(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) **EP 3 051 019 A1**

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
03.08.2016 Bulletin 2016/31

(51) Int Cl.:
D06F 75/12 *(2006.01)* ***D06F 75/14*** *(2006.01)*

(21) Application number: **16000180.6**

(22) Date of filing: **26.01.2016**

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA ME
Designated Validation States:
MA MD

(30) Priority: **27.01.2015 IT MI20150083**

(71) Applicant: **Tenacta Group S.p.A.**
24052 Azzano S. Paolo (BG) (IT)

(72) Inventors:
- **Pietra, Diego**
  I-24052 Azzano San Paolo (BG) (IT)
- **Aguti, Alberto**
  I-24052 Azzano San Paolo (BG) (IT)
- **Morgandi, Arturo**
  I-24052 Azzano San Paolo (BG) (IT)

(74) Representative: **Contessini, Pier Carlo**
Via dei Canzi, 22/1
20134 Milano (IT)

(54) IRONING APPARATUS

(57) The present invention relates to an ironing apparatus comprising: a water tank, a filter for reducing the water hardness placed in fluid communication with the tank and adapted to receive and filter the water contained in the tank, an iron that comprises at least a main body and a thermo-conductive metal plate secured to the base of the main body and adapted to receive the filtered water from the filter. Furthermore, the filter for reducing the water hardness comprises at least one ion exchange resin provided with silver ions.

Such a filter for reducing the water hardness provided with ion-exchange resins supplied of silver ions is able to prolong the life of the iron, reducing the hardness of the filtered water and preventing the formation of algae in the filter itself, thus avoiding thereby the formation of limestone and the proliferation of algae in both resins and other parts of the hydraulic lines in the iron.

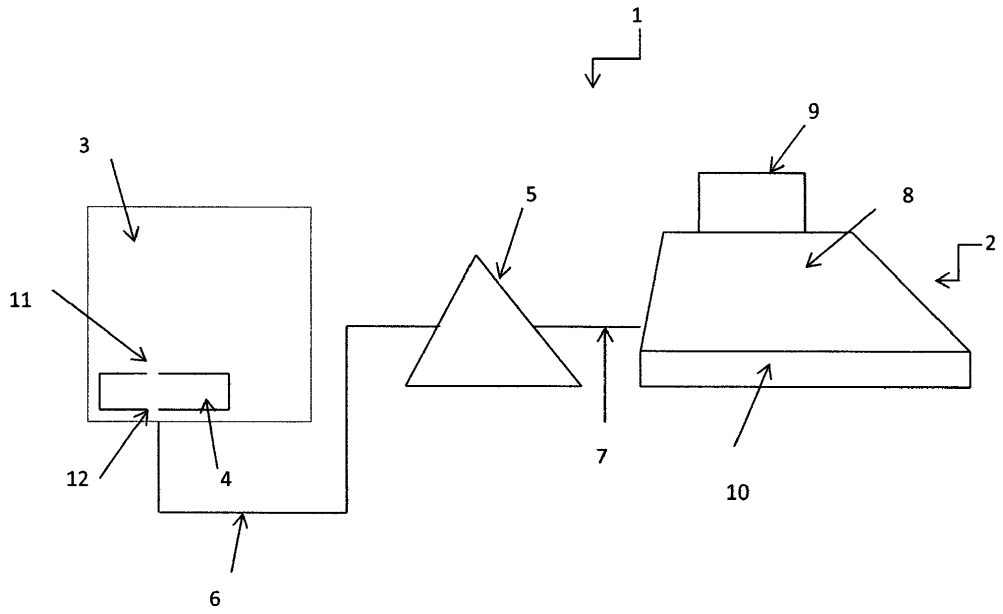

Fig. 1

EP 3 051 019 A1

Description

Field of the invention

[0001] The present invention relates to an ironing apparatus. In particular, the present invention relates to an ironing apparatus of the type comprising an iron, a water tank, and a filter for reducing the water hardness which contains ion exchange resins.

State of the art.

[0002] Irons with ion exchange resin to soften water or, in other words, to reduce the water hardness are known in the art.

[0003] However, in such irons known in the art, provided with ion-exchange resins, the algae formation is frequently found inside the ion exchange resins due to the stagnation of water in the resins themselves; these algae render dirty the water and, consequently, the iron itself unusable.

[0004] There are also known in the art irons that use metal or plastic surfaces, which are treated with silver ions or with silver nanoparticles, for releasing silver ions in the water for bacteriostatic action purposes of the steam on the fabrics to be ironed.

[0005] However, such metal or plastic surfaces treated with silver ions or with silver nanoparticles of such known in the art irons release a minimum silver amount and thus the bacteriostatic effect is not very effective; furthermore, the silver percentage is difficult to be modified.

[0006] Finally, there are also known in the art irons which have a water tank comprising sterilizing agents containing silver ions, such as for example the iron disclosed in the Chinese utility model published with no. CN 203174392U on behalf Zhejiang Yueli, as well as in the Japanese patent application published under n. JP 2007/209439, which describes a steam iron comprising a water tank in which a casing containing a bactericidal agent containing silver ions is housed, wherein the water tank supplies water to a vaporization chamber prepared on the iron base. Thanks to the silver ions the bacteria formation in the water tank is prevented.

[0007] Finally, the Japanese patent application published under n. JP 2008/061670 describes an iron able to spray water drops comprising silver ions onto the clothes to be ironed in order to obtain an anti-microbial and deodorant action.

[0008] However, such known in the art irons do not describe the presence of water softener filters and therefore they tend to generate a considerable scale formation during the time caused by the water hardness, which in the long run blocks the water and steam conduits, limiting the product life.

[0009] Therefore, the Applicant of the present invention has tried to solve the technical problem as how to reduce the water hardness in a simple and economical way and, consequently, how to reduce the scale formation with the use of ion exchange resins, while still decreasing the risk related to the algae formation due to the water stagnation in the resins.

Summary of the invention

[0010] In a first aspect the present invention relates to an ironing apparatus such as that indicated in claim 1.

[0011] The Applicant of the present application has in fact surprisingly found that an ironing apparatus comprising: a water tank; a filter for reducing the water hardness positioned in fluid communication with said water tank and adapted to receive and filter the water contained in said tank; an iron comprising at least a main body and a thermo-conductive metal plate secured to the base of said main body and able to receive the water filtered from said filter for reducing the water hardness, wherein said filter for reducing the water hardness comprises at least one ion exchange resin provided with silver ions, is able to prolong the iron life.

[0012] In fact, such ion exchange resins provided with silver ions are in contact with the water coming from the tank and prevent the algae formation in the filter itself, thus also avoiding thereby the algae proliferation in other parts of the hydraulic conduits present in the iron, which could help to escalate the proper functioning of the iron itself.

[0013] Furthermore, such ion exchange resins provided with silver ions also reduce the water hardness in the iron, thus reducing, as a result, the limestone formation.

[0014] Finally, the ion-exchange resins provided with silver ions release a greater silver amount compared to the silver amount with which the known in the art iron metal or plastic surfaces are treated. Being more silver released, a steam production having a better bacteriostatic function on tissues subjected to ironing is thus obtained; furthermore, the advantage of being able to easily modify the silver percentage in ion exchange resins is also obtained, and consequently the silver amount that will arrive through the steam onto the to be ironed fabrics, while this action is more expensive and complex in the known in the art irons.

[0015] Preferably, said filter comprises a mixture of ion exchange resins capable of exchanging different types of ions. More preferably, said filter, in addition to said ion-exchange resins provided with silver ions, also comprises at least a second type of ion exchange resins.

[0016] Preferably, said second type of ion exchange resin is a resin of the weak cationic type, also called WAC type resin (from the English phrase "weak acid cation"), such as to provide a large ion exchange capacity, reducing the temporary water hardness (hereinafter also called "carbonate hardness").

[0017] Preferably, said second type of ion exchange resin is a resin of the WAC type comprising at least one functional group capable of exchanging H^+ ions; preferably, said at least one functional group is selected from the R-COOH carboxylic acid group, which, being the rad-

ical of a weak acid, is equipped with a strong affinity only in respect of the cations linked to bicarbonate, from which derive the name of weak cationic resins.

[0018] Typically, the WAC resins exchange some of the H^+ ions present on the functional group with the cations present in solution, such as Na^+, K^+, Ca^{++}, Mg^{++}, Cu^{++}, Ni^{++}, Pb^{++}, Zn^{++}, and the like. At the end of this reaction, the water will be depleted of its cations and rich in hydrogen ions (therefore resulting acid).

[0019] Preferably, said filter, in addition to said ion-exchange resins provided with silver ions, also comprises at least a third type of ion exchange resins.

[0020] Preferably, said third type of ion exchange resins is another resin of the WAC type, different from the second WAC type of ion exchange resin, able to exchange Na^+ ions (instead of H^+ ions as the second WAC type resin).

[0021] Preferably, said filter, in addition to said ion-exchange resins provided with silver ions, also includes both said second type of ion exchange resins, capable of exchanging H^+ ions, and said third type of ion exchange resins, capable of exchanging Na^+ ions.

[0022] In this way, the mixture of ion exchange resins of the second and of the third type allows, with the ion exchange resins of the second type, to further reduce the carbonate hardness (which is the most harmful for the irons), and then to reduce the limestone formation, softening the water and then, through the ion exchange resins of the third type, to balance the pH of the filtered water rendered acid after the reaction of the water with the second WAC type resin, thus further reducing the corrosion problem of the metals present in the iron, which results in a product longer life.

[0023] Preferably, the assembly of said second type and of said third type of ion exchange resins is such as to obtain a filtered water having a pH value in the range from 3.5 to 6.5, preferably from about 4.0 to about 6.0, more preferably of about 5.0.

[0024] In this way, reducing the pH lowering of the water to values of no less than 3.5, the assembly of said second type and of said third type of ion exchange resins is such as to reduce the provocation of corrosion phenomena in aluminum (element forming the base of the iron) when it comes into contact with water or steam.

[0025] Moreover, said third type of ion exchange resins is very reactive and is therefore able, especially at the beginning of the reaction, to also reduce the permanent hardness of the water.

[0026] In one embodiment, said filter comprises said mixture of ion exchange resins constiting in said ion-exchange resin provided with silver ions, said second type of ion exchange resin and said third type of ion exchange resins, each of said ion exchange resin being separately inserted into the filter one each other.

[0027] In another embodiment, said filter comprises said mixture of ion exchange resins, wherein said ion exchange resin provided with silver ions is combined with a single WAC ion exchange resin in which are inserted both the H^+ ions of the second type of ion exchange resin and the Na^+ ions of the third type of ion exchange resins.

[0028] In a further embodiment, said filter comprises said mixture of ion exchange resins consisting in a single WAC ion exchange resin in which are inserted the silver ions, the H^+ ions of the second type of ion exchange resin, and the Na^+ ions of the third type of ion exchange resin.

[0029] Preferably, said filter comprises a mixture consisting of ion exchange resin having silver ions, at least a second type of ion exchange resin capable of exchanging H^+ ions, and at least a third type of ion exchange resin capable of exchanging ions Na^+, in such a way that said ion exchange resin having silver ions are from about 1% to about 5% of the mixture of ion exchange resins present in the filter, said second type of ion exchange resin capable of exchanging H^+ ions are from about 60% to about 90% of the mixture of ion exchange resins present in the filter, and said third type of ion exchange resin capable of exchanging Na^+ ions are from about 10% to about 40% of the mixture of exchange resin ion in the filter.

[0030] Preferably, said ion exchange resins provided with silver ions are composed of a polymer matrix (usually granules of a few millimeters in diameter) in which ions are trapped or incorporated, available for the ion exchange.

[0031] Preferably, said filter has an elongated shape, such as a cylindrical, parallelepiped or polyhedral shape.

[0032] Preferably, said filter consisting of ion exchange resins provided with silver ions is replaceable by the user.

[0033] In a first embodiment, said water tank and said filter are positioned outside said iron.

[0034] This embodiment is particularly advantageous when the user wants to use an iron with high autonomy offered by an increased capacity of the water tank.

[0035] In such a first embodiment, the ironing apparatus of the present invention also comprises a device able to transfer the filtered water from said filter to said iron, in particular to said thermo-conductive metal plate of said iron. Preferably, said device is a pump, more preferably a micro-electric pump, or any other mechanical, electrical or electronic means capable of transferring the filtered water from a first position to a second position.

[0036] Conversely, in a second embodiment, said water tank and said filter are incorporated inside said iron itself.

[0037] This other solution is particularly advantageous when the user wants to use an iron for short periods and therefore he/she does not require a great capacity of the water tank.

[0038] In such a second embodiment, preferably said filter is positioned within the iron and above said thermo-conductive metal plate of the iron, in such a way the filtered water passes by gravity to said plate.

[0039] In this particular configuration of the second embodiment, due to the gravity, it is therefore not necessary the presence of any device, such as the described above pump with reference to the first embodiment, capable of

transferring the filtered water from said filter to said thermo-conductive metal plate of the iron.

[0040] In any one of the first or second embodiment, said water tank is in fluid communication with said filter according to various embodiments.

[0041] For example, said water tank and said filter can be in fluid communication by means of a device able to transfer the water to be filtered from said water tank to said filter. Preferably, said device is the same device described with reference to the first embodiment, able to transfer said water filtered from said filter to said thermo-conductive metal plate of said iron. In this way, a single device is used both to transfer the water to be filtered from said tank to said filter and for transferring said filtered water from said filter to said thermo-conductive metal plate of said iron.

[0042] Alternatively, said water tank and said filter can be in fluid communication such that said water tank is positioned above said filter, in contact with it, so that the water passes by gravity from the tank to the filter.

[0043] In this way, the particular arrangement of the water tank standing above the filter with ion-exchange resins supplied with silver ions allows the same filter to be directly fed by the water contained in the tank which, by gravity, descends from the tank to the filter, without being necessary the activation of any mechanical or electrical device, such as a pump, for transferring the water to be filtered from the tank to the filter.

[0044] In another alternative, said water tank and said filter can be in fluid communication such that said water tank is positioned above said filter, remotely and connected to it by means of a connecting pipe, so that the water equally passes by gravity from the tank to the filter. Also in this case it is not necessary the activation of any device to allow the transfer of the water to be filtered from the tank to the filter.

[0045] In a second aspect the present invention relates to a method for prolonging the life of an iron in an ironing apparatus such as that one indicated in claim 12.

[0046] The Applicant of the present application has in fact surprisingly found that a method for prolonging the life of an iron in an ironing apparatus comprising a) a water tank, b) a filter located in fluid communication with said water tank and adapted to receive and filter the water coming from said tank to reduce the hardness of the water, c) said iron, consisting of at least a main body and by a thermo-conductive metal plate secured to the base of said body main and adapted to receive said filtered water from said filter; the method being characterized by inserting in said filter at least one ion exchange resin provided with silver ions, is able to reduce the algae proliferation in the resins and in the other parts of the hydraulic conduits present in the iron, which would contribute to degenerate the proper functioning of the iron itself, and to reduce the water hardness in the iron, thus reducing, as a result, the limestone formation.

[0047] Moreover, it said method is also able to obtain a better bacteriostatic effect on fabrics ironed thanks to a greater amount of silver released from the ion-exchange resins.

[0048] Preferably, the ironing apparatus used in said method is that one described above with reference to the first aspect of the invention, including all the characteristics therein be considered as preferred aspects of the invention and particular embodiments.

[0049] Further characteristics and advantages of the present invention will become more apparent from an examination of the following detailed description of some preferred embodiments, but not exclusive, illustrated only by way of non-limiting example, with the support of the attached drawing, wherein:

- Figure 1 is a schematic view of a first embodiment of an ironing apparatus according to the present invention;
- Figure 2 is a schematic view of a second embodiment of an ironing apparatus according to the present invention; and
- Figure 3 is a schematic view of a further embodiment of an ironing apparatus according to the present invention.

Detailed Description

[0050] The following detailed description refers to particular embodiments of the apparatus for ironing of the present invention, without limiting the content.

[0051] In Figure 1 it is shown schematically an ironing apparatus 1 according to a first embodiment of the invention which includes an iron 2, a water tank 3 containing at its inside a filter 4 for reducing the water hardness, a pump 5, and two ducts 6,7 for connecting, respectively, the tank 3 to the pump 5 and the pump 5 to the iron 2. In this first embodimentof the invention, the water tank 3, the filter 4 for reducing the hardness of the water and the pump 5 are positioned outside the filter 2, with the filter 5 positioned at the base of the water tank 3.

[0052] The water tank 3 is adapted to contain water at ambient temperature and at atmospheric pressure; it is substantially parallelepiped-shaped, with slightly rounded edges at the corners. It is provided with at least one opening (not shown) to be able to be filled with water.

[0053] During use, when the pump 5 is in operation, part of the water contained in the tank 3 enters the filter 4 for reducing the hardness of the water through the inlet 11 and, after being filtered and softened by means of the ion exchange resin provided with silver ions contained in the filter 4, it exits through the outlet 12 to be supplied to the main body 8 of the iron 2, by means of the ducts 6 and 7 and the pump 5.

[0054] The pump 5 is of conventional type, typically it is a micro-electric pump.

[0055] The iron 2 is of conventional type and typically comprises a main body 8, a handle 9, a thermo-conduc-

tive metal plate 10 secured to the base of the main body 8 and heat generating means (not shown in the figure) associated to the plate 10 in order to heat the plate 10 itself during use for cloth ironing.

[0056] When water comes in contact with the plate 10, being heated by means of the heat generating means, steam in known manner is created.

[0057] The plate 10 is typically provided with holes (not shown in the figure) for the generated steam emission. In addition, it is typically made of aluminum.

[0058] The heat generating means typically comprise a conventional electrical resistance embedded in the plate 10.

[0059] The filter 4 has an elongated and narrow shape, for example cylindrical, parallelepiped or polyhedral; this allows the entire water flow to be effectively filtered. In a preferred form, the filter 4 extends for most of the length of the water tank 3.

[0060] In order to reduce the water hardness the filter 4 comprises at least one filtering zone (not shown) that typically comprises filtering material for the to be filtered water passage. The filter 4 comprises water-permeable fixing elements suitable to keep the filtering material inside the filtering zone and at the same time to allow the water passage through them.

[0061] In particular, in order to reduce water hardness, the filter 4 comprises ion exchange resins as filtering material, wherein the resins are composed of a polymer matrix (usually granules of a few millimeters in diameter) wherein ions are trapped or incorporated, available for the ion exchange. The filter 4 is preferably made of polypropylene which is an at low cost readily available on the market material and easy to seal by welding.

[0062] In one embodiment, in order to reduce the water hardness, the filter 4 comprises at least one ion exchange resin containing silver ions.

[0063] Thanks to the presence of silver ions in the ion exchange resin contained in the filter 4 for reducing the water hardness, a reduction in the algae proliferation is obtained in both the ion exchange resin and in the other parts of the hydraulic conduits present in the iron 2, which would cause the degeneration of the proper functioning of the iron 2 itself. In addition, such ion exchange resins provided with silver ions reduce water hardness in the iron, thus reducing, as a result, the limestone formation, thus prolonging the iron life.

[0064] In addition, a greater amount of silver released by the ion-exchange resins provided with silver ions is also obtained, resulting in a higher production of steam having a bacteriostatic function on tissues subjected to ironing, with the additional benefit compared to known in the art irons to easily modify the silver percentage in the resins.

[0065] In another embodiment, the filter 4 for reducing the water hardness comprises a mixture of ion exchange resins comprising a first ion exchange resin containing silver ions and a second ion exchange resin of the weak cationic type ("WAC") capable of exchanging H^+ ions, wherein such second resin capable of exchanging H^+ ions is about 60-90% of the resin mixture present in the filter 4. Thanks to the presence also of the second ion exchange resin capable of exchanging H^+ ions contained in the filter 4 for reducing the water hardness, in addition to the first ion exchange resin provided with silver ions, a reduction of temporary carbonate water hardness is also obtained.

[0066] In a further embodiment, the filter 4 for reducing the water hardness comprises a mixture of ion exchange resins comprising a first ion exchange resin containing silver ions and a second ion exchange resin of the weak cationic type ("WAC") able to exchange both H^+ ions and Na^+ ions. The first ion exchange resin containing silver ions is about 1-5% with respect to the mixture of ion exchange resins present in the filter 4, the second ion exchange resin capable of exchanging H^+ ions is about 60-90% of the mixture resin present in the filter 4 and the one able to exchange Na^+ ions is about 10-40% of the resin mixture present in the filter 4. Thanks to the presence in the filter 4 for reducing the water hardness also of a ionic exchange resin able to exchange Na^+ ions, in addition to the presence of ion exchange resin supplied by silver ions and the ion exchange resin capable of exchanging H^+ ions, the water, once filtered by the filter 4, showed a reduction of the pH reduction to about 5.0 and a lower hardness compared to the water contained in the tank before being filtered (which had a pH of about 7.0). In this way, the corrosion problems in the aluminum (which forms the base of the iron) when in contact with water or with steam were reduced.

[0067] In Figure 2 an ironing apparatus 1 according to a second embodiment of the invention is schematically shown which differs from the first embodiment described above with reference to Figure 1 only by the fact that the water tank 3, the filter 4 for reducing the water hardness, the pump 5, and the two ducts 6,7 for connecting, respectively, the tank 3 to the pump 5 and the pump 5 to the thermo-conductive metal plate 10 secured to the base of the main body 8 of the iron 2, are positioned inside the filter 2 (rather than outside, as in the first embodiment).

[0068] In Figure 3 an ironing apparatus 1 according to a further embodiment of the invention is schematically shown which differs from the second embodiment described above with reference to Figure 2 for the fact that the filter 4 for reducing the water hardness is positioned above the thermo-conductive metal plate 10 so that the water passes by gravity from the filter 4 to the plate 10 through the duct 7. In this way, no pump is needed for transmitting the filtered water from the filter 4 to the plate 10, as it was instead the case in the analogous second embodiment described above with reference to Figure 2.

[0069] Of course, many modifications and variations of the preferred embodiments described above will be evident to those skilled in the art, still remaining within the scope of the invention.

[0070] For example, there may be more than one input 11 to ensure that the water coming from the tank 3 comes

into contact with the filter 4 for reducing the water hardness to be filtered, as well as it may be present more than one output 12 to provide the filtered water to the main body 8 of the iron 2, by means of the ducts 6 and 7 and the pump 5.

[0071] In addition, there may be other solutions for putting into communication the tank 3 with the filter 4 to allow the water coming from the tank 3 to be filtered by the filter 4. For example, the water tank can be placed above the filter, directly in contact with it, or remotely via a connection tube, so that the water passes by gravity from the tank to the filter, without having to use a pump or other similar device to allow the passage of water from the tank to the filter. In such a situation, wherein the water passes by gravity from the tank to the filter, the pump 5 can be used only in case a device is required to allow the passage of the filtered water to the thermo-conductive metal plate 10 secured to the base of the main body 8 of the iron 2.

[0072] Accordingly, the present invention is not limited to the preferred embodiments described, illustrated only by way of example and not limitative, but is defined by the following claims.

Claims

1. Ironing apparatus (1) comprising:

a) a water tank (3),
b) a filter (4) for reducing the water hardness, positioned in fluid communication with said water tank (3), and adapted to receive and filter the water contained in said water tank (3),
c) an iron (2) comprising at least a main body (8) and a thermo-conductive metal plate (10) fixed to the base of said main body (8) and adapted to receive said filtered water from said filter (4) for reducing the water hardness;

characterized in that said filter (4) for reducing the water hardness comprises at least one ion exchange resin provided with silver ions.

2. Apparatus (1) according to claim 1, wherein said filter (4) for reducing the water hardness comprises a blend of ion exchange resins comprising at least a first resin type provided with said silver ions and at least a second resin type of the weak cation type comprising at least one functional group capable of exchanging hydrogen H^+ ions.

3. Apparatus (1) according to claim 1 or 2, wherein said filter (4) for reducing the water hardness further comprises at least a third resin type of the weak cationic type capable of exchanging Na^+ ions.

4. Apparatus (1) according to claim 3, wherein the blend of said second type and of said third type of resins is such as to obtain a filtered water having a pH value in the range from 3.5 to 6.5.

5. Apparatus (1) according to any one of claims 1 to 4, wherein said filter (4) for reducing the water hardness comprises a blend consisting of at least a first type of resin provided with silver ions, at least a second type of resins capable of exchanging hydrogen H^+ ions, and at least a third type of resins capable of exchanging Na^+ ions, so that said resins provided with silver ions are from about 1% to about 5% of the resins present in the filter (4), said second type of resins capable of exchanging H^+ ions are from about 60% to about 90% of the resins present in the filter (4), and said third type of resins capable of exchanging Na^+ ions are from about 10% to about 40% of the resins present in the filter (4).

6. Apparatus (1) according to any one of claims 1 to 5, wherein said water tank (3) and said filter (4) for reducing the water hardness are positioned outside said iron (2).

7. Apparatus (1) according to any one of claims 1 to 5, wherein said water tank (3) and said filter (4) for reducing the water hardness are incorporated inside said iron (2).

8. Apparatus (1) according to any one of the preceding claims, which further comprises a device (5) capable of transferring said water filtered by said filter (4) for reducing the water hardness to said thermo-conductive metal plate (10) of said iron (2).

9. Apparatus (1) according to any one of the preceding claims, which further comprises a device (5) capable of fluidly connecting said water tank (3) with said filter (4) for reducing the water hardness.

10. Apparatus (1) according to any one of claims 6 or 7, wherein said water tank (3) is in fluid communication with, and positioned above, said filter (4) for reducing the water hardness so that the water passes by gravity from the water tank (3) to the filter (4).

11. Apparatus (1) according to claim 7, wherein said filter (4) for reducing the water hardness is positioned above said thermo-conductive metal plate (10) so that the water passes by gravity from the filter (4) to the plate (10).

12. A method for prolonging the life of an iron (2) in an ironing apparatus (1), the apparatus (1) comprising: a) a water tank (3), b) a filter (4) for reducing the water hardness, positioned in fluid communication with said water tank (3), and adapted to receive and filter the water contained in said water tank (3), c)

said iron (2) comprising at least a main body (8) and a thermo-conductive metal plate (10) fixed to the base of said main body (8) and adapted to receive said filtered water from said filter (4);
the method being **characterized by** inserting in said filter (4) for reducing the water hardness at least one ion exchange resin provided with silver ions.

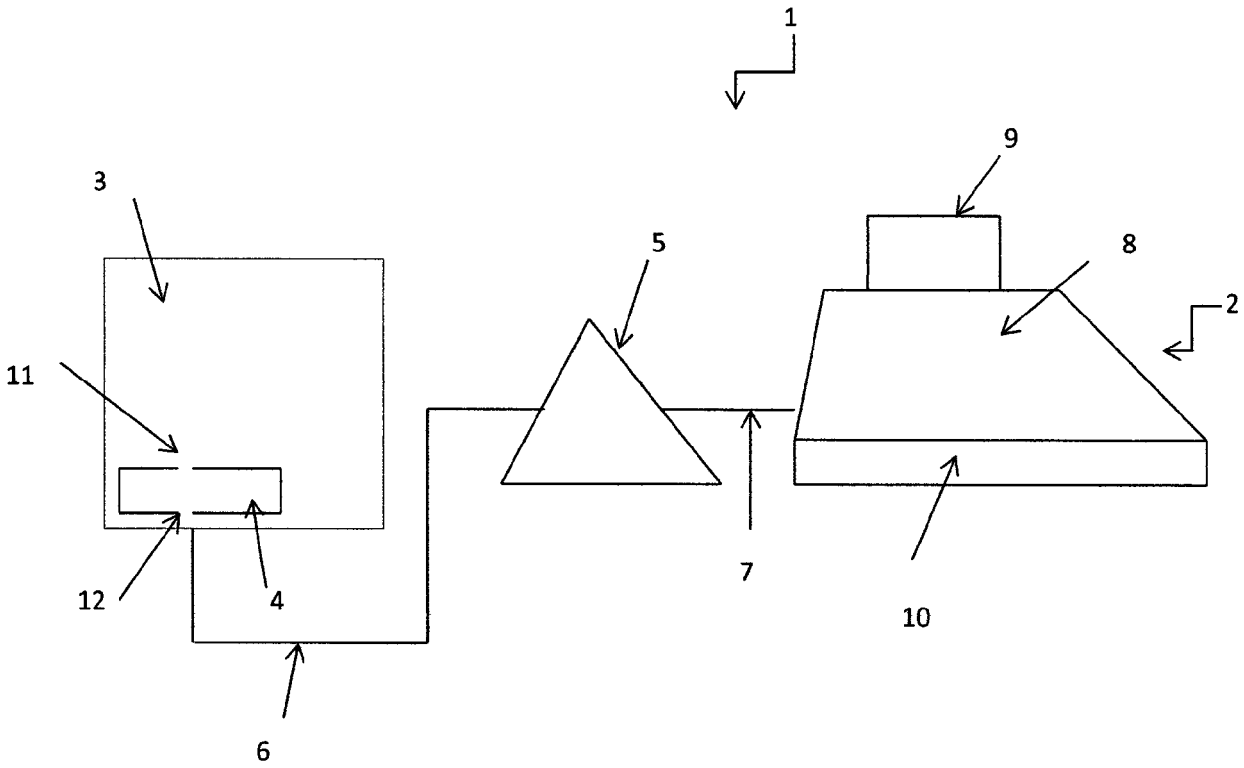

Fig. 1

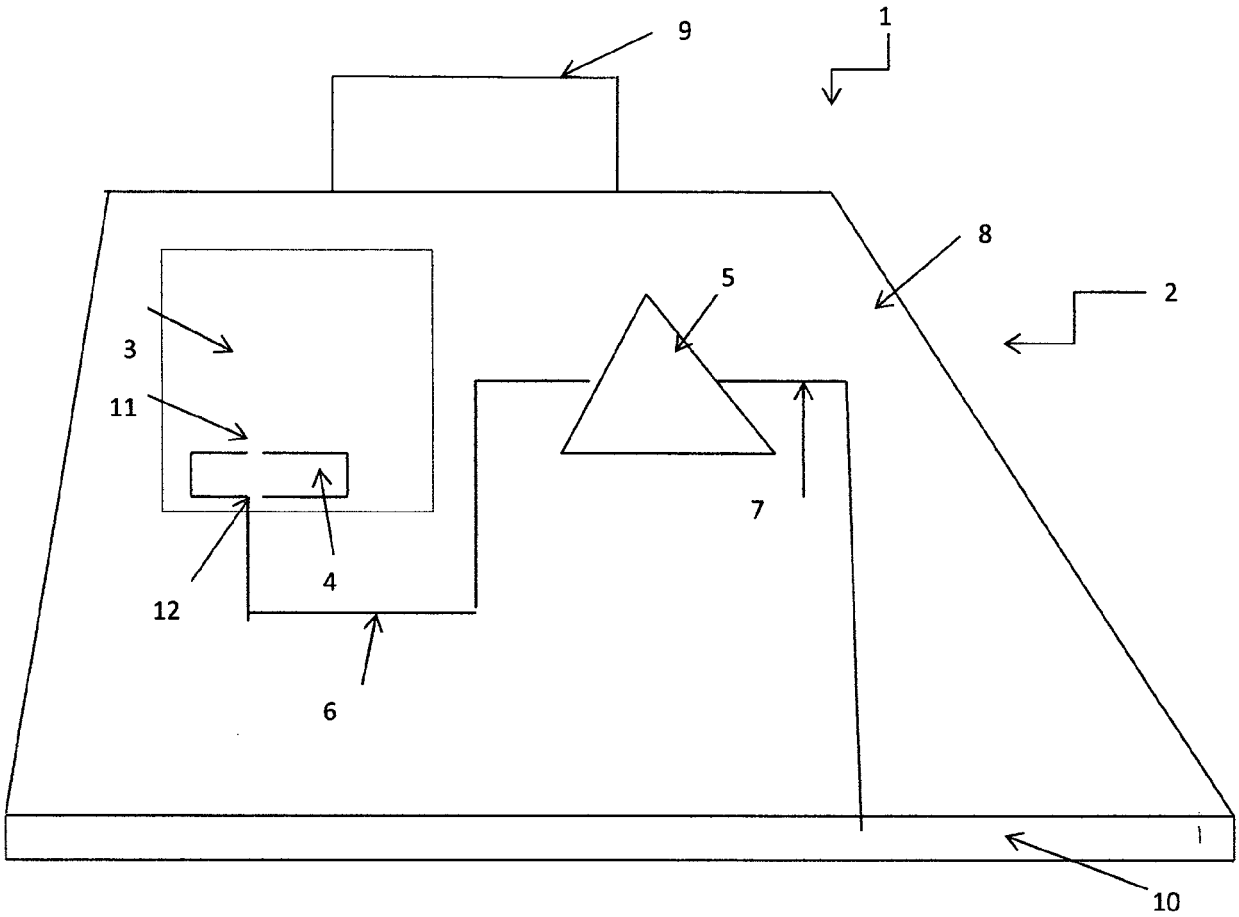

Fig. 2

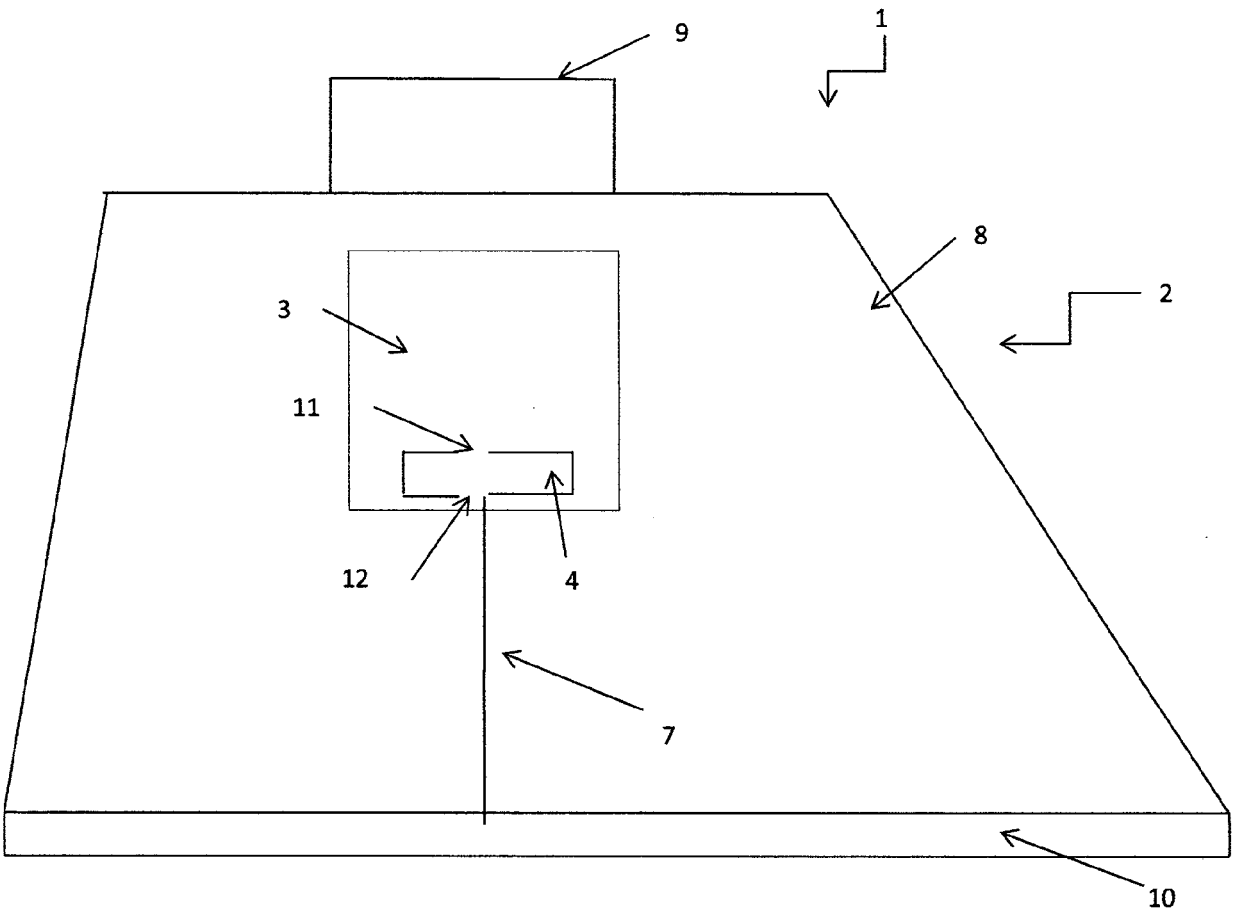

Fig. 3

Europäisches Patentamt
European Patent Office
Office européen des brevets

EUROPEAN SEARCH REPORT

Application Number
EP 16 00 0180

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
A	EP 1 616 992 A1 (IMETEC SPA [IT]) 18 January 2006 (2006-01-18) * paragraph [0038] - paragraph [0047]; figure 1 *	1-12	INV. D06F75/12 D06F75/14
A	US 6 640 472 B1 (WU TSAN-KUEN [TW]) 4 November 2003 (2003-11-04) * column 2, line 46 - column 3, line 53 * * column 5, line 57 - column 5, line 60; figures 3,4 *	1-12	
A,D	JP 2007 209439 A (TOSHIBA CORP; TOSHIBA CONSUMER MARKETING; TOSHIBA KADEN SEIZO KK; TOSH) 23 August 2007 (2007-08-23) * abstract; figure 9 *	1-12	
A,D	JP 2008 061670 A (SANYO ELECTRIC CO; TOKYO SANYO ELECTRIC CO) 21 March 2008 (2008-03-21) * abstract; figure 3 *	1-12	
A,D	CN 203 174 392 U (ZHEJIANG YUELI ELECTRICAL CO LTD) 4 September 2013 (2013-09-04) * abstract; figures 1,2 *	1-12	TECHNICAL FIELDS SEARCHED (IPC) D06F
A	EP 2 803 761 A1 (SEB SA [FR]) 19 November 2014 (2014-11-19) * paragraph [0033] - paragraph [0049]; figures 1,5 *	1-12	
A	GB 2 308 135 A (SINGER CO NV [AN]) 18 June 1997 (1997-06-18) * page 3, line 6 - page 5, line 23; figures 2,3 *	1-12	
A	CN 201 738 163 U (JINSONG ZHOU) 9 February 2011 (2011-02-09) * abstract; figures 1,2 *	1,12	

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	12 May 2016	Fachin, Fabiano

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

EPO FORM 1503 03.82 (P04C01)

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 16 00 0180

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

12-05-2016

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP 1616992 A1	18-01-2006	AT 448354 T	15-11-2009
		EP 1616992 A1	18-01-2006
		ES 2336560 T3	14-04-2010
		PT 1616992 E	18-02-2010
US 6640472 B1	04-11-2003	NONE	
JP 2007209439 A	23-08-2007	NONE	
JP 2008061670 A	21-03-2008	JP 4988275 B2	01-08-2012
		JP 2008061670 A	21-03-2008
CN 203174392 U	04-09-2013	NONE	
EP 2803761 A1	19-11-2014	AU 2014202670 A1	04-12-2014
		CA 2849781 A1	16-11-2014
		CN 104164779 A	26-11-2014
		EP 2803761 A1	19-11-2014
		ES 2565431 T3	04-04-2016
		FR 3005666 A1	21-11-2014
		RU 2014118532 A	20-11-2015
GB 2308135 A	18-06-1997	NONE	
CN 201738163 U	09-02-2011	NONE	

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- CN 203174392 U **[0006]**
- JP 2007209439 A **[0006]**
- JP 2008061670 A **[0007]**