

**NBC FILTER UNIT WITH VENTILATION BYPASS****FIELD OF THE INVENTION**

The present invention relates to a Nuclear Biological Chemical (NBC) filter unit for residential safe room NBC filtration system, more particularly to an NBC filter unit with integral ventilation bypass.

**BACKGROUND OF THE INVENTION**

National civilian defense authorities such as US DEPARTMENT OF HOMELAND SECURITY (DHS) and Israel's HOME FRONT COMMAND (HFC) instruct citizens to enter a sealed shelter in case of a nuclear, biological or chemical attack. In Israel, every living unit includes a sealed, blast protected safe room built to Israeli government standards. The regulations in Israel enforces installation of an NBC filtration and ventilation system in the blast protected safe room of every new discrete living unit. The term NBC, standing for "Nuclear Biological Chemical", is used throughout this patent application at the broad interpretation, meaning at list one of: Nuclear, Biological and Chemical. Accordingly NBC does not mean that all of the capabilities are necessary for the application, for example a filter providing Biological and Chemical attack protection, but none or only partial Nuclear attack protection, is yet considered an NBC filter unit for the purpose of this application.

Israeli Patent No. 124273 (US. Pat. No. 6,328,775) to the present applicant, describes a compact, portable system for protection against the penetration of contaminated air into a protected space. When the described unit is installed in a blast protected safe room, the system includes an air intake fitted through an exterior wall of the building, carrying a blast valve at the outer side of the wall and a quick connect flange at the inner side of the wall. An air exhaust unit is mounted through a preferably opposite interior wall of the safe room, provided with an over-pressure relief valve. The system further includes a portable NBC filter unit attachable to the air intake by means of the quick connect flange and a portable electric blower unit operated by mains power and optionally backed up by an internal battery. The blower unit is attachable to the outlet of the filter unit directly or with a flexible extension duct. A hand operated air pump is also included providing protection even in case of mains power failure. During normal conditions the filter and blower are stored in an easy to reach place and the safe room is available for daily use. Upon declaration of an NBC emergency state, the portable NBC filter is connected to the air intake and the portable electric blower is attached to the outlet of the filter.

Long stay in the air tight safe room even at times of only conventional hazard, require

active ventilation through the air intake. With the system described above it is possible to attach the electric blower or the hand operated air pump directly to the quick connect flange of the air intake, thus ventilating the safe room without NBC filtration. The NBC filter unit is kept sealed until an NBC hazard is declared and the NBC filter is attached between the air intake quick connect flange and the electric blower or hand pump.

However, new regulations require that the NBC filtration system should be fixedly installed in position and be ready for use with minimal settings.

Until recently, even for the newer fixed in place systems, there was a need upon declaration of NBC hazard, to remove air tight seals fitted to the inlet and outlet of the NBC filter unit and to assemble the NBC filter unit between the air intake and a flexible duct leading to the electric blower. The need to assemble the NBC filter unit is now eliminated according to Israeli patent application 214577 to the present applicant, describing a two-way changeover valve within an NBC air filtration system that allows changing from ventilation mode to NBC filtration mode by only switching a manual state selector handle attached thereon.

The changeover valve has a primary inlet, air-flow coupled with the air intake, a primary outlet, air-flow coupled with the electric blower or hand pump, a secondary inlet, air-flow coupled with the NBC filter unit outlet and a secondary outlet, air-flow coupled with the NBC filter unit inlet. An arrangement of swivel flaps or plate drag mechanism, in the changeover valve directs air from the primary inlet to the primary outlet, either directly (ventilation mode) or through the NBC filter unit (NBC filtration mode). When the NBC filtration system is set to ventilation mode the flaps or drag plates seal the NBC filter unit inlet and outlet to prevent intrusion of moisture or other contaminations into the NBC filter unit.

A typical NBC filter unit includes a particulate filter and a gas adsorption filter. The gas adsorption filter is composed of a packed layer of activated carbon granulates. The carbon layer compression is maintained by a spring loaded perforated plate fitted above the carbon layer to sustain integrity and tightness of the carbon pack.

Israeli patent application 226357 to the present applicant, describes a filter unit assembly comprising a casing made of two drawn sheet-metal segments, permanently seamed to each other by a rim crimping process. The casing holds a particulate filter mounted to the air inlet casing segment, and an adsorption granulate filter packed into the air outlet casing segment. A perforated plate and springs are fitted over the adsorption granulate filter during assembly. The springs being adapted to apply pressure to the perforated plate when the casing

segments are seam joined, thus reducing assembly components and cost.

However in order to use a standard NBC filter unit such as hereby described, with the changeover valve as described in IL 214577, there is a need to supply a first duct or additional cover that leads incoming air from the air intake towards the primary inlet of the change over valve, a second duct or cover that communicates between the change over valve secondary outlet and the inlet of the NBC filter unit, a third duct or cover that communicates between the change over valve secondary inlet and the outlet of the NBC filter unit, and a fourth duct or cover that leads air from the primary outlet of the change over valve to the electric blower or manual air pump.

It will be apparent to the person skilled in the art, that such ducts or covers are complicated in shape and costly in production. Airtight sealing of the ducts or covers during assembly is difficult and may end with unsafe cross leaks. Consequently, there is a need to simplify the arrangement, improve quality and safety, reduce the amount of components and reduce production and assembly cost.

## **SUMMARY OF THE INVENTION**

Accordingly, it is a principal object of the present invention to overcome the disadvantages and limitations of prior art systems and provide a filter unit for residential safe room NBC filtration system, with integral ventilation bypass. According to the present invention there is provided an NBC filter unit comprising a casing, at least one inlet port and at least one outlet port. The casing encapsulates a particulate filter and a gas adsorption filter. The NBC filter unit further comprises an integral ventilation bypass and air flow direction means selectively operated to direct air flow internally from the at least one inlet port to the at least one outlet port, either through the bypass, constituting a ventilation mode, or through the particulate filter and gas adsorption filter constituting an NBC filtration mode.

The casing volume further includes four volumetric compartments, a primary inlet compartment adjacent the at least one inlet port, a primary outlet compartment adjacent the at least one outlet port, a secondary inlet compartment upstream the particulate filter and a secondary outlet compartment downstream the gas adsorption filter.

The primary inlet compartment and primary outlet compartment are air flow communicated through the integral ventilation bypass when the flow direction means are set to ventilation mode. At the same time, the secondary inlet compartment and the secondary

outlet compartment are air tight sealed from ambience by the flow direction means.

When the flow direction means are set to NBC filtration mode, the primary inlet compartment and secondary inlet compartment are air flow communicated, and the primary outlet compartment and secondary outlet compartment are air flow communicated. At the same time, the primary inlet compartment and primary outlet compartment are airflow disconnected.

Upon reaching end of life period or in case of NBC contamination, the NBC filter unit including the integral ventilation bypass and air flow direction means is replaced as a single disposable unit.

Optionally, the NBC filter unit further comprises an internal shell, the internal shell encapsulates: the particulate filter, the gas adsorption filter, the secondary inlet compartment upstream the particulate filter and the secondary outlet compartment downstream the gas adsorption filter.

## **BRIEF DESCRIPTION OF THE DRAWINGS**

The invention and the way it may be carried out in practice, will be understood with reference to the following illustrative figures, by way of non-limiting example only, in which like reference numerals identify like elements, and in which:

Fig. 1 is a perspective view of an NBC filter unit made according to one embodiment of the present invention;

Fig. 2 is a perspective longitudinal section through the NBC filter unit of Fig. 1;

Fig. 3 is an elevated sectional view of the NBC filter unit of Fig. 1, with the air flow direction means selected to operate at ventilation mode;

Fig. 4 is an elevated sectional view of the NBC filter unit of Fig. 1, with the air flow direction means selected to operate at NBC filtration mode;

Fig. 5 is an elevated sectional view of a second embodiment of the present invention, demonstrating an NBC filter unit with the air flow direction means selected to operate at ventilation mode;

Fig. 6 is an elevated sectional view as in Fig. 5, with the air flow direction means selected to operate at NBC filtration mode;

Fig. 7 is an elevated sectional view of a third embodiment of the present invention, demonstrating an NBC filter unit with the air flow direction means selected to operate at ventilation mode; and

Fig. 8 is an elevated sectional view as in Fig. 7, with the air flow direction means selected to operate at NBC filtration mode.

## DETAILED DESCRIPTION OF EMBODIMENTS

With reference to the figures, in which like reference numerals identify like elements even through different embodiments of the invention, there is shown in Fig. 1, a perspective view of an NBC filter unit, generally referenced 10, made according to one embodiment of the present invention. The term NBC, standing for “Nuclear Biological Chemical”, is used throughout this patent application at the broad interpretation, meaning at list one of: Nuclear, Biological and Chemical. Accordingly NBC does not mean that all of the capabilities are necessary for the application, for example a filter unit providing Biological and Chemical attack protection, but none or only partial Nuclear attack protection, is yet considered an NBC filter unit for the purpose of this application. The filter unit 10 external appearance may accept a cuboid shape (Figs. 1 to 4) or cylindrical shape (Figs. 5 to 8), although any of the embodiments may accept any type of volumetric shape. The filter unit 10 comprising a casing 12 made of two casing segments 60, 62 preferably permanently joined to each other.

As known in the art of NBC protected safe rooms, an air intake pipe is embedded during building construction into the concrete casting of the safe room exterior wall. The air intake pipe typically carries a standard or quick connect fixation flange at the inner side of the exterior wall and may be provided with a blast valve.

The NBC filter unit 10 may be air flow communicated to the air intake by means of a duct or directly mounted by optional standard or quick connect mating flange 13 onto the fixation flange of the safe room air intake pipe (not shown). The casing segment 62 facing the safe room air intake is shown in Fig. 1, with the flange 13 surrounding an at least one inlet port 14. The casing segment 60 facing the space of the safe room includes at least one outlet port 16 (Fig. 2).

The common aspects of the different embodiments of the present invention will now be explained with reference to Figs. 2 to 8.

The casing 12 encapsulates directly or further inside a particulate filter 18, of the

radial type as shown in the figures, or optionally of the axial type as known in the art, and a gas adsorption filter 20. The NBC filter unit 10 further comprises an integral ventilation bypass 22 and air flow direction means generally referenced 24 selectively operated for instance by handle 70 (Fig. 1) to direct air flow internally, either through the ventilation bypass 22, constituting a ventilation mode, or through the particulate filter 18 and gas adsorption filter 20 constituting an NBC filtration mode.

The casing 12 internal volume includes four volumetric compartments, a primary inlet compartment 30 adjacent the inlet port 14, a primary outlet compartment 32 adjacent the at least one outlet port 16, a secondary inlet compartment 34 upstream the particulate filter 18, and a secondary outlet compartment 36 downstream the gas adsorption filter 20. The space between the particulate filter 18 and the gas adsorption filter 20 is preferably kept to a minimum providing free air flow there between.

The primary inlet compartment 30 and the primary outlet compartment 32 are air flow communicated through the integral ventilation bypass 22 when the flow direction means 24 are set to ventilation mode as shown in Fig. 3 and applicable also to Figs. 5 and 7 as will be hereinafter explained. In order to keep moisture and contaminating gases away from the gas adsorption filter during normal times, the secondary inlet compartment 34 and the secondary outlet compartment 36 are air tight sealed from ambience by the flow direction means 24 when the flow direction means 24 are set to ventilation mode.

When the air flow direction means 24 are set to NBC filtration mode, as shown in Fig. 4 and applicable also to Figs. 6 and 8 as will be hereinafter explained, the primary inlet compartment 30 and secondary inlet compartment 34 are air flow communicated, and at the same time, the primary outlet compartment 32 and secondary outlet compartment 36 are air flow communicated, while the primary inlet compartment 30 and primary outlet compartment 32 are airflow disconnected.

As known in the art of NBC filters there is a certain shelf life period after which the filter unit must be replaced even if not used. Upon reaching end of life period or in case of NBC contamination, the NBC filter unit 10 including the integral ventilation bypass 22 and air flow direction means 24 is replaced as a single disposable unit. Replacement of the entire unit contributes to safety of the operator, not being exposed to possible contaminant caught in the air flow direction means.

With reference to Figs 2 to 6, according to optional embodiments of the invention, the NBC filter unit further comprises an internal shell 38, the internal shell 38 encapsulates the particulate filter 18, the gas adsorption filter 20, the secondary inlet compartment 34

upstream the particulate filter 18 and the secondary outlet compartment 36 downstream the gas adsorption filter 20.

According to one embodiment of the invention illustrated in Figs. 1 to 4, the NBC filter unit 10 comprises an internal shell 38, preferably not centered with the casing 12 to allow larger free space at one side. The internal shell 38 encapsulates the above mentioned particulate filter and gas adsorption filter, the secondary inlet compartment 34 located upstream the particulate filter 18 and the secondary outlet compartment 36 located downstream the gas adsorption filter 20.

According to the above embodiment, the air flow direction means generally referenced 24 comprises a pair of swivel flaps 26. Selecting between ventilation mode or NBC filtration mode is performed by simultaneously rotating the flaps 26 a quarter of a turn one clockwise and the other counterclockwise by means of the handle 70 and pair of mating gears 72 (Fig. 1). Springs (not shown) are provided to force one of two stable states of the flaps as shown in Figs. 3 and 4. The ventilation bypass 22 is constructed as a lateral flow path 73 (Fig. 3) located at one end of the NBC filter unit at the space between the internal shell 38 and the casing 12.

The initial position of the swivel flaps 26 during normal times and even during conventional hazard is the ventilation mode (Fig. 3) where the flaps made of or covered with elastomer, are pressed by spring loading against openings located on the wall of the internal shell 38, thus blocking the passage into the secondary inlet compartment 34 and out from the secondary outlet compartment 36. The flaps 26 have an appropriate sealing properties for protection of the gas adsorption filter 20 from intrusion of moisture, gases and foreign particles. During NBC hazard, the mode of operation is changed by flaps 26 being rotated and pressed by spring loading against separation fins 85 being part of the shell 38, thus the bypass 22 path is closed and air is forced by an electric blower of the NBC filtration system (not shown), to flow through the particulate filter 18 and gas adsorption filter 20 (Fig. 4).

At the NBC filtration mode, the two flaps 26 are closing against each other, yet a ventilation slot 68 formed between the two mating shell 38 halves is extending through the casing 12 to the safe room space providing double safety in case that the flaps are leaking. The venting slot 68 equalizes the pressure of the bypass 22 portion located between the flaps 26, to the safe room pressure, such that even if both the upstream flap facing the primary inlet compartment 30, and the downstream flap facing the primary outlet compartment 32 leaks, clean air will be drawn back from the safe room space through venting slot 68, without risking the safe room occupants.

The one or more outlet ports 16, may be provided with a resilient one way valve 77 to prevent back-flow as required for appropriate operation of additional components of the NBC filtration system (not shown).

According to a second embodiment of the invention illustrated in Figs. 5 and 6, the NBC filter unit 10 comprises an internal shell 38 which is preferably centrally located and axially movable in the casing 12. The internal shell encapsulates the secondary inlet compartment 34 located upstream the particulate filter 18 and the secondary outlet compartment 36 located downstream the gas adsorption filter 20. According to the present embodiment, the air flow direction means generally referenced 24 comprises a peripheral gasket 40 and seat 42, combined with radial perforations 44 located around the primary inlet compartment 30 and radial perforations 45 fitted substantially centrally to the inner side of casing segment 60, at the secondary outlet compartment 36. The ventilation bypass 22 (Fig. 5) is constructed as a peripheral gap located between the internal shell 38 and the casing 12.

Selecting between ventilation mode and NBC filtration mode is performed by axially sliding the internal shell 38 in the casing 12, fully forwards (Fig. 5) or fully backwards (Fig. 6) respectively. Sliding the internal shell 38 back and forth is performed by axially pushing or pulling at least one handle 54 protruding through a slot 56 made to the casing segment 62 wall. It will be understood that other mechanisms such as for example, push handle with spring return, eccentric transversal axis, bolt and nut arrangement, or any other mechanism may provide the same movement and fall under the scope of the present invention. Springs or other mechanical means are provided to force the internal shell 38 to one of the two stable operation modes, thus avoiding an undesired intermediate position.

During operation at ventilation mode (Fig. 5), air enters the primary inlet compartment 30, passes through perforations 44 into the ventilation bypass 22 and directly through primary outlet compartment 32 to outlet ports 16 equipped with optional one way valves 77.

At NBC filtration mode (Fig. 6), the ventilation bypass 22 is blocked by the gasket 40 now in contact with seat 42. Air enters the primary inlet compartment 30, passes through perforations 44 through secondary inlet compartment 34, particulate filter 18, then through gas adsorption filter 20, secondary outlet compartment 36, and through now open perforations 45 into the primary outlet compartment 32, then to outlet ports 16 equipped with optional one way valves 77.

A peripheral seal 81, fitted to casing segment 62 around perforations 44, is sealing between the primary inlet compartment 30 downstream towards the ventilation bypass 22,

providing double safety in case that gasket 40 leaks. A venting slot 68 equalizes the pressure of the bypass 22 space between seal 81 and gasket 40 to the safe room pressure, such that even if both gasket 40 and the double safety seal 81 leaks, clean air will be drawn back from the safe room space through venting slot 68, without risking the safe room occupants.

According to a third embodiment of the invention illustrated in Figs. 7 and 8, the casing 12 is axially movable in relation to a hollow member 50, sealingly passing, substantially centrally, through the secondary inlet compartment 34 located upstream the particulate filter 18 and through the secondary outlet compartment 36 located downstream the gas adsorption filter 20. The hollow member 50 comprises the primary inlet compartment 30 adjacent the inlet port 14, and the primary outlet compartment 32 adjacent the outlet port 16.

According to the present embodiment, the air flow direction means 24 comprises radial perforations 74 made to the fixed hollow member 50 around the primary inlet compartment 30, radial perforations 75 made to the fixed hollow member 50 around the primary outlet compartment 32, and radial perforations 76 made to the internal wall of the secondary outlet compartment 36, combined with a circular channel 46 surrounding the hollow member 50. The ventilation bypass 22 is constructed by the radial perforations 74 and 75 on the fixed hollow member 50 wall, and a gasket sealed circumferential channel 46 surrounding the hollow member 50.

Selection between ventilation mode and NBC filtration mode is performed by axially sliding the casing 12 about the hollow member 50, fully backwards (Fig. 7) or fully forwards (Fig. 8) respectively. It will be understood that to the same extent, the casing 12 may be fixed in position and the hollow member 50 being pushed or pulled in relation to the casing 12. Springs or other mechanical means are provided to force the casing 12 to one of the two stable operation modes, thus avoiding an undesired intermediate position.

During operation at ventilation mode (Fig. 7), air enters the primary inlet compartment 30, passes through perforations 74 into the ventilation bypass 22 circumferential channel 46, then through perforations 75 and directly through primary outlet compartment 32 to outlet port 16 equipped with optional one way valve 77.

At NBC filtration mode (Fig. 8), the ventilation bypass 22 is blocked by the seal 79 sealing between the circumferential channel 46 and hollow member 50. Air enters the primary inlet compartment 30, passes through perforations 74, through the secondary inlet compartment 34, particulate filter 18, then through gas adsorption filter 20, the secondary outlet compartment 36, and through now open perforations 76 into the primary outlet compartment 32, and outlet ports 16 equipped with optional one way valve 77.

A planar plug 82 with peripheral seal 84, attached to casing segment 60 by spacers 86, is sealing a portion of the ventilation bypass 22 upstream seal 84, to provide double safety in case that seal 79 leaks. A venting hole 68 equalizes the pressure of the ventilation bypass 22 volume located between seal 79 and seal 84, to the safe room pressure such that even if both seal 79 and the double safety seal 84 leaks, clean air will be drawn back from the safe room space through venting hole 68, without risking the safe room occupants.

An option common to all of the embodiments of the present invention, suggests that at least one of the casing 12 and shell 38, if applicable, is composed of two segments permanently joined to each other using a rim crimping process.

The gas adsorption filter 20 is composed of a packed layer of activated carbon granulates, the carbon granulate layer is tightened by a perforated plate 64 fitted on top of the carbon granulate layer. The perforated plate 64 fitted on top of the carbon granulate layer is loaded by at least one spring 66 (shown schematically) fitted thereon to apply pressure on the perforated plate 64 when the casing 12 or shell 38 segments are joined.

For double safety, a portion of the ventilation bypass 22 of each of the above embodiments is provided with upstream and downstream seals. A pressure equalizing vent passage 68 is provided between the ventilation bypass 22 and the safe room space. The vent passage 68 provides another safety feature when the NBC system operates at NBC filtration mode. If one of the bypass 22 upstream seals leaks, such as the upstream flap of Fig. 4, or the upstream seal 81 of Fig. 6, or the upstream seal 79 of Fig. 8, and even if the bypass 22 downstream seal leaks such as the downstream flap of Fig. 4, or the downstream gasket 40 of Fig. 6, or the downstream seal 84 of Fig. 8, the blower (not shown) of the NBC filtration system will recirculate clean air from the space of the safe room without sucking contaminated air from the inlet port as explained above in relation to each of the embodiments.

It will be appreciated that the specific embodiments of the present invention described above and illustrated in the accompanying drawings are set forth merely for purposes of example. Other variations, modifications, and applications of the present invention will readily occur to those skilled in the art. It is therefore clarified that all such variations are considered within the scope and spirit of the invention. Accordingly, the protection sought herein is as set forth in the claims below.

**CLAIMS:**

1. An NBC filter unit for use in a safe room NBC filtration system, comprising: a casing; at least one inlet port; at least one outlet port; a particulate filter; and a gas adsorption filter; wherein said NBC filter unit further comprises an integral ventilation bypass and air flow direction means selectively operated to direct air flow internally from said at least one inlet port to said at least one outlet port, either through said bypass, constituting a ventilation mode, or through said particulate filter and gas adsorption filter constituting an NBC filtration mode.
2. An NBC filter unit as claimed in claim 1, further comprising four volumetric compartments, a primary inlet compartment adjacent said at least one inlet port, a primary outlet compartment adjacent said at least one outlet port, a secondary inlet compartment upstream said particulate filter and a secondary outlet compartment downstream said gas adsorption filter.
3. An NBC filter unit as claimed in claim 2, wherein said primary inlet compartment and said primary outlet compartment are air flow communicated through said integral ventilation bypass, when said flow direction means are set to said ventilation mode.
4. An NBC filter unit as claimed in claim 2, wherein said secondary inlet compartment and said secondary outlet compartment are air tight sealed from ambiance by said flow direction means when said flow direction means are set to said ventilation mode.
5. An NBC filter unit as claimed in claim 2, wherein said primary inlet compartment and said secondary inlet compartment are air flow communicated; said primary outlet compartment and said secondary outlet compartment are air flow communicated; and said primary inlet compartment and said primary outlet compartment are airflow disconnected; when said flow direction means are set to said NBC filtration mode.
6. An NBC filter unit as claimed in claim 1, wherein upon reaching an end of life period or in case of NBC contamination, said NBC filter unit including said integral ventilation bypass and said air flow direction means is replaced as a single disposable unit.
7. An NBC filter unit as claimed in claim 2, further comprising an internal shell, said internal shell encapsulates: said particulate filter; said gas adsorption filter; said secondary inlet compartment upstream said particulate filter; and said secondary outlet compartment downstream said gas adsorption filter.
8. An NBC filter unit as claimed in claim 7, wherein said air flow direction means comprises a pair of swivel flaps and wherein selecting between said ventilation mode and

said NBC filtration mode is performed by simultaneously rotating said flaps.

9. An NBC filter unit as claimed in claim 8, wherein said ventilation bypass is constructed as a lateral flow path located at one end of said filter unit between said internal shell 38 and said casing.

10. An NBC filter unit as claimed in claim 7, wherein said internal shell is axially movable in said casing, and wherein said air flow direction means comprises a peripheral gasket and seat combined with radial perforations located around said primary inlet compartment and radial perforations located substantially centrally at the secondary outlet compartment, and wherein selecting between said ventilation mode and said NBC filtration mode is performed by axially moving said internal shell in said casing, fully forwards or fully backwards respectively.

11. An NBC filter unit as claimed in claim 10, wherein said ventilation bypass is constructed as a peripheral gap located between said internal shell and said casing.

12. An NBC filter unit as claimed in claim 10, wherein moving said internal shell is performed by axially pushing or pulling at least one handle protruding through a slot made to said casing wall.

13. An NBC filter unit as claimed in claim 2, wherein said casing is axially movable in relation to a hollow member, sealingly passing, substantially centrally, through said secondary inlet compartment, said particulate filter, said gas adsorption filter and said secondary outlet compartment, said hollow member comprises said primary inlet compartment adjacent said inlet port, and said primary outlet compartment adjacent said outlet port, and wherein said air flow direction means comprises radial perforations made to said hollow member around said primary inlet compartment, radial perforations made to said hollow member around said primary outlet compartment, radial perforations made to an internal wall of said secondary outlet compartment, combined with a circular channel surrounding said hollow member.

14. An NBC filter unit as claimed in claim 13, wherein selection between said ventilation mode and said NBC filtration mode is performed by axially sliding said casing in relation to said hollow member, fully backwards or fully forwards respectively.

15. An NBC filter unit as claimed in claim 13, wherein said ventilation bypass is constructed as said radial perforations made to said fixed hollow member and said circular channel surrounding said hollow member.

16. An NBC filter unit as claimed in claim 7 wherein at least one of said casing and said shell is composed of two segments permanently joined to each other using a rim crimping

process.

17. An NBC filter unit as claimed in claim 16, wherein said gas adsorption filter is composed of a packed layer of activated carbon granulates, said carbon granulate layer is tightened by a perforated plate fitted on top of said carbon granulate layer.

18. An NBC filter unit as claimed in claim 17, wherein said perforated plate fitted on top of said carbon granulate layer is loaded by at least one spring fitted thereon to apply pressure on said perforated plate when said casing segments or said shell segments are joined.

19. An NBC filter unit as claimed in claim 1, wherein a pressure equalizing vent passage is provided between said ventilation bypass and said safe room space.