



Europäisches Patentamt
European Patent Office
Office européen des brevets



Publication number:

0 420 103 A2

12

EUROPEAN PATENT APPLICATION

21 Application number: **90118310.3**

51 Int. Cl.⁵: **D06F 43/08**

22 Date of filing: **24.09.90**

30 Priority: **27.09.89 IT 363389**

43 Date of publication of application:
03.04.91 Bulletin 91/14

84 Designated Contracting States:
DE FR GB

71 Applicant: **MULTIMAX S.r.l.**
Via Bizzarri 6
I-40010 Sala Bolognese (Bologna)(IT)

72 Inventor: **Innesto, Giovanni**
Via Stoppato 35
I-40128 Bologna(IT)

74 Representative: **Modiano, Guido et al**
MODIANO, JOSIF, PISANTY & STAUB
Modiano & Associati Via Meravigli, 16
I-20123 Milano(IT)

54 **Closed-circuit dry-cleaning machine.**

57 The closed-circuit dry-cleaning machine, of the type which comprises a washing container connected to the input and to the output of a closed circuit which is adapted to be crossed by a flow of warm air for drying a washing solvent, has a cooling device for recovering the solvent, constituted by a refrigeration circuit (1) which has a compressor (2) adapted to circulate a refrigerating fluid drawn from a tank (3) through a duct (4) which branches out into two portions (4a,4b) which respectively pass through a drying unit (6) and a unit (7) for cooling the solvent; these units are provided with respective valve means (8,9) for expanding the refrigerating fluid.

EP 0 420 103 A2

CLOSED-CIRCUIT DRY-CLEANING MACHINE

The present invention relates to a closed-circuit dry-cleaning machine.

As is known, dry-cleaning machines generally use a solvent such as perchloroethylene for washing. At the end of the washing step, the washed fabrics are dried by circulating within the washing container an adequate flow of warm air which causes the evaporation of the solvent. The warm drying air is circulated in a closed circuit provided with a cooling device for recovering the solvent.

In conventional dry-cleaning machines, said cooling device consists of an evaporator through which there flows a refrigerating fluid fed by a conventional compressor driven refrigeration system. Essentially, the mixture of air and solvent vapors which exits from the washing container is conveyed so as to strike the evaporator of the refrigeration system, so that the solvent condenses and can therefore be collected and reused in other washing cycles. The air, purified of the solvent, is instead heated and again circulated to the washing container until the drying step is completed.

The recovered solvent is then subjected to a distillation step so as to separate the impurities surfacing during the washing.

It has been furthermore proposed to use the condenser of the refrigeration system to perform at least a partial heating of the drying air. This naturally affords an energy saving.

However, known dry-cleaning machines still have significant limitations from the economy point of view. In particular, the dry-cleaning system usually provides the water-cooling of the refrigerating fluid and of the solvent vapors produced by distillation.

The aim of the present invention is to solve the above described problem by providing a dry-cleaning machine which operates in closed circuit, with recovery of the solvent by means of a refrigeration system which allows to also cool the refrigerating fluid during drying and to cool the solvent vapors during distillation.

Within the scope of this aim, a further object of the present invention is to provide a dry-cleaning machine which is simple in concept and is safely reliable in operation.

This aim and this object are both achieved, according to the invention, by the present closed-circuit dry cleaning machine, of the kind which comprises a washing container connected to the input and to the output of a closed circuit which is adapted to be traversed by a flow of warm air for the drying of a washing solvent and is provided with a cooling device for recovering the solvent, characterized in that said cooling device consists of

a refrigeration circuit having a compressor adapted to circulate a refrigerating fluid drawn from a tank through a duct which branches out into two portions which respectively pass through a drying unit and a unit for cooling said solvent, said units having respective valve means for the expansion of said refrigerating fluid.

Further characteristics of the invention will become apparent from the detailed description of a preferred embodiment of the closed-circuit dry-cleaning machine, illustrated only by way of non limitative example in the accompanying drawings, wherein:

the only figure is a diagram of the refrigeration circuit of the dry-cleaning machine according to the invention.

With reference to the above figure, the refrigeration circuit of the dry cleaning machine is generally indicated by the reference numeral 1. Said refrigeration circuit has a compressor 2 which is adapted to circulate an appropriate refrigerating fluid, such as freon; the refrigerating fluid is drawn from a tank 3 through a duct 4 and returns to said tank through a duct 5.

The drawing duct 4 branches out into two portions 4a, 4b which respectively pass through a drying unit 6 and a unit 7 for cooling the solvent, such as perchloroethylene, used in the machine. The drying unit 6 and the cooling unit 7 are provided with respective thermostatic expansion valves 8 and 9 for the expansion of the refrigerating fluid; the units 6 and 7 are furthermore controlled by respective electric valves 10 and 11 arranged on the ducts 4a and 4b.

The return duct 5 has a heat exchanger 12 which constitutes the condenser of the refrigeration circuit.

The duct 5 furthermore has a parallel branching 5a, 5b which has a further unit 13 which is intended to act as heat pump and is adapted to preheat the flow of air which is intended to pass through the washing container; a one-way valve 14 is arranged after said unit 13. The two branches 5a, 5b of the duct 5 are cutoff by respective electric valves 15 and 16. Downstream of the unit 13 a further solvent heat exchanger 21 is provided.

The refrigeration circuit is furthermore provided with a low-pressure switch 17 and with a high-pressure switch 18 which are respectively arranged on the ducts 4 and 5, and with a further electric valve 19 arranged upstream of the heat exchanger 12. Finally, downstream of the tank 3 a filter 20 for the refrigerating fluid is provided.

The operation of the described machine is as follows. When the dry-cleaning machine is not

washing, the electric valves 11 and 19 are opened. The refrigerating fluid therefore passes through the cooling unit 7 and cools the solvent, whereas the heat produced by the refrigeration system is dispersed by means of the heat exchanger 12.

During drying, the electric valves 10 and 16 are opened so that the refrigerating fluid circulates through the units 6 and 13. In this case, in the solvent heat exchanger 21 the cooled solvent removes from the refrigerating fluid the excess heat, which has not been used in the heat pump. During the removal of the solvent, the electric valve remains open and the electric valve 15 is opened, while the electric valve 16 is instead closed. The refrigerating fluid exiting from the compressor 2 is sent to the solvent heat exchanger 21.

Finally, during distillation the previously cooled solvent is used to cool the solvent vapors to be recovered.

To conclude, the described refrigeration system has a solvent cooling circuit which replaces the conventional water-based cooling of the refrigerating fluid and the equally water-based cooling of the solvent vapors in distillation.

In the practical execution of the invention, the materials employed, as well as the shape and dimensions, may be any according to the requirements.

Where technical features mentioned in any claim are followed by reference signs, those reference signs have been included for the sole purpose of increasing the intelligibility of the claims and accordingly such reference signs do not have any limiting effect on the scope of each element identified by way of example by such reference signs.

Claims

1. Closed-circuit dry-cleaning machine, of the type which comprises a washing container connected to the input and to the output of a closed circuit which is adapted to be traversed by a flow of warm air to dry a washing solvent and is provided with a cooling device for the recovery of the solvent, characterized in that said cooling device consists of a refrigeration circuit (1) having a compressor (2) adapted to circulate a refrigerating fluid drawn from a tank (3) through a duct (4) which branches out into two portions (4a,4b) which respectively pass through a drying unit (6) and a unit (7) for cooling said solvent, said units (6,7) being provided with respective valve means (8,9) for expanding said refrigerating fluid.

2. Machine according to claim 1, characterized in that said refrigeration circuit (1) has a duct (5) for returning the refrigerating fluid to said tank (3), said

duct (5) branching out into two portions (5a,5b) which respectively pass through an air heat exchanger (12) adapted to act as condenser in said refrigeration circuit, a further unit (13) intended to act as heat pump and a further solvent heat exchanger.

3. Machine according to claim 1, characterized in that said portions of the drawing duct (5) are cutoff by respective electric valves (15,16) actuated so as to allow the passage of said refrigerating fluid alternately through said cooling unit, for the cooling of said solvent, and through said drying unit during drying.

4. Machine according to claim 1, characterized in that said valve means are constituted by thermostatic expansion valves for the expansion of said refrigerating fluid.

5

10

15

20

25

30

35

40

45

50

55

