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(54) **VACUUM PUMPING SYSTEM PROVIDED WITH A SOUNDPROOFING ARRANGEMENT**

(57) The present invention relates to a vacuum pumping system (100) comprising a vacuum pump (10) and provided with a soundproofing arrangement (40, 50, 60). The vacuum pumping system of the invention comprises a vacuum pump (10) accommodated in a pump housing and a soundproofing hood (50) surrounding said pump housing and provided with a hood air inlet (52) and a hood air outlet (54). In order to improve dampening of the noise generated by the vacuum pumping system, one

or more additional soundproofing shielding element(s) is/are provided between the hood air inlet and the pump housing air inlet and/or between the hood air outlet and the pump housing air outlet, respectively. In a preferred embodiment of the invention, said one or more additional soundproofing shielding element(s) is/are designed as a casing (40) surrounding said pump housing and provided with a casing air inlet (46) and a casing air outlet (48).

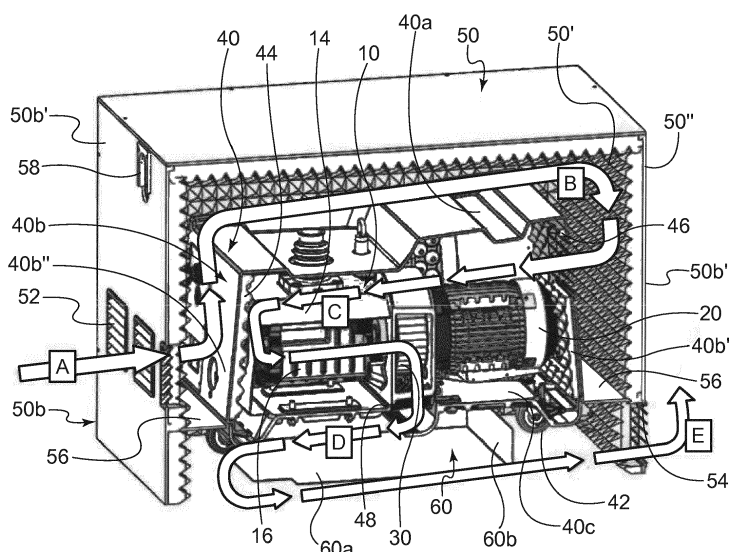


Fig. 3

Description

Technical Field of the Invention

[0001] The present invention relates to a vacuum pumping system comprising a vacuum pump and provided with a soundproofing arrangement.

[0002] More particularly, the present invention relates to a vacuum pumping system comprising a rotary vane vacuum pump and provided with a soundproofing arrangement.

Prior Art

[0003] Vacuum pumps are employed in a wide range of applications for obtaining subatmospheric pressure conditions, going from rough vacuum conditions (i.e. about 10^{-1} Pa) to very high vacuum conditions (i.e. about 10^{-8} Pa).

[0004] More specifically, rotary vane vacuum pumps are mechanical pumps, namely positive displacement pumps, that are generally used to obtain low vacuum conditions, in a pressure range from atmospheric pressure to about 10^{-1} Pa.

[0005] According to prior art, rotary vane vacuum pumps generally include a pump housing having a gas suction port and a gas exhaust port and receiving a stator defining a cylindrical chamber; a cylindrical rotor is eccentrically arranged inside the stator chamber, which rotor is equipped with spring-loaded radial vanes cooperating with the wall of the stator chamber for pumping a gas from the gas suction port to the gas exhaust port. The pump housing is filled with oil so that the stator is immersed in an oil bath, which has the function of cooling down and lubricating the pump and isolating it from the outside environment.

[0006] Pumps of such kind are known for instance from US 6,019,585 and GB 2151091A.

[0007] Still according to prior art, a drive motor, namely an electric motor, is operatively connected to the pump through a shaft connection in order to drive in rotation the rotation shaft of the pump rotor. The drive motor is typically arranged outside the pump housing and it is connected to the pump housing through an interface flange.

[0008] One or more blowers or fans are provided for cooling down the rotary vane vacuum pump and, in particular, for keeping the temperature of the oil of the vacuum pump oil bath in the pump housing below a predetermined temperature threshold.

[0009] The above-described vacuum pumping systems generate a considerable amount of noise, which makes working conditions in their vicinity uncomfortable and which is considered a severe drawback in laboratory environments.

[0010] Vacuum pumping systems comprising other kinds of vacuum pumps including moving parts (such, as for instance, turbomolecular pumps, which are commonly used for obtaining high vacuum conditions) and/or

comprising pump accessories including moving parts also generate noise, which could represent a remarkable drawbacks in some applications.

[0011] The noise generated by a vacuum pumping system increases upon increase of the pumping speed of the vacuum pump.

[0012] Accordingly, a possible solution for reducing the noise generated by the vacuum pumping system is to run the vacuum pump at low speed.

[0013] However, such a solution is not attractive, as it would negatively affect the performance of the vacuum pumping system.

[0014] In order to dampen the noise generated by the vacuum pumping system while running the vacuum pump at high speed, it has been suggested to provide the vacuum pumping system with a casing enclosing the vacuum pump and its drive motor.

[0015] US 5,145,335 discloses a vacuum pumping system comprising a rotary vane vacuum pump comprising a first housing, receiving the pump stator and the pump rotor and filled with oil, a drive motor associated to the vacuum pump, and a second housing surrounding the first housing and the drive motor.

[0016] The presence of such second housing allows to partially reduce the noise transmitted to the surrounding environment by the vacuum pump and by its drive motor.

[0017] However, some noise is in any case transferred to the surrounding environment, also in view of the need of providing the second housing with an air inlet and an air outlet in order to allow an air stream to flow inside the second housing for cooling down the vacuum pump and the drive motor.

[0018] As a result, the noise-dampening effect obtained by a solution as disclosed in US 5, 145, 335 has proven to be insufficient for certain applications (such as the so-called "quiet laboratories"), in which a noise lower than 55dB, and preferably lower than 50 dB, is required in the environment surrounding the vacuum pumping system.

[0019] It is also to be considered that the presence of a soundproofing arrangement can cause a remarkable deterioration of the cooling of the vacuum pump.

[0020] US 2010/0116583 suggests to provide a soundproofing hood that radially encloses the vacuum pumping system and is open at both axial ends, so that the cooling of the vacuum pumping system is not hindered.

[0021] However, such a solution would not be sufficiently effective in dampening the noise generated by the vacuum pumping system and, in particular, it would not be capable of satisfying the above-mentioned need of keeping the noise below a threshold of 50 - 55 dB in certain applications.

[0022] As an alternative, the soundproofing arrangement should be provided with its own blowers or fans in order to guarantee that the temperature of the vacuum pump is kept below a desired threshold.

[0023] It is evident that the provision of such additional

blowers or fans (and of the related electronic circuitry and control arrangements) is highly disadvantageous, since on one hand it involves additional costs and power consumption, and on the other hand it makes the vacuum pumping system less reliable, as it introduces additional potential sources of failures and malfunctioning.

[0024] In view of the above, it is an object of the present invention to obviate the above-identified drawbacks by providing a vacuum pumping system provided with an improved soundproofing arrangement, capable of dampening the noise generated by the vacuum pumping system to below a threshold of 50 - 55 dB.

[0025] It is another object of the present invention to provide a vacuum pumping system provided with an improved soundproofing arrangement which allows to maintain the noise below the desired threshold without reducing the speed of the vacuum pump.

[0026] It is a further object of the present invention to provide a vacuum pumping system provided with an improved soundproofing arrangement which does not deteriorate the cooling of the vacuum pumping system and does not involve the need for additional cooling devices.

[0027] The above-identified and other objects are achieved by a vacuum pumping system as claimed in the appended claims.

Summary of the Invention

[0028] In general, the vacuum pumping system of the invention comprises a vacuum pump, accommodated in a pump housing, and a soundproofing hood which surrounds the pump housing and is provided with a hood air inlet, which is in communication with the pump housing air inlet, for allowing fresh air to flow into the inside of the hood and then through the vacuum pump for cooling it down, and with a hood air outlet, which is in communication with the pump housing air outlet, for allowing heated air coming from the vacuum pump to flow out from the hood.

[0029] According to the invention, the vacuum pumping system comprises one or more additional soundproofing shielding element(s) arranged between the hood air inlet and/or outlet and the pump housing air inlet and/or outlet, respectively.

[0030] Thanks to the presence of said additional soundproofing shielding element(s), a straight air flow from the surrounding environment to the vacuum pump through the hood air inlet and the pump housing inlet and/or a straight air flow from the vacuum pump to the surrounding environment through the pump housing outlet and the hood air outlet can be prevented, which allows to strongly reduce the noise generated by the vacuum pumping system and transmitted to the surrounding environment, down to below a threshold of 50 - 55 dB.

[0031] According to a preferred embodiment of the invention, said additional soundproofing shielding element(s) is/are designed as a casing surrounding the pump housing, said casing being provided with an air

inlet and an air outlet for allowing fresh air to flow into the casing and then through the vacuum pump for cooling it down and for allowing heated air coming from the vacuum pump to be discharged from the casing, respectively.

[0032] According to this preferred embodiment of the invention, the hood air inlet is preferably provided on the peripheral wall of the soundproofing hood at a location which is as far as possible from the casing air inlet of the underlying casing, so that the noise dampening effect is optimized, the path of the fresh air inside the hood and around the casing surrounding the vacuum pump is maximized and the cooling efficiency is also maximized. According to the above preferred embodiment of the invention, the hood air outlet is preferably provided in the peripheral wall of the soundproofing hood at a location which is as far as possible from the location of the hood air inlet on said peripheral wall of the soundproofing hood, so that heat exchange between the fresh air entering through said hood air inlet and the heated air exiting through said hood air outlet can be prevented. According to a particularly preferred embodiment of the invention, said additional soundproofing shielding element(s) is/are designed as a casing surrounding the pump housing and raised above the floor and the casing air outlet is provided at the bottom wall of the casing.

[0033] According to such embodiment, the vacuum pumping system of the invention further comprises a soundproofing tray provided at the bottom wall of the casing, between the casing air outlet and the floor.

[0034] According to a preferred embodiment of the invention, the soundproofing hood is provided with a partition extending from the inner wall of the soundproofing hood to the outer wall of the underlying casing and separating a space in which the hood air inlet and the casing air inlet are arranged from a space in which the hood air outlet and the casing air outlet are arranged.

[0035] Preferably, such partition completely separates the space in which the hood air inlet and the casing air inlet are arranged from the space in which the hood air outlet and the casing air outlet are arranged.

[0036] Thanks to the presence of the above-mentioned partition, in the vacuum pumping system according to the invention the heated air coming out of the vacuum pump through the casing air outlet is prevented from coming into contact with the fresh air entering the vacuum pump through the casing air inlet. As a consequence, the temperature of the fresh air entering the vacuum pump is not raised by possible mixing with the heated air coming out of the vacuum pump itself.

[0037] Thanks to this measure, the cooling of the vacuum pump is effective and there is no need of providing the soundproofing hood with additional cooling means.

[0038] Advantageously, the provision of the soundproofing arrangement of the invention does not involve any relevant increase in manufacturing costs and power consumption, and the overall design of the vacuum pumping system according to the invention is simple and reliable.

[0039] According to a preferred embodiment of the invention, the soundproofing hood and/or the additional soundproofing shielding element(s) and/or the soundproofing tray (if provided) has/have a multi-layered structure comprising several layers of soundproofing material, including at least a first, inner layer made of sound-absorbing material and a second, outer layer made of sound-insulating material.

Brief Description of the Drawings

[0040] The features and advantages of the invention will become more evident from the following detailed description of an embodiment thereof, given by way of non-limiting example with reference to the accompanying drawings, in which:

Figures 1a and 1b are perspective views showing the overall outer appearance of the vacuum pumping system according to the invention;

Figure 2 is a further perspective view of the vacuum pumping system according to the invention, with a side wall of the soundproofing hood removed; and
Figure 3 is a cutaway view schematically showing the vacuum pumping system according to the invention.

Detailed Description of a Preferred Embodiment

[0041] In the detailed description of a preferred embodiment of the invention which follows, reference will be made by way of example to a vacuum pumping system comprising a rotary vane vacuum pump.

[0042] Such an exemplary embodiment has not to be considered as limiting the scope of the present invention, which could be applied to vacuum pumping systems comprising any kind of vacuum pump that generates noise.

[0043] Referring to the attached Figures, a vacuum pumping system 100 according to the invention is shown.

[0044] With particular reference to Figure 3, in a per se known manner, the vacuum pumping system 100 comprises a rotary vane vacuum pump 10 and a drive motor 20.

[0045] The rotary vane vacuum pump 10 comprises a pump housing 12 in which a gas suction port and a gas exhaust port are defined. A stator 14 defining a cylindrical stator chamber is received inside the pump housing 12. A rotor 16 is also received in the pump housing 12, said rotor having an axis parallel to the axis of the stator chamber, but being eccentrically arranged relative to the stator chamber axis.

[0046] Depending on different applications and pumping requirements, the rotor 16 can be a single-stage rotor or a dual-stage rotor. Each stage of the rotor 16 is equipped with one or more radially movable radial vanes that are mounted on the rotor 16 and kept against the wall of the stator chamber.

[0047] The pump housing 12 is filled with such an amount of oil that the stator 14 is immersed in an oil bath acting as cooling and lubricating fluid.

[0048] The drive motor 20 typically is an electric motor.

[0049] The drive motor 20 is arranged externally to the pump housing 12 and cantilevered thereon, said drive motor 20 driving in rotation the pump rotor 16. More in detail, the shaft of the rotor of the drive motor 20 is connected to shaft of the pump rotor 16 for driving the latter in rotation about its axis.

[0050] A cooling fan 30 for cooling the vacuum pump 10, and more particularly the oil of the oil bath of the vacuum pump, is also mounted on the shaft of the drive motor 20.

[0051] In order to reduce the noise generated by the vacuum pumping system and transmitted to the surrounding environment, a soundproofing hood 50 is provided, which soundproofing hood surrounds the pump housing 12 as well as the drive motor 20.

[0052] In the illustrated preferred embodiment, the soundproofing hood 50 comprises a roof 50a and a peripheral wall 50b completely surrounding the pump housing 12. In the illustrated embodiment, the roof 50a has a rectangular shape and the peripheral wall 50b comprises four side walls, equal and parallel two by two, which downwardly extend from respective sides of the roof 50a.

[0053] The roof 50a and the side walls forming the peripheral wall 50b are preferably made as separate parts, which can be assembled together, for instance by screws or rivets.

[0054] As can be seen from the Figures, in the illustrated embodiment the soundproofing hood does not comprise any bottom wall. This allows the soundproofing hood 50 to be easily lowered onto the pump housing 12 after the latter has been moved to the desired location and this also allows said soundproofing hood 50 to be easily lifted from the pump housing 12 when necessary, for instance for inspection or maintenance of the vacuum pumping system.

[0055] It is evident that, in an alternative embodiment, the soundproofing hood 50 could be provided with a bottom wall, if desired. In a further alternative embodiment, the soundproofing hood could be provided with a peripheral frame extending from the lower edge of the peripheral wall 50b and having a suitable width so as not to interfere with the casing when the soundproofing hood is lowered or lifted.

[0056] As can be seen in Figures 2 and 3, the soundproofing hood 50 preferably has a multi-layered structure comprising two or more layers made of soundproofing material.

[0057] In the illustrated preferred embodiment, the soundproofing hood 50 comprises a first, inner layer 50' made of a sound-absorbing material and a second, outer layer 50'' made of a sound-insulating material. The first, inner layer can be made, for instance, of an open-cell foam such as polyurethane foam and it can be provided with pyramid or wedge shapes on its inner side. The sec-

ond, outer layer can be made, for instance, of a heavy plastic material having long molecules.

[0058] In general, the number, thickness and materials of the soundproofing hood 50 can be chosen in each case according to the need of the specific application, taking into account the vacuum pump size and speed, the spectrum of the generated noise and the required threshold for the noise in the environment surrounding the vacuum pumping system.

[0059] The soundproofing hood 50 is provided with a hood air inlet 52, which is in communication with the pump housing air inlet, for allowing a stream of fresh air to enter the hood for cooling down the vacuum pump 10, and it is also provided with a hood air outlet 54, which is in communication with the pump housing air outlet, for discharging the heated air, which has passed through the vacuum pump and has cooled it down, from the hood.

[0060] Although the hood 50 dampens the noise generated by the vacuum pumping system 100, it has proven to be unable to reduce the noise in the environment surrounding the vacuum pumping system below the threshold required in certain demanding applications such as the so-called "quiet laboratories", i.e. to below the threshold of 50 - 55 dB.

[0061] According to the invention, in order to improve the noise dampening effect and to further reduce the noise generated by the vacuum pumping system and transmitted to the outside environment, one or more additional soundproofing shielding element(s) is/are arranged between the hood air inlet and/or outlet and the pump housing air inlet and/or outlet, respectively.

[0062] In a very simple embodiment of the invention, the vacuum pumping system according to the invention may comprise a suitably shaped wall arranged between the hood air inlet 52 and the pump housing air inlet and/or a suitably shaped wall arranged between the pump housing air outlet and the hood air outlet 54.

[0063] However, in the preferred embodiment shown in the drawings, such additional soundproofing shielding element(s) is/are designed as a casing 40 which can be contained under the soundproofing hood 50 and surrounds the pump housing 12, so as to form an effective shield between the hood air inlet and the pump housing air inlet and between the hood air outlet and the pump housing air outlet, respectively.

[0064] Preferably, the casing 40 has a top wall 40a, a peripheral wall 40b completely surrounding the pump housing 12 and the drive motor 20 and a bottom wall 40c. In the illustrated embodiment, the top wall 40a and the bottom wall 40c of the casing have a substantially rectangular outline, and the peripheral wall 40b of the casing correspondingly comprises four side walls, substantially equal and parallel two by two. The casing 40 is preferably mounted on wheels 42, allowing to move the vacuum pumping system 100 in the surrounding environment for carrying it to the desired location. Thanks to the presence of the wheels 42, the bottom wall 40c of the casing 40 is raised above the floor.

[0065] In order to effectively dampening the noise generated by the vacuum pumping system, the casing 40 is provided with a soundproofing lining 44, at least partially covering the inner surface of the casing. Such a soundproofing lining 44 comprises at least one layer made of a soundproofing material, namely a sound-absorbing material such as polyurethane foam. The casing 40 is provided with a casing air inlet 46 for allowing a stream of fresh air to enter the casing for cooling down the vacuum pump 10. The casing air inlet 46 is preferably provided in the peripheral wall 40b of the casing 40, at a location which is as far as possible from the cooling air inlet of the pump housing 12 (i.e. in the side wall 40b' of the peripheral wall 40b opposite to the pump housing inlet), so that the path of the fresh air around the pump housing 12 is maximized and the cooling of the vacuum pump is accordingly optimized.

[0066] The casing 40 is also provided with a casing air outlet 48 for discharging the heated air, which has passed through the vacuum pump and has cooled it down, from the casing. The casing air outlet 48 is preferably provided in the bottom wall 40c of the casing.

[0067] Thanks to the provision of the additional soundproofing shielding element(s), namely of the casing 40, the noise generated by the vacuum pumping system in the surrounding environment can be further dampened, below the threshold required in certain demanding applications such as the so-called "quiet laboratories".

[0068] According to the preferred embodiment of the invention shown in the drawings, the soundproofing hood 50 is provided with a partition 56 extending from the inner wall of the soundproofing hood 50 to the outer wall of the underlying casing 40 and separating a space in which the hood air inlet 52 and the casing air inlet 46 are arranged from a space in which the hood air outlet 54 and the casing air outlet 48 are arranged. Preferably, said partition 56 is suitably shaped so as to completely separate the space in which the hood air inlet 52 and the casing air inlet 46 are arranged from the space in which the hood air outlet 54 and the casing air outlet 48 are arranged.

[0069] Thanks to the partition 56, any contact and heat exchange between the fresh air entering through the hood air inlet 52 and flowing to the casing air inlet 46 (and then to the pump housing air inlet) and the heated air coming out of the pump housing and flowing from the casing air outlet 48 to the hood air outlet 54 is prevented.

[0070] As a consequence, the temperature of the fresh air entering the vacuum pump is not raised before entering the casing 40, the cooling of the vacuum pump is effective and there is no need to provide the soundproofing hood 50 with additional cooling means.

[0071] This involves several advantages: first of all, there is no need to provide the soundproofing hood with electrical connections and/or control arrangements, which makes such soundproofing hood simple and inexpensive; secondly, the provision of the soundproofing hood does not cause any increase in the overall power

consumption of the vacuum pumping system of the invention; thirdly, the provision of the soundproofing hood does not involve the introduction of additional components which could be potential sources of failures and malfunctioning.

[0072] In the preferred embodiment of the invention shown in the Figures, the hood air inlet 52 is provided in a first side wall 50b' of the hood peripheral wall 50b, at a certain height above the lower edge of said peripheral wall, and the hood air outlet 54 is provided in a second, opposite side wall 50b'' of the hood peripheral wall 50b, close to the lower edge of said peripheral wall (see for instance Figures 1a and 1b). Due to the fact that the hood air inlet 52 and the hood air outlet 54 are arranged on opposite side walls of the hood peripheral wall 50b, they are as far as possible from each other, so that any heat exchange between the fresh air entering the hood air inlet and the heated air coming out of the hood air outlet is effectively prevented.

[0073] In this embodiment, the partition 56 is formed as a peripheral frame extending all along the inner side of the peripheral wall 50b of the soundproofing hood 50, at a height below the hood air inlet 52 and above the hood air outlet 54, and extending to the outer wall of the casing 40, so as to completely and effectively separate a space in which the hood air inlet 52 and the casing air inlet 46 are located from a space in which the hood air outlet 54 and the casing air outlet 48 are located.

[0074] Such partition 56 can be made of any suitable material, e.g. paperboard.

[0075] As can be seen from Figure 2, the soundproofing hood 50 is preferably arranged with respect to the underlying casing 40 in such a way that the hood air inlet 52 is as far as possible from the casing air inlet 46. In other words, the side wall 50b' of the hood peripheral wall 50b in which the hood air inlet is provided is on the opposite side with respect to the side wall 40b' of the casing peripheral wall 40b in which the casing air inlet is provided.

[0076] Such arrangement provides two different advantages: on one hand, the hood air inlet is far from the casing air inlet so that the noise transmission through the casing air inlet and the hood air inlet is strongly reduced; on the other hand, the path of the fresh air inside the soundproofing hood and around the casing enclosing the vacuum pump is maximized, so that the cooling effect on the vacuum pump is correspondingly maximized.

[0077] In the Figures it can be seen that the peripheral wall 50b of the soundproofing hood 50 is further provided with an additional opening 58 for the passage of electrical cables and connections (not shown) of the vacuum pumping system 100. Such opening 58 is preferably arranged near the hood air inlet 52, i.e. as far as possible from the casing air inlet 46, in order to minimize noise transmission therethrough.

[0078] In the illustrated embodiment, the casing air outlet 48 is provided in the bottom wall 40c of the casing, so that the flow of heated air coming out of the casing is

directed toward the underlying floor.

[0079] In order to dampen the noise possibly generated by said heated air outflow, the vacuum pumping system 100 according to the invention may further comprise a soundproofing tray 60 to be arranged at the casing air outlet 48, between such casing air outlet and the floor.

[0080] The presence of such soundproofing tray 60 further enhances the noise dampening effect.

[0081] Analogously to the soundproofing hood 50, also the soundproofing tray 60 preferably has a multi-layered structure comprising two or more layers made of soundproofing material, most preferably including a first, upper layer made of sound-absorbing material, and a second, lower layer made of sound insulating material.

[0082] According to a preferred embodiment of the invention, the soundproofing tray 60 preferably has an "L" shape, with a first arm 60a substantially parallel to the bottom wall 40c of the casing 40 and a second arm 60b substantially perpendicular to said casing bottom wall 40c and interposed between the casing air outlet 48 and the hood air outlet 54. Due to such specific shape, namely due to the presence of the second arm 60b of the soundproofing tray 60, the soundproofing tray 60 allows to obtain a further advantage: the heated air discharged from the casing air outlet 46 cannot directly flow to the hood air outlet 54, but it is forced to further flow around the casing 40 before leaving the soundproofing hood, thus further increasing the length of the flow path inside said soundproofing hood and further increasing the cooling of the vacuum pump.

[0083] The overall path of the cooling air inside the vacuum pumping system 100 of the invention is indicated by thick arrows in the attached Figures. The fresh air sucked by the fan 30 enters the soundproofing hood 50 through the hood air inlet 54 (A) and it is forced to flow along the facing side wall 40b'' of the peripheral wall 40b of the casing 40 and along the whole area of the top wall 40a of said casing before reaching the casing air inlet 46 (B). After passing through said casing air inlet 46, the air is forced to flow around the pump housing 12 before reaching the opposite side of said pump housing (C) and penetrating into it. Then the air passes through the vacuum pump 10 and is discharged through the casing air outlet 48. At this stage, the air is further forced to flow along the bottom wall 40c of the casing 40 (D) before leaving the soundproofing hood through the hood air outlet 54 (E). All along such path the heat exchange between the vacuum pump and the cooling air takes place, so that by maximizing the length of the air flow path, the cooling efficiency is also maximized.

[0084] It is to be noted that the heated air coming out of the casing air outlet 48 is warmer than the fresh air entering through the hood air inlet 52, so that it would have the tendency to move upwards and mix with the colder fresh air. However, in the illustrated embodiment this is effectively avoided by the provision of the partition 56.

[0085] It is evident from the above description that the

vacuum pumping system according to the invention allows to achieve the objects set forth above.

[0086] Experimental tests carried out by the Applicant proved that, thanks to the presence of the soundproofing hood, the noise in the environment surrounding the vacuum pumping system of the invention is effectively reduced to below the required threshold of 50 - 55 dB.

[0087] It is also evident that the above exemplary embodiment has been given for a better understanding of the invention and not for limiting the scope of protection of the invention itself and that, starting from the above disclosure, many variants that fall within the scope of protection of the invention will be evident to those skilled in the art.

[0088] More particularly, although reference has been made to a rotary vane vacuum pump in such exemplary embodiment, it will be evident to the person skilled in the art that the invention could also be applied to any other vacuum pumping system comprising a vacuum pump and/or vacuum pump accessories which generate(s) an undesired noise.

Claims

1. A vacuum pumping system (100) comprising:

- a vacuum pump (10) accommodated in a pump housing (12);
- a soundproofing hood (50), which surrounds said pump housing (12) and is provided with a hood air inlet (52), which is in communication with a pump housing air inlet, and with a hood air outlet (54), which is in communication with a pump housing air outlet, **characterised in that** one or more additional soundproofing shielding element(s) is/are provided between said hood air inlet (52) and said pump housing air inlet and/or said hood air outlet port (54) and said pump housing air outlet.

2. Vacuum pumping system (100) according to claim 1, wherein additional soundproofing shielding element(s) is/are designed as a casing (40) which surrounds said pump housing (12) and which is provided with a casing air inlet (46) and with a casing air outlet (48).

3. Vacuum pumping system (100) according to claim 1 or 2, wherein said soundproofing hood (50) comprises a roof (50a) and a peripheral wall (50b), which is formed by a plurality of side walls and completely surrounding said pump housing (12).

4. Vacuum pumping system (100) according to claim 3, wherein said hood air inlet (52) is provided in a first side wall (50b') of said peripheral wall (50b) of said soundproofing hood, at a certain height above

the lower edge of said peripheral wall, and said hood air outlet (54) is provided in a second, opposite side wall (50b'') of said peripheral wall (50b) of said soundproofing hood, close to the lower edge of said peripheral wall.

5. Vacuum pumping system (100) according to claim 2, wherein said casing (40) has a top wall (40a), a peripheral wall (40b), formed by a plurality of side walls and completely surrounding said pump housing and said drive motor, and a bottom wall (40c).

6. Vacuum pumping system (100) according to claim 5, wherein said casing air inlet (46) is provided in one (40b') of the side walls forming said peripheral wall (40b) of said casing and said casing air outlet (48) is provided in said bottom wall (40c) of said casing.

7. Vacuum pumping system (100) according to claims 4 and 6, wherein said soundproofing hood (50) is arranged with respect to said casing (40) so that said first side wall (50b') of said peripheral wall (50b) of said soundproofing hood in which said hood air inlet (52) is provided is on the opposite side with respect to said side wall (40b') of said peripheral wall (40b) of said casing in which said casing air inlet (46) is provided.

8. Vacuum pumping system (100) according to claim 6, wherein said vacuum pumping system (100) further comprises a soundproofing tray (60) arranged below said bottom wall (40c) of said casing, at said casing air outlet port (48).

9. Vacuum pumping system (100) according to claim 2, wherein said soundproofing hood (50) is provided with a partition (56) extending from the inner wall of said soundproofing hood (50) to the outer wall of said underlying casing (40) and separating a space in which said hood air inlet (52) and said casing air inlet (46) are arranged from a space in which said hood air outlet (54) and said casing air outlet (48) are arranged.

10. Vacuum pumping system (100) according to claim 9, wherein said partition (56) is formed as a peripheral frame extending all along the inner side of said peripheral wall (50b) of said soundproofing hood, at a height below said hood inlet port (52) and above said hood outlet port (54), and extending to the outer wall of said casing (40).

11. Vacuum pumping system (100) according to any of the preceding claims, wherein said soundproofing hood (50) and/or said one or more additional soundproofing shielding element(s) has/have a multi-layered structure comprising two or more layers made

of soundproofing material.

12. Vacuum pumping system (100) according to claim 11, wherein said soundproofing hood (50) and/or said one or more additional soundproofing shielding element(s) has/have a first, inner layer (50') made of a sound-absorbing material and a second, outer layer (50'') made of sound-insulating material. 5

13. Vacuum pumping system (100) according to any of the preceding claims, wherein said vacuum pumping system further comprises a drive motor (20) for driving said vacuum pump and/or a cooling fan (30) for cooling said vacuum pump. 10
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14. Vacuum pumping system (100) according to any of the preceding claims, wherein said vacuum pump (10) is a rotary vane vacuum pump (10) including a pump stator (14) defining a cylindrical stator chamber and a pump rotor (16) received in said stator chamber and having an axis parallel to the axis of the stator chamber and eccentrically arranged relative to the stator chamber axis, said pump stator and said pump rotor being accommodated in said pump housing (12) and said pump housing being filled with oil. 20
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15. A vacuum pumping system (100) comprising:
 - a vacuum pump (10) accommodated in a pump housing (12), 30
 - a casing (40), which surrounds said pump housing (12) and which is provided with a casing air inlet (46) and with a casing air outlet port (48); and 35
 - a soundproofing hood (50), which covers said casing (40) and is provided with a hood air inlet (52), which is in communication with said casing air inlet (46), and with a hood air outlet (54), which is in communication with said casing air outlet (48), **characterized in that** said soundproofing hood (50) is provided with a partition (56) extending from the inner wall of said soundproofing hood (50) to the outer wall of said underlying casing (40) and separating a space in which said hood air inlet (52) and said casing air inlet (46) are arranged from a space in which said hood air outlet (54) and said casing air outlet (48) are arranged. 40
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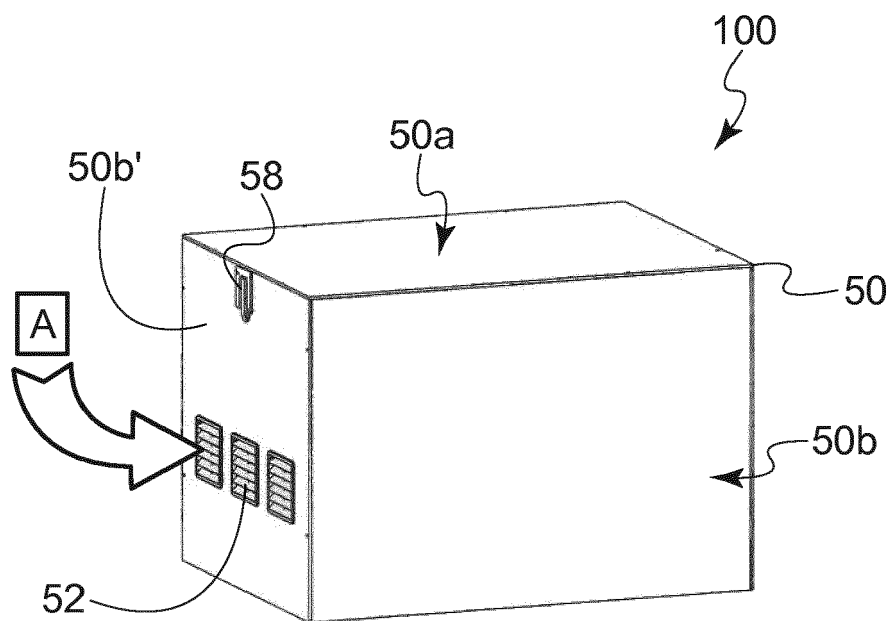


Fig. 1a

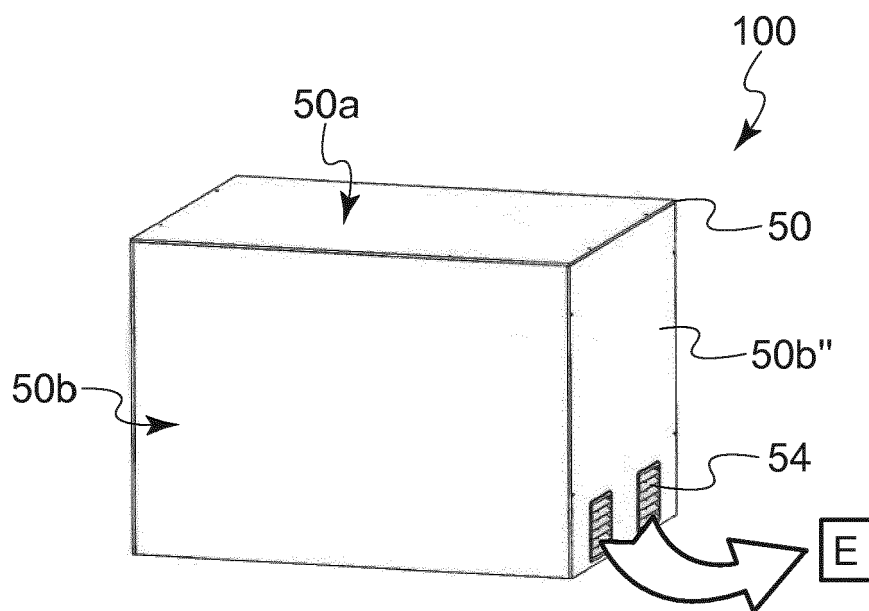


Fig. 1b

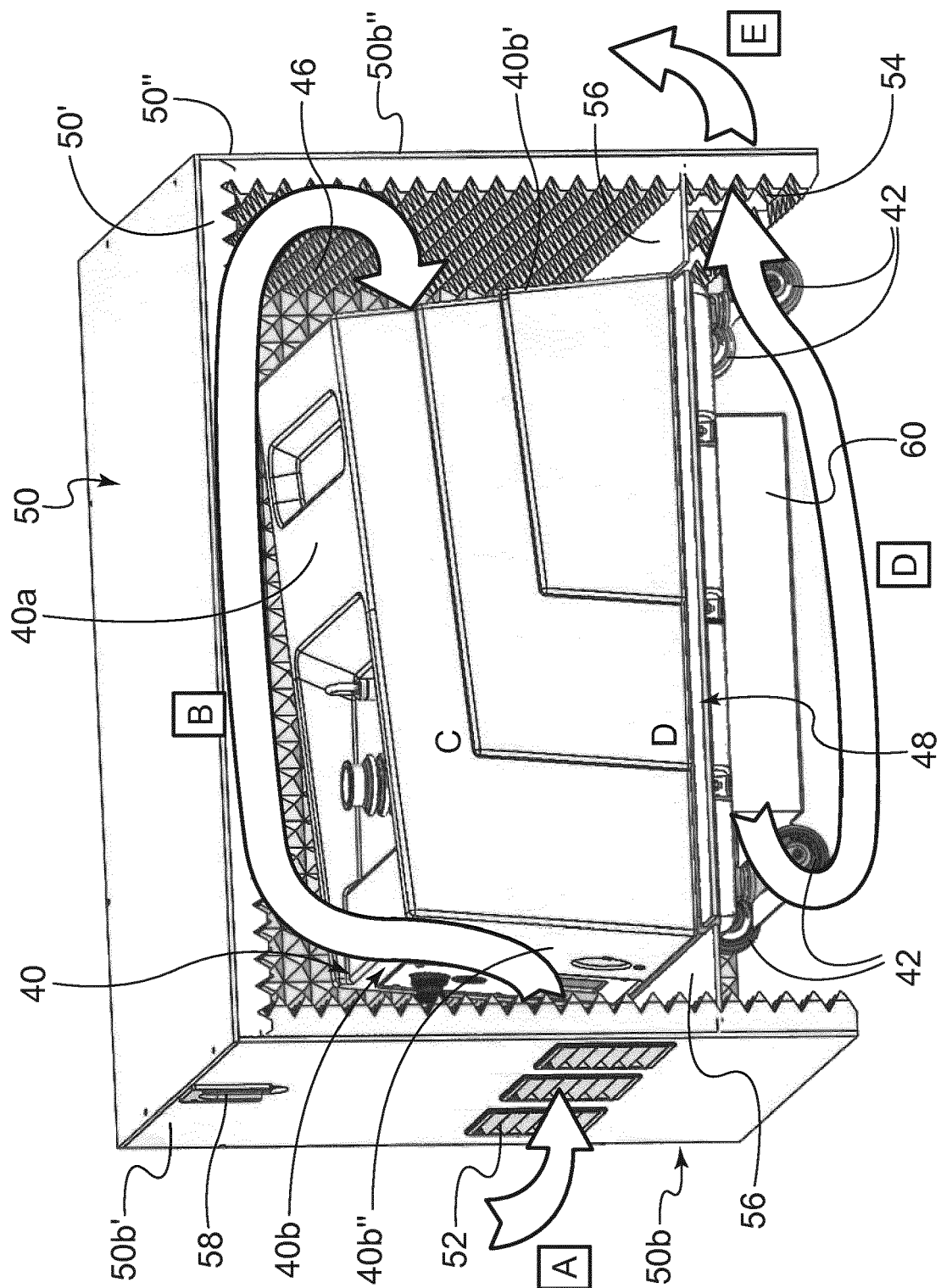


Fig. 2

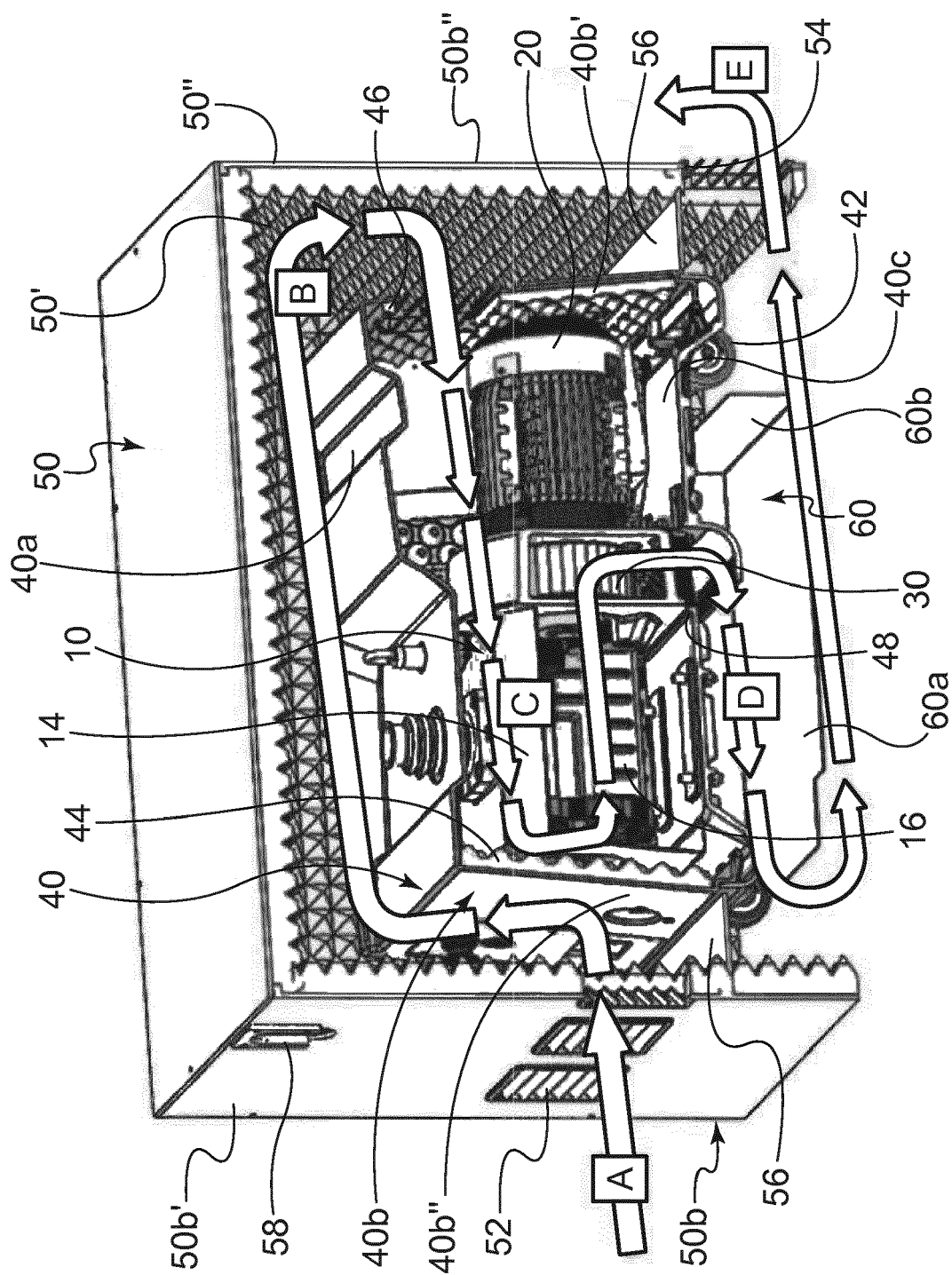


Fig. 3



EUROPEAN SEARCH REPORT

Application Number
EP 17 20 4792

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Place of search Munich		Date of completion of the search 18 April 2018	Examiner Bocage, Stéphane
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