(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) **EP 1 988 206 A1**

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
**05.11.2008 Bulletin 2008/45**

(51) Int Cl.:
***D06F 37/20*** *(2006.01)* ***D06F 39/00*** *(2006.01)*

(21) Application number: **07107413.2**

(22) Date of filing: **03.05.2007**

(84) Designated Contracting States:
**AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HU IE IS IT LI LT LU LV MC MT NL PL PT RO SE SI SK TR**
Designated Extension States:
**AL BA HR MK RS**

(71) Applicant: **Electrolux Home Products Corporation N.V.**
**1930 Zaventem (BE)**

(72) Inventor: **Casagrande, Stefano**
**33091 Vito d'Asio (Pordenone) (IT)**

(74) Representative: **Gonella, Mario et al**
**PROPRIA S.r.l.**
**P.O. Box 365**
**Via della Colonna, 35**
**33170 Pordenone (IT)**

# (54) Washing machine with improved sensor for load weight

(57) Washing machine comprising an outer casing housing (1) an oscillating washing assembly (2) suspended elastically to said casing through at least a spring (3,4), at least a vibration-damping strut (5,50) placed between an outer portion of said washing assembly and a respective anchoring point which is connected, even elastically, to said casing, measurement means (12) able of measuring the excursion of the washing assembly, and able of generating and transferring a signal representative of the vertical excursion of the washing assembly; said casing is provided, preferably on the lower part if it, with elastic means (7,8,77,88,52) able of assuming a predetermined resting position, and said excursion measurement means are applied between a definite point (13) firmly connected to said casing, and a predefined position of said elastic means. An end part of said damping strut is engaged to a lower portion (6) of said washing assembly, while the opposite end part of the same damping strut is engaged to an anchoring point (5A,55) placed on said elastic means.

In a preferred embodiment said elastic means comprise two springs, preferably spirally shaped, which are independent, aligned, vertically oriented, connected to each other between the two respectively facing sides (7B,8B); the opposed extremes of said two springs are solidly connected to respective distinct portions of said casing.

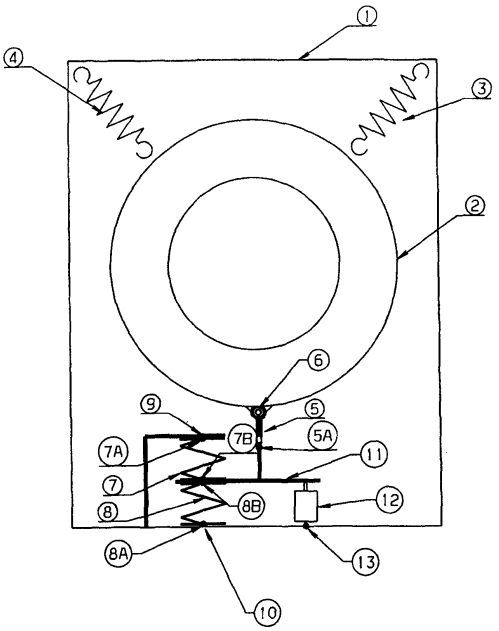



FIG. 1

EP 1 988 206 A1

## Description

**[0001]** The present invention refers to a washing machine, such as a clothes washing machine or a combined clothes washing and drying machine, provided with means adapted to measure the weight of the clothes loaded in a washing assembly that is suspended elastically to the framework of the machine with the aid of spring means such as vibration dampers or the like.

**[0002]** In the prior art some solutions are known, which are provided with means able of detecting the load weight, and that are based on sensors of various types, well known, comprising sensors functioning by magnetostriction, also called load cells, as for example US 6, 460,381, or capacitive elements as in US 4,742,698, or still simpler elements which are representative of an excursion, obviously associated to suitable spring means.

**[0003]** The patent GB 2087438 divulgates a conventional solution, in which the washing machine is provided with a washing tub mounted with sensor and transducer means providing an information on the tub weight, and, by subtraction, on the washing load weight.

**[0004]** Also the patent (published.) EP 1264925 divulgates a washing machine with a cabinet, provided with supporting feet, and lodging a washing assembly elastically suspended to the machine structure through at least a damper, and comprising at least a displacement sensor of said washing assembly, wherein said sensor is interposed between said dumper and the machine structure, upstream of said supporting feet, in such a way to detect the weight variations of the washing assembly independently of the damper braking force and of the machine weight.

**[0005]** All said solutions, even if theoretically effective and functional, however in practice they have been not extensively and appreciably used for the following common drawback: when these sensor means are activated , they supply an information which is a function of the absolute vertical position of the tub, due to the fact that said absolute vertical position is a function of the contrasting actions between the tub total weight, drum and load included, and the action of the elastic support of the sustaining springs, it comes out that the load weighting becomes extremely uncertain.

**[0006]** As a matter of facts the load weight is normally only a small fraction of the tub overall weight, drum included, and so the obvious variations in the actual tub weight, due to a natural variations of the various constructive factors which are unavoidably involved, and whose overall amount is really unknown, prevents a precise exact load measurement, whose actual value is being as "masked" by said variations.

**[0007]** If however one wishes to reduce such a drawback by detecting an initial reference measurement related to the weight of the empty tub, and then to proceed to detect the load weight by measuring the further excursion after the load introduction, the following drawback is experienced, which is raised by the circumstance that the excursion of the sensor, actually used, shall vary on a quite wide excursion range.

**[0008]** However such a requirement, as well known to the man skilled in the art, turns to be always very complicate and particularly expensive, whatever is the technology and the kind of device which are normally used for the choose excursion sensor.

**[0009]** It therefore is a purpose of the present invention to provide a washing machine equipped with weight measurement means of the wash-load, based on the tub excursion, in which the typical above explained drawbacks encountered in the prior art are minimized.

**[0010]** In particular, it is a purpose of the present invention to provide a washing machine of the above specified kind, which is adapted to measure the wash-load with an high precision level and in a reliable manner, using a less expensive solution.

**[0011]** According to the present invention, these and further aims are reached in a washing machine with a weight detecting means embodying the features and characteristics as defined and recited in the appended claims.

Features and advantages of the present invention may anyway be more readily understood from the description that is given below by way of non-limiting example with reference to the accompanying drawings, in which:

- Figure 1 is a schematic view of a washing machine according to the present invention;
- Figure 2 is an enlarged view of a detail of the weight detecting means of the washing machine, according to a first embodiment thereof;
- Figure 3 is a view of a different embodiment of the weight detecting means shown in Figure 2.
- Figure 4 is a diagrammatical view of the characteristic curve force/elongation of the spring 2 shown in fig. 2,
- Figure 5A and 5B are respective vertical front view and perspective view of a further embodiment of the invention.
- Fig. 6 is an enlarged view of an improved embodiment of the weight detecting means according to the invention.

**[0012]** With particular reference to the above mentioned Figures 1 and 2, the washing machine according to the invention, both top-loader and front-loader, is comprising an outer casing 1 that houses an oscillating tub 2 which is elastically suspended to the framework of the washing machine by means of springs 3 and 4, which elastically support said tub with respect to said casing in a known way, and a damping strut 5 placed between an outer portion 6 of said tub and an anchoring point 5A whose exact position is here explained: said casing 1 is provided on its lower portion with a couple of springs 7, 8 which are preferably spiralled shaped, are independent, in the meaning that they are distinct, aligned, vertically oriented, and connected to each other by the two

respectively facing sides 7B, 8B.

**[0013]** The opposite extremes 7A, 8A of said two springs 7, 8 are fixed, obviously on a vertical position each other, in respective distinct and vertical portions 9, 10, which are solid with said casing 1.

**[0014]** An horizontally extending position arm 11 is connected to said two opposite sides 7B, 8B of said two springs 7, 8 which then coincide in the same physical point ,even if its position is variable.

**[0015]** Said anchoring point 5A of said damping strut 5 is identified on said position arm 11.

**[0016]** A means 12 to measure the excursion is being mounted between said position arm 11 and a different specific point 13 of said cabinet; said means 12 is vertically placed below or above said arm 11; said measurement means may be any type among a number of types which are available in the prior art and, being not a part of the instant invention, is not further explained.

**[0017]** The information generated by said measurement means 12, and which detects the vertical position of said two facing sides 7B and 8B is sent to a command and control unit, not shown, able of processing the signals received according to the following logic:

**[0018]** Before of beginning the drying, and before of introducing the wash-load into the drum, the tub/drum assembly net weight, obviously without the weight of a possible water load, is supported by the overall action of said springs 3 and 4 and by said springs 7 and 8; however said springs 7 and 8 reciprocally settle in an equilibrium position, spontaneously reacting to the force therein driven.

**[0019]** However said force cannot be stronger than the friction force of said damping strut 5, as otherwise the force impressed by said portion 6 on said damping strut 5 would be transferred by the same damping strut, which would accordingly change its own inner configuration; the force that is then actually transmitted on said position arm 11 is the minimum force, and as a consequence the position arm takes a resting position, which is detected and transmitted by said excursion sensor 12.

**[0020]** So such a signal is able to provide the information of a position corresponding to the configuration which is automatically taken by said damping strut with the tub empty; as a conclusion the signal of said sensor 12 may be taken as a reference signal with the no bath in the tub.

**[0021]** When the wash-load is being introduced inside the drum, said portion 6 of the tub will press on said damping strut 5, which obviously tends to take a shorter length, due to the elastic reaction acting on the position arm 11; however such an effect is only valid until the elastic reaction of the arm 11 is stronger than the friction resistance of the damping strut 5; as a matter of facts when the force acting on the damper 5 due to the effect of the load weight becomes smaller than the friction force of the same damper, this transfers rigidly such a force on the position arm 11, which consequently acts on said two springs 7 and 8; these then allow the same arm 11 to assume a final position duly detected by the same excursion sensor 12 .

**[0022]** Therefore, by properly adjusting the friction forces of said damping strut 5, and the forces of said springs 7 and 8, a situation can be achieved wherein it is possible to find a relationship linking the sensor excursion, i. e. the distance between the sensor initial position with the tub empty and the position after load introduction, due to the load effect, to the load weight.

**[0023]** It can be then obtained a method for a simple, reliable and not expensive weighting of a wash-load inside the drum.

**[0024]** The advantage of such a method and of the related means consists in that the sensor excursion can be only ascribed to the wash-load weight and not to the tub weight , so eliminating the complained effect of "load masking" and as a conclusion obtaining a properly precise measurement.

**[0025]** Moreover, due to the intrinsic precision of said measurement means, it can be obtained an even very limited operating excursion of said sensor 12 , which however can be accepted.

**[0026]** And therefore, with a limited working excursion, the invention ultimate purpose is achieved, consisting in using a position sensor which is reliable, and still very cheap.

**[0027]** The described solution suggests some advantageous improvements:

the first improvement consists in the following: in order to make sure that with the tub empty said damper will automatically self-regulate so to exert the minimum force on said springs 7 and 8, then before of introducing the wash-load into the drum, a short drum rotation step is carried out, the tub being still empty; therefore, after said rotation step, and so after the consequent drum shaking, it may be reasonably supposed that said dumper is being submitted to a force which is smaller then its force of initial friction, i. e. to a minimum force which is the force exerted by said springs 7, 8 in resting conditions; said force can also be zero, when the tub is perfectly and only supported by said spring 3, 4, and as a consequence is in an equilibrium position.

**[0028]** In these conditions, the relevant tub position is duly detected and taken as a reference position by the sensor 12.

**[0029]** The second improvement consists in the fact (see fig. 3), that the braking action on the tub 1 is using not one damping strut 5 only, but two separate dampers 5 and 50,which are placed in respective positions which are basically symmetrical with respect to a vertical plane passing through the same tub centre; of course in such a case the second damper 50 is provided with a respective couple of springs 70 and 80, and with a relevant position arm 110, and of with associated devices, in a substantially symmetrical way to what applicable to the first damper 5, with exception that no related position

sensor is associated to said second damper 50.

**[0030]** Such an improvement allows to balance the tub behaviour during the operation, and mainly during the initial steps for tub alignment, with the tub empty, and for the successive wash-load weighting.

**[0031]** The third improvement consists in providing said springs 7, 8 with an initial total force which is smaller, but only a little smaller, of the initial friction force of the damper; with ref. to fig. 4, it is desirable that the friction force "fa" be stronger than the reaction force "fr" of said springs so that the excursion, from which the was-load weight is measured, be the widest possible, even if it has to be limited by the existing costs constraints.

**[0032]** In the facts in this case the advantage can be exploited that during the initial aligning step for the initial tub position, and also without such alignment, the position of the tub itself is determined with a suitable precision, overcoming the predicted inaccuracies due to the normal variability of the initial friction force of the damper.

**[0033]** As a matter of facts, if by absurd the spring forces would be absolutely relevant and prevailing, one would obtain that the tub position would be detected with absolute precision; however in said case it would be impossible to detect the wash-load weight, as the variation of the position of the position arm 11 would be not sensibly affected.

**[0034]** On the contrary, if the damper friction force would be largely stronger than the spring elastic forces, then the load weight would generate a long sensor excursion, which is not compatible with the purpose of cost containment.

**[0035]** A fourth improvement consists in providing the washing machine with suitable command and control means able of automatically carrying out said rotation step of the drum, as soon as the machine is being switched on; moreover at this time the drum is being automatically blocked in closing position.

**[0036]** The fifth improvement consists in making said couples of springs 7, 8 and 70, 80, as if a sole spring showing the same features and working properties of the respective two springs it is intended to substitute.

**[0037]** The relevant position arm may be therefore connected in a solid manner to a proper intermediate portion of said sole spring, using connecting means well known in the art.

**[0038]** A further improvement is represented in fig. 6; there is shown that the springs, which are used in the invention, are two separate, independent and vertically aligned springs 77, 88 with a respective facing sides 77B and 88B; said facing sides are connected to a support base 79, which is solidly linked to said casing 1.

**[0039]** The two opposite sides 77A and 88A of said springs are inter-connected by a rod 83, sliding inside said support base 79, without interfering with them, so as, if the end side 77A or 88A is being pressed, or axially pulled, said force is automatically transferred to the other spring, which is forced by a kind of stress which is exactly the contrary, as one can easily imagine.

**[0040]** In this case the position arm 11 is placed in the common position of the anchoring point 5A of the dumping strut 5 with the corresponding outer side 77A of the spring 77; of course even in this case the position sensor 12 is applied between said arm 11 and a point 130 firm to the casing 1.

**[0041]** The embodiments up to now discussed, though simple and effective, however can show some encumbrance, and still not fully satisfactory costs, due to the use of a spiral spring; an improved embodiment aimed to achieve further results both for the encumbrance and for the cost is schematically shown in fig. 5.

**[0042]** It is possible to observe that a base element 50 is provided, which is shaped as a flat plate and formed with an empty , i.e. deprived of material, inner zone 51; a flat portion 52 protrudes out from an internal edge 53 of said base element and extends inside said inner zone 51.

**[0043]** In practice, said portion 52 projects into said inner empty zone 51, however basically laying on the same plane.

**[0044]** The damper 5 is connected with its higher portion with the outer portion 6 of said tub 2, as in the previously described case, while its lower portion 54 is connected to a point 55 of the outer edge of said flat portion 52.

**[0045]** The excursion sensor 12 is connected to the ring-shaped portion of said base element 50, and is normally provided with a touching finger 18; according to the present embodiment, the central body of said sensor 12 is firmly connected to a point 14 placed in the outer ring-shaped zone of said base element 50, while the lower end of said touching finger 18 is applied against a position 16 of said flat portion which comprises the position arm 11 as previously defined; as a matter of facts, in the present case said flat portion is working both as said arm 11, and as said two springs.

**[0046]** Preferably said position 16 is placed close to the edge which is the farthest from said internal edge 53 on which said flat portion 52 is fixed.

**[0047]** Said base element is finally firmly connected to the machine frame, and particularly to its pedestal.

**[0048]** Now it will be clear to the man skilled in the art that such embodiment is fully equivalent, from the functional point of view, to the previously described embodiments; as a matter of facts the sole apparent constructional difference refers only to the substitution of the two springs 7 and 8, aligned and facing each other on a common side, with the flat protruding portion 52.

**[0049]** However such constructional difference doesn't change the operation of this excursion sensor, as said portion 52 is made of a flexible material, whose said edge 16 can be elastically bended both upwards and downwards.

**[0050]** As said portion 52 can assume a defined resting position, when it is being forced vertically, up or down, it tends to elastically return to said resting position, which is here assumed as a reference position with the drum

empty.

**[0051]** When the drum is filled with the wash-load, its weight increases accordingly, and said increase is being transferred to the tub. The increased tub weight pushes the damper downwards, which to its time, if its initial friction resistance is stronger than the initial spring reaction, will push said elastic flat portion 52 away from said resting reference position and downwards, showing a position drift which is a function of the wash-load; said position drift is then immediately obviously detected by said excursion sensor 12.

**[0052]** As a conclusion, said elastic flat portion 52, and as a consequence said excursion sensor 12, will provide an information which is a true function of the actual wash-load weight.

## Claims

1. Washing machine comprising an outer casing provided with a casing (1) housing an oscillating washing assembly (2) suspended elastically to said casing through at least a spring (3, 4), at least a vibration-damping strut (5, 50), placed between an outer portion of said washing assembly and a respective anchoring point which is fixed, also elastically fixed to said casing, measurement means (12) able of measuring the excursion of said washing assembly (2), and able of generating and transferring a signal representative of the vertical component of the washing assembly excursion, **characterized in that**:

   said casing is provided on a part of it, and preferably on the lower part if it, with elastic means (7, 8, 77, 88, 52) able of taking a predetermined resting position, said excursion measurement means (12) are applied between a definite point (13) which is firmly connected to said casing, and a predefined position arm (11) linked to said elastic means (7, 8, 77, 88, 52), a terminal part of said damping strut (5) is engaged to a lower portion (6) of said washing assembly, while the opposite terminal part of the same damping strut, to an anchoring point (5A, 55) connected to said position arm (11).

2. Washing machine according to claim 1, **characterized in that** said elastic means comprise two springs (7, 8), preferably spirally shaped, which are independent, aligned, vertically oriented, connected to each other between the two respectively facing sides (7B, 8B), **in that** the opposed extremes (7A, 7B) of said two springs are solidly connected to respective distinct portions (9, 10) of said casing, and **in that** said position arm (11) is connected to said facing sides (7B, 8B) of said respective springs (7, 8).

3. Washing machine according to claim 1, **characterized in that** said elastic means comprise two springs (77, 78), preferably spirally shaped, which are independent, aligned, vertically oriented, connected to each other between the two respective facing sides (77B, 88B) which are solidly connected to a support means (79) which is fixed to said casing, **in that** the end sides (77A, 88A) of said two springs are solidly connected to respective ends of a rod (83), one (77A) of said end sides being connected to said position arm (11).

4. Washing machine according to claim 1, **characterized in that** said elastic means comprise a flat elastic portion (52) protruding from an inner edge (53) of a base element (50) which is solidly connected to said casing (1), and **in that** said measurement means, able of measuring the excursion of said sensor (12), are provided with a finger (18) whose sensing end is in contact to a defined point (15) of said flat elastic portion (52).

5. Washing machine according to one of the previous claims, **characterized in that** the component, which is oriented parallel to the respective damping strut, of the initial activating force for said elastic means, is stronger than the initial friction force of said respective dumping strut (5, 50).

6. Washing machine according to claim4, **characterized in that** said component of said initial activating force is just a little stronger than said initial friction force.

7. Washing machine according to claim 2, **characterized in that** said two springs (7, 8) are realized by a sole spring, connected in a respective intermediate point with said position arm (11).

8. Washing machine according to any of the previous claims, **characterized in that**:

   said measuring means are able of transmitting the information, generated by said position sensor (12) relevant to the position of said elastic means, to suitable processing means, and that said processing means are able to correlate said information to the actual wash-load weight.

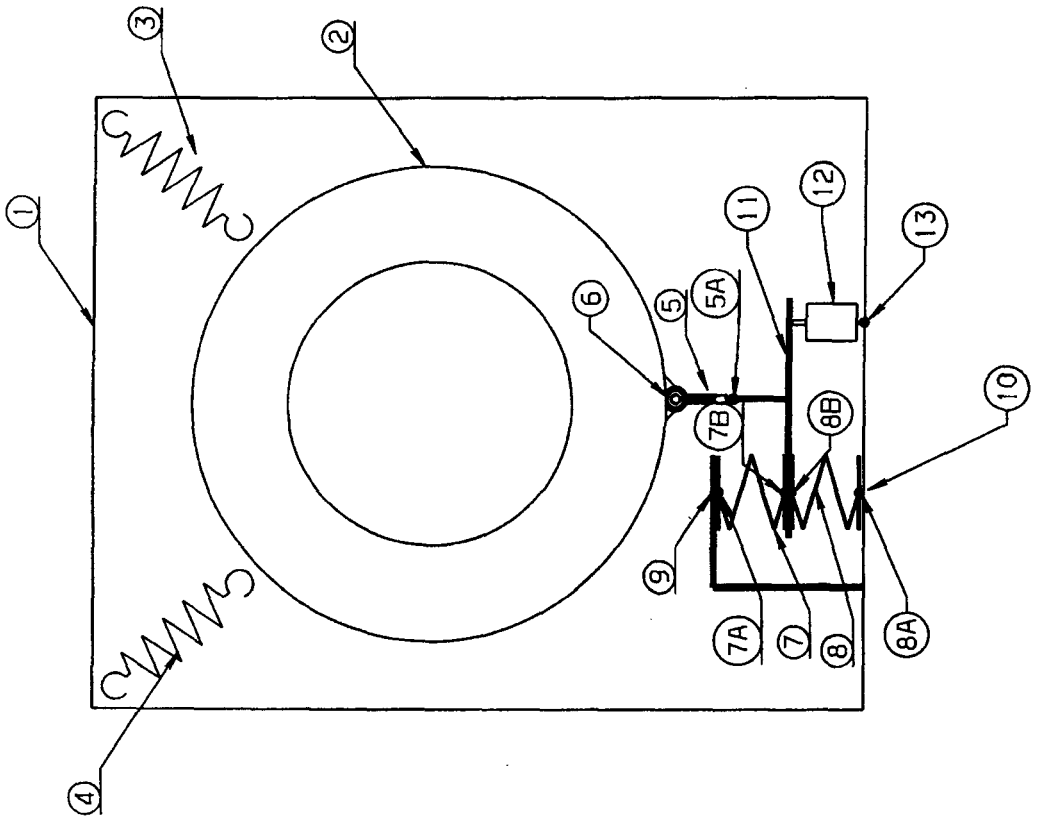



FIG. 1

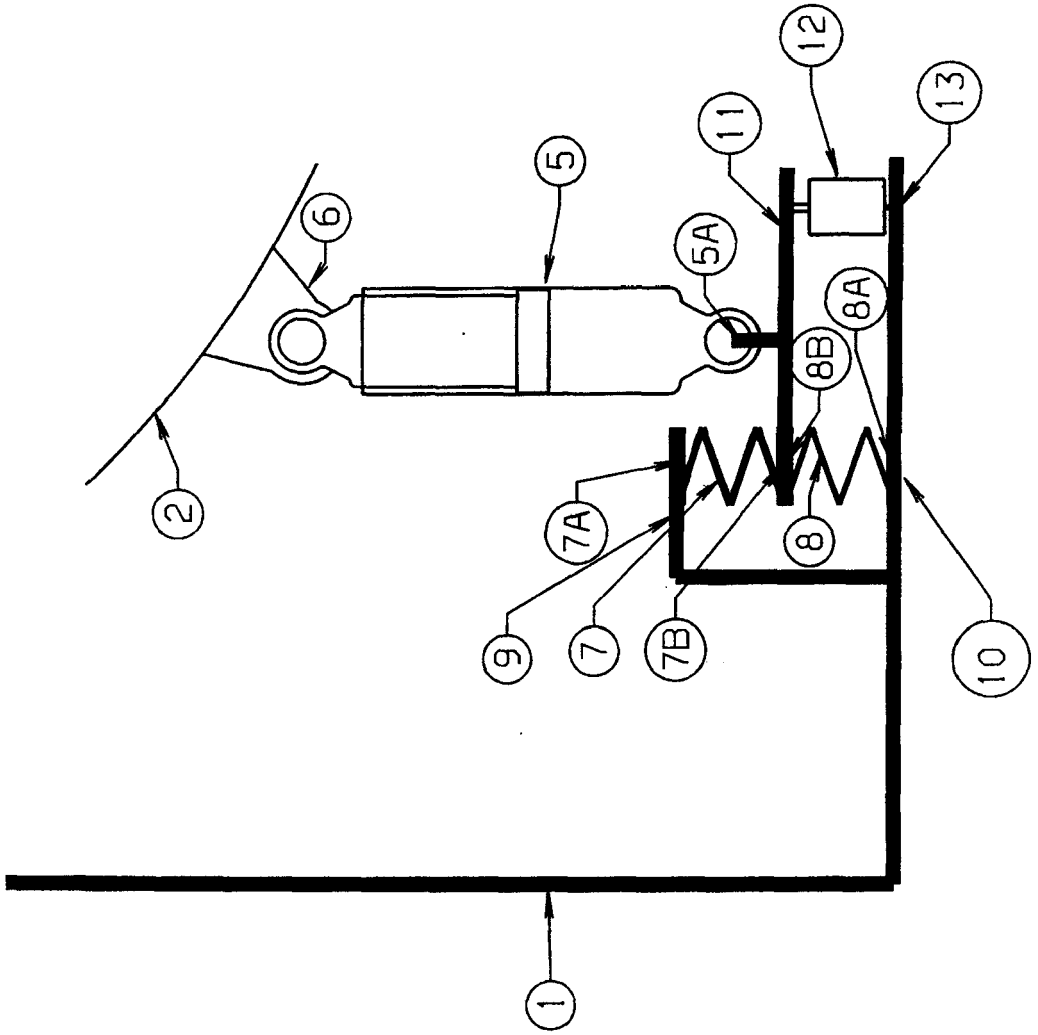
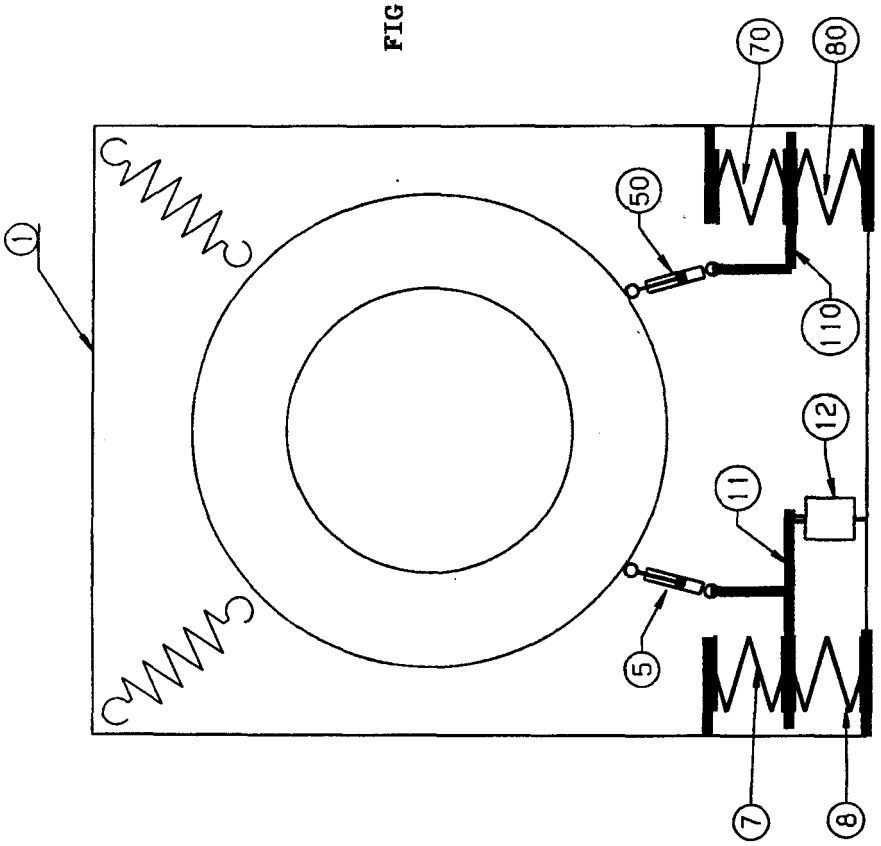



Fig. 2

FIG. 3



**Appendix 2**

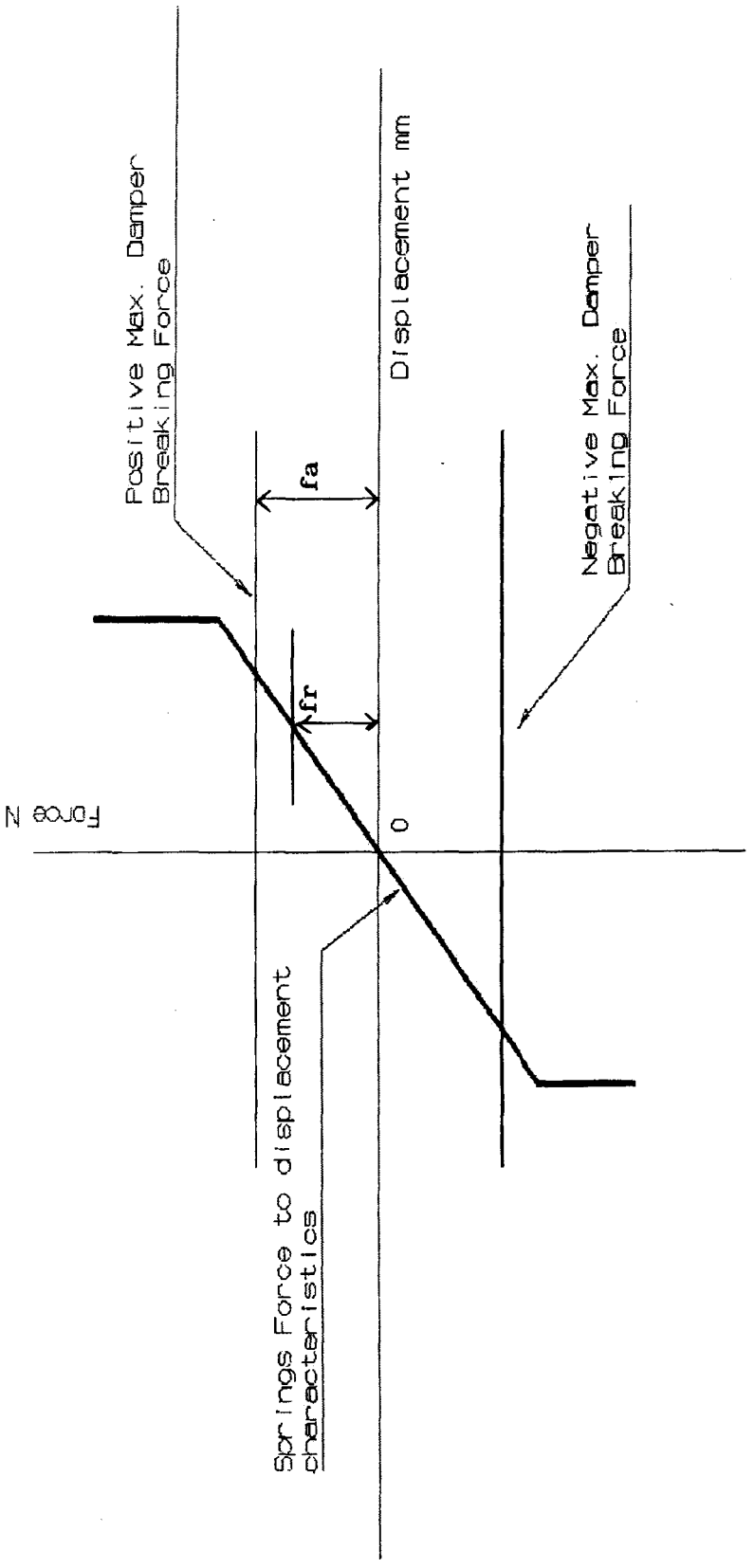



FIG. 4

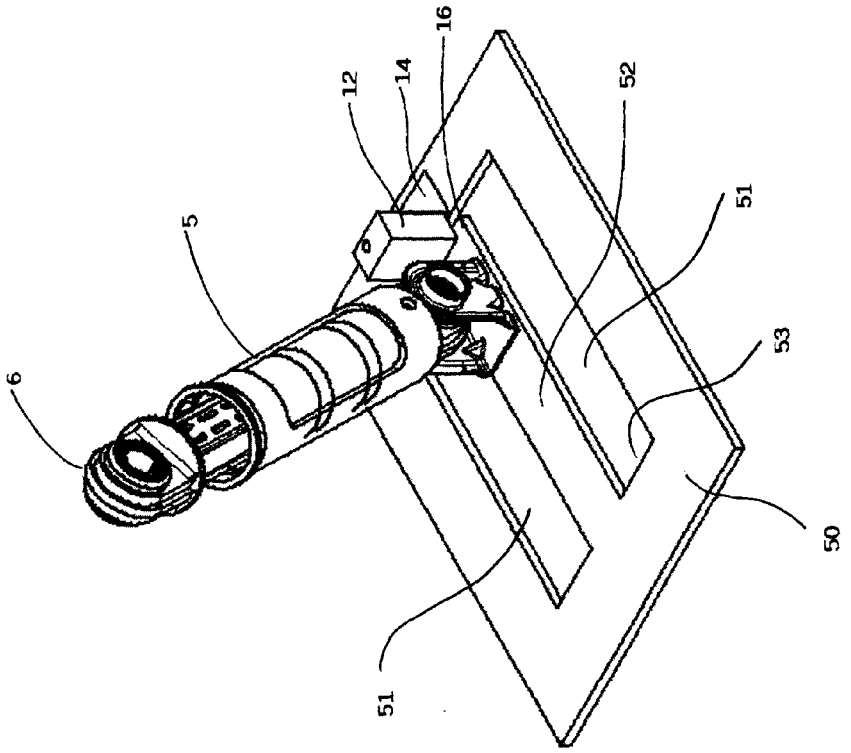

16
14
12
52
5
51
6
53
50
51

FIG. 5B

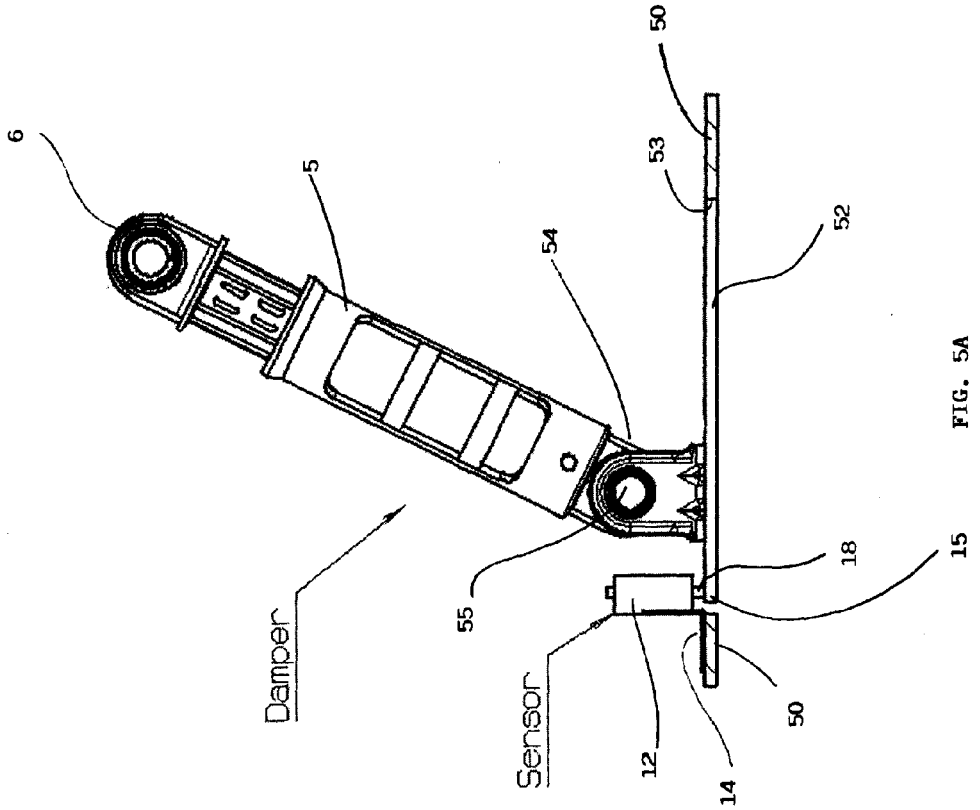

50
53
6
5
52
54
18
15
55
Damper
Sensor
50
12
14

FIG. 5A

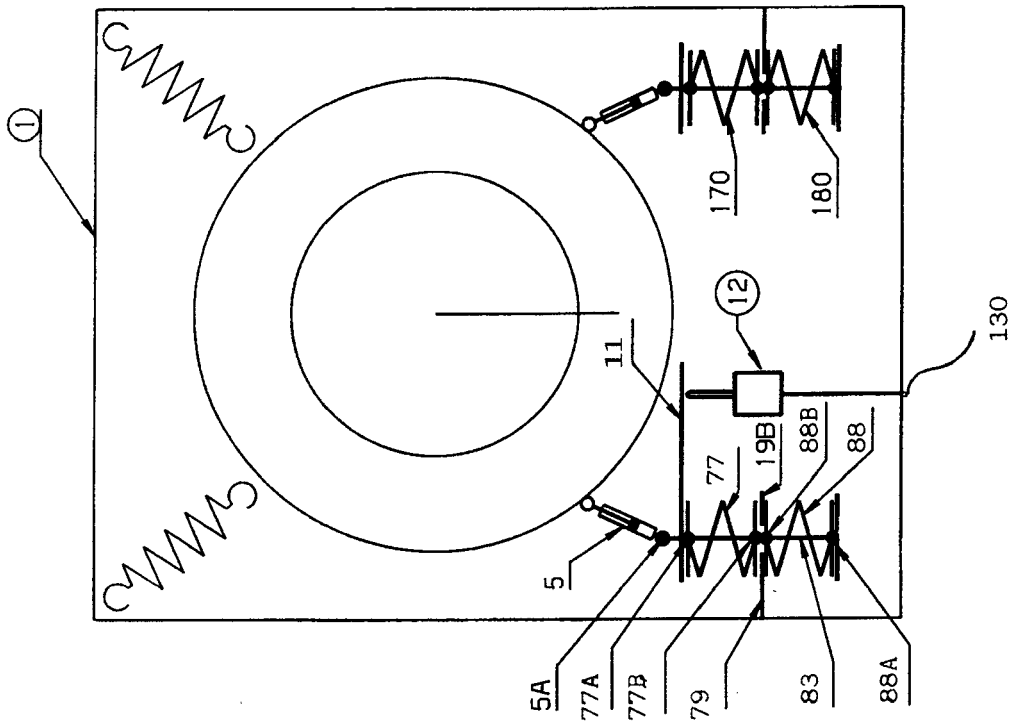



FIG. 6

European Patent Office

# EUROPEAN SEARCH REPORT

Application Number
EP 07 10 7413

## DOCUMENTS CONSIDERED TO BE RELEVANT

| Category | Citation of document with indication, where appropriate, of relevant passages | Relevant to claim | CLASSIFICATION OF THE APPLICATION (IPC) |
|---|---|---|---|
| D,X | EP 1 264 925 A (ELECTROLUX HOME PROD CORP [BE]) 11 December 2002 (2002-12-11)<br>* the whole document *<br>----- | 1,8 | INV.<br>D06F37/20<br>D06F39/00 |
| A | EP 1 258 556 A1 (MIELE & CIE [DE])<br>20 November 2002 (2002-11-20)<br>* the whole document *<br>----- | 1-8 | |
| A | DE 298 12 393 U1 (AEG HAUSGERAETE GMBH [DE]) 18 November 1999 (1999-11-18)<br>* the whole document *<br>----- | 1-8 | |
| | | | TECHNICAL FIELDS SEARCHED (IPC)<br>D06F |

The present search report has been drawn up for all claims

| Place of search | Date of completion of the search | Examiner |
|---|---|---|
| Munich | 31 October 2007 | DIAZ, M |

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

3

EPO FORM 1503 03.82 (P04C01)

## ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 07 10 7413

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
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

31-10-2007

| Patent document cited in search report | Publication date | Patent family member(s) | Publication date |
|---|---|---|---|
| EP 1264925 A | 11-12-2002 | IT PN20010041 A1 | 09-12-2002 |
| EP 1258556 A1 | 20-11-2002 | AT 276396 T | 15-10-2004 |
| | | DE 10122749 A1 | 05-12-2002 |
| | | ES 2227351 T3 | 01-04-2005 |
| DE 29812393 U1 | 18-11-1999 | NONE | |

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

## REFERENCES CITED IN THE DESCRIPTION

*This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.*

### Patent documents cited in the description


- US 6460381 B **[0002]**
- US 4742698 A **[0002]**
- GB 2087438 A **[0003]**
- EP 1264925 A **[0004]**