

Description

[0001] The present invention refers to a household dishwashing machine, comprising a door and a dispensing device of washing agents.

[0002] As known, household dishwashing machines usually perform a plurality of different operation cycles or programs, which are selected by the user according to washing requirements.

[0003] For instance, dishwashing machines presently available in trade are usually equipped with the following wash programs:

- a basic wash program, for washing normally dirty crockery dried up to a certain degree; this program usually comprises one or two initial cold pre-wash steps, a hot wash step, at least a cold rinse, a hot rinse and a final drying step;
- an intensive wash program, for washing very dirty crockery or in case of food rests particularly difficult to remove (such as very dry or burn rests); this program usually comprises one or two initial cold pre-wash steps, a hot wash step, a first cold rinse, a second cold rinse, a third hot rinse and a final drying step;
- an economy wash program, for washing less dirty crockery or partial crockery loads; this program usually comprises an initial cold pre-wash step, a hot wash step, a first cold rinse, a second hot rinse and a final drying step;
- a quick wash program, for a wash cycle like the previous one, should the user wish to wash partial crockery loads in a shorter time; this program usually comprises an initial hot wash step, one cold or hot rinse alone, and eventually a final drying step;
- a soaking program, which cannot be strictly defined as a wash program, since it consists of a simple soaking of the crockery; this program is used to prevent an extreme drying up of more consistent soil particles as well as to postpone a complete washing of the crockery.

[0004] All these programs (apart the soaking program) provide a main wash step, normally with hot water, which is mainly responsible for the quality of the whole wash program being selected. In main line, both the "wash" and "hot rinse" steps are always performed adding special washing agents or rinse aids to be filled by the user in a suitable dispensing device; in some instances, also at least one of the "pre-wash" steps can be performed adding a washing agent. To this purpose, therefore, the dishwasher can be provided with appropriate dispensing devices, which have separate compartments or tanks for containing various specific washing agents for the above steps of a wash program; typically, these washing agents consist of a solid washing agent, i.e. either a powder or in form of a tablet, dispensed during the wash step, and of a liquid additive,

such as a rinse aid to be dispensed during the hot rinse step.

[0005] With reference to the dishwashers, the washing agents dispenser usually comprises a body made from plastic material partially built-in in the dishwasher inner-door, i.e. the side of the front loading door of the machine facing inside the washing tub.

[0006] The above body delimits a compartment in its front area for containing a single dose of washing agent, required for executing the wash step; this compartment has a small cover, which is opened at the appropriate time of the wash cycle by the programming device of the machine; in this way, substantially at the beginning of the hot wash step, the entire single dose of solid washing agent is discharged into the washing tub.

[0007] A tank is also provided inside the dispenser body for containing a second liquid washing agent, typically a rinse aid; in general, the capacity of this tank is such to contain enough liquid agent to perform several wash cycles: thus, the machine user will only have to fill the tank periodically through an appropriate plug; the dispenser also has inside a small chamber associated to the above tank, for dosing the amount of rinse aid to be dispensed during a wash cycle; during machine operation, an actuator will be instructed by a programmer or timer to release a discharge outlet in line with the above dosing chamber, so the rinse-aid dose can flow down from the latter into the washing tub of the dishwasher.

[0008] The dispenser is formed to have the filling port of the compartment containing the washing agent facing upward when the machine door is open; therefore, after the door has been brought to a horizontal position, the user can fill the washing agent into said compartment, close its cover and then close the door again (with the door in this position the user is also able to fill the rinse-aid tank); the cover of the compartment for the washing agent is usually a tilting or sliding type; its opening, at the appropriate time during the wash cycle for the washing agent to fall down by gravity into the tub is controlled by a programmer or timer of the machine.

[0009] According to the above technique previously known, filling of the washing agent in the relevant compartment has to be performed with the machine door open, i.e. in a relatively uncomfortable position for the user, considering that unlike the rinse aid, the washing agent either as powder or in the form of a tablet has to be necessarily loaded before starting each wash cycle.

[0010] Concerning a likely use of washing agent also during pre-wash, some dispenser devices have an additional compartment, separated from the compartment containing the washing agent for the wash step. In this event, the cover for closing the compartment of the washing agent will also extend to cover the additional compartment, but the latter has either front passages or located in its lower section: therefore, when closing the dishwasher door (i.e. bringing it from its horizontal position to a vertical position), most of the washing agent

contained in the additional compartment will fall down by gravity into the washing tub and be used during the first pre-wash step.

[0011] It should be noticed, how according to the present state of the art, this additional compartment is specifically used for containing the washing agent required to perform the first pre-wash step; therefore, the user has to fill with washing agent both the compartment for the wash step and the compartment for the pre-wash step.

[0012] In those instances where the dispenser device of the dishwasher does not provide the above additional compartment, the user wanting to perform the first pre-wash step with washing agent will have to fill a little amount of detergent powder (same as used for the wash steps) directly in the washing tub of the machine before closing the door and starting machine operation.

[0013] Dispenser devices are also known, wherein the compartment of the single dose of washing agent for the wash step is fitted with ports ensuring a calibrated water inlet at the beginning of the wash cycle.

[0014] Therefore, through these ports a small amount of water can enter in the compartment containing the washing agent and entrain a portion of the latter into the washing tub during the pre-wash step; subsequently, at the start of the hot wash, the machine programmer causes the cover of the compartment of the washing agent to open, so that the residual portion of the latter may fall down by gravity into the tub.

[0015] Washing machines are also known, wherein the loading door is not a tilting door but is linearly sliding on special guides; the solution described in FR-A-2.674.426 applies for specific reference to a dishwashing machine with two baskets; in other known solutions, the dishwashers have only one basket in the form of a sliding drawer for containing the crockery to be washed, whose front wall is actually the machine door.

[0016] Also in these machines, the washing agents dispenser is fastened to the machine door or anyway to a wall or vertical surface delimiting the washing tub; as a result the dispenser is always laying on the same resting plane, independently from the open or closed condition of the door.

[0017] The dispensers used on such machines must be fitted with a special electric pump for performing both the dosage and dispensing of the liquid washing agent. As to detergent powder or in solid form, these dispensers comprise a seat for housing a container open upwards, which is hinged on its bottom end and partially tilting.

[0018] The above container can be partially extracted from its seat inclining it out of the dispenser body for the intake of the washing agent dose; a reverse movement of the container takes it back to its relevant housing seat delimited in the dispenser body.

[0019] This solution is rather complicated and expensive, since it presumes to have a special hydraulic circuit being apt to convey water inside the above container of

the washing agent, in order to obtain its removal and conveyance into the washing tub of the machine; the solution is further complicated, expensive and critical considering that such an hydraulic circuit should be partially housed within the machine door.

[0020] It is the object of the present invention to solve the above drawbacks and provide a dishwashing machine fitted with a dispensing device of washing agents being apt to dispense an amount of washing agent required for performing a treatment cycle of the machine, which is easy to manufacture, comfortable to use and has a reliable cost effective operation.

[0021] Following exhaustive practical tests, the present invention is also based on the acknowledgment that the above common art does not ensure adequate utilization of the single dose of washing agent loaded in the machine, i.e. optimal utilization of the capacity the latter may offer for improving washing quality.

[0022] On one hand, the solutions presently known are unable to ensure an efficient dosage of the washing agent for performing one or more pre-wash steps.

[0023] On the other hand, dispensing a nearly complete dose of washing agent in solid form in just one time upon starting the main wash step, will quickly exhaust the whole chemical-physical action of the washing agent during the first part of the step itself.

[0024] In this frame, it is a further aim of the present invention to provide a dishwashing machine, wherein a single dose of washing agent may be utilized at its best for the improvement of washing quality.

[0025] In order to achieve these and other aims to become more apparent later, it is the object of the present invention to provide a household dishwashing machine incorporating the features of the annexed claims, which form an integral part of the description herein.

[0026] Further objects, features and advantages of the present invention will become apparent from the following detailed description and annexed drawings, which are supplied by way of non limiting example, wherein:

- Fig. 1 shows a front view of an inner door, pertaining to the door of a dishwashing machine manufactured according to the present invention;
- Fig. 2 shows schematically a section of a dispensing device of washing agents for a household dishwashing machine, according to a possible embodiment of the present invention, in a first operating condition;
- Fig. 3 shows schematically a section of the dispensing device of washing agents of Fig. 2, in a second operating condition;
- Fig. 4 shows schematically a section of the dispensing device of washing agents of Fig. 2, in a third operating condition;
- Fig. 5 shows an embodiment example of a dosing-dispensing system of a liquid washing agent of the dispenser device of Fig. 2.

[0027] Manufacture and operation of the household dishwashing machine object of the present invention is commonly known, save for the special configuration of the door and of the dispensing device of washing agents, as further described. Therefore, the dishwasher shall not be described nor illustrated in detail in the following description. Here it is simply specified that this washing machine is equipped at least with:

- a control system, being apt to supervise the execution of a plurality of different wash programs, such as a basic cycle, an intensive cycle, an economy cycle, etc.; each one of these programs comprising a plurality of sequential steps, such as a likely pre-wash step, a main wash step, a rinse step, etc., according to the known state of art;
- a washing tub, with a front door, wherein one or more baskets for containing the crockery to be washed are located;
- water inlet and dosing means inside the tub, comprising e.g. an intake hose, a solenoid valve and a pressure switch;
- heating means for the water supplied to the washing tub, comprising e.g. an electric heater;
- means for spraying the water supplied to the washing tub on the crockery, for its filtering and circulating, comprising e.g. a washing pump, a filter system and rotary sprayers;
- discharge means for the water used during the various steps of the wash cycle, comprising e.g. a duct and a discharge pump;
- at least a washing agents dispenser.

[0028] In Fig. 1 reference CP indicates the inner-door of the dishwashing machine according to the present invention as a whole, i.e. the portion of the door usually consisting of a stainless steel shell, facing inside the washing tub of the machine.

[0029] Reference PI indicates a drawn area of the inner door CP, delimited in the upper section of the latter and protruding out on the front; BS indicates an upper edge of the inner door CP, i.e. of the above drawn area PI.

[0030] According to a significant feature of the present invention, the dispensing device of washing agents fitting the machine is mostly inserted inside the door, in particular in the drawn area PI; this dispenser is indicated in its whole with 1 in Fig. 1.

[0031] As it will be noticed, the upper section of the dispenser 1 indicated with ZS, is directly facing out and protruding slightly on the upper edge BS of the inner door CP, through a port delimited in the edge; the lower section of the dispenser 1, indicated with ZI is overhanging below the drawn area PI, through a relevant port delimited in the latter; appropriate common sealing means are provided between the sections ZS and ZI and their relevant ports delimited in the inner door CP, of known type, for preventing water infiltration to the inner side of

the machine door.

[0032] Fig. 1 also illustrate how in the above example, the upper section ZS of the dispenser 1 delimits three separate filling ports, namely:

- a filling port for a single dose of detergent powder, indicated with AD;
- a filling port for a liquid rinse-aid, indicated with AB;
- a filling port for at least a detergent tablet, indicated with AP.

[0033] In the preferred embodiment of the invention, the dispenser 1 has a manually operated tilting cover fitted with proper sealing means, indicated with CO in the Figures 2-4, being apt to shut simultaneously at least the ports AD and AP for the washing agent in solid form (powder or tablet); closure of the rinse-aid port AB is preferably obtained by means of a classic common plug indicated with TP in the Figures 2-4, which is anyway also covered by the above cover CO when the latter is in its relevant closed position.

[0034] As said, the body of the dispenser 1 is inserted substantially goes through the drawn area PI of the inner door CP; thus, the lower section ZI of the dispenser 1 is directly facing inside the washing tub; to this purpose, as it will be seen later, discharge outlets are obtained in the portion ZI for the various washing agents contained in the dispenser 1.

[0035] The above dispensing device 1 is shown schematically in sections in the Figures 2, 3 and 4, in different operating conditions.

[0036] The dispenser 1 comprises a boxed body 2 from plastic material, wherein the following elements are delimited:

- a compartment 3, for containing a single dose of detergent powder, i.e. an amount of washing agent required for performing a single wash cycle; the amount of washing agent that can be contained in the compartment 3 is substantially equal to the amount of the known single-dose dispensers with movable cover mentioned at the beginning of the present description;
- a compartment 4, for containing at least a tablet of washing agent;
- a tank 5, for containing a liquid rinse-aid; said tank having a capacity such to contain an enough amount of liquid agent for performing several washing cycles;
- a chamber 6, associated to the above tank, for the dosage of single rinse-aid doses to be dispensed during one same wash cycle.

[0037] The compartment 3 communicates with the above filling port AD and has a lower discharge outlet indicated with 3A. A dosing dispensing element indicated as a whole with 7 is assembled in the body 2 below the outlet 3A; in the example, the element 7 comprises

a linear sliding element, wherein a through-cavity 7A is delimited; this cavity 7A being apt to contain an amount of washing agent volumetrically defined, equalling a portion or fraction of the single dose contained in the compartment 3.

[0038] The compartment 4 communicates with the above filling port AP and has a lower port 4A.

[0039] Reference 8 indicates a second movable element, which slides linearly between the dosing element 7 and the bottom wall of the body 2; this movable element 8 has a through-port 8A, whose functions will be further described.

[0040] References 9A and 9B indicate two discharge outlets delimited in the bottom wall of the body 2, i.e. in the section ZI of the dispenser 1 represented in Fig. 1, namely the portion extending out of the drawn area PI of the inner door CP.

[0041] The port 9A is so sized to extend both below the port 3A of the compartment 3 and below the through-port 8A of the movable element 8, when the dispenser 1 is in the rest condition illustrated in Fig. 2, for the purposes further described.

[0042] Vice-versa, the discharge outlet 9B is located in line with the lower port 4A of the compartment 4; Fig. 2 shows how an end portion of the movable element 8 will extend in the compartment 4 partially shutting its lower outlet 4A, when the dispenser 1 is in its rest condition.

[0043] Reference 10 indicates a first common actuator, such as a thermal actuator, which has an operating shaft or piston 10A; the actuator 10 is commonly fastened inside the body 2 of the dispenser.

[0044] Reference 11 indicates a first lever pivoted on the body 2 at a location P1; the lever 11 has slots on both ends, wherein both the end of the shaft 10A of the actuator 10 and an extension 7B of the dosing element 7 are commonly engaged.

[0045] Reference 12 indicates a second common actuator, such as a thermal actuator, which has an operating shaft or piston 12A; also the actuator 12 is commonly fastened inside the body 2 of the dispenser 1.

[0046] Reference 13 indicates a second lever pivoted on the body 2 at a location P2; also the lever 13 has slots on both ends, wherein both the end of the shaft 12A of the actuator 12 and an extension 8B extending from an upright 8C of the movable element 8 are commonly engaged.

[0047] Finally, reference 14 indicates a rod coupled to said upright 8C of the movable element 8, which pertains to a rinse-aid dosing-dispensing system.

[0048] According to the present invention, the dishwasher door is preferably fitted with common means for an intermediate stop of the angular movement of the door itself; these means consisting eventually of balls or pins, which are pushed by relevant springs for their partial extension out of the two side edges of the door, and are apt to engage in respective seats delimited in the side edges of the front access aperture to the wash-

ing tub of the machine; thus, when the door is closed, the above pins are capable of entering the above seats and keep the door steadily in a half-closed position, with the edge BS of the inner door CP facing upwards; a subsequent thrust on the door will release the above pins from their seats for complete closure of the door.

[0049] Obviously, the above means ensuring a steady half-closed position of the door can be obtained through other common techniques; for instance, they may be integrated in the door hinging means to the machine cabinet.

[0050] Operation of the dispenser 1 of Fig. 2 for dispensing the washing agent, is as follows.

[0051] Before starting a wash cycle, the user opens the dishwasher door and loads the crockery to be washed in the relevant baskets in the usual way.

[0052] Then the door is brought to its steady half-closed position as above, with the upper edge BS of the inner door CP facing upwards.

[0053] Now the user can open the upper cover CO of the dispenser 1 and fill the single dose of washing agent for performing the cycle in the compartment 3 through the inlet AD; if required, the user can also remove the plug TP and fill the tank 5 with rinse aid through the inlet AB; the cover CO can be closed again after the likely closure of the plug TP.

[0054] The user will then close the dishwasher door and start the wash cycle.

[0055] During manual filling of the detergent powder in the compartment 3, a portion of it will reach by gravity through the inlet 3A the cavity 7A of the dosing element 7 in line with the same inlet 3A; in this operating position illustrated in Fig. 2, the cavity 7A is closed on its bottom by the upper surface of the movable element 8; thus, the cavity 7A can be filled with a defined amount of washing agent.

[0056] At the appropriate time the control system of the machine will instruct the device 1 for dispensing the washing agent.

[0057] In particular, the actuator 10 is supplied, so that its piston 10A to determine an angular movement of the lever 11 around the pivoting point P1 and the element 7 to move linearly to the right (with reference to Figures 2-4). Thus, the cavity 7A is brought in line with the through-port 8A of the movable element 8, which is in line with the discharge outlet 9A; as a result, the amount of washing agent contained in the compartment 7A can freely fall down into the machine tub for the washing of the crockery. This condition is illustrated in Fig. 3.

[0058] As soon as dispensing has been performed, the actuator 10 is deactivated so that its relevant piston 10A, lever 11 and dosing element 7 to go back to their original position of Fig. 2, where the cavity 7A can be filled with washing agent again through the port 3A; as it will be noticed, the return of the element 7 to its original position can be either obtained or favoured by common elastic means (e.g. integrated in the actuator 10).

[0059] At a subsequent time of the wash cycle, the

control system will instruct the actuator 10 of the device 1 again for dispensing a new portion of the detergent powder contained in the compartment 3; as it can be guessed, this occurs exactly as described above, i.e. a linear movement of the element 7 is produced until the cavity 7A is brought in line with the through-port 8A and then with the discharge outlet 9A; moreover, a new filling of the cavity 7A can be eventually obtained with the subsequent return of the element 7.

[0060] The number of supplies of the actuator 10 is preferably calculated according to the maximum capacity of the compartment 3, so as to ensure dispensing of nearly the total amount of washing agent at subsequent intervals as described above.

[0061] Dispensing of the final portion of detergent powder, vice-versa, is obtained supplying the actuator 12 through the control system of the machine.

[0062] Following this supply, the shaft 12A of the actuator 12 causes the lever 13 to perform an angular movement around the pivoting point P2; a linear translation to the left of the movable element 8 is obtained (with reference to Figures 2-4) with resulting thrust of the rod 14 toward inside the chamber 6 for dosing the rinse aid from the tank 5.

[0063] Through the same movement of the movable element 8, the through-port 8A is brought in line with the cavity 7A of the element 7 with the inside of the compartment 3 directly communicating inside the washing tub of the machine. This condition is illustrated in Fig. 4. In this condition, the residual portion of washing agent eventually available in the compartment 3 can fall into the tub through the filling port 3A, the cavity 7A of the element 7, the through-port 8A of the movable element 8 and the discharge outlet 9A of the body 2. In This condition, moreover, a portion of the water sprayed inside the tub by the spraying elements of the dishwasher, can reach the compartment 3 inside and wash it thoroughly; it should be noticed how in this operating condition a displacement of the movable element 8 will also cause a complete opening of the lower port 4A of the compartment 4: thus, water can reach also the compartment 4 inside and wash it thoroughly.

[0064] The actuator 12 will remain supplied until a first dispensing of rinse aid is provided by the wash cycle of the machine.

[0065] In this event, the control system of the machine stops supply to the actuator 12, with a consequent return of the movable element 8 to the original position of Fig. 2; also in this instance, the return of the movable element 8 to its original position can be obtained or favoured by common elastic means, e.g. integrated in the actuator 12.

[0066] The return movement of the element 8 obviously causes a reverse movement of the rod 14, through which the rinse aid previously dosed in the chamber is dispensed; an example of the rinse aid dispensing procedure will become more apparent in the following description.

[0067] From the above it is clear how the dispenser 1 of the machine according to the present invention permits :

- 5 - the realization of a "fractioning" of the single dose of detergent powder originally filled in the compartment 3, in a plurality of sub-doses of a predefined volume,
- 10 - dispensing at least a respective sub-dose of detergent powder in the course of at least two different steps of a wash cycle, or dispensing a plurality of said sub-doses within at least one same cycle step.

[0068] In this frame, according to an advantageous embodiment of the present invention, the control system of the dishwasher is programmed for instructing a first dispensing of the washing agent already during a pre-wash step provided by the cycle, even if a cold one, in order to utilize the mechanical/abrasive features of the washing agent; this procedure will actually ensure a substantial soil removal since the first wash step, independently from water temperature.

[0069] Analogous considerations obviously also apply for a likely second pre-wash step, also cold, provided by the selected cycle.

[0070] Moreover, according to a significant feature of the present invention, the control system of the machine can be programmed for a plurality of actuations of the device 1 in the subsequent main wash step, to obtain dispensing of portions or fractions of the washing agent at separate intervals.

[0071] Thus, two or more separate portions of washing agent can be dispensed within the same main wash step; for instance, a first dispensing will be conveniently performed at the beginning of this step, when the wash fluid has not yet reached the working temperature, and a second dispensing will be performed a certain time after that the same step has started, when the fluid temperature is assumed to have been reached (the attainment of this temperature may also be detected through appropriate sensing means); thus, the mechanical/abrasive features of the washing agent are fully utilized during the first part of the wash step (i.e. after a first dispensing) and during the second part of the wash step (i.e. after a second dispensing).

[0072] Obviously, the steps for at least one dispensing of the washing agent and the steps for dispensing the washing agent at several intervals, are established since the design stage of the control system of the machine, depending on the type of wash cycle type the user can select and the capacity of the compartment 3.

[0073] It should also be noticed how through a supply sequence of the actuator 12 a plurality of rinse-aid dispensing actions can also be performed within one same rinse step and/or at least in the course of two different rinse steps.

[0074] As to the likely use of a detergent tablet, operation of the device 1 is described below, assuming also

in this instance that the device 1 is in its rest position as illustrated in Fig. 2.

[0075] Before starting a wash cycle, the user of the dishwasher opens the machine door and loads the crockery to be washed in the appropriate baskets, in the usual way.

[0076] Then the user can bring the door to the above steady half-closed position, with the upper edge BS of the inner door CP facing upwards. In this condition, the user can open the cover CO and introduce the detergent tablet in the compartment 4 through the inlet AP; if required, the user can also fill the tank 5 with rinse-aid; then the cover CO can be closed again. The user will then finally close the dishwasher door and start the wash cycle.

[0077] When in the compartment 4 the detergent tablet is filled, the former will rest by gravity on the end portion of the movable element 8, extending inside the compartment 4 in line with its lower port 4A.

[0078] In this condition, due to the half-open of the port 4A and the open of the discharge outlet 9, a portion of the water sprayed inside the tub by the spraying elements of the dishwasher, during the wash cycle, can reach inside the compartment 4 and obtain a partial pre-dissolution of the detergent tablet; as a result, a portion of this washing agent will reach the tub of the machine through the same port 4A and discharge outlet 9B for the washing of the crockery.

[0079] At a subsequent time, the control system of the machine will supply the actuator 12 as previously described; in this event the residual portion of the tablet is finally dispensed (typically, this occurs strictly during the wash step of the cycle).

[0080] As described above, operation of the actuator 12 causes a linear translation of the movable element 8 to the left (with reference to Figures 2-4), with a consequent thrust of the rod 14 inside the chamber 6; through the same movement of the movable element 8, the port 4A of the compartment 4 is completely opened, so the residual portion of the detergent tablet will fall down through the discharge outlet 9B into the washing tub of the machine.

[0081] Moreover, this movement will bring the through-port 8A in line with the cavity 7A of the element 7, so the inside of the compartment 3 will communicate directly with the inside of the washing tub of the machine; in the above condition, illustrated in Fig. 4, the compartments 3 and 4 are also washed inside, as previously described.

[0082] Also in this instance, supply of the actuator 12 is maintained until the cycle provides for dispensing a first amount of rinse aid.

[0083] Then the control system of the machine will stop supply to the actuator 12 for the movable element 8 to return to its original position illustrated in Fig. 2; this movement obviously causes a reverse movement of the rod 14, through which the rinse aid will be dispensed. From the above it is clear how also in the above example

a "fractioning" of the single detergent tablet is obtained by the dispenser 1.

[0084] Fig. 5 is representing a possible embodiment of the rinse-aid dosing/dispensing system for the dispenser 1.

[0085] In this Figure, reference 5 indicates the rinse-aid tank and reference 6 the dosing chamber, as mentioned above.

[0086] According to the suggested embodiment, inside the chamber 6 is located a hollow cylindrical body 15, the inside of the latter communicates directly with the tank 5 through a port 16; reference 17 indicates common sealing means operating between the chamber 6, the body 15 and the rod 14, to prevent the rinse-aid from running out of the body 15; finally, reference 18 indicates a plunger element solidly connected to the rod 14 inside the body 15.

[0087] The cylindrical body 15 also has a calibrated discharge outlet not visible in Fig. 5 on the rear of the plunger element 18, substantially in line with the port 16; said calibrated discharge outlet communicates with a discharge duct, not represented, in communication with the lower section of the body 2 of the dispenser 1, indicated with ZI in Fig. 1; it should be noticed that also the inner part of the tank 5 is in communication with the lower section of the body 2 through a common venting duct, also not represented; the above ducts are conveniently in the form of a siphon.

[0088] Operation of the rinse-aid dosing/dispensing system illustrated in Fig. 5 is very simple.

[0089] With the system in rest condition as illustrated in Fig. 5, the plunger element 18 will keep both the port 16 and discharge outlet on the rear of the plunger element, in closed condition. After actuation of the actuator 12 and the consequent movement of the element 8, as described above, the rod 14 is pushed inside the cylindrical body 15; following this movement, the plunger element 18 is gradually displaced to the left (with reference to Fig. 5), causing the port 16 and calibrated discharge outlet to open, and subsequently, a rinse-aid flow from the tank 5 inside the body 15, filling the latter.

[0090] Thus, the dosing of the amount of rinse aid to be dispensed is performed.

[0091] Following supply deactivation of the actuator 12, and the consequent movement of the element 8 as previously described, the rod 14 is pulled out of the cylindrical body 15; following this movement, the plunger element 18 will gradually move to the right (with reference to Fig. 5), causing the rinse aid contained in the body 15 to flow in the relevant calibrated port and from here inside the washing tub through the above discharge duct.

[0092] Thus, the amount of rinse aid previously dosed by the cylindrical body 15 is dispensed.

[0093] At it will be noticed, the operating principle of the system illustrated in Fig. 5 works substantially like a "syringe", which permits, as previously mentioned, to perform a plurality of rinse-aid dispensing actions within

one same rinse step and/or during at least two different rinse steps, through a supply sequence of the actuator 12.

[0094] The present invention obviously provides practical advantages for an easy use of the dishwasher.

[0095] A first essential advantage is an extremely comfortable filling operation of the various washing agents, which can be performed with the machine door half-opened due to the special position of the dispenser 1, its upper section ZS being in line with the upper edge of the inner door CP.

[0096] In dishwashing machines according to common art, the dispenser represents a bulk inside the tub reducing its useful space; in this connection it should also be noticed how conventional dispensers, fitted with a movable cover, normally require a free space on their front for the opening of said cover.

[0097] On the contrary, according to the present invention, the dispenser 1 is mainly built-in inside the machine door to remove any bulks inside the washing tub as well as the need of a free space on the front; it should also be noticed how most common inner doors already have an upper drawn section as previously indicated with PI.

[0098] Other significant practical advantages are featured by the dispensing device 1 comprising only one dedicated compartment 3 and/or 4 for the single dose of washing agent to be used; thus, the user is actually forced to use such a compartment for filling the whole single dose of washing agent required for performing the wash cycle, either in powder or in the form of tablets.

[0099] As mentioned, a portion of such a washing agent can be utilized during the first cycle step (first and/or second pre-wash), but requiring no specific decision by the user, who is not even required to perform additional operations than usually requested for common dishwashing machines.

[0100] According to the present invention, the use of a single dose of detergent powder can also be optimised fractioning it in several doses volumetrically defined, which are dispensed at the most appropriate intervals of one same wash cycle.

[0101] In this frame, therefore, a first fraction of the single dose of detergent powder can be utilized during a pre-wash step of the cycle; the device 1 will then allow dispensing a second fraction of the single dose of detergent powder also during a second pre-wash step of the cycle, provided it is included.

[0102] The device 1 also ensures a plurality of dispensing within one same step of the wash cycle; in this case, the control system of the machine will control dispensing of a third and fourth fractions of the single dose of detergent powder at separate intervals during the main hot wash step provided by the cycle.

[0103] Optimisation of the single dose of detergent powder filled in the machine is thus obtained for improving washing quality.

[0104] All this is obtained automatically and inde-

pendently from the choice or decision operated by the machine user; the only condition for the user is to fill the compartment 3 with washing agent, but this is obviously an essential presupposition for washing, i.e. an operation the user has to perform anyway.

[0105] If required, the present invention also provides for adequate "diversified" utilization of a detergent tablet, i.e. the capability of utilizing portions of such a washing agent at subsequent intervals; the same applies for the rinse aid, which can be dispensed at several intervals.

[0106] From the above description the features of the dishwashing machine object of the present invention will be clear, and also the ensuing advantages are clear.

[0107] It is obvious that many other changes are possible for the man skilled in the art to the dishwashing machine and program object of the present invention, without departing from the novelty principles of the innovative idea, and it is clear that in practical actuation of the invention the components may be replaced with technical equivalent elements.

[0108] A possible implementation provides a plate housing on the inner side of the inner-door CP (i.e. the opposite side to the side shown in Fig. 1) being apt to

- enclose the body of the dispenser 1,
- isolate it from the inner side of the door, wherein live components are located,
- convey possible rinse-aid leakages from the tank 5 and/or chamber 6 directly into the tub through the same port of the drawn section PI, wherefrom the dispenser lower section ZI is extending out.

[0109] Finally, it is clear how the section ZS and/or section ZI do not necessarily have to protrude outside the inner door CP, since they can simply face or be in line with the relevant ports delimited in the inner door itself, with relevant sealing means provided to hinder water infiltration inside the machine door.

[0110] The present invention has been previously described with reference to application to dishwashing machines fitted with a tilting front door or lid; however, it is clear that the present invention can also be applied to machines fitted with linear sliding doors or in the form of a drawer, as mentioned at the beginning of the description herein.

Claims

1. A household dishwashing machine, comprising:

- a control system, being apt to control execution of a plurality of different wash programs, with at least one of said programs comprising at least a number of sequential steps;
- a washing tub fitted with a movable front door; a section (CP) of said door facing inside said

tub, said section (CP) comprising at least an upper edge (BS) and a drawn area (PI) near said edge (BS);

- a washing agents dispenser (1), associated to said door, whose body (2) is delimiting at least:
 - a compartment (3,4) for containing a single dose of a solid washing agent, required for the execution of a single wash program, said compartment (3,4) having a respective filling port (AD,AP),
 - a tank (5) for containing an enough amount of a liquid washing agent for executing of a plurality of wash programs, said tank having a respective filling port (AB);

characterized in that most part of the body (2) of said dispenser (1) is assembled inside said door, so that

- a first portion (ZS) of said body (2) delimiting said filling ports (AD,AP,AB) is in line with a first passage delimited in said upper edge (BS),
- a second portion (ZI) of said body (2), delimiting at least an outlet for discharging the solid washing agent contained in said compartment (3,4) into the washing tub, is in line with a second port delimited in said drawn area (PI).

2. A household dishwashing machine according to claim 1, **characterized in that** said second port is delimited in a lower edge of said drawn area (PI).
3. A household dishwashing machine according to claim 1, **characterized in that** said first portion (ZS) extends outside said first port.
4. A household dishwashing machine according to claim 1 or 2, **characterized in that** said second portion (ZI) extends outside said second port.
5. A household dishwashing machine according to claim 1, **characterized in that** said dispenser (1) comprises means (7,8) for dividing said single dose of solid washing agent in a plurality of sub-doses having a substantially predefined amount, and that said control system is programmed for controlling said means (7,8), in order to dispense at least a respective sub-dose of solid washing agent during at least two separate steps of a wash program, or to dispense a plurality of said sub-doses at separate intervals within at least one same step of a wash program.
6. A household dishwashing machine according to claim 1, **characterized in that** said compartment (3,4) has a lower port (3A,4A).

7. A household dishwashing machine according to claims 5 and 6, **characterized in that** said means comprise a dosing and dispensing element (7), at least partially movable below said lower port (3A, 4A).

8. A household dishwashing machine according to claim 7, **characterized in that** said means comprise a movable element (8) between said element (7) and a wall of said body (2), wherein said discharge outlet (9A,9B) is delimited.

9. A household dishwashing machine according to the previous claim, **characterized in that** said movable element (8) has a through-port (8A), constantly in communication with said discharge outlet (9A,9B).

10. A household dishwashing machine according to claims 7 and 9, **characterized in that** said element (7) comprises at least a compartment or cavity (7A), being apt to contain one of said sub-doses, said element (7) being movable for moving said compartment or cavity (7A) at least from a first to a second position, where in said first position said compartment or cavity (7A) is in line with said lower port (3A) and in said second position said compartment or cavity (7A) is in line with said through-port (8A).

11. A household dishwashing machine according to the previous claim, **characterized in that** said movable element (8) can be translated for moving said through-port (8A) at least from a first to a second position, where in said first position said through-port (8A) does not communicate with said compartment or cavity (7A), and in said second position said through-port (8A) is in line with said compartment or cavity (7A), the latter being also in line with said lower port (3A).

12. A household dishwashing machine according to at least one of the previous claims, **characterized in that** said element (7) is a linear sliding or translatable type.

13. A household dishwashing machine according to at least one of the previous claim, **characterized in that** said movable element (8) is a linear sliding or translatable type.

14. A household dishwashing machine according to at least one of the previous claim, **characterized in that** said dispenser (1) comprises first actuating means (10,11) for producing the movement of said element (7).

15. A household dishwashing machine according to at least one of the previous claim, **characterized in that** said dispenser (1) comprises second actuating

means (12,13) for producing the movement of said movable element (8).

16. A household dishwashing machine according to claim 1, **characterized in that** said dispenser (1) comprises a system (6,14-18) for splitting said amount of liquid washing agent in a plurality of sub-doses having a substantially predefined amount, and that said control system is programmed for controlling said system in order to dispense at least a respective sub-dose of liquid washing agent within at least two separate steps of a wash program, or dispense a plurality of said sub-doses at separate intervals within at least one same step of a wash program. 10
17. A household dishwashing machine according to the previous claim, **characterized in that** said system (6,14-18) comprises a dosing chamber (6,15) communicating with said tank (5), and a movable plunger element (14,18) in said chamber (6,15). 15
18. A household dishwashing machine according to the previous claim, **characterized in that** said dosing chamber (6,15) has a discharge duct ending in said second portion (ZI) of said body (2). 20
19. A household dishwashing machine according to claims 8 and 17, **characterized in that** said plunger element (14,18) is actuated by means of said movable element (8). 25
20. A household dishwashing machine according to claim 1, **characterized in that** said compartment (4) is apt to contain a detergent tablet. 30
21. A household dishwashing machine according to the previous claim, **characterized in that** it provides means (8) to perform a initial pre-dissolution of said detergent tablet inside said compartment (4) and dispense at least a dissolved portion of said detergent tablet into said tub through said lower port (4A) and said discharge outlet (9B). 35
22. A household dishwashing machine according to the previous claim, **characterized in that** said means (8) can be actuated to subsequently perform dispensing of the portion of said detergent tablet not dissolved inside said compartment (4), into said tub through said lower port (4A) and said discharge outlet (9B). 40
23. A household dishwashing machine according to the previous claim, **characterized in that** said body (2) delimits a first compartment (3) with a filling port (AD), for containing the detergent powder, a second compartment (4) with a filling port (AP), for containing at least a detergent tablet, a tank with a filling 45

port (AB), for containing a liquid additive (5), said filling ports (AD,AP,AB) being located in said first portion (ZS) of said body (2).

24. A household dishwashing machine according to the previous claim, **characterized in that** to said body (2) is associated a cover (CO), being apt to close said filling port or ports (AD,AP,AB), said cover (CO), in particular, being a tilting type. 50
25. A household dishwashing machine according to claim 1, **characterized in that** said door is an angular movable door and provides means for an intermediate stop of its angular movement, so as to keep said door steadily in a half-closed position, with said upper edge (BS) facing upwards. 55
26. A household dishwashing machine according to claim 1, **characterized in that** it provides a housing for said body (2) of the dispenser (1) inside said door, said housing being in particular apt to
 - isolate said body (2) from the inner side of the door, wherein live components are located,
 - convey possible leakages of said liquid washing agent through said second port directly inside the tub.

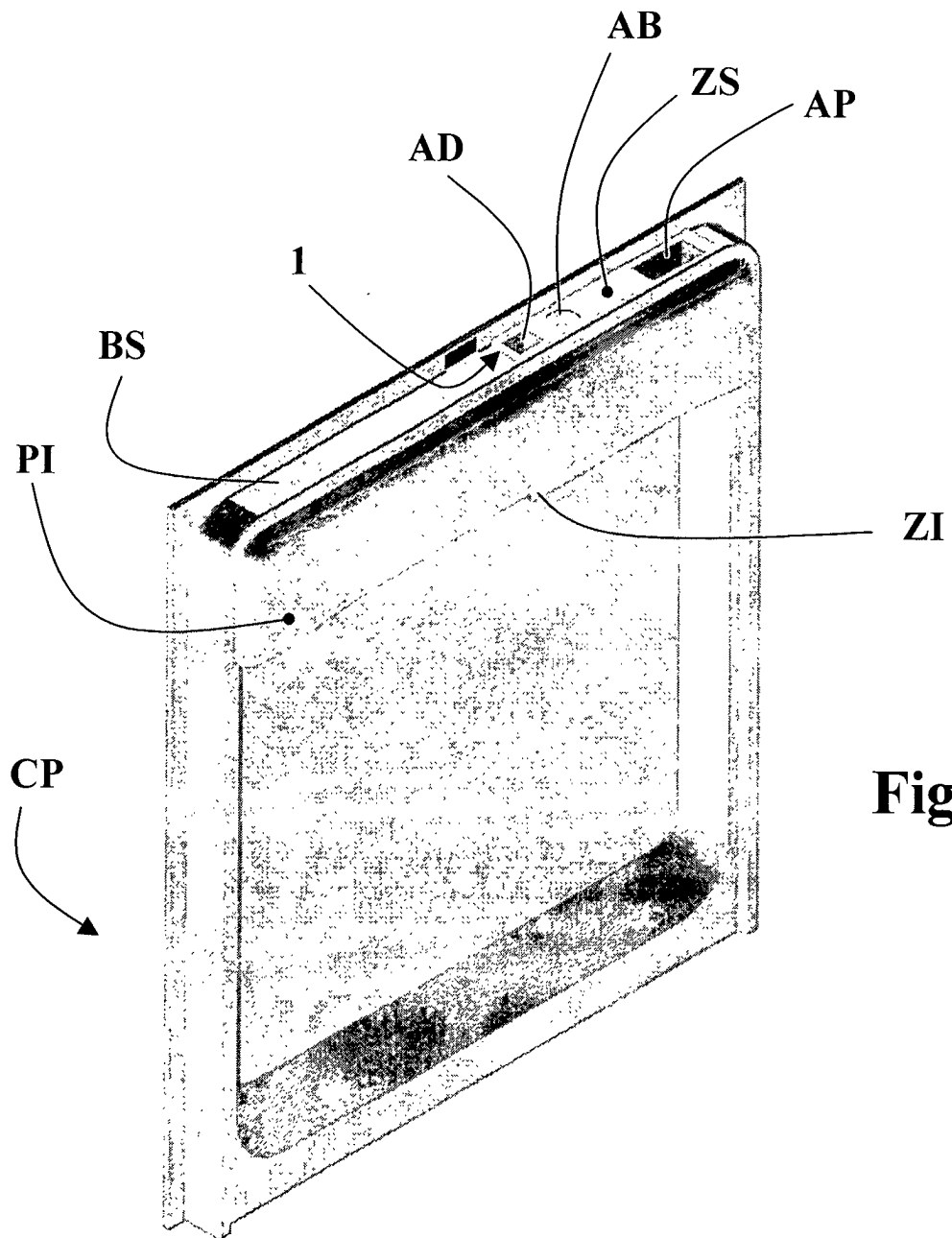


Fig. 1

Fig. 2

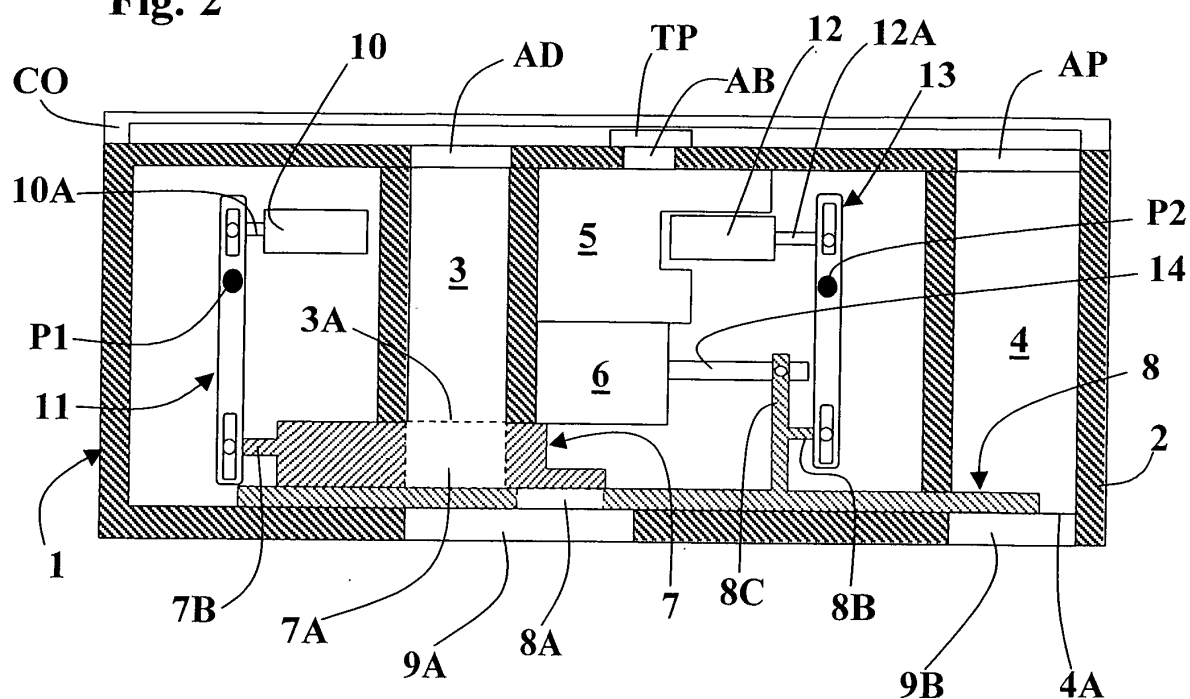


Fig. 3

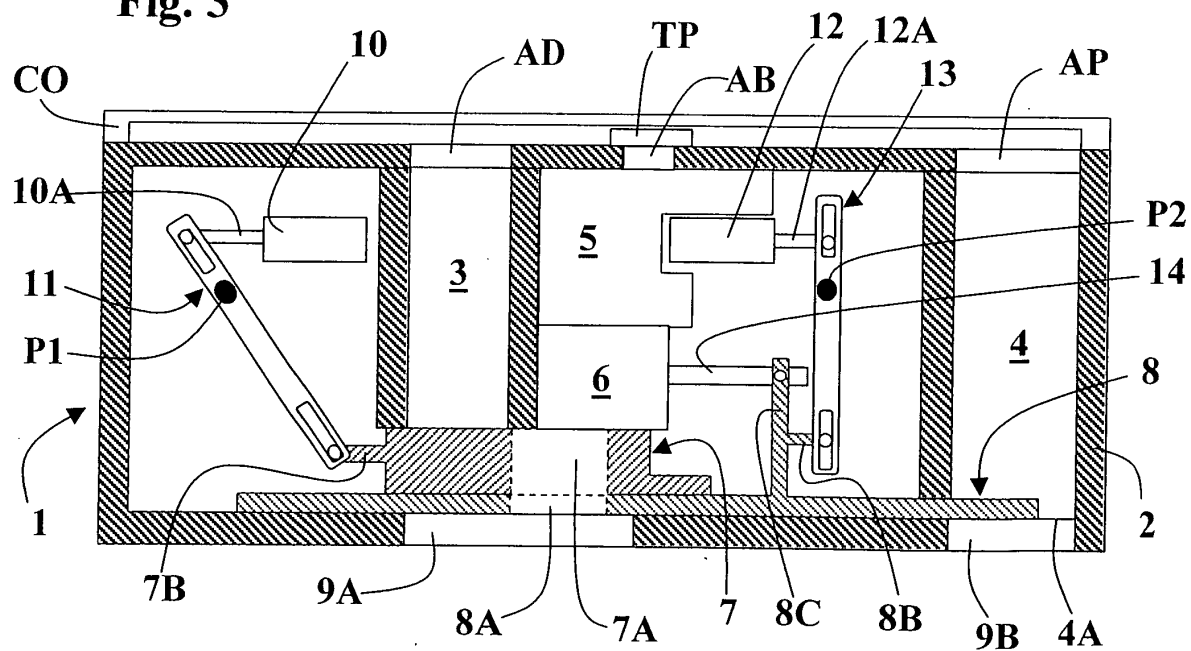


Fig. 4

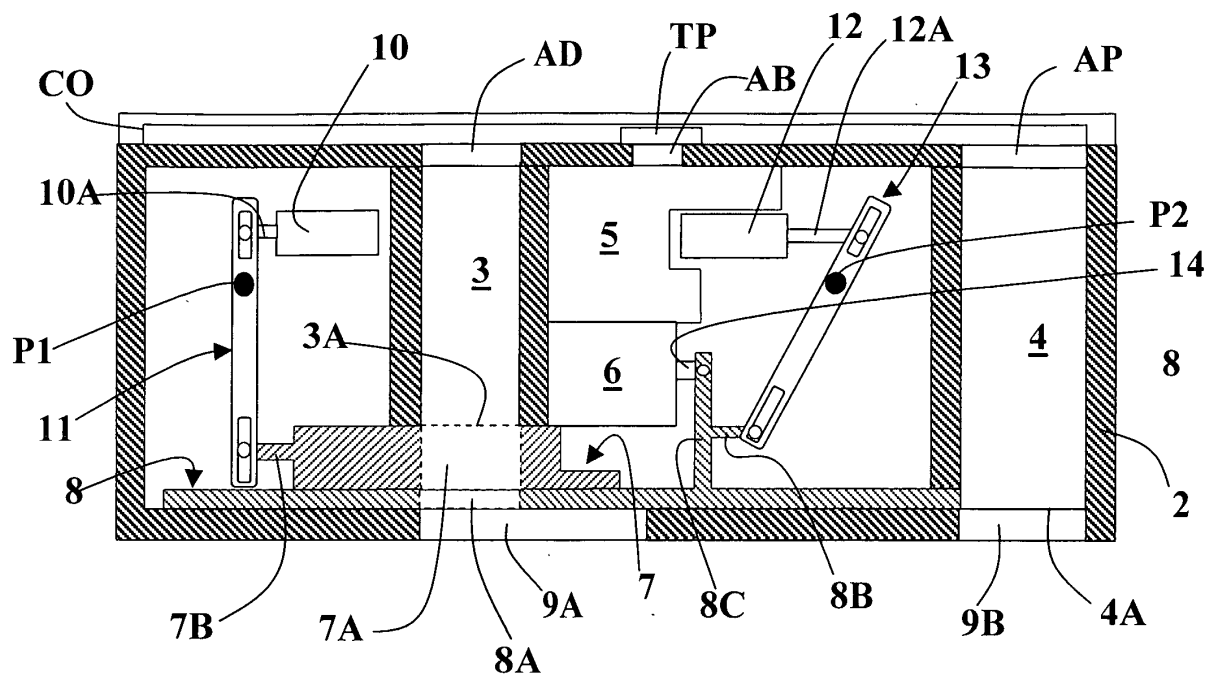


Fig. 5

