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(54) **Vibration-isolated mounting or pump unit arrangement for household appliance**

(57) Vibration-isolated mounting arrangement for a household appliance, in particular for a dishwasher or washing machine, the arrangement comprising: a motor unit (1), a cantilever unit (2), a damping suspension device (6), and a securing device (3,4). The suspension device (6) is connecting the motor unit (1) to the cantilever unit (2) and is adapted to bear the motor unit (1). The suspension device (6) and the securing device (3,4) are arranged separate of each other, in particular are spaced apart of each other. The suspension device (6) provides a non-locking detachable connection between the motor unit (1) and the cantilever unit (2). The securing device (3,4) is providing a locking connection (10,12) between the motor unit (1) and the cantilever unit (2) or an supporting element of the household appliance, wherein the securing device (3,4) has or essentially has a non-bearing function with respect to the motor unit (1). The motor unit (1) is attachable to and detachable from the cantilever unit (2) via the suspension device (6) in a predefined line of movement and wherein the securing device (3,4) is adapted to block the movement of the motor unit (1) relative to the cantilever unit (2) along the predefined line of movement (D).

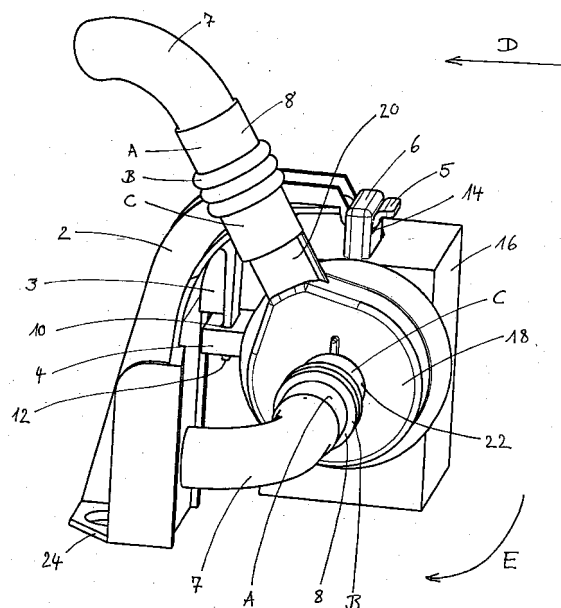


Fig. 1

Description

[0001] The invention relates to a vibration-isolated mounting or pump unit arrangement for a household or home appliance, in particular for a dishwasher or washing machine, for reducing operation noise transmission.

[0002] EP 1 245 859 A2 discloses a vibration-isolated bearing for a motor or motor powered unit of a household appliance with at least one elastic bearing element. According to one embodiment a single bearing element is provided supporting a motor at its center of mass. In another embodiment an angular element is arranged at a side wall of a dishwasher and at the cantilever arm of the angular element a motor is elastically suspended. Also a multi-connection suspension using several rubber bands is suggested.

[0003] It is an object of the invention to provide a pump unit arrangement and a vibration-isolated mounting arrangement reducing vibration and noise propagation. Further it is an object to provide a household appliance comprising such a vibration-isolating pump unit arrangement and/or mounting arrangement.

[0004] The invention is defined in claims 1, 12 and 16, respectively.

[0005] Particular embodiments are set out in the dependent claims.

[0006] According to claim 1 a vibration-isolated mounting arrangement for a household appliance is provided. The arrangement comprises a motor unit, a cantilever unit, a damping suspension device and a securing device. The motor unit is a motor or a component powered by a motor, in particular a pump unit, for example a recirculation pump of a washing machine or a draining pump of a dishwasher. Preferably the cantilever unit has a horizontal portion and a vertical portion comprising a base. The base is attachable, for example by fixing means, to the inside of the household or home appliance. The cantilever unit is preferably formed to be at least partially resilient or elastic, for additionally contributing to the dampening function of the damping suspension device.

[0007] The dampening provided by the damping suspension device includes reducing or preventing a transfer of structure-borne noise, sound or vibration propagation from the operating motor unit to the cantilever unit. Further movements of the motor unit are damped, essentially in a direction of a bearing axis of the suspension device. The movements occur for example during a transport of the household appliance where the mounting arrangement has to provide a secure transport connection.

[0008] The motor unit is connected to the cantilever unit or a supporting element of the household appliance via the damping suspension device, wherein the damping suspension device bears the motor unit. Via the damping suspension device, the motor unit is connected to a connecting portion of the cantilever unit which may be an element of the household appliance. For example the connection is provided to a free end of the horizontal

portion of the cantilever unit. The damping suspension device provides a non-locking detachable connection between the motor unit and the cantilever unit. Preferably the suspension device is slideable or pluggable connected to the cantilever unit or element of the household appliance and is preferably made of elastic and/or resilient material. The slideable and pluggable connection provides an easy mounting of the motor unit to the cantilever unit via the suspension device. According to one embodiment the suspension device is arranged on top of the motor unit in particular at a position defined by a vertical extension of its center of mass.

[0009] The securing device is arranged separate from the suspension device. Preferably the securing device is arranged between the element of the household appliance and a side of the motor unit facing the element of the household appliance. More preferably the securing device is arranged between the vertical portion of the cantilever unit and a side of the motor unit facing the vertical portion of the cantilever unit. The securing device provides a locking connection between the motor unit and the cantilever unit or an supporting element of the household appliance, for example by a plug-in connection. The securing device has (essentially) a non-bearing function with respect to the motor unit. The non-bearing connection is for example provided by a coupling clearance in the locking connection, preferably provided by a coupling clearance of the plug-in connection. The coupling clearance reduces or prevents the structure-borne noise, sound or vibration propagation via the securing device from the motor unit to the cantilever unit or element of the household appliance.

[0010] The motor unit is attachable to and detachable from the cantilever unit via the suspension device along a predefined line of movement. The predefined line of movement is defined by requiring no or essentially no force for the attaching or detaching of the motor unit to the cantilever unit or element of the household appliance via the suspension device. I.e. the predefined line of movement for providing the connection of the suspension device is the free movement when the securing device would not be present. The predefined line of movement is essentially a connecting line between the suspension device and the connecting portion of the cantilever unit or the element of the household appliance. Preferably the predefined line of movement runs in a horizontal plane.

[0011] The securing device is adapted to block the movement of the motor unit relative to the cantilever unit along the predefined line of movement, after the attaching of the motor unit via the suspension device and the securing device. The position of the attached damping device and of the motor unit is fixed or stabilized by the securing device with respect to the predefined line of movement.

[0012] For mounting the motor unit to the cantilever unit or element of the household appliance via the suspension device and the securing device, a mounting line

of movement is required during assembling. The mounting line of movement overcomes the blocking of the securing device which blocks the movement along the predefined line of movement. The suspension device is slideable or pluggable coupled to the second coupling element by a combination of the predefined line of movement and a bending movement, by which the suspension device is stretched and bend by a force, to align the first and second securing element. Thereby the springy or elastic form of the cantilever unit reduces the force needed to stretch the suspension device for aligning. After the aligning of the first and second securing element, in particular the aligning of the opening to the protruding element, the force applied to the suspension device is released and a restoring force of the suspension device pulls the securing device and the cantilever unit in the locking connection.

[0013] In a preferred embodiment the predefined line of movement is essentially perpendicular to a movement for connecting or separating the locking connection of the securing device. Preferably the movement for providing the locking connection is vertical. Because the predefined line of movement of the suspension device is essentially perpendicular to the movement providing the locking connection, a turning or oscillating movement of the motor unit about a bearing axis of the suspension device is blocked by the securing device.

[0014] According to one embodiment the securing device comprises at least one first securing element and at least one second securing element. The first and second securing elements preferably provide a plug-in connection. For example the at least one second or first securing element comprises an opening to receive a protruding element of the at least one first or second securing element. The first or second securing element is preferably integrally formed at the cantilever unit, in particular formed as a cast or moulded component, and the second or first securing element is attached to the side of the motor unit. To provide the non-bearing function of the securing device, for example the opening comprises a larger cross section than a cross section of the protruding element.

[0015] In a preferred embodiment the securing device has at least one damping section or portion, in particular the first or second securing element is made of a resilient or elastic material. During a blocking of the turning or oscillating movement of the motor unit in the locking connection, a contact between the first and second securing element is damped. Therefore the noise and vibration transmission is reduced or prevented.

[0016] In a preferred embodiment the suspension device comprises a first coupling element. The first coupling element is provided for coupling the suspension element to a second coupling element arranged at the cantilever unit or motor unit. The second coupling element is preferably integrally formed at the cantilever unit or motor unit, in particular formed as a cast or moulded component, for example as a hook-like component. The first

coupling element is preferably a through hole in the suspension device. The suspension device is preferably slideably or pluggably connected to the second coupling element. This provides a quick-release connection, wherein no tools are required for connecting the suspension device to the second coupling element. The attaching and detaching of the motor unit to the cantilever unit or element of the household appliance via the mounting line of movement, requires no tools and is simply performed by hand. This particularly advantageous as commonly inside the household appliance only little space is provided for using tools.

[0017] The resiliency and therefore the restoring force of the damping suspension device assure that the locking connection of the securing device is locked during an operation of the motor unit, a transport of the arrangement. The securing device provides a transportation lock for the motor unit which remains attached at the motor unit and cantilever unit during operation of the motor unit. This is particularly advantageous as commonly disposable transportation locks are provided and after a removal these transportation locks are usually not reusable. Because the transportation lock provided by the securing device is not removed, the motor unit is still secured at a later transport of the arrangement or household appliance, for example during a move.

[0018] According to claim 12, a pump unit arrangement for a household appliance, in particular for a dishwasher or washing machine is provided. The arrangement comprises a pump unit having a pump housing with an intake port and/or an outlet port. The pump unit is for example a recirculation pump for a washing machine or a draining pump for a dishwasher. The intake port and/or the outlet port are preferably integrally formed at the pump housing, in particular formed as a cast or moulded component. Further the pump unit arrangement comprises at least one fluid line, for example a hose or tube adapted to carry fluids. The fluid line is coupled to the intake or outlet port via at least one damping element. The damping element provides a vibration-isolated coupling between the intake or outlet port and the at least one fluid line. Therefore a transfer of structure-borne noise, sound or vibration of the operating motor unit to the fluid line are reduced or prevented.

[0019] The damping element is preferably slideably or pluggably coupled to the fluid line or ports, for example bushing-like. The slideable or pluggable coupling facilitates the coupling between the damping element and the fluid line or ports, as no tools are needed for the coupling. This is particularly advantageous, as commonly inside the household appliance only little space for using tools is provided.

[0020] In a preferred embodiment the damping element comprises a damping portion, which is integrally formed between a first and a second portion of the damping element. The first or second portion is coupled to the fluid line and the second or first portion is coupled to the intake or outlet port. Preferably the damping portion is

formed as a corrugated hose or a bellow.

[0021] In a preferred embodiment the at least one damping element or at least the damping portion is resilient and the material of the damping element is for example Polyethylene or Polypropylene. The resilient material of the damping element and/or the form of the damping portion reduces or prevents the sound or vibration propagation from the motor unit to the fluid line. Further a force applied to the fluid line due to movements of the motor unit during a transport are damped or compensated by the damping element.

[0022] A further advantage is that low-price plastic-material fluid lines with high structure-borne noise transmission properties can be used without reducing the vibration isolation of the pump unit to the fluid line, because the damping element provides the vibration-isolated coupling between the pump unit and the fluid line.

[0023] In an alternative embodiment the at least one damping element is integrally formed at an end of the at least one fluid line or at the intake port and/or outlet port. In this case the number of components is reduced. For example the damping element may be integrally cast or molded to the intake and/or outlet port or the at least one fluid line. The connection to the counterpart component (outlet port/fluid line and/or intake port/fluid line) is again made via the damping element. Here preferably only one portion for a pluggable or sliding connection to the counterpart component is provided.

[0024] Claim 16 defines a household appliance, in particular dishwasher or washing machine having at least one vibration-isolated mounting arrangement and/or at least one pump unit arrangement. In a preferred embodiment the cantilever unit of the at least one vibration-isolated mounting arrangement is attached inside the household appliance over or on a foot or in a corner of the household appliance.

[0025] Reference is made in detail to a preferred embodiment of the invention, an example of which is illustrated in the accompanying drawing.

[0026] Fig. 1 shows a preferred embodiment of a vibration-isolated mounting arrangement for a dishwasher. The arrangement comprises a motor unit 1, having a motor 16 and a pump housing 18. The motor unit 1 is detachably connected to a cantilever unit 2 via a damping suspension element 6. The suspension element 6 is arranged on top of the motor unit 1 in a position defined by the vertical extension of a centre of mass of said motor unit 1. The suspension element 6 comprises a through hole 14 which is coupled to a hook element 5, which is integrally formed at the free end of the cantilever unit 2 as a casted or moulded component.

[0027] The attaching and detaching of the motor unit 1 to the cantilever unit 2 via the through hole 14 and the hook element 5 is provided along a predefined line of movement (see arrow D) which is essentially horizontal, wherein the movement is a sliding on or plugging in of the through hole 14 to the hook element 5. The predefined line of movement D is defined by requiring no or essen-

tially no force for connecting the through hole 14 to the hook element 5. The connection of the motor unit 1 to the cantilever unit 2, via the through hole 14 and the hook element 5, is non-locked and quick-releasable.

[0028] The damping suspension element 6 is made of a resilient material, which is adapted to damp a transfer of structure-borne noise, sound or vibration of the motor unit 1 to the cantilever unit 2 and to damp movements of the motor unit 1 during a transport of the arrangement.

[0029] A securing device 3, 4 is arranged between a side of the motor unit 1 and the cantilever unit 2 comprising a first and second securing element 3, 4. The first securing element 3 comprises a protruding stud 12 and is integrally formed at the cantilever unit 2 as a moulded or cast component. The second securing element 4 is fixed to the side of the motor unit, is resilient and comprises an opening 10 to receive the protruding stud 12. The opening 10 has a larger cross-section than the protruding stud 12, therefore a coupling clearance is provided in a locking connection between the opening 10 and the protruding stud 12. The coupling by the securing device 3, 4 does normally not support the motor unit 1. Further, the coupling clearance reduces or prevents sound or vibration propagation via the securing device 3, 4 from the motor unit 1 to the cantilever unit 2.

[0030] For mounting the motor unit 1 to the cantilever unit 2 such as providing the connections via the suspension element 6 and the securing device 3, 4, a mounting line of movement (see arrow E) is required during assembling. The mounting line of movement E overcomes the blocking of the securing device 3, 4 which blocks the movement along the horizontal predefined line of movement D. In the mounting line of movement E the suspension element 6 is slideable or pluggable coupled to the second coupling element 5 by a combination of a horizontal movement and a bending movement by which the resilient material of the suspension element 6 is stretched and bend by a force, to align the protruding stud 12 to the opening 10. After the alignment between the protruding stud 12 and the opening 10 of the securing device 3, 4 has been achieved, the force applied to stretch the suspension element 6 is released, and the restoring force of the suspension element 6 pulls the securing device 3, 4 in the locking connection 10, 12.

[0031] The base 24 of the cantilever unit 2 is preferably attached inside the dishwasher over or on a foot or in a corner of the dishwasher (not shown).

[0032] An intake port 22 and an outlet port 20 are arranged on a pump housing 18. Hoses 7 are respectively coupled to each port 22, 20 by a bushing-like damping element 8. The damping element 8 is integrally formed and comprises a corrugated hose B, a first connection part A and a second connection part B. The coupling is provided by a sliding on or plugging to of the first connection part A to one of the hoses 7 and of the second connection part B to the intake 22 or outlet 20 port, respectively. The damping element 8 is resilient and has a Shore-A hardness of less than or equal to 40. Preferably

the Shore-A hardness is less than or equal to 38, more preferably less or equal to 35. The material of the damping element 8 is for example Polyethylene or Polypropylene.

Reference Numerals List

[0033]

- 1 motor unit
- 2 cantilever unit
- 3 first securing element
- 4 second securing element
- 5 hook element
- 6 damping suspension element
- 7 hose
- 8 damping element
- 10 opening
- 12 protruding stud
- 14 through hole
- 16 motor
- 18 pump housing
- 20 outlet port
- 22 intake port
- 24 base

- A first connection part
- B damping part
- C second connection part
- D arrow
- E arrow

Claims

1. Vibration-isolated mounting arrangement for a household appliance, in particular for a dishwasher or washing machine, the arrangement comprising:

a motor unit (1),
a cantilever unit (2),
a damping suspension device (6), and
a securing device (3, 4);

wherein the suspension device (6) is connecting the motor unit (1) to the cantilever unit (2) and is adapted to bear the motor unit (1),

characterized in that

the suspension device (6) and the securing device (3, 4) are arranged separate of each other, in particular are spaced apart of each other, wherein the suspension device (6) provides a non-locking detachable connection between the motor unit (1) and the cantilever unit (2), and
the securing device (3, 4) is providing a locking connection (10, 12) between the motor unit (1) and the cantilever unit (2) or an supporting element of the household appliance, wherein the securing device

(3, 4) has or essentially has a non-bearing function with respect to the motor unit (1),
wherein the motor unit (1) is attachable to and detachable from the cantilever unit (2) via the suspension device (6) in a predefined line of movement and wherein the securing device (3, 4) is adapted to block the movement of the motor unit (1) relative to the cantilever unit (2) along the predefined line of movement (D).

2. Vibration-isolated mounting arrangement of claim 1, wherein the predefined line of movement (D) is essentially perpendicular to a movement for connecting or separating the locking connection (10, 12).

3. Vibration-isolated mounting arrangement of claim 1 or 2, wherein the predefined line of movement (D) runs or essentially runs in a horizontal plane.

4. Vibration-isolated mounting arrangement of claim 1, 2 or 3, wherein the securing device (3, 4) comprises a coupling clearance in the locking connection (10, 12) of the motor unit (1) to the cantilever unit (2) or element of the household appliance.

5. Vibration-isolated mounting arrangement of any of the previous claims, wherein the securing device (3, 4) has at least one damping portion (4).

6. Vibration-isolated mounting arrangement of any of the previous claims, wherein the securing device (3, 4) comprises at least one first securing element (3) and at least one second securing element (4), and wherein the at least one first or second securing element (3, 4) is adapted to receive the at least one second or first securing element (4, 3).

7. Vibration-isolated mounting arrangement of claim 6, wherein the at least one second or first securing element (4, 3) comprises an opening (10) to receive a protruding element (12) of the at least one first or second securing element (3, 4).

8. Vibration-isolated mounting arrangement of any of the previous claims, wherein the suspension device (6) comprises a first coupling element (14), wherein the first coupling element (14) is provided for coupling the suspension element (6) to a second coupling element (5) arranged at the cantilever unit (2) or motor unit (1).

9. Vibration-isolated mounting arrangement of claim 8, wherein the coupling connection provided by the first and second coupling element (14, 5) is a quick-release connection.

10. Vibration-isolated mounting arrangement of any of claims 6 to 9, wherein the second coupling element

(5) and/or the at least one first securing element (3) is integrally formed at the cantilever unit (2), in particular formed as a molded component.

the household appliance over or on a foot or in a corner of the household appliance.

11. Vibration-isolated mounting arrangement according to any of the previous claims, wherein the motor unit (1) is a motor (16) or a component powered by a motor, in particular a pump unit (16, 18). 5
12. Pump unit arrangement for a household appliance, in particular for a dishwasher or washing machine, the arrangement comprising: 10
 - a pump unit (16, 18) comprising a pump housing (18) with an intake port (22) and/or an outlet port (20); 15
 - at least one fluid line (7); and
 - at least one damping element (8) providing a vibration-isolated coupling between the intake (22) or outlet port (20) and the at least one fluid line (7), or 20
 - at least one damping element (8) being arranged at the intake and/or outlet port (22, 20) or the at least one fluid line (7) and providing a vibration-isolated coupling to the at least one fluid line (7) or the intake and/or outlet port (22, 20), respectively. 25
13. Pump unit arrangement of claim 12, wherein the damping element (8) comprises a damping portion (B) integrally formed between a first and a second portion (A, C) of the damping element (8), wherein the damping portion (B) is in particular a corrugated hose or a bellow. 30

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14. Pump unit arrangement of claim 13, wherein the first portion (A) is adapted to be slideably or pluggably coupled to the fluid line (7) and/or the second portion (C) is adapted to be slideably or pluggably coupled to the intake (22) or outlet port (20). 40

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15. Pump unit arrangement of any of claims 12 to 14, wherein the at least one damping element (8) or at least the damping portion (B) is resilient and has a Shore-A hardness of less than or equal to 40, preferably the Shore-A hardness is less than or equal to 38, more preferably less than or equal to 35. 50

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16. Household appliance, in particular-dishwasher or washing machine, comprising at least one vibration-isolated mounting arrangement according to any of the previous claims 1 to 11 and/or at least one pump unit arrangement according to any of the previous claims 12 to 15. 55
17. Household appliance according to claim 16, wherein the cantilever unit (2) of the at least one vibration-isolated mounting arrangement is attached inside

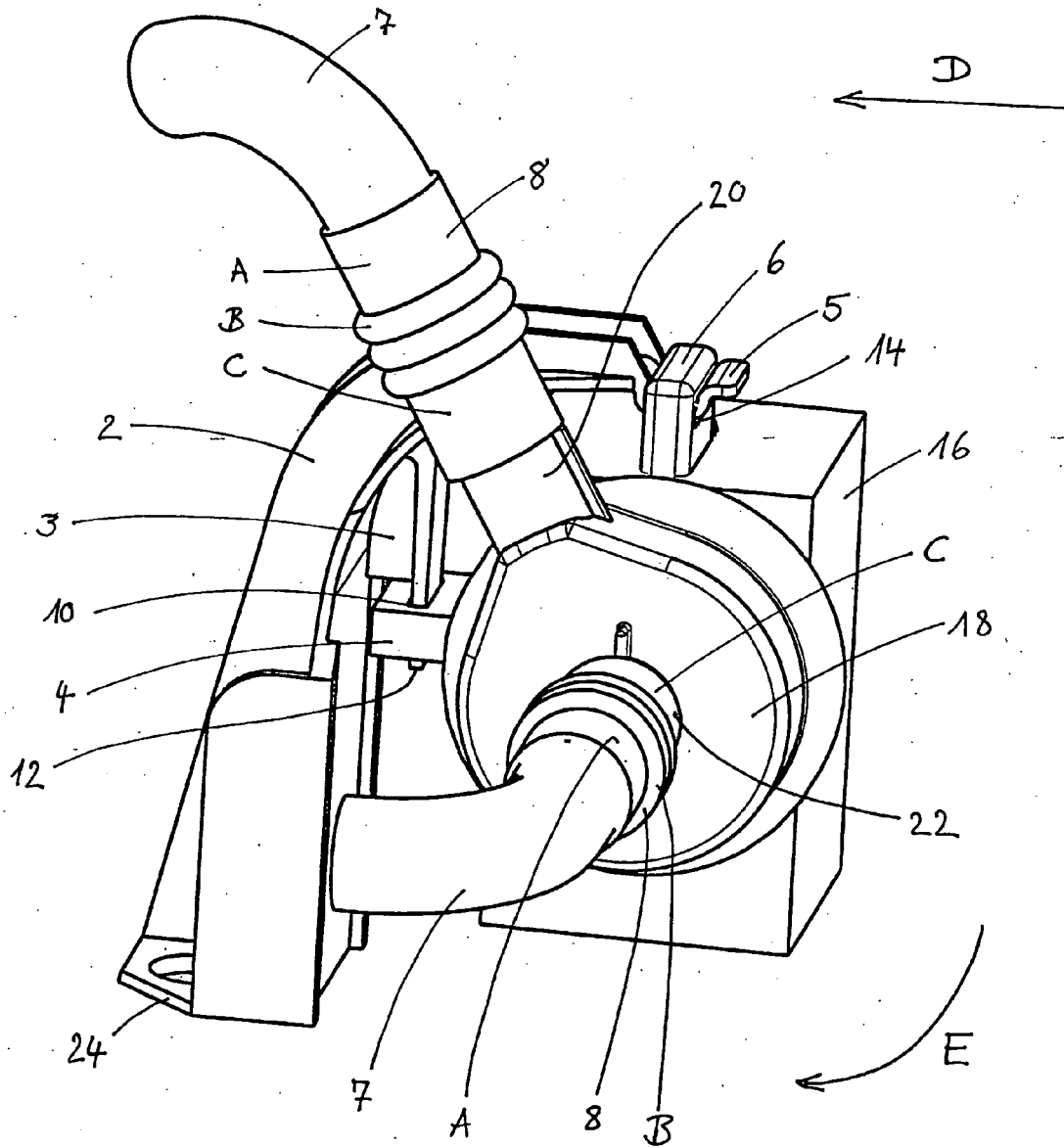


Fig. 1



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EUROPEAN SEARCH REPORT

Application Number
EP 07 00 2592

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		-/--	
The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 31 August 2007	Examiner Prussen, Jean
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

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EPO FORM 1503 03.82 (P04C01)



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EUROPEAN SEARCH REPORT

Application Number
EP 07 00 2592

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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The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 31 August 2007	Examiner Prussen, Jean
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

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EPO FORM 1503 03.82 (P04C01)



European Patent
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Application Number

EP 07 00 2592

CLAIMS INCURRING FEES

The present European patent application comprised at the time of filing more than ten claims.

- ☐ Only part of the claims have been paid within the prescribed time limit. The present European search report has been drawn up for the first ten claims and for those claims for which claims fees have been paid, namely claim(s):
- ☐ No claims fees have been paid within the prescribed time limit. The present European search report has been drawn up for the first ten claims.

LACK OF UNITY OF INVENTION

The Search Division considers that the present European patent application does not comply with the requirements of unity of invention and relates to several inventions or groups of inventions, namely:

see sheet B

- ☒ All further search fees have been paid within the fixed time limit. The present European search report has been drawn up for all claims.
- ☐ As all searchable claims could be searched without effort justifying an additional fee, the Search Division did not invite payment of any additional fee.
- ☐ Only part of the further search fees have been paid within the fixed time limit. The present European search report has been drawn up for those parts of the European patent application which relate to the inventions in respect of which search fees have been paid, namely claims:
- ☐ None of the further search fees have been paid within the fixed time limit. The present European search report has been drawn up for those parts of the European patent application which relate to the invention first mentioned in the claims, namely claims:



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**LACK OF UNITY OF INVENTION
SHEET B**

Application Number
EP 07 00 2592

The Search Division considers that the present European patent application does not comply with the requirements of unity of invention and relates to several inventions or groups of inventions, namely:

1. claims: 1-11,16,17

Vibration-isolated mounting arrangement with a suspension
device and a securing device

2. claims: 12-17

Pump unit arrangement with a damping element between the
intake or outlet and one fluid line

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 07 00 2592

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
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REFERENCES CITED IN THE DESCRIPTION

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