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(71) Applicant: **Filcar S.p.A.**
42100 Reggio Emilia (IT)

(72) Inventors:
- **Virga, Giuseppe**
  42100 Reggio Emilia (IT)
- **Baschieri, Elio**
  42100 Reggio Emilia (IT)
- **Di Betta, Lino**
  42100 Reggio Emilia (IT)

(74) Representative: **Tansini, Elio Fabrizio et al**
BUGNION S.p.A.
Viale Lancetti 17
20158 Milano (IT)

(54) Suction plant

(57) A suction plant comprising: a sucking apparatus (10); a control device (20) active on the sucking apparatus (10); a plurality of operating stations (30), each provided with a user base (31) associated with the sucking apparatus (10) and drivable between an operating condition at which it carries out a sucking action and a rest condition, and with a wireless transmission module (32) suitable to generate a wireless signal (100) representative of the operating condition or the rest condition. The plant (1) further comprises a wireless reception module (40) associated with the wireless transmission modules (32) for receiving the wireless signals (100) and connected to the control device (20) to send the contents of the wireless signals (100) to the latter. The control device (20) is adapted to switch on/off the sucking apparatus (10) depending on the contents of the wireless signals (100).

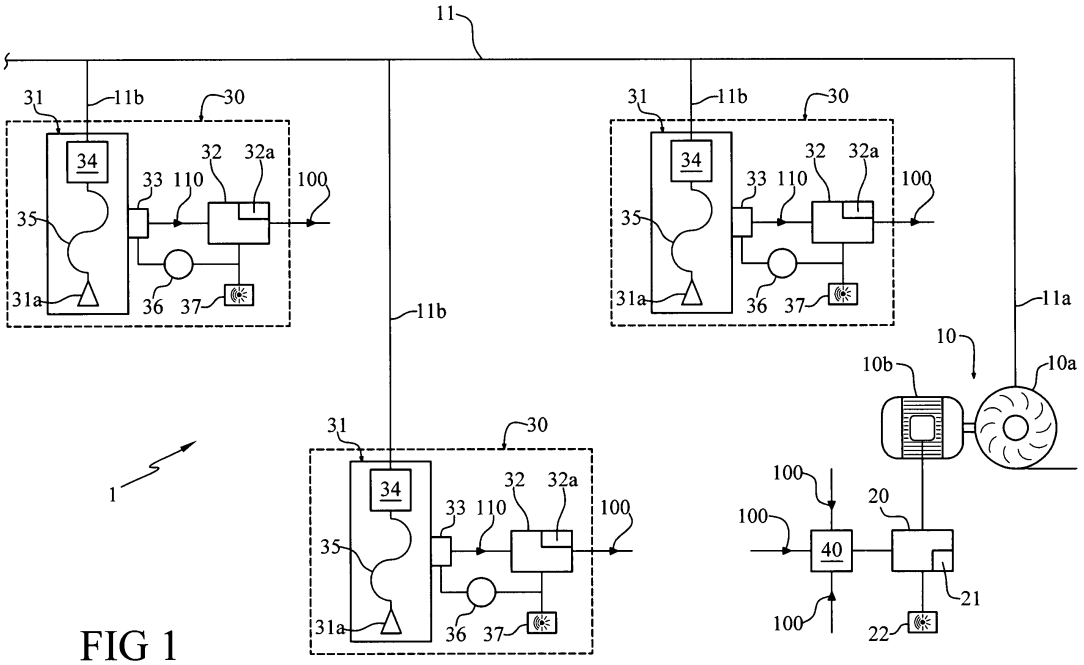

FIG 1

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Description

[0001] The present invention relates to a suction plant.

[0002] The invention can be used in centralised suction plants for gases, flue gases or powders; application of same widely occurs in different production sectors such as the engineering industry, automotive industry and workshops for repair, maintenance and diagnosis of motor-vehicles.

[0003] In particular, by way of non-limiting example, the invention applies to suction plants for exhaust gases of motor-vehicles, suction plants for welding flue gases, suction plants for sanding and polishing powders.

[0004] It is known that suction plants presently available on the market comprise: a sucking apparatus; a control device acting on the sucking apparatus; and a plurality of operating stations each provided with a branching-off duct suitable to operate on a respective vehicle, for example.

[0005] A main duct allows a connection between the sucking apparatus and the different branching-off ducts, to allow suction exactly at each operating station.

[0006] The function of the control device is to switch the sucking apparatus on and off depending on whether at least one station is operated or not.

[0007] For the purpose, the state of the art offers a solution obtained through wiring in parallel of electric enabling elements, representative of the operating state of the individual stations, so that connection with the control device takes place by a single pair of cables.

[0008] In this manner it is possible to obtain an automated management of the activation of the sucking apparatus; however, the control device cannot be provided with the information relating to the number of active stations, for controlled powering of the sucking apparatus.

[0009] In a further known solution each station is connected to the control device through a respective cable and the control device is provided with a plurality of inputs, each uniquely dedicated to the cable coming from a respective operating position.

[0010] In this manner, the control device can know whether all the operating stations are in a rest condition (so as to switch the sucking apparatus off or keep it switched off), or whether at least one operating station is in use condition, so as to switch the sucking apparatus on and keep it switched on.

[0011] The structure briefly described above has different operating limits that are clearly apparent. First of all, the required wiring for carrying out the above mentioned connections makes the plant structure complicated and expensive.

[0012] In addition, should it be necessary to add one or more operating stations, for instance when an operating station is required to be moved, use of wired connections would give rise to a great number of problems and complications.

[0013] In particular, due to the fact that the control device must necessarily dedicate an input to each cable coming from the operating stations, there is a physical limit that is substantially insuperable to the maximum number of operating stations that can be managed by a single control device.

[0014] In addition, should the system be applied to plants provided with movable stations (e.g. sucking trucks or coilers sliding on a raceway) use of one or more catenary wires mounted on the raceway line or of sliding contacts is made necessary.

[0015] Accordingly, the present invention aims at providing a suction plant having a simple and cheap structure.

[0016] Another aim of the invention is to provide a suction plant characterised by an important operating flexibility, in particular when it appears to be necessary to add new connections between a control device and the operating stations and when one or more operating stations are to be positioned differently.

[0017] It is a further aim of the invention to provide a suction plant in which there is a reduction of the risks that the communication between operating stations and control device be interrupted, due to break/cut-off of the cables used caused by the tools or machinery employed in the environment in which the plant is.

[0018] The foregoing and further aims are substantially achieved by a suction plant as described in the appended claims.

[0019] Further features and advantages will become more apparent from the detailed description of a preferred but not exclusive embodiment of the invention.

[0020] This description is taken hereinafter with reference to the accompanying drawings, also given by way of non-limiting example, in which:

- Fig. 1 is a block diagram of the plant in accordance with the invention;
- Fig. 2 diagrammatically shows a side view of a device being part of the plant seen in Fig. 1;
- Fig. 3 shows the structure of a signal used in the plant seen in Fig. 1.

[0021] With reference to the drawings, a suction plant in accordance with the present invention has been generally identified by reference numeral 1.

[0022] As mentioned above, plant 1 advantageously applies to the vehicle sector (motor-vehicles and/or motorcycles, for example), where diagnosis and maintenance operations are to be carried out and the exhaust gases produced by said vehicles are to be sucked.

[0023] Plant 1 can be also used where operations such as suction of sanding and/or polishing powders, suction of welding flue gases, etc. are to be carried out.

[0024] Plant 1 first of all comprises a sucking apparatus 10. Preferably, the sucking apparatus 10 comprises an exhaust fan 10a operated by an electric motor.

[0025] Plant 1 further comprises a control device 20 acting on the sucking apparatus 10. In particular, the control device 20 has the function of switching the sucking

apparatus 10 on/off and preferably adjusting the suction intensity of same.

[0026] Plant 1 also comprises a plurality of operating stations 30. Each operating station 30 is equipped with a user base 31 operatively associated with said sucking apparatus 10 and suitable to be driven between an operating condition at which it carries out suction and a rest condition.

[0027] In the rest condition the user base 31 is substantially switched off. In the operating condition, the user base 31, for example, allows the exhaust gases of a vehicle, welding flue gases, working waste substantially in the form of powder resulting from sanding or polishing operations, etc. to be sucked.

[0028] In particular, in a first embodiment each user base is adapted to be applied to an exhaust pipe of a vehicle for suction of the exhaust gases or flue gases thereof.

[0029] In a second embodiment each user base 31 is suitable to be associated with a sanding or polishing tool to suck working waste in the form of powder.

[0030] In a third embodiment each user base 31 is adapted to be associated with a welding tool to suck the welding flue gases produced during the working operations. In this case the user base 31 can comprise a sucking hood (of suitable sizes) to be positioned on the welding point.

[0031] As clarified in the following, the control device 20 switches on or keeps in the switched-on position the sucking apparatus 10, if at least one of the user bases 31 is in the operating condition.

[0032] Each operating station 30 further comprises a wireless transmission module 32, adapted to generate a wireless signal 100 representative of the operating or rest condition in which the user base 31 is.

[0033] Preferably, plant 1 comprises a main duct 11, having one end 11a connected to the sucking apparatus 10, preferably through a connecting pipeline and a plurality of branching-off elements 11b each connected to a respective user base 31.

[0034] In an embodiment, the main duct 11 consists of a stiff pipeline, having said branching-off elements 11b for connection with the user bases 31.

[0035] In a different embodiment, the main duct 11 is a line of a sucking channel, the branching-off elements 11b of which consist of ogives being part of respective support elements 34 slidable along the channel itself. The functional character of said support elements 34 will be clarified hereinafter.

[0036] Each user base 31, in particular, is provided with a pipeline 35, that is preferably flexible or articulated, enabling connection with the respective branching-off element 11b of the main duct 11.

[0037] As diagrammatically shown in Fig. 2, the flexible or articulated pipeline 35 can be supported by a support element 34 performing a dual function, i.e. that of supporting the pipeline 35 and of connecting it to the respective branching-off element 11b.

[0038] Each user base 31 can be also provided with an operating end 31a opposite to the end connected to said branching-off element 11b of the main duct 11, adapted to be moved close to the working point for performing the suction activity when required.

[0039] For instance, the operating end 31a can be connected to the free end of the flexible or articulated pipeline 35 opposite to said support element 34.

[0040] Advantageously, each operating station 30 comprises a detection module 33 for determining whether the user base 31 of the same operating station 30 is in the operating condition or in the rest condition.

[0041] The detection module 33 is therefore designed to generate a signal of state 110 for the transmission module 32; the contents of said wireless signal 100 are therefore determined by the state signal 110 generated by the detection module 33.

[0042] In a preferred embodiment, each operating station 30 is provided with a support element 34, preferably consisting of a coiler/decoiler (diagrammatically shown in Fig. 2), connected to the main duct 11 through the branching-off element 11b.

[0043] By said coiler/decoiler, the flexible pipeline 35 is rolled and unrolled, depending on whether it is to be brought to the rest or the operating condition.

[0044] The detection module 33 can therefore comprise a rotation sensor 33a applied to the coiler/decoiler 34.

[0045] The rotation sensor 33a can comprise a reed sensor for example, having at least one magnetic portion Rm and at least one portion Rs sensitive to the magnetic field generated by the magnetic portion Rm.

[0046] The magnetic portion Rm can be associated with pipeline 35 or it is in any case moved when pipeline 35 is rolled or unrolled; the sensitive portion Rs on the contrary is substantially integral with the coiler/decoiler 34 structure and keeps substantially stationary also following rolling/unrolling of pipeline 35.

[0047] Practically, when the user base 31 is moved from the rest condition to the operating condition, or vice versa (i.e. when the flexible pipeline is rolled or unrolled by coiler/decoiler 34), the magnetic portion Rm and sensitive portion Rs are correspondingly moved close to and away form each other, thus detecting the displacement being carried out.

[0048] Preferably, the reed sensor has at least one pair of sensitive portions Rs, so as to be able to detect not only the general displacements of pipeline 35, but also the specific movement direction (rolling or unrolling).

[0049] In fact, by suitably positioning the two sensitive portions Rs (so as for example to form an angle well different from 180°, of 60° for example, with the rotation axis of the coiler/decoiler 34) and measuring the time t1 intervening between a first condition in which the magnetic portion Rm faces the first sensitive portion and a second condition in which the magnetic portion Rm faces the second sensitive portion, and subsequently measuring the time t2 intervening between the second condition

and a third condition in which the magnetic portion Rm faces again the first sensitive portion, it is possible to distinguish the rotation direction of the coiler by comparing the two values t1 and t2.

[0050] It is to be noted that a similar solution can be obtained with one sensitive portion Rs alone and a pair of magnetic portions Rm.

[0051] In a different embodiment, the detection module 33 can comprise an abutment or proximity sensor, applied to the user base 31, and in particular to the operating end of the latter, to determine when at least one portion of the user base 31 is moved away from or close to a predetermined surface.

[0052] In more detail, the predetermined surface can consist of a wall or structure portion in the vicinity of which a predetermined part of the user base 31 stays (the operating portion 31a or a portion of pipeline 35, for example), when the user base is in the rest condition.

[0053] Therefore, the abutment or proximity sensor can detect when the user base 31 is in the rest condition, or when it is in the operating condition.

[0054] In a further embodiment, the detection module 33 can comprise a sensor for detecting passage of flue gases or exhaust gases at the user base 31.

[0055] This sensor can include a temperature detector for example; this temperature detector, by detecting temperature increases due to passage of flue gases or exhaust gases, can signal to the transmission module 32 that the user base in question is in the operating condition.

[0056] It is also provided, in particular when the user base 31 is adapted to be associated with a welding tool, that the detection module 33 should comprise a switch mounted on said suction hood, and/or a current sensor applied to the welding tool (the latter consisting of an arc welder, for example) and/or an optical sensor adapted to detect the radiation emitted during welding (an infrared radiation and/or ultraviolet radiation, for example).

[0057] As said above, each transmission module 32 generates a wireless signal 100 containing at least the data incorporated in the state signal 110 generated by the respective detection module 33.

[0058] Advantageously, each transmission module can comprises storage means 32a to store an identification code ID associated with the transmission module 32. By way of example, the storage means 32a can comprise a dip switch in which the position of the different pins defines at least the identification code ID of the transmission module 32.

[0059] Alternatively, the storage means 32a can comprise a memory of the optical type, electronic type, etc. suitably associated with the transmission module 32 to enable incorporation of the identification code ID into the wireless signal 100.

[0060] Therefore, each wireless signal 100 is preferably made up of at least two portions (Fig. 3):

- a first portion 100a, in which the identification code ID of the wireless transmission module 32 generating said wireless signal 100 is contained;
- a second portion 100b representative of the rest condition or the operating condition in which the user base 31 of the operating station 30 is, to which the wireless transmission module 32 generating said wireless signal 100 belongs.

[0061] Conveniently, plant 1 further comprises a wireless reception module 40 operatively associated with the wireless transmission modules 32 of the different operating stations 30 for receiving the wireless signals 100.

[0062] The wireless reception module 40 is connected to the control device 20 to send the contents of said wireless signals 100 thereto.

[0063] In this way, the control device 20 can switch on/off the sucking apparatus 10 depending on the contents of the wireless signals 100 received through said reception module 40.

[0064] Preferably, the control device 20 further determines an operating intensity of the sucking apparatus 10 depending on the number of user bases 31 that are in the operating condition. In other words, the greater the number of the base users 31 in the operating condition, the greater the operating intensity of the sucking apparatus 10.

[0065] In addition, when all user bases 31 are in the rest condition, the control device 20 carries out switching off of the sucking apparatus 10 (or keeps said apparatus switched off).

[0066] Advantageously, the control device 20 comprises a storage register 21 to store, as a function of the wireless signals 100 received, which user bases 31 are in the operating condition and/or which user bases 31 are in the rest condition. In this manner, the control device 20 will be able to establish if the sucking apparatus 10 is to be active and the activation intensity.

[0067] Preferably, each wireless signal 100 also comprises a third portion 100c in which an identification parameter P of the wireless reception module 40 is contained (Fig. 3). This identification parameter P can be stored in said storage means 32a, for example.

[0068] By way of example, should the storage means 32a comprise a dip switch, three pins could be dedicated to definition of the identification parameter P, so as to identify the wireless reception module 40 being the addressee, while five pins could be used to define the identification code ID of the transmission module 32 being the sender.

[0069] This solution is particularly advantageous, should different plants or at least different sub-systems comprising several reception modules, each associated with a transmission module group, be located inside the same environment, since by this solution the wireless signals generated by the transmission modules 32 are prevented from being received by the reception modules belonging to other plants or other sub-systems. For instance, up to thirty-two wireless transmission modules

32 can be associated with each wireless reception module 40.

[0070] Advantageously, the control device 20 is provided with a programmable micro-controller, in which the operating algorithm of the plant can be loaded. In this way, use of electromechanical panels or PLC for management of the plant automation can be avoided.

[0071] Preferably, each transmission module 32 for sending the respective wireless signals 100 uses a packet transmission technique with pseudo-random intervals, so as to make the likelihood that the reception module 40 may receive substantially simultaneous signals very reduced.

[0072] In a preferred embodiment, the different transmission modules 32 transmit on the same carrier, and this carrier by way of example can have a frequency included between 430 MHz and 435 MHz, and in particular between 433.05 MHz and 434.79 MHz. For instance, the carrier frequency can be of 433.92 MHz.

[0073] Preferably, each operating station 30 is provided with an auxiliary reception module (not shown) while the control device 20 comprises an auxiliary transmission module (not shown); in this way a two-direction communication can be obtained between the control device 20 and the different operating stations 30.

[0074] Preferably, each operating station 30 is provided with a powering unit 36, in particular of the battery type, so as to be substantially independent of wired connections to be connected to the mains.

[0075] The powering unit 36 is used for feeding at least the transmission module 32 and, preferably, also the detection module 33. The transmission module 32 can therefore operate as follows.

[0076] As far as the charge of the powering unit 36 is higher than a first threshold, transmission of the above described wireless signals 100 is carried out normally, so as to communicate the related information to the control device 20. When the powering unit charge goes under a first threshold, together with the information relating to the operating or rest condition of the operating station 30, the transmission module 32 sends the control device 20 a bit packet representative of the fact that the powering unit charge begins getting exhausted.

[0077] When the charge of the powering unit 36 goes under a second threshold, lower than said first threshold, the transmission module 32 sends no information of state relating to the operating station 30 any longer, but only a bit packet representative of the fact that the powering unit charge is close to full exhaustion.

[0078] The operating station 30 is also provided with signalling means 37 such as one or more LEDs, to indicate (in a visual manner) that the powering unit 36 is close to exhaustion.

[0079] Preferably, the control device 20 too is associated with respective signalling means 22 comprising one or more LEDs for example, so as to indicate the presence of one or more powering units 36 close to exhaustion.

[0080] An indication such as the above described one is particularly useful since the transmission modules 32 are mounted to different heights and it is therefore important for the operators to know that the battery is close to exhaustion with some advance so as to organise the intervention for maintenance which involves use of step-ladders, lifting means or scaffolds, etc.

[0081] Advantageously, each transmission module 32 can be driven between an operating condition at which it transmits said signals and/or packets relating to the state of the respective powering unit 36 and a stand-by condition at which it does not substantially perform any activity and is waiting for commands.

[0082] In particular, each transmission module 32 can be normally in the stand-by condition; when it is necessary to carry out a transmission, the transmission module 32 is driven to its operating condition for a predetermined time interval (5 seconds, for example) to be then driven to the stand-by condition again. This for the purpose of minimising consumption and therefore maximising duration of the powering unit charge.

[0083] In a preferred embodiment, plant 1 can be provided to be set in a "diagnostic" modality in which the transmission modules 32 simulate transmission of wireless signals relating to the state of the respective user base 31 and the charge state of the respective powering unit 36, and the control device 20 simulates its response to these signals without however really acting on the sucking apparatus 10. In this way the good quality of the communication between the transmission modules 32 and the reception module 40 can be checked.

[0084] The invention achieves important advantages.

[0085] First of all, the plant of the invention has a simple and cheap structure. In addition, it has an important operating flexibility, in particular when new connections are required to be added between the control device and operating stations, and when one or more operating stations are required to be positioned differently.

[0086] Another advantages resides in that, in the suction plant in accordance with the invention, it is reduced the risk that the communication between operating stations and control device be interrupted, due to break/cut-off of the cables used caused by the tools or machinery employed in the environment in which the plant is.

[0087] Furthermore, due to the above described structure as hereinafter claimed, operation of the sucking apparatus can be adjusted in an optimised manner, as the suction intensity can be controlled depending on the number of active user bases.

Claims

1. A suction plant comprising:

- a sucking apparatus (10);
- a control device (20) acting on the sucking apparatus (10);
- a plurality of operating stations (30), each pro-

vided with:

· a user base (31) operatively associated with said sucking apparatus (10) and drivable between an operating condition at which it carries out a sucking action, and a rest condition;
· a wireless transmission module (32) suitable to generate a wireless signal (100) representative of the operating condition or of the rest condition;

- a wireless reception module (40) operatively associated with said wireless transmission modules (32) for receiving said wireless signals (100) and connected to said control device (20) for sending the contents of said wireless signals (100) to the latter,

said control device (20) being adapted to switch on/off the sucking apparatus (10) depending on the contents of the wireless signals (100).

2. A plant as claimed in claim 1, wherein each of said transmission modules (32) comprises storage means (32a) to store at least one identification code (ID) associated with said transmission module (32).

3. A plant as claimed in claim 2, wherein each of said wireless signals (100) comprises:

- a first portion (100a) in which the identification code (ID) of the wireless transmission module (32) generating said wireless signal (100) is contained;
- a second portion (100b) representative of the rest condition or the operating condition taken by the user base (31) of the operating station (30) to which the wireless module (32) generating said wireless signal (100) belongs.

4. A plant as claimed in claim 3, wherein each of said wireless signals (100) further comprises a third portion (100c) in which an identification parameter (P) of said wireless reception module (40) is contained.

5. A plant as claimed in anyone of claims 2 to 4, wherein said storage means (32a) is designed to also store an identification parameter (P) of said wireless reception module (40).

6. A plant as claimed in anyone of the preceding claims, wherein each of said operating stations (30) further comprises a detection module (33) for determining whether the user base (31) of said operating station (30) is in the operating condition or in the rest condition and generating a signal of state (110) intended for said transmission module (32).

7. A plant as claimed in anyone of the preceding claims, wherein each of said user bases (31) comprises a preferably flexible or articulated pipeline (35) for carrying out said suction action.

8. A plant as claimed in claims 6 and 7, wherein each of said operating stations (30) comprises a support element (34) consisting of a coiler/decoiler for said pipeline (35), said detection module (33) comprising a rotation sensor (33a) applied to said coiler/decoiler (34).

9. A plant as claimed in claim 6, wherein said detection module (33) comprises an abutment or proximity sensor applied to said user base (31) for determining when at least one portion of said user base (31) is moved away from or close to a predetermined surface.

10. A plant as claimed in claim 6, wherein said detection module (33) comprises a sensor for detecting passage of flue gases or exhaust gases close to said user base (31).

11. A plant as claimed in anyone of the preceding claims, wherein said control device (20) switches said sucking apparatus (10) on or keeps it to a switched-on condition if at least one of said user bases (31) is in the operating condition.

12. A plant as claimed in anyone of the preceding claims, wherein said control device (20) determines an operating intensity of said sucking apparatus (10) as a function of the number of user bases (31) that are in the operating condition.

13. A plant as claimed in anyone of the preceding claims, wherein said control device (20) switches off said sucking apparatus (10) off or keeps it to a switched-off condition if all user bases (31) are in the rest condition.

14. A plant as claimed in anyone of the preceding claims, wherein said control device (20) comprises a storage register (21) to store which user bases (31) are in the operating condition and/or which user bases (31) are in the rest condition, as a function of said wireless signals (100).

15. A plant as claimed in anyone of the preceding claims, further comprising a main duct (11) having one end (11a) connected to said sucking apparatus (10) and a plurality of inputs (11b) each connected to a respective one of said user bases (31).

16. A plant as claimed in anyone of the preceding claims, wherein each of said user bases (31) is adapted to be applied to an exhaust duct of a vehicle for suction

of the exhaust or flue gases.

17. A plant as claimed in anyone of the preceding claims, wherein each of said user bases (31) is adapted to be associated with a sanding or polishing tool for suction of working waste in the form of powder.

18. A plant as claimed in anyone of the preceding claims, wherein each of said user bases (31) is adapted to be associated with a welding tool, said detection module (33) preferably comprising a current sensor and/or a radiation sensor to determine whether said welding tool is in the operating condition.

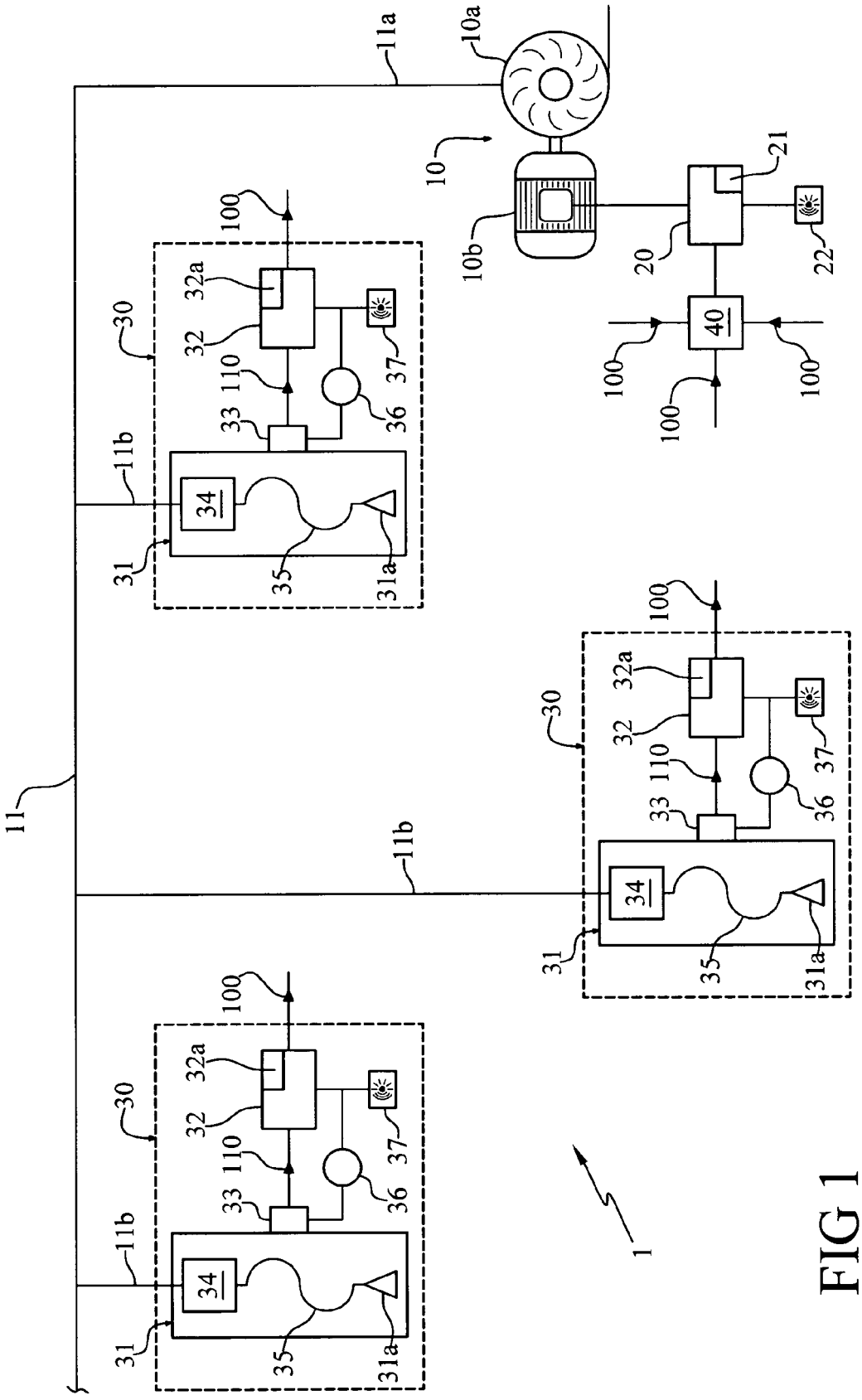
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FIG 1

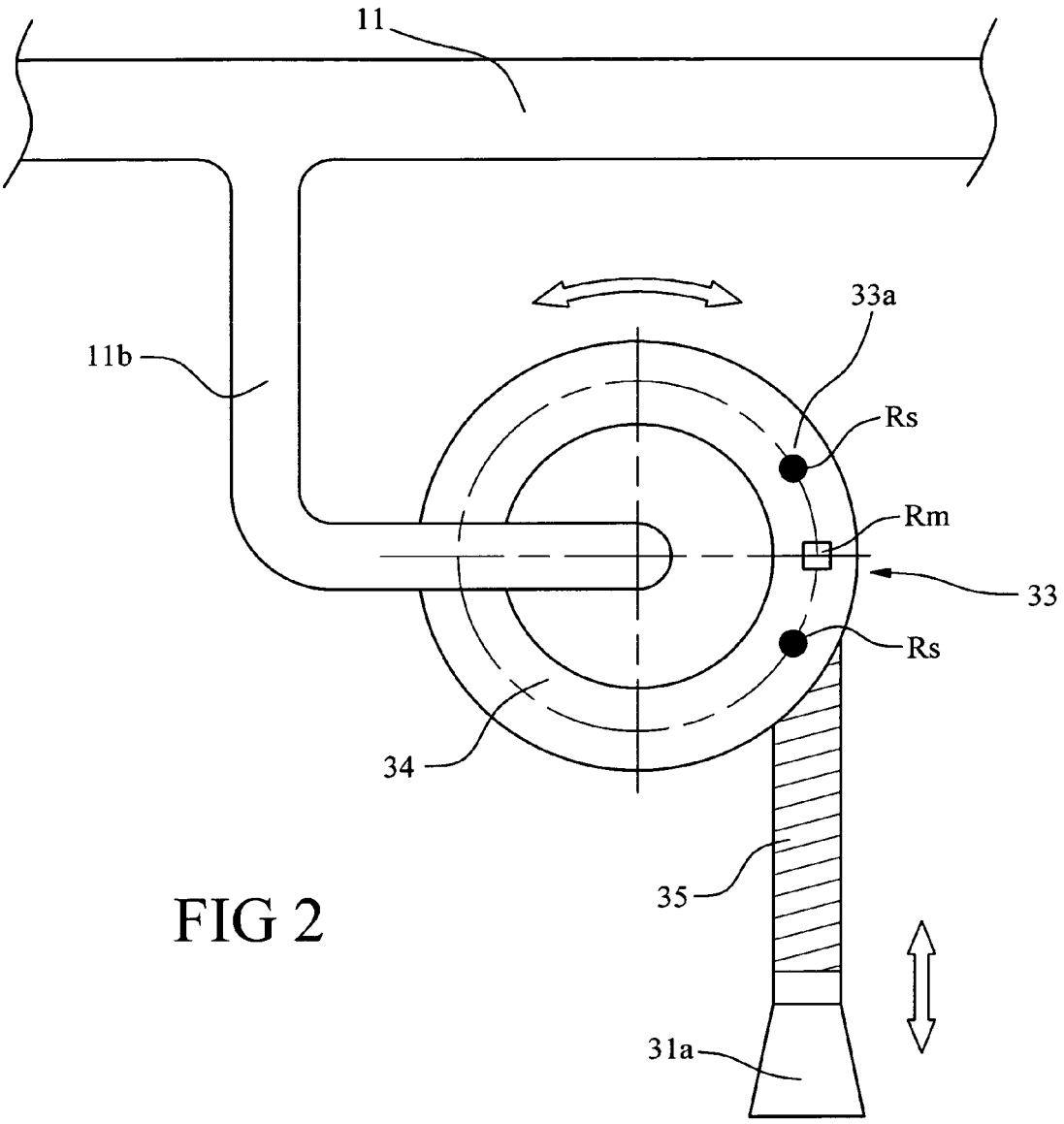

FIG 2

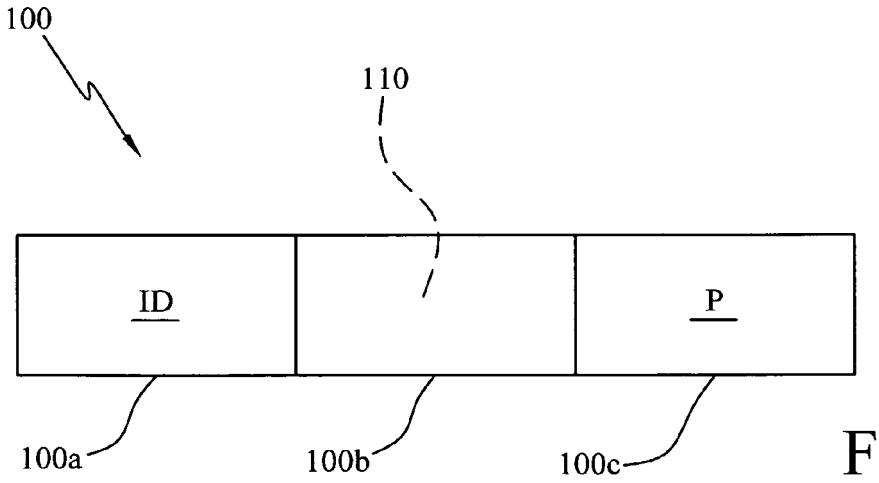

FIG 3

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EUROPEAN SEARCH REPORT

Application Number
EP 08 42 5491

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
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A	US 7 344 089 B1 (SUTTERFIELD BILL R [US]) 18 March 2008 (2008-03-18) * abstract; figures 1,2 *	1-18	
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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	3 December 2008	Muller, Gérard

CATEGORY OF CITED DOCUMENTS

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