



INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

<p>(51) International Patent Classification ⁵ : A23L 3/3409, 3/3418, A23B 4/16 B65B 25/00</p>	A1	<p>(11) International Publication Number: WO 91/15969</p> <p>(43) International Publication Date: 31 October 1991 (31.10.91)</p>
<p>(21) International Application Number: PCT/US91/02639</p> <p>(22) International Filing Date: 17 April 1991 (17.04.91)</p> <p>(30) Priority data: 510,947 19 April 1990 (19.04.90) US</p> <p>(71) Applicant: PAKOR, INC. [US/US]; P.O. Box 667, Livingston, TX 77531 (US).</p> <p>(72) Inventor: MITCHELL, Jerry, L. ; 306 East Lake, Livingston, TX 77351 (US).</p> <p>(74) Agent: TROP, Timothy; Arnold, White & Durkee, P.O. Box 4433, Houston, TX 77210 (US).</p>		<p>(81) Designated States: AT, AT (European patent), AU, BB, BE (European patent), BF (OAPI patent), BG, BJ (OAPI patent), BR, CA, CF (OAPI patent), CG (OAPI patent), CH, CH (European patent), CM (OAPI patent), DE, DE (European patent), DK, DK (European patent), ES, ES (European patent), FI, FR (European patent), GA (OAPI patent), GB, GB (European patent), GR (European patent), HU, IT (European patent), JP, KP, KR, LK, LU, LU (European patent), MC, MG, ML (OAPI patent), MR (OAPI patent), MW, NL, NL (European patent), NO, PL, RO, SD, SE, SE (European patent), SN (OAPI patent), SU, TD (OAPI patent), TG (OAPI patent).</p> <p>Published <i>With international search report. Before the expiration of the time limit for amending the claims and to be republished in the event of the receipt of amendments.</i></p>
<p>(54) Title: IN SITU METHOD FOR EXTENDING THE SHELF LIFE OF PERISHABLE PRODUCTS</p>		
<p>(57) Abstract</p> <p>A method for prolonging the shelf life of products is disclosed, said method generally comprising sealing said product in a gas tight package where said sealing operation is conducted in the presence of an oxidizing agent so as to entrap a selected amount of said agent in said package in direct communication with said product, maintaining said oxidizing agent around said product for a time sufficient to substantially reduce microbial activity on the surface of said product, and then removing said agent while maintaining the sealed condition of said package.</p>		

FOR THE PURPOSES OF INFORMATION ONLY

Codes used to identify States party to the PCT on the front pages of pamphlets publishing international applications under the PCT.

AT	Austria	ES	Spain	MG	Madagascar
AU	Australia	FI	Finland	ML	Mali
BB	Barbados	FR	France	MN	Mongolia
BE	Belgium	GA	Gabon	MR	Mauritania
BF	Burkina Faso	GB	United Kingdom	MW	Malawi
BG	Bulgaria	GN	Guinea	NL	Netherlands
BJ	Benin	GR	Greece	NO	Norway
BR	Brazil	HU	Hungary	PL	Poland
CA	Canada	IT	Italy	RO	Romania
CF	Central African Republic	JP	Japan	SD	Sudan
CG	Congo	KP	Democratic People's Republic of Korea	SE	Sweden
CH	Switzerland	KR	Republic of Korea	SN	Senegal
CI	Côte d'Ivoire	LI	Liechtenstein	SU	Soviet Union
CM	Cameroon	LK	Sri Lanka	TD	Chad
CS	Czechoslovakia	LU	Luxembourg	TG	Togo
DE	Germany	MC	Monaco	US	United States of America
DK	Denmark				

-1-

5

10

IN SITU METHOD FOR EXTENDING THE
SHELF LIFE OF PERISHABLE PRODUCTS

15 The present invention generally relates to a method
for extending the shelf life of perishable products by
exposing said products to an oxidizer, preferably ozone
gas, for a time sufficient to substantially reduce
microbial activity on the surface of said product. More
specifically, the present invention relates to a method
20 whereby a selected concentration of an oxidizer is
introduced into a sealed container containing a perishable
product for a time sufficient to neutralize or eliminate
microbial activity present on said product, whereupon said
oxidizer is removed or diluted. When microbial activity
25 has thus been neutralized, the product may be exposed to a
vacuum or other gases for purposes of transportation or
presentation to the consumer.

30 Perishable products, specifically meat, poultry, or
fish products, are generally cleaned and packaged at a
slaughterhouse or other processing facility preparatory to
shipment to various retail outlets. These products are
commonly packaged in containers such as plastic wrapped
trays, pouches of plastic, paper or plastic coated paper
35 bags, food storage tubes and the like. These containers
are typically pliant relative to rigid cans, bottles and
cans in that they are flexible or soft to the touch. They
are also frequently transparent, as in the case of meats,
to enable customers to view the product. These products,

-2-

5 especially meats, are also commonly packaged in the oxygen-nitrogen atmosphere naturally occurring at such processing facilities. Packaging of perishable products in such a fashion, however, ordinarily causes fairly rapid reduction of the quality of the product with resultant spoilage. This phenomenon occurs, though at a slower pace, even when such products are maintained in a refrigerated condition.

10 Product spoilage is partially a result of the multiplication of bacteria introduced onto the surface of the product during processing. Such contamination is particularly pronounced in the processing of poultry. Moreover, the atmosphere introduced into the product
15 container also contributes to spoilage since such atmosphere may contain a variety of airborne bacteria. Spoilage is also enhanced by "cross contamination" which is often brought about as a result of the common handling of such products by human or mechanized devices during the
20 packaging stage. In such cases, contamination may be widely spread and distributed as the result of common handling.

25 The rate of increase in the number of surface bacteria determines in large part the shelf life of the product. In this respect, a perishable product is generally considered to have a shelf life determined by the amount of time necessary for the bacterial count to reach proportions which render the product unfit for
30 consumption. This shelf life varies depending on the product and the conditions under which the product is processed and packaged. Fish and poultry traditionally have very short shelf lives when stored in an unfrozen state, whereas the shelf life for meat is generally
35 longer. Regardless of the type of product, however, the presence of certain bacteria, especially the salmonella

-3-

bacteria, can render the product dangerous for consumption even when present in small amounts.

5 As a result of the above described problems relating to bacterial growth, perishable products are refrigerated or frozen to enhance their shelf life. A lowering in temperature is effective to reduce spoilage, since it results in a slowing of the rate of reproduction of the bacteria. For this reason, a perishable product generally
10 will not spoil if frozen, but will almost immediately spoil if stored at room temperature in the absence of preservatives.

15 A number of techniques have evolved to utilize the benefits of freezing. One commercial preservation and storage method involves subjecting various products, especially pork and poultry, to temperatures slightly below 32°F (0°C). This technique, often referred to as "crusting" literally involves the freezing of the outer
20 layer of the product. Products subjected to this technique are "slacked out" and displayed for sale in a refrigerated, non frozen state. Bulk retail and institutional packages of various perishable products are sometimes handled in this fashion.

25 Some products, however, especially poultry products, are felt to deteriorate in quality once subjected to freezing. Additionally, it is often times undesirable to freeze a product if further processing is contemplated at
30 a secondary processing facility. For these reasons, other techniques have been developed to store or transport the product while maintaining the product at temperatures above freezing.

35 One such technique is vacuum packing. Vacuum packing inhibits bacterial growth by removing the operative oxygen

-4-

environment necessary to sustain aerobic growth.

Disadvantages with vacuum packing, however, include the purplish color induced in meat products which often times inhibits the appearance of such products for purposes of retail sale. Vacuum packing also results in the creation of an undesirable liquid exudate which is caused by package pressure differential. If commercial sale of vacuum packed products is desired, the product also must often be removed from the vacuum pack and exposed to oxygen such that the meat may "bloom." When exposed to oxygen, however, surface bacteria derived from the processing or packing stage are then able to multiply and soon begin to move the product toward spoilage.

Other non-frozen techniques have been employed to enhance the life of a perishable product. A second technique involves packing the product in a carbon dioxide atmosphere. The CO₂ atmosphere, like the vacuum pack, also inhibits the growth of aerobic bacteria. Similar to the vacuum pack, however, the CO₂ atmosphere does not reduce the number of bacteria on the product resultant from processing or packing. Thus the product, when exposed to an aerobic environment, begins to degrade as a result of residual bacteria.

The above described techniques are useful, therefore, only from the standpoint of marginally prolonging the life of a perishable product during shipping, or when it is otherwise possible to maintain an aerobic environment around the product. These techniques do not, however, result in the destruction of bacteria. Moreover, these techniques fail to check the growth of anaerobic bacteria.

Ozone (O₃) has been widely used as an oxidizing agent for bacterial, virus, and mold control for meat and fish storage, fresh fish processing, produce storage,

restaurants, cooling towers, animal feed products, marine
life, beverage plants, swimming pools, potable water
systems, and tertiary waste systems. Ozone is also
currently widely used for odor control in air conditioning
5 systems, industrial plants, restaurants, mortuaries, rest
homes and other applications. Ozone gas is a very strong
oxidizing agent having an oxidation potential more than
twice that of chlorine and approximately three times that
of hydrogen peroxide. Ozone also has the advantage of
10 breaking down upon use as an oxidant into oxygen, which is
normally beneficial. The use of ozone for the
sterilization or preservation of food products is
described in U.S. Patent No. 4,549,477. The '477 patent
describes both the historical applications (batch process)
15 as well as the application of ozone in a continuous
process whereby the perishable product is moved through a
treatment zone filled with ozone.

Disadvantages associated with the above described
20 prior art techniques utilizing ozone include the
possibility of recontamination of the product after it is
moved out of the ozone flushed region and into a packaging
area. This possibility of contamination is enhanced if
the product is not already positioned in the package but
25 must be positioned either mechanically or manually.
Further, the aforescribed processes do not allow for the
possible retention of a partial amount of the oxidizing
gas in the package.

30 The present method addresses the above noted and
other disadvantages by providing a method in which the
non-frozen shelf life of a perishable product may be
greatly enhanced. Additionally, the present method may
enable the storage of products at temperatures above those
35 ordinarily believed necessary to prevent spoilage. Thus,
the invention is especially directed at the packaging of

non-frozen, perishable products which are marketed in
pliant containers. Treatment of the products to enhance
their quality, appearance or other aspects is carried
while the products are in a sealed, packaged condition.

5

In a general aspect, the present invention is
directed to a method whereby a perishable product is
exposed to an oxidizer for a time sufficient to eliminate
or substantially reduce the number of microorganisms
present on the surface of said product. More
specifically, the present invention is directed to a
method of sealing a perishable product in a gas tight
package while simultaneously subjecting the product to
direct contact with an oxidizer so as to result in the
containment of the oxidizer environment in the package.
This oxidizing environment is maintained around the
product for such time as is necessary to neutralize
microorganisms present on its surface. A second gas may
then be introduced into the package for purposes of
transportation, storage, or presentation of the product to
the consumer.

10
15
20

In accordance with the spirit of the invention, the
package is sealed in a controlled environment containing a
selected concentration of an oxidizing gas. When the
product has been exposed to the oxidizer for a sufficient
time, depending on a number of variables including the
type of product, the product weight, etc., the oxidizer is
withdrawn or flushed from the package and the package is
filled with a gas suitable for transportation, or
alternatively, an environment suitable for presentation to
the consumer. This gas may include a CO₂ atmosphere
adapted to suppress the growth of any bacteria not
eliminated as a result of exposure to the oxidizer.
Alternatively, an oxygen rich atmosphere may be introduced
into the package so as to enhance the appearance of the

25
30
35

-7-

meat product for purposes of retail sale. In another aspect, a vacuum may also be drawn around the product subsequent to introduction of the oxidizer. In a preferred aspect of the invention, the oxidizer is withdrawn from the product package via a valve disposed in the package so as to maintain the sealed gas tight integrity of the package itself. A septum valve is especially contemplated, because of its self-sealing activity.

10

The method of the present invention has a number of advantages over the art. One such advantage is the ability of the present method to significantly reduce the number of aerobic and anaerobic microorganisms present on the surface of a given product. In such a fashion the shelf life of the product can be substantially increased. When used in combination with conventional preservation techniques such as freezing, an even greater shelf life may be realized. Further, the elimination or substantial reduction in the number of surface bacteria resultant from the present method allows for the storage of some perishable products for extended periods of time without the need for refrigeration. This is beneficial in remote areas or in the event that refrigeration facilities are unavailable.

15

20

25

Other objects and advantages of the invention will become apparent from the following detailed description made in conjunction with the accompanying drawings.

30

The present invention is directed to a method for substantially extending the shelf life of a perishable product, e.g., a meat, poultry, or fish product, by exposing the product to an oxidizing agent for a time sufficient to kill or substantially reduce a substantial majority of microorganisms present on the surface of the

35

-8-

product. When the perishable product has been in contact with the oxidizer for a sufficient period of time, the oxidizer is entirely or partially removed, whereupon the package is evacuated or filled with a second gas
5 compatible with the considerations of the consumer.

Though the present invention has particular application to fresh meat, poultry or fish products, application of the method of the invention to other
10 perishable products is also contemplated within the spirit of the invention. Likewise, the present invention may have application in the area of medical technology or research or similar areas where sterilization is desired.

15 In a preferred mode of the present invention, a perishable product is placed in a gas tight package tray having means to raise the product above the surface of the tray so as to allow maximum gas circulation about the exterior of the product. Such a tray design is seen in
20 applicant's co-pending application Serial No. 214,195. A gas tight top is then secured to the tray, thus sealing the atmosphere present during the packaging process. Alternately, other hermetically sealed containers may be used such as for example, flexible film pouches, plastic
25 coated paper bags, or food storage tubes. It is desirable that such package or tray be provided with a septum valve or other resealable system valve or the like so as to enable gas extraction or modification while the sealed condition of the package is maintained. An example of
30 such a package design is seen in applicant's corresponding application serial no. 214,915.

During this packaging procedure, a controlled concentration of an oxidizer solution is introduced into
35 the package so as to ensure contact between the oxidizer and all surfaces of the product. It is envisioned that

ozone gas (O_3) may be used, although gaseous forms of other oxidizers such as fluorine (F_2), hydrogen peroxide, (H_2O_2) potassium permanganate ($KMnO_4$), hypobromous acid ($HOBr$), hypochlorous acid ($HOCl$), chlorine (Cl_2), chlorine dioxide (ClO_2), Oxygen (O_2), Bromine (Br_2), or Iodine (I_2), are also contemplated within the spirit of the present invention though not all such oxidizers would be compatible with food products. Moreover, it will be recognized that some oxidizers may be more effective than others for any given product. Preferably, the above described packaging processes are undertaken in a sealed chamber such as those utilized to manufacture gas flush packaging.

The type, weight, and age of the product determine both the concentration of the oxidizer and the amount of time it is maintained in contact with the product's surface. Retention time is also determined by the type of oxidizer used in conjunction with the product. In instances involving fish or poultry, it may be necessary to use higher concentrations of the oxidizer. In such instances, it may also be desired to allow a longer residence time of the oxidizer around the product. Such may also be true when the product includes a high fat content which may be particularly susceptible to oxidation. For instances where the sterilization of a medical or other nonorganic material is contemplated, concentrations and residence times of the exposure may expectedly increase.

When a desired residence time has been completed, the oxidizer may be flushed or evacuated from the package. Alternatively, the oxidizer may be diluted by the injection of a second gas into the sealed container. In some instances it may be desired to draw a vacuum in the package for purposes of transporting the product. This

-10-

latter option may be desirable since the maintenance of a vacuum substantially inhibits bacterial growth which is already substantially reduced by exposure to the oxidizer. In other instances, it may be desirable to replace the oxidizer with a growth inhibiting gas such as CO₂. In all instances where gas injection or replacement is contemplated, however, it is desired that the replacement gas be controlled so as to be substantially free of bacteria. It is further desired that gas exchange or modification be conducted while the product remains in the sealed container.

Gas exchange may be conducted in a manner disclosed in applicant's corresponding application. Utilizing such an apparatus, gas exchange, extraction or modification may be accomplished while maintaining the sealed condition of the package.

CLAIMS:

1. A method for processing a perishable product so as to
5 enhance its shelf life comprising the sequential steps of:
- positioning the product in a gas impermeable package;
- sealing said product in said package while
10 simultaneously exposing said product to an
oxidizer capable of reducing microbial activity
on the product so as to include said oxidizer in
said package;
- 15 maintaining said oxidizer in said package and in
communication with said product for a time
sufficient to inhibit microbial activity on the
surface of said product; and
- 20 removing said oxidizer from said package while
maintaining the sealed condition of said
package.
- 25 2. The method of claim 1 wherein said oxidizer comprise
 O_3 , F_2 , H_2O_2 , $KMnO_4$, V_1 , Cl_2 , O_2 , Br_2 , I_2 , $HOBr$, or $HOCl$.
- 30 3. The method for enhancing the shelf life of a
perishable product comprising the sequential steps of:
- sealing the product in a gas tight container in the
presence of an oxidizer;
- 35 maintaining said oxidizer in said container for a
time sufficient for said oxidizer to react with

-12-

microorganisms occurring on the surface of said product;

5 extracting said oxidizer from said container through a valve located in said container; and

introducing a second, microorganism growth inhibiting gas in said container.

10

4. A method to extend the shelf life of a perishable product which has been sealed in a container with a first gas, the method comprising:

15 extracting said first gas from the interior of said package while maintaining the sealed condition of said package;

20 injecting a selected concentration of a gaseous oxidizing agent into said package while again maintaining the sealed condition thereof;

25 maintaining said agent in said package for a time sufficient to substantially reduce microorganisms present on the surface of said product; and

30 withdrawing the majority of said oxidizing agent from said package and replacing said agent with a third gas.

35 5. The method of claim 4 wherein gas exchange is accomplished via a resealable valve disposed in said package.

-13-

6. The method of claim 4 wherein the oxidizing agent is O₃, F₂, H₂O₂, KMnO₄, Cl₂, O₂, Br₂, I₂, HOBr, or HOCl.

5 7. The method of claim 4 where said third gas reduces spoilage on said product.

10 8. The method of claim 4 where said third gas includes CO₂.

15 9. A method of packaging in a pliant container a product which is subject to bacterial spoilage, which comprises:

sealing the product in a pliant container with an atmosphere containing a gaseous oxidizing agent capable of reducing spoilage bacteria within the container, and

20

thereafter reducing the amount of the gaseous oxidizing agent while maintaining the seal of the container.

25

10. The method of claim 9 in which the reduction in the amount of the oxidizing agent comprises evacuating the oxidizing agent from the container.

30

11. The method of claim 9 in which the reduction in the amount of the oxidizing agent comprises flushing the oxidizing agent from the container with a second gas capable of suppressing the growth of bacteria within the container.

35

-14-

12. A method of packaging in a pliant container a food product subject to spoilage by bacteria which comprises:

5 sealing the food product in the pliant container with a gaseous oxidizing agent of a type and in a concentration capable of sterilizing the food product;

10 maintaining the gaseous oxidizing agent in the sealed container for a period sufficient to effect such sterilization; and

15 thereafter removing the gaseous oxidizing agent from the container while maintaining the container in its sealed condition.

20 13. The method of claim 12 wherein the removal of the gaseous oxidizing agent is effected by flushing the gaseous oxidizing agent from the container with another gas capable of suppressing bacterial spoilage of the product.

25 14. The method of claim 13 wherein the other gas is capable of providing the product with a selected property

30 15. The method of claim 14 in which the product is a meat product and the other gas comprises oxygen in an amount sufficient to bloom the meat product.

35 16. A method of packaging in a pliant container a food product subject to spoilage by bacteria which comprises:

-15-

sealing the food product in the pliant container with
a gaseous oxidizing agent capable of providing a
sterile atmosphere in the container;

5 maintaining the gaseous oxidizing agent in the
 container for a time sufficient to provide a
 sterile atmosphere in the container; and

10 thereafter removing at least a portion of the gaseous
 oxidizing agent from the container while
 maintaining the sealed condition of the
 container.

INTERNATIONAL SEARCH REPORT

International Application No PCT/US 91/02639

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all) ⁶				
According to International Patent Classification (IPC) or to both National Classification and IPC				
IPC ⁵ : A 23 L 3/3409, 3/3418, A 23 B 4/16, B 65 B 25/00				
II. FIELDS SEARCHED				
Minimum Documentation Searched ⁷				
Classification System	Classification Symbols			
IPC ⁵	A 23 L, A 23 B, B 65 B			
Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched ⁸				
III. DOCUMENTS CONSIDERED TO BE RELEVANT ⁹				
Category ^a	Citation of Document, ¹¹ with indication, where appropriate, of the relevant passages ¹²	Relevant to Claim No. ¹³		
A	US, A, 3939287 (ORWIG et al.) 17 February 1976 see claims --	1,3,4,12, 13		
A	Patent Abstracts of Japan, vol. 12, no. 258 (C-513)(3105), 20 July 1988 & JP, A, 63042676 (DAISHIRO FUJI- SHIMA) 23 February 1988 see the abstract --	1,2,9,12, 16		
A	Patent Abstracts of Japan, vol. 5, no. 89 (C-58)(761), 10 June 1981 & JP, A, 56035975 (ASAHI DOW K.K.) 8 April 1981 see the abstract --	1,2,9,12, 16		
A	Patent Abstracts of Japan, vol. 5, no. 156 (C-74)(828), 6 October 1981 ./.	1,2,9,12, 16		
<table style="width: 100%; border: none;"> <tr> <td style="width: 50%; vertical-align: top;"> <ul style="list-style-type: none"> * Special categories of cited documents: ¹⁰ "A" document defining the general state of the art which is not considered to be of particular relevance "E" earlier document but published on or after the international filing date "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified) "O" document referring to an oral disclosure, use, exhibition or other means "P" document published prior to the international filing date but later than the priority date claimed </td> <td style="width: 50%; vertical-align: top;"> <ul style="list-style-type: none"> "T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art. "Z" document member of the same patent family </td> </tr> </table>			<ul style="list-style-type: none"> * Special categories of cited documents: ¹⁰ "A" document defining the general state of the art which is not considered to be of particular relevance "E" earlier document but published on or after the international filing date "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified) "O" document referring to an oral disclosure, use, exhibition or other means "P" document published prior to the international filing date but later than the priority date claimed 	<ul style="list-style-type: none"> "T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art. "Z" document member of the same patent family
<ul style="list-style-type: none"> * Special categories of cited documents: ¹⁰ "A" document defining the general state of the art which is not considered to be of particular relevance "E" earlier document but published on or after the international filing date "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified) "O" document referring to an oral disclosure, use, exhibition or other means "P" document published prior to the international filing date but later than the priority date claimed 	<ul style="list-style-type: none"> "T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art. "Z" document member of the same patent family 			
IV. CERTIFICATION				
Date of the Actual Completion of the International Search	Date of Mailing of this International Search Report			
30th July 1991	30. 08. 91			
International Searching Authority	Signature of Authorized Officer			
EUROPEAN PATENT OFFICE	M. PEIS M. Peis			

III. DOCUMENTS CONSIDERED TO BE RELEVANT (CONTINUED FROM THE SECOND SHEET)		
Category *	Citation of Document, ** with indication, where appropriate, of the relevant passages	Relevant to Claim No.
	& JP, A, 56088786 (HIROE OGAWA) 18 July 1981 see the abstract --	
A	FR, A, 2481672 (MULTIVAC SEPP HAGGEN- MULLER KG) 6 November 1981 see claims --	3,4,7,8
A	GB, A, 2031710 (NV WA HOEK'S MACHINE EN ZUURSTOFFFABRIEK) 30 April 1980 --	
A	FR, A, 1136525 (J.-C. SEAILLES) 15 May 1957 -----	

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

US 9102639

SA 46979

This annex lists the patent family members relating to the patent documents cited in the above-mentioned international search report. The members are as contained in the European Patent Office EDP file on 27/08/91. The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US-A- 3939287	17-02-76	None	
FR-A- 2481672	06-11-81	None	
GB-A- 2031710	30-04-80	NL-A- 7809763 DE-A, C 2938666	31-03-80 10-04-80
FR-A- 1136525		None	