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(54) Washing and/or drying machine

(57) A washing or drying machine (A), comprising a cabinet (C) and a tub (T) supporting a rotating drum, further comprises an electronic unit having a device (T) for generating and emitting an alternating quasistatic electrical field mainly in the area of the cabinet (C) and a receiver (12) adapted to detect values and/or changes of the alternating electrical field indicative of load parameters inside the drum, such as the type or amount of load and/or the load movement pattern inside the drum.

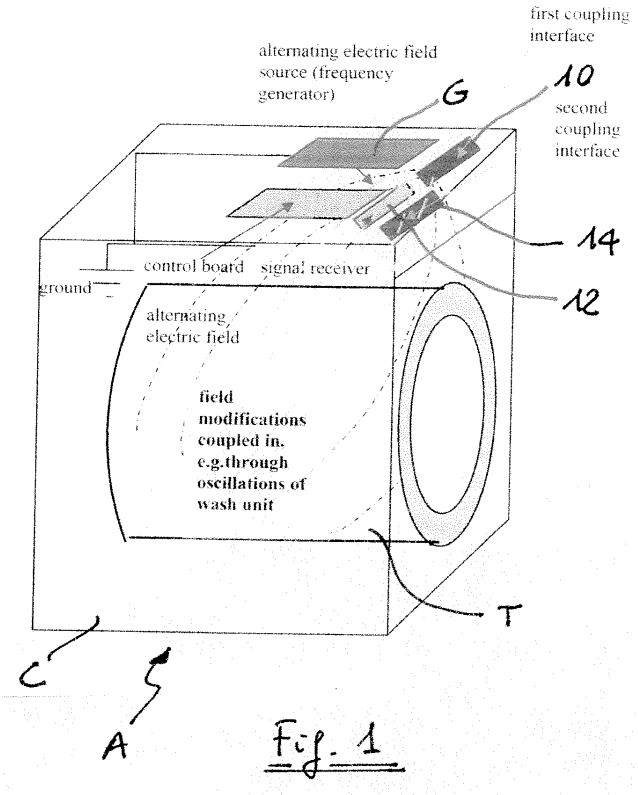

Fig. 1

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Description

[0001] The present invention relates to a washing or drying machine comprising a cabinet and a tub supporting a rotatable drum.

[0002] It is well known in the art of washing appliances the need of detecting values of laundry load in order to adjust the washing cycle chosen by the user. In the past the washing or drying machines had fixed programs and no possibility of adjusting the cycle in view of the actual working condition of the appliance. In the last years the need of improving the energy efficiency of the appliances has led the appliance manufacturers to find new technical solutions for taking care of the actual working conditions of the appliance (for instance the actual laundry load of a washing machine) in order to adjust the general working cycle chosen by the user. This need has also led the manufacturers to install in each appliance several kinds of sensors for detecting signals indicative of the laundry load, the load unbalance, the soil content of washing liquor and so on, such sensors increasing the overall cost of the appliance.

[0003] As an example, the knowledge of the load movements in a washer is crucial to set the optimum cycle parameters. In horizontal axis washers the optimum drum rotation speed to clean a small load is different from that of a large load as the falling movement pattern depends on the load size. Yet most appliances treat the laundry at a preset speed assuming a full load. While in the usual tumbling movement of the laundry the items of a near-full load are lifted up to the top of the drum and fall into the wash liquor from high above as intended by the designer, the items of a small-volume load may either perform an undesired rolling movement in the lower part of the drum, or may cling to the drum wall and not perform a falling movement at all. Thus time, energy, and (in the rinse process) also water is wasted if a small load is treated at the same drum rotation speed as a large load. Another undesired effect in laundry washers and dryers is tangling of the laundry, which can result in laundry damage due to high friction between tangled layers, but also reduced wash or dry performances. The problem is partially solved today by designing the reversing movement (rotation in one direction, pause, rotation in opposite direction) in such a way that a "usual" load of near-full volume consisting of small to medium-size items will not tangle too much.

[0004] State-of-the-art knowledge permits limited adaptations. For example, the load size can be estimated from the load soakability measured with a flow meter in combination with a level sensor, or from motor torque or other motor parameters.

[0005] These known methods imply the use of different technologies and sensors, adversely impacting the final cost of the appliance. Yet there is no known feasible and cheap method of detecting all together:

- the laundry volume,
- the free volume in the appliance,
- the actual laundry movement,
- the actual tangling.

[0006] There is no known method in which the actual laundry movement is measured and the information is used as a feedback to the electronic control unit in order to adapt the drum speed or the reversing pattern until optimum drum movement for this particular load is reached.

[0007] It is therefore an object of the present invention to provide a washing machine or a drying machine capable of detecting signals indicative of the above working parameters in a not expensive and reliable way. It is therefore a purpose of the present invention to provide an appliance that can retrieve and apply information on the free volume, laundry movement, and changes of the movement over the duration of the wash or dry cycle in a laundry washer, dryer, or washer-dryer in order to set the optimum drum speed for the actual load, set the optimum reversing pattern for the actual load and warn the consumer if the appliance is overloaded.

[0008] The above object is reached thanks to the features listed in the appended claims. Further advantages and features of a washing or drying machine according to the present invention will be presented in the following detailed description, provided as a non limiting example, with reference to the attached drawings in which:

- figure 1 is a schematic perspective view of a washing machine according to the present invention;
- figure 2a is a schematic front view of the drum of the washer of figure 1 showing the laundry movement for different laundry loads;
- figure 2b is a qualitative switching pattern for the different loads of figure 2a and according to a second embodiment of the invention;
- figure 3a is a switching pattern similar to figure 2b and relating to two different tangling conditions of the laundry load;
- figure 3b is a speed profile of two tumbling patterns according to the two different tangling conditions of figure 3a; and
- figure 4 is a schematic view of position/movement detection by measuring electrical field amplitude changes with a remotely accessible data media.

[0009] According to the present invention, the electronic control unit of the appliance comprises a device for generating and emitting an alternating electrical field in the area of the cabinet (i.e. towards the inside of the appliance) and a receiver adapted to detect changes of the alternating field transmission.

[0010] The alternating electrical field is preferably a quasistatic, very long-wave electric field at frequency close to 100 kHz, even if other kinds of electrical fields may be used as well. The quasistatic, very long-wave electric field is disclosed in WO-A-2007/000353. This

field is generated by a field emitter consisting of a current source, an oscillator and a modulator. Through antennas and a coupling interface 10 (figure 1), e.g. a plate made of copper or other metal, the maximum of the electric field strength is directed towards a particular space inside the appliance, as shown by dotted lines in figure 1.

[0011] The capacitance within this space can be changed by:

- the presence of a conductive body within this space, e.g.
  - a human being or an animal,
  - a piece of moist laundry,
  - water,
- the presence of a dielectric body, e.g.
  - a piece of dry laundry.

[0012] A dynamic change of the capacitance will be initiated by:

- a human being or an animal moving inside this space,
- a piece of load (e.g. an item of a wash load or drying load) moving within the space,
- water moving inside the space,
- changing conductivity of water, e.g. when detergent is dissolved,
- parts of the appliance oscillating, changing their positions relative to the field source 10 and/or receiver 12.

[0013] The electric field generator G is placed inside the cabinet C of the appliance, e.g. inside a control part (main control board, user interface, or another control unit) of a domestic or commercial washer, laundry dryer, or washer-dryer. The field maximum is directed towards the space inside the appliance cabinet, e.g. inside the drum or tub T of a laundering appliance A.

[0014] According to a first embodiment of the present invention, the static or dynamic capacitance can be measured by determining the change of the electric field transmission through a second coupling interface 14 (figure 1) and the signal receiver 12.

[0015] According to a second embodiment of the present invention (shown in figure 4) detection of changes in the electric field can also be realized with remotely accessible data media, preferably in the form of zero power switches (ZPS), which can be mounted to the moving parts of the appliance to be investigated. This second embodiment of the invention is not only suitable for detecting the amount and the movement pattern of laundry inside the appliance, but also for the following further applications:

- detect uneven levelling of appliance,
- detect oscillating parts, and
- open door detection.

[0016] The electric field generator G is used as a ZPS server providing the field energy to operate a low-cost capacitive switch with very low, near-zero power take-up. The zero power switch consists of a coupling interface and an oscillator with a constant frequency output in the range from 0 to 10 kHz. This constant frequency can be used as a signature for identifying the respective ZPS and distinguishing it from noise signals and/or from other ZPSs in the same machine or other machines situated nearby.

[0017] When the ZPS is approaching an electrode, the ZPS will execute a switching process, whereupon it will couple an electromagnetic signal of its characteristic frequency back into the field. The change in the electric field initiated by the ZPS switching can be detected by a signal receiver 12 and evaluated in a control. By means of a Fast Fourier Transform the frequency emitted by the ZPS can be identified.

[0018] For movement or position detection, a ZPS can function as a transducer which provides coupling interfaces to take up a field amplitude signal and pass the amplitude information on to the ZPS server. The change of distance between the ZPS and the server, and/or the ZPS and a nearby conductive part, e.g. the appliance cabinet C or a nearby fixed part made conductive through e.g. copper plating, causes a change of electric field amplitude at the (moving) location of the ZPS.

[0019] A first coupling interface 10 ("2nd electrode" in figure 4) of the ZPS is acting as a receiver. A second coupling interface ("3rd electrode" in figure 4) of the ZPS acts as an emitter that initiates a field modification the amplitude of which is a measure of the amplitude received.

[0020] The size and/or pattern of field modifications through this process can be detected by the signal receiver 12, passed on to the appliance control and compared to amplitudes and/or patterns stored in the appliance control (for instance as look up tables) for a selection of cases.

[0021] With regard to the specific technical problem of detecting laundry movement or detecting the ratio between the volume of the load in the drum and the free volume in the drum, reference is made to the following description.

[0022] When a laundering appliance is loaded with textiles, a dielectric is brought into the alternating electric field inside the drum. The range of dielectric permittivity of garments or other textiles is large but differs clearly from the permittivity of air. Thus the field inside the appliance will be changed. The change can be detected via the signal receiver and evaluated in the appliance control. The signal ranges for small-volume, medium-volume, and large-volume load of the most extreme (least conductive and most conductive) fibre types can be stored in the appliance control and the measured signal can be

compared against these ranges. An indication can be given out on the user interface to what percentage the appliance is full. It will be beneficial to combine this method with a detection of whether the appliance door is open or closed, as the door has a large influence on the electrical field.

[0023] For the detection of laundry fall and adaptation of drum movement, a preferred method makes use of zero power switches (ZPS) which can be mounted to the lifters of the drum or at other places inside drum to detect if laundry is sticking to the drum wall or falling in the desired manner. In this specific case the electric field generator is used as a ZPS server providing the field energy to operate a low-cost capacitive switch with very low, near-zero power take-up. The zero power switch consists of a coupling interface and an oscillator with a fixed frequency output in the range from 0 to 10 kHz. This fixed frequency is functioning as an identification signature. When the ZPS is touched by a conductive body, e.g. an item of wet laundry, the ZPS will execute a switching process, whereupon it will couple an electromagnetic signal of its characteristic frequency back into the field. The change in the electric field initiated by the ZPS switching can be detected by a signal receiver and evaluated in a control. By means of a Fast Fourier Transform the frequency emitted by the ZPS can be identified. If each lifter is equipped with one or two ZPSs, it can be detected after how long a laundry item resting on a lifter is leaving its place at the drum wall and starting to fall down. The patterns of ZPS switching sequences for the following cases are stored in the appliance control:

a) desirable tumbling movements of a load: laundry being lifted up to highest point of drum, then falling down. The falling path will be short for a large load volume, large for a small load volume - see figures 2a and 2b;
b) undesired rolling movement in lower part of drum (characteristic for small load exposed to inappropriate drum speed);
c) undesired clinging of laundry to inner drum wall ("laundry ring") with very little laundry fall;
d) overloaded appliance with laundry pressed to drum on all sides;
e) tangled load, characterized by (see figure 3a and 3b):

- an initially larger load volume which is gradually decreasing through compression over the duration of the wash (or dry) cycle;
- initial movement pattern: several items with desired laundry fall;
- final movement, in the most extreme case: one large stiff item performing a large-scale rolling movement, no proper laundry fall.

[0024] The measured signal patterns are compared against stored patterns and the control unit of the appliance can react as follows:

a) desired tumbling movement: either no change or small adaptations of drum speed or reversing pattern for optimization of laundry movement. The load volume measured before the cycle start can be used as an input for the appliance control to compare the measured ZPS switching sequence during the cycle against the optimum load movement that can be expected for this load size;
b) rolling movement: increase drum speed gradually until desired laundry fall is observed;
c) laundry ring: decrease drum speed gradually until desired laundry fall is detected;
d) overloaded appliance: give out warning on user interface, possibly increase cycle duration to reach good wash performance;
e) tangled load: possibilities are:

- add water to loosen the tightly tangled layers;
- shorten the tumbling period for each direction of the drum rotation to avoid that the tangling will further increase;
- lengthen the reversing pauses (motor-off-phases) to allow for complete settling of laundry before the next rotation phase starts.

[0025] It is also possible to mount additional ZPSs to the tub T (basket). This will give additional information about the lowering of the tub, which is indicative of the load mass and soakability and the movement pattern of the tub, displaying incidents of heavy load fall.

[0026] A washing or drying machine according to the present invention can use the electrical field inside the cabinet C also for other purposes, which can be considered as advantageous side effects of the technical solution according to the invention. Among all the other purposes, the detection of bad levelling of the appliance is one of the most interesting.

[0027] When putting up a washer, dryer, or washer-dryer in a household, the consumer is expected to level the appliance by adjusting the height of the appliance feet. This is not always done successfully. Some consumers will not even attempt to level the appliance, either because they are not conscious that this is necessary, or because they forget it, or because they have difficulty in doing so. The adjusting of the appliance feet may be difficult if the appliance is heavy and/or it is put up in a narrow space.

[0028] Some consumers will attempt to level the appliance but not be wholly successful; there are cases known of consumers who are placing small supports of wood, metal, plastic or other unsuitable items under the appliance feet to level them, instead of actually changing the height of the feet. These items will break or slip from under the appliance feet e.g. when the appliance is spinning. When the appliance is spinning with a heavy, unevenly distributed load (heavy unbalance), it may slip from

its original position unless it is fixed to the floor with screws. If the floor is very uneven, the appliance may not be well levelled any more even if the original levelling was good. This is especially the case with wooden floors which will strongly vibrate under the oscillations of the appliance.

[0029] One of the most negative consequences of bad levelling is "jumping" of the machine, i.e. the appliance can move from its position on the floor. In extreme cases water inlet tubes were reported to have broken due to this. Appliances standing on a socket may fall from it and break and people may be harmed.

[0030] There can be also a damage of the appliance since appliance parts are heavily shaken and can hit the cabinet or other parts, leading to mechanical damage of the appliance. Moreover the appliance can get very noisy due to shock and vibration. Modern horizontal axis washers usually dispose of an unbalance detection system to manage unevenly distributed loads. Extreme cases of uneven appliance levelling may contribute as noise factors to the unbalance detected by such a system, so that spinning will be skipped or performed with reduced rotation speed. However there is no known system that explicitly detects insufficient levelling. The consumer will not usually see a connection between the bad spinning performance of his appliance and its bad levelling.

[0031] In an insufficiently levelled machine many conductive (metal) and dielectric parts will shake heavily especially during the spinning phase of a washer, but also in a less severe manner during normal drum rotation of a washer, dryer, or washer-dryer. This results in noise-type multi-frequency changes of the electric field inside the appliance, which can be detected via the signal receiver and fed to the appliance control for evaluation. A distinction between unbalanced load and bad levelling has to be carried out by the control unit of the appliance. Unbalance caused through uneven load distribution will cause a sharp peak of the noise signal during the short period of time when the drum is going through so-called critical speed at the start of spinning. The critical speed is the drum rotation speed which corresponds to the resonance frequency of the wash unit. In contrast, the noise originating from bad levelling of the appliance feet will stay high for a long time after the passing of critical speed. Weaker noise will also be detectable during normal drum movement (wash speed or drying tumble speed).

[0032] The behaviour of the signal during spinning is also indicative of:

- whether the signal noise is originating from outer sources (e.g. electromagnetic disturbances from a dryer standing on top of a washer, or other electrical appliances run nearby) or from the appliance itself;
- whether the appliance oscillation is enhanced by an unfavourable vibrating floor. According to another feature of the present invention, zero power switches (ZPS) can be used for amplitude evaluation. This method is more precise in that typical tilting movements of the wash unit can be identified, given that a sufficient number of ZPSs is applied in suitable locations. It can also be ascertained which foot of the appliance stands lowest.

[0033] Detection is accomplished with ZPSs mounted to the wash unit. Preferred positions of the ZPSs are as follows:

- for tilting detection: on the outer surface of the tub - top side, in three locations: front, middle, and back along the drum axis;
- additional positions for determining which foot stands lowest: outer surface of tub - top side, two additional locations: to the utmost left and right from the drum axis.

  If bad levelling of the appliance is detected, the consumer can be warned through a message on the user interface. If the display of the user interface is suitable for more extensive instructions, the user can be given advice how to accomplish the adjustment of the appliance feet.

[0034] To prevent damage to the appliance and harm to people the spinning can be performed at reduced rotation speed as long as the bad levelling persists.

[0035] If a vibrating floor is detected, the consumer can be warned that his appliance is put up on a poorly suited floor.

[0036] Another side effect of a washing or drying machine according to the invention is the detection of bodies inside the drum of the machine, for instance a child or a domestic animal. State-of-the-art safety provisions are especially implemented in appliances sold to the United States of America, due to the product liability regulations in this country. They include:

- to implement a choking protection, providing a sufficient air supply to the drum of the appliance so that a child locked inside will survive

Disadvantages:

[0037]

a) this will protect the child or animal only as long as the appliance is not started.

b) The child or animal may still faint if it starts moving in panic and its oxygen demand increases beyond the supply

- to run a "child routine". State-of-the art methods are:

  ● A small volume of water is dispensed ahead of the actual cycle start and the electrically operated door lock bolt is left open for the first minutes of the cycle. This is intended to alarm the child. It is hoped that the child will successfully

attempt to open the door in time to free itself.

● With the same intention of alarming the child and motivating it to free itself, the appliance drum is set into slow motion, e.g. half a rotation of the drum done once or repeatedly, ahead of the actual cycle start.

[0038] This known method has several disadvantages because it is relying on the mere hope that the child will have both the presence of mind and the physical and mental ability to free itself within a few minutes. Moreover the inability of a pet to free itself by opening the door from inside is evident. Then the routine is run ahead of each cycle - consuming time, energy, and possibly water - regardless of whether a child or animal is actually inside the appliance or not. The child routine is irritating for the user. Many users will stand by after starting a cycle until they can see water dispensed in normal manner and/or the drum rotating normally. They will have to wait longer if the child routine is run first. Users who have not familiarized themselves with safety provisions may be worried whether the appliance is functioning correctly.

[0039] With a machine according to the invention the alternating electrical field already used for detecting the load or the load movement inside the drum can be also used for detecting the accidental presence of living bodies inside the drum, therefore providing a secure child and animal protection system which detects the presence of such a creature inside an appliance, warns the user about the child or animal in the appliance, blocks the start of the appliance as long as there is a child or animal inside and does not run a routine to warn a child in the appliance unless there is actually a child or animal inside.

[0040] The electrical impedance of the body of a human of child size or of an animal of pet size lies within a known range around 1 kΩ, depending on:

- the body mass;
- the body fat content;
- the environment moisture: dry, water-wet, salt-water-wet, or other;
- the contact points (e.g.: one hand touching open current source, other hand touching ground);
- electric field characteristics: contact voltage, static or alternating field, frequency of alternating field;

[0041] This impedance range corresponds to a conductivity range. Thus the capacitance change initiated by the presence of a child or pet in an appliance can be calculated or measured with artificial samples representing the same conductivity range. The range of possible field changes that may be caused by the presence of a child or animal inside the drum of the appliance can be stored in the appliance control. At the start of a cycle, e.g. a wash cycle in a washer, the field change detected by the signal receiver is fed to the appliance control and compared to the range of field changes stored for the presence of a child or animal. If the detected value lies within this range, the appliance is blocked from starting and a warning message is displayed on the user interface or a warning sound given out. An override function can be foreseen to enable the user to start the appliance if he is sure that there is only e.g. laundry inside. This is important because e.g. a load of moist laundry may have impedance that lies within the same range as the impedance of a child or pet.

Additional safety possibilities:

[0042]

- If the presence of a child or animal is detected and override is activated, the conventional child routine with a splash of water or soft drum movement can still be run.
- Wet laundry with same conductivity may be distinguished from a child or pet by using additional information which is available from the appliance control without adding parts. E.g. if a washer is equipped with a drum speed sensor, the drum speed can be measured. If the movement pattern is not representing evenly falling laundry but is superimposed with an independent active movement, the cycle shall be stopped at once and no override shall be permitted until the door of the appliance has been opened for a minimum time of several seconds.
  According to the above solution, the presence of a living creature can be securely detected without spending additional water, without additional energy consumption given that the field generation and detection system is already present for other detection purposes, and without or with very little added time.

[0043] Another technical problem that can be easily solved by a washing or drying machine according to the invention is the detection of the door configuration (open or close). Horizontal-axis laundering appliances (washers, dryers, or washer-dryers) cannot be started until the door is securely closed. Otherwise laundry would fall out of the appliance and water would flow out. Therefore such appliances have a closed-door detection.

[0044] The common known solution is a mechanical hook or pin which will move a slider when it snaps in place at the closing of the door. The slider will initiate an electrical switching process. The switching signal is passed on to the appliance control to release the start function.

[0045] Disadvantages of this known solution are as follows:

- the cost of the mechanical part is not negligible;
- in addition cables and plugs are necessary;
- depending on the timer (e.g. with electromechanical or hybrid timers, which are common in low-range to mid-range appliances), a sensitive and costly mechanical connection between the pin or hook and the

user interface is necessary, which may consist of a leverage or Bowden wire;

- the system is sensitive, malfunctions happen frequently. There are several tolerance-prone mechanical parts involved, which make both the assembly and the correct operation difficult;
- because of manufacturing tolerances and / or wear and tear, some hooks or pins will not easily snap in or sliders will not react at once. In this case customers often have to try twice (closing, opening, closing the door with increased force) until the appliance registers that the door is closed. This is extremely annoying for the user;
- the changing of door hinges from the left to the right side of the appliance, or vice versa, is usually impossible in washers, and possible but complicated in dryers. The position of the pin or hook on the appliance door has to be changed by the user.

[0046] In a machine according to the invention, it is possible not only to detect the load, the laundry movement or the presence of bodies inside the drum, but it is also possible to detect in a cheap and robust way whether the appliance door is closed, without need for cables, plugs, and mechanical parts such as hooks, pins, sliders, or Bowden wires.

[0047] According to a first solution, a zero power switch (ZPS) can be attached to a point of the door which will only touch the door frame when the door is securely closed, e.g. the point opposite of the hinges. A counter electrode is mounted to the door frame at the corresponding location. When the door is closed, the ZPS location of the door will touch the counter electrode location in the frame. This will initiate a switching event coupling the ZPS characteristic frequency into the quasistatic electric field, which can be detected by the signal receiver and fed to the appliance control for identification with Fast Fourier Transform methods.

[0048] According to a second solution for the detection of door configuration, a ZPS is used with amplitude evaluation. Hardware is the same as in the above first solution, but the door position is determined by evaluating a change of amplitude. The change of distance between the ZPS and the counter electrode *("conductive material" in figure* 4) causes a change of electric field amplitude at the moving location of the ZPS. The information on the size of the field modification is coupled back into the field by the ZPSs coupling interfaces (*2nd and 3rd electrodes in figure 4)* and can be detected by the signal receiver, passed on to the appliance control and compared to amplitudes (lookup table or curve) stored in the appliance control for various opening angles of the door.

[0049] The opened or closed position of the appliance door has a very significant influence on the quasistatic electric field. The impact of the door usually surmounts the influence of laundry on the electric field by far. This effect is due to:

- the comparatively high volume of dielectric and conductive materials which is brought into the field when closing the door; and
- the fact that a closed door will act as a field delimiter to the appliance.

[0050] The effect of the door position on the field and its influence on the signal detected by the signal receiver, with different amounts and types of laundry inside the drum, can be measured during the development and design of the appliance. These data can be stored in the appliance control and compared to the actual signal detected by the receiver ahead of the start of a wash or dry cycle. If this type of closed door detection is to be implemented it is important that the maximum of electric field amplitude be directed to the point on the door frame towards which the door closes, in order to achieve a reliable distinction between a door left ajar and a securely closed door. The solution according to the present invention may also be used for detecting the working condition of a drain pump used in the washing machine, particularly for detecting when air is present in the drain pump.

[0051] The outlet of the appliance can be equipped with a zero power switch. When the outlet is filled with water, the intensity of the quasistatic electric field will increase due to the presence of conductive liquid. The switching power of the zero power switch is chosen in such a way that it is surpassed only when the ZPS location is covered in water. Thus the ZPS switching process will couple its characteristic frequency into the field only if the drain pump is not transporting air. The absence of this ZPSs characteristic frequency - indicative of the drain pump running dry - can be detected through the signal receiver and identified by the appliance control with a Fast Fourier Transform. On detection, the draining can be stopped. If the detection of air transport occurs during spinning, the spinning can be interrupted for e.g. 15 seconds. If the outlet fills with water during this time, this is a sign that water could not be drained off because a water ring had built up, which has decayed when spinning was interrupted. In this case spinning can be resumed and the drain pump can be activated again. Otherwise - if no more water is accumulating in the outlet because the laundry is already spun out completely - spinning can be ended.

[0052] A further advantage of the present invention is that a dry load can be distinguished from a wet load through the large difference in electrical impedance. This information can be applied as an input for load detection. Common detection methods for the load amount in washers rely on the soakability of the load measured with a flow meter in combination with a water level sensor. These measurements are distorted if the user loads the washer with moist or wet laundry, which is often the case. E.g. consumers usually will not dry their wet bath towels, rain-soaked garments, or wet floor cloths before washing them.

[0053] The method does not require cables between

the location of measurement (e.g. wash unit, appliance door) and the appliance control. Therefore it is cost-effective (no added cost of cables, plugs, cable fixations, assembly) and it is robust (no signal disturbances from antenna effect of cables or from the changing capacitance of a swinging cable). This is an important advantage especially if sensors are mounted to moving parts. In the case of moving or vibrating parts no stiff wiring is possible between the part and the appliance control. State-of-the-art methods of avoiding signal disturbances stemming from cables include the use of bus systems for signal transfer, but bus systems add cost and complexity.

Claims

1. Washing or drying machine (A), comprising a cabinet (C) and a tub (T) supporting a rotating drum, **characterized in that** it comprises an electronic unit having a device (G) for generating and emitting an alternating electrical field mainly in the area of the cabinet (C) and a receiver (12) adapted to detect values and/or changes of the alternating electrical field indicative of load parameters inside the drum, such as the type or amount of load and/or the load movement pattern inside the drum.

2. Washing or drying machine according to claim 1, wherein remotely accessible data media are mounted on moving parts of the machine such as the lifters of the drum.

3. Washing or drying machine according to claim 1 or 2, wherein the alternating electrical field is a quasi-static electrical field.

4. Washing or drying machine according to claim 2, wherein the remotely accessible data media comprise a zero power switch.

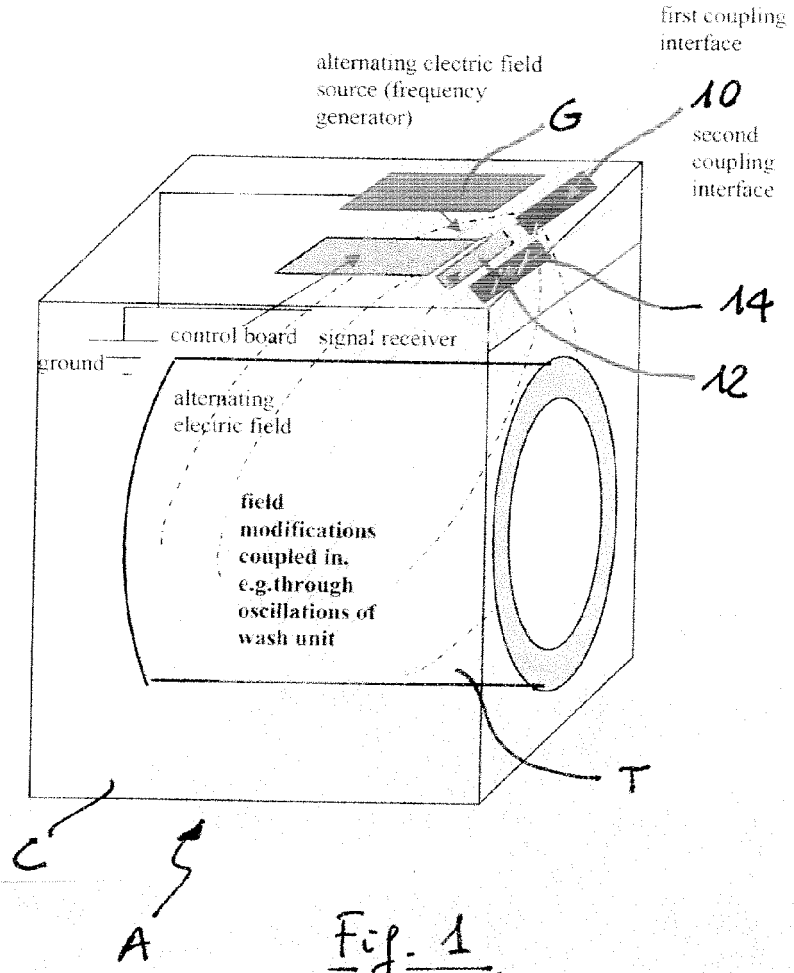
5. Washing or drying machine according to claim 1, wherein the changes of the alternating field are indicative of the degree of tangling of the laundry load.

6. Washing or drying machine according to any of the preceding claims, wherein the changes of the alternating field are indicative of a living body inside the machine drum.

7. Washing or drying machine according to any of claims 1 to 5, wherein the changes of the alternating field are indicative of an unevenly levelled machine.

8. Washing or drying machine according to any of claims 2 to 7, wherein the signals from the remotely accessible data media are indicative of oscillating parts.

9. Washing or drying machine according to any of claims 2 to 7, wherein the signals from the remotely accessible data media are indicative of the configuration of the door of the machine.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alternating electric field source (frequency generator)
G
10
second coupling interface
14
12
control board
signal receiver
ground
alternating electric field
field modifications coupled in, e.g.through oscillations of wash unit
T
C
A

Fig. 1

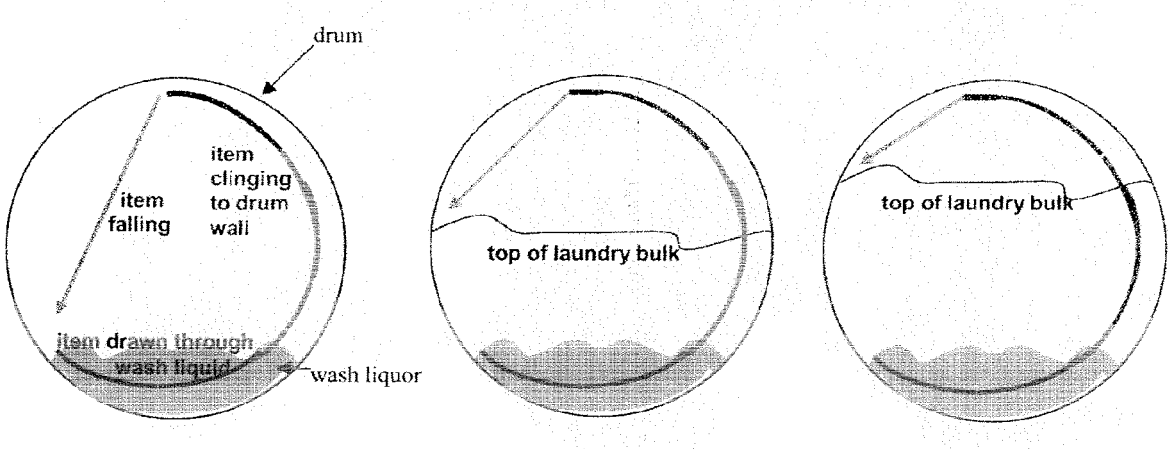
drum
item falling
item clinging to drum wall
item drawn through wash liquid
wash liquor
top of laundry bulk
top of laundry bulk
small load
medium load
full load

Fig. 2a

Fig. 2b

Fig. 3a

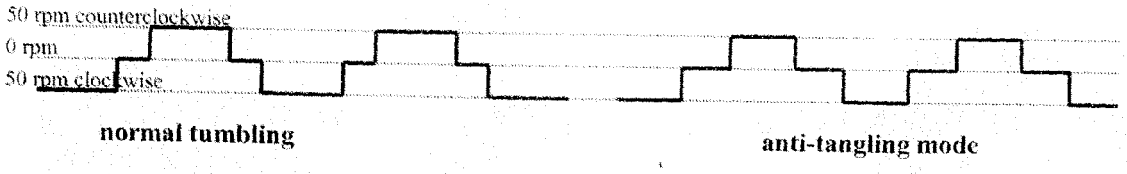

Fig. 3b

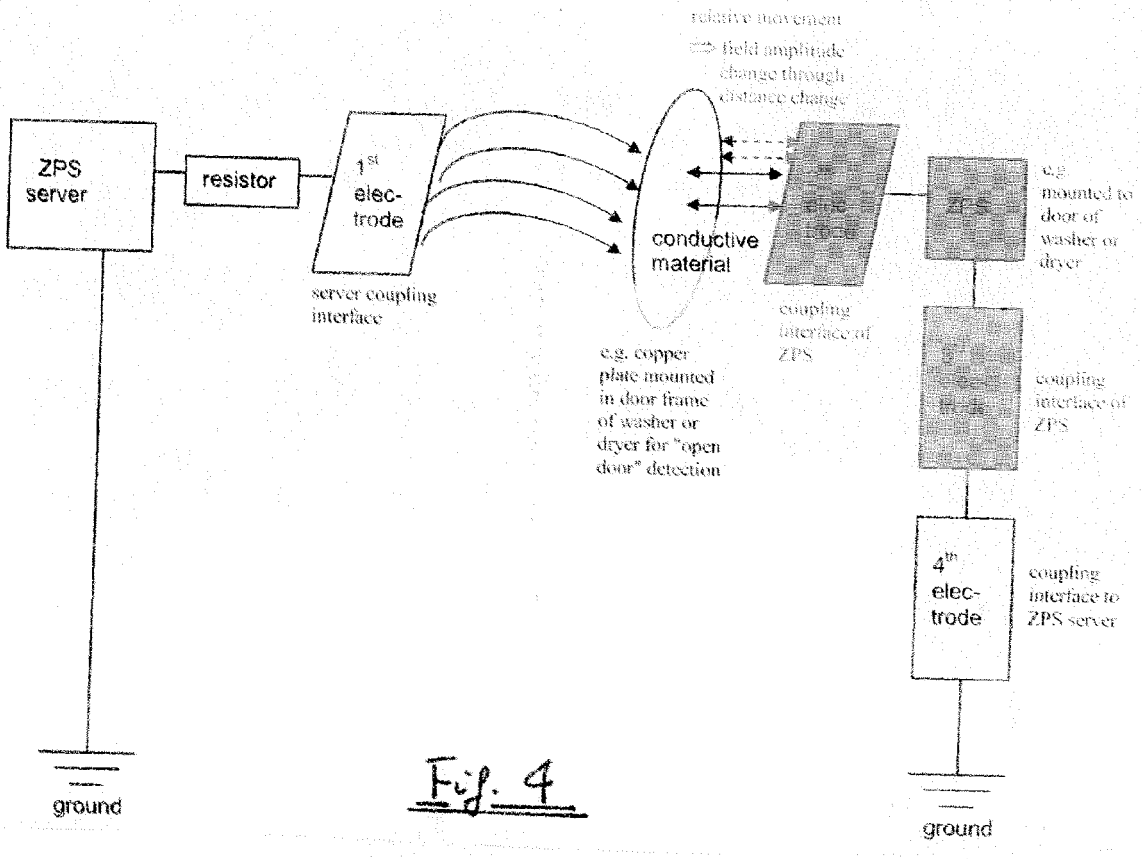

Fig. 4

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EUROPEAN SEARCH REPORT

Application Number
EP 08 10 1718

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Place of search	Date of completion of the search	Examiner
Munich	2 October 2008	Clivio, Eugenio

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