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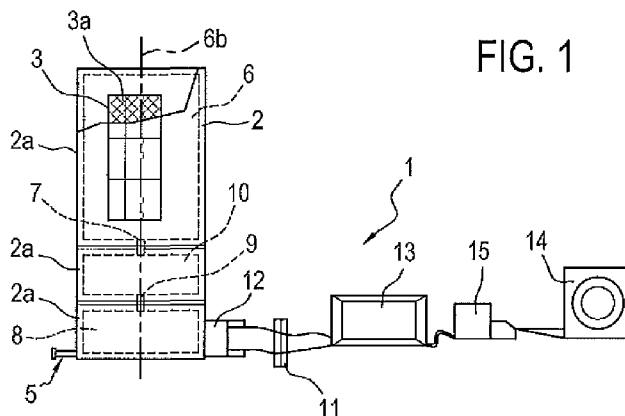
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(54) Title: AUXILIARY GENERATOR OF ELECTRICAL ENERGY.



(57) Abstract: An auxiliary generator of electrical energy, comprising an external shell (2) provided with at least one intake opening (3) for a fluid and at least one outlet opening (4) for the fluid; a rotor (6) housed inside the shell (2) along the path of the fluid from said intake opening (3) to said outlet opening (4); said rotor (6) being provided with a plurality of vanes (6a) for intercepting the fluid and with an output shaft (7); a generator (8) of electrical current housed inside the shell (2), provided with an input shaft (9) mechanically connected to the output shaft (7) of the rotor (6), and provided with at least one output electrical terminal (11); and an at least one accumulator (13) of electrical energy electrically connected to said output electrical terminal (11).

## **DESCRIPTION**

### **AUXILIARY GENERATOR OF ELECTRICAL ENERGY**

#### **Technical field**

The present invention concerns an auxiliary generator of electrical energy.

#### **Background art**

In various sectors of the art there is a perceived need for being able, in case of necessity or emergency, or simply for convenience or for ecological reasons, to have available an auxiliary source of electrical energy.

Usually, such auxiliary sources of electrical energy consist of energy accumulators in the form of rechargeable batteries.

The charge capacity of such batteries varies according to whether they are destined for small power users or high power users.

Examples of small power users are cellphones, audio/video players (e.g. mp3 players, tablets) or electronic devices in general, lighting equipment, alarm services, emergency services etc.

Examples of high power users are motors in the automobile sector, but also in the motorcycle and cycle sector, etc.

In various situations, where an electrical energy distribution network is not available, for example in isolated locations far from centres of habitation, the problem of recharging batteries often arises, with the result that once the charge accumulated in them is exhausted, the batteries themselves become unusable.

Furthermore, in the mobility sector there is a particular perceived need to have available a "zero emission" energy source, i.e. one that is capable of making energy available without any release of polluting emissions.

#### **Disclosure of the invention**

The aim of the present invention is to make available an auxiliary

generator of electrical energy which overcomes the disadvantage mentioned above and which satisfies the needs expressed above.

A further aim of the present invention is to make available an auxiliary generator of electrical energy of compact dimensions.

In particular, an aim of the present invention is to make available an auxiliary generator of electrical energy of portable type.

Said aims are fully achieved by the auxiliary generator of electrical energy subject of the present invention, which is characterised by what is contained in the claims stated below.

### **Brief description of the drawings**

The characteristics of the auxiliary generator of electrical energy subject of the present invention, will become more apparent from the following description of a preferred embodiment, illustrated, purely by way of non-limiting example, in the attached plates of drawings in which:

- figure 1 schematically illustrates a first embodiment of the auxiliary generator of electrical energy which is the subject of the present invention;
- figure 1a is a view in cross section of what is illustrated in figure 1;
- figure 2 schematically illustrates a rear view of the auxiliary generator of electrical energy which is the subject of the present invention, referred to in the previous drawings;
- figure 2a is a view on plan of what is illustrated in figure 2;
- figure 3 schematically illustrates a second embodiment of the auxiliary generator of electrical energy which is the subject of the present invention;
- figure 3a is a view in cross section of what is illustrated in figure 3;
- figure 3b is a side view of what is illustrated in figure 3;
- figures 4a, 4b, 5a, 5b, 8, 8a, 15 and 15a represent respective constructive variants of the generator which is the subject of the present invention;

- figures 6, 6a, 6b and 6c show a first application of the generator which is the subject of the present invention;
- figure 7 shows a second application of the generator which is the subject of the present invention;
- figure 9 schematically illustrates a third embodiment of the auxiliary generator of electrical energy which is the subject of the present invention;
- figure 9a is a view in cross section of what is illustrated in figure 9;
- figure 9b is a side view of what is illustrated in figure 9;
- figure 10 shows a third application of the generator which is the subject of the present invention;
- figure 11 shows a fourth application of the generator which is the subject of the present invention;
- figure 12 shows a fifth application of the generator which is the subject of the present invention;
- figure 13 shows a sixth application of the generator which is the subject of the present invention;
- figure 14 shows a seventh application of the generator which is the subject of the present invention;
- figure 14a is a view on plan and in partial section of what is illustrated in figure 14;
- figure 16 shows an eighth application of the generator which is the subject of the present invention;
- figure 16a is a rear view of what is illustrated in figure 16;
- figure 17 shows a ninth application of the generator which is the subject of the present invention;
- figures 17a, 17b and 17c are respective views in transverse section of what is illustrated in figure 17;
- figure 18 shows a tenth application of the generator which is the subject of the present invention;
- figure 18a shows in more detail what is illustrated in figure 18;

- figure 18b is a view on plan of what is illustrated in figure 18a;
- figure 18c is a side view of what is illustrated in figure 18a;
- figure 19 shows an eleventh application of the generator which is the subject of the present invention; and
- figure 19a is a side view of what is illustrated in figure 19.

### **Detailed description of preferred embodiments of the invention**

With reference to figures 1 and 1a, reference no. 1 indicates an auxiliary generator of electrical energy.

The generator 1 comprises an external shell 2 provided with at least one intake opening 3 for a fluid and at least one outlet opening 4 for the fluid.

Openings 3 and 4 are provided with respective grids 3a and 4a for protection and safety.

The fluid is to be understood to be in relative motion with respect to the generator 1. This fluid can be a gas, particularly air. Alternatively, this fluid can be a liquid, particularly water.

Openings 3 and 4 can be single or multiple. In the specific case, a single inlet opening 3 and two outlet openings 4 are provided, or vice versa.

In particular the shell 2 has a substantially cylindrical shape. Preferably the shell is made of plastic or metal material.

Preferably, furthermore, the shell has a modular structure, i.e. it is compoundable by assembling in axial alignment several elementary blocks 2a, cylindrical in this particular case.

Assembly of the elementary blocks 2a requires them to be fixed to each other by interlocking or by bolting.

Preferably the shell 2 is of compact dimensions, such as to make the generator 1 of portable type and/or easy to install in small spaces.

The shell 2 is advantageously provided with an element 5 for fixing to an external body.

The fixing element 5 can be of clamp type or screw type, or of the type with clips (pincers provided with a spring to return them to the gripping

position).

The above-mentioned external body can be, for example, a means of transport.

Examples of applications on means of transport are illustrated in figures 6, 6a, 6b, 6c, 7, 10, 11, 12, 13, 14, 14a, 16 and 16a.

Alternatively, the above-mentioned external body can be, for example, a fixed structure.

Examples of applications on fixed structures are illustrated in figures 17, 17a, 17b, 17c, 18, 18a, 18b and 18c.

The auxiliary generator 1 comprises furthermore a rotor 6 housed inside the shell 2 along the path of the fluid from the intake opening(s) 3 to the outlet opening(s) 4.

The rotor 6 is provided with a plurality of vanes 6a for intercepting the fluid and with an output shaft 7.

The rotor 6 is arranged inside the shell 2 with its central axis 6b of rotation perpendicular to the path of the fluid from the intake opening(s) 3 to the outlet opening(s) 4 (see figure 4b in this connection).

The auxiliary generator 1 comprises furthermore an electric current generator 8, which is also housed inside the shell 2.

The current generator 8 (dynamo or alternator) is provided with an input shaft 9, which is mechanically connected to the output shaft 7 of the rotor 6.

The mechanical connection between the current generator 8 and the rotor 6 can be direct (case not illustrated) or indirect, through a speed multiplier 10. In this case, also the multiplier 10 is housed inside the shell 2 and is physically and mechanically interposed between the output shaft 7 of the rotor 6 and the input shaft 9 of the electric current generator 8.

It should be noted that, in this configuration, a first block 2a of the shell 2 contains the rotor 6, a second block 2a contains the speed multiplier 10 and a third block 2a contains the current generator 8.

The three blocks 2a can, conveniently, have different longitudinal

dimensions.

The electric current generator 8 is provided with at least one electric output terminal 11, which depends on an electronic control unit 12 for controlling the generator 8 itself. The control unit 12 can be mounted either outside the shell 2, as in the example shown, or it, too, can be contained inside the shell 2, to be precise, inside block 2a which contains the current generator 8, or inside a respective further block 2a.

An electrical energy accumulator 13, which is electrically connected to the above-mentioned terminal 11, also forms part of the auxiliary generator 1.

The accumulator 13 is in the form of one or more rechargeable batteries, for example of lithium ion type.

According to a first embodiment, the accumulator 13 is arranged outside the shell 2, so as to make its placement independent and more convenient.

According to an alternative embodiment, the accumulator 13 is arranged inside the shell 2, so as to make the auxiliary generator 1 more immediately usable, in particular when it is required to be portable (as is evident in figures 18a and 19). In this case, the accumulator 13 can be housed inside a respective further block 2a.

The accumulator 13 can be connected directly to a user 14, or via an inverter 15, depending on whether the user must be supplied in direct current or in alternating current. In this case, too, the inverter 15 can be housed inside a respective further block 2a, or can be arranged outside the shell 2.

It should be noted that the accumulator 13, where it is not integrated into the shell 2, can be removed from the relative housing for subsequent use where necessary or desired.

In this case, the accumulator 13 is arranged in the relative housing and fixed thereto with quick attach/release means.

In the variant of figures 2 and 2a, in which for simplicity the elements outside the shell 2 are not shown, the rotor 6 is arranged inside the shell 2

with its axis 6b of rotation parallel to the path of the fluid from the intake opening(s) 3 to the outlet opening(s) 4 (see figure 4a in this connection). More precisely, in this case four axial intake openings 3, i.e. formed on the circular end of the shell 2, and four lateral output openings 4 (only two of these are shown in figure 2), i.e. formed on the cylindrical periphery of the shell 2 are provided.

Alternatively, according to a variant not illustrated, four lateral intake openings 3 (i.e. formed on the cylindrical periphery of the shell 2) and four axial outlet openings 4 (i.e. formed on the circular end of the shell 2) can be provided.

In the variant of figures 3, 3a and 3b the rotor 6 is provided with at least two sections, each provided with a respective configuration of the vanes 6a for intercepting the fluid. Precisely, the configuration of the vanes 6a of one section is different from that of the axially adjacent section, so as to intercept the fluid in a more effective and constant manner.

A further example of a multi-section rotor 6 is provided by figures 8 and 8a, which refer to a rotor 6 provided with three axially adjacent sections in sequence.

Furthermore, still with reference to figures 3, 3a and 3b, the intake opening 3, with the respective grid 3a, is mounted on an air conveyor 16 formed by a radially projecting portion of the shell 2. Two outlet openings 4 are also provided, arranged in a position opposite to the intake opening 3.

Figures 5a and 5b illustrate possible electrical configurations in parallel and, respectively, in series, of several generators 1 subject of the present invention.

Figures 6, 6a, 6b and 6c show a generator 1, subject of the present invention, mounted on a car, in particular behind the grid located on the front bonnet.

In particular, figures 6, 6a show an installation in which the central axis 6b of the rotor 6 (and of the shell 2) is arranged horizontally and transversely to the airflow generated by the car; figure 6b shows an installation in which

the central axis 6b of the rotor 6 (and of the shell 2) is arranged vertically and transversely to the airflow generated by the car movement; and figure 6c shows an installation in which the central axis 6b of the rotor 6 (and of the shell 2) is arranged horizontally and in the direction of the airflow generated by the car movement.

In relation to the application of the generator 1 on board a vehicle, it should be noted that the movement of the vehicle itself determines a relative speed between the fluid in which the vehicle is immersed (for example, air) and the generator 1 so that the rotor 6 can be driven in rotation by the fluid itself.

The energy available through the accumulator 13 can be used instantly at the moment of generation, i.e. even during the phase of rotation of the rotor 6, besides with rotor 6 stationary.

More generally, the energy made available through the accumulator 13 can be used in any manner, for example to supply electrical systems on the vehicle and/or to convey energy to an electrical network.

Figure 7 shows an installation variant with respect to what has been described with reference to figures 6, 6a, 6b and 6c. In particular a duct 17 for conveying the air is provided, thanks to which the generator 1 can also be positioned in a position distant from the grid located on the front bonnet.

This duct 17 can advantageously also be used in other applications and/or vehicles, to enable the generator 1 to be positioned in any desired position with respect to the external environment.

Figures 9, 9a, 9b show a variant of what is already described with reference to figures 3, 3a, 3b.

According to this variant, the shell 2 is provided with a sort of weathervane 18 having the function of orienting the generator 1 on the basis of the fluid flow which strikes it.

According to this variant, the generator 1 comprises a first half-shell 30 and a second half-shell 31, rotatably connected to each other.

The first half-shell 30 is preferably the lower half-shell.

The first half-shell 30 is attachable to a frame and the second half-shell 31 can rotate with respect to the first half-shell 30.

The second half-shell 31 is preferably the upper half-shell.

The weathervane 18 is mounted fixed onto the second half-shell 31, so as to be able to rotate with respect to the first half-shell 30.

The second half-shell 31 also carries the intake port and the outlet port, so that the weathervane 18, the intake port and the outlet port are solidly connected to each other.

In this way, advantageously, the generator 1 results in being always oriented in the direction of the wind, so that the quantity of energy produced can be maximised.

In fact, the weathervane 18 (and consequently the second half-shell 31 which carries the intake port and the outlet port) becomes rotated by the wind.

According to this variant a single outlet opening 4 is furthermore provided; however, it is clear that two or more outlet openings 4 could also be provided.

Figure 10 shows a generator 1, subject of the present invention, installed on a bicycle.

The generator 1, assembled on the handlebar, can be advantageously equipped with at least one light source 19, which is housed on the outer periphery of the shell 2 and is supplied by the accumulator 13 which is integrated into the inside of the shell 2.

The light source 19 can advantageously constitute the bicycle's lighting device. In this case, the generator 1 can supply energy also to a lamp installed in the rear zone of the bicycle.

The generator 1 can furthermore be, for example, of the type described in figures 19 and 19a, which illustrate a generator 1 of portable type comprising, besides the above-mentioned light source 19, at least one USB socket 20 for external users. The USB socket 20 is housed on the

outer periphery of the shell 2 and is supplied by the accumulator 13 which is integrated into the inside of the shell 2. In this embodiment, the fixing element 5 is advantageously of the quick assembly and quick dismantling type, for example by clips.

Figure 11 shows a generator 1, subject of the present invention, installed on a motorcycle. The accumulator 13 can be integrated into the shell 2 or arranged in a remote position.

In the event that the motorcycle is driven by electricity or is of so-called hybrid type, the accumulator 13 can be utilised as an alternative to the basic battery of accumulators for the electric drive, after switching between the two energy sources.

More generally, in the case of a vehicle which comprises both the accumulator 13 and a battery other than the accumulator 13 having the aim of driving the vehicle in motion, it should be noted that switching between the two sources of energy (accumulator 13 and battery) is performed on the basis of a detected voltage value of the accumulator 13 and/or of the battery.

It should be noted that, according to another aspect, the electrical systems (drives etc.) of the vehicle can be supplied, alternatively, by the accumulator 13 or by the battery, depending on a detected voltage value of the accumulator 13 and/or of the battery.

Furthermore, according to this aspect, the generator 1 can be electrically connected to the accumulator 13 or to the battery, to recharge them.

It should be noted that the vehicle comprises a control unit, configured for effecting a double switching:

- a first switching on the electrical systems side (user) which allows either the accumulator 13 or the battery to be electrically coupled to the electrical systems;
- a second switching on the generator side, which allows either the accumulator 13 or the battery to be electrically coupled to the generator 1 to be recharged.

The same considerations hold also in the case, not illustrated, of a car with electric or hybrid drive.

Figure 12 shows a plurality of generators 1, subject of the present invention, installed on a railway or subway carriage.

The accumulators 13 (only one shown in the drawing) can be used both during electrical blackouts and in case of faults in the carriage to keep the lights, air conditioning and so forth operating. Furthermore, in the event that the carriage is stationary for ordinary maintenance, the accumulators 13 can provide electrical energy in services to the public, such as for example charging points for cellphones, computers etc.

Figures 13, 14, 14a, 16 and 16a show a plurality of generators 1, subject of the present invention, installed on means of transport such as trams and similar. In such installations, no. 21 indicates a socket through which it is possible to exploit the energy accumulated in the accumulators 13, or in the accumulator 13 in the event that there is a single one. In such installations, besides the possibility of electrical configurations in parallel and, respectively, in series according to what is illustrated in figures 5a and 5b, it is possible to physically house the generators in series (cascade) and/or in parallel inside suitable air ducting 22, as is shown in figures 14, 14a, 15, 15a, 16.

Figure 17 shows a generator 1, subject of the present invention, installed in a flue in which a fluid flows.

The fluid can be conveyed into the flue by conveying means (ventilators etc.) or as a result of the difference in density between the fluid at the bottom of the flue and the external air.

Preferably, according to this application, the generator 1 is installed in a flue into which a fluid is made to pass at a temperature higher than that of the external air.

Even more preferably, the generator 1 is installed in a flue of a thermal combustion apparatus (such as for example a stove).

The rotor 6 is, in this case, made to rotate from the upward movement of

the air.

Figures 18, 18a, 18b and 18c show a generator 1, subject of the present invention, installed in a railway tunnel, a subway tunnel or a road/motorway tunnel.

In this case, the generator 1, fixed to a wall of the tunnel, is advantageously provided with a lighting device 23 of its own, having for example the function of signalling or lighting for transport in the tunnel.

In a similar way to what was described with reference to figures 3, 3a and 3b, the generator 1 is furthermore advantageously equipped with an air conveyor 24 formed by a radially projecting portion of the shell 2.

In a further application not illustrated, the generator 1, subject of the present invention, can be installed on the hull of a craft or boat below the waterline.

## CLAIMS

1. An auxiliary generator of electrical energy, comprising:
  - an external shell (2) provided with at least one intake opening (3) for a fluid and at least one outlet opening (4) for the fluid;
  - a rotor (6) housed inside the shell (2) along the path of the fluid from said intake opening (3) to said outlet opening (4); said rotor (6) being provided with a plurality of vanes (6a) for intercepting the fluid and an output shaft (7);
  - a generator (8) of electrical current housed inside the shell (2), provided with an input shaft (9) mechanically connected to the output shaft (7) of the rotor (6), and provided with at least one output electrical terminal (11); and
  - at least one accumulator (13) of electrical energy electrically connected to said output electrical terminal (11).
2. An auxiliary generator of electrical energy according to claim 1, characterised in that said accumulator (13) is arranged outside the shell (2).
3. An auxiliary generator of electrical energy according to claim 1, characterised in that said accumulator (13) is arranged inside the shell (2).
4. An auxiliary generator of electrical energy according to any of claims 1 to 3, characterised by comprising at least one USB socket (20) for external users, said USB socket (20) being housed on the external periphery of said shell (2) and being supplied by said accumulator (13).
5. An auxiliary generator of electrical energy according to any of claims 1 to 4, characterised by comprising at least one light source (19); said light source (19) being housed on the outer periphery of said shell (2) and being supplied by said accumulator (13).

6. An auxiliary generator of electrical energy according to any of claims 1 to 5, characterised by comprising a multiplier (10) housed inside the shell (2) and mechanically interposed between the output shaft (7) of the rotor (6) and the input shaft (9) of the generator (8) of electrical current.
7. An auxiliary generator of electrical energy according to any of claims 1 to 6, characterised in that said shell (2) is provided with an element (5) for fixing to an external body.
8. An auxiliary generator of electrical energy according to any of claims 1 to 7, characterised in that said external shell (2) comprises a first half-shell (30) and a second half-shell (31) rotatably coupled to each other, said second half-shell (31) carrying the intake port (3) and the outlet port (4), the generator (1) comprising a weathervane (18) fixed to the second half-shell (31) so as to rotate the second half-shell (31) and orient the input opening (3) in the direction of the wind.
9. An auxiliary generator of electrical energy according to any of claims 1 to 7, characterised in that said shell (2) is provided with an element (5) for fixing by clip to an external body, in particular to a means of transport.
10. An auxiliary generator of electrical energy according to any of claims 1 to 9, characterised in that said shell (2) is of compact dimensions, such as to make the generator (1) itself of portable type.
11. An auxiliary generator of electrical energy according to any of claims 1 to 10, characterised in that said rotor (6) is arranged inside the shell (2) with its axis (6b) of rotation parallel to the path of the fluid from said intake opening (3) to said outlet opening (4).
12. An auxiliary generator of electrical energy according to any of claims 1 to 10, characterised in that said rotor (6) is arranged inside the shell (2) with its axis (6b) of rotation perpendicular to the path of

the fluid from said intake opening (3) to said outlet opening (4).

13. An auxiliary generator of electrical energy according to any of claims 1 to 12, characterised in that said rotor (6) is provided with at least two sections, each provided with a respective configuration of the vanes (6a) for intercepting the fluid; the configuration of the vanes (6a) of one section being different from that of the axially adjacent section.
14. An auxiliary generator of electrical energy according to any of claims 1 to 13, characterised in that said shell (2) features a modular structure, being compoundable by assembling several elementary blocks (2a) in axial alignment.
15. An auxiliary generator of electrical energy according to claim 14, characterised in that assembling said elementary blocks (2a) provides a reciprocal interlocking or screw fixing thereof.

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FIG. 1

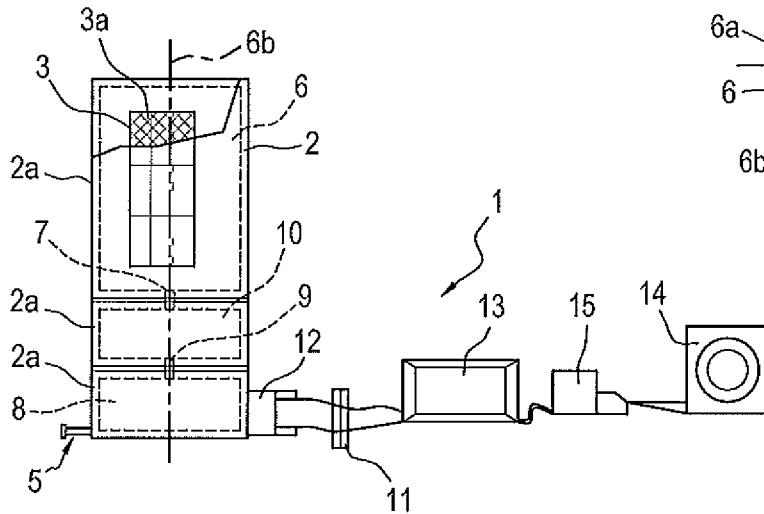


FIG. 1a

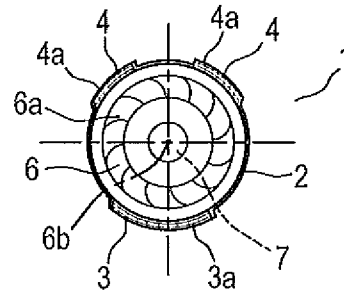


FIG. 2

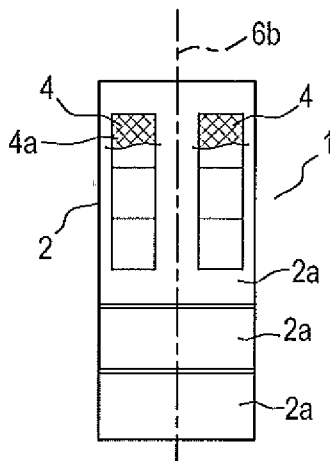


FIG. 3

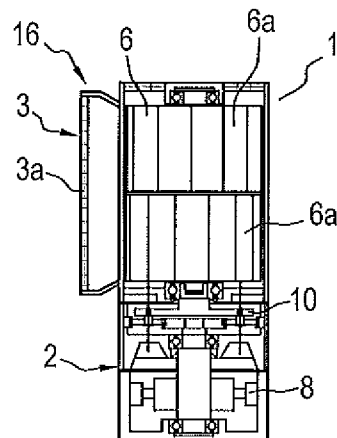


FIG. 3b

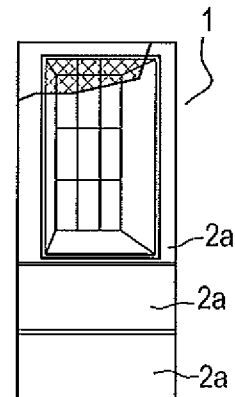


FIG. 2a

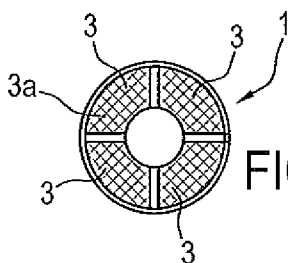
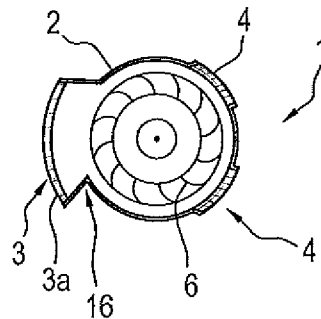


FIG. 3a



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FIG. 4a

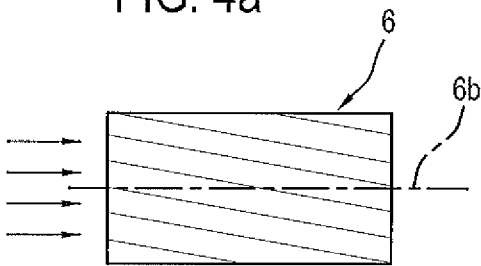


FIG. 4b

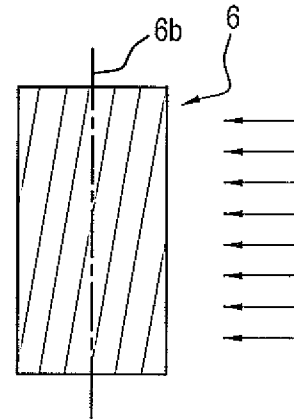


FIG. 5a

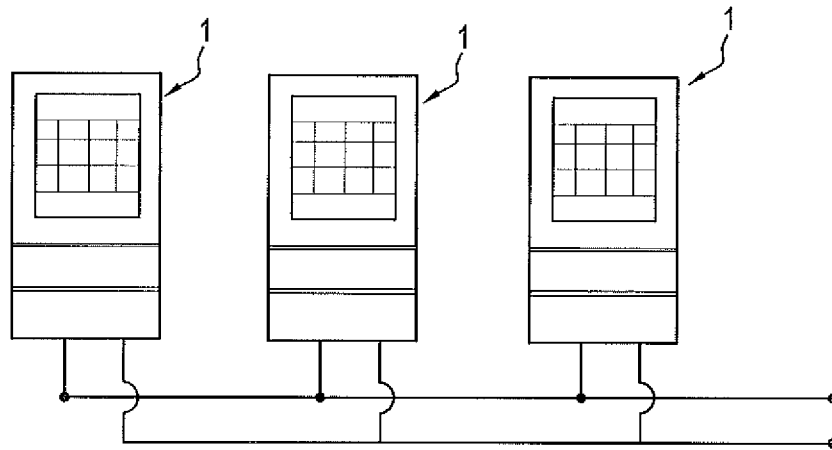
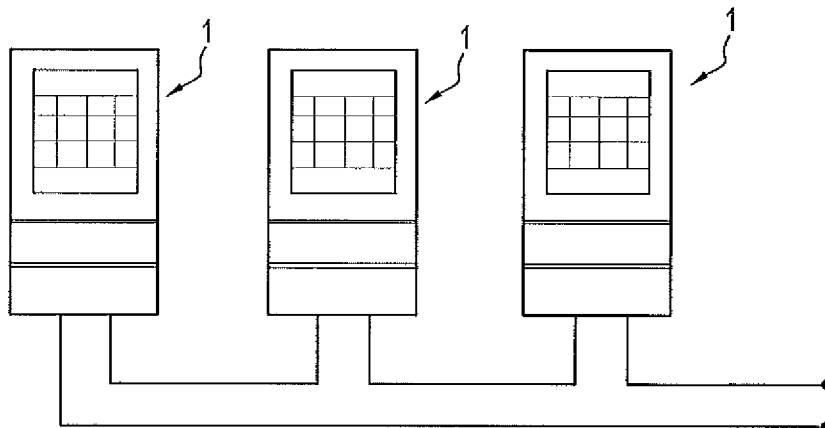


FIG. 5b



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FIG. 6

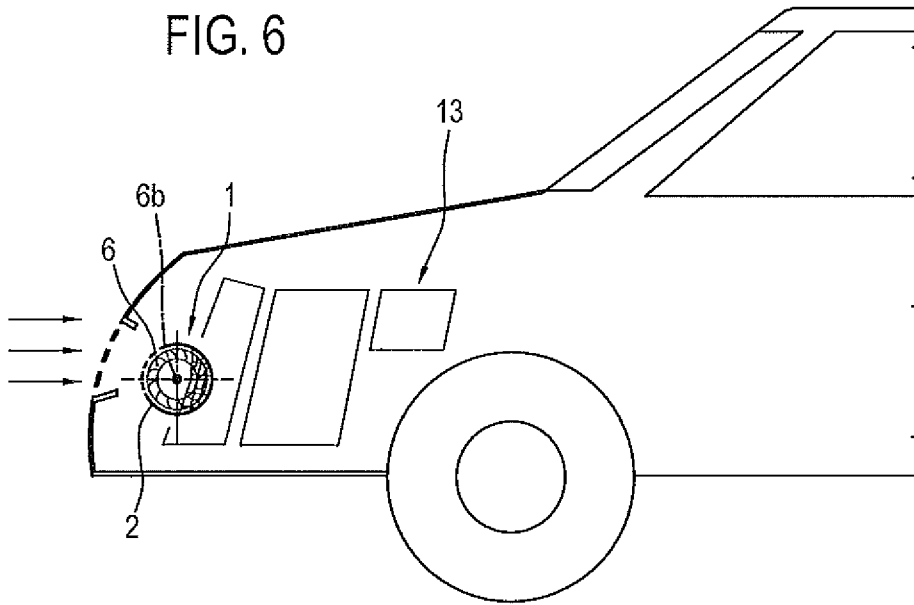


FIG. 6a

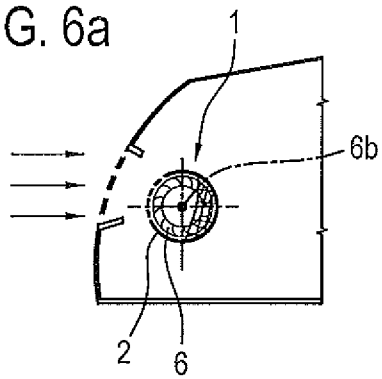


FIG. 6b

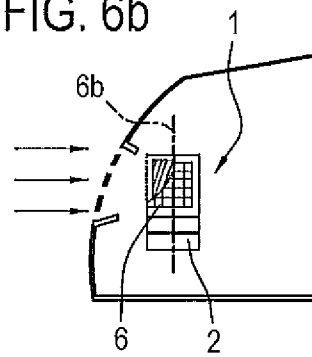
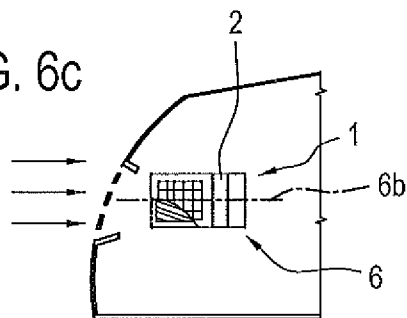


FIG. 6c



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FIG. 7

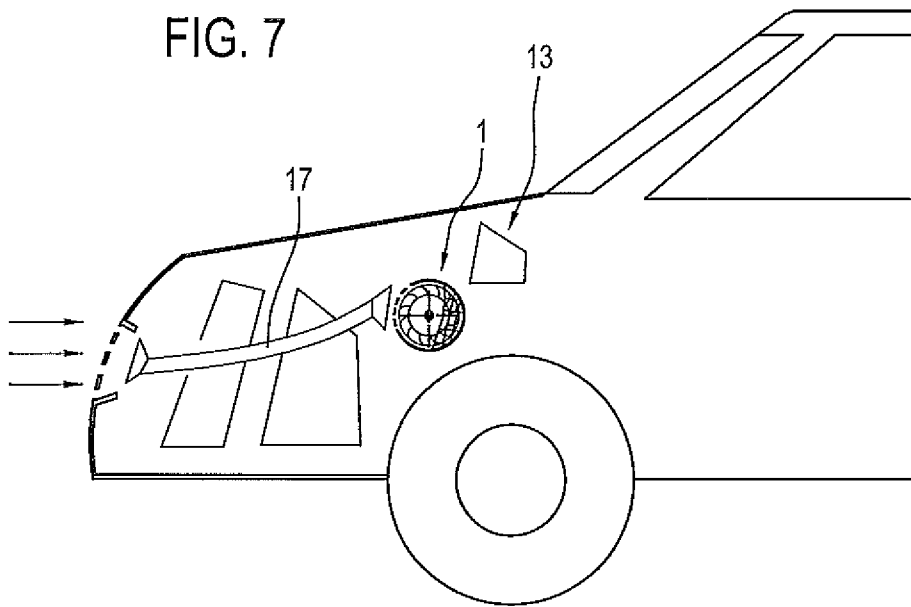


FIG. 8

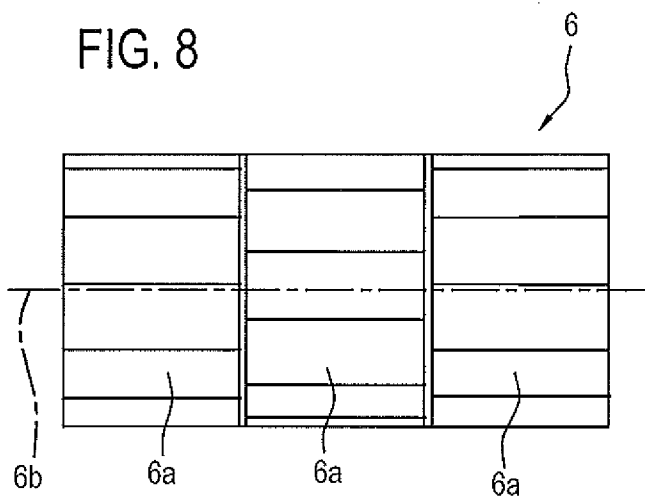
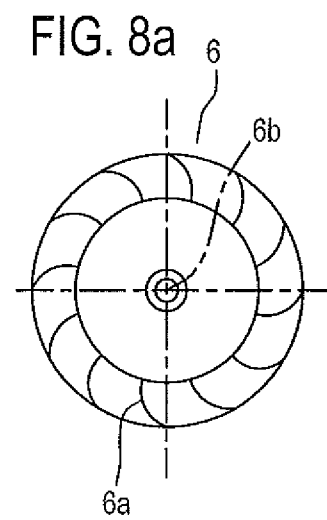


FIG. 8a



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FIG. 9

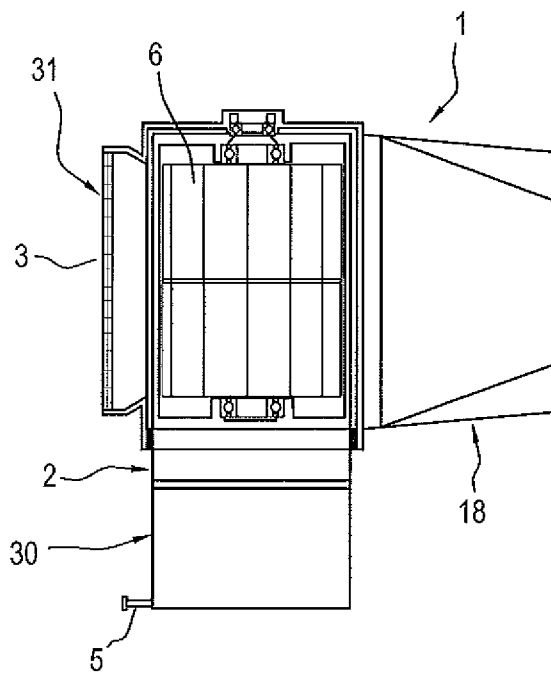


FIG. 9b

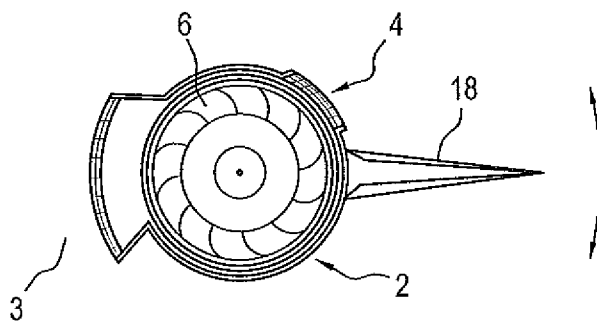
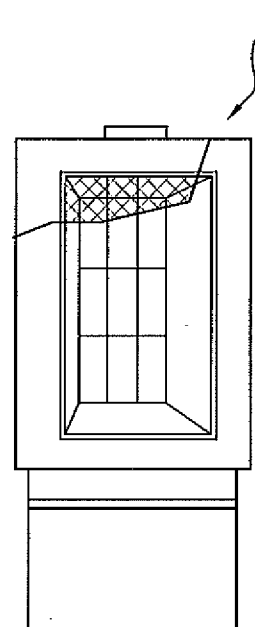


FIG. 9a

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FIG. 10

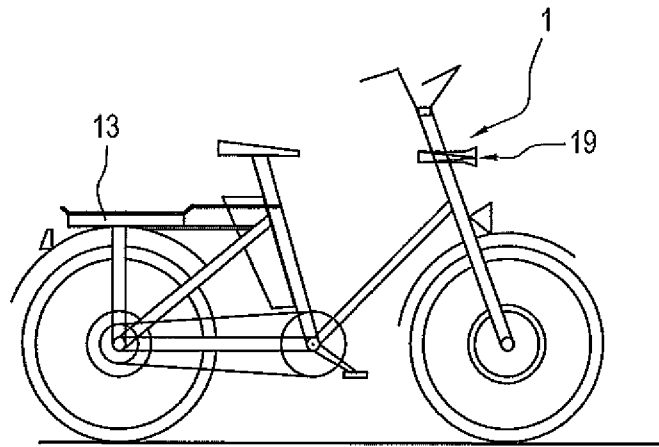


FIG. 11

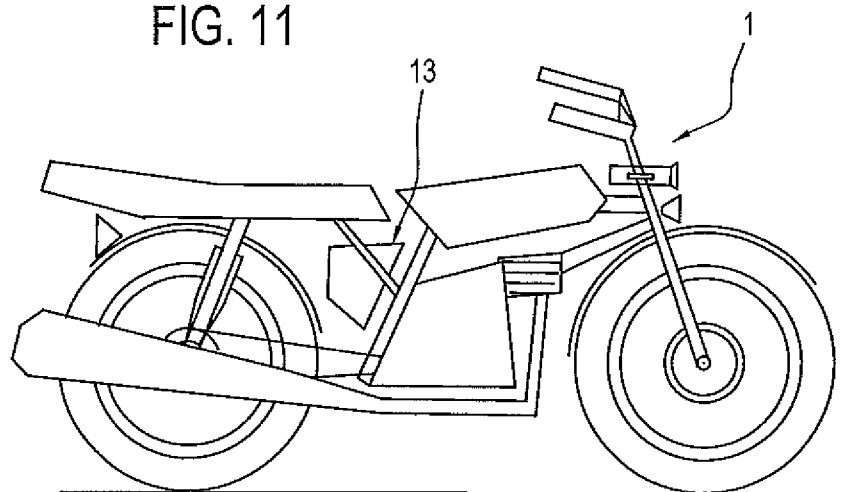


FIG. 12

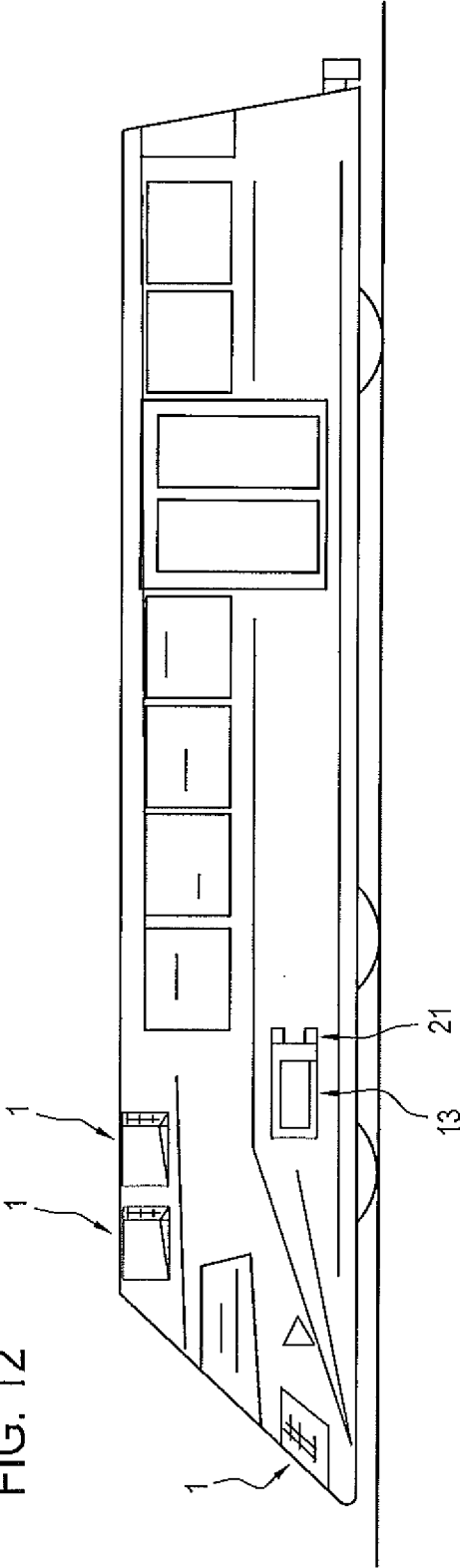
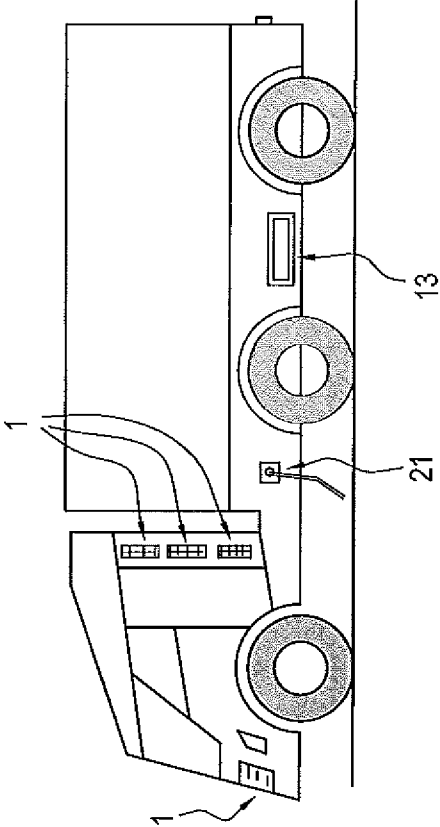


FIG. 13



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FIG. 14

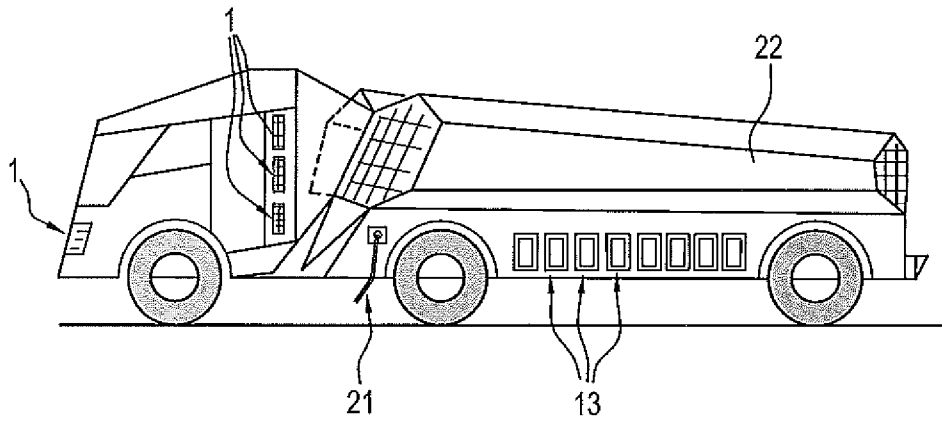
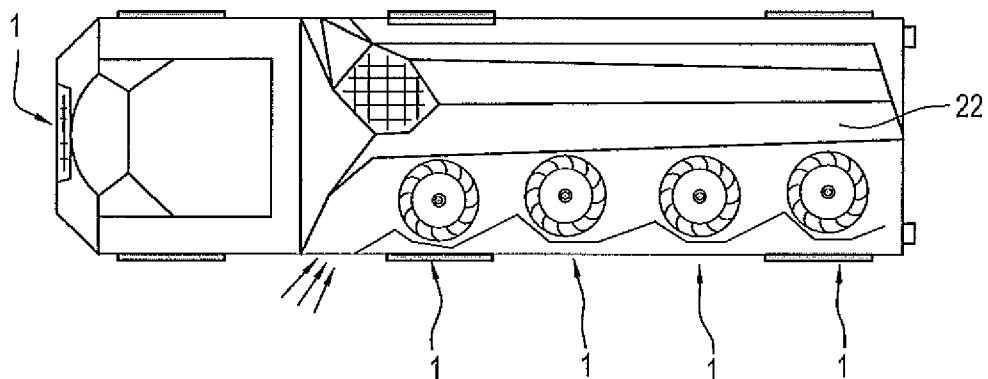


FIG. 14a



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FIG. 15

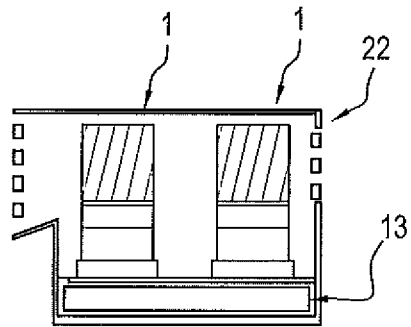


FIG. 15a

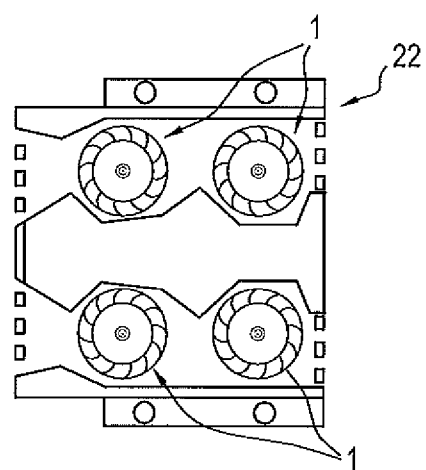


FIG. 16

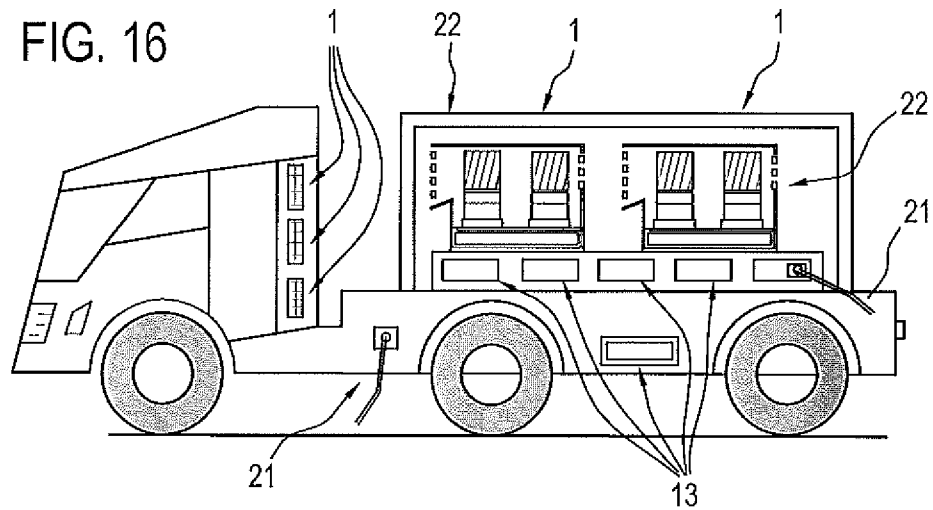
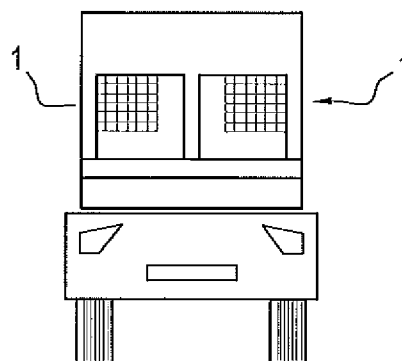
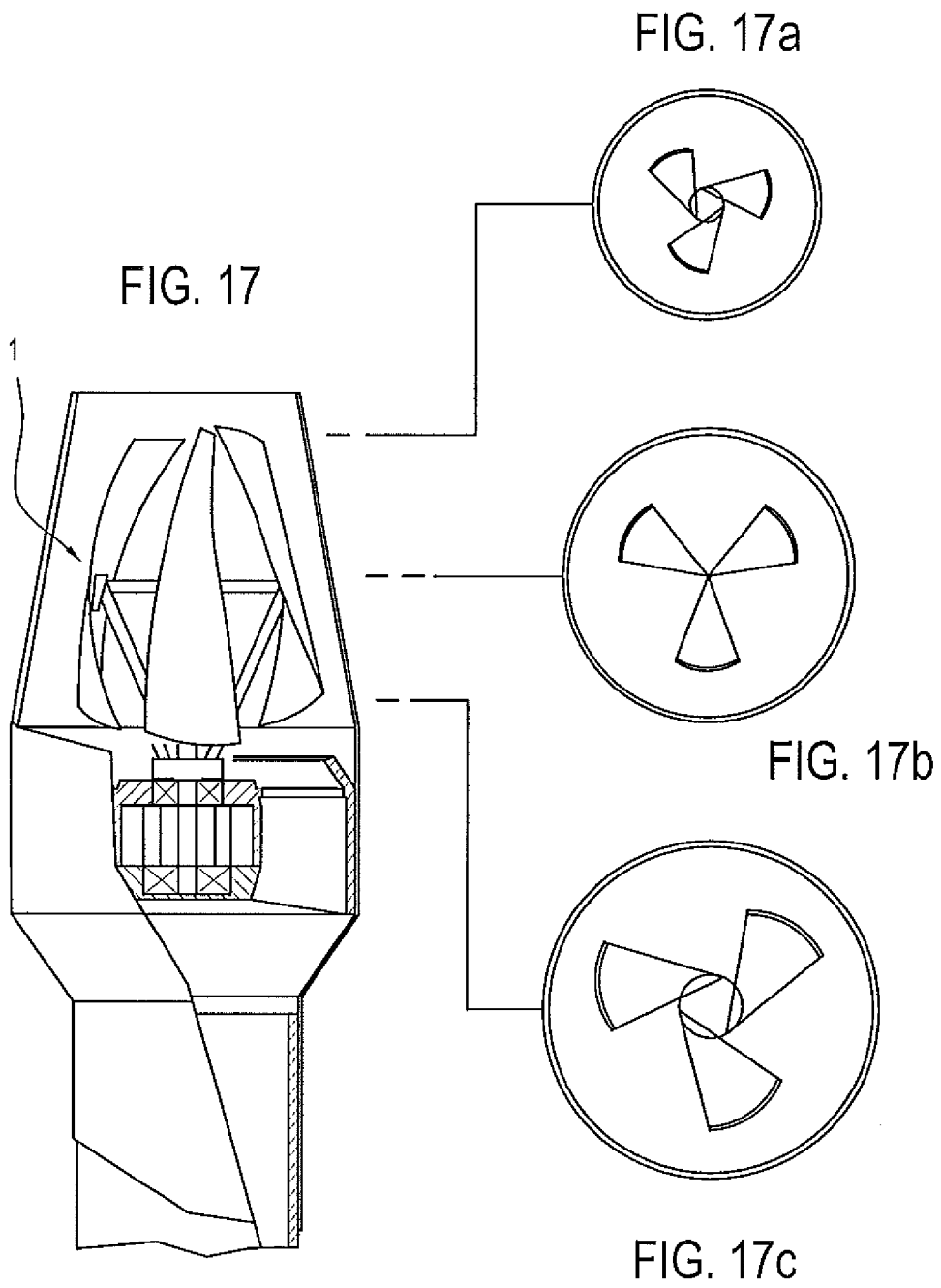


FIG. 16a



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FIG. 18

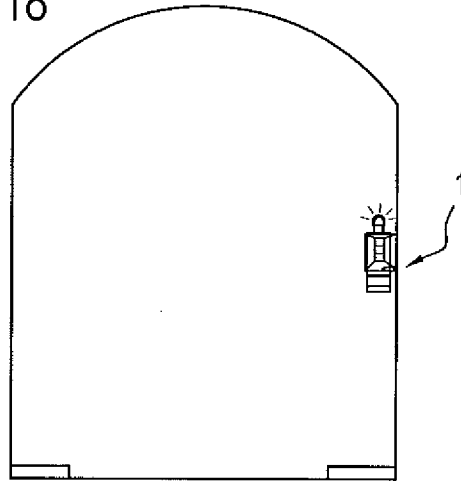


FIG. 18a

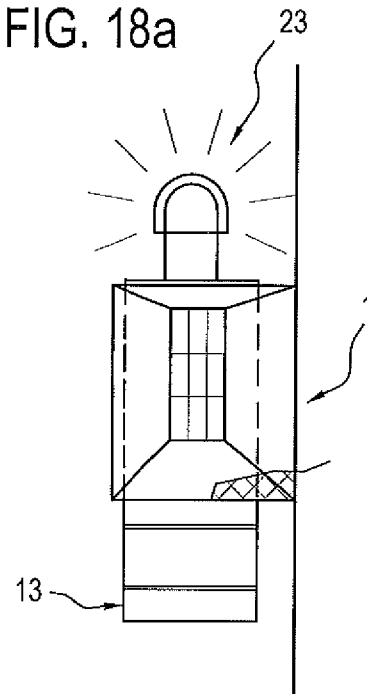


FIG. 18c

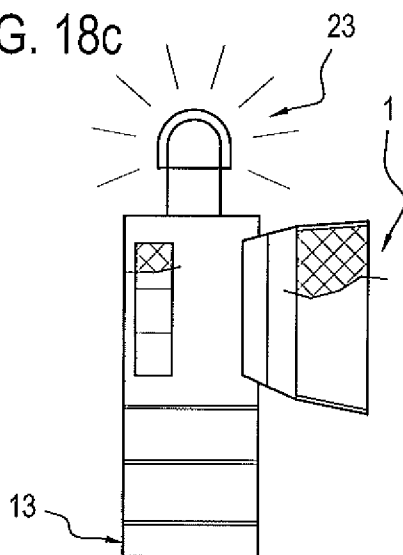


FIG. 18b

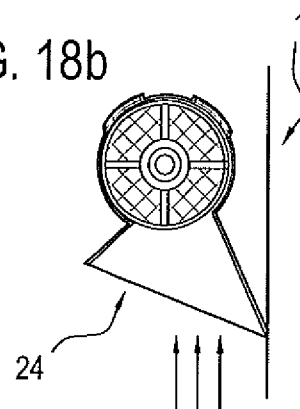


FIG. 19a

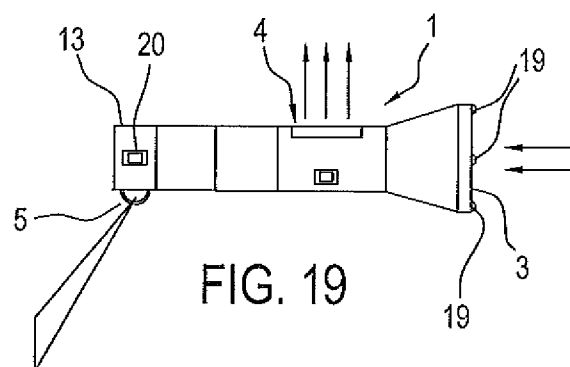
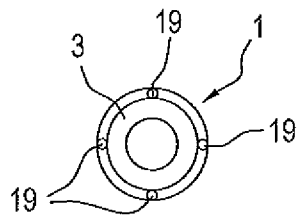


FIG. 19

# INTERNATIONAL SEARCH REPORT

International application No

PCT/IB2014/063156

## A. CLASSIFICATION OF SUBJECT MATTER

INV. F03D9/02 F03D1/04 F03D3/04  
ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)  
F03D

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPO-Internal, WPI Data

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

| Category* | Citation of document, with indication, where appropriate, of the relevant passages                                                                                                                                           | Relevant to claim No. |
|-----------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|
| X         | US 2011/198856 A1 (LING KENGE S [US])<br>18 August 2011 (2011-08-18)<br>paragraph [0024] - paragraph [0035]<br>paragraph [0039] - paragraph [0041]<br>paragraph [0053]<br>paragraph [0055] - paragraph [0060]<br>figures 2-7 | 1,2,5-8,<br>10,12-15  |
| X         | US 2008/272733 A1 (HUANG ARTHUR C [TW])<br>6 November 2008 (2008-11-06)<br>abstract<br>paragraph [0015] - paragraph [0020]<br>paragraph [0026] - paragraph [0032]<br>figures 1-4<br><br>-----<br>-/--                        | 1,3-5,7,<br>9-11,13   |

☒ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

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Date of the actual completion of the international search

19 November 2014

Date of mailing of the international search report

26/11/2014

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Westermayer, Philipp

## INTERNATIONAL SEARCH REPORT

International application No

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C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

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|-----------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|
| X         | US 2009/261776 A1 (CHANG JEN-TSORNG [TW])<br>22 October 2009 (2009-10-22)<br>abstract<br>paragraph [0014] - paragraph [0017]<br>paragraph [0024]<br>figures 1-4<br>-----                                                         | 1,3,5,<br>10,11,13    |
| X         | US 2007/098542 A1 (STREEMAN FOY [US] ET<br>AL) 3 May 2007 (2007-05-03)<br>abstract<br>paragraph [0040] - paragraph [0045]<br>paragraph [0051]<br>paragraph [0054]<br>paragraph [0057] - paragraph [0058]<br>figures 1-6<br>----- | 1,2,6-8,<br>10,12-15  |
| X         | EP 2 003 465 A2 (CHU CHARLES [TW])<br>17 December 2008 (2008-12-17)<br>abstract<br>paragraph [0009] - paragraph [0013]<br>figures 1,2,3<br>-----                                                                                 | 1,3,7,<br>9-11,13     |

# INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/IB2014/063156

| Patent document<br>cited in search report |    | Publication<br>date | Patent family<br>member(s) | Publication<br>date |
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