

DescriptionDRY CLEANING WASHING MACHINE HAVING A WATERLESS SOLVENT
FILTERING APPARATUS

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Field of the Invention

This invention relates generally with a dry cleaning washing machine using silicon liquid solvent, and particularly with such a dry cleaning washing machine, wherein the washing machine utilizes air to dry the articles, lengthened unroll time and has a silicon solvent filtering apparatus which operates mechanically.

Background of the Invention

Nowadays dry cleaning washing machines are available, which can wash articles with kind of fabric such as wool, silk, and other soft fabric which cannot be washed using water media but waterless solvent. After cleaning, the articles will be dried up in the washing machine, so that the articles will get out of the machine after cleaning process in dry condition. This particular dry cleaning washing machine is expensive and consumes big electric power.

The particular dry cleaning washing machine needs a liquid solvent purifying system by distillation, so that it needs also high temperatures, which is obtained by electronic elements, to distillate solvent to vapour. Further, vapour bubble will become clean pure solvent. This method consumes big electric power.

There is also an available article drying system in a dry cleaning washing machine with hot air flow from an electrical heating source, so that the system consumes also big electric power.

Based on the above shortcomings of the particular dry cleaning washing machine, inventor of this invention has endeavoured to obtain a dry cleaning washing machine which can eliminate the above shortcomings. The usable aspects are

5 (1) use of a washing machine having a computer program and is available in the market, (2) use of waterless solvent with low flash point, safe for the environment and health,

(3) solvent filtering apparatus to purify the solvent for reuse, (4) lengthen time and rotating speed of the unroll

10 program at the end of extract program to drying program, and (5) installing additional fan to take in air and a exhaust duct in outer wall of the washing machine, so that the articles can be dried up under room temperature in the washing machine during the lengthened unroll stage.

15 Additional information of the the washing machine having computer program, washing program consists of following steps :

1. Pre wash
2. Main wash
- 20 3. Rinse 1
4. Rinse 2
5. Final Rinse
6. Extract
7. Unroll
- 25 8. Stop

The object of the unroll program is to untangle the articles due to final extract process, by slowly and alternately rotating the drum. The articles can be easily untangled as to ease taking them out of the washing machine.

Summary of the Invention

An object of the invention is to provide a dry clening washing system, wherein the system is a computer program comprising steps of :

- 5 1. Pre wash
2. Main wash
3. Rinse 1
4. Rinse 2
5. Final Rinse
- 10 6. Extract
7. Lengthened unroll amd adjusted rotating speed
8. Stop

Another object of the invention is to provide a dry clening washing machine to conduct the above object.

- 15 Further object of the invention is to provide a dry clening washing machine which can recycle and reuse the solvent.

To achieve the above objects this invention provides a dry cleaning washing machine with an additional inlet opening to suck air into the drum of the washing machine, and an additional outlet opening to take air out of the washing machine, the inlet and outlet openings being provided with a fan as to maximize the air flow within the drum. Inlet and outlet openings of the drum of the washing machine are located at the upper side of the outer wall of the washing machine. Another additional equipment for the washing machine is a solvent filtering apparatus.

Dry cleaning washing machine according to the invention can be manufactured specially. This invention also provides a dry cleaning washing machine made by modifying an existing washing machine which has computer program. The modification is the additional inlet and outlet ducts provided with a

fan, both ducts are fixed at the upper side of the outer wall of the washing machine.

The solvent filtering apparatus is separated from the washing machine and functions to filter the used and dirty solvent, so that the solvent will be clean and reusable.

Inventor gained the modification through experiment. Outer wall of washing machine is cut out to make an opening at left side and an opening at right of the upper side of the wall of washing machine. Around the openings an air duct of stainless steel is mounted perpendicularly and is welded around the openings at the outer wall of the washing machine. At an end of the air duct a threaded plastic pipe is connected and clamped by steel wire, which functions to tighten the connection between air duct and threaded plastic pipe so that air will not leak out. The threaded plastic pipe lies perpendicular to the outer wall, as well as the air ducts, then turns at right angle to the rear cover of the washing machine, where the air ducts and the threaded plastic pipe function as air inlet into the washing machine and air outlet from the washing machine. Because the plastic pipe is threaded, it will be flexible in resisting oscillation when the washing machine operates. The threaded plastic pipe is suspended on the upper frame of the washing machine, so that it will operate to damp oscillation of the washing machine and of the threaded plastic pipe when the washing machine operates. An end of the threaded plastic pipe is connected to the rear cover of the washing machine. The rear cover is perforated as to let the air flow freely.

At a left end of the threaded plastic pipe a fan is mounted to help suck air into the inner drum of the washing machine. When the drum rotates clockwise, air circulation within the washing machine will be accelerated so that drying of the articles will be faster. The fan operates

after receiving signal from the unroll program and the fan will stop working when the unroll program ends.

Solvent filtering apparatus outside the washing machine operates as follows : the used solvent flows out of the washing machine, then undergoes fabric fiber filtering process which separate fiber, button, pin and other big objects. Thereafter the solvent undergoes water separation process which separates the dirty solvent from water, then the dirty solvent is received in the dirty solvent tank. Dirty solvent pump will suck the dirty solvent out to an organic filtering element which filters sand particles, active carbon filtering which filters smaller particles and deodorizes the solvent, nano filtering which filters very smooth particles in size of nano or 10^{-9} , so that the solvent becomes clean and clear again. The final step, the solvent flows through UV lamp which kills bacteria. The clean solvent is received in the clean solvent tank and will be sucked out by clean solvent pump to reuse in the next washing process.

Water separation process runs as follows : at first the water originates from human's sweat and water-based dirt which stick to the clothing. The available dry cleaning washing machines have also a water separating means using solvent PCE (perchloroethylene). The solvent used in this invention has a density less than that of water. Water separation process runs by putting in the liquid slowly into a tank for a certain time span, so that water and solvent separation process will run naturally according to the different densities. Therefore 2 separated layers will be developed, where water will be below the solvent; then water and solvent can easily flow to two different tanks. The duct for solvent lies at top of the tank, duct for water lies at the bottom of the tank.

Air duct pipe is made of 304 or 306 stainless steel and flexible plastic pipe.

Important aspect is the use of washing machine having computer program, steel pipe connection and threaded plastic pipe without leakage, selection of fan capacity according to the capacity of the washing machine, use of solvent which can vapourize at low temperature and is safe for health and environment, such as dodecamethylcyclotetrasiloxane (D6) which has been deemed safe by the Danish Ministry of the Environment - Environmental Protection Agency - Evaluation of health hazards and proposal of health-based quality criteria for ambient air.

Washing machine according to the invention can also use solvent containing octamethyl-cyclotetrasiloxane or decamethyl-cyclopentasiloxane. Both substances have been deemed safe by the institution mentioned above.

Brief Description of the Drawings

Figure 1 is a side view of a dry cleaning washing machine according to the invention with outer drum having opening and equipment of air duct.

Figure 2 is a front view of a dry cleaning washing machine according to the invention where air duct pipes are visible at the top left and right of the drum of washing machine.

Figure 3 is a cross sectional view of a dry cleaning washing machine according to the invention where outlet air duct pipe is visible with a fan.

Figure 4 is a filtering system with steel tank and pumps.

Detailed Description of the Invention

Figure 1 is a side view of a dry cleaning washing machine (1) with an outer drum of the washing machine (2), an opening (3) on the wall of the washing machine, and
5 equipment to fix in the washing machine : steel pipe (4), threaded plastic pipe (5) to extend air duct (25), steel wire clamp (6), threaded plastic pipe connection clamp (5) with air duct (25), fan (7), fan bolt (8), spiral steel wire (9) to suspend threaded plastic pipe (5). An opening (3)
10 lies at the top side of the outer drum (2), functions to suck in the air into the inner drum of the washing machine (1). Steel pipes (4) are fixed in the opening (3) as an air inlet and outlet ducts (25).

The air duct (25) is extended with the threaded plastic
15 pipe (5), and reinforced with a steel wire clamp (6) at the connection between the air duct (25) and threaded plastic pipe (5). The threaded plastic pipe (5) is connected with top frame (10) of washing machine (1) with a spiral steel wire (9). See Figure 2.

Figure 3 shows a cross section of the dry cleaning
20 washing machine (1). It is visible that the air duct (25) is suspended on the top frame (10) of the washing machine (1). Fan (7) is connected with the threaded plastic pipe (5), and is fixed on the rear cover (11) of the washing machine (11)
25 using bolt (8). Function of fan (7) is to suck in air into the outer drum (2) of the washing machine (1).

Washing machine (1) has a computer program to wash, one of which is a command "unroll" at the end of the extract process. By lengthening the unroll command the washing
30 machine (1) obtain extra time to dry the articles under room temperature. In the extract process drum speed is reduced and the drum rotates alternately. Therefore the washing machine (1) can untangle the articles, so that the articles

can be easily taken out of the washing machine (1). During the unroll process the articles would be dried.

Figure 4 is a diagram of a solvent filtering apparatus working as follows : dry cleaning washing machine (1) is located above the filtering apparatus (12). The dirty solvent flowing out of the washing machine directly enters gravitationally into the fiber separator (13), then the dirty solvent enters the separator of dirty water and solvent (14), dirty water enters the dirty water tank (15) to be discharged periodically, while the waterless solvent flows into the dirty solvent tank (22). From the dirty solvent tank (22) the solvent is sucked by the dirty solvent pump (17) through particle filter (18), active carbon filter (19) to filter colour substance and odour, nano filter (20) to achieve clean solvent and through UV lamp (21) to kill bacteria, and finally enters the clean solvent tank (22). The clean solvent is sucked by the clean solvent pump (23) into the washing machine (1) for reuse. The connection between the elements of the filtering apparatus (12) is made with medium PVC pipe.

The solvent dodecamethylcyclohexasiloxane (D6) vapourizes easily under room temperature, as well as octamethyl-cyclotetrasiloxane and decamethyl-cyclopentasiloxane. When processed by the filtering apparatus (12), these solvents will vapourize quickly. Their vapour is safe to the operator and environment.

According to the above disclosure, it can be concluded that the dry cleaning washing machine (1) according to the invention exposes following advantages :

1. Washing machine (1) can be applied as a dry cleaning washing machine so the it saves the initial investment.

2. The dry cleaning washing machine according this invention can dry up the articles under room temperature as to save electric power.
3. The solvent filtering apparatus (12) can filter the dirty solvent without high temperature or distillation as to save electric power.
4. The solvent can be reused so that the operating cost of the washing machine (1) is reduces.

This invention has been disclosed by the above description. It can be understood that modification, variation or amendment can be made thereto without deviating from the scope of this invention. Therefore this invention is described by, but not limited, with the accompanying claims.

Explanation of reference numbers :

1. Dry cleaning washing machine
2. Outer drum
3. Opening
4. Steel pipe
5. Threaded plastic pipe
6. Steel wire clamp
7. Fab (with electric wire)
8. Screw
9. Steel wire with spiral
10. Top frame
11. Perforated rear cover
12. Solvent filtering apparatus
13. Fiber separator
14. Dirty water and dirty solvent separator
15. Dirty water tank
16. Dirty solvent tank

17. Dirty solvent pump
18. Particle filter
19. Carbon active filter
20. Nano filter
- 5 21. UV lamp
22. Clean solvent tank
23. Clean solvent pump
24. PVC pipe
25. Air duct

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I Claim

1. A dry cleaning washing machine (1) modified from an existing dry cleaning washing machine having computer program, washing machine (1) comprises an opening (3),
5 an air duct (25), a fan (7) and a solvent filtering apparatus (12).
2. The dry cleaning washing machine (1) according to claim 1, where the modification is conducted as follows :
10 a. cut the outer drum (2) of the washing machine to form an opening (3) at the top side of the outer drum (2);
b. fix a steel pipe by welding on around the opening (3);
c. fix a threaded plastic pipe (5) to a steel pipe (4)
15 up to the rear cover (11) of the washing machine (1);
d. fix a steel wire clamp (6) on the connection of the steel pipe (4) and the threaded plastic pipe (5) to form the air duct (25) suspended on the top side of outer drum (2);
20 e. make rear cover (11) perforated;
f. fix the fan (7) at an end of the threaded plastic pipe (5) with bolt (8); and
g. fix the fan (7) on the perforated rear cover (11).
- 25 3. The dry cleaning washing machine (1) according to claim 1, where the unroll program is lengthened at the step of extract process.
- 30 4. The dry cleaning washing machine (1) according to claim 2, where the inner drum rotates at low speed and alternately with computer program for drying the articles.

5. The dry cleaning washing machine (1) according to claim 1, where the fan (7) operates at the step of drying.
- 5 6. The dry cleaning washing machine (1) according to claim 1, where the solvent filtering apparatus (12) is located under the dry cleaning washing machine (1), so that the used solvent enters the filtering apparatus (12) gravitationally.
- 10 7. The dry cleaning washing machine (1) according to claim 5, where the solvent filtering apparatus (12) comprises a fiber separator (13), dirty water and dirty solvent separator (14), dirty water tank (15), dirty solvent tank (22), dirty solvent pump (17), particle filter (18), active carbon filter (19), nano filter (20), ultra violet lamp (21), clean solvent tank (22) and clean solvent pump (23).
- 15 8. The dry cleaning washing machine (1) according to claims 6 and 7, wherein
- 20 a. the fiber separator (13) functions to separate coarse things which may be trapped within the articles, and lies at the top left side of the fiber separator (12);
- 25 b. the dirty water and dirty solvent separator (14) receives liquid flowing out of the fiber separator (13), and lies under the fiber separator (13);
- 30 c. the dirty water tank (15) functions to receive the dirty water separated from the solvent, and lies between the dirty water and dirty solvent separator (14) and the dirty solvent tank (16);

- d. the dirty solvent tank (16) functions to receive the dirty solvent separated from the dirty water, and lies at the bottom left side of the solvent filtering apparatus (12);
 - 5 e. dirty solvent pump (17) pumps the dirty solvent to the particle filter (18), and lies above the dirty solvent tank (22);
 - f. the particle filter (18) receives and cleans the dirty solvent pumped by the dirty solvent pump (17), with normal filter, and lies at the top right side of the solvent filtering apparatus (12);
 - 10 g. the active carbon filter (19) filters the colour and odour of the solvent flowing out of the particle filter (18), and lies under the particle filter (18);
 - 15 h. the nano filter (20) cleans the solvent flowing out of the active carbon filter (19), and lies under the active carbon filter (19);
 - i. ultra violet light (21) kills the bacteria in the solvent flowing out of the nano filter (20), and lies under the nano filter (20);
 - 20 j. the clean solvent tank (22) receives the solvent flowing out of the ultra violet lamp (21), and lies under the ultra biolet lamp (21);
 - k. the clean solvent pump (23) pumps clean solvent from the clean solvent tank (22) into the dry cleaning washing machine (1) for reuse.
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9. The dry cleaning washing machine (1) according to claim 1, where the washing machine (1) uses waterless solvent dodecamethylhexasiloxane (D6), octamethyl-
- 30 cyclotetrasiloxane atau decamethyl-cyclopentasiloxane which vaporizes under room temperature and is safe for human health.