ONLINE UPS SYSTEM WITH COMBINED AIR AND WATER COOLING

TECHNICAL FIELD OF THE INVENTION

The invention relates to an UPS-system in which the following components are arranged in a machine cabinet: (i) an AC-to-DC converter having a power output stage and connected to a DC voltage link on its output side, (ii) a DC-to-AC converter having a further power output stage and connected to the DC voltage link on its input side, (iii) a bidirectional DC-to-AC converter having an even further power output stage and connected to the DC voltage link, (iv) a motor/generator connected to the AC side of the bidirectional DC-to-AC converter, a flywheel mechanically coupled to a rotor of the motor/generator, (v) a bypass to the AC-to-DC converter and the DC-to-AC converter connected in series, in which a bypass switch is arranged, (vi) a controller for the AC-to-DC converter, the DC-to-AC converter, the motor/generator and the bypass switch, as well as (vii) a blower which draws air out of the surroundings of the machine cabinet through an air filter into the machine cabinet, blows the air within the machine cabinet through a heat exchanger, and ejects the air out of the machine cabinet again.

Due to the AC-to-DC converter and the DC-to-AC converter connected in series, this UPS-system is a so-called Online-UPS which can supply loads connected to the output of the DC-to-AC converter via this series connection out of a main AC source. With the aid of the AC-to-DC converter and the DC-to-AC converter connected in series, the quality of the AC current provided to the loads can be enhanced as compared to the main AC source. If, however, the output quality of the AC current is sufficient, the load can be supplied directly out of the main AC source, bypassing the AC-to-DC converter and the DC-to-AC converter via the bypass. In case of a partial or complete failure of the main AC source, the load can be supplied via the motor/generator, the bidirectional DC-to-AC converter and the DC-to-AC converter out of the flywheel. For this purpose, the flywheel has to be put in rotation up front via the AC-to-DC converter, the bidirectional DC-to-AC converter and the motor/generator to store kinetic energy therein.

Particularly, the UPS-system is a compact UPS-system arranged in a machine cabinet having a high power density as compared to its dimensions. With such a high power density, the heat balance of the UPS-system has particularly to be attended to.

PRIOR ART

An UPS-system comprising a housing, a flywheel energy storage unit that provides short term backup energy to a load and is arranged within the housing, and a UPS electronic unit that provides continuous power to the load from one of the following power sources: a flywheel unit, a utility power supply and a long term source of backup power which is also arranged in the housing, is known from **EP 1 226 643 B1**. A cooling system for cooling the flywheel unit and the UPS electronic unit has a forced air convection cooling system which draws cooling air across the flywheel unit and the UPS electronic unit. Particularly, the convection cooling system leads the cooling air at first across the flywheel unit and then across the UPS electronic unit. Further, the convection cooling system comprises a plurality of blowers and each blower has a dampening element that runs air drawn by the blower outside of that housing again. The damping elements each have a flap which is opened and closed depending on a pressure difference between the interior pressure and the outside pressure of the housing. The housing has a stable base at which the flywheel unit is supported, and a frame mounted to the base that holds a control electronic for the flywheel unit and the UPS electronic unit. The base and the frame of the housing are together cladded by side panels and access door panels and a lid in which the flaps are provided.

An apparatus for uninterrupted power supply which is to be connected between an AC source whose interruptions are to be bridged, and one or more loads to be supplied with AC current is known from **DE 198 52 125 C1**. The apparatus includes at least one rectifier for the input AC current, accumulators for intermediately storing electric energy, at least one DC-to-AC converter for the battery voltage of the accumulators, and a control electronic. A power current flows through electric coil forms, particularly inductors and chokes, and solid-state electronic components of the apparatus. The coil forms are arranged in a first basin filled with a first cooling liquid. A line system for a second cooling liquid has heat exchange surfaces facing the first cooling liquid and the solid-state electronic components. A pressure compensation means provided for the first cooling liquid has a compressible gas volume. A heat exchanger is provided for the second cooling liquid to withdraw heat therefrom. In the known apparatus for uninterrupted power supply, no cooling air from the outside is leaded through the apparatus to avoid the buildup of contaminations. It has a closed housing for all electronic and electric components, out of which and into which only the current lines and the lines for the second cooling liquid exit and enter, respectively. The heat exchanger is arranged outside this housing.

An UPS-system with direct cooling of different ones of its heat producing components is known from **US 2010/0085708 A1**. The heat producing components of this UPS-system are arranged in a switch cabinet and include an AC-to-DC converter, a DC-to-AC converter, a switch and at least one transformer. The AC-to-DC converter, the DC-to-AC converter and the switch are cooled by cooling plates through which a cooling liquid flows. The cooling liquid is circulated by a pump in a cooling liquid circuit in which a heat exchanger is arranged. In a heat exchanger, the excess air is transferred from the cooling liquid to air by which the transformer is air-cooled. The known UPS-system uses a battery as an energy storage. As another option of a backup power supply, that one out of a flywheel is mentioned.

An UPS-system comprising a cooling device made of an air cooler to which a liquid cooler is mounted is known from **WO 2007/065666 A2.** Here, the air cooler is arranged between the liquid cooler and heat producing electric components, particularly power semiconductors, as a heat bridge between the heat producing components and the liquid cooler. The liquid cooler serves for increasing the cooling performance of the cooling device as compared to its formation of the air cooler only.

OBJECT OF THE INVENTION

It is the object of the invention to enhance an UPS-system of the kind descripted at the beginning, which corresponds to the preamble of independent claim 1, with regard to its cooling system in such a way that its power density can be increased without problems occurring with regard to its heat balance.

SOLUTION

The object of the invention is solved by an UPS-system comprising the features of independent claim 1. Preferred embodiments of the UPS-system according to the invention are defined in the dependent claims.

DESCRIPTION OF THE INVENTION

In an UPS-system according to the invention, the following components are arranged in a machine cabinet: (i) an AC-to-DC converter having a power output stage and connected to a DC

voltage link on its output side, (ii) a DC-to-AC converter having a further power output stage and connected to the DC voltage link on its input side, (iii) a bidirectional DC-to-AC converter having an even further power output stage and connected to the DC voltage link, (iv) a motor/generator connected to the AC side of the bidirectional DC-to-AC converter, a flywheel mechanically coupled to a rotor of the motor/generator, (v) a bypass to the AC-to-DC converter and the DC-to-AC converter connected in series, in which a bypass switch is arranged, (vi) a controller for the AC-to-DC converter, the DC-to-AC converter, the motor/generator and the bypass switch, as well as (vii) a blower which draws air out of the surroundings of the machine cabinet through an air filter into the machine cabinet, blows the air within the machine cabinet through a heat exchanger, and ejects the air out of the machine cabinet again. According to the invention, the heat exchanger, together with a coolant pump, cooling channels through the motor/generator and cooling bodies for the power output stages, is arranged in a closed coolant circuit, wherein the coolant channels through the motor/generator include stator channels which run through the stator of the motor/generator.

The UPS-system according to the invention has a hybrid cooling system which uses the heat capacitance of air out of the surroundings both for a basic cooling of the components arranged in the machine cabinet and an enhanced heat removal from critical components by means of a coolant. The coolant is cooled in the heat exchanger through which the air drawn into the machine cabinet is blown within the machine cabinet, before it is ejected out of the machine cabinet again. The coolant is circulated by the coolant pump through a coolant circuit in which, besides the coolant pump, coolant channels through the motor/generator and cooling bodies for the power output stages are arranged. Thus, at least the motor/generator and the power output stages of the converters are cooled by means of the coolant. This, however, does not exclude that a coolant cooling is also provided for even further components of the UPS-system within the machine cabinet. However, for example, the controller of the UPS-system is as a rule sufficiently cooled with air, as the electric powers flowing therethrough are only small. Further, it has to be considered that no higher voltages are present in the controller, which in case of contaminations within the machine cabinet would be connected with a relevant danger of spark overs. There, where higher voltages are present in the UPS-system according to the invention, like for example in the power output stages of the converters, the coolant cooling is employed. Further, a contamination of the interior of the machine cabinet is obviated by means of the air filters, through which the air is drawn into the machine cabinet.

In the UPS-system according to the invention, the integration of the motor/generator into the coolant circuit is unusual. This, however, allows for a very considerable increase in the power density of the UPS-system with regard to the kinetic energy, which is stored in the flywheel mechanically coupled to the rotor of the motor/generator. The coolant, which flows through the stator channels through the stator of the motor/generator, does not only cool the stator as such but also the bearings for the rotor of the motor/generator.

It is preferred, if the coolant channels through the motor/generator further include housing channels which run through a housing of the motor/generator. If both the stator and the housing of the motor/generator are cooled by coolant, an indirect cooling of the rotor of the motor/generator rotating in between is also achieved. This particularly applies, if the housing of the motor/generator does not only enclose the rotor but also the flywheel mechanically coupled thereto.

In the UPS-system according to the invention, a particularly compact construction of the motor/generator is preferred in which the flywheel encloses the rotor of the motor/generator. In other words, in the UPS-system according to the invention, the physical mass of the rotor of the motor/generator is increased to such an extent that it is effective as a flywheel mechanically coupled to the rotor, in the rotation of which a considerable kinetic energy for the backup supply of a load by the UPS-system can be stored. In this embodiment of the UPS-system according to the invention, the flywheel which is coupled to the rotor of the motor/generator may, without further measures, not be decoupled or otherwise separated from the rotor but forms a closed constructional unit together with the rotor.

In the motor/generator of the UPS-system according to the invention, the stator channels and the housing channels may be connected in parallel. Often, for a forced flow through the coolant channels, it is preferred, if the stator channels and the housing channels are connected in series. In this case, the stator channels can be arranged downstream of the housing channels.

Generally, the cooling bodies for the power output stages and the coolant channels may also be connected in series, wherein the cooling bodies may be arranged downstream of the coolant channels. It may, however, be preferred to connect the cooling bodies and the coolant channels in parallel to be able to differently adjust the coolant cooling of the motor/generator and of the power output stages according to the present needs by means of valves in the coolant circuit.

In the UPS-system according to the invention, a coolant cooling for filter inductors, which are, as a rule, part of the output side DC-to-AC converter but also of the input side AC-to-DC converter and, thus, also arranged in the machine cabinet, may also be integrated into the coolant circuit. Here, it may be advantageous to arrange the coolant cooling downstream of the cooling bodies for the power output stages, because the filter inductors will cope with a certain increase in temperature without problem.

Further, a compensation reservoir for the coolant is preferably arranged in the coolant circuit. This compensation reservoir may optionally enclose a compressible gas volume. In principal, the coolant may be gaseous or vaporous. Preferably, however, it is a cooling liquid.

With regard to the cooling with air, the blower, the air filter and further air guiding devices of the UPS-system according to the invention are preferably arranged such that they lead a plurality of partial flows of the air through the machine cabinet in parallel to each other, which are only merged upon entrance of the air into the blower. One of the partial flows of the air through the machine cabinet may be leaded around the motor/generator and may cool the motor/generator in addition to the cooling with the coolant. A further partial flow may be leaded around the filter inductors of the DC-to-AC converter and/or the AC-to-DC converter to cool them alone or in combination with an additional coolant cooling. An even further partial flow of the air may be leaded around the bypass switch of the bypass to cool it. The controller of the UPS-system may be cooled by an even further partial flow of the air. Often, however, a convection cooling will be sufficient here so that it can be done without a forced circulation of the air in the area of the controller.

The heat exchanger in the coolant circuit may particularly be arranged upstream of the blower and thus in the merged partial flows of the air through the machine cabinet. In the heat exchanger, direct heat exchange between the air and the coolant may occur. Thus, the UPS-system according to the invention, as a rule, does without the use of a second coolant, which could, for example, be evaporated and condensed again in a circle process to reduce the temperature of the coolant leaded through the coolant circuit below the temperature of the air which is blown through the heat exchanger.

Preferably, the machine cabinet of the UPS-system according to the invention includes two partial cabinets arranged side by side, which form separate transport units of the UPS-system. Here, a partition wall of the machine cabinet may be formed by two overlapping walls of the partial cabinets, which separate the partial cabinets from one another but which are provided with aligned

air passage openings. For the transport of the partial cabinets, these air passage openings may be closed.

Particularly, the one partial cabinet may enclose the motor/generator, the blower, the exchanger and the coolant pump, i.e. all components of the UPS-system with movable parts, whereas the other partial cabinets includes the power output stages, the filter inductors of the DC-to-AC converter and/or the AC-to-DC converter, the bypass switch and the controller, i.e. all purely electric or electronic components of the UPS-system.

Advantageous developments of the invention result from the claims, the description and the drawings. The advantages of features and of combinations of a plurality of features mentioned at the beginning of the description only serve as examples and may be used alternatively or cumulatively without the necessity of embodiments according to the invention having to obtain these advantages. Without changing the scope of protection as defined by the enclosed claims, the following applies with respect to the disclosure of the original application and the patent: further features may be taken from the drawings, in particular from the illustrated designs and the dimensions of a plurality of components with respect to one another as well as from their relative arrangement and their operative connection. The combination of features of different embodiments of the invention or of features of different claims independent of the chosen references of the claims is also possible, and it is motivated herewith. This also relates to features which are illustrated in separate drawings, or which are mentioned when describing them. These features may also be combined with features of different claims. Furthermore, it is possible that further embodiments of the invention do not have the features mentioned in the claims.

The number of the features mentioned in the claims and in the description is to be understood to cover this exact number and a greater number than the mentioned number without having to explicitly use the adverb "at least". For example, if a heat exchanger is mentioned, this is to be understood such that there is exactly one heat exchanger or there are two heat exchangers or more heat exchangers. The features listed in the claims may be supplemented by other features, or these features may be the only features of the respective product.

The reference signs contained in the claims are not limiting the extent of the matter protected by the claims. Their sole function is to make the claims easier to understand.

BRIEF DESCRIPTION OF THE DRAWINGS

In the following, the invention is further explained and described with respect to preferred exemplary embodiments illustrated in the drawings.

Fig. 1 is a schematic depiction of a cooling system of an UPS-system according to the invention.

Fig. 2 is a schematic depiction of the electric and electronic design of the UPS system according to the invention according to Fig. 1.

Fig. 3 shows a motor/generator of the UPS-system according to the invention according to Fig. 1 in a top view, and

Fig. 4 shows the motor/generator according to Fig. 3 in a sectional view according to a section line A-A drawn in Fig. 3

DESCRIPTION OF THE DRAWINGS

The UPS-system 1 depicted in **Figs. 1 and 2** with regard to different aspects, serves for an uninterrupted supply of a load 2 with electric power. The UPS-system 1 is connected between the load 2 and a main AC source 3, for example a public AC grid 4, see Fig. 2. Between an input 5 and an output 6, the UPS-system 1 comprises an AC-to-DC converter 7 and a DC-to-AC converter 8 connected in series, wherein to a DC voltage link 9 connected in between a motor/generator 10 is additionally connected via a bidirectional DC-to-AC converter 51. A flywheel, which is rotated in operation of the motor/generator 10, is mechanically coupled to the rotor of the motor/generator 1. If the main AC source fails, the electric energy stored in the rotating flywheel can be used for supplying the load 2 with electric power via the motor/generator 10 operated as a generator and the DC-to-AC converter 8. By means of the AC-to-DC converter 7 and the DC-to-AC converter 8 connected in series and using the motor/generator 10, the quality of the current out of the main AC source 3 may be enhanced, and the supply of the load 2 with electric power may be stabilized, even if the main AC source 3 does not fail. Further, the UPS-system 1 includes a bypass 11 with a bypass switch 12, which is provided in parallel to the AC-to-DC converter 7 and the DC-to-AC converter 8 connected in series and which serves for bridging this series connection, when the load 2 can be supplied directly out of the main AC source 3. A basic supply of the load 2 out of

the main AC voltage 3 while stabilizing the voltage present at the output 6 by means of the DC-to-AC converter 8 is enabled by an additional inductor 13 in the bypass 11. A controller 14 of the UPS-system 1 is provided for the AC-to-DC converter 7, the DC-to-AC converter 8, the bypass switch 12 and the motor/generator 10. The controller 14 also controls a cooling system 15 of the UPS-system 1. All components 7 to 15 of the UPS-system 1 are arranged in a machine cabinet 16.

Fig. 1 shows that this machine cabinet 16 has two partial cabinets 17 and 18 arranged side by side, wherein a partition wall 19 of the machine cabinet 16 is formed by two overlapping walls 20 and 21 of the partial cabinets 17 and 18, in which aligned air passage openings 22 and 23 are provided. All components of the UPS-system 1 with moveable parts are arranged in the partial cabinet 17, whereas the partial cabinet 18 houses the purely electric and electronic components. A blower 24 of the cooling system 15 in the partial cabinet 17 draws air out of the surroundings 25 through air filters 26 in the bottom area of both partial cabinets 17 and 18 into the machine cabinets 16. The blower 24 blows the air through a heat exchanger 27 and then ejects it out of the machine cabinet 16 again. Here, the air filter 26, the blower 24 and further not depicted air guiding devices are designed and arranged in such a way that a plurality of partial flows 28 to 31 of the air runs through the machine cabinet until all partial flows 28 to 31 are merged upon entry of the air into the blower 24, and a merged main flow 32 runs through the heat exchanger 27 and out of the machine cabinet 16. The one partial flow 28 runs across the motor/generator 10. The partial flow 29 runs across power output stages 33 of the AC-to-DC converter 7, the DC-to-AC converter 8 and the bidirectional DC-to-AC converter 51. The partial flow 30 runs across filter inductors 34 of the AC-to-DC converter 7 and the DC-to-AC converter 8; and the partial flow 31 runs across the bypass 11. These partial flows or a further one of the partial flows of the air through the machine cabinet 16 may flow across the controller 14, or the controller 14 may be arranged out of these partial flows and be cooled by convection only. An additional coolant circuit 35 is provided for the motor/generator 10 and the power output stages 33 of the DC-to-AC converter 8, in which the heat exchanger 27, a compensation reservoir 36, a coolant pump 37, coolant channels through the motor/generator 10 and cooling bodies 38 for the power output stages 23 are arranged. Here, the coolant channels through the motor/generator 10 and the cooling bodies 38 are connected in parallel. By means of the coolant circuit 35, those components of the UPS-system 1, which, with a high power density of the UPS-system 1, have the highest tendency to overheat, are selectively additionally cooled with coolant. For controlling the cooling system 15, the controller 14, besides the blower 24, may operate the coolant pump 37 and valves 50 which adjust the relative flow through the coolant channels through the motor/generator 10

with regard to the flow through the cooling bodies 38. However, there is no need that the valves are operated by the controller 14, instead they may only be adjusted once to set the relative flows through the coolant channels through the motor/generator 10 and the cooling components 38.

Fig. 3 shows the motor/generator 10 of the UPS-system in a top view, and **Fig. 4** in a sectional view along a vertical section line A-A according to Fig. 3. The motor/generator 10 comprises a housing 39 in the middle of which a stator 40 is arranged. Around the stator 40, a rotor 42 is mounted in rotation bearings 43 and 44 rotating about a vertical rotation axis 41. The rotor 42 is mechanically coupled to a flywheel 45, which rotates with the rotor 42 about the rotation axis 41. In operation of the motor/generator 10 as a motor, the flywheel 45 is rotated about the rotation axis 41 to store kinetic energy in the flywheel 45. This kinetic energy may be re-transformed into electric energy, when the motor/generator 10 is operated as a generator. The coolant channels 46 of the coolant circuit 35 through the motor/generator 10 include housing channels 47 through the housing 39 and for cooling the housing 39, and stator channels 48 through the stator 40. Further, **Fig. 4** shows a lower vertical support 49 via which the motor/generator 10 is mounted in the partial cabinet 17 of the machine cabinet 16.

LIST OF REFERENCE NUMERALS

1	UPS-system
2	load
3	main AC source
4	public current grid
5	input
6	output
7	AC-to-DC converter
8	DC-to-AC converter
9	DC voltage link
10	motor/generator
11	bypass
12	bypass switch
13	inductor
14	controller
15	cooling system
16	machine cabinet
17	partial cabinet
18	partial cabinet
19	partition wall
20	wall
21	wall
22	air passage opening
23	air passage opening
24	blower
25	surroundings
26	air filter
27	heat exchanger
28-31	partial flow
32	main flow
33	power output stage
34	filter inductor
35	coolant circuit

36 compensation reservoir
37 coolant pump
38 cooling body
39 housing
40 stator
41 rotation axis
42 rotor
43 rotation bearing
44 rotation bearing
45 flywheel
46 coolant channel
47 housing channel
48 stator channel
49 vertical support
50 valve
51 bidirectional DC-to-AC converter

CLAIMS

1. UPS-system (1), in which the following components are arranged in a machine cabinet (16):

- an AC-to-DC converter (7) having a power output stage (33) and connected to a DC voltage link (33) on its output side,
- a DC-to-AC converter (8) having a further power output stage (33) and connected to the DC voltage link (9) on its input side,
- a bidirectional DC-to-AC converter (51) having an even further power output stage (33) and connected to the DC voltage link (9),
- a bypass (11) to the AC-to-DC converter (7) and the DC-to-AC converter (8) connected in series, in which a bypass switch (12) is arranged,
- a controller (14) for the AC-to-DC converter (7), the DC-to-AC converter (8), and the bypass switch (12) and
- a blower (24) drawing air out of surroundings (25) of the machine cabinet (16) through air filters (26) into the machine cabinet (16), blowing the air within the machine cabinet (16) through a heat exchanger (27) and ejecting the air out of the machine cabinet (16) again,
- a coolant circuit (35), in which the heat exchanger (27) is arranged together with a coolant pump (37) and cooling bodies (38) for the power output stages (33),

characterized in

- that a motor/generator (10) having a rotor (42) to which a flywheel (45) is mechanically coupled is connected to the bidirectional DC-to-AC converter (51) at its AC side,
- that coolant channels (46) through the motor/generator (10) are arranged in the coolant circuit (35), wherein the coolant channels (46) include stator channels (48) which run through a stator (40) of the motor/generator (10).

2. UPS-system (1) according to claim 1, **characterized in** that the coolant channels (46) include housing channels (47) which run through a housing (39) of the motor/generator (10).

3. UPS-system (1) according to claim 2, **characterized in** that the housing (39) encloses the rotor (42) and the flywheel (45) coupled thereto.

4. UPS-system (1) according to claim 2 or 3, **characterized in** the stator channels (48) are connected in parallel to the housing channels (47), or that the stator channels (48) and the housing channel (47) are connected in series.

5. UPS-system (1) according to claim 2 or 3, **characterized in** that the stator channels (48) and the housing channels (47) are connected in series, wherein the stator channels (48) are arranged downstream of the housing channels (47).

6. UPS-system (1) according to any of the preceding claims, **characterized in** that the flywheel (45) encloses the rotor (42) of the rotor/generator (10).

7. UPS-system (1) according to any of the preceding claims, **characterized in** that the cooling bodies (38) and the coolant channels (46) are connected in parallel, or that the cooling channels (38) and the coolant channels (46) are connected in series, wherein the cooling bodies (38) are optionally arranged downstream of the cooling channels (46).

8. UPS-system (1) according to any of the preceding claims, **characterized in** that a coolant cooling for filter inductors (34) of the AC-to-DC converter (7) and/or of the DC-to-AC converter (8) is arranged in the coolant circuit (35), wherein the coolant cooling is optionally arranged downstream of the cooling bodies (38).

9. UPS-system (1) according to any of the preceding claims, **characterized in** that a compensation reservoir (36), which optionally includes a compressible gas volume, is arranged in the coolant circuit (35).

10. UPS-system (1) according to any of the preceding claims, **characterized in** that the blower (24), the air filters (26) and further air guiding devices are arranged and designed such that they lead a first partial flow (28) of the air through the machine cabinet (16) around the motor/generator (10).

11. UPS-system (1) according to any of the preceding claims, **characterized in** that the blower (24), the air filters (26) and further air guiding devices are arranged and designed such that they lead a second partial flow (30) of the air through the machine cabinet (16) around filter inductors (34) of the AC-to-DC converter (7) and/or the DC-to-AC converter (8).

12. UPS-system (1) according to any of the preceding claims, **characterized in** that the blower (24), the air filters (26) and further air guiding devices are arranged and designed such

that they a lead a third partial flow (31) of the air through the machine cabinet (16) around the bypass switch (12).

13. UPS-system (1) according to any of the claims 10 to 12, **characterized in** that the blower (24) and the further air guiding devices are arranged and designed such that they merge all partial flows (28, 29, 30, 31) upon entry of the air in the blower (27), wherein the heat exchanger (27) is optionally arranged downstream of the blower (24).

14. UPS-system (1) according to any of the preceding claims, **characterized in** that the machine cabinet (16) comprises two partial cabinet (17, 18) arranged side by side, wherein a partition wall (19) of the machine cabinet (16) is formed by two overlapping walls (20, 21) of the partial cabinets (17, 18) having aligned air passage openings (22, 23).

15. UPS-system (1) according to claims 14, **characterized in** that the one partial cabinet (17) encloses the motor/generator (10), the blower (24), the heat exchanger (27) and the coolant pump (37), and that the other partial cabinet (18) encloses the power output stages (33), filter inductors (34) of the AC-to-DC converter (7) and/or the DC-to-AC converter (8), the bypass switch (12) and the controller (14).