 is attached to a support pin 7, coaxially fixed to the said back wall 6. The support pin 7 is supported in such a way that it may rotate freely by a hub 8, attached to the back wall or base 9 of the washer

cylinder 1 and is kinematically connected to the aforementioned drive means, which cause the drum 3 to rotate about its axis of rotation, coinciding with the axis of rotation of the support pin 7. The drum 3 is, therefore, suspended from the washer cylinder 1, by the support pin 7, and by the hub 8.

Near to the loading/unloading opening 2, the washer cylinder 1 has a door 10 which moves in accordance with the opening or sealing of the loading/unloading opening 2. In figure 1 the door 10 pivots above the washer cylinder 1 around a horizontal axis, and at its base has known means collectively denoted by a lock 11, which allow the door 10 to be closed with the seal and the seal to be maintained.

A gap 12 is formed between the drum 3 and the washer cylinder 1. The gap communicates with the inside of drum 3 by means of a plurality of holes 13, at least on the revolving surface or shell 14 of the drum 3, as illustrated in figure 1.

The washer cylinder 1 also has, at its base, an outlet 15 for the solvent used to wash products and, at the top, an inlet 16 for clean solvent and a connector 17 for connection to a system which is not illustrated and which generates a vacuum within the washer cylinder 1. The connector 17 may coincide with the outlet 15, but should this be the case, the presence of one-way valves consisting, for example, of a siphon 36, along the outlet 15 pipe is indispensable, as shown in figure 1. Moreover, the siphon 36 must be kept at a temperature at which the solvent contained in it does not evaporate and return to the washer cylinder 1. In accordance with the provisions for the method according to the present invention, the washer cylinder 1 is, therefore, structured so as to resist the internal generation of high vacuums, and to prevent leakages, thus maintaining the level of the vacuum. The vacuum is, obviously, also generated within the drum 3, thanks to the presence of the holes 13.

Observation of figure 1 reveals that the washer cylinder 1 contains part of a heating system 18 which, during drying of the products, heats them by means of their contact with a section of the drum 3.

The heating system 18 is completely isolated from the inside of the washer cylinder 1, the part of the system inside the washer cylinder 1 lying against the walls of the drum 3. Hereinafter, the term heating system 18 shall denote the part of the heating system 18 inside the washer cylinder 1, this being the part which most interests the present invention.

The heating system 18 consists of a delivery pipeline 19 and a waste pipe 20, positioned parallel to the axis of rotation of the drum 3, and a diffusion pipe 21 located in the base 6 and shell 14 of the drum 3.

Observation of figure 1 reveals that the delivery pipeline 19 and waste pipe 20 are placed coaxially to one another and to the axis of rotation of the drum 3. The delivery pipeline 19 runs inside the waste pipe 20, which passes directly through the hub 8.

The diffusion pipe 21, from the delivery pipeline 19, consists of a chamber 22 in the base 6 of the drum 3, a plurality of longitudinal pipes 23, for example, as shown in the embodiment illustrated by way of example, in ridges 24 which extend longitudinally within the shell 14 of the drum 3, and at least one radial pipe 25 on the exterior of the base 6 of the drum 3. The ridges 24 also cause remixing of the products to be washed.

The chamber 22 may be structured in two different ways, that is to say, it may cover the entire surface of the base 6, as illustrated in figure 1, or only a part, as shown in figures 2 and 3. As illustrated in figures 2 and 3, the chamber 22 is star-shaped, with a central section 26 and a plurality of radial sections or pipes 27, whose number corresponds to the number of ridges 24 and longitudinal pipes 23. The central section 26, obviously, communicates with the delivery pipeline 19, whilst the radial pipes 27 communicate with the longitudinal pipes 23.

The conical wall of the central section 26, facing the inside of the drum 3 and denoted by 28, extends towards the centre of the drum 3, to which it is positioned coaxially. The wall 28 allows an increase in the surface for contact and heat exchange between the hot fluid in the central section 26 of the chamber 22 and the products washed and the environment which surrounds them, increasing remixing of the products in collaboration with the ridges 24. Moreover, the inlet 29 of the delivery pipeline 19 is located near to the vertex of the wall 28, so that the hot fluid supplied by the delivery pipeline 19 immediately comes into contact with the centre of the wall 28, then runs along it before occupying the entire central section 26 and flowing along the radial pipes 27 and longitudinal pipes 23 (see figure 1).

The ridges 24 which house the longitudinal pipes 23 also contain a longitudinal divider 30, which separates the longitudinal pipes 23 into two sections 23a and 23b, which lie parallel to and communicate with one another at the front wall 4 of the drum 3. Section 23a, on the inside, communicates with a relative radial pipe 27, whilst section 23b, on the outside, communicates with a circular chamber 33 positioned on the exterior of the base 6, which in turn communicates with the radial pipe 25.

Observation of figure 1 reveals that the door 10 is hollow and thus forms a chamber 31 which is part of the heating system 18. The wall of the door 10 facing the inside of the drum 3 and denoted by 32 is substantially conical, in the same way as the opposite wall 28, with which it works for increased remixing of the products to be washed, or those which have been washed. The wall 32 contributes to the increase in the surface for contact and heat exchange between the hot fluid which occupies the chamber 31 and the products washed and the environment around them.

The heating system 18 also includes a hot fluid (such as water) generator which is not illustrated.

In a washing system which has a washer cylinder 1 structured in this way, upon completion of the washing stage, inside the washer cylinder 1 and, therefore, also the drum 3, a vacuum is generated until a residual pressure is obtained which corresponds to a boiling temperature for the solvent used approximately 30-45°C lower than the solvent's flash point. Since the flash point of a hydrocarbon solvent is around 95°C, the solvent can be made to evaporate inside the washer cylinder 1 by the vacuum generated at a temperature of around 50°C. The heating system 18 supplies hot water, at a temperature of around 50°C, which heats the walls of the diffusion pipe 21 to the said temperature. Products which come into contact with these heated walls are rapidly heated, and the drops of solvent which coat them are heated and evaporate. The system which generates the desired vacuum can also remove the evaporated solvent from the washer cylinder 1, after which the solvent is recovered, for example by a recovery device for which an Application for an Industrial Patent exists in the name of the same Applicant, the solvent then being treated in a safe fashion.

With the exception of the door 10, where the hot water follows an extremely simple route, the hot water is supplied to the delivery pipeline 19, from which it is forced against the wall 28, then into the radial pipes 27 and, from here, along sections 23a and 23b, before arriving at the circular chamber 33 and the radial pipe 25, from which it travels to the outlet 20.

A comparison of figures 1 and 2 shows that the surface for contact and heat exchange between the hot walls of the heating system 18 and the products washed is very large and guarantees optimum heat exchange.

To facilitate recovery of the evaporated solvent, at least the shell 37 of the washer cylinder 1 can be cooled, as shown in figure 1. For this purpose, the shell 37 can be fitted with a chamber 35 through which a cold fluid flows, for example water which can be supplied through a relative inlet 38 and drained from an outlet 39. In figure 1 the chamber 35 is obtained by applying a jacket 34 to the outside of the shell 37. In this way, the solvent which evaporates and arrives near to the shell 37 condenses and is drained off through the outlet 15 and siphon 36.

The resulting washing and drying system is extremely effective and has a simple structure, bringing both economic and practical advantages.

The absence of forced ventilation devices and vacuum generation systems make control of the entire washing and drying system much simpler and easier.

The safety aspect is no less important, since if the vacuum generation system develops a fault and ceases to function, no danger arises because the temperature of the heating water is well below the flash point temperature and cannot cause the solvent

to ignite. This same concept is also valid when, at the end of the drying stage, the washed and dried products are removed and replaced with other products to be washed, and more solvent is supplied for a new washing stage which, as is known, is carried out at normal atmospheric pressure. Wherever the chamber 35 is envisaged, the problem of the critical temperature at the start of the washing cycle, already averted as described, is further reduced.

Another advantage of the method and system according to the present invention, made possible by the low operating temperatures during all system operating stages, is the fact that even products which cannot resist high temperatures, such as garments made of synthetic materials, can be washed and dried.

The present invention, thus designed, may be subject to numerous modifications and variations, all covered by the design concept. Moreover, all parts may be replaced with technically equivalent elements.

Claims

1) A method for drying under vacuum in a non-inert atmosphere products in general, such as clothing or metal, plastic or similar parts, which have been washed in one or more drums (3) using flammable solvents, such as hydrocarbons, characterized in that the drying stage is effected by creating a low vacuum within the environment, to obtain a residual pressure which prevents the generation and spread of air flows within the environment, and corresponds to a boiling temperature for the said solvent which is well below its flash point; the heat necessary to dry the said products is transmitted by contact of the products with one or more walls of a heated body operating in the said environment, heated by means (18) which do not interact with the said environment.

2) The method as defined in claim 1, characterized in that the said transmission of heat occurs by the contact of said products with one or more sections of the drum (3), heated by means (18) which do not interact with the atmosphere of the said environment.

3) The method as defined in claim 1, characterized in that the said drying stage is carried out by creating a low vacuum within the environment, with a residual pressure which corresponds to a boiling temperature for the said solvent which is several tens of degrees lower than its flash point.

4) The method as defined in claim 1, characterized in that the said drying stage is carried out by creating a low vacuum within the environment, with a residual pressure which corresponds to a boiling temperature for the said solvent which is 30 - 45°C lower than its flash point.

5) A system for washing products in general, such as clothing, metal, plastic and similar parts, using

flammable solvents in accordance with the method defined in the previous claims and of the type which includes a washer cylinder (1) with a sealable loading/unloading opening (2) and a drum (3) which contains or receives the products to be washed and can rotate in both directions about a horizontal axis of rotation within the washer cylinder (1), characterized in that the said washer cylinder (1) communicates with a system which generates inside it a vacuum sufficient to prevent the generation and spread of air flows within the washer cylinder (1) itself, and corresponding to a boiling temperature for the said solvent which is well below the solvent's flash point, and containing a system (18) designed to heat one or more sections of the walls of the said drum (3) in order to heat the products, said heating system (18) being arranged and operating completely isolated from the said vacuum generation system.

6) The system as defined in claim 5, characterized in that the said heating system (18) is arranged inside the washer cylinder (1) in contact with the walls of the drum (3).

7) The system as defined in claim 5, in which the said drum (3) is substantially cylindrical, turns about its own horizontally positioned axis of rotation and, having in correspondence with its front wall (4), a loading/unloading opening (5) which coincides with the loading/unloading opening (2) of the said washer cylinder (1), characterized in that the said heating system (18) consists of at least a delivery pipeline (19) and a waste pipe (20) placed parallel to the axis of rotation of the said drum (3), and a diffusion pipe (21) in the back wall or base (6) and the rotating wall or shell (14) of the drum (3), said delivery pipeline (19) and waste pipe (20) and said diffusion pipe (21) being insulated, at least as regards the flow of fluids, from the inside of the washer cylinder (1) and the drum (3).

8) The system as defined in claim 7, characterized in that the said delivery pipeline (19) and waste pipe (20) are positioned coaxially to one another and to the axis of rotation of the said drum (3), and the delivery pipeline (19) runs inside the waste pipe (20).

9) The system as defined in claim 7, characterized in that the said diffusion pipe (21) consists, starting from the delivery pipeline (19), of a chamber (22) in the base (6) of the drum (3), a plurality of longitudinal pipes (23) in ridges (24) which extend longitudinally inside the shell (14) of the said drum (3), and at least one radial pipe (25) running along the outside of the base (6) of the drum (3).

10) The system as defined in claim 9, characterized in that the said chamber (22) covers the entire base (6) of the said drum (3).

11) The system as defined in claim 9, characterized in that the said chamber (22) consists of a central section (26), positioned coaxially to the drum (3) and communicating with the said delivery pipeline (19), and a plurality of radial pipes (27), each of which

leaves the said central section (26) and runs towards a respective longitudinal pipe (23) with which it communicates.

12) The system as defined in claim 11, characterized in that the wall (28) facing the inside of the said drum (3) and bordering the central section (26) of the chamber (22) is substantially conical, coaxial to the drum (3), and extends into the drum in order to increase the surface for contact and heat exchange with the products to be dried. 5
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13) The system as defined in claim 12, characterized in that the inlet (29) of the delivery pipeline (19) is located near to the said central section (26), so that the fluid which it supplies runs along the said wall (28) before entering the said chamber (22). 15

14) The system as defined in claim 5, in which the loading/unloading opening (2) of the said washer cylinder (1) can be closed by means of a door (10), characterized in that the said door (10) is hollow and thus forms a chamber (31) which is part of the said heating system (18). 20

15) The system as defined in claim 14, characterized in that the wall (32) of the said door (10) which faces the inside of the said washer cylinder (1) and drum (3) is substantially conical and extends into the washer cylinder (1) and drum (3), thus increasing the surface for contact and heat exchange with the products to be dried. 25

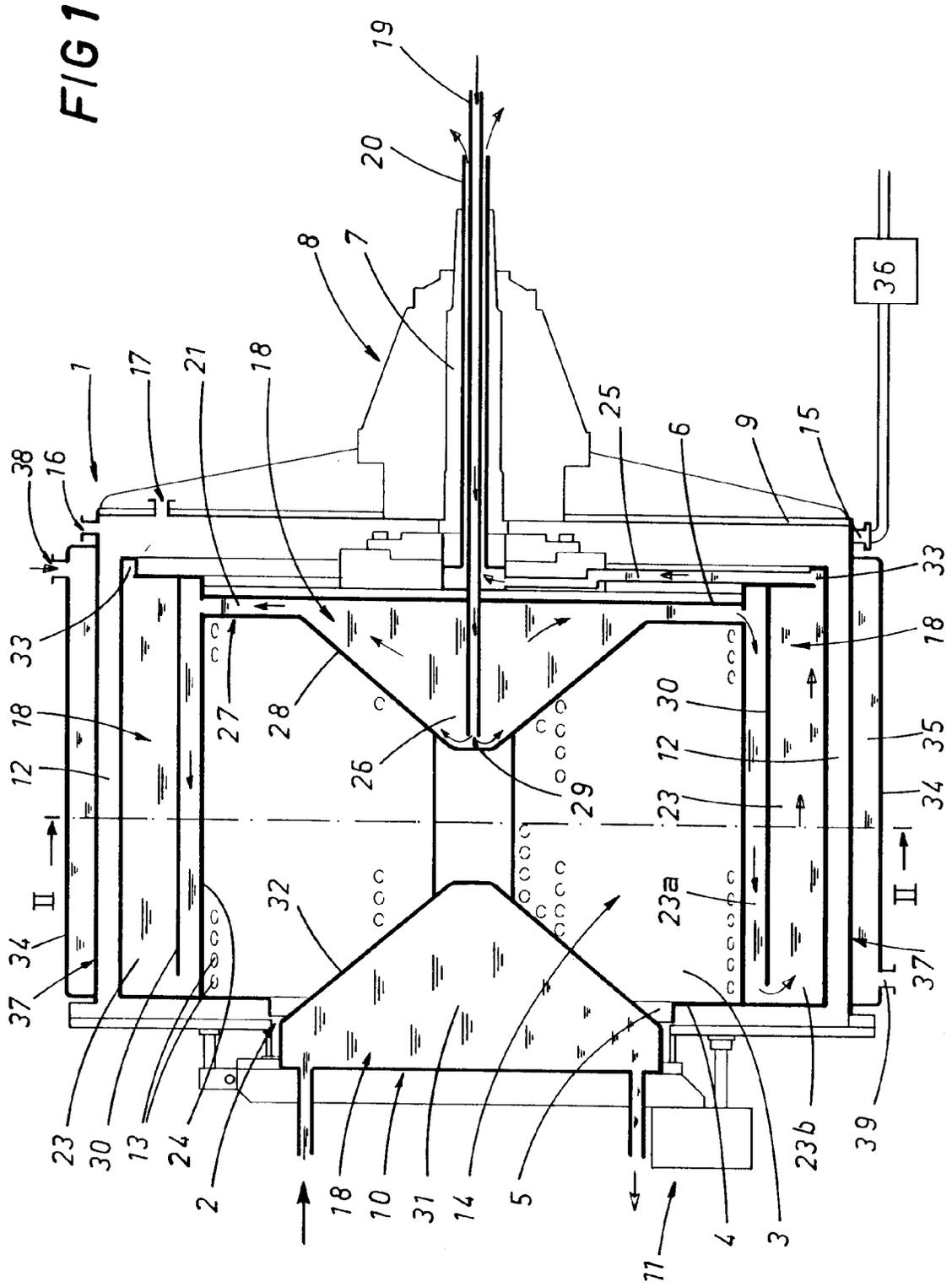
16) The system as defined in claim 5, characterized in that at least the revolving wall or shell (37) of the said washer cylinder (1) is hollow and houses the flow of a cold liquid intended to cool the said shell (37), causing the solvent which evaporates during the product drying stage to condense upon contact with its surface. 30
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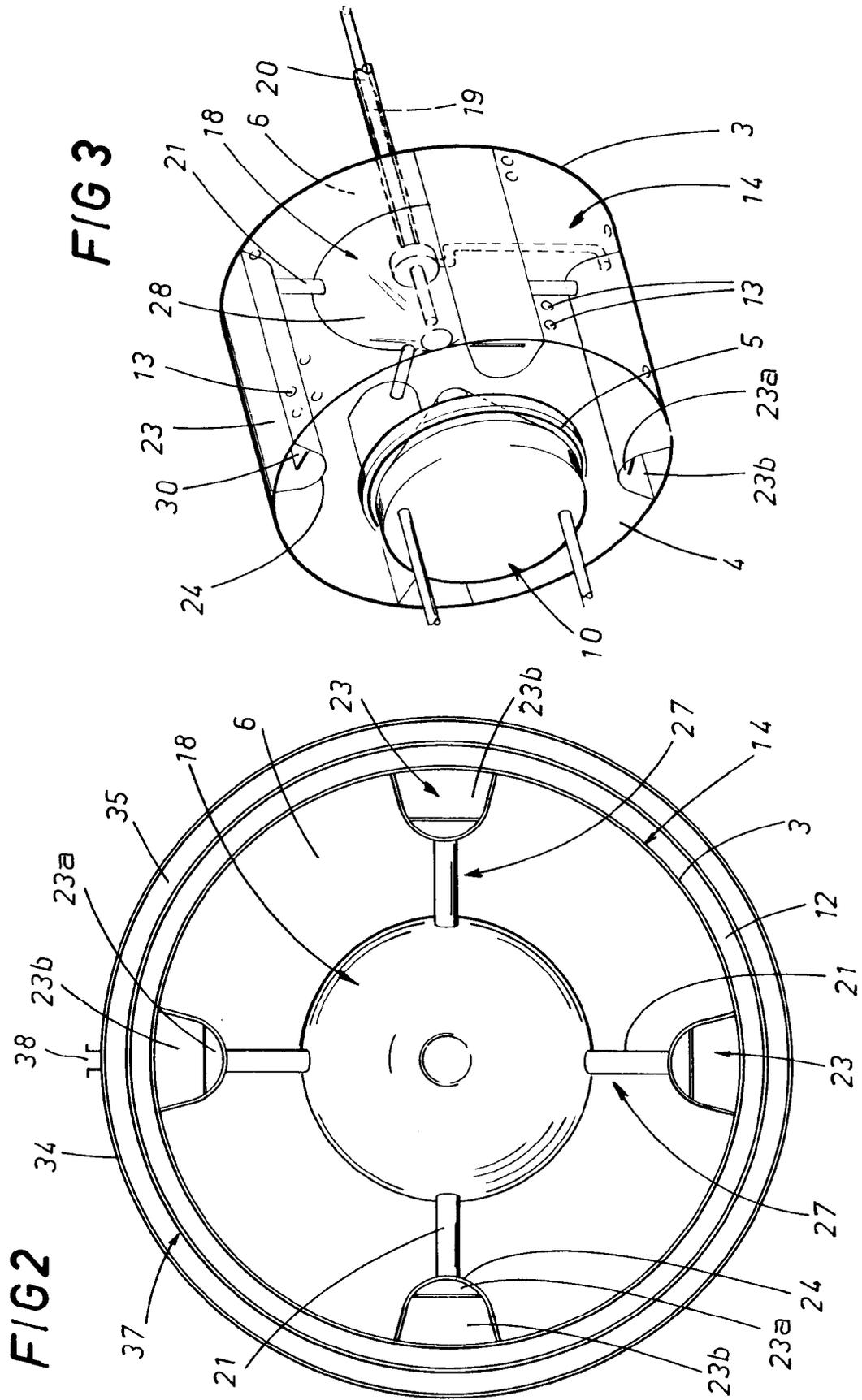
17) The system as defined in claim 5, characterized in that at least the revolving wall or shell (37) of the said washer cylinder (1) has an external jacket (34), designed to form a chamber (35) together with the shell (37), through which a cold fluid flows in order to cool the shell (37), causing the solvent which evaporates during the product drying stage to condense upon contact with its surface. 40
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European Patent
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EUROPEAN SEARCH REPORT

Application Number
EP 95 83 0092

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
Y	EP-A-0 527 699 (REWATEC AG REINIGUNGS- UND WASCHECHNIK) * the whole document * ---	1-6, 16, 17	F26B11/04 D06F43/00 D06F58/26
Y	DE-A-36 41 665 (BEHNKE ET AL) * the whole document * ---	1-6, 16, 17	
A	GB-A-397 236 (NIELD) * the whole document * ---	2, 6, 7, 9	
A	US-A-2 267 259 (ADT) * the whole document * ---	2, 6-10	
A	DE-A-16 29 044 (QUARZWERKE GMBH) * the whole document * ---	2, 6-9	
A	DE-A-21 05 865 (SIEMENS-ELEKTROGERÄTE GMBH) * the whole document * ---	2, 6	
A	US-A-3 036 384 (DICKE) * the whole document * ---	14	TECHNICAL FIELDS SEARCHED (Int.Cl.6)
A	US-A-5 131 169 (JASTER) ---		F26B D06F
A	GB-A-414 015 (QUESTER) -----		
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 14 June 1995	Examiner Silvis, H
CATEGORY OF CITED DOCUMENTS		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document	
X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document			

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