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(54) Closed-circuit dry-cleaning machine

Trockenreinigungsmaschine mit einem geschlossenen Kreis

Machine de nettoyage à sec à circuit fermé

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Description

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. A machine of this type, as defined in the preamble of claim 1, is known from US-A-3,391,550.

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 a closed-circuit dry-cleaning machine as defined in the appended claims.

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 ma-

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. A closed-circuit dry-cleaning machine comprising a refrigeration circuit (1) having a tank (3) containing refrigerating fluid, a compressor (2) for drawing the refrigerating fluid from said tank (3) through a drawing duct (4) and for returning the refrigerating fluid to said tank (3) through a return duct (5), said drawing duct branching out into two portions (4a, 4b), passing respectively through a drying unit (6) and a perchloroethylene solvent cooling unit (7), and each having refrigerating fluid expansion valves (8, 9), said return duct (5) having a heat exchanger (12) constituting a condenser of said refrigeration circuit (1), characterized in that said return duct further has parallel to said heat exchanger two branches (5a, 5b) provided with respective electric cutoff valves (15, 16), one of said branches (5b) having a heat pump (13) for preheating air to be passed through a washing container, a one-way valve (14) provided downstream of said heat pump (13), and in that a portion of said return duct (5) located downstream of said heat pump (13) passes through a perchloroethylene solvent heat exchanger (21), whereby during drying cooled solvent in said perchloroethylene solvent heat exchanger (21) removes excess heat not used in said heat pump (13) from said refrigeration circuit (1).

2. A closed-circuit dry cleaning machine according to claim 1, characterized in that it further comprises a low-pressure switch (17) connected to said drawing duct (4) between said compressor (2) and said perchloroethylene solvent cooling unit (7), an electric valve (19) connected to said return duct (5) upstream of said heat exchanger (12) constituting the condenser of said refrigeration circuit (1), and a high-pressure switch (18) connected to said return duct (5) between said compressor (2) and said electric valve (19).

Patentansprüche

1. Eine Trockenreinigungsmaschine mit einem geschlossenen Kreis, bestehend aus einem Kühlkreis (1) mit einem Kühlmittelbehälter (3), einem Kom-

pressor (2) für den Abzug des Kühlmittels aus dem Behälter (3) durch eine Leitung (4) und die Rückführung zum Behälter (3) durch eine Rückleitung (5), welche Leitungsführung sich in zwei Abschnitte (4 a, 4 b) verzweigt und eine Trocknungseinheit (6) und eine Perchlorethylen-Lösungskühleinheit (7) passiert und von denen jede ein Kühlmittelexpansionsventil (8, 9) aufweist, wobei die Rückleitung (5) einen Wärmetauscher (12) enthält, der einen Kondensator des Kühlmittelkreises (1) bildet, dadurch gekennzeichnet, daß die Rückleitung ferner parallel zum Wärmetauscher zwei Zweige (5 a, 5 b) mit jeweils elektrischen Abschaltventilen (15, 16) enthält und einer der Zweige (5 b) eine Wärmepumpe (13) für die Vorheizung von durch einen Waschbehälter zu leitender Luft aufweist, der abströmseitig ein Einwegventil (14) zugeordnet ist, und daß ein Teil der Rückleitung (5) abströmseitig vor der Wärmepumpe (13) durch eine Perchlorethylen-Lösungswärmetauscher (21) geführt ist, wobei während der Trocknung gekühlte Lösung im Perchlorethylen-Lösungswärmetauscher (21) in der Wärmepumpe (13) nicht benötigte Überschuwärme aus dem Kühlmittelkreis (1) abführt.

2. Eine Trockenreinigungsmaschine nach Anspruch 1, dadurch gekennzeichnet, daß sie ferner einen Niederdruckschalter (17) verbunden mit der Leitung (4), zwischen dem Kompressor (2) und der Perchlorethylen-Lösungskühleinheit (7) enthält, ein elektrisches Ventil (19), verbunden mit der Rückleitung (5) zuströmseitig zum den Kondensator des Kühlmittelkreises (1) bildenden Wärmetauschers (12) und ein Hochdruckventil (18), verbunden mit der Rückleitung (5) zwischen dem Kompressor (2) und dem elektrischen Ventil (19).

Revendications

1. Machine de nettoyage à sec à circuit fermé, comprenant un circuit de réfrigération (1) incluant un réservoir (3) contenant un fluide réfrigérant, un compresseur (2) pour extraire le fluide réfrigérant dudit réservoir (3) au travers d'un conduit d'extraction (4) et pour ramener le fluide réfrigérant audit réservoir (3) au travers d'un conduit de retour (5), ledit conduit d'extraction se ramifiant en deux parties (4a,4b), passant respectivement au travers d'une unité de séchage (6) et d'une unité (7) de refroidissement à solvant au perchloroéthylène, et chacune ayant une soupape d'expansion de fluide réfrigérant (8,9), ledit conduit de retour (5) présentant un échangeur de chaleur (12) constituant un condensateur dudit circuit de réfrigération (1), caractérisée en ce que ledit conduit de retour comporte de plus, en parallèle sur ledit échangeur de chaleur, deux branches

(5a,5b) pourvues de clapets respectifs de fermeture électrique (15, 16), une desdites branches (5b) comportant une pompe à chaleur (13) pour préchauffer l'air destiné à passer au travers d'un conteneur de lavage, un clapet antiretour (14) disposé en aval de ladite pompe à chaleur (13), et en ce que une partie dudit conduit de retour (5), disposée en aval de ladite pompe à chaleur (13), passe au travers d'un échangeur de chaleur (21) à solvant au perchloroéthylène, tandis que, lors du séchage, le solvant refroidit dans ledit échangeur de chaleur (21) au solvant au perchloroéthylène, enlève dudit circuit réfrigérant l'excès de chaleur inutilisé dans ladite pompe à chaleur (13).

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2. Machine de nettoyage à sec à circuit fermé selon la revendication 1, caractérisée en ce qu'elle comporte en outre un interrupteur (17) à basse pression relié audit conduit d'extraction (4) entre ledit compresseur (2) et ladite unité (7) de refroidissement à solvant au perchloroéthylène, un clapet électrique (19) relié audit conduit de retour (5) en amont dudit échangeur de chaleur (12) constituant le condenseur dudit circuit de réfrigération (1), et un interrupteur haute pression (18) relié audit conduit de retour (5) entre ledit compresseur (2) et ledit clapet électrique (19).

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