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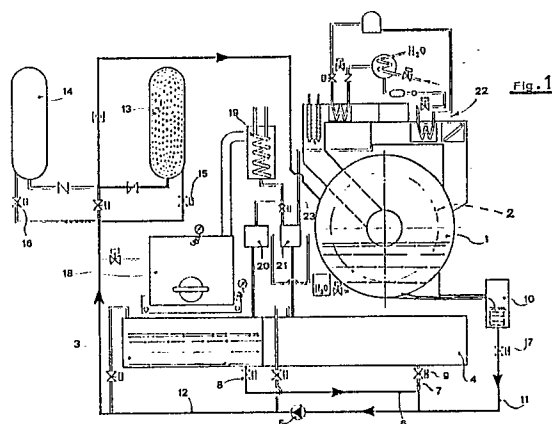
71 Applicant: **RENZACCI S.P.A. INDUSTRIA LAVATRICI**
13, Via Morandi
I-06012 Città di Castello (Perugia) (IT)

72 Inventor: **Renzacci, Gabrio**
18, Via N. Machiavelli
I-06012 Città Di Castello Perugia (IT)

74 Representative: **Bardini, Marco Luigi et al**
c/o Società Italiana Brevetti S.p.A. Corso dei Tintori 25
I-50122 Firenze (IT)

54 Dry cleaning machine for garments, fabrics and the like.

57 Garments, fabrics and similar articles are dry-cleaned by firstly washing them with a high-boiling solvent and then rinsing them with a low-boiling solvent. The dry-cleaning machine operating in such a way comprises, two separate tanks (3,4) for both solvents which can be selectively put into communication with the washing drum (1) housing the rotatable basket (2) where the articles are contained, according to a prefixed operation sequence. The machine also comprises two separate filtration units (13,14) for both solvents and the conventional distillation unit (18) for the periodical solvent regeneration, as well as the air circulation unit (22) for the drying of the articles with recovery of the residual solvent.



Description

DRY CLEANING MACHINE FOR GARMENTS, FABRICS AND THE LIKE

The present invention relates to a machine for dry cleaning garments, fabrics and similar goods.

The dry cleaning machines of the conventional type are usually formed by a drum housing a rotatable perforated basket accessible from the outside and suitable for containing the goods to be cleaned. A solvent coming from a receiving tank is circulated within the drum and through the basket during the solvent washing step. The conventional machines are furthermore equipped with an air circulated unit for drying the material contained within the rotating basket at the end of the solvent washing step associated to a unit for the recovery of the residual solvent entrained with the circulated air, generally comprising an evaporator and a condenser. A filtration equipment for the solvent and a distillation unit for the periodical regeneration of the soiled solvent is further provided.

The conventional dry cleaning machines are designed to work with only one type of solvent and more particularly either with a high boiling solvent, such as perchloroethylene or trichloroethylene, or with a low boiling solvent, such as R.113, R.11, 1,1,1 and similar ones.

The dry cleaning machines working with a high boiling solvent involve a shorter washing time than those working with a low boiling solvent, thanks to the higher degreasing coefficient of the high boiling solvents. On the other hand high boiling solvents are also considerably strong and therefore not much suitable for delicate and synthetic fabrics, as well as for both patent leather and oil-tanned leather. Moreover the use of a high boiling solvent results in a greater power consumption required for evaporating it from the washed garments and a longer drying time with respect to the low boiling solvents.

The use of low boiling solvents involve a shorter drying cycle and lower operating temperature, as they are more easily evaporable. Therefore the machines using low boiling solvents are characterized by a lower consumption and are particularly suitable for delicate garments made of silk and synthetic fibers and for washing articles made of patent leather and oil-tanned leather. On the other hand they show a lower cleaning power with regard to cotton and wool fabrics, especially when they are considerably soiled.

From the foregoing, it is apparent that the conventional dry cleaning machines present limitations of use according to the type of solvent used and operating features that can be improved mainly to the aim of reducing the power consumptions.

The object of the present invention is to provide a process for dry-cleaning garments, fabrics and similar articles which is free from the above cited limitations and drawbacks.

A further object of the present invention is to provide a dry cleaning machine for garments, fabrics and similar articles which can be operated at its optimum conditions no matter what kind of article is handled.

Another object of the present invention is to provide a dry cleaning machine as above which performs the drying operation with a lower power consumption with respect to the conventional dry cleaning machine without prejudice to the level of cleaning that can be attained with the machine.

These results are obtained with the invention by providing a process for dry cleaning garments, fabrics and similar articles wherein said articles are first washed with a high boiling solvent and then rinsed with a low boiling solvent whereby the subsequent drying phase can be performed at less severe operating conditions than actually done.

More particularly after the washing with the high-boiling solvent, the articles are centrifuged for a first time to remove most of the solvent from them, the remaining being removed during the rinsing phase with the low-boiling solvent. After rinsing, the articles are then centrifuged for a second time to remove most of the low-boiling solvent, while the residual low-boiling solvent is removed by the hot air circulated during the drying phase.

Furthermore, according to the invention, a dry-cleaning machine for garments, fabrics and the like is provided, which is characterized in that it comprises at least a tank for a high boiling solvent and at least a tank for a low boiling solvent that can be put alternately and selectively into communication, through respective filtration units, with the drum where the basket containing the articles to be washed is placed. In this way, on the one hand, it is possible to select either type of solvent according to the characteristics of the articles to be washed loaded to the drum; on the other hand, it is possible to perform a washing cycle with a high boiling solvent and the subsequent rinsing cycle with a low boiling solvent which can be more easily removed and recovered during the drying cycle with lower power consumption and lower risk of damaging the articles to be washed.

Further characteristics and advantages of the dry cleaning machine according to the invention will be apparent from the following description of a preferred exemplifying and not limiting embodiment, made with reference to the attached drawing, wherein:

- Figure 1 is a schematic view of the machine according to the present invention wherein the circulation of the high boiling solvent is shown;

- Figure 2 is the same schematic view of the figure 1, but showing the circulation of the low boiling solvent.

With reference to the above figures, it has been indicated at 1 a drum or tumbler housing a rotatable perforated drum or basket 2 (shown in dotted lines) accessible from the outside and fit for containing garments, linen, fabrics and other similar goods to be cleaned. It has been furthermore indicated at 3 a tank containing a high boiling solvent, such as trichloroethylene, at 4 a tank containing a low boiling solvent, such as R.113, and at 5 a pump for the

circulation of either solvent. The suction of pump 5 communicates with tanks 3 and 4 through conduits 6 and 7 on which solenoid valves 8 and 9 respectively are mounted. The suction of pump 5 is also connected to a receiving pot 10 for the solvent, coming from the drum 1, through a conduit 11 on which a solenoid valve 17 is mounted. On the discharge line 12 of pump 5 there are installed two filtration units 13 and 14, arranged in parallel, through which the high boiling solvent and the low boiling solvent are respectively passed prior to feeding them to drum 1. On the inlet side of filtration units 13 and 14 solenoid valves 15 and 16 respectively are mounted. From the foregoing, it is apparent that, when loading the drum 1 with the selected solvent, solenoid valve 17 located at the outlet side of receiving pot 10 is kept closed, while either valves 8 and 15, relevant to the high boiling solvent circuit, or valves 7 and 16, relevant to the low boiling solvent circuit, are kept open. During the washing phase, wherein the solvent loaded to drum 1 is circulated, solenoid valve 17 is open as well as one of the valves 15 and 16, whilst the valves 8 and 9 on the outlet side of tanks 3 and 4 will be kept closed.

The machine according to the invention is furthermore equipped with a still 18 of the conventional type for the periodic regeneration of the solvent, said still 18 being installed in parallel to drum 1 and being provided with a condenser 19 from which the condensed, purified solvent is sent back to tanks 3 or 4 through respective buffer pots 20 and 21.

The dry-cleaning machine according to the invention is finally equipped with a unit for the circulation of hot air through basket 2, generally indicated at 22 in the figures, in such a way to provide for the drying of the articles after the centrifugation phase. The unit 22, which is associated to a refrigeration unit for the recovery of the residual solvent entrained with the circulating air, is not described in detail because it is well known to a person skilled in the art.

The machine according to the invention can be operated according to washing cycles involving the use of a single solvent and of two solvents.

In the first case, reference has to be made to figure 1, if a high boiling solvent is used, and to Figure 2, if a low boiling solvent is used, where the relevant operating circuits are shown with an expanded black line.

In the second case, the following is the operation of the machine. With reference to the figure 1, at first pump 5 sucks the high boiling solvent from tank 3 and sends it to drum 1 passing through filter 13. During the washing phase, whose duration may vary from 4 to 7 minutes, the solvent is circulated in the circuit connecting drum 1 with pump 5 and filter 13. After the washing phase, the solvent is collected in the relevant tank 3 and, with the centrifugation phase, whose duration may vary from 1.5 to 3 minutes, as more solvent as possible is removed from the articles. After the centrifugation phase, the articles are rinsed with low boiling solvent (see figure 2). To this purpose, pump 5 sucks the solvent from tank 4 and feeds it to drum 1 passing through filter 14 and with the solenoid valve 17 being kept closed. When a prefixed liquid level in drum 1 has been

reached, a solvent circulation through pump 5 (having opened valve 17) and filter 14 is started for a period of time comprised between 3 and 5 minutes, at the conclusion of which the solvent is collected in the relevant tank 4 and a final centrifugation is performed prior to proceed to the drying phase.

As it can be easily understood, during the rinsing phase a substantial amount of the high boiling solvent, still retained by the garments, is washed out with the low boiling solvent. The high boiling solvent is separated from the low boiling solvent by distillation. The distillation can be carried out either after each washing cycle, in order to avoid pollution of the solvent contained in tank 4, or periodically, i.e. after a prefixed number of cycles and/or as a function of the amount of dirt the solvent will have accumulated in tank 4. After rinsing with the low boiling solvent, the garments are dried by circulating hot air produced by unit 22. The drying phase lasts from 8 to 20 minutes during which the residual low boiling solvent entrained by the circulating air is condensed and separated from it to be returned to the relevant tank 4 through a conduit 23 and buffer pot 21.

Thanks to the rinsing operation with the low boiling solvent, the dry-cleaning machine according to the invention allows certain advantageous results to be attained. A first important result is the substitution of the low boiling solvent for the high boiling solvent in the embedded garments with the advantage that the next drying cycle has a shorter duration and a lower power consumption due to the higher volatility of the solvent and the corresponding lower drying temperature. Finally, thanks to the less severe operating conditions (reduced drying time and lower temperature), a better cleaning quality, excellent colour vividness and greater softness of the washed garments can be attained.

Advantageously, the dry-cleaning machine according to the invention is equipped with a programmable control unit for selecting the different operating modes and for automatically controlling the operating sequence within each selected mode, as well as for the automatic control of the distillation operations. Such a control unit being of the conventional type and well known to a person skilled in the art is not described nor shown.

Claims

1. Dry-cleaning machine for garments, fabrics and similar articles, of the type comprising a drum (1) housing a rotatable basket (2), accessible from the outside, fit for containing the articles to be washed by means of a solvent, tank means (3,4) for containing said solvent, means for circulating the solvent between said drum (1) and said tank means (3,4), a solvent filtration unit (13,14) installed downstream of said solvent circulation means, a distillation unit (18) for the periodical solvent regeneration, and a unit (22) for the circulation of hot air through

said drum to dry said articles at the end of the washing cycle, associated to means for the recovery of the solvent entrained by the circulating hot air, said machine being characterized in that said tank means comprises at least a tank (3) for a high boiling solvent and at least a tank (4) for a low boiling solvent, said solvent circulation means comprising a pump (5) and valve means (8,9,15,16) for selectively putting either tanks (3,4) into communication with said drum (1), said filtration unit (13,14) and said distillation unit (18) according to a prefixed program, whereby said machine can be operated according to washing cycles using either said low boiling or said high boiling solvent and furthermore according to a combined operating cycle wherein the articles are washed with the high boiling solvent and rinsed with the low boiling solvent.

2. Machine according to the claim 1, wherein said solvent filtration unit comprises a filtering group (13) for said high boiling solvent and a filtering group (14) for said low boiling solvent arranged in parallel and selectively operable.

3. Machine according to the previous claims, wherein said solvent circulation means comprises a pump (5) whose suction side is connected to said tanks (3,4) and discharge side is connected to said drum (1) through said filtration unit (13,14), said valve means (8,9,15,16) consisting of solenoid valves installed on the pump suction side, between said pump (5) and said tanks (3,4), and on the pump

discharge side, between said pump (5) and said filtration unit (13, 14) so as to selectively put into communication the low-and high-boiling solvent tanks (3,4) with the respective low and high-boiling solvent filtering groups (13,14).

4. Machine according to the previous claims, wherein said means for the recovery of the solvent entrained by the circulating hot air selectively communicate both with the: high- and the low-boiling solvent tank.

5. A process for the dry-cleaning of garments, fabrics and similar articles characterized in that it comprises the steps of

- washing said articles with a high-boiling solvent;
- centrifuging said articles to remove a substantial amount of said high-boiling solvent;
- rinsing said articles with a low-boiling solvent to remove any residual high-boiling solvent;
- centrifuging said articles to remove a substantial amount of low-boiling solvent;
- drying said articles with circulating hot air which removes any residual low boiling solvent therefrom.

6. A process according to claim 5, wherein said low-boiling solvent is periodically purified by distillation.

7. A process according to claim 5 and 6, wherein said residual low-boiling solvent entrained with the circulating hot air is recovered by condensation.

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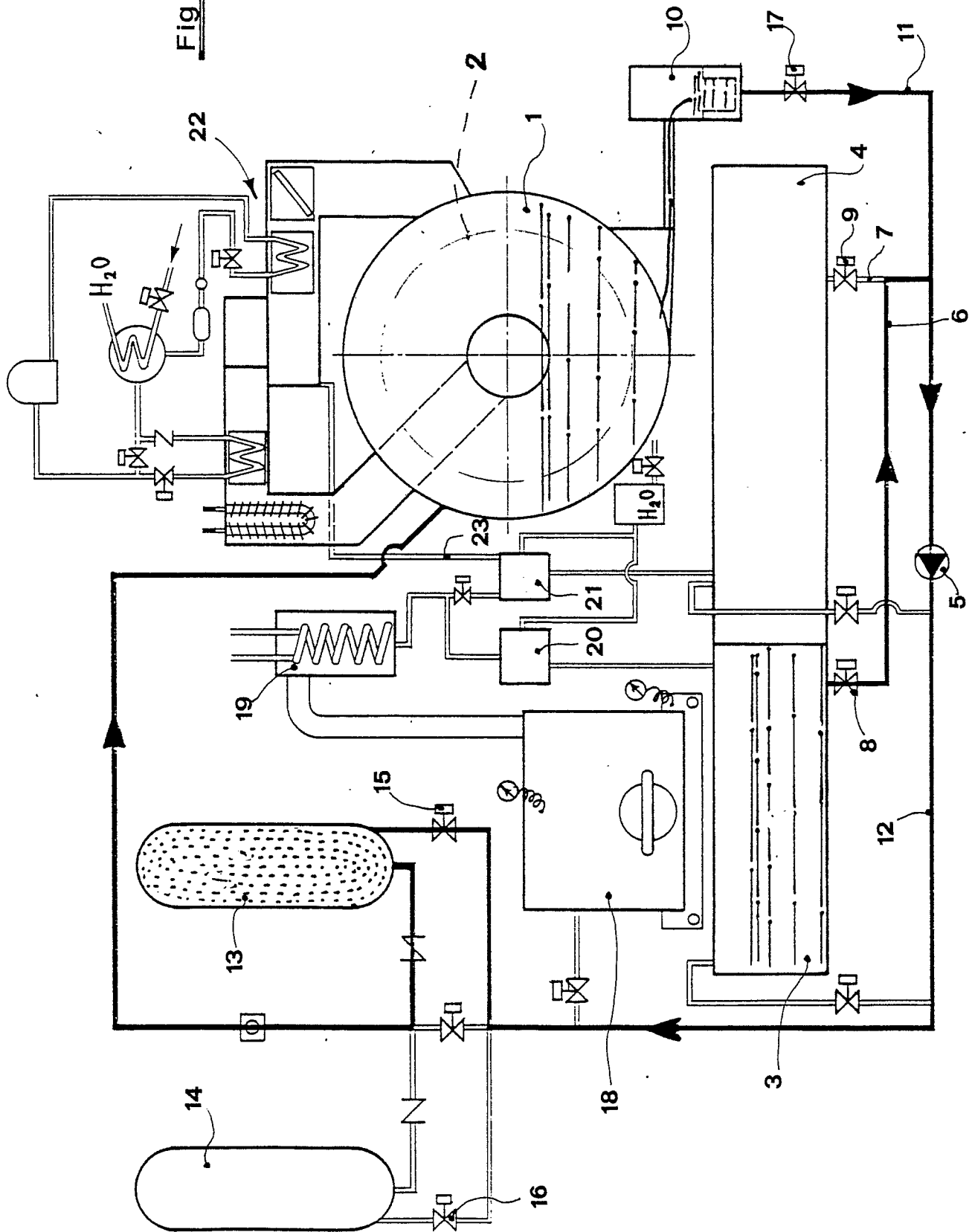
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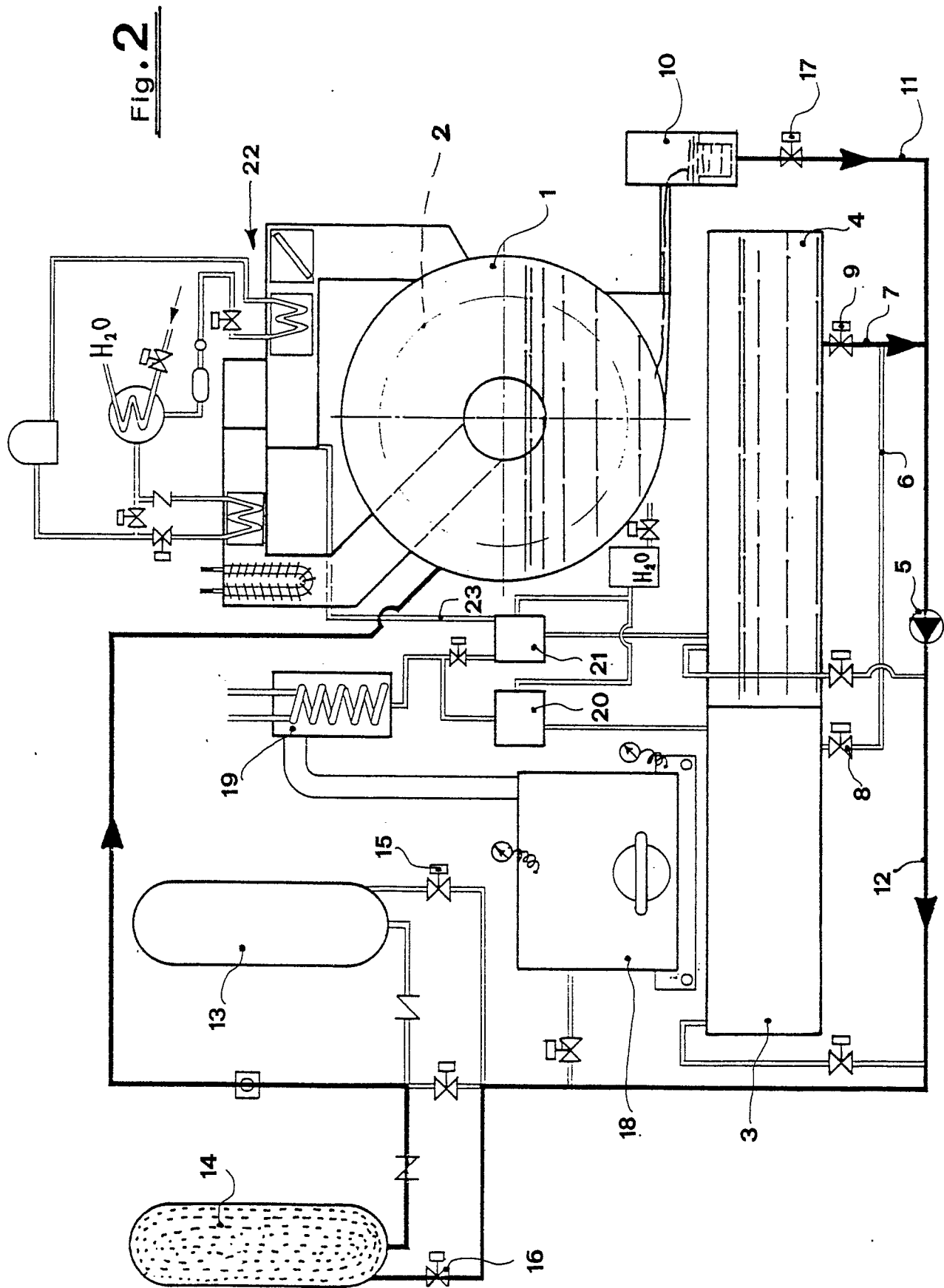
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Fig. 1







European Patent
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EUROPEAN SEARCH REPORT

Application Number

EP 88 83 0494

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.4)
X	EP-A-186621 (MITSUBISHI JUKOGYO KABUSHIKI KAISHA) * page 11, line 17 - line 24 * * page 15, line 24 - page 16, line 24 * * page 21 - 24; figures - * * abstract * ---	1-7	D06F43/00 D06F43/08
A	FR-A-2126943 (CRAVERO) * claims -, figures - * ---	1-3, 5, 6	
A	FR-A-1318663 (BRILLET...) * page 3, column 1, line 22 - line 40 * * page 3, column 2, line 38 - line 44 * * figure . * ---	1-3, 5, 6	
A	US-A-2964934 (SHIELDS) * column 1 - column 2; figure 9 * -----	1-4	
			TECHNICAL FIELDS SEARCHED (Int. Cl.4)
			D06F
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 28 FEBRUARY 1989	Examiner COURRIER G.L.A.
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			