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(54) **WATER HEATER MADE OF PLASTIC, IN PARTICULAR PRESSURIZED WATER HEATER**

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CHAUFFE-EAU EN MATIERE PLASTIQUE, NOTAMMENT CHAUFFE-EAU SOUS PRESSION

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(56) References cited:
EP-A- 0 674 139 **WO-A-85/00552**
FR-A- 2 620 803

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Description

Technical Field

[0001] The invention relates to a water heater apparatus made of plastic material, in particular, though not exclusively, used as a pressurised water heater and tank. The apparatus is entirely made of plastic material.

Background Art

[0002] As is well known, electric water heaters and tanks are traditionally based on steel tanks, hot-rolled in the cylindrical part and drawn steel for the upper and lower closure walls.

[0003] The various parts are assembled by means of welding and are thereafter coated to render the internal parts rust-resistant and give the apparatus a necessarily long working life.

[0004] A problem which has continually dogged manufacturers of heating apparatus for domestic use has been that of realising an internal coating, as uniform as possible, which can guarantee reliability and long working life.

[0005] In the attempt to overcome this problem, various solutions have been proposed, involving much research into coating processes and choice of special materials.

[0006] Among the materials experimented are low-alloy steel coated with zinc and with glazes constituted by thermo-setting resin mixtures of epoxy-phenolic or pre-polymerized types, or steel coated with glaze, constituting a porcellainized coating arrived at through use of sophisticated spraying and hardening systems, copper sheets without internal coatings (especially popular in Anglo-Saxon countries), stainless steel, all instead of low-alloy steel, not to forget the last-named, internally coated with filmable thermoplastic polyamide resins (PA 12-Polyamide RILSAN).

[0007] Low-alloy steel heaters use magnesium-based changeable elements which are substituted, during the corrosion process, for the steel components of the apparatus.

[0008] The use of steel materials and coatings as mentioned above only partially reaches the requirements, inasmuch as corrosion onset phenomena can appear before the end of the apparatus guarantee period and give rise to problems and contestations vis-à-vis the reliability of the apparatus.

[0009] Furthermore, such contestations and phenomena have negative effects on the manufacturer's image and damage economic results.

[0010] The main drawbacks essentially relate to the steel materials used in making the product, which do not always correspond to the fixed specifications, to the protective coatings applied and to the variability of the conditions of the technological processes used during the various phases of the manufacturing process.

[0011] Normally, electric hot-water tanks, for example those made with low-alloy carbon steel tanks, comprise an autoclave flange group housing an electric resistance element, having a potential which correlates to the volume and use of the apparatus, and the inlet and outlet pipes; a system of outside covering constituted by polypropylene shells filled with CaCO_3 whose primary function is aesthetic (the area between the tank and the external shell is usually filled with semi-rigid polyurethane foam acting as a heat insulation and, to a limited extent, as internal supports for the PP shells, which in any case are not subject to any particular stress during use; (the autoclave flange, apart from the electrical resistance element, also supports a thermostatic system and a sacrificial element basically made of magnesium (Mg), which acts as a rust safeguard, within certain limits, for the internal parts of the boiler (the boiler is advantageously coated at 15-40 μ with heat-hardening glazes - in some cases, in longer-duration heaters, the internal surface of the boiler is glaze-porcellainized).

[0012] In the light of above, in recent years more and more attention has come to be placed on the solution to the problems relating to quality and reliability.

[0013] Attempts have therefore been made to manufacture heaters in thermoplastic materials.

[0014] In this context, none of the attempts made up to now, i.e. the present invention, have led to commercially valid solutions.

[0015] In particular, the proposed solutions have come up against problems connected with the fact that the heaters are pressurised.

[0016] Both FR 2 620 803 and WO 85/00552 both give specifications for water heaters having a substantially plastic structure; each of the various main components are made of the plastic material considered the best for the specific function (pressure and temperature strength, insulation, outer cover); unfortunately, both the disclosures give no solution to the recover and recycling of the plastic material because they are not compatible, i. e. not blendable together, neither it is possible or easy their separation; furthermore, in both the suggested solutions, to strengthen the tank, a mineral fibre envelope is used whose mass would be excessive, if compared with the plastic mass, if, once milled with the other components, would be used as reinforcing mineral agent.

[0017] It must be pointed out that, normally, it is not possible to melt and mix together different thermoplastic species in order to obtain a new material from the blend. Technically it is said that the not mixable materials are incompatible each other. Many additives have been developed that render compatible, i. e. mixable in a homogenous blend, different materials but they are to be prepared specifically for each couple or group of materials to compatibilize so that it is practically impossible to utilise this technology for the recycling of generic and not well known thermoplastics.

[0018] In the way of a realistic opportunity of re-utilisation of the plastic material, EP 0 674 139 represents

a remarkable progress since it discloses how to build a water heater structure using a unique material as for the tank as for the insulating protection and the outer envelope. So an easy recovery and recycling of the water heater structure is realistically possible but there is the drawback that the chosen unique material obliges necessarily, in general, to a compromise which does not allow the selection of the best plastic material for each of the various and very different functions to be assured to each one of the water heater components.

[0019] On the contrary, the present invention solves the above-mentioned special needs while solving the described drawbacks.

[0020] The present invention is based on the following research:

- into the use of polymer materials modified by alloying with other technical polymers, added to improve the apparatus' resistance properties during working conditions, and to combat aging through providing a definitive protection against corrosion. The materials are chosen in relation to their workability in making non-traditional geometrical conformations, design innovation and better compatibility with normal sanitary appliance styles and designs;
- into transformation using up-to-date pressing methods, including multi-layer pressing;
- into wholesale recycling of the entire apparatus (except the heating and thermal control parts) which comprises not only the container wherein the water is heated and stored in volumes of 5÷100 litres, but also the necessary thermal insulation and external covering accessories, through the use of homogeneous or inter-compatible materials suitable for rapid and economical recycling for other applications.

[0021] During the applicant's research programme, most attention was focused on the material used, and the best results were obtained with thermoplastic materials, especially suited to recycling operations.

[0022] It is well known that over the last few decades applications of plastic materials have been made in ever-wider fields where previously steel, ceramics and concrete/fibre were before the most-favoured materials.

[0023] This evolution has led to the overcoming of a number of problems involving among other things corrosion (including external corrosion), joining and sealing, weight (plastic is lighter than steel) and manufacturing and modelling costs, not to mention the costs of the materials themselves.

[0024] For example, high-density polythene (obtained through a low-pressure polymerisation of ethylene) has helped to overcome problems deriving from the passage of high-pressure fluids, while, still with reference to polythene, its hot-welding characteristics have led to faster water pipe-laying and have helped to reduce the

need for expensive and frequent maintenance checks on the pipes.

[0025] The research at the foundation of what is proposed in the present invention relates to the search for basic characteristics, from the mechanical point of view, which are sufficiently high-quality and long-lasting (within certain limits) under average pressure conditions (corresponding to the pressure of the municipal water supply) and under maximum temperature conditions reached during the heating of water inside domestic water tanks, under a normal filling/emptying regime.

[0026] A further aim of the invention is to satisfy the utility characteristics of the basic thermoplastic materials as well as the additional alloy components and accessories from a hygienic point of view, thus the invention will meet the international hygienic requirements on organic and inorganic migration in relation to toxic or pollutant characteristics.

[0027] Furthermore, workability characteristics were looked for, in the transformation from raw materials to finished product, through injection-molding, or blow-molding or heat-forming methods. These characteristics, which relate directly to the shape of thermoplastic products, are of fundamental importance to formation processes, but also have much relevance with regard to subsequent problems connected with indeformability (crystallisation connected with cooling) and welding techniques of the various parts of the product.

[0028] A further important objective of the present invention is that the component parts should be entirely recyclable, as prescribed in the existing legislative dispositions and surely in future ones (probably getting progressively tighter and more stringent).

[0029] A still further aim of the present invention is to obtain high reliability over long time periods - already the market is demanding five year guarantees or longer.

[0030] The aims as set out above highlight problems which have caused real obstacles to the manufacture of apparatus responding to all the demands being made.

[0031] Various attempts have been made to use thermoplastic materials to substitute metals.

[0032] In particular, partial attempts have been made using external coatings which have no function of resistance to mechanical and thermal conditions, and entirely in the field of manufactures destined for very low-pressure heating use of small tanks.

[0033] Thus water-heaters with 5 to 12 litre capacities are available on the market (in Italy, Germany, Spain) - obviously having limited performance.

[0034] The use of film-forming resins, too, based on 12-carbon -atom polyamides (PA) as internal rust-protection coatings have produced only poor results, whether due to the presence of water-absorbing characteristics on the part of polyamide resins, or following on from this phenomenon, due to the formation of blisters leading over time the corrosion thanks to the damp getting under the film-coating itself.

[0035] In the light of the above and considering the

need to solve all of the above problems, the invention provides a new water heater, offering various boiler volumes (for example, from 5 to 100 litres), made of technopolymer plastic materials having utilizable shapes, wherein the choice of thermoplastic materials, their shaping and structural design, coherent with the characteristics of the thermoplastic material, give the boiler adequate resistance to repeated P/T cycles on values up to 8 bars and 95° C and increase its resistance to aging to at least 5 years.

Disclosure of invention

[0036] Thus the invention relates to a water heating apparatus made of plastic material, in particular a pressurised water heater comprising a water tank made of thermoplastic polymer material, insulation arranged externally to said tank, made of material which is or which has been made compatible to the water tank, and a shell which is external of said insulation.

[0037] Said external shell can also be made of a material compatible with the water tank, in the case of smaller volume tanks, while for larger tanks it could be made of traditional materials.

[0038] Preferably, according to the invention, the water tank can be made of polyolefin, polymer and copolymer materials, based on styrol and/or butadiene and/or acrylates, polyamides, polyphenylethyls, polyethylsulfone and polysulfone resins or blends thereof, or polymeric mixtures thereof.

[0039] With the invention, a reinforcing agent or filler can be added to the material used to make the water tank, at a percentage comprised between 10 and 40%, preferably between 20 and 30%, with the aim of improving the mechanical characteristics and the size stability.

[0040] In particular, as a reinforcing agent, glass fibre or spheres can be used, while talcum might be used as a filler material, or calcium carbonate or mica. Obviously reinforcing materials can be used in combination with fillers.

[0041] Other materials, known as coupling agents, can be added, for improving the reinforcement and filler adhesion to the polymers or mixtures.

[0042] Also, if polymer blends or mixtures are being used, compatibilizing agents or mixtures thereof can be added to improve polymer cohesion. These agents can also be used for the insulating material and/or for the external shell.

[0043] Furthermore, nucleation agents can be used, optimised for the purpose, for crystalline materials.

[0044] Antistatic agents can also be added, as can anti-UV agents, fireproof materials, colorants and lubricants.

[0045] Finally, stabilising agents of various nature and composition can be added, to reduce time-induced changes in the polymer characteristics.

[0046] The boiler water tank of the invention can be made by pressing, injection or blow-moulding.

[0047] In an embodiment of the invention, the water tank can be made in two or more partial shells, welded together, for example by heat welding or by press-fitting, or gluing.

[0048] The external shell can be made, according to the invention, separately with respect to the insulation, or as an external skin or "crust" of the insulation.

[0049] The invention will now be described, purely in the form of an illustration, with particular reference to the figures of the accompanying drawings, in which:

figure 1 is a sectioned view of a water heater according to the prior art;

figure 2 is a sectioned view of an embodiment of a water heater according to the invention.

[0050] Figure 1 shows a prior-art water heater 1 having a metal water tank 2 containing the resistance 3 and the sacrificial anode 4.

[0051] Insulation 5 is arranged externally of the water tank 2, closed by an external shell 6 made of plastic.

[0052] Obviously the water heater 1 exhibits all of the above-mentioned drawbacks of the prior art.

[0053] The water heater 11 of figure 2 exhibits a water tank 12 made of polymer thermoplastic material made in two halves, joined together in the example by means of heat welding.

[0054] The insulation 13, made of a material which is compatible or compatibilized with the material used for the water tank 12 (with the aim of avoiding any recycling problems of the water heater 11 at the end of its working life), is arranged externally of the water tank 12.

[0055] The external shell 16 is also made of a material which is compatible or compatibilized with that of the water tank 12.

[0056] The resistance 14 and the thermostat shield 15 are inside the water tank 12.

[0057] As already mentioned, to the thermoplastic materials used as primary matrix, various fillers and reinforcements can be added, namely crystallisation-control additives, dimensional stability and thermal and mechanical phenomena agents (including those phenomena connected with internal stress during the formation process), and oxidation stabilizers. All of these can improve the duration of the matrix material over quite long time periods.

[0058] Modifying additives can also be used, for changing viscosity properties and in general rheological properties, ensuring a better workability in the pressing of the pieces, all with the aim of obtaining regular shapes and breadths.

[0059] If the boiler body 12 is to be obtained through injection-molding, one of the most common technologies, not only for thermoplastic materials but also for elastomers and thermosetting materials, the water tank 12 is made in one or two parts and welded using methods largely experimented during the development of the

present invention.

[0060] The water tank 12 can also be obtained using pressing methods known as blow-molding, with one or more layers, which as the advantage that a better regulation of the breadth of the hollow body walls can be achieved, which walls constitute the water tank itself, thanks to the movable central nucleus of blowing heads and special mold geometries. This in today's world offers an excellent technological advantage, and simplifies the formation process of boilers having complex geometrical shapes.

[0061] The good insulation properties of polyurethane now in use, and obtained by mixing two pre-polymerized components (isocyanate and polyhydric alcohols) usually treated with halogenates (FCKW 11, 12, 113-115) chloro-fluorinate-alkanes, are due to the low density values (from 0,02 to 0.08 g/cm³).

[0062] The use of these products, however, will certainly gradually cease due to new normatives, because of the greenhouse effect A changeover is even now under way to non-destructive chlorine-free H-FKW's for manufacture of PUR foams with CO₂ as the agent

[0063] Other alternative techniques are being developed which will lead to the elimination of FCKW, which are based on the partial substitution of foam plastic with vacuum elements. This process is difficult to apply in the case of water heaters. In boiler insulation, even where chlorine is not much used, new techniques and materials have replaced PUR based products, for reasons of recyclability at the end of the heaters' working life, and pains have been taken to avoid mixing in with the recyclable materials others which are not so.

[0064] In the present invention, the insulation 13 of the heater is constituted by pressed shells made of chemically-foamed thermoplastic material, not damaging to the environment and having a density which is similar to that of PUR.

[0065] This is obtained using polyolefin or polystyrol polymers (made compatible with the water tank material and the coating 16 if any).

[0066] As regards the coating, the apparatus obtained according to the invention, in particular related to the use of chemically-foamed polyolefin produced by heat-pressing, can have, instead of the external shells, obtained by injection-molding of polypropylene resins filled with CaCO₃, a heat-forming process with thermoplastic sheets, contemporaneous to the formation of the foamed insulating shells.

[0067] In this way the water tank will be coated with two or more shells made off foamed material having an external surface constituted by a "skin" derived from the forming and perfect adhesion of the foam to a sheet, whose material will be homogeneous or compatible with the material constituting the boiler and the insulation.

[0068] Purely by way of example, a more detailed illustration is given here of one of the preferred versions of the constructional technology according to the invention, applied to the making of a spherical boiler of a small

water heater, volume 10 litres and having an internal diameter of about 270 mm.

[0069] Using propylene having high mechanical characteristics, polymerised in the gassy state and taking care to control crystallisation speed so as to avoid large-size spherulites, a boiler of the breadth of 15 to 25 mm can be made, with a creep factor so contained as to guarantee aqueduct-level pressure resistance and to function at working temperature for 5 years.

[0070] The boiler can be made in two shells, obtained by injection molding and simply welded together by rotary heat pressing, or the boiler can be obtained in a single piece by blow molding.

Claims

1. A water heater (11), in particular a pressurised water heater, including a water tank (12), a thermal insulation (13) and an external shell (16), in which almost said water tank (12) and said thermal insulation (13) are made of thermoplastic polymer materials or material blends, **characterised in that**, for entire recycling the thermoplastic polymer materials or material blends used for the water tank (12) and the thermal insulation (13) are different from each other but chosen between materials or material blends compatible with each other or made compatible by means of compatibilizing agents.
2. A water heater (11), according to claim 1, **characterised in that**, in the case in which the external shell (16) is also made of a thermoplastic polymer material or of a material blend and this material or material blend is different from that chosen for almost the water tank (12) or the thermal insulation (13), said thermoplastic polymer material or material blend is compatible or made compatible by means of compatibilizing agents with the other materials or material blends present in said water heater (11).
3. A water heater (11), according to claims 1 or 2, **characterised in that**, said water tank (12) is made using polyolefin, polymer or copolymer materials based on styrol and/or butadiene and/or acrylates, polyamides, polyphenylethyls, polyethylsulfone and polysulfone resins or blends thereof, or polymeric mixtures thereof.
4. A water heater (11), according to claims 1, 2 or 3, **characterised in that**, a reinforcing agent or a filler is added to the material used for making the water tank (12), in a percentage of between 10 and 40%, preferably between 20 and 30%.
5. A water heater (11), according to claims 4 or 5, **characterised in that**, glass fibre or glass spheres

are used as a reinforcing agent.

6. A water heater (11), according to claims 4 or 5, **characterised in that**, talc, calcium carbonate or mica are used as filler.

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7. A water heater (11), according to any of the preceding claims, **characterised in that**, coupling agents or a mixture thereof are added to said material to improve the adhesion characteristics of the reinforcing agents and fillers.

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8. A water heater (11), according to any of the preceding claims, **characterised in that**, in the case of use of blends or mixtures of polymers, compatibilizing agents or mixtures thereof are added to enable the polymers to blend one to another.

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9. A water heater (11), according to any of the preceding claims, **characterised in that**, in the case in which also the thermal insulation (13) and/or the external shell (16) are made of blends or mixtures of polymers, also for these components said compatibilizing agents or mixtures thereof are used.

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10. A water heater (11), according to any of the preceding claims, **characterised in that**, nucleizing agents optimised for use with crystalline thermoplastic materials are used.

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11. A water heater (11), according to any of the preceding claims, **characterised in that**, antistatic, anti UV, fireproofing, colouring and lubricant agents are added.

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12. A water heater (11), according to any of the preceding claims, **characterised in that**, in order to reduce change in the polymer characteristics over an extended period of time stabilising agents of various nature and composition are added.

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13. A water heater (11), according to any of the preceding claims, **characterised in that**, the water tank (12) is made by injection moulding or by blow moulding.

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14. A water heater (11), according to any of the preceding claims, **characterised in that**, said water tank (12) is made of two half-shells, joined together by welding, for example by heat welding or by pressure-fitting, or by gluing.

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15. A water heater (11), according to any of the preceding claims, **characterised in that**, said external shell (16) is made separately from the insulation (13).

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16. A water heater (11), according to any of the preceding

ing claims, **characterised in that**, said external shell (16) is made as an external skin or crust of the insulation (13).

Patentansprüche

1. Ein Wasserheizgerät (11), insbesondere ein Wasserheizgerät mit innerem Überdruck, mit einem Wassertank (12), einer Wärmedämmung (13) und einer äußeren Schale (16), in der der besagte Wassertank (12) und die besagte Wärmedämmung (13) aus thermoplastischen Polymermaterial oder -materialmischungen gefertigt werden, **dadurch gekennzeichnet, dass** die thermoplastischen Polymermaterialien oder -materialmischung, die für den Wassertank (12) und die Wärmedämmung (13) verwendet werden, für die ganze Wiederverwendung voneinander verschieden sind, jedoch aus Materialien oder Materialmischungen ausgewählt werden, die miteinander kompatibel sind oder durch die Verwendung von kompatibilitätsfördernden Mitteln miteinander kompatibel gemacht werden.

2. Ein Wasserheizgerät (11) gemäß Anspruch 1, **dadurch gekennzeichnet, dass** in dem Fall, in dem die äußere Schale (16) ebenfalls aus einem thermoplastischen Polymermaterial oder -materialgemisch gefertigt wird, das von dem verschieden ist, das für den Wassertank (12) oder die Wärmedämmung (13) verwendet wird, das genannte thermoplastische Polymermaterial oder -materialgemisch mit den anderen in besagtem Wasserheizgerät (11) vorhandenen Materialien oder Materialmischen kompatibel ist oder durch kompatibilitätsfördernde Mittel kompatibel gemacht wird.

3. Ein Wasserheizgerät (11) gemäß Anspruch 1 oder 2, **dadurch gekennzeichnet, dass** der genannte Wassertank (12) unter Verwendung von Materialien aus Polyolefin, Polymer oder Kopolymer auf Basis von Styrol-, und/oder Butadien-, und/oder Acrylat-, Polyamid-, Polyphenylethyl-, Polyethylsulfon- und Polysulfonharzen, Gemischen davon oder polymerischen Mischungen davon gefertigt werden.

4. Ein Wasserheizgerät (11) gemäß Anspruch 1, 2 oder 3, **dadurch gekennzeichnet, dass** ein Verstärkungsmittel oder ein Füllstoff zum Material hinzugegeben werden, das zur Fertigung des Wassertanks (12) verwendet wird, in einem Prozentsatz zwischen 10 und 40%, vorzugsweise zwischen 20 und 30%.

5. Ein Wasserheizgerät (11) gemäß Anspruch 4, **dadurch gekennzeichnet, dass** Kugeln aus Glasfaser oder Glas zur Verstärkung verwendet werden.

6. Ein Wasserheizgerät (11) gemäß Anspruch 4, **dadurch gekennzeichnet, dass** Talk, Kalziumkarbonat oder Glimmer als Füllstoff verwendet werden.
7. Ein Wasserheizgerät (11) gemäß einem beliebigen der vorausgehenden Ansprüche, **dadurch gekennzeichnet, dass Verbindungsmitteln oder eine** Mischung davon dem besagten Material hinzugegeben werden, um die Adhäsionseigenschaften der verstärkungsmittel und der Füllstoffe zu verbessern.
8. Ein Wasserheizgerät (11) gemäß einem beliebigen der vorausgehenden Ansprüche, **dadurch gekennzeichnet, dass** im Falle der Verwendung von Polymermischungen oder -gemischen kompatibilitätsfördernde Mitteln oder Mischungen davon hinzugegeben werden, um die Mischung der Polymere miteinander zu ermöglichen.
9. Ein Wasserheizgerät (11) gemäß einem beliebigen der vorausgehenden Ansprüche, **dadurch gekennzeichnet, dass** falls auch die Wärmedämmung (13) und/oder die äußere Schale (16) aus Polymermischungen oder -gemischen gefertigt werden, ebenfalls für diese Komponenten die genannten kompatibilitätsfördernden Mittel oder Mischungen davon verwendet werden.
10. Ein Wasserheizgerät (11) gemäß einem beliebigen der vorausgehenden Ansprüche, **dadurch gekennzeichnet, dass** für den Einsatz mit kristallinen Thermoplasten optimierte kernbildungsfördernde Mittel verwendet werden.
11. Ein Wasserheizgerät (11) gemäß einem beliebigen der vorausgehenden Ansprüche, **dadurch gekennzeichnet, dass** antistatische, UV-feste, feuerfeste, färbende und schmierende Mittel hinzugefügt werden.
12. Ein Wasserheizgerät (11) gemäß einem beliebigen der vorausgehenden Ansprüche, **dadurch gekennzeichnet, dass** zur Reduzierung der Veränderung des Polymers über einen ausgedehnten Zeitraum stabilisierende Mittel unterschiedlicher Art und Zusammensetzung hinzugefügt werden.
13. Ein Wasserheizgerät (11) gemäß einem beliebigen der vorausgehenden Ansprüche, **dadurch gekennzeichnet, dass** der Wassertank (12) durch Spritzguss oder Blasformung gefertigt wird.
14. Ein Wasserheizgerät (11) gemäß einem beliebigen der vorausgehenden Ansprüche, **dadurch gekennzeichnet, dass** der Wassertank (12) aus zwei fest verbundene Halbschalen gefertigt wird, zum Beispiel durch Schweißung, Druckverbindung oder

Verkleben.

15. Ein Wasserheizgerät (11) gemäß einem beliebigen der vorausgehenden Ansprüche, **dadurch gekennzeichnet, dass** die besagte äußere Schale (16) separat von der Dämmung (13) gefertigt wird.
16. Ein Wasserheizgerät (11) gemäß einem beliebigen der vorausgehenden Ansprüche, **dadurch gekennzeichnet, dass** die besagten äußere Schale (16) als äußere Haut oder Kruste der Dämmung (13) ausgeführt ist.

15 Revendications

1. Un chauffe-eau (11), en particulier un chauffe-eau pressurisé, comprenant un réservoir d'eau (12), un isolant thermique (13) et un revêtement extérieur (16), dans lequel ledit réservoir d'eau (12) et ledit isolant thermique (13) sont fait en matériaux polymériques thermoplastiques ou en mélanges de matériaux, **caractérisé par le fait que**, pour le recyclage total, les matériaux polymériques thermoplastiques ou les mélanges de matériaux utilisés pour le réservoir d'eau (12) et pour l'isolant thermique (13) sont différents les uns des autres mais sont choisis parmi les matériaux ou les mélanges de matériaux compatibles les uns avec les autres ou bien sont rendus compatibles grâce à des agents destinés à les rendre compatibles.
2. Un chauffe-eau (11), comme celui de la revendication 1, **caractérisé par le fait que**, si le revêtement extérieur (16) est également fait en matériau polymérique thermoplastique ou en un mélange de matériaux et si ce matériau ou ce mélange de matériaux est différent de celui choisi pour le réservoir d'eau (12) ou pour l'isolant thermique (13), ledit matériau polymérique thermoplastique ou ledit mélange de matériaux est compatible ou est rendu compatible grâce à des agents destinés à les rendre compatibles avec les autres matériaux ou avec les mélanges de matériaux présents dans ledit chauffe-eau (11).
3. Un chauffe-eau (11), comme celui des revendications 1 et 2, **caractérisé par le fait que** le dit réservoir d'eau (12) est fait en matériaux polyoléfiniques, polymériques ou copolymériques à base de styrol et/ou de butadiène et/ou d'acrylates, de polyamides, de polyphényléthyls, de résines de polyéthylsulfone et de polysulfone ou de mélanges desdits matériaux, ou de mixtures polymériques desdits matériaux.
4. Un chauffe-eau (11), comme celui des revendications 1, 2 et 3, **caractérisé par le fait qu'un agent**

de renfort ou un matériau de remplissage est ajouté au matériau utilisé pour faire le réservoir d'eau (12) dans un pourcentage allant de 10% à 40%, de préférence de 20% à 30%.

5. Un chauffe-eau (11), comme celui des revendications 4, **caractérisé par le fait que** des sphères en fibre de verre ou en verre sont utilisées comme agents de renfort. 5
6. Un chauffe-eau (11), comme celui des revendications 4, **caractérisé par le fait que** du talc, du carbonate de calcium ou du mica sont utilisés comme matériaux de remplissage. 10
7. Un chauffe-eau (11), comme celui de n'importe laquelle des revendications précédentes, **caractérisé par le fait que** des agents d'accouplement ou une mixture desdits agents sont ajoutés audit matériau pour améliorer les caractéristiques d'adhésion des agents de renfort et des matériaux de remplissage. 20
8. Un chauffe-eau (11), comme celui de n'importe laquelle des revendications précédentes, **caractérisé par le fait que**, si l'on utilise des mélanges ou des mixtures de polymères, des agents destinés à les rendre compatibles ou des mixtures desdits agents sont ajoutés pour permettre aux polymères de se mélanger les uns aux autres. 25 30
9. Un chauffe-eau (11), comme celui de n'importe laquelle des revendications précédentes, **caractérisé par le fait que**, si l'isolant thermique (13) et /ou le revêtement extérieur (16) sont également faits en mélanges ou en mixtures de polymères, lesdits agents destinés à les rendre compatibles ou des mixtures desdits agents sont utilisés également pour ces composants. 35 40
10. Un chauffe-eau (11), comme celui de n'importe laquelle des revendications précédentes, **caractérisé par le fait que** sont utilisés des agents nucléisants optimisés pour qu'ils puissent être utilisés avec des matériaux thermoplastiques cristallins. 45
11. Un chauffe-eau (11), comme celui de n'importe laquelle des revendications précédentes, **caractérisé par le fait que** sont ajoutés des agents antistatiques, anti UV, ignifuges, colorants et lubrifiants. 50
12. Un chauffe-eau (11), comme celui de n'importe laquelle des revendications précédentes, **caractérisé par le fait que**, afin de réduire les changements dans les caractéristiques du polymère sur une longue période de temps, sont ajoutés des agents stabilisants de nature différente et de composition différente. 55

13. Un chauffe-eau (11), comme celui de n'importe laquelle des revendications précédentes, **caractérisé par le fait que** l'on réalise le réservoir d'eau (12) en le moulant par injection ou en le moulant par soufflage.

14. Un chauffe-eau (11), comme celui de n'importe laquelle des revendications précédentes, **caractérisé par le fait que** ledit réservoir d'eau (12) est fait de deux demi-carasses que l'on a unies ensemble en les soudant, par exemple en les soudant à chaud ou en les emboîtant par pression ou en les collant.

15. Un chauffe-eau (11), comme celui de n'importe laquelle des revendications précédentes, **caractérisé par le fait que** ledit revêtement extérieur (16) est fait séparément de l'isolant (13).

16. Un chauffe-eau (11), comme celui de n'importe laquelle des revendications précédentes, **caractérisé par le fait que** ledit revêtement extérieur (16) est fait comme une peau extérieure ou comme une croûte de l'isolant (13).

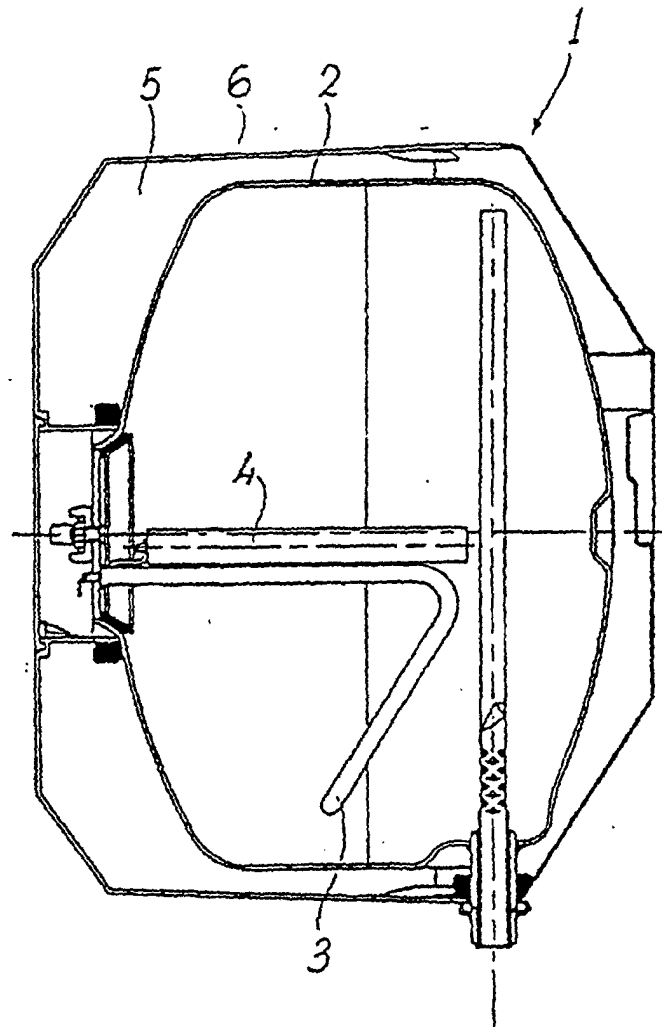


FIG. 1

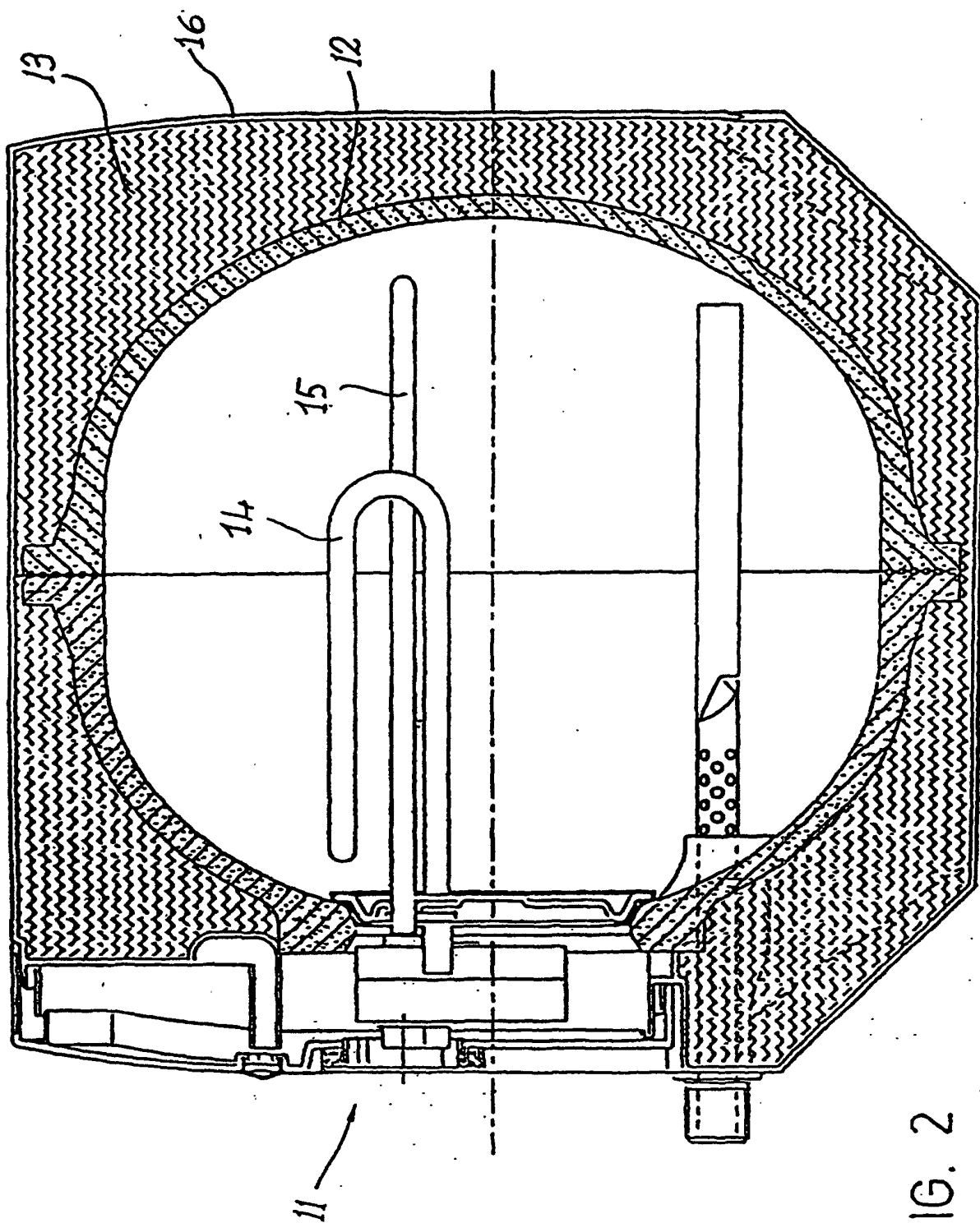


FIG. 2