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Description

[0001] The present invention relates to a household appliance.

[0002] More specifically, the present invention relates to a laundry washing machine to which the following description refers purely by way of example.

[0003] As is known, high-speed rotation of the revolving drum of the washing machine produces severe machine vibrations which are transferred to the casing of the washing machine, and which normally become much more problematic as the speed of the revolving drums increases.

[0004] To reduce machine vibrations, in today's laundry washing machines the entire washing assembly (i.e. the washing tub and the revolving drum mounted in axially rotating manner inside the washing tub) is normally suspended in floating manner into the machine casing via a system of springs and dampers designed to absorb the vibrations before they reach the casing.

[0005] In particular installation conditions, however, the floating suspension system fails to sufficiently reduce machine vibrations reaching the casing, so that the washing machine becomes noisy. For example, when a washing machine rests on a flexible floor, such as a wooden floor, a soft floor, or a floor resting on a thin slab, the vibrations generated by the revolving drum during the spin cycle may be resonance-amplified to an unacceptable noise level, and may damage not only the washing machine but also the floor.

[0006] To overcame this drawback today's high-end washing machines are also provided with a vibration damper fixed to the casing to reduce vibrations of the washing machine at resonance speeds, and which comprises an oscillating mass and a number of coil springs connecting the oscillating mass to the washing machine casing. The oscillating mass and the coil spring system are properly dimensioned to vibrate, during rotation of the drum, in phase-opposition with respect to vibrations transmitted to the casing by the floating suspension system, thus reducing the amplitude of the casing vibrations.

[0007] Unfortunately the above cited vibration dampers - traditionally known as "Frahm dampers" - only provide for optimum dumping performance over a limited range of the possible drum rotation speeds, i.e. over a limited range of the possible vibration frequencies.

[0008] Moreover, the drum rotation speeds at which resonance phenomena take place also depend on the unevenly distribution of the laundry on the lateral wall of the revolving drum, and on the installation conditions (for example on the type of floor upon which the washing machine rests). Thus resonance phenomena vary from one washing machine to another and from one installation place to another, and it is therefore practically impossible to precisely determine, at manufacturing stage, the frequencies at which to tune up the "Frahm damper".

[0009] Accordingly, in known washing machines with tuned vibration dampers, performance of the dampers is not always entirely satisfactory and is invariably below expectations.

[0010] US 2005/188472 A1 discloses a washer comprising a tub, a drum rotatably provided within the tub, a cylinder supported by either a base or the tub, a piston supported by either the tub or the base, the piston being coupled with the cylinder to enable a relative reciprocating motion, the piston generating a magnetic force with power impression; the washer also comprises a vibration-absorbing part provided within the cylinder, the vibration-absorbing part generating a frictional force by coming into contact with an inner circumference of the cylinder, the vibration-absorbing part being attached to the piston by the magnetic force to absorb a vibration transferred to the cylinder or the piston. US 2005/188472 A1 also discloses a washer comprising a tub, a drum rotatably provided within the tub, a cylinder and a piston supported by a base and the tub, the cylinder and the piston being assembled together to enable relative reciprocating motion; the washer also comprises a vibration-absorbing part provided within the cylinder, the vibration-absorbing part generating a magnetic force with power impression, the vibration-absorbing part being attached to the piston by the magnetic force to absorb a vibration transferred to the cylinder or the piston.

[0011] It is an object of the present invention to provide a vibration damper offering optimum performance over the full range of the possible drum rotation speeds, regardless of laundry distribution into the drum and of the installation place.

[0012] According to the present invention, there is provided a household appliance as claimed in the accompanying Claims.

[0013] A non-limiting embodiment of the present invention will be described by way of example with reference to the accompanying drawings, in which:

- Figure 1 shows a perspective view, with parts in section and parts removed for clarity, of a laundry washing machine with a vibration damper in accordance with the teachings of the present invention;
- Figure 2 shows a schematic front view of a second embodiment of the vibration damper of Figure 1 washing machine; and
- Figure 3 shows a schematic front view of a third embodiment of the vibration damper of Figure 1 washing machine.

[0014] With reference to Figure 1, Number 1 indicates as a whole a household appliance comprising a casing 2 which is liable to severe machine vibrations during functioning.

[0015] In particular, in the example shown household appliance 1 is a laundry washing machine 1 comprising a parallelepiped-shaped outer box casing 2 resting on the floor; a cylindrical washing tub 3 which is connected in floating manner to casing 2 by a suspension system 4; and a revolving drum 5 for housing the laundry to be

washed, and which is fitted in rotary manner inside washing tub 3.

[0016] More specifically, in the example shown washing tub 3 is provided with a front opening 3a faced to a corresponding laundry loading and unloading opening (not shown) which is formed in the front face of casing 2 and is selectively closable by a door (not shown) hinged to casing 2; whereas revolving drum 5 is mounted in axially rotating manner inside washing tub 3 about a horizontal rotation axis A.

[0017] As regards suspension system 4, in the example shown it consists of a number of coil springs 6 (only one shown in Figure 1) connecting the washing tub 3 to the upper portion of casing 2, combined with one or more dampers 7.

[0018] With reference to Figure 1, washing machine 1 also comprises an electric motor 8 which is mechanically connected to drum 5 so as to rotate, on command, drum 5 about its longitudinal rotation axis A inside washing tub 3.

[0019] Washing tub 3, revolving drum 5, and the other washing machine component parts suspended from casing 2 via suspension system 4 form the washing assembly of the washing machine.

[0020] With reference to Figure 1, household appliance 1, i.e. washing machine 1 also comprises a vibration damper 9 which is fixed to casing 2 to reduce vibrations transmitted to casing 2 by suspension system 4 as revolving drum 5 rotates.

[0021] More specifically, vibration damper 9 is fixed inside casing 2 and comprises a supporting bar 10 rigidly fixed to casing 2 and extending parallel to a horizontal reference axis B which is preferably, though not necessarily, perpendicular to rotation axis A of drum 5; a first permanent-, or electro- magnet 11 which generates a constant magnetic field and is rigidly fitted to supporting bar 10 with its magnetic poles aligned with reference axis B; and a second electromagnet 12 fitted in sliding manner to supporting bar 10 so as that one of its two magnetic.poles is directly faced to one of the magnetic poles of magnet 11, thus allowing the magnetic field of electromagnet 12 to interact with the magnetic field of magnet 11.

[0022] With reference to figure 1, vibration damper 9 also comprises an electric power unit 13 which is capable to power the induction coil of electromagnet 12 with a variable-frequency alternate current, so that electromagnet 12 generates a variable magnetic field which, interacting with the magnetic field generated by magnet 11, causes a reciprocating movement of electromagnet 12 along supporting bar 10. Magnetic poles having the same magnetic polarity, in fact, tend to push away one from the other, whereas magnetic poles having opposite magnetic polarity tend to attract one to the other.

[0023] Obviously the reciprocating movement of electromagnet 12 along supporting bar 10 causes mechanical vibration which are transmitted to casing 2. The frequency of said mechanical vibrations depends on the frequency of the alternate current supplied to the induction coil of electromagnet 12.

[0024] With reference to figure 1, vibration damper 9 finally comprises an accelerometer 14 or similar sensor capable of determine, instant by instant, the amplitude and frequency spectrum of casing 2 vibrations; and an electronic central control unit 15 which receives the signals from sensor 14 and is capable to determine, instant by instant, the appropriate frequency of the alternate current to be supplied to electromagnet 12 for producing mechanical vibrations in phase-opposition with respect to the mechanical vibrations transmitted to casing 2 via suspension system 4, so as to reduce casing 2 vibrations amplitude in the whole range of the possible rotation speeds of revolving drum 5.

[0025] More specifically, electronic central control unit 15 of vibration damper 9 controls electric power unit 13 for tuning up, instant by instant, the maximum value and frequency of the alternate current supplied to electromagnet 12 according to the actual amplitude and frequency spectrum of casing 2 vibration, for performing a selective damping of casing 2 vibrations while revolving drum 5 is rotating at any speed causing dangerous resonance phenomena and/or causing excessive noise.

[0026] With reference to Figure 1, in the example shown magnet 11 consists of cylindrical-shaped permanent magnet extending coaxial to reference axis B of supporting bar 10, and having its magnetic north pole directly faced to electromagnet 12, whereas electromagnet 12 consists of an upside down L-shaped metallic body 16 having preferably, though not necessarily, ferromagnetic characteristics, and which has its horizontal upper portion 16a fitted in sliding manner to supporting bar 10; and of an induction coil 17 of electrically conducting material, which is rigidly fitted to the vertical lower portion 16b of metallic body 16 so as to generate, when supplied with electric current, a magnetic field which creates on metallic body 16 a magnetic north pole and a magnetic south poles.

[0027] Electric power unit 13 of vibration damper 9 powers induction coil 17 of electromagnet 12 with a variable-frequency alternate current, so that the magnetic north and south poles on metallic body 16 shift their position in synchrony with the alternate current.

[0028] Operation of laundry washing machine 1 and vibration damper 9 can be deduced from the foregoing description with no further explanation required, except to state that vibration damper 9 is able to reduce vibrations amplitude over the whole range of the possible rotation speeds of revolving drum 5. Moreover, being able to tune up the mechanical vibrations of electromagnet 12 with respect to any possible resonant frequency of the washing machine structure, vibration damper 9 eliminates all resonance phenomena.

[0029] The use of vibration damper 9, as described above, has therefore numerous advantages: stability and silenceness of the landry washing machine 1 is strongly increased at any possible rotation speed of revolving

drum 5. In fact, contrary to conventional currently used Frahm dampers (i.e. comprising a small oscillating mass and a number of coil springs) which work fine in a limited frequency range of casing 2 vibrations, operativeness of vibration damper 9 extends to all possible frequencies of casing 2 vibrations.

[0030] Clearly, changes may be made to vibration damper 9 as described herein without, however, departing from the scope of the present invention.

[0031] For example, with reference to Figure 2, according to an alternative embodiment vibration damper 9 may comprise a further electromagnet 18 which is fitted in sliding manner to supporting bar 10, on the opposite side of electromagnet 12 with respect to magnet 11, so as to be faced to the second magnetic pole of magnet 11. In other words, electromagnets 12 and 18 are located on opposite sides of magnet 11.

[0032] Likewise electromagnet 12, electromagnet 18 has one of its two magnetic poles directly faced to one of the magnetic poles of magnet 11 for allowing its magnetic field to interact with the magnetic field of magnet 11; and electric power unit 13 powers the induction coil of electromagnet 18 with a variable-frequency alternate current so that also electromagnet 18 generates a variable magnetic field which, interacting with the magnetic field generated by magnet 11, causes a reciprocating movement of electromagnet 18 along supporting bar 10.

[0033] In which embodiment, electronic central control unit 15 of vibration damper 9 may control electric power unit 13 for tuning up, instant by instant, the alternate current supplied to electromagnet 12 and the alternate current supplied to electromagnet 18 independently one from the other.

[0034] If the alternate current supplied to electromagnet 12 is equal to the alternate current supplied to electromagnet 18, electromagnet 18 moves in synchrony with electromagnet 12 thus the seismic mass is doubled and the amplitude of the mechanical vibrations generated by vibration damper 9 is doubled.

[0035] If the alternate current supplied to electromagnet 12 differs from the alternate current supplied to electromagnet 18, vibration damper 9 generates two mechanical vibrations having two different frequencies, thus allowing a much more accurate dumping of the vibrations transmitted to casing 2 via suspension system 4.

[0036] With reference to Figure 3, in a still further embodiment vibration damper 9 may comprise two supporting bars 10 and 10' which are rigidly fixed to casing 2 one parallel to the other, and each of which extends parallel to a respective horizontal reference axis B, B' which is preferably, though not necessarily, perpendicular to rotation axis A of drum 5; two permanent-, or electro- magnets 11 and 11', each of which generates a constant magnetic field and is rigidly fitted to a respective supporting bar 10 or 10' with its two magnetic poles aligned with reference axis B, B' of the bar; and two electromagnets 12 and 12' fitted in sliding manner to supporting bars 10 and 10' on opposite sides of both magnets 11 and 11', so as that each electromagnet 12, 12' has its two magnetic poles directly faced each to a respective magnetic pole of a different magnet 11, 11', thus allowing the magnetic field of both electromagnets 12 and 12' to interact with the magnetic field of both magnets 11 and 11'.

[0037] More specifically, in the example shown supporting bars 10 and 10' lie, one above the other, on a common vertical plane which is perpendicular to rotation axis A of drum 5, whereas the two permanent-, or electromagnets 11 and 11' are rigidly fixed to supporting bars 10 and 10' vertically aligned one above the other with a specular orientation of the magnetic poles.

[0038] As regards the two electromagnets 12 and 12', each of them consists of a preferably, though not necessarily, ferromagnetic C-shaped metallic body 19 having each of its two end-portions 19a fitted in sliding manner to a respective supporting bar 10, 10', so as to be directly faced to a corresponding permanent-, or electro- magnet 11 or 11'; and of an induction coil 20 of electrically conducting material, which is rigidly fitted to the central portion 19b of metallic body 16 so as to generate, when supplied with electric current, a magnetic field which creates on metallic body 16 a magnetic north pole and a magnetic south pole.

[0039] Also in this embodiment, electric power unit 13 powers the induction coil 20 of each electromagnet 12, 12' with a specific variable-frequency alternate current, so that each electromagnet 12, 12' generates a corresponding variable magnetic field which, interacting with the magnetic fields generated by both magnets 11 and 11', causes a reciprocating movement of the electromagnet 12, 12' along both supporting bars 10 and 10'; whereas electronic central control unit 15 controls electric power unit 13 for tuning up, instant by instant, the alternate current supplied to each of the two electromagnets 12 and 12'.

[0040] If powered with the same alternate current, the two electromagnets 12 and 12' move in synchrony along supporting bars 10 and 10', doubling the seismic mass and, thus, the amplitude of the mechanical vibrations generated by vibration damper.

[0041] If powered with different alternate currents, the two electromagnets 12 and 12' reciprocate along supporting bars 10 and 10' at different frequencies, thus allowing vibration damper 9 to generate two different mechanical vibrations.

[0042] Finally, according to an alternative structure of vibration damper 9, electromagnet/s 12, 12' and 18 may be rigidly fixed to supporting bar/s 10, 10', while permanent-, or electro- magnet/s 11 and 11' may be fitted in sliding manner to supporting bar/s 10 and 10'.

Claims

1. Household appliance (1) comprising a casing (2) subjected to vibrations, and a vibration damper (9) fixed to said casing (2) to reduce casing vibrations;

the household appliance (1) being **characterized in that** said vibration damper (9) comprises:

- a supporting frame (10) rigidly fixed to the appliance casing (2);
- at least a first magnet (11, 11'; 12, 18, 12') rigidly fitted to the supporting frame (10), and
- at least a second magnet (12, 18, 12'; 11, 11') fitted in sliding manner to said supporting frame (10) so as to have one of its magnetic poles faced to one of the magnetic poles of the first magnet (11) for allowing the magnetic field of said second magnet (12, 18, 12'; 11, 11') to interact with the magnetic field of said first magnet (11, 11'; 12, 18, 12');

the first magnet (11, 11'; 12, 18, 12') or the second magnet (12, 18, 12'; 11, 11') being an electromagnet (12, 12', 18), and the vibration damper (9) also comprising:

- electric power means (13) capable to power the induction coil (17, 20) of said electromagnet (12, 12', 18) with an alternate current so as to cause reciprocating movement of the second magnet (12, 18, 12'; 11, 11') along said supporting frame (10), and
- a central control unit (15) which controls the electric power means (13) and is capable to determine, instant by instant, the frequency of the alternate current to be supplied to the induction coil (17, 20) of said electromagnet (12, 12', 18) for producing mechanical vibrations almost in phase-opposition with respect to the mechanical vibrations of the appliance casing (2).

2. Household appliance as claimed in Claim 1, **characterized by** also comprising detecting means (14) capable to determine, instant by instant, the amplitude and frequency spectrum of the mechanical vibrations of the appliance casing (2); the central control unit (15) being connected to said detecting means (14), and being able to determine the frequency of the alternate current to be supplied to the induction coil (17, 20) of said electromagnet (12, 12', 18) on the basis of the amplitude and frequency spectrum of said mechanical vibrations.

3. Household appliance as claimed in any of the foregoing Claims, **characterized in that** the first magnet (11, 11'; 12, 18, 12') or the second magnet (12, 18, 12'; 11, 11') not being an electromagnet (12, 12', 18) is a permanent-magnet (11, 11').

4. Household appliance as claimed in any one of the foregoing Claims, **characterized in that** said second magnet (12, 18, 12'; 11, 11') is able to reciprocate on said supporting frame (10) along an substantially horizontal reference axis (B).

5. Household appliance as claimed in any one of the foregoing Claims, **characterized in that** said vibration damper (9) comprises a couple of second magnets (12, 18, 12'; 11, 11') fitted in sliding manner to said supporting frame (10) on opposite sides of said first magnet (11, 11'; 12, 18, 12').

6. Household appliance as claimed in Claim 5, **characterized in that** said vibration damper (9) comprises a couple of first magnets (11, 11'; 12, 18, 12') located between said second magnets (12, 18, 12'; 11, 11'); each of said first magnets (11, 11' ; 12, 18, 12') being faced to one of the two magnetic poles of each second magnet (12, 18, 12'; 11, 11').

7. Household appliance as claimed in any one of Claims 1 to 4, **characterized in that** said vibration damper (9) comprises a couple of first magnets (11, 11'; 12, 18, 12') fixed to said supporting frame (10) on opposite sides of said second magnet (12, 18, 12'; 11, 11').

8. Household appliance as claimed in any one of the foregoing Claims, **characterized in that** said vibration damper (9) is fixed inside of said casing (2).

9. Household applianceas claimed in any one of the foregoing Claims, **characterized in that** it is a laundry washing machine (1).

10. Household appliance as claimed in Claims 9 and 4, **characterized in that** said washing machine (1) comprises a revolving drum (5) for housing the laundry to be washed, and which is fitted in rotary manner inside the casing (2) about a given rotation axis (A); the reference axis (B) along which the second magnet (12, 18, 12'; 11, 11') reciprocates, being substantially perpendicular to said rotation axis (A).

Patentansprüche

1. Haushaltsgerät (1), umfassend ein Gehäuse (2), das Schwingungen unterworfen ist, und einen an dem Gehäuse (2) befestigten Schwingungsdämpfer (9), um die Schwingungen des Gehäuses zu reduzieren, wobei das Haushaltsgerät (1) **dadurch gekennzeichnet ist, dass** der Schwingungsdämpfer (9) umfasst:

- einen Tragrahmen (10), der starr an dem Gehäuse (2) des Geräts befestigt ist;
- mindestens einen ersten Magneten (11, 11'; 12, 18, 12'), der starr an dem Tragrahmen (10) angebracht ist, und
- mindestens einen zweiten Magneten (12, 18,

12’; 11, 11’), der schiebbar an dem Tragrahmen (10) angebracht ist, derart, dass einer seiner Magnetpole einem der Magnetpole des ersten Magneten (11) gegenüberliegt, um es dem Magnetfeld des zweiten Magneten (12, 18, 12’; 11, 11’) zu ermöglichen, mit dem Magnetfeld des ersten Magneten (11, 11’; 12, 18, 12’) zu interagieren;
wobei der erste Magnet (11, 11’; 12, 18, 12’) oder der zweite Magnet (12, 18, 12’; 11, 11’) ein Elektromagnet (12, 12’, 18) ist, und wobei der Schwingungsdämpfer (9) auch Folgendes umfasst:

- Stromversorgungsmittel (13), die geeignet sind, die Induktionsspule (17, 20) des Elektromagneten (12, 12’, 18) mit einem Wechselstrom zu versorgen, um eine hin- und hergehende Bewegung des zweiten Magneten (12, 18, 12’; 11, 11’) entlang dem Tragrahmen (10) hervorzurufen, und
- eine zentrale Steuereinheit (15), die die Stromversorgungsmittel (13) steuert und geeignet ist, von Augenblick zu Augenblick die Frequenz des Wechselstroms zu bestimmen, der der Induktionsspule (17, 20) des Elektromagneten (12, 12’, 18) zuzuführen ist, um mechanische Schwingungen zu erzeugen, die in Bezug auf die mechanischen Schwingungen des Gehäuses (2) des Geräts annähernd gegenphasig sind.

2. Haushaltsgerät nach Anspruch 1, **dadurch gekennzeichnet, dass** es auch Erkennungsmittel (14) umfasst, die geeignet sind, von Augenblick zu Augenblick das Amplituden- und Frequenzspektrum der mechanischen Schwingungen des Gehäuses (2) des Geräts zu bestimmen; wobei die zentrale Steuereinheit (15) mit den Erkennungsmitteln (14) verbunden ist und geeignet ist, auf der Basis des Amplituden- und Frequenzspektrums der mechanischen Schwingungen die Frequenz des Wechselstroms zu bestimmen, der der Induktionsspule (17, 20) des Elektromagneten (12, 12’, 18) zuzuführen ist.

3. Haushaltsgerät nach einem der vorhergehenden Ansprüche, **dadurch gekennzeichnet, dass** der erste Magnet (11, 11’; 12, 18, 12’) oder der zweite Magnet (12, 18, 12’; 11, 11’), der kein Elektromagnet (12, 12’, 18) ist, ein Permanentmagnet (11, 11’) ist.

4. Haushaltsgerät nach einem der vorhergehenden Ansprüche, **dadurch gekennzeichnet, dass** der zweite Magnet (12, 18, 12’; 11, 11’) geeignet ist, an dem Tragrahmen (10) entlang einer im Wesentlichen horizontalen Bezugsachse (B) eine hin- und hergehende Bewegung auszuführen.

5. Haushaltsgerät nach einem der vorhergehenden Ansprüche, **dadurch gekennzeichnet, dass** der Schwingungsdämpfer (9) ein Paar zweiter Magneten (12, 18, 12’; 11, 11’) umfasst, die an Seiten, die dem ersten Magneten (11, 11’; 12, 18, 12’) entgegengesetzt sind, schiebbar an dem Tragrahmen (10) angebracht sind.

6. Haushaltsgerät nach Anspruch 5, **dadurch gekennzeichnet, dass** der Schwingungsdämpfer (9) ein Paar erster Magneten (11, 11’; 12, 18, 12’) umfasst, die zwischen den zweiten Magneten (12, 18, 12’; 11, 11’) angeordnet sind; wobei jeder der ersten Magneten (11, 11’; 12, 18, 12’) einem der zwei Magnetpole jedes zweiten Magneten (12, 18, 12’; 11, 11’) gegenüberliegt.

7. Haushaltsgerät nach einem der Ansprüche 1 bis 4, **dadurch gekennzeichnet, dass** der Schwingungsdämpfer (9) ein Paar erster Magneten (11, 11’; 12, 18, 12’) umfasst, die am Tragrahmen (10) an Seiten befestigt sind, die dem zweiten Magneten (12, 18, 12’; 11, 11’) entgegengesetzt sind.

8. Haushaltsgerät nach einem der vorhergehenden Ansprüche, **dadurch gekennzeichnet, dass** der Schwingungsdämpfer (9) innerhalb des Gehäuses (2) befestigt ist.

9. Haushaltsgerät nach einem der vorhergehenden Ansprüche, **dadurch gekennzeichnet, dass** es eine Wäschewaschmaschine (1) ist.

10. Haushaltsgerät nach den Ansprüchen 9 und 4, **dadurch gekennzeichnet, dass** die Waschmaschine (1) eine sich drehende Trommel (5) umfasst, die die zu waschende Wäsche aufnimmt und in dem Gehäuse (2) drehbar um eine gegebene Drehachse (A) montiert ist; wobei die Bezugsachse (B), an der sich der zweite Magnet (12, 18, 12’; 11, 11’) hin- und herbewegt, im Wesentlichen senkrecht zu der Drehachse (A) ist.

Revendications

1. Appareil domestique (1) comprenant un boîtier (2) soumis à des vibrations, et un amortisseur de vibrations (9) fixé audit boîtier (2) pour réduire les vibrations du boîtier ; l’appareil domestique (1) étant **caractérisé en ce que** ledit amortisseur de vibrations (9) comprend :

- un cadre de support (10) fixé de façon rigide au boîtier de l’appareil (2) ;
- au moins un premier aimant (11, 11’ ; 12, 18, 12’) ajusté de façon rigide au cadre de support (10),

et

- au moins un deuxième aimant (12, 18, 12' ; 11, 11') ajusté de façon coulissante audit cadre de support (10) de sorte à avoir un de ses pôles magnétiques tourné vers l'un des pôles magnétiques du premier aimant (11) pour permettre au champ magnétique dudit deuxième aimant (12, 18, 12' ; 11, 11') d'interagir avec le champ magnétique dudit premier aimant (11, 11' ; 12, 18, 12') ;

le premier aimant (11, 11' ; 12, 18, 12') ou le deuxième aimant (12, 18, 12' ; 11, 11') étant un électroaimant (12, 12', 18), et l'amortisseur de vibrations (9) comprenant également :

- un moyen d'alimentation électrique (13) capable d'alimenter la bobine d'induction (17, 20) dudit électroaimant (12, 12', 18) avec un courant alternatif de sorte à créer un mouvement de va-et-vient du deuxième aimant (12, 18, 12' ; 11, 11') le long dudit cadre de support (10), et
- une unité de commande centrale (15) qui commande le moyen d'alimentation électrique (13) et est capable de déterminer, instant par instant, la fréquence du courant alternatif à fournir à la bobine d'induction (17, 20) dudit électroaimant (12, 12' ; 18) pour produire des vibrations mécaniques presque en opposition de phase par rapport aux vibrations mécaniques du boîtier de l'appareil (2).

2. Appareil domestique selon la revendication 1, **caractérisé en ce qu'**il comprend également un moyen de détection (14) capable de déterminer, instant par instant, le spectre d'amplitude et de fréquence des vibrations mécaniques du boîtier de l'appareil (2) ; l'unité centrale de commande (15) étant connectée audit moyen de détection (14) et étant capable de déterminer la fréquence du courant alternatif à fournir à la bobine d'induction (17, 20) dudit électroaimant (12, 12', 18) sur la base du spectre d'amplitude et de fréquence desdites vibrations mécaniques.

3. Appareil domestique selon l'une quelconque des revendications précédentes, **caractérisé en ce que** le premier aimant (11, 11' ; 12, 18, 12') ou le deuxième aimant (12, 18, 12' ; 11, 11') qui n'est pas un électroaimant (12, 12', 18) est un aimant permanent (11, 11').

4. Appareil domestique selon l'une quelconque des revendications précédentes, **caractérisé en ce que** ledit deuxième aimant (12, 18, 12' ; 11, 11') est capable d'effectuer un mouvement de va-et-vient sur ledit cadre de support (10) le long d'un axe de référence sensiblement horizontal (B).

5. Appareil domestique selon l'une quelconque des revendications précédentes, **caractérisé en ce que** ledit amortisseur de vibrations (9) comprend un couple de deuxièmes aimants (12, 18, 12' ; 11, 11') ajustés de manière coulissante audit cadre de support (10) sur des côtés opposés dudit premier aimant (11, 11' ; 12, 18, 12').

6. Appareil domestique selon la revendication 5, **caractérisé en ce que** ledit amortisseur de vibrations (9) comprend un couple de premiers aimants (11, 11' ; 12, 18, 12') situés entre lesdits deuxièmes aimants (12, 18, 12' ; 11, 11') ; chacun desdits premiers aimants (11, 11' ; 12, 18, 12') étant tourné vers l'un des deux pôles magnétiques de chaque deuxième aimant (12, 18, 12' ; 11, 11').

7. Appareil domestique selon l'une quelconque des revendications 1 à 4, **caractérisé en ce que** ledit amortisseur de vibrations (9) comprend un couple de premiers aimants (11, 11' ; 12, 18, 12') fixés audit cadre de support (10) sur des côtés opposés dudit deuxième aimant (12, 18, 12' ; 11, 11').

8. Appareil domestique selon l'une quelconque des revendications précédentes, **caractérisé en ce que** ledit amortisseur de vibrations (9) est fixé à l'intérieur dudit boîtier (2).

9. Appareil domestique selon l'une quelconque des revendications précédentes, **caractérisé en ce qu'**il s'agit d'une machine à laver le linge (1).

10. Appareil domestique selon les revendications 9 et 4, **caractérisé en ce que** ladite machine à laver (1) comprend un tambour rotatif (5) pour loger le linge à laver, et qui est ajusté de manière rotative à l'intérieur du boîtier (2) autour d'un axe de rotation donné (A) ; l'axe de référence (B) le long duquel le deuxième aimant (12, 18, 12' ; 11, 11') effectue un mouvement de va-et-vient, étant sensiblement perpendiculaire audit axe de rotation (A).

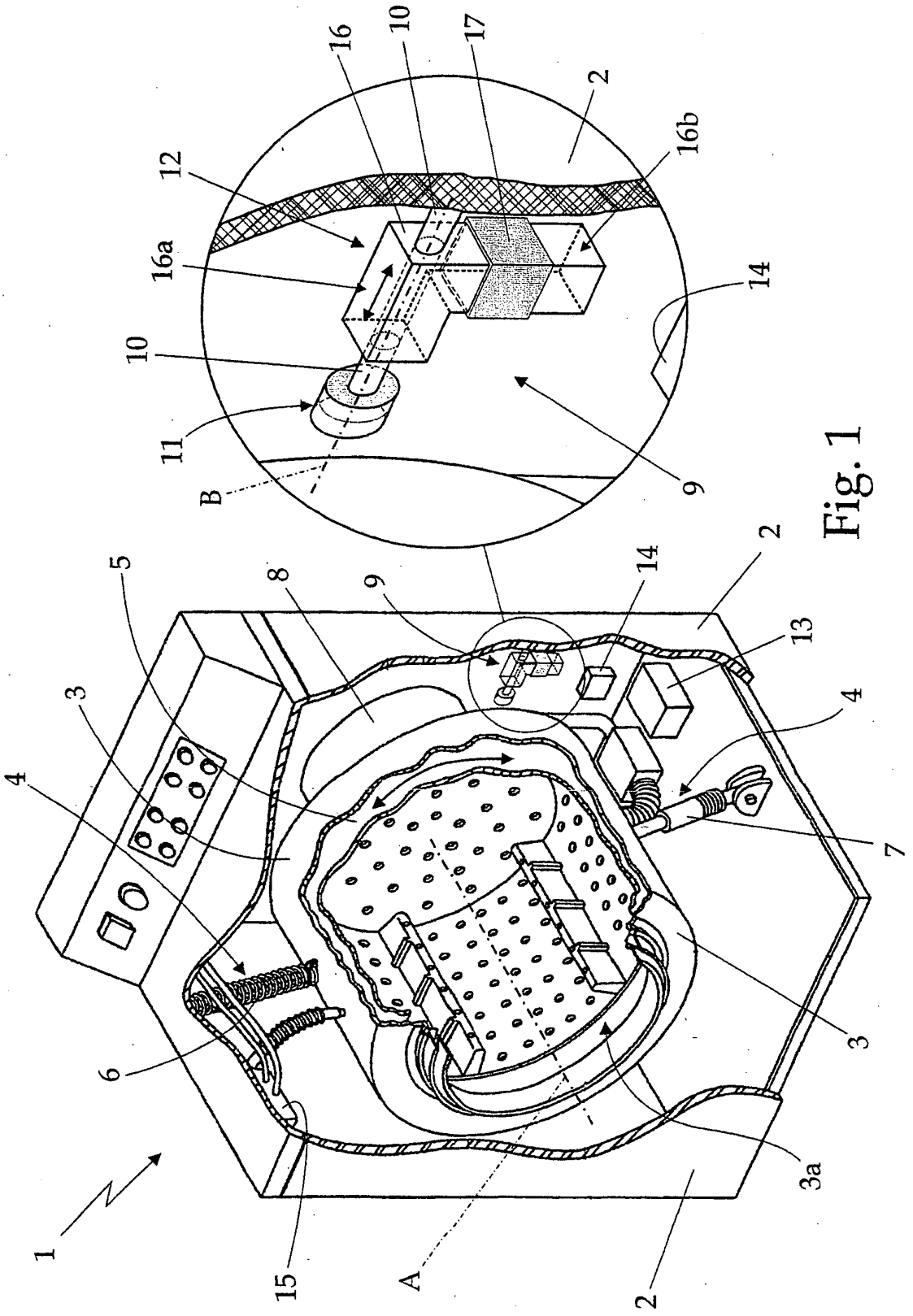


Fig. 1

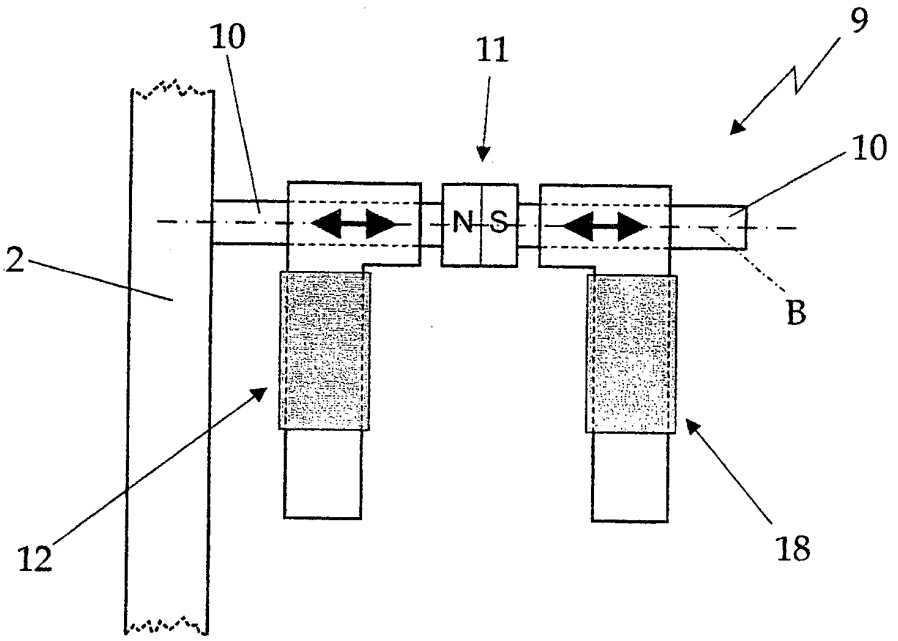

10
11
9
10
N
S
2
B
12
18

Fig. 2

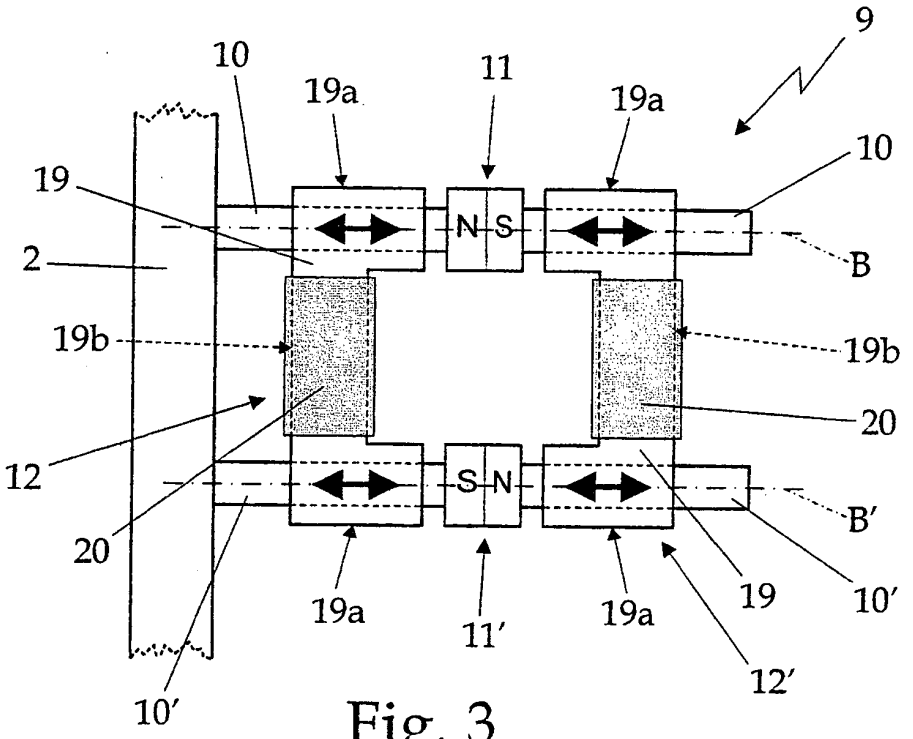

9
10
19a
11
19a
10
19
N
S
2
B
19b
19b
20
12
S
N
B′
20
19a
11′
19a
19
10′
12′
10′

Fig. 3

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

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