SPRUSON & FERGUSON

Australia

Patents Act 1990

NOTICE OF ENTITLEMENT

I, John Gordon Hinde, of 31 Market Street, Sydney, New South Wales, 2000, Australia, being the patent attorney for the Applicant/Nominated Person in respect of Application No 10598/95 state the following:-

The Applicant/Nominated Person is the actual inventor.

The Applicant(s)/Nominated Person(s) is/are entitled to rely on the application(s) listed in the Declaration under Article 8 of the PCT as follows:

Madpack - Servicos Internacionale, LDA made the basic application and assigned their rights in the invention including the priority rights accruing from the said basic application insofar as Australia is concerned to the Applicant/Nominated Person

The basic application listed on the Declaration under Article 8 of the PCT is the first application made in a Convention country in respect of the invention.

DATED this 30th day of January 1997

....

John Gordon Hinde

IRN: 340229

INSTR CODE: 50573

eab:8948T

AU9510598

(12) PATENT ABRIDGMENT (11) Document No. AU-B-10598/95
(19) AUSTRALIAN PATENT OFFICE (10) Acceptance No. 685883

(54) Title
METHOD FOR INERTING PACKAGING COVERS, DEVICES THEREFOR, AND PACKAGING COVER USED THEREIN

International Patent Classification(s)
(51)[6] B65B 031/04 B65D 081/20 F16K 015/08

(21) Application No. : 10598/95 (22) Application Date : 07.12.94

(87) PCT Publication Number : WO95/15887

(30) Priority Data

(31) Number (32) Date (33) Country
9301362 08.12.93 BE BELGIUM

(43) Publication Date : 27.06.95

(44) Publication Date of Accepted Application : 29.01.98

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(56) Prior Art Documents
DE 2921706
US 4344467
US 3521806

(57) Claim

1. An inerting process for packaging covers, said process comprising the following steps:

(A) - placing an item to be packed within at least one composite sheet as a packaging cover which is substantially closed with the exception of a first and second hole, the first hole being used to exhaust the inner atmosphere present inside the packaging cover and the second hole being used to inject an inert gas into said cover,

(B) - successively exhausting the inner atmosphere present inside the cover through a first valve adapted to be sealed with respect to the first hole in the packaging cover an injecting the inert gas through a second valve adapted to be sealed with respect to a second hole in the packaging cover, and

(C) - a continuously measuring parameter related to the relative humidity level in the packaging cover,

wherein said steps of exhausting the inner atmosphere present inside the packaging cover and injecting the inert gas being completed when a predetermined relative humidity level has been reached, and whereby the steps of exhausting the inner atmosphere of the packaging cover and of injecting the inert gas occur as delayed cycles with each exhausting of the inner atmosphere being immediately compensated for by an injection of the inert gas, and all the above described cyclic steps are effected so that the pressure inside the packaging cover is close to equal with the pressure of the external atmosphere.

.../2

4. A device for carrying out the process according to any one of the preceding claims, said device comprising an inert gas source having a pressure-reducer connected with a valve adapted to control or cut off the inert gas injection, said control valve being connected through a first flexible fitting with the cover through a first valve secured to the cover, and other device for creating a slight underpressure in the packaging cover connected with said cover through a second flexible fitting and a second valve secured to the cover, the second valve including a flow rate control valve and a non-return valve.

10598/95

PCT

ANNOUNCEMENT OF THE LATER PUBLICATION OF INTERNATIONAL SEARCH REPORTS

DEMANDE INTERNATIO … MATIERE DE BREVETS (PCT)

(51) Classification internationale des brevets 6 : B65B 31/04, F16K 15/18, B65D 81/20	A3	(11) Numéro de publication internationale: **WO 95/15887** (43) Date de publication internationale: 15 juin 1995 (15.06.95)

(21) Numéro de la demande internationale: PCT/BE94/00093

(22) Date de dépôt international: 7 décembre 1994 (07.12.94)

(30) Données relatives à la priorité:
9301362 8 décembre 1993 (08.12.93) BE

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(81) Etats désignés: AM, AU, BB, BG, BR, BY, CA, CN, CZ, EE, FI, GE, HU, JP, KE, KG, KP, KR, KZ, LK, LR, LT, LV, MD, MG, MN, MW, NO, NZ, PL, RO, RU, SD, SI, SK, TJ, TT, UA, US, UZ, VN, brevet européen (AT, BE, CH, DE, DK, ES, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), brevet OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, ML, MR, NE, SN, TD, TG), brevet ARIPO (KE, MW, SD, SZ).

Publiée
Avec rapport de recherche internationale.
Avant l'expiration du délai prévu pour la modification des revendications, sera republiée si de telles modifications sont reçues.

(88) Date de publication du rapport de recherche internationale: 27 juillet 1995 (27.07.95)

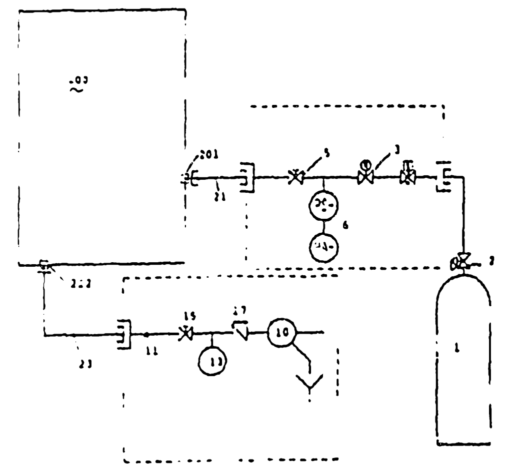
685883

(54) Title: METHOD FOR INERTING PACKAGING COVERS, DEVICES THEREFOR, AND PACKAGING COVER USED THEREIN

(54) Titre: PROCEDE D'INERTAGE DE HOUSSES D'EMBALLAGE, DISPOSITIFS POUR LA MISE EN ŒUVRE DUDIT PROCEDE, AINSI QUE HOUSSE D'EMBALLAGE UTILISEE

(57) Abstract

A method for inerting packaging covers, particularly industrial packaging covers, wherein the object to be packaged is placed on at least one composite sheet forming a packaging cover (100) which is completely sealed except for at least two apertures (201, 202) used both for extracting the atmosphere contained in the packaging cover and for injecting an inert gas (1), preferably nitrogen, into said cover; the atmosphere contained in the packaging cover is extracted through a first valve sealingly fitted to a first aperture (202), and inert gas is injected through a second valve sealingly fitted to a second aperture (201) in the cover; a parameter related to the relative humidity level within the packaging cover is continuously measured (11); and both the extraction of the atmosphere contained in the packaging cover and the injection of inert gas are stopped once the relative humidity level required by the customer has been achieved. All the above steps are performed in such a way that a virtual balance is maintained between the pressure inside the packaging cover and the pressure of the surrounding atmosphere.



(57) Abrégé

Procédé d'inertage de housses d'emballages, et en particulier de housses d'emballage industriel, caractérisé en ce que l'on effectue les opérations: on pose l'objet à emballer sur au moins une feuille composite qui sert de housse d'emballage (100), que l'on referme de manière totalement étanche, à l'exception d'au moins deux orifices (201, 202) qui sont utilisés d'une part pour extraire l'atmosphère interne présente dans la housse d'emballage et d'autre part pour injecter un gaz inerte (1), de préférence de l'azote, dans ladite housse; on effectue une extraction de l'atmosphère interne présente dans la housse d'emballage, via une première valve adaptée de manière parfaitement étanche à un premier orifice (202) de la housse d'emballage et une injection de gaz inerte via une seconde valve adaptée de manière totalement étanche à un second orifice (201) de la housse d'emballage; on effectue de manière constante une mesure (11) d'un paramètre lié au taux d'humidité relative régnant dans la housse d'emballage; on termine les opérations d'extraction de l'atmosphère interne présente dans la housse d'emballage et d'injection de gaz inerte lorsqu'on a atteint le taux d'humidité relative requis en fonction des besoins du client final; toutes les opérations décrites ci-dessus étant effectuées de manière que la pression présente à l'intérieur de la housse d'emballage soit proche de l'équilibre avec celle de l'atmosphère externe.

OPI DATE 27/06/95 APPLN. ID 10598/95
AOJP DATE 17/08/95 PCT NUMBER PCT/BE94/00093

AU9510598

DEMANDE INTERNATIONALE PUBLIEE EN VERTU DU TRAITE DE COOPERATION EN MATIERE DE BREVETS (PCT)

(51) Classification internationale des brevets 6 : **B65B 31/04, F16K 15/08, B65D 81/20** A2

(11) Numéro de publication internationale: **WO 95/15887**

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Publiée
Sans rapport de recherche internationale, sera republiée dès réception de ce rapport.

see folio 5

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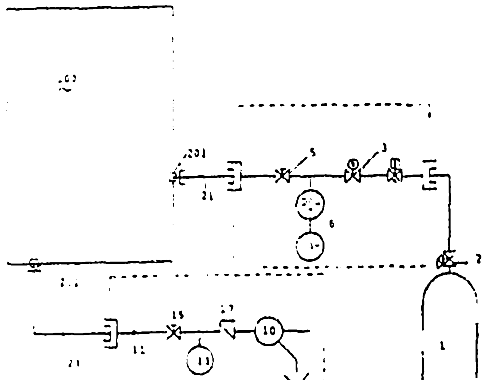
A method for inerting packaging covers, particularly industrial packaging covers, wherein the object to be packaged is placed on at least one composite sheet forming a packaging cover (100) which is completely sealed except for at least two apertures (201, 202) used both for extracting the atmosphere contained in the packaging cover and for injecting an inert gas (1), preferably nitrogen, into said cover; the atmosphere contained in the packaging cover is extracted through a first valve sealingly fitted to a first aperture (202), and inert gas is injected through a second valve sealingly fitted to a second aperture (201) in the cover; a parameter related to the relative humidity level within the packaging cover is continuously measured (11); and both the extraction of the atmosphere contained in the packaging cover and the injection of inert gas are stopped once the relative humidity level required by the customer has been achieved. All the above steps are performed in such a way that a virtual balance is maintained between the pressure inside the packaging cover and the pressure of the surrounding atmosphere.



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Method for Inerting Packaging Covers, Devices Therefor, and Packaging Cover Used Therein

Object of the Invention

The present invention relates to an inerting process for moisture-proof packaging covers, a machine and valves for carrying out such a process, as well as such packaging covers used, for the industrial packaging of products which can be altered by moisture, oxygen and external pollutants of various types.

In the field of the invention, the term "inerting" means placing products under an inert atmosphere as above-defined and further detailed below.

Prior art sustaining the present invention

Various packaging or storage systems are presently used by packaging or industrial companies. Currently most items, such as industrial products, are packed in a strong cover, for example, in non-woven fabrics. The most delicate or the sharpest parts are reinforced by a so-called "bubblepack" or similar materials. Drying agents are then put inside the cover in quantities determined by the manufacturer according to the water vapour permeation of the cover and the packaging volume. Blocking elements are then positioned to immobilize the product being packed. A metallized cover is then placed above the whole assembly and a vacuum is applied inside the cover so as to protect the packed piece of equipment. Finally the whole "package" is put into a wood box to provide complete protection for the packed product. This packaging or storage procedure has various disadvantages.

Firstly, the positioning of the non-woven fabric cover and the positioning of the reinforcing or blocking elements inside the cover requires a large amount of costly labour. The reinforcing elements are also expensive and often introduce moisture or other pollutants inside the cover.

Further, the drying agents are rarely heated enough to be made completely anhydrous and are used as such. Since they are themselves packed in moisture-containing bags, they are already water-saturated when they are put into the cover and reject their excess moisture inside the cover.

Moreover, the vacuum is applied by a vacuum cleaner held by a worker above the cover opening which remains partially open after the cover has been partially closed until the whole assembly is sealed by welding by another worker. This results in only a partial vacuum and moisture and other pollutants may remain inside the cover.

Finally, existing covers in the market are relatively porous and allow passage of moisture or other pollutants therethrough. Moreover, they are quite thin and easily perforated, which makes them very sensitive to tearing or other damage during any handling, especially welding.

Further, in case of long-term storage of materials sensitive to moisture or other pollutants, it is necessary at the present time to re-open the covers, to remove the drying agents, substitute new drying agents and close the covers again. This requires a large amount of time and costly labour and possibly a further material cost when the cover has to be replaced by a new one and gives no guarantee as to the good condition of the materials contained in the covers.

Other industrial companies, for example in the armament field or the metallurgical industry, send their products to specialized companies who oil them or coat them with oiled paper. When they arrive at their destination, the products are sent to another specialized company where they are un-oiled. These processes add to the cost of the industrial products.

Some companies dip their products into wax and the extreme costs involved in un-waxing the products for use makes the process uneconomical.

Other companies also hold their products in rooms which are especially heated or permanently provided with hot air so as to remove moisture, which is also quite expensive.

Other companies hold their products in nitrogen-containing containers. The process is convenient, but requires that the items of equipment to not have large dimensions so as to be able to fit into the container, which is not always the case. This process is thus quite limited.

Other companies manufacture reusable tents or covers having more or less the shape of the object to be packed so as to prevent oxidation under continuous air or nitrogen flow. That process is very expensive because the covers used are porous, so that there are continuous gas leakages and, because of the porosity of the covers, gas must be added frequently, which is quite expensive per se and requires machinery and the intervention of several workers, which further increases cost.

The inerting process is already known in the foodstuffs field where, for example, nitrogen is injected in sachets containing foodstuffs such as half-baked rice, fresh salad and the like, so as to store ready-to-eat products for a limited time. That system runs continuously for a limited period of time, since the aim is not to store products indefinitely, but just to market fresh consumables. In the period between the production of the fresh product and the consumption thereof, the products are also stored under nitrogen in cabinets provided therefor which are expensive because of their size and the sophisticated equipment required to maintain an appropriate pressurized nitrogen environment. Those cabinets are stored in distribution centers for fresh products and the nitrogen injected into the sachets is only used for the instantaneous transportation of products to supermarkets.

In summary, the current packaging and storage systems are generally expensive and have disadvantages. In a more and more internationalized world, there is a need for a packaging and/or storage system which can hold products in good condition, such as those produced by a mill, regardless of the country where they are stored or dispatched. Moreover, taking customer requirements into account, packaging should also be reliable and cheap, particularly in labour cost. Finally, and importantly, the nitrogen processing treatment should be done in situ, namely on the yard for industrial items or in the plantation for fresh products like fruit or vegetables and the like.

Except for the containers under nitrogen used mainly by the Army or large institutions for industrial items, or for the large installations used by the producers of fresh products, with the resulting space inconvenients, nobody has yet provided a flexible cover system under nitrogen treated by a reliable and inexpensive machine to inject nitrogen precisely and measuredly so as to store and pack any items for a long period of time and in any place where such a treatment is required.

US-A-4 344 467 describes a machine which continuously controls oxygen discharge and inert gas filling in any cover. That single discharging/feeding device is inserted into a hole in the cover in a non gas-proof way. However, no system is provided to re-close the cover and the final oxygen content is not precisely known, which is inconvenient. The machine is also stationary and can only be used continuously on one packaging cover.

US patent 3 521 806 relates to a packaging for protecting perishable products such as flowers and foodstuffs. It also describes a device which sends an inert gas through a tube to force the air inside the packaging out through another tube without any checking.

FR-A-2 218 250 relates to a process in which a vacuum is applied in a plastics cover and nitrogen is injected through tyre valves after drying agents have been placed into the cover. Again, neither measurement nor checking of the relative humidity level inside the cover, is described.

FR-A-2 653 405 relates to an industrial packaging in which forced air circulation is carried out by forcing the inner atmosphere onto drying agents. A stationary machine is described which dries the inner atmosphere of the industrial packaging and which starts again each time sensors detect a variation of the moisture level.

DE-2 129 706 describes a machine for storing foodstuffs products. That machine is used for storage and transportation as a cabinet of large dimensions. The inner part thereof can be heated or cooled.

Object of the Invention

It is an object of the present invention to substantially overcome or at least ameliorate one or more of the deficiencies of the prior art.

Summary of the Invention

Accordingly, in a first aspect, the present invention discloses an inerting process for packaging covers, said process comprising the following steps:

(A) - placing an item to be packed within at least one composite sheet as a packaging cover which is substantially closed with the exception of a first and second hole, the first hole being used to exhaust the inner atmosphere present inside the packaging cover and the second hole being used to inject an inert gas into said cover,

(B) - successively exhausting the inner atmosphere present inside the cover through a first valve adapted to be sealed with respect to the first hole in the packaging cover an injecting the inert gas through a second valve adapted to be sealed with respect to a second hole in the packaging cover, and

(C) - a continuously measuring parameter related to the relative humidity level in the packaging cover,

wherein said steps of exhausting the inner atmosphere present inside the packaging cover and injecting the inert gas being completed when a predetermined relative humidity level has been reached, and whereby the steps of exhausting the inner atmosphere of the packaging cover and of injecting the inert gas occur as delayed cycles with each exhausting of the inner atmosphere being immediately compensated for by an injection of the inert gas, and all the above described cyclic steps are effected so that the pressure inside the packaging cover is close to equal with the pressure of the external atmosphere.

In a second aspect, the present invention discloses a device for carrying out the process according to the first aspect, said device comprising an inert gas source having a pressure-reducer connected with a valve adapted to control or cut off the inert gas injection, said control valve being connected through a first flexible fitting with the cover through a first valve secured to the cover, and other device for creating a slight underpressure in the packaging cover connected with said cover through a second flexible fitting and a second valve secured to the cover, the second valve including a flow rate control valve and a non-return valve.

The steps of exhausting the inner atmosphere and injecting an inert gas can be carried out either simultaneously or in a delayed way (successively).

When carrying out the steps simultaneously, it is necessary that the flow rates of the inert gas and the inner atmosphere exhausted be equivalent so that the pressure inside the packaging cover is equivalent or close to the external pressure.

When carrying out said steps successively, more precisely as a cycle, a slight underpressure is first applied by exhaustion of the inner atmosphere inside the packaging cover and then, when that step is completed, an injection of inert gas will be effected so as to compensate immediately for the slight underpressure created inside the packaging cover. In the latter case, it will be necessary to effect various times of the exhaustion/injection cycle until the required relative humidity level is obtained inside the [illegible]ging cover.

The two holes for exhausting the inner atmosphere and injecting the inert gas in the packaging cover are preferably arranged in mutual opposed locations on said cover.

The inerting process can also be improved according to customers needs. For example, the number of sensors used can be varied to indicate other variables (such as pressure, temperatures, oxygen, pH, and the like) or also to indicate on a liquid crystal display not only the values of those variables, but also other graphic time representations according to customers needs. Those variables are important when they have to be adjusted according to other criteria than those above-mentioned for transportation or storage of items with rubber gaskets which could be inevitably dried if the atmosphere only comprises nitrogen.

In air transportation of industrial items or artworks, for example, purging elements can be also used, which are inverted valves and are preferably conveniently calibrated so as to compensate for the volume increase inside the cover because of the pressure decrease inside the plane due to altitude.

All the above improvements are within the scope of the present invention.

The inert gas used is preferably nitrogen because it is inert, but also because it is dry and has a drying effect. Of course, other gases can be used according to the present invention depending upon the end use, but nitrogen is the preferred gas for economic and practical reasons.

In the case of rubber gaskets being present, a small quantity of wet nitrogen will be injected in order not to dry the gaskets without any moisture being really present. The nitrogen used will be an almost pure gas according to the recommendations of the company L'Air Liquide. The case being, for foodstuffs storage, alimentary nitrogen will be used also according to the recommendations of L'Air Liquide. For all those types of nitrogen, L'Air Liquide guarantee no dew point up to -60°C, which avoids any condensation inside the cover.

The actual inerting process is carried out so that the pressure inside the cover is permanently not so far from equilibrium with the external atmosphere. Possibly, during the process and more particularly when it is carried out as a cycle, a slight underpressure can remain with respect to the external atmosphere, so as to create an intake of inert gas. That slight underpressure is always compensated for by the injection of inert gas.

According to another preferred embodiment, a slight overpressure of the inert gas inside the packaging cover may remain more particularly towards the end of the process so as to counteract any possible penetration of moisture from outside.

Working permanently with a pressure close to the external atmosphere allows to reduce any explosion risks due to the possible presence of petrol or kerosene for example for the packaging of military items of equipment.

As far as the humidity level is concerned, it depends upon the needs of the end customer. In most cases, a humidity level lower than 30% is required so as to avoid any oxidation.

As far as the oxygen level is concerned, which depends of course upon the relative humidity level inside the cover, it is quite low, preferably lower than 0.2% according to a preferred embodiment. That also advantageously limits explosion risk. Another advantage is that any insects present in the cover are killed with such a low oxygen level.

According to another embodiment, it will be required to hold a minimum oxygen level, more particularly in the case of perishable products like fruit.

Brief description of the drawings

The inerting machine as well as the valves used to carry out the present invention will be now described further in detail referring to the accompanying drawings wherein :

Fig. 1 is a schematic diagram of a machine for carrying out the process accordingly to an embodiment of the invention; and

Fig. 2 is an exploded view of a valve according to an embodiment of the invention.

Description of various preferred embodiments of the present invention

Fig. 1 shows a block diagram of the general structure of the machine according to the invention. All represented elements are standard components existing on the market.

Referring now to Fig. 1, for simplicity sake, two enclosures in broken lines are represented which do not reflect reality. In fact, both enclosures are normally grouped together into a single unit constituting said machine.

Firstly, the enclosure which allows connection of a source of inert gas 1, in the present case represented by a nitrogen bottle, with a packaging cover 100 will be described. The nitrogen bottle 1 is provided with a pressure-reducer 2 in turn connected to a valve 3. The valve 3 is configured to cut off the source of inert gas 1 from the packaging cover 100 or control the inert gas flow rate.

The valve 3 can be a modulating valve which is particularly recommended when working in a simultaneous mode. In that case, the valve modulates and controls the inert gas flow rate according to the volume of the atmosphere simultaneously extracted from the cover so that the pressure inside the packaging cover 100 is more or less equivalent to the external atmosphere.

According to another embodiment, more particularly when working as a cycle, the valve can be simply a solenoid valve which controls the opening or closing of the source of inert gas.

The valve 3 can be connected to an extra valve which is a manual cutoff valve 5.

A security manometer 6 is also present between the valve 3 and the cutoff valve 5 and, in case of an overpressure, closes an extra valve 4 which is a solenoid valve and a securing valve.

The cutoff valve 5 avoids any penetration of unwanted particles into the internal tubes, especially during transportation. The cutoff valve 5 is connected to the packaging cover 100 through a flexible fitting 21 which is secured directly to a tight valve 200 which will be described in further detail below.

The second enclosure represented in broken lines in Fig. 1, shows the connection of a vacuum pump 10 or any other device suitable for creating a slight underpressure with the packaging cover 100. The vacuum pump 10 or any equivalent device is connected with a flow rate controlling valve 15. The valve 15 is connected with a non-return valve 17 via a pressure transmitter 13 which, on basis of the principle of strength gauges, will supply a signal (4 to 20 mA or 0 to 10 V) corresponding to the pressure present in the packaging cover 100.

The control valve 15 is connected with the cover 100 through a flexible fitting 23 which is secured itself to a valve 202 which will be described in further detail below.

A moisture sensor 11 is present between the cover 100 and the control valve 15.

According to a preferred embodiment, the moisture sensor 11 can be integrated directly into the valve 202 such as described below.

The measurements given by the moisture sensor 11 and the pressure transmitter 13 define either the opening degree of the valve 3 when it is a modulating valve, or the opening time of said valve 3 when it is a solenoid valve, through the programmable controller.

The non-return valve 17, at the end of the substitution of an inert gas for air, automatically cuts off the inner atmosphere inside the packaging cover 100 from the external atmosphere by cutting it off from the vacuum pump 10 or any equivalent device. Thus, by closing the non-return valve 17, a measurement of pressure and relative humidity is made which reflects the conditions inside the packaging cover 100. The non-return valve 17 automatically runs at the end of each substitution of exhausted air by an inert gas. In case of a step of a larger period of time, an additional manual valve is required. Further, the flow rate of the vacuum pump 10 can be modified depending upon the items to be packed. In most cases, an average flow rate of 35/65 m^3 per hour is sufficient. In that case, a regular packaging operation will take a few minutes.

The programmable controller present on the front side of the machine for carrying out the process according to the invention is known per se and will not be described further.

The machine is different from the prior art machines because it has no injection pump and the pressure reducing valve of a nitrogen bottle is used as an injector and is quite easily controllable at a given pressure, for example 6 or 8 bar. The machine has a small size and can be easily transported in a van to any yard, which is not the case with prior art machines.

Moreover, the machine according to the invention is inexpensive and is within easy reach of many middle-size companies or producers, which was not the case with prior art machines. Finally, the prior art machines are almost exclusively manufactured for foodstuffs whereas the machine according to the present invention has a more versatile use, mainly in the packaging field for industrial products. To summarize, the machine according to the invention is practical, less bulky, simple in design and inexpensive.

The valves used are especially designed valves according to the present invention which can be secured simply to cover the material. The valves allow application of a slight underpressure by air exhaustion or to inject an inert gas such as nitrogen into a tight enclosure which is a packaging cover. They are generally made of plastics such as PVC, Teflon or another material of the same type for economic reasons, but could be also produced from other appropriate materials.

The valve according to the invention is represented in Fig. 2. The valve 200 or 202 generally comprises a body formed with various elements to be assembled beforehand, namely a diffuser 101, a spring 104, a plug provided as a circular plate, an O-ring 110 preferably in rubber or a convenient plastics material, and a circular ring 109 to allow a tight securing into the hole of the packaging cover 100.

The diffuser 101 is shaped as a short cylindrical tube the wall of which includes four circular holes 102 regularly distributed on the periphery thereof. The holes 102 are big enough to allow the application of an underpressure or to inject nitrogen. The diffuser 101 is externally threaded on its lower part. The diffuser 101 is designed to be secured to the ring 109 which has a circular recess 106 on its upper part. The circular recess 106 is threaded internally to receive the diffuser 101 by screwing. To enhance the tightness of the assembly, an O-ring 110 will be put into the circular recess 106 between the diffuser 101 and the ring 109. It will be held in position and slightly crushed when the diffuser 101 is screwed to the ring 109, thereby ensuring a perfect tightness.

Before assembling the diffuser 101, the O-ring 110 and the ring 109, the spring 104 and the circular plate serving as a plug 105 are put into the diffuser 101 in the sequence of steps indicated in Fig. 2.

The ring 109 is generally formed with a circular flange 107 on the upper part thereof - which has the internally threaded circular recess 106 mentioned above - and a short tube part 108 of lesser diameter on its lower part. The short tube part 108 is designed to go through a hole bored in the cover 100 by a punch. The short tube part 108 is externally threaded and screwed on a nut 111 which is arranged on the other side of the cover 100. The nut 111 is ring-shaped with approximately the same diameter as the circular flange 107 of the ring 109 and is provided with a central internally threaded hole to be screwed on the short tube part 108. The short tube part 108 goes slightly beyond the nut 111 whose object is to secure the packaging cover 100. -

The assembling of the whole system is achieved quite easily by screwing. Moreover the valve takes up little room and merges tightly with the cover.

Together with the above-described valve, two elements have been developed which complete the valve and assure a better performance of it. Namely, a short sleeve 112 which is internally threaded at one end for screwing onto a short cylindrical part 108. The sleeve 112 is an intermediate part between the valve and a tip 115 of a flexible fitting leading to either the nitrogen bottle or the vacuum pump. The sleeve 112 is not supposed to stay on the valve, because the valve would project too much outside and could be caught by various objects during the packaging, which could damage the valve and possibly break the cover sealing. The sleeve 112 is removed each time and can be re-used various times.

The joint between the sleeve 112 and the tip 115 provides a tightness between the elements and assures a quick release without too much loss or tightness. It is made with a wedge system. The external surface of the sleeve 112 is slightly tapered, the part turned to the cover having the biggest diameter. The inside of the tip 115 has the same tapering, which gives a better tightness when both parts are fitted into each other. The sleeve 112 has a groove 113 which is, in a first part as shown in Fig. 2, parallel to the sleeve axis on a distance of a few centimeters, making afterwards an angle of +/- 100° downwards with respect to the axial direction clockwise so as to form a holding part. When both elements are fitted into each other, a convenient tightening is obtained by engagement of a lug projecting from the inner wall of the tip 115 into the groove 113. To do so, the tip 115 is pressed onto the sleeve 113 and, when it reaches its path end, it is then rotated clockwise until the internal and external surfaces of the tip 115 and the sleeve 112 bear against each other.

A metal rod 114 projects from the tip 115 by a predetermined length, the length being such as, when the tip 115 is secured to the sleeve 112, the tip end oriented towards the valve bears against the spring plate 105 to press on the spring 104. In order to help the pushing movement, the end of the rod 114 oriented towards the valve has a flared shape which allows it to bear efficiently onto the center of the circular plate 105. The metal rod 114 is thin enough on most of its length so as not to disturb the gas flow going through. Care is taken to avoid any risk of buckling the rod 114 which is compression stressed.

When the tip 115 is plugged and secured to the sleeve 112 as above-mentioned, the rod 114 pushes onto the circular plate 105 and brings it up to the end of its path at the bottom of the diffuser 110, thereby uncovering the four holes 102 provided in the wall of the diffuser 101. Consequently, the way is free to inject nitrogen or to apply a vacuum. When the operation is completed, the tip 115 is unfastened, the spring expands and brings back the circular plate 105 to its starting point, thereby covering the four holes 102 and instantaneously sealing the cover 100.

When the tip 115 is moved anticlockwise to disconnect it from the sleeve 112, the diffuser spring expands, quickly forcing the rod 114, which allows an extremely quick disconnection of the tip 115 and an almost instantaneous sealing of the cover, that results in almost no gas. loss, and, generally speaking, a perfect sealing, and the keeping of a gas equilibrium inside the cover 101.

The tip 115 can be incorporated into the flexible fitting leading to the vacuum pump or to the nitrogen bottle. It can also be an independent item to be connected which the tips of such fittings. In the case of materials to be regularly checked, the tip 115 can be connected with the tip of a moisture sensor.

The spring 104 will be dimensioned so as to resist pressure differences between the inside and the outside of the cover 100 of about 1 bar or slightly less.

The pressure of nitrogen alone, between 6 and 10 bar, can press on the spring 104, open the plug 105 and allow the operation of the valve and that option is included into the scope of the invention. However, generally speaking, the system described above system is preferred because its allows the passage of the gas flow with neither slipstream nor development of forces due to the pressure by a simple mechanical action. Moreover, in the case of the second valve connected to the vacuum pump, the pressure is directed on the opposite direction from the nitrogen pressure and the mechanical system developed in the valve according to the invention allows the use of one and the same valve for two different operations.

Both complementary elements formed by the sleeve 112 and the tip 115 can be made of plastics or metal. The rod 114 can be made of metal in order to guarantee higher strength.

The sleeve 112 and the corresponding tip 115 can also be formed integrally according to another embodiment on the condition that the valve is activated by a rod system as described above or in any other way.

That will be the case mainly when any sensor (humidity, pressure, temperature, etc.) is connected with the valve for checking long-term stored products.

Finally, the valve according to the invention can be used as a purge when it is reversed, that is to say with the diffuser 101 outside the cover 100. In that case, the spring 104 arranged inside the diffuser 101 with be calibrated more or less at one bar when working at an equal pressure or at a higher value when working with a slight overpressure. The reverse mounted valve is very important in the case of air transportation of products. The packages material is loaded in the store-rooms of cargo planes. Those store-rooms are unperfectly air-conditioned so that during the flight, the pressure decrease in the store-room leads to a cover inflation which can lead to bursting of the cover. In that case, the valve according to the invention acts as a purge to exhaust the excess nitrogen outside, even if the cover is to be reinflated at destination.

The diffuser 101 is so called because of its diffusing action which spreads nitrogen regularly in all directions inside the cover 100 to remove moisture from all places of the cover 100. This is assisted by the action of the vacuum pump. Moreover, if one and/or both valves are to be recovered, it is possible, as above mentioned, to secure them to extension parts to be subsequently cut. The side arrangements of the holes 102 allows the valves to do their job whereas normal valves with lengthwise flow cannot work because they would be pushed against the extension wall, which would prevent the nitrogen flow from entering normally the extension part and would lead to the breaking thereof. In the case of the valve connected with the vacuum pump, the extension part would be pushed against the vacuum hole and the action of the vacuum pump would be cancelled, which could lead to an overheating of the vacuum pump.

The valves preferably used are two diagonally arranged valves so as to help the nitrogen scanning and remove moisture in any places of the cover. Once the operation is effected, the valves should not necessarily remain on the cover, except in case of storage where one valve will be left to allow checking of the nitrogen atmosphere through a moisture sensor integrated into one of the valves during the checks. Removing the valve(s) from the cover is quite simple. It is sufficient to fit the valve on a projecting extension part provided on the cover and to weld that projection which will be then cut. As the valves can be partially recovered, handling costs are reduced.

Although the quick connection system of the tip to the valve is described partially in the description and the drawings, the invention also aims at using any system implementing a rod pushing onto a plate against a spring effect. Other variations, taken separately or together, can also be used without departing from the spirit and scope of the invention.

The present invention also covers the use of a sensor, more particularly a capacitive sensor, which allows measurement of the relative humidity level inside the cover. The sensor is preferably integrated into the above described valve. According to that embodiment, it can be envisaged and even recommended to leave the sensor in the valve once the inerting process for the packaging cover has been achieved. In such a way measurements and checkings of the relative humidity level inside the packaging cover can be made throughout the whole storage period.

The storage period can be almost indefinite on the condition that the materials under cover are regularly checked and the covers are not manipulated.

Nowadays for long term storage, conditioned or at least non wet premises are provided. Within the scope of the invention, storage can be made anywhere, even outside under a shed by taking normal precautions.

The concept explained above requires covers of good quality which prevent moisture from entering the cover to be efficient.

Some products have been found particularly convenient therefor; they are formed with at least XF film between 70 and 300 gsm, an aluminium foil or EVOH or another material convenient to improve the gas-tightness, particularly a water vapour tightness, and any other product to improve this aspect, including another XF film between 70 and 300 gsm.

The XF is a biaxially stretched laminated film of polyolefins in three or four plies and of which the central part (being present at 70 - 80%) comprises a mixture of olefins so as to obtain, by laminating and stretching, an interlocked arrangement which gives a higher strength.

XF film can thus be considered as a triaxial or quadriaxial film.

Preferably, XF film is a film comprised between 70 and 180 gsm. This grade can be used in overpressure or in equipressure according to the needs.

The present invention also relates to all products manufactured with films similar to XF film.

Exemples of convenient products include more particularly the products marketed under the trademarks MILPAC 113, MILPAC 113 Plus, MILPAC 143 and MILPAC 153, amongst others, described further in details below.

Example 1

MILPAC 113 : a laminate as follows :

17 gsm metallized polyester
20 gsm PEBD
54 gsm aluminium foil
40 gsm PEBD
150 gsm XF film

Example 2

MILPAC 113 Plus : a laminate as follows :

17 gsm metallized polyester
20 gsm PEBD
70 gsm XF film
20 gsm PEBD
54 gsm aluminium foil
40 gsm PEBD
90 gsm XF film

Exemple 3

MILPAC 143 : a laminate as follows :

17 gsm metallized polyester
20 gsm PEBD
26 gsm aluminium foil
40 gsm PEBD
70 gsm XF film

Example 4

MILPAC 153 : a laminate as follows:

17 gsm materialized polyester
20 gsm PEBD
26 gsm aluminium foil
40 gsm PEBD
90 gsm XF film

Those different products which form the cover according to the present invention are manufactured by a process wherein each layer is secured to the other one by extrusion and not by glue laminating. In that latter technique, the glue frequently becomes fragile during welding at high temperature and creates a weakening zone which shows a poor welding peel strength.

In order to highlight the specific particularities and the advantages obtained by using the products according to the present invention, comparisons have been made with conventional products which comprise :

Product A :

GM24 (Rhône-Poulenc) formed as follows :

- polyester
- aluminium
- linear polythene

wherein the bindings between the successive layers are made by glue laminating.

Product B :

VACUMATIC (Brangs + Heindrich) formed as follows :

- polyester
- aluminium
- Valeron

wherein the bindings between the successive layers are made by glue laminating.

Product C :

VALSEM S165 (SNEC) formed as follows :

- polyester

- aluminium
- Valeron

wherein the bindings between the successive layers are made by glue laminating.

Product D :

Moistop 662 formed as follows :

- polyester
- aluminium
- linear polythene

wherein the bindings between the successive layers are made by glue laminating.

As shown in the following tables, the conventional products are made either with linear polythene which has no initiated tear resistance or with a Valeron layer which is a flat biaxially-oriented film formed with two films having interleaved fibers.

Table I shows the welding peel strength for weldings effected by heated welding grips in two conditions :

Condition (1) : a température of 190°C during 3 sec at a pressure of 3 bar

Condition (2) : a température of 170°C during 2 sec at a pressure of 3 bar

Table I

	Condition (1)	Condition (2)
MILPAC 143	98,96 N	99,28 N
MILPAC 153	94,65 N	73,35 N
MILPAC 113	> 110 N	> 110 N
MILPAC 113+	> 110 N	> 110 N
PRODUCT A	61,48 N	76,28 N
PRODUCT B	47,75 N	41,10 N

PRODUCT C	78,13 N	75,20 N

Table II shows peel and tensile strength for pulse weldings.

Tableau II

	Peel	Tensile
MILPAC 113	107,1 N	151,9 N
MILPAC 113+	102 N	177 N
PRODUCT A	82,2 N	148 N
PRODUCT B	45 N	123,1 N
PRODUCT C	73 N	137 N
PRODUCT D	47,3 N	101,7 N

Table III shows initiated tear resistance (BS 2782 standard) either in machine direction or crosswise.

Tableau III

	Machine direction	Crosswise
PRODUCT A	1,35 N	2, 18 N
PRODUCT B	8,49 N	4,55 N
PRODUCT C	8,79 N	6,12 N
PRODUCT D	1,77 N	1,34 N
MILPAC 143	11,51 N	10,41 N
MILPAC 153	10,81 N	12,94 N
MILPAC 113	29,12 N	50,16 N
MILPAC 113+	23,73 N	22,75 N

Table IV shows the dynamic puncture resistance.

Table IV

	Puncture resistance
PRODUCT A	1,8
PRODUCT B	2,6
PRODUCT D	1,3
MILPAC 143	2,8
MILPAC 153	3,5
MILPAC 113	4,5
MILPAC 113+	7,5

Moreover, the way of manufacturing and the flexibility of the XF film make the MILPAC products particularly flexible and provide a substrate for the aluminium foil which will not be damaged even if the product is creased or folded.

The products according to the present invention combine advantageously and surprisingly the following characteristics :

- welding peel strength
- initiated tear resistance
- puncture resistance
- integrity of the aluminium foil

Moreover, the MILPAC products have a better gas-tightness, in particular a better vapor tightness, with respect to the prior art products.

Table V describes the water vapor transmission level for prior art products and products according to the invention.

Table V

	Water vapor transmission ($g/m^2/24$ h)
PRODUCT B	0,06
PRODUCT C	0,05
MILPAC 113	0,018
MILPAC 143	0,001
MILPAC 153	0,007

The claims defining the invention are as follows:

1. An inerting process for packaging covers, said process comprising the following steps:

(A) - placing an item to be packed within at least one composite sheet as a packaging cover which is substantially closed with the exception of a first and second hole, the first hole being used to exhaust the inner atmosphere present inside the packaging cover and the second hole being used to inject an inert gas into said cover,

(B) - successively exhausting the inner atmosphere present inside the cover through a first valve adapted to be sealed with respect to the first hole in the packaging cover an injecting the inert gas through a second valve adapted to be sealed with respect to a second hole in the packaging cover, and

(C) - a continuously measuring parameter related to the relative humidity level in the packaging cover,

wherein said steps of exhausting the inner atmosphere present inside the packaging cover and injecting the inert gas being completed when a predetermined relative humidity level has been reached, and whereby the steps of exhausting the inner atmosphere of the packaging cover and of injecting the inert gas occur as delayed cycles with each exhausting of the inner atmosphere being immediately compensated for by an injection of the inert gas, and all the above described cyclic steps are effected so that the pressure inside the packaging cover is close to equal with the pressure of the external atmosphere.

2. A process according to claim 1, wherein the inert gas is nitrogen.

3. A process according to claim 1 or 2, characterized in that the first and second two holes are arranged in mutual opposed locations on said cover.

4. A device for carrying out the process according to any one of the preceding claims, said device comprising an inert gas source having a pressure-reducer connected with a valve adapted to control or cut off the inert gas injection, said control valve being connected through a first flexible fitting with the cover through a first valve secured to the cover, and other device for creating a slight underpressure in the packaging cover connected with said cover through a second flexible fitting and a second valve secured to the cover, the second valve including a flow rate control valve and a non-return valve.

5. A device as claimed in claim 4, wherein the inert gas source is a nitrogen bottle.

6. A device as claimed in claim 4 or 5, wherein the device for creating a slight underpressure is a vacuum pump.

7. A device according to claim 4, 5 or 6, characterized in that the first and second valves each comprise a body consisting of a diffuser, a spring applied onto

a plug formed with a circular plate, an O-ring and a circular ring, said circular ring adapted to secure the valve to the cover.

8. A device according to claim 7, characterized in that the diffuser includes a short cylindrical tube of which the wall includes at least four circular holes regularly distributed on the periphery thereof, the holes being big enough to allow to apply a vacuum or to inject the inert gas, wherein the diffuser is externally threaded on its lower part so as to be mounted on the ring which includes a circular recess internally threaded on its upper part which receives and engages the diffuser by screwing.

9. A device according to claim 8, characterized in that the O-ring is secured in a circular recess between the diffuser and the ring and is held in position and slightly crushed when the diffuser is screwed to the ring thereby ensuring a sealing therebetween.

10. Device according to any one of claims 4 to 9, characterized in that the first or second valve comprise an element which allows the valve to be connected directly with a moisture sensor.

11. Device according to claim 10, characterized in that the moisture sensor is and integrated into the second valve.

12. An inerting process for packaging covers, said process substantially as hereinbefore described with reference to the accompanying drawings.

13. A device for carrying out the process of any one of claims 1 to 3, said device substantially as hereinbefore described with reference to the accompanying drawings.

Dated 17 October, 1997
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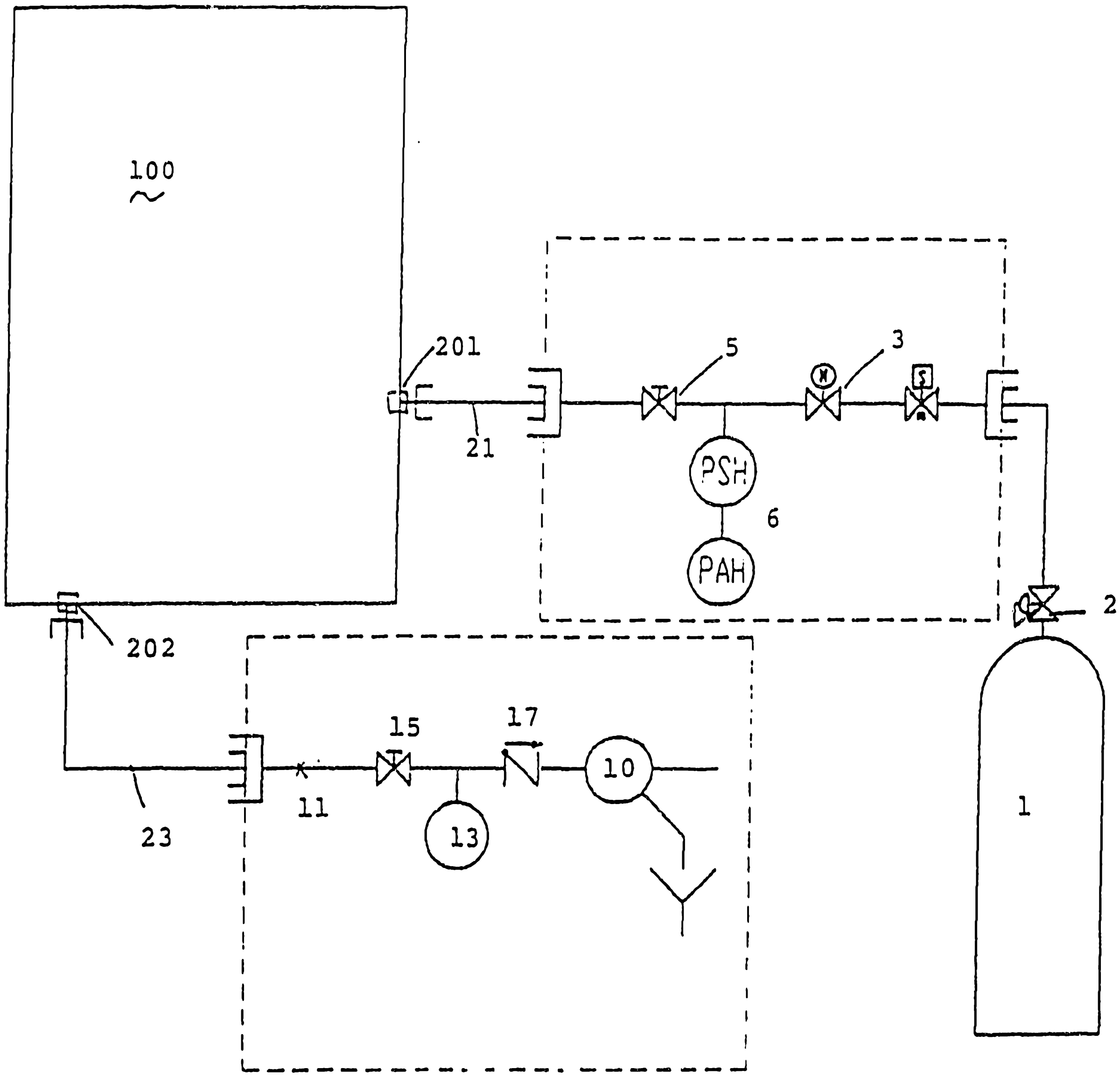

FIG. 1

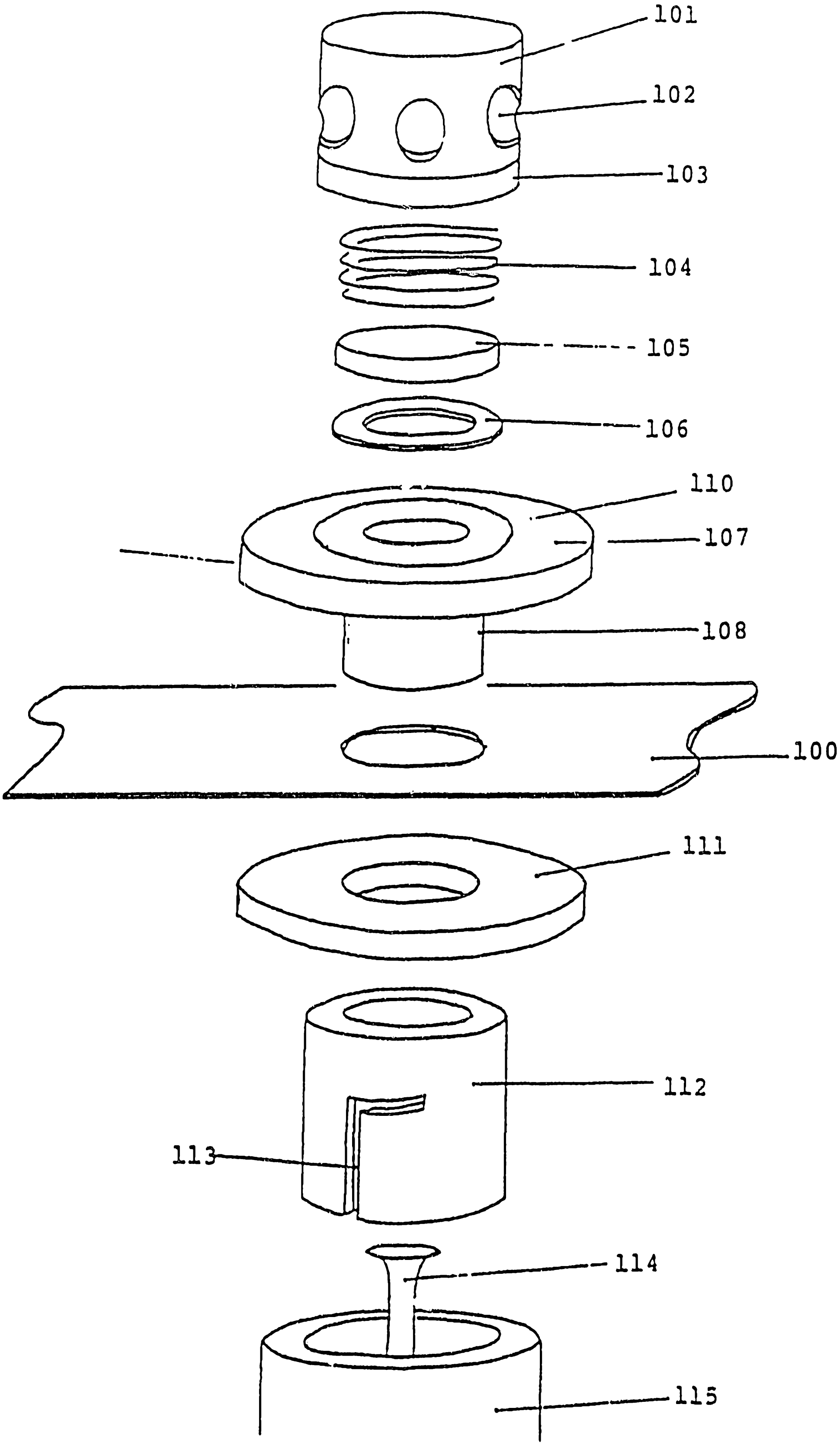

FIG. 2