An ultrasonic washing machine is disclosed. The ultrasonic washing machine can have a machine body and a drum housed within the machine body, the drum having an opening for loading and unloading laundry. The ultrasonic washing machine can include a front door attached to the machine body and covering the opening. The ultrasonic transducers can be placed on an interior surface of the front door so as to be in direct contact with washing fluid when the washing machine is in operation. A control unit coupled to the one or more ultrasonic transducers.
ULTRASONIC WASHER

[0001] Embodiments relate generally to washing machines and, more particularly, to an ultrasonic washing machine having one or more ultrasonic transducers in communication with washing fluid.

[0002] Conventional high-efficiency clothes washing machines may suffer from limitations related to cleaning clothes thoroughly while trying to minimize the use of water and detergents.

[0003] Embodiments were conceived in light of the above-mentioned limitations among other things.

BRIEF DESCRIPTION OF THE DRAWINGS

[0004] FIG. 1 shows a front view of an exemplary washing machine in accordance with at least one embodiment.

[0005] FIG. 2 shows a side view of a washing machine in accordance with at least one embodiment.

[0006] FIG. 3 shows an exploded view of a washing machine drum and front door in accordance with at least one embodiment.

DETAILED DESCRIPTION

[0007] FIG. 1 shows a washing machine 10 having a front door 1, one or more ultrasonic transducers 2, washing fluid 3, and a control line 4.

[0008] In operation, the washing machine 10 washes clothes using washing fluid 3. A control unit (see, e.g., FIG. 2, reference number 6) controls the one or more ultrasonic transducers 2 to provide ultrasonic energy to the washing fluid 3. The ultrasonic energy can help remove particles from the clothes being washed. So, in addition to (or as an alternative to) the mechanical agitation of the washing machine, ultrasonic energy is applied to the water surrounding the clothes being washed and can be used to dislodge particles of dirt or mud or other debris or stains that need to be removed from the clothes. The ultrasonic energy can also create microscopic bubbles in the washing fluid that help to clean the clothes.

[0009] Through application of ultrasonic energy in addition to mechanical agitation, the amount of mechanical agitation can be reduced thereby reducing the abrasion of clothes being washed and also reducing the amount of electrical energy needed to perform a washing cycle. By achieving washing using ultrasonic energy, the amount of detergents being used may also be reduced.

[0010] An ultrasonic washing machine can be used for household laundry, industrial laundry and/or commercial laundry.

[0011] FIG. 2 shows a cut-away side view of washing machine 10. The washing machine 10 includes a control unit 6 connected to the ultrasonic transducers 2 via the control wiring 4. The washing machine 10 also includes a drum 5.

[0012] In operation, a control unit 6 communicates control signals to the ultrasonic transducers 2 via the control harness 4. As shown in FIG. 2, the ultrasonic transducers 2 are in direct communication with the washing fluid being held in the drum 5. By having the transducers mounted on the front door of the front-loading washing machine, it allows them to be in direct contact with the washing fluid and not be obstructed by the drum or other component of the washing machine. The control unit 6 can be used to select whether ultrasonic cleaning is used in addition to mechanical agitation or instead of mechanical agitation. The control unit 6 can also be used to select the power setting for the ultrasonic transducers. The power setting can be selected based on the type of clothing, the cleaning cycle, or the like.

[0013] FIG. 3 shows an exploded view of the drum 5, the front door 1, and the one or more ultrasonic transducers 2. It is important to note that the ultrasonic transducers 2 are not obstructed by the drum 5.

[0014] The operation of the washing machine 10 can be adjusted (e.g., by changing washing cycle parameters) based on the use of and settings associated with ultrasonic cleaning. In other words, the control unit 6 can take into account whether ultrasonic cleaning has been selected and at what power setting or what power level the ultrasonic cleaning has been selected for and can adjust other parameters of the washing cycle. In addition to potentially improving the cleaning of clothes being washed in the washing machine 10, the use of ultrasonic energy can permit a washing machine to be less noisy and may also reduce the formation of scale or mineral deposits on internal surfaces of the machine (e.g., drum, heater, pipes, or the like). As mentioned above, the use of ultrasonic energy can permit a washing machine to use less mechanical energy and less heat energy, thereby reducing the overall cost of operating the machine by reducing the electrical energy required to perform a clothes washing cycle.

[0015] Application of ultrasonic energy to the washing fluid can permit a machine having a larger drum size and thereby washing a larger quantity of clothes and still maintain the high level of cleaning of the clothes.

[0016] Use of ultrasonic energy may also permit a clothes washing cycle to occur in less time than using mechanical agitation alone.

[0017] Also, it will be appreciated that in addition to washing clothing, linens or other articles made of cloth, the ultrasonic washing machine described herein can be used for the disinfection and cleaning of other items such as vegetables, fruits or the like.

[0018] It is, therefore, apparent that there is provided, in accordance with the various embodiments disclosed herein, ultrasonic washing machines.

[0019] While the invention has been described in conjunction with a number of embodiments, it is evident that many alternatives, modifications and variations would be, or are apparent to those of ordinary skill in the applicable arts. Accordingly, Applicant intends to embrace all such alternatives, modifications, equivalents and variations that are within the spirit and scope of the invention.

What is claimed is:
1. A washing machine comprising:
   a machine body;
   a drum housed within the machine body, the drum having an opening for loading and unloading laundry;
   a front door attached to the machine body and covering the opening;
   one or more ultrasonic transducers disposed on an interior surface of the front door so as to be in direct contact with washing fluid when the washing machine is in operation; and
   a control unit coupled to the one or more ultrasonic transducers.
2. The washing machine of claim 1, wherein the control unit is programmed to permit a user to select the use of ultrasonic cleaning.
3. The washing machine of claim 1, wherein the control unit is programmed to permit a user to select a power level associated with ultrasonic cleaning.
4. The washing machine of claim 1, wherein the control unit can alter washing machine cleaning parameters based on settings associated with ultrasonic cleaning.

5. A washing machine comprising:
   one or more ultrasonic transducers disposed on an interior surface of a front door so as to be in direct contact with washing fluid when the washing machine is in operation; and
   a control unit coupled to the one or more ultrasonic transducers.

6. The washing machine of claim 5, wherein the control unit is programmed to permit a user to select a washing mode using only ultrasonic cleaning.

7. The washing machine of claim 5, wherein the control unit is programmed to permit a user to select a washing mode using mechanical agitation and ultrasonic cleaning.

8. The washing machine of claim 5, wherein the control unit is programmed to permit a user to select a power level associated with ultrasonic cleaning.

9. The washing machine of claim 5, wherein the control unit can alter washing machine cleaning parameters based on settings associated with ultrasonic cleaning.

10. A washing machine comprising:
    a machine body;
    a front door attached to the machine body and covering the opening;
    one or more ultrasonic transducers disposed on an interior surface of the front door so as to be in direct contact with washing fluid when the washing machine is in operation; and
    a control unit coupled to the one or more ultrasonic transducers.

11. The washing machine of claim 10, wherein the control unit is programmed to permit a user to select the use of ultrasonic cleaning.

12. The washing machine of claim 10, wherein the control unit is programmed to permit a user to select a power level associated with ultrasonic cleaning.

13. The washing machine of claim 10, wherein the control unit can alter washing machine cleaning parameters based on settings associated with ultrasonic cleaning.