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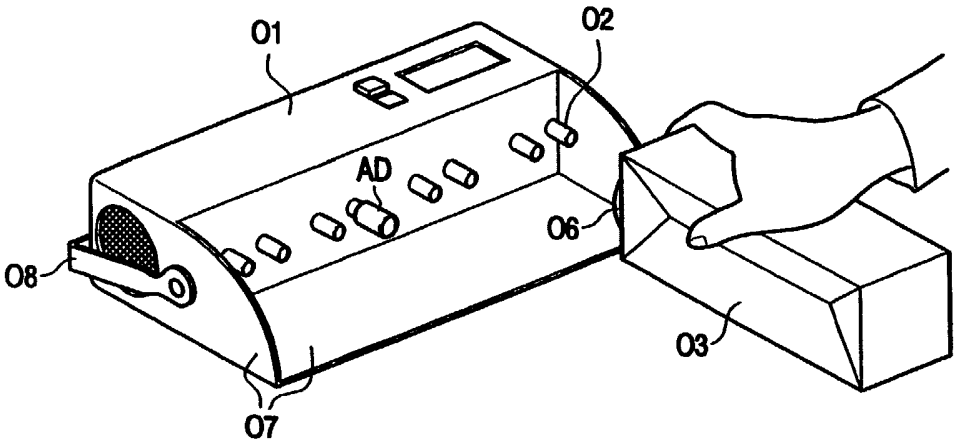

(57) Abstract: A system comprises an ozone generating unit (OI) which supplies ozonized gas at an outlet (O2), and a container (O3) which encloses at least one object to be disinfected or sterilized. The container (O3) comprises coupling means (O6) which allow the container (O3) to be removably coupled to the outlet (O2). The coupling means (O6) comprise closing means for closing the container (O3) to become airtight when the container (O3) is decoupled from the outlet (O2).

WO 03/068274 A2

Sterilizing or disinfecting device.

The invention relates to a system comprising an ozone gas generating unit and a container for enclosing at least one object, the gas generating unit comprises an outlet for supplying an ozonized gas to the container to disinfect or sterilize the at least one object.

The invention further relates to a container for enclosing at least one object to be disinfected or sterilized, an ozone-generating unit for use in this system, and to a method of disinfecting or sterilizing an object in a container.

US-A-3,719,017 discloses a sterilizing and packaging device. An article to be sterilized is placed in a plastic bag from which air is withdrawn and replaced with a sterilizing medium, preferably ozone mist. The exhausting, refilling and sealing are performed automatically. The bag is sealed leaving the article in the sterilized medium. However, a lot of plastic bags with objects need to be transported if the sterilized objects have to be used in a remote area.

It is an object of the invention to provide a system of an ozone generator unit for disinfecting and/or sterilizing objects and a container which allow a lower number of objects to be transported.

A first aspect of the invention provides a system comprising an ozone generating unit for supplying ozonized gas at an outlet, and a container for enclosing at least one object to be disinfected or sterilized, the container comprising coupling means for removably coupling the container to the outlet, wherein the coupling means comprise closing means for closing the container to become substantially airtight when the container is decoupled from the outlet.

A second aspect of the invention provides a container for enclosing at least one object to be disinfected or sterilized, the container comprising coupling means for removably coupling the container to an ozone generating unit, wherein the coupling means comprise closing means for closing the container to become substantially airtight when the container is decoupled from the ozone generating unit.

A third aspect of the invention provides an ozone generating unit for supplying ozonized gas characterized in that the ozone generating unit has an outlet comprising means for cooperating with a container being removably attachable to the outlet.

A fourth aspect of the invention provides a method of disinfecting or sterilizing an object in a container as claimed in claim 26.

If disinfected or sterilized objects have to be used in remote areas, it often is difficult to predict how many objects have to be transported. Further, it may be cumbersome or impractical to transport a large amount of disinfected or sterilized objects in their containers. For example, in aerospace use or military use such as in a submarine, a low weight and minimal space are very important factors, and it is not possible to stow a large amount of disinfected or sterilized objects. Also in medical care in the field, it is often difficult to predict how many disinfected or sterilized objects will be required. For example, on the battle field it is not known how many wounded people will be encountered.

The invention is based on the insight that if disinfected or sterilized objects have to be used in remote areas, it should be possible to disinfect or sterilize the objects in the field. This requires a portable and mobile system and reusable containers. Used objects can be put in the reusable container and be disinfected or sterilized in the field.

The advantage of the system in accordance with the invention is that objects which are subjected to the sterilizing gas when the container is attached to the ozone generating unit can be transported in the disinfected and/or sterilized condition within the container after this container is detached from the gas generator. Therefore, the container must be closed when detached from the gas generator. The container will be airtight in the detached state and the disinfected and/or sterilized condition will be kept. The container makes contact to receive the sterilizing gas when re-connected to the gas generator. The re-connect ability ensures that the container or at least relevant parts of it can be reused.

For example, a limited number of objects and reusable containers are carried to the persons on the battle field. When the objects are all or almost all used, the used objects are inserted in the reusable container which is hooked up to the ozone gas generator in a car and sterilized in the field.

Preferably, the closing means automatically close the container when it is decoupled from the ozone gas generator, and contamination of the object in the container by, for example, aerobe micro-organisms is prevented. Thus, the closed container is substantially airtight or gastight. If the container is used to store the disinfected and/or sterilized object, it is important that outside gas or air is unable to enter. The storage of the treated object(s) in

the container is an advantage for non-mobile users if a stock of disinfected and/or sterilized objects is required while cross-contamination should be prevented.

A further drawback of the single use plastic bags disclosed in US-A-3,719,017 is that for each object to be treated a new bag is required. This adds to the costs, and because the used bags will be thrown away this contaminates the environment. The containers in accordance with the first aspect of the invention are reusable due to the self-closing coupling means. Thus although the containers itself are more expensive, the multiple use will be cheaper.

It is possible to couple several containers to corresponding outlets of the ozone generating unit. These containers and objects present in the containers can than be sterilized and/or disinfected in parallel.

In an embodiment as defined in claim 2, the outlets of the ozone generating unit comprise closing means which automatically close the outlet when no container is connected. This allows using an ozone generating unit which comprises multiple outlets to operate even when not to all outlets a container is attached. The cycle time will be significantly shorter if less or smaller containers are attached, because the ozone concentration changes rapidly in smaller volumes.

Both the closing means which automatically close the container and which automatically close the outlets of the ozone generating unit can be of any suitable construction.

In an embodiment as defined in claim 3, the adapter when coupled to an outlet causes the closing means of this outlet to open such that the room where the ozone generating unit is placed will be disinfected and/or sterilized.

In an embodiment as defined in claim 4, multiple outlets are available to supply the gas. This allows the use of several containers at the same time, which is considerably less time consuming than using a single container several consecutive times. It is also possible to use an outlet not coupled to a container to disinfect a room. The shape of the boxes is selected to use the available space optimally. Again, this is an important issue when the available space is limited. Preferably the row of containers extends in the horizontal or vertical direction.

In an embodiment as defined in claim 5, the container comprises a flexible heat sealable material or a flexible material comprising a sealable material at its interior. The sealable material at the interior surface may be wax or temperature sensitive glue. In the now following both solutions are referred to as sealable material. The sealable material surrounds

the at least one object and is gastight coupled to the coupling means. This allows to disinfect or sterilize the at least one object when the coupling means is connected to the ozone generating unit and than remove the object, or as many objects as required while preserving the disinfected or sterilized condition of the object(s).

An object is removed by using a seal device which comprises a cutting element and a heat generating element. The cutting element cuts the sealable material around the object, the heat generating element seals the sealable materia... both sides of the incision made by the cutting element. The sealing is performed at substantially the same time as the cutting to prevent contaminations to reach the object. The sealing is performed on both sides to conserve the disinfected or sterilized state of both the object to be removed as the neighboring object which is not yet removed.

The sealing at both sides of the cutter may be performed by two separate heat generating devices sealing actually a small strip at both sides of the cutter. It is also possible to use a single heating device which heats a strip wide enough to allow the cutter to cut within the strip. Preferably, the sealable material is first sealed and than cut to avoid contamination of the objects.

Although the sealable material is not re-usable as it has to be opened when the object has to be used, the relevant (most expensive) part which is the coupling means is reusable. The sealable material may be gastight coupled to the coupling means with a flexible ring-shaped material such as rubber, or an elastic band. In this embodiment, the coupling means is preferably a septum, but other coupling means may be used, such as self-closing valves. These self-closing coupling means are well know in the art.

In an embodiment as defined in claim 7, the valve or septum automatically closes the container airtight when decoupled from the ozone-generating unit. This is very convenient for the user and prevents that the user forgets to close the container before or at the time of decoupling.

In an embodiment as defined in claim 8, the container is foldable or stackable. This is important if a place to store the containers when not in use is limited, which for example is the case in aerospace use, in submarines, or when the system is used as a mobile system.

In an embodiment as defined in claim 9, the container comprises a flexible heat sealable material or a flexible material comprising a sealable material at its interior. The sealable material at the interior surface may be wax or temperature sensitive glue. In the now following both solutions are referred to as sealable material. The sealable material surrounds

the at least one object and is gastight coupled to the coupling means. This allows to disinfect or sterilize the at least one object when the coupling means is connected to the ozone generating unit and than remove the object, or as many objects as required while preserving the disinfected or sterilized condition of the object(s).

In an embodiment as defined in claim 10, a tray to support the objects is provided inside the bag of sealable material or the tray is arranged to support the bag with objects. The tray is preferably of a substantially rigid material. During the cutting and sealing action, only the sealable material or both the sealable material and the tray are cut, and the sealable material is sealed on the tray. Thus, if the bag supports the tray, the sealable material of the bag surrounding the objects is sealed, if the bag is in the tray, the sealable material is sealed to the tray at least at the side of the tray supporting the objects.

In an embodiment as defined in claim 11, the container comprises means to improve the distribution in the container of the gas entering via the coupling means.

In an embodiment as defined in claim 12, the gas is distributed via a channel or duct which has holes distributed in space. The channel is connected to the coupling means and extends into the interior of the container. The gas entering the channel via the coupling means, leaves the channel via the holes at different positions in the container. Consequently, the flow of the gas through the container will be improved. Usually, a further coupling means is present through which the gas leaves the container towards the ozone generating unit. Usually, the coupling means through which the gas enters the container and the coupling means through which the gas leaves the containers are positioned relatively near to each other. This hampers a good distribution of the gas through the container. The channel will lead the gas further away from the coupling means and thus improve the distribution.

In an embodiment as defined in claim 13, the container is formed of sealable material (at least for a substantial part, the couplers are usually of another material). The channel or duct is created by locally sealing the sealable material.

In an embodiment as defined in claim 14, the outlet is shaped or comprises provisions to allow a container to be removably and repeatedly coupled to it. Thus, the ozone generator is able to disinfect or sterilize objects in reusable containers.

In an embodiment as defined in claim 15, the outlet of the ozone generator comprises a hollow protrusion with a radially arranged opening for providing the ozonized gas to the container. This construction allows optimal cooperation with a container comprising a valve closing mechanism.

In an embodiment as defined in claim 16, the outlet of the ozone generator comprises a hollow sharp-pointed protrusion which provides the ozonized gas to the container. This construction allows optimal cooperation with a container comprising a septum closing mechanism.

In an embodiment as defined in claim 17, multiple outlets are available to supply the gas. This allows the use of several containers at the same time, which is considerably less time consuming than using a single container several times. It is also possible to use an outlet not coupled to a container to disinfect a room. If the outlet also comprises a self-closing coupler, an adapter may be attached to the outlet such that the self-closing coupler opens and the room can be disinfected.

In an embodiment as defined in claim 18, the containers are easily transported or carried together with the ozone-generating unit. This is advantageous in mobile use of the system. This is especially advantageous if the containers are foldable and are in the folded up state. Any other shape of the containers enabling to minimize the volume may be used, for example, the containers may be shaped to be easily stackable.

In an embodiment as defined in claim 20, the ozone-generating unit comprises a handle. The handle has two functions. In a first position the handle allows the unit to be carried. In the second position, the handle cooperates with the container to prevent decoupling of the container from the outlet. For example, the handle may cooperate with a rim in the container, or may catch behind a (screw) cap of the container such that it is impossible to move the container away from the outlet.

In an embodiment as defined in claim 21, in the second position of the handle, the handle is locked with respect to the cabinet of the ozone-generating unit during a disinfecting or sterilizing operation. For example, a solenoid driven projection projects out of cabinet into a recess of the handle. When the disinfecting or sterilizing operation has been finished, the solenoid driven projection is activated to withdraw out of the recess, the handle can be moved to release the container. The ozone-generating unit may further comprise a sensor to detect whether the handle is correctly moved into the second position. The disinfecting or sterilizing operation is started only if the handle is in the correct position.

In an embodiment as defined in claim 22, the container is coupled to the ozone-generating unit both via an outlet and an inlet. This allows the ozonized gas to circulate via the ozone generator through the container. Thus, the ozonized gas is first entered into the container via the outlet to disinfect and/or sterilize the object(s) after which the ozonized gas is removed from the container via the inlet. The circulation has the advantage

that only a small ozone generator is required to reach the desired ozone concentration. A small ozone generator is important in situations wherein the ozone-generating unit should have limited dimensions and weight, independent on the reusability of the container.

In an embodiment as defined in claim 23, the ambient air is supplied to the ozone generator. This is advantageous in situations wherein special gases (such as substantially pure oxygen) are not or not readably available.

These and other aspects of the invention are apparent from and will be elucidated with reference to the embodiments described hereinafter.

Brief description of the drawings

In the drawings:

Fig. 1 shows a system in accordance with the invention,

Figs. 2 show embodiments of the foldable and reusable containers in several stages from folded up to coupled to the ozone-generating unit,

Fig. 3 shows an embodiment of an automatic opening and closing valve system of the container,

Figs. 4 show an embodiment of an automatic opening and closing septum of the container,

Fig. 5 shows the ozone-generating unit with a handle,

Fig. 6 shows a block diagram of a circuit controlling the locking of the handle of the ozone-generating unit,

Fig. 7 shows another embodiment of a container in accordance with the invention,

Fig. 8 shows another embodiment of a container in accordance with the invention,

Figs. 9 show an embodiment of a sealing device,

Fig. 10 shows an embodiment of a container with improved gas distribution,

Fig. 11 shows another embodiment of a container with improved gas distribution,

Fig. 12 shows the embodiment of the container of Fig. 11 as a top view,

Fig. 13 shows schematically an embodiment of the ozone-generating unit, and

Fig. 14 shows schematically another embodiment of the ozone-generating unit.

In different Figures, the same references refer to the same elements having the same function.

Fig. 1 shows a system in accordance with the invention. The system comprises an ozone-generating unit O1, a container or packaging O3, and an area to store the containers O3 when folded up. Besides storing the containers when being transported, this area also supports the containers during the disinfecting and/or sterilization operation. The ozone-generating unit comprises a handle O8 which allows carrying the ozone generating unit O1.

The ozone-generating unit further comprises at least one group of an inlet and an outlet tube O2. In the example shown, four groups are available. This allows disinfecting or sterilizing the interior of up to four containers at the same time. Any other number of groups may be selected to accommodate the needs in a predetermined application of the ozone-generating unit.

Especially, the reusability of the containers is an important feature as this limits the number of disinfected or sterilized packaged objects which have to be carried or stored at a remote location such as in aerospace, in military use, for example in a submarine, or for medical use in remote areas. It allows disinfecting or sterilizing used and thus contaminated objects in the field. A limited number of objects and reusable containers only will suffice.

Thus, the mobile use of the system is a very important aspect. The user doesn't want to carry along many items on his trip, further, he often can't predict how many packaged disinfected or sterilized objects he will need. This doesn't only require portability of the system (with or without a handle), but it also requires special measures to be taken to enable mobile use, such as re-usable, preferably foldable containers which may be stored in the system when folded up, and preferably an energizing other than from the mains. Preferably, the containers are constructed to reduce the space occupied when transported in or on the system.

The mobile system may be energized, for example, by a (rechargeable) battery or by solar cells. It is also important that it is possible to sterilize while traveling, for example in a car.

To allow the use of the system in aerospace or military operations, it is advantageous if the outer dimensions of the system are selected according to the standardized dimensions prescribed by these organizations.

Preferably, the foldable containers (also referred to as packaging) functions not only as a sterilization chamber, but also as a protection for storage and therefore is made

of stronger material than usual plastic bags. By way of example, the packaging is made of polycarbonate or polyethyleen. Again, with foldable is meant configurable and/or deformable such that less space is occupied.

The container O3 has coupling means O6 which cooperate with the inlet and outlet tube O2 to allow the outlet to supply the ozonized gas to the interior of the container O3. The ozonized gas leaves the interior of the container O3 via the inlet. The availability of both an output and input allows recirculation of the ozonized gas through the ozone generator and the interior of the container O3. Consequently, a higher ozone concentration can be achieved, or, preferably, a smaller ozone generator can be used. In a practical setup, the recirculation enables to downsize the generator by about 5 times, compared to continuously fresh gas supply. Preferably, ambient air is used as the gas because this is readily available.

The area to store the containers O3 when folded up is bordered by the area where the groups of inlets and outlets are positioned, and the flanges O7. This area may also store containers O3 which are stacked or which are not folded up.

Because the ozone is directly applied to the object in the container O3, a low ozone concentration and a low humidity suffices to disinfect and/or sterilize the object(s) in the container. Also, it is not required to use a very low pressure below the atmospheric pressure. The low ozone concentration allows using only a small ozone generator, and thus a low power consumption is reached. The cycle times will be shorter because the ozone concentration changes more rapidly for a low concentration. Further, the amount of corrosion will be low, which increases the life time of the ozone generating unit. A vacuum pump is not required as the pressure need not be far below the atmospheric pressure. The air need not be moistened. Consequently, a simple, lightweight ozone generating unit can be used.

Figs. 2 show an embodiment of the foldable and reusable containers in several stages from folded up to coupled to the ozone-generating unit.

Fig. 2A shows the folded up containers O3 stored in the storage area of the ozone-generating unit O1 during carrying of the ozone-generating unit.

Fig. 2B shows a stage in the unfolding of the foldable container O3.

Fig. 2C shows the completely unfolded container O3.

Fig. 2D shows the screw cap O6 which is screwed on the container O3 (after the object to be treated has been inserted in the container O3) to make the container O3 substantially airtight. In the cap O6 closing means are provided which automatically open when the outlet and inlet O2 are inserted, and which automatically close substantially airtight

when the container O3 is not coupled to the inlet and outlet O2. It is possible to use a click cap O6, however usually a screwed cap O6 is better airtight than a clicked cap O6.

To assure the sterility of the objects, the packaging O3 should preferably be closed automatically when the user removes it from the ozone generator unit O1. Therefore the cap or cover O6 of the packaging O3 contains a self-closing mechanism. There exist many ways to achieve this, for example by a valve (see Fig. 3) or by a septum (rubber membrane), (see Fig. 4).

Fig. 2E shows four containers O3 coupled to the groups of inlets and outlets O2. It is not essential to the invention that the containers O3 all have the same dimensions. For example, instead of the four containers O3 shown, it is possible to use two containers as shown and a single container having the dimensions of two containers.

It is not essential to the invention that the containers are foldable and have a screwed cap O6. For example, also stackable containers with a cover or top lid with integrated couplers can be used.

Fig. 3 shows an embodiment of an automatic opening and closing valve system of the container O3.

The packaging O3 comprises a foldable part V5 which in unfolded situation is closed by screwing a cover V4 (O6 in Fig. 2D) onto it.

The connection tube(s) O2 of the ozone generator unit has a protrusion V1 with radially arranged apertures V2. The valve of the container O3 comprises a tube like construction with apertures V3 and a piston V6 which, when the container O3 is not coupled to the outlet, is pushed by a spring V7 to close the container O3. When the protrusion V1 with the apertures V2 is moved into the valve the piston V6 moves backwards to the bottom of the container O3, enabling ozone to flow into the packaging O3 via the apertures V2 and V3.

When the tube O2 is moved out of the valve, the spring V7 presses the piston V6 forwards towards the inlet of the container O3, and automatically closes the valve and thus the packaging O3.

The closing valve system shown in Fig. 3 only closes the container O3 gastight (and thus airtight). It is also possible to use a valve system which closes both the container O3 and the connection tube(s) O2 of the ozone generating unit when the container O3 is detached.

Figs. 4 show an embodiment of an automatic opening and closing septum of the container. Fig. 4A shows an outside view of the container O3, Fig. 4B shows a cross section of the container O3.

The packaging O3 comprises a foldable part P10 which in unfolded situation is closed by screwing a cover P9 (O6 in Fig. 2D) onto it.

In stead of using a valve, a septum can be used as the automatic closing system of the packaging O3. The septum P8 is integrated in the cover P9 of the packaging O3. This septum P8 is a rubber membrane. Sharp pointed tubes P11 of the ozone generator unit outlet and inlet O2 puncture the septum. When pulling back the tubes P11, the elastic rubber material closes the punctured hole directly. Other elastic material than rubber may be used as well. Preferably, the tubes P11 have a small diameter allowing the rubber of the septum to close with a high degree of air-tightness.

Fig. 5 shows the ozone-generating unit with a handle.

The handle O8 has two functions. In a first position POS1 the handle O8 allows the unit to be carried. In the second position POS2, the handle O8 cooperates with the container O3 to prevent decoupling of the container O3 from the outlet O2.

During sterilization it should not be possible to remove the container O3 from the generator unit O1. Therefore, the user has to lock the container O3 with a locking bar which in this Figure is the handle O8. The bar O8 catches hold of the container O3 just behind the screw cap O6. It is also possible to provide a recess or rim in the container O3 which cooperates with the handle O8 to prevent the container O3 to be decoupled from the unit O1 by moving the container O3 away from the outlet and inlet O2.

In the second position of the handle O8, the handle O8 is locked with respect to the cabinet of the ozone-generating unit O1 during a disinfecting or sterilizing operation. For example, a solenoid driven projection O12 projects out of cabinet into a recess R1 of the handle O8. When the disinfecting or sterilizing operation has been finished, the solenoid driven projection O12 is activated to withdraw out of the recess R1. The handle O8 is free to be moved to release the container O3 for decoupling from the outlet and inlet O2.

The ozone-generating unit O1 may further comprises a sensor R3 to detect whether the handle O8 is correctly moved into the second position POS2. The disinfecting or sterilizing operation is started only if is detected that the handle O8 is in the correct position.

The solenoid driven projection O12 projects out of cabinet into the recess R1 if the solenoid is not powered. This has the advantage that if the power fails, the projection is

still fixating the bar O8, and the user can't remove the containers O3 from the unit O1 (and thus will be prevented to be exposed to a too high ozone concentration). At the end of the sterilization process, the electronics powers the solenoid and the solenoid projection O9 is withdrawn from the recess or opening R1, enabling the user to remove the containers O3 from the unit O1.

The handle O8 may be easily moved from the first position POS1 to the second position POS2 if it rotates around a rotating point R2 provided by a rotating mechanism.

Preferably, the handle O8 prevents decoupling of the container O3 as long as the ozone concentration in the container O3 is above a predetermined level.

If no handle O8 is present, other mechanical parts, such as a door covering the outlet O2 may prevent to decouple the container O3 during the disinfecting and/or sterilizing process.

Fig. 6 shows a block diagram of a circuit controlling the locking of the handle of the ozone-generating unit.

The circuit comprises a detector DE and a controller CO.

The detector DE is coupled to the sensor R3 to receive information whether the handle O8 is correctly positioned in the second position. The detector DE further supplies a detector signal DS to the controller CO. The controller CO controls the disinfecting or sterilizing operation with the signal IS, and supplies a control signal CS to the solenoid driven projection O12.

The controller CO controls the unit O1 to not start the disinfecting or sterilizing operation as long as the detector DE detects that the handle O8 is not in the correct locking position.

The controller CO does not activate the solenoid driven projection O12 during the disinfecting or sterilizing operation. And thus, the solenoid driven projection O12 projects out of the cabinet of the unit O1 during the disinfecting or sterilizing operation to prevent to move the handle O8 away from the second position POS2. Consequently, the containers O3 can not be decoupled. The controller CO does activate the solenoid driven projection O12 after the disinfecting or sterilizing operation has been finished to allow decoupling of the containers O3.

Fig. 7 shows another embodiment of a container in accordance with the invention.

The container O3 comprises the reusable coupling means O6, which in this embodiment comprises a septum O10. Any other automatically closing mechanism can be used, for example, self-closing valves can be used, preferably one is used as an inlet and another one is used as an outlet. The coupling means O6 has provisions to enable to couple a bag of a flexible heat sealable material or a flexible material comprising a sealable material at its interior substantially airtight to the coupling means O6.

The sealable material at the interior surface may be wax or temperature sensitive glue. In the now following both the directly sealable flexible material and the flexible material with a layer of sealable material on the interior surface is referred to as sealable material O4.

The sealable material O4 surrounds a plurality of objects O9 and is gastight coupled to the coupling means O6. This allows to disinfect or sterilize the plurality of objects O9 when the coupling means O6 is connected to the ozone generating unit O1 all together. After the disinfecting or sterilizing operation one object O9, or as many objects O9 as required can be removed while preserving the disinfected or sterilized condition of the removed object(s) O9.

An object O9 is removed by using a seal device S (see Figs. 8). The cutting element S1 cuts the sealable material O4 around the object O9, the heat generating element S2 seals the sealable material at both sides of the incision made by the cutting element S1. The sealing is performed at substantially the same time as the cutting to prevent contaminations to reach the object O9. The sealing is performed on both sides to conserve the disinfected or sterilized state of both the object O9 to be removed as the neighboring object O9 which is not yet to be removed. The sealing at both sides of the cutter may be performed by two separate heat generating devices sealing actually a small strip at both sides of the cutter. It is also possible to use a single heating device which heats a strip wide enough to allow the cutter to cut within the strip. Preferably, the sealable material is first sealed and than cut to avoid contamination of the objects.

Although the sealable material O4 is not reusable because it has to be opened when the object O9 has to be used, the relevant (most expensive) part which is the coupling means O6 is reusable. The sealable material O4 may be gastight coupled to the coupling means O6 with a flexible ring-shaped material O5 such as rubber, or an elastic band which may be tensed around a protruding rim of the coupling means O6 arranged around the septum

O10. Any other provision to substantially airtight attach the sealable material O4 to the coupling means may be used.

It is possible to use a tray O11 to support the objects O9. The tray O11 is preferably of a substantially rigid material. During the cutting and sealing action, only the sealable material O4 or both the sealable material O4 and the tray O11 are cut, and the sealable material O4 is sealed on the tray O11 such that the object O9 is airtight enclosed. Preferably, the coupling means O6 comprises a provision to coupled the tray O11 to the coupling means O6, preferably in a rigid but removable manner.

Although in Fig. 7 the objects O9 all have the same shape and dimensions, it is possible to put different objects with different shapes in the container O3.

Fig. 8 shows another embodiment of a container in accordance with the invention. The container O3 comprises the reusable coupling means O6, which in this embodiment comprises self-closing valves, one is used as an inlet and another one used as an outlet.

Figs. 9 show an embodiment of a sealing device. Fig. 9A shows a front view, and Fig. 9B shows a cross sectional view of the sealing device S.

The sealing device S comprises a cutting wheel S1, a heat-generating element S2, and a guiding wheel S3. The cutting element S1 cuts the sealable material O4 around the object O9, the heat generating element S2 seals the sealable material at both sides of the incision made by the cutting element S1. The guiding wheel S3 supports the sealing device S when it is pressed on the sealable material.

Fig. 10 shows an embodiment of a container with improved gas distribution. Fig. 10 shows part of the ozone generating unit O1 with one of the groups of an inlet tube and an outlet tube O2. The container O3 has couplers O6 which cooperate with the inlet tube and the outlet tube O2. If the container O3 is attached to the ozone generator unit O1, the couplers O6 are opened to allow gas to enter the container O3 via the outlet tube and to leave the container O3 via the inlet tube. The couplers O6 will automatically close the container O3 gastight when decoupled from the inlet and outlet O2. Preferably, also the inlet and outlet O2 comprise self-closing couplers. The container O3 comprises a hollow pipe DP which is connected to the coupler O6 associated with the outlet tube O2. The pipe DP comprises outlet holes distributed along its length. The arrows indicate the flow of the gas entering the

container O3 via the holes in the pipe DP. Instead of the pipe DP any other construction may be used which improves the distribution of the gas into the container O3.

Fig. 11 shows another embodiment of a container with improved gas distribution. The container O3 shown in Fig. 11 comprises a bag made of sealable material. Preferably, the bag surrounds the objects O9 to be treated and is supported by a tray O11. In the bag O3, a provision is present to improve the gas distribution into the bag. This provision may be a separate channel CH with holes HO, but may also be made be locally sealing the material such that the channel CH with displaced holes HO is created.

Fig. 12 shows the embodiment of the container of Fig. 11 in a top view. The container O3 is supported by the tray O11 and is connected via the couplers O6 the ozone generator unit O1. The handle O8 prevents the container O3 to be decoupled from the ozone generator unit O1 as long as the ozone concentration in the container O3 is above a predetermined limit. The sealed areas SA of the container O3 are indicated by dashed lines. The channel CH with the openings HO is shown at the right hand side of the bag. The arrows indicate the gas flow through the bag.

Fig. 13 shows schematically an embodiment of the ozone-generating unit.

The ozone-generating unit comprises a circulation pump 5 which may suck ambient air via a first and a second path to its input. The first path comprises a series arrangement of a dust filter 1, an air dryer 2, a one way valve 3, and a two-way valve 4. The second path comprises a series arrangement of the dust filter 1, the air dryer 2, a one way valve 15, and a two-way valve 14. The input of the pump 5 is connected to the inlets IN1 to IN4 of the unit O1 via a one way valve 16. An output of the pump 5 is connected to inputs of two corona discharge chambers 7 and 8 via the 2 way valve 6. The inputs of the two chambers 7 and 8 are connected via a one way valve 18, an ozone destruction filter 11 and a two way valve 12 to the output of the pump 5. The outputs of the chambers 7 and 8 are connected to the outlets OUT1 to OUT4 of the unit O1 via a two-way valve 11. The outputs of the chambers 7 and 8 are further connected to the ambient air via a one way valve 9 and an ozone destruction filter 10.

The ozone-generating unit O1 further comprises a battery and/or a solar cell 20 to supply a power supply voltage VB to the internal circuits of the ozone-generating unit O1.

An ozone sensor 17 is arranged in the input pipe connected to the inputs IN1 to IN4. A delta pressure sensor 19 is arranged to measure the pressure at the input of the pump 5.

The complete process of disinfecting or sterilizing is controlled by electronics (not shown). The process comprises the next successive steps: a power on phase, a self test phase, a creating under-pressure phase, a preparation phase preceding the sterilization process, the sterilization phase, and a phase wherein the ozone is removed out of the containers O3.

At the start of the power on phase, all valves are closed. Once the power is switched on, the valves are set as follows. The two-way valve 11 is closed, thus gas cannot flow towards the containers O3 via the outlets OUT1 to OUT4. The two-way valve 6 is open, thus gas can flow towards the ozone generators 7 and 8. The two-way valve 12 is closed, and the gas cannot flow through the ozone destruction filter 13. The two-way valve 14 is closed and reduction valve 15 is closed, which prevents air to flow into the system via these valves. The gas is prevented to flow via non return valve 16 and the ozone sensor 17 into the containers O3.

Air enters the system via a dust filter 1. Then the air is dried, for example with a Peltier element provided in the air dryer 2. The dried air increases the lifetime of the ozone generators 7 and 8.

A too low pressure is prevented by reduction valve 3 which opens when the pressure at the input of the pump 5 becomes too low allowing air to enter the system. A too high pressure is prevented by distributing gas out of the system via the one way valve 9.

The dried air flows through the two-way valve 4, and enters the circulation pump 5. Via the pump 5, the dried air is distributed out of the system via the two-way valve 6, the ozone generators 7 and 8 (which are switched off), the non-returning valve 9 and the ozone destruction filter 10.

In the preparation phase preceding the sterilization phase, the air is recirculated by the pump 5 through the containers O3 and the ozone generators 7 and 8 which are still switched off. The circulation must be ongoing before the sterilization with ozone starts, to prevent locally a very high ozone concentration once the ozone generators 7 and 8 are switched on.

The circulation pump 5 establishes an under pressure (compared to the ambient pressure) at the inlets IN1 to IN 4. The under pressure needs to be maintained to be

able to produce an under pressure in the containers O3 before the ozone is supplied. This improves the required distribution of ozone in hollow objects O9, later in the process.

When the standard delta p sensor 19 detects a sufficient low under pressure, the two-way valve 11 is opened. Now the circulation through the containers O3 starts. Once the two-way valve 11 is opened, the two-way valve 4 will be closed, to prevent the air from the outside to enter the system.

The air re-circulates in a circulation path which comprises the pump 5, the two-way-valve 6, the ozone generators 7 and /or 8, the two-way valve 11, out of the unit A1 to the containers O3, back into the unit O1, via the ozone sensor 17, the non-return valve16, and the delta p sensor 19 to the pump 5.

Once the circulation pump 5 has established a constant flow (for example determined by measuring the power consumption and RPM (Rounds Per Minute) of the circulation pump 5), the ozone generators 7 and 8 will be turned on, and the disinfection or sterilizing starts. Now a gas mixture of ozone and air is circulated in the circulation path.

The recirculation proceeds until the ozone sensor 19 measures the required ozone concentration.

Now, the pressure should slightly increase, causing the ozone to better flow through hollow spaces. The reduction valve 15 maintains a slightly lower pressure difference than reduction valve 3. To slightly increase the pressure the two-way valve 14 opens. The reduction valve 15 allows an additional flow of air from outside system to enter, until the required pressure difference has been achieved.

The added air from the outside flows through the dust filter 1, the air dryer 2, the reduction valve 15, the two-way valve 14, the delta p sensor 19 (where it mixes with the already available gas mixture), via the circulation pump 5, the two way valve 6, the ozone generators 7 and /or 8, the two way valve 11, the containers O3, the ozone sensor 17, non returning valve 16, to the delta p sensor 19, where it enters the circulation pump 5 again.

Once the delta p sensor 19 measures the required pressure, the two-way valve 14 closes (the two-way valve 4 is still closed).

Non return valve 16 prevents that air that has not yet been exposed to the ozone generators 7 and 8 directly flows into the containers O3. The non-return valve 18 prevents that the ozone gas mixture flows through the ozone destruction filter 13 (this would decrease the ozone concentration resulting in insufficient sterilization).

In case the pressure suddenly rises (for example, something drops down on the containers, the ozone gas mixture can escape the system via the one way valve 9 and the ozone destruction filter 10.

Once the above items are assured and once the ozone sensor 17 measures the desired ozone concentration, one of the ozone generators 7 or 8 may be switched off, this saves energy and it prevents an ozone concentration peak.

When the required sterilization time has elapsed, the ozone generator 7 or 8 will be switched off. After that, In the phase wherein the ozone is removed out of the containers O3, the two-way valve 12 is opened. The gas mixture flows through the ozone destruction filter 13 and the ozone is converted into (sterile) oxygen, which is not toxic. Once the two-way valve 12 is opened, the two-way valve 6 will be closed, preventing a peak in the pressure in the circulation pump 5.

Once the ozone concentration is low enough (measured by ozone sensor 17), the two-way valve 11 will be closed, and the internal gas mixture will be pumped to the outside via the filter 10, creating an under-pressure in the containers, enabling ozone to flow out of the hollow spaces. Also this ozone will be converted into oxygen via ozone destruction filter 13 before it leaves the system at the second filter 10, which functions as redundant safety measure.

The maximal allowable ozone concentration to which human beings may be exposed is 0,06 Ppm. The ozone removing phase has to last long enough to obtain a value below this limit. An ozone sensor which can measure such a low concentration of ozone is expensive. However, it is not required to use such an expensive ozone sensor that can measure in the range of 0 up to 1000 ppm. Measurements in the range of 2 up to 1000 ppm can also be used. If tests (with qualified test equipment) show that the ozone removing time should be 10 minutes to decrease the concentration from 2 ppm down to 0,06 ppm, then in the real situation, it will be multiplied with a safety factor 2 (or more), so it is for sure that all ozone is destructed. So instead of selecting a sensor that can measure 0,06 ppm (and above) it's cheaper to select a sensor that can measure 2 ppm (and above) and to add additional ozone removing time.

The dust filter 1 must be replaced before it reaches it end of lifetime. The lifetime of the filter 1 has to be determined by tests in worst case scenario (dusty, moisturized environment). If the lifetime of the filter is 500 sterilization cycles, then the filter must be replaced when about 480 cycles has been passed. A suitable programmed micro controller or dedicated hardware counts the number of cycles. If the 480 cycles have been passed, a fuse

which is integrated in the filter will be interrupted. If the fuse interrupted, the system knows that the filter must be replaced and will warn the user by sound and display until a new filter is inserted. It is not possible to take out and put back the same filter. The system will detect this abuse of use (because of the blown fuse) and will keep on warning the user by electronics and the user interface.

Fig. 14 shows schematically another embodiment of the ozone-generating unit. This simplified ozone-generating unit O1 comprises a dust filter DF in series with a controllable valve V1, a check valve DV, an ozone generator OG and a controllable valve V3. In one mode of operation, ambient air enters the dust filter DF and reaches the containers O3 via the outlets O2o of the ozone generator and the inlet couplers O6i of the containers O3 if the controllable valves V1 and V3 are opened. A gas distribution provision DP is connected to the coupler O6 to improve the distribution of the gas in the container O3.

A series arrangement of an ozone sensor OS, a humidity sensor HU, a temperature sensor TE, a pump PU, a controllable valve V2 and the ozone generator OG is present between the inlets O2i and the outlets O2o of the ozone generating unit O1. A delta pressure sensor DPS senses the difference between the ambient pressure and the internal pressure. An ozone destructor OD is arranged between a junction J1 and a junction J2.

The operation of the ozone generator unit O1 is elucidated in the now following.

First step: create an internal pressure lower than the ambient pressure to prevent ozone leakage from the system to the surroundings. The controllable valves V1, V2 are open and V3 is closed, the pump is on and the ozone generator OG is off. Air flows out of the system until the delta pressure sensor DPS indicates that delta pressure is at the required level.

Second step: building up the ozone concentration in the system. Before the actual disinfection and/or sterilization starts, the ozone concentration should be built up. The controllable valves V1, V2 and V3 are controlled to be closed, open, open, respectively. Both the pump PU and the ozone generator OG are on. The ozone concentration is measured by the ozone sensor OS, and ozone is produced until the required level is achieved.

Third step: the disinfection and/or sterilization. The actual disinfection and/or sterilization starts once the ozone concentration is at the required level. During disinfection and/or sterilization, both the ozone concentration and the pressure are controlled by sensors and a micro-controller (not shown). The sterilization time is fixed.

Preferably, the internal pressure should alternate to enable ozone to enter into hollow shapes of the objects. However the internal pressure should always be lower than the ambient pressure.

To decrease the pressure difference between the internal pressure and the ambient pressure (thus, to increase the internal pressure), the controllable valves V1 to V3 are opened, the pump PU is switched off while the ozone generator OG is on. Consequently, air flows into the system.

To increase the pressure difference between the internal pressure and the ambient pressure (thus to decrease the internal pressure), the controllable valves V1, V2 and V3 are controlled to be open, open and closed, respectively. Both the pump PU and the ozone generator OG are on. Thus, air flows out of the system. Before leaving the system, ozone is converted back to oxygen by the ozone destruction filter OD.

Fourth step: removing (rinsing) the ozone in the system. After disinfection and/or sterilization, ozone must be converted back into oxygen via the ozone destructor OD. The converted ozone will be re-circulated in the system, otherwise, the internal pressure will become too low. The controllable valves V1, V2 and V3 are controlled to be closed, closed and open, respectively. The pump PU is on, and the ozone generator OG is off. Again, also during removal of the ozone, the internal pressure should preferably alternate to enable ozone to escape out of hollow shapes of the objects. The internal pressure should always be lower than the external pressure. The ozone sensor OS measures the ozone concentration. The fourth step is ready when the concentration of the ozone drops below a predetermined low level.

Last step: the internal pressure is brought back to the ambient pressure. After ozone conversion, the under-pressure should be released to keep micro-organisms out of the packaging during storage and transport of the sterilized instruments. When all ozone molecules are converted into oxygen, the pressure difference will be brought back to zero mbar. All the controllable valves V1 to V3 are open, and both the pump PU and the ozone generator OG are off.

It should be noted that the above-mentioned embodiments illustrate rather than limit the invention, and that those skilled in the art will be able to design many alternative embodiments without departing from the scope of the appended claims.

The closing means shown in detail in Figs. 3 and 4B, and shown schematically in Figs. 7, 8, 10, 11 and 12, may comprise any suitable automatically closing system, for example an automatically closing valve.

In the claims, any reference signs placed between parenthesis shall not be construed as limiting the claim. The word "comprising" does not exclude the presence of other elements or steps than those listed in a claim. The invention can be implemented by means of hardware comprising several distinct elements, and by means of a suitably programmed computer. In the device claim enumerating several means, several of these means can be embodied by one and the same item of hardware.

CLAIMS:

1. A system comprising

an ozone generating unit (O1) for supplying ozonized gas at an outlet (O2), and

a container (O3) for enclosing at least one object (O9) to be disinfected or sterilized, the container (O3) comprising coupling means (O6) for removably coupling the container (O3) to the outlet (O2), wherein the coupling means (O6) comprise closing means (V6, V7; P8) for closing the container (O3) to become substantially airtight when the container (O3) is decoupled from the outlet (O2).

2. A system as claimed in claim 1, characterized in that the outlet (O2) comprises an outlet closing means (O2) for automatically closing the outlet (O2) when the container (O3) is decoupled from the outlet (O2).

3. A system as claimed in claim 2, characterized in that the system further comprises an adapter (AD) cooperating with the closing means (O2) for opening the closing means (O2) when attached to the closing means (O2).

4. A system as claimed in claim 1, characterized in that the ozone generating unit (O1) comprises multiple outlets (O2) being arranged in a row, and that the containers (O3) are substantially box shaped, wherein between adjacent walls of neighboring containers (O3) substantially no free space is left.

5. A system as claimed in claim 1, characterized in that the coupling means (O6) is shaped for allowing a substantially gastight coupling of a flexible heat sealable material or a flexible material comprising a sealable material at its interior (O4) surrounding the at least one object (O9), the system further comprises a sealing device (S) comprising a cutting element (S1) for cutting the flexible material (O4), and an heating element (S2) for sealing the flexible material (O4) directly or via the sealable material at both sides of an incision made by the cutting element (S1).

6. A container (O3) for enclosing at least one object (O9) to be disinfected or sterilized, the container (O3) comprising coupling means (O6) for removably coupling the container (O3) to an ozone generating unit (O1), wherein the coupling means (O6) comprise closing means (V6, V7; P8) for closing the container (O3) to become substantially airtight when the container (O3) is decoupled from the ozone generating unit (O1).

7. A container (O3) as claimed in claim 6, characterized in that the closing means (V6, V7; P8) comprise a valve or septum (P8) for automatically closing the container (O3) when the container is decoupled from the ozone generating unit (O1).

8. A container (O3) as claimed in claim 6, characterized in that the container (O3) is foldable or stackable.

9. A container (O3) as claimed in claim 6, characterized in that the coupling means (O6) is shaped for allowing a substantially gastight coupling of a flexible heat sealable material or a flexible material comprising a sealable material at its interior (O4) surrounding the at least one object (O9).

10. A container (O3) as claimed in claim 9, characterized in that the coupling means (O6) comprises a means to couple a tray (O11) for supporting the at least one object (O9) to the coupling means (O6).

11. A container (O3) as claimed in claim 6, characterized in that the container comprises means for distributing (DP; CH, HO) gas entering via the coupling means (O6).

12. A container (O3) as claimed in claim 11, characterized in that the means for distributing gas (DP; CH, HO) comprises a channel with distributed holes, the channel extending in an interior of the container.

13. A container (O3) as claimed in claim 6, characterized in that the container comprises a channel with holes for distributing (DP; CH, HO) gas entering via the coupling means (O6), the channel being formed by sealed portions of a flexible heat sealable material or a flexible material comprising a sealable material at its interior (O4) surrounding the at least one object (O9) and forming walls of the container (O3).

14. An ozone generating unit (O1) for supplying ozonized gas characterized in that the ozone generating unit (O1) has an outlet (O2) comprising means (V1; P11) for cooperating with a container (O3) being removably attachable to the outlet (O2).

15. An ozone generating unit (O1) as claimed in claim 14, characterized in that the means (V1; P11) for cooperating with the container (O3) comprises a hollow protrusion (V1) with a radially arranged opening (V2) for providing the ozonized gas to the container (O3).

16. An ozone generating unit (O1) as claimed in claim 14, characterized in that the means (V1; P11) for cooperating with the container (O3) comprises a hollow sharp-pointed protrusion (P11) for providing the ozonized gas to the container (O3).

17. An ozone generating unit (O1) as claimed in claim 14, characterized in that the ozone generating unit (O1) comprises multiple outlets (O2) for removably coupling multiple containers (O3) at the same time.

18. An ozone generating unit (O1) as claimed in claim 17, characterized in that the ozone generating unit (O1) is constructed for creating a storage area for the containers (O3).

19. An ozone generating unit (O1) as claimed in claim 18, characterized in that the ozone generating unit (O1) comprises sidewalls (O7) surrounding an area comprising the multiple outlets (O2) for forming the storage area for the containers (O3).

20. An ozone generating unit (O1) as claimed in claim 14, characterized in that the ozone generating unit (O1) comprises a handle (O8) having a carrying position (POS1) for carrying the ozone generator unit (O1) and a locking position (POS2) wherein the handle (O8) cooperates with the container (O3) to prevent decoupling of the container from the outlet (O2).

21. An ozone generating unit (O1) as claimed in claim 19, characterized in that the ozone generating unit (O1) further comprises

a controlled locking means (O12) for locking the handle (O8) in the locking position (POS2),

a controller (CO) coupled to the controlled locking means (O12) for unlocking the handle (O8) when in the locking position (POS2) when the disinfecting or sterilizing operation is terminated.

22. An ozone generating unit (O1) as claimed in claim 14, characterized in that ozone generating unit (O1) comprises

an ozone generator (7, 8) for generating ozonized gas,

a pump (5) for supplying the ozonized gas to the container (O3) via the outlet (O2), and

a gas inlet (O2) cooperating with the interior of the container (O3), when the container (O3) is coupled to the ozone generator unit (O1),

the pump (5) being arranged in series with the ozone generator (7, 8), the series arrangement of the pump (5) and the ozone generator (7, 8) being coupled between the inlet (O2) and the outlet (O2) for circulating ozonized gas through the container (O3).

23. An ozone generating unit (O1) as claimed in claim 14, characterized in that ozone generating unit comprises an ozone generator (7, 8) for generating ozonized air.

24. An ozone generating unit (O1) as claimed in claim 14, characterized in that the ozone generating unit comprises at least one battery or solar cell (20) to provide its operating power.

25. An ozone generating unit (O1) as claimed in claim 14, characterized in that the outlet (O2) comprises an outlet closing means (O2) for closing the outlet (O2) when the container (O3) is decoupled from the outlet (O2).

26. A method of disinfecting or sterilizing an object (O9) in a container (O3) comprising coupling means (O6) for removably coupling the container (O3) to an ozone generating unit (O1),

wherein the coupling means (O6) comprise closing means (V6, V7; P8) for closing the container (O3) to become airtight when the container (O3) is decoupled from the ozone

generating unit (O1), the method supplying a disinfecting or sterilizing ozonized gas to the container (O3) when coupled to the ozone generating unit (O1).

27. A method of disinfecting or sterilizing an object (O9) in a container (O3) as claimed in claim 26, characterized in that the method comprises

surrounding the at least one object (O9) with a flexible heat sealable material or a flexible material comprising a sealable material at its interior (O4),

coupling the flexible heat sealable material or the flexible material comprising a sealable material at its interior (O4) gastight to the coupling means (O6),

coupling (O2) the coupling means (O10) to the ozone generating unit (O1),

supplying (5) the disinfecting or sterilizing ozonized gas to the container (O3),

cutting (S) the flexible heat sealable material or the flexible material comprising a sealable material at its interior (O4), and at substantially the same time sealing (S) the transparent heat sealable material or the flexible material comprising a sealable material at its interior (O4) to obtain a airtight container (O3).

28. A method of disinfecting or sterilizing an object (O9) in a container (O3) as claimed in claim 26, characterized in that the sealing (S) precedes the cutting (S).

29. A method of disinfecting or sterilizing an object (O9) in a container (O3) as claimed in claim 26, characterized in that the container (O3) comprises a tray (O11) for supporting at least one object (O9), the method comprising

surrounding the tray (O11) and the at least one object (O9) with a flexible heat sealable material or the flexible material comprising a sealable material at its interior (O4),

coupling the transparent heat sealable material or the flexible material comprising a sealable material at its interior (O4) gastight to the coupling means (O6),

coupling (O2) the coupling means (O6) to the ozone generating unit (O1),

supplying (5) the disinfecting or sterilizing ozonized gas to the container (O3),

cutting (S) the transparent heat sealable material or the flexible material comprising a sealable material at its interior (O4), and at substantially the same time sealing (S) the transparent heat sealable material or the flexible material comprising a sealable material at its interior (O4) on the area of the tray (O11) to obtain an airtight container having walls formed by the transparent heat sealable material (O4) and the area of the tray (O11) and comprising the at least one object (O9) in its interior.

30. A method of disinfecting or sterilizing an object (O9) in a container (O3) as claimed in claim 26, characterized in that the container (O3) comprises a tray (O11) for supporting at least one object (O9), the method comprising

surrounding the at least one object (O9) with a flexible heat sealable material or the flexible material comprising a sealable material at its interior (O4),

coupling the transparent heat sealable material or the flexible material comprising a sealable material at its interior (O4) gastight to the coupling means (O6),

coupling (O2) the coupling means (O6) to the ozone generating unit (O1),

supplying (5) the disinfecting or sterilizing ozonized gas to the container (O3),

cutting (S) the transparent heat sealable material or the flexible material comprising a sealable material at its interior (O4), and at substantially the same time sealing (S) the transparent heat sealable material or the flexible material comprising a sealable material at its interior (O4) on the area of the tray (O11) to obtain an airtight container having walls formed by the transparent heat sealable material (O4) and comprising the at least one object (O9) in its interior.

31. A method of disinfecting or sterilizing an object (O9) in a container (O3) as claimed in claim 29 or 30, characterized in that the sealable material is first sealed and than cut to avoid contamination of the objects.

32. A method of disinfecting or sterilizing an object (O9) in a container (O3) as claimed in claim 29, characterized in that a plurality of objects (O9) is supported by the tray (O11), and that the cutting and sealing step (S) is repeated for every object (O9).

33. A method of disinfecting or sterilizing an object (O9) in a container (O3) as claimed in claim 32, characterized in that the plurality of objects (O9) have similar or different shapes.

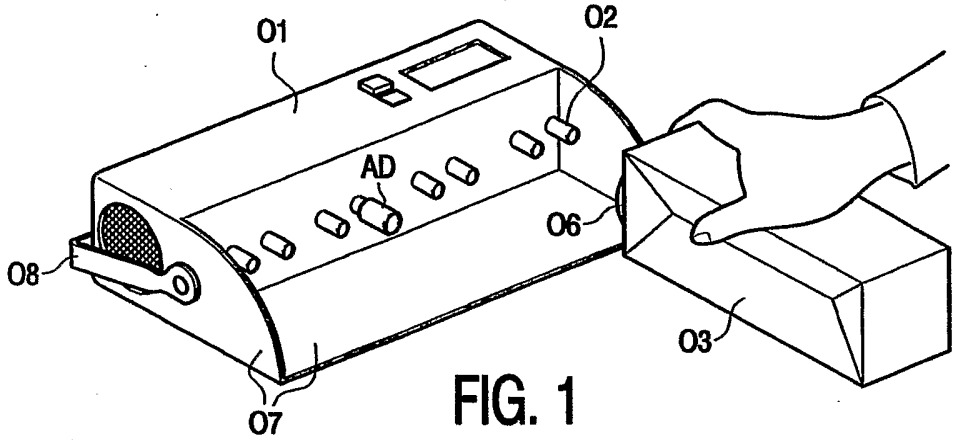

FIG. 1

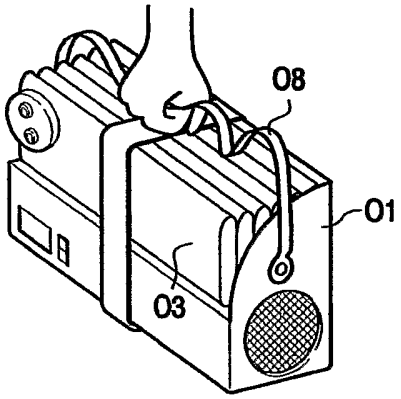

FIG. 2a

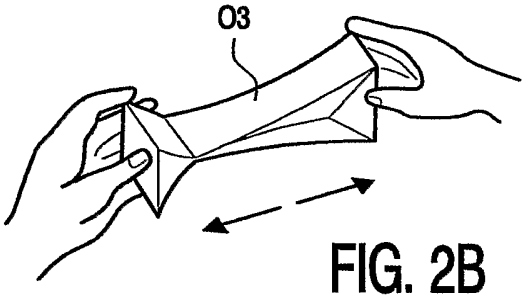

FIG. 2B

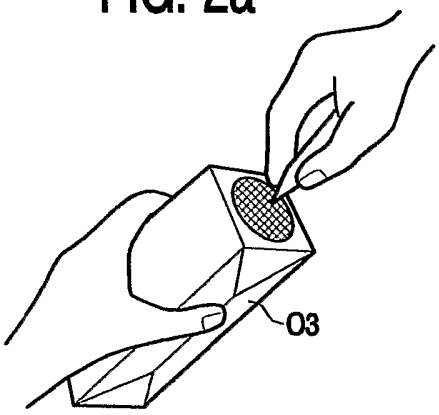

FIG. 2C

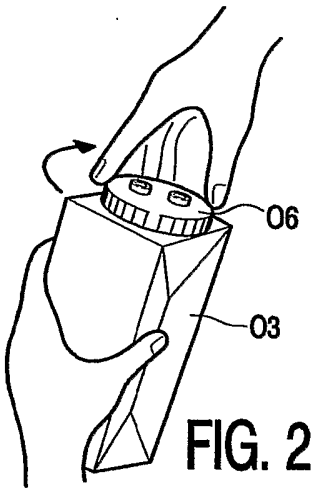

FIG. 2D

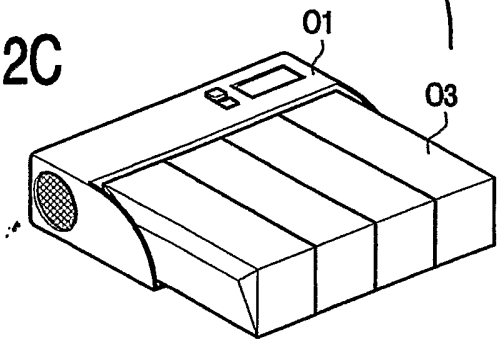

FIG. 2E

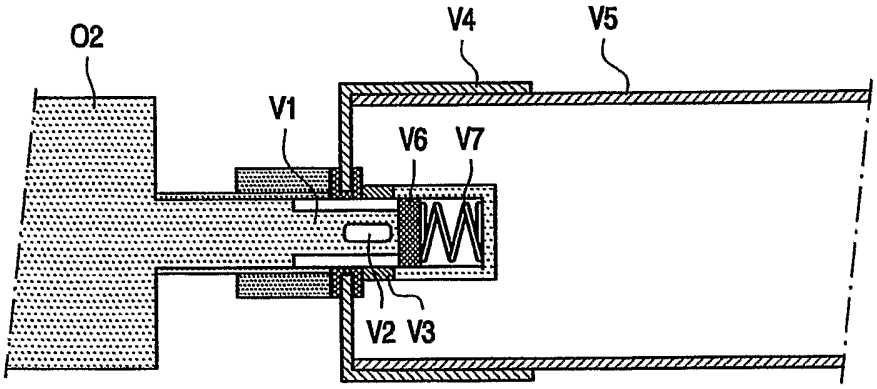

FIG. 3

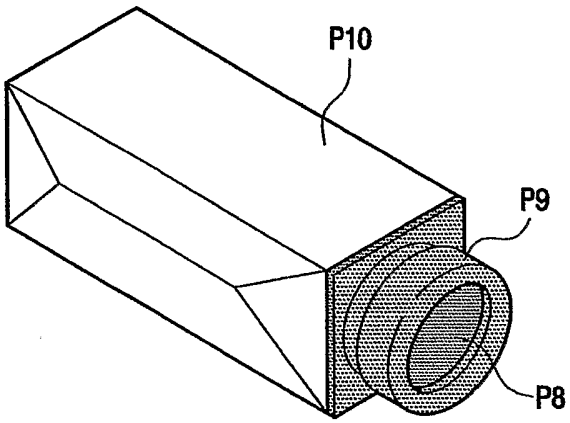

FIG. 4A

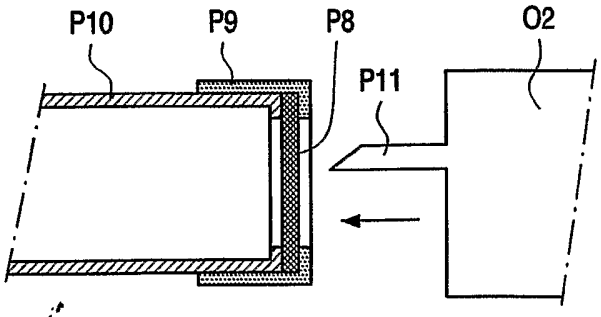

FIG. 4B

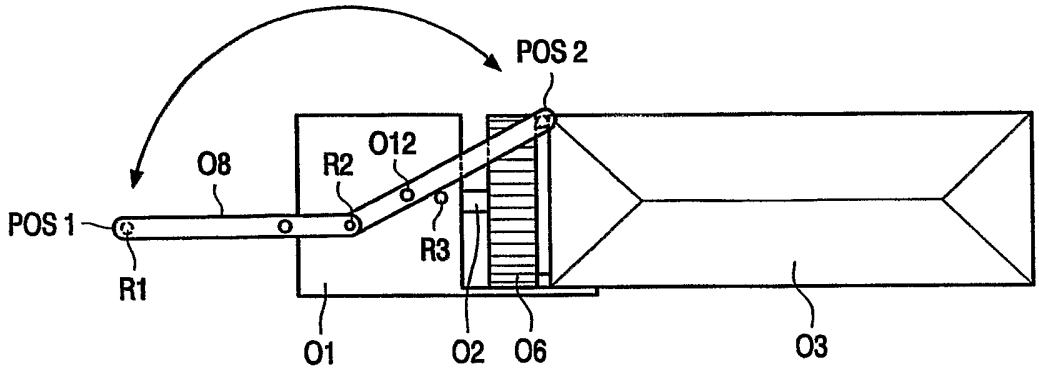

FIG. 5

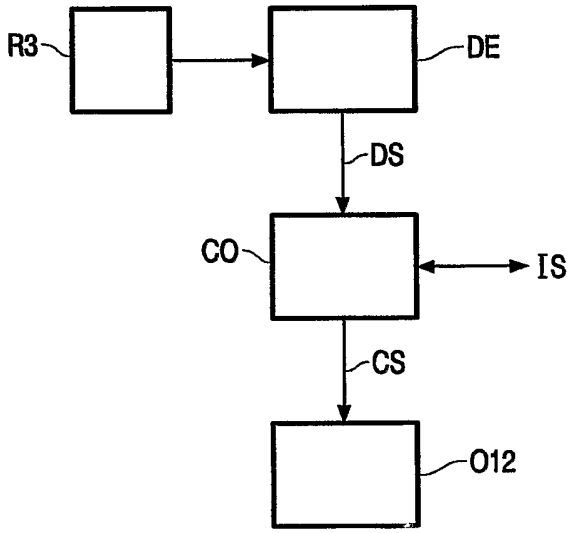

FIG. 6

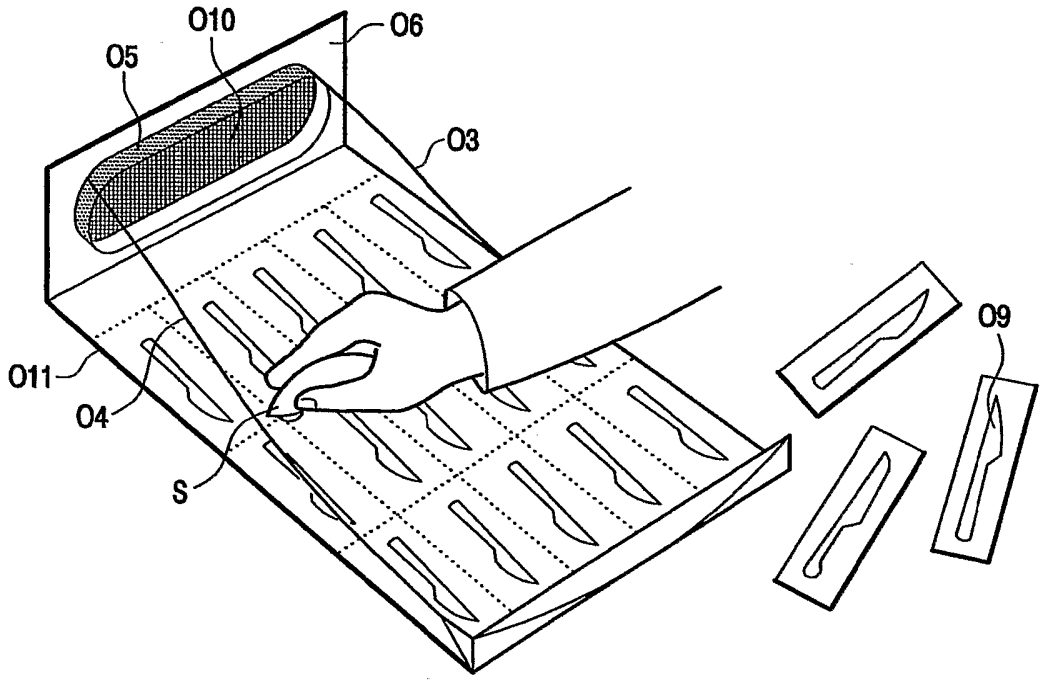

FIG. 7

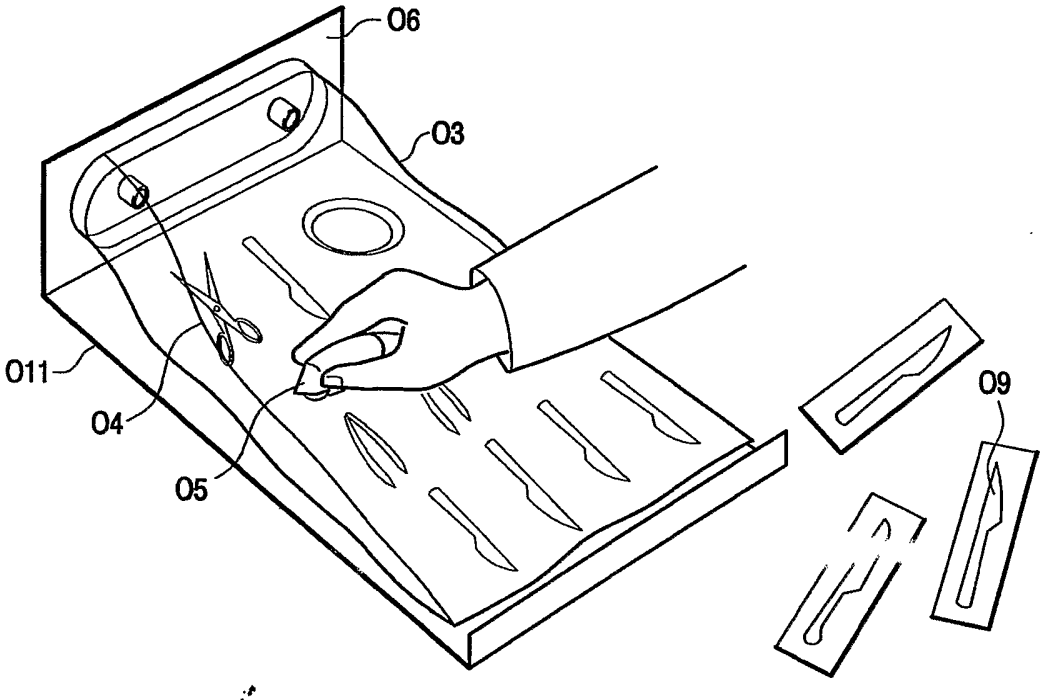

FIG. 8

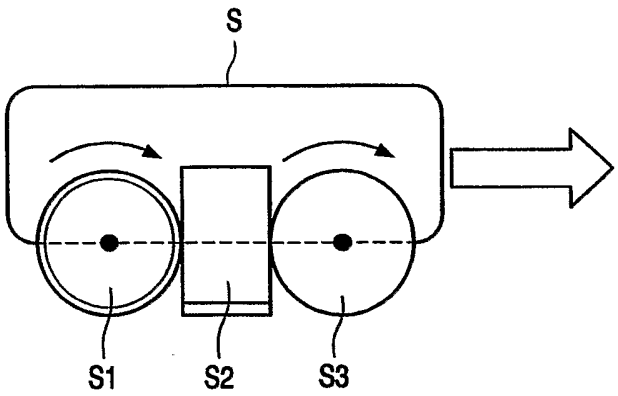

FIG. 9A

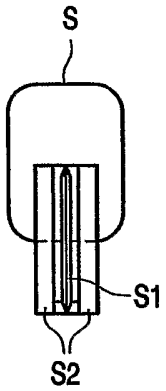

FIG. 9B

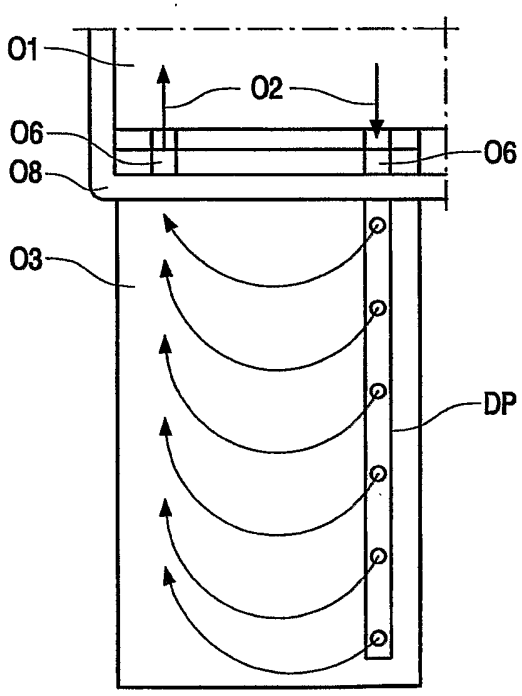

FIG. 10

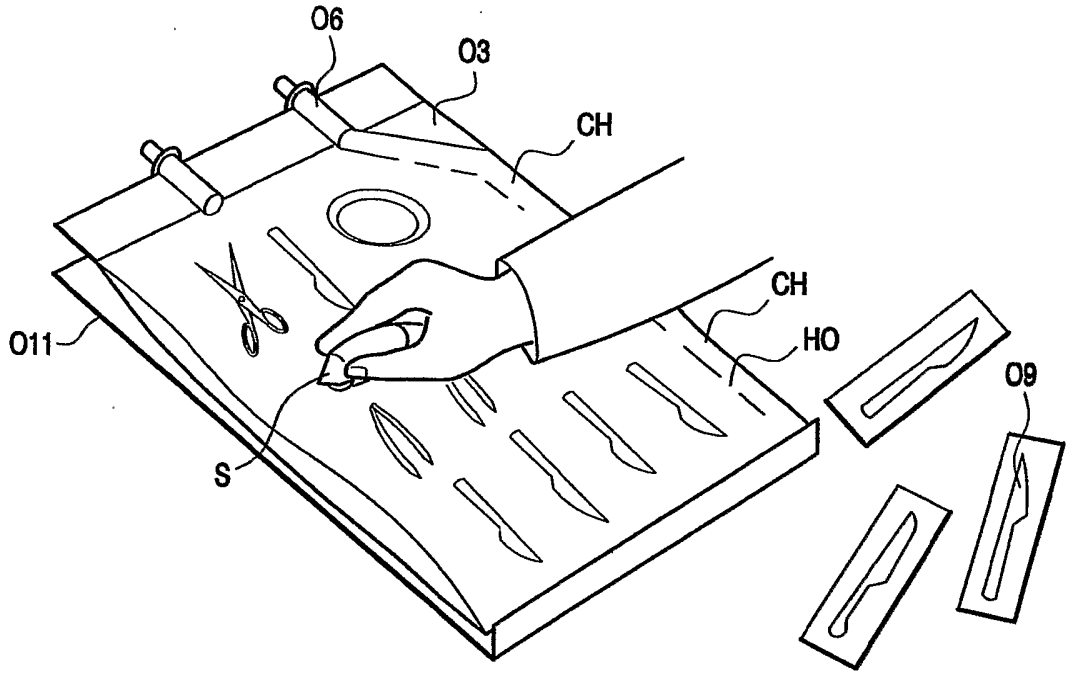

FIG. 11

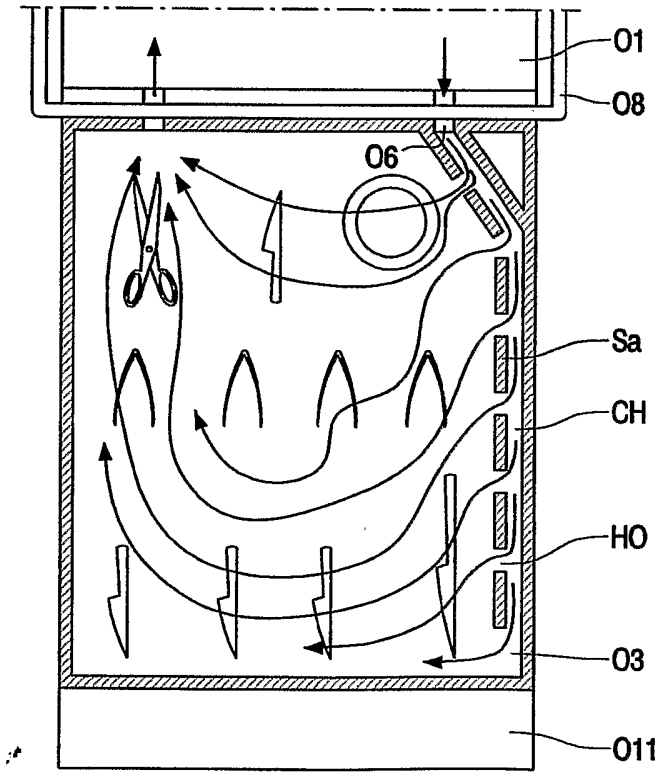

FIG. 12

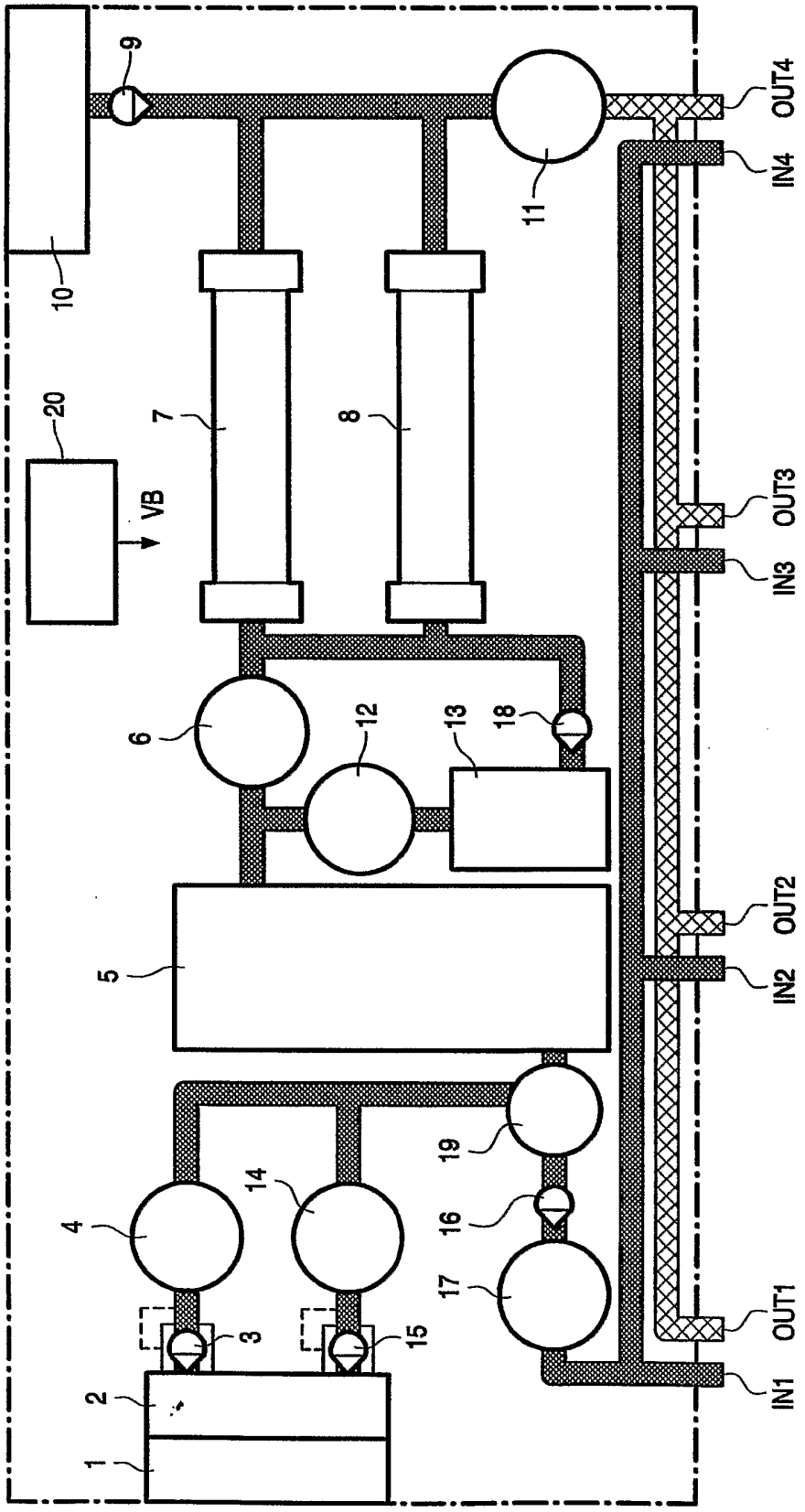
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FIG. 13

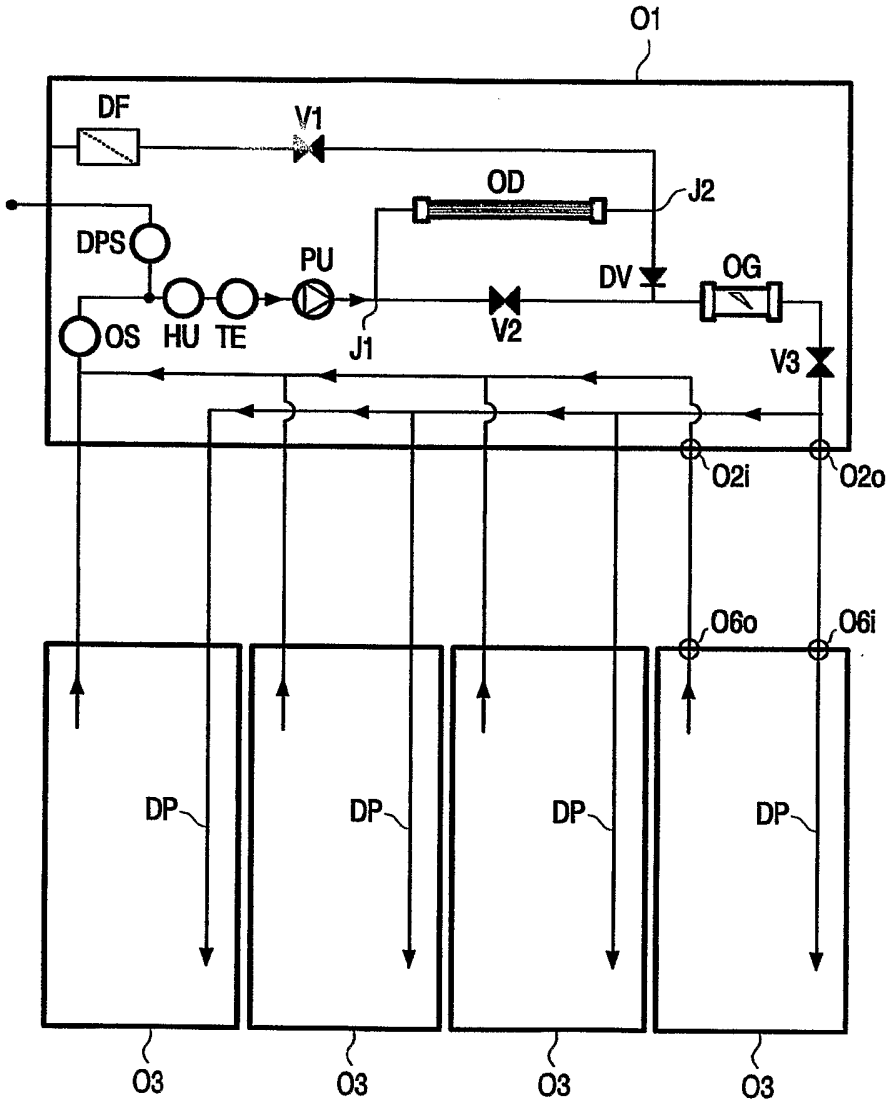
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FIG. 14