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(54) A WASHING MACHINE FOR WASHING EMPTY CONTAINERS AND AN OPERATING METHOD THEREOF

(57) A washing machine (1; 1') for washing empty containers (2) includes a conveyor device (4) for conveying the containers (2) along a washing path (Q), at least one bath (11; 12) holding a cleaning medium and through which the washing path (Q) extends, and at least one corresponding ultrasonic wave generator (UG; UG') coupled to the bath (11; 12) for propagating ultrasonic waves through the cleaning medium, such that the containers (2) receive an ultrasonic cleaning treatment during their advancement through the bath (11; 12).

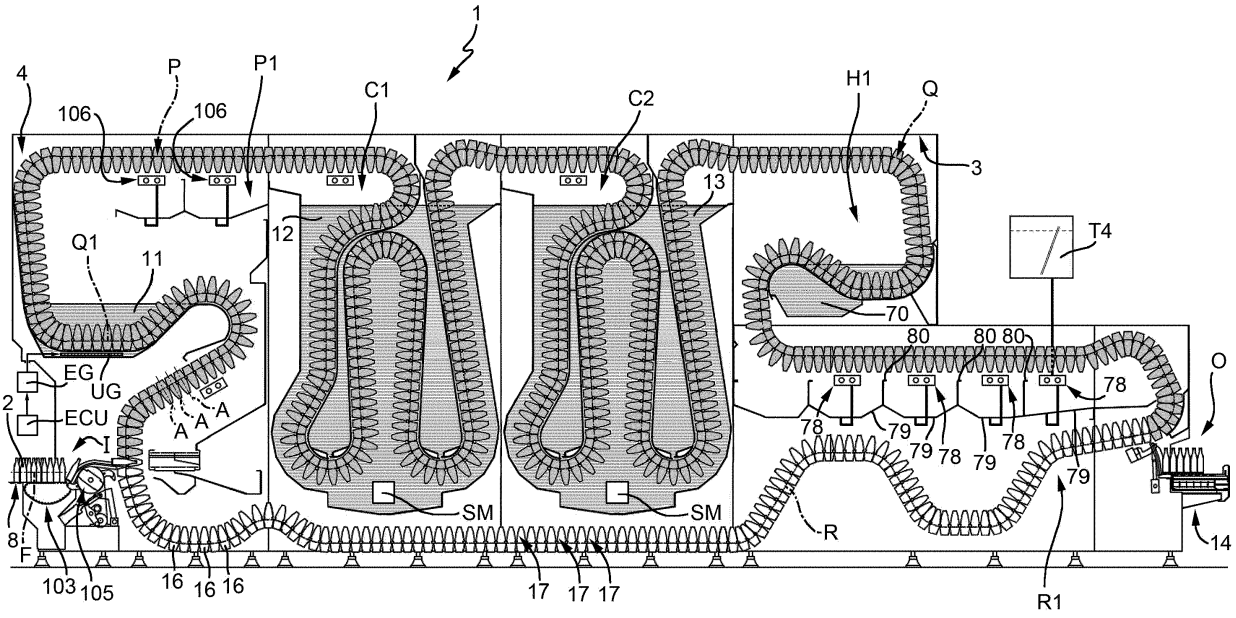

FIG. 1

EP 3 666 403 A1

Description

[0001] The invention relates to a washing machine for washing empty containers and to an operating method thereof.

[0002] In general, washing machines are known with the purpose of cleaning the empty containers upstream of a filling and a labelling station, in which the containers are respectively filled with a pourable product and labelled with respective labels.

[0003] An example of washing machine is known, e.g. from EP2727660 in the name of the same Applicant.

[0004] Known washing machines essentially comprise:

- a feeding system;
- a washing tunnel;
- a looped chain conveyor advancing the containers along a closed washing path and extending inside the washing tunnel from an inlet station to an outlet station; and
- a plurality of sequential treatment zones arranged between the inlet station and the outlet station, and through which the chain conveyor advances the containers.

[0005] In detail, the chain conveyor comprises a plurality of beams, which are fed at the inlet station by the feeding system with respective rows of containers.

[0006] In particular, each beam comprises a plurality of aligned pockets, which receive, convey and outlet the respective washed containers.

[0007] Each beam is discharged of the respective washed containers at the outlet station and then is returned to the inlet station, where it receives new empty containers to be washed.

[0008] According to the advancing direction of containers along the washing tunnel, the treatment zones comprise, in sequence, a prewash zone, a first cleaning zone, a second cleaning zone and a plurality of consecutive rinsing zones.

[0009] The prewash zone, the first cleaning zone, and the second cleaning zone comprise respective cleaning baths, which are filled with a washing chemical agent at high temperature and through which the containers are advanced.

[0010] Each rinsing zone comprises one or more rinsing baths filled with rinsing liquid and/or ejecting devices for directing sprinkles of rinsing liquid toward the containers.

[0011] In general, containers needs to be treated through the cleaning zones for a relatively long time to be effectively deprived from the most encrusted dirt mounds, especially the ones heavily sedimented at the bottom of the containers themselves.

[0012] Moreover, the treatment through the cleaning zones requires high consumption of energy, since being essentially based on the quantity of chemical agent used in a washing cycle and the temperature of the same chemical agent.

[0013] An attempt to replace known washing machines with a cleaning device having an increased cleaning power and being energetically efficient has been disclosed by WO2016202493, wherein ultrasonic waves are exploited for disaggregating dirt deposits onto empty containers to be washed.

[0014] In particular, WO2016202493 discloses a method for cleaning containers and a corresponding cleaning device, according to which the containers are treated with a jet of water provided with air bubbles and ultrasonic waves herein generated and propagated.

[0015] The ultrasonic waves propagate in water and, more in general, in a medium with a relative periodic motion with respect to the medium itself, such that local micro-zones within the medium pass periodically from a depressurized to a pressurized state.

[0016] During the depressurized state, air dissolved within the medium tends to form many microbubbles, which implode when pressure increases so as to release energy.

[0017] Such energy may be useful to disaggregate the aforementioned encrusted dirt mounds, such that cleaning the containers results significantly eased.

[0018] Although the cleaning device disclosed by WO2016202493 represents an important contribution to the state of the art, a need is still felt to improve known washing machines from the point of view of saving energy and reducing operational times, as well as dimensions of the same washing machines.

[0019] It is an object of the invention to provide a washing machine for washing empty containers, which allows meeting the abovementioned need.

[0020] This object is achieved by the invention as it relates to a washing machine for washing empty containers, as claimed in claim 1.

[0021] The invention further relates to an operating method of a washing machine for washing empty containers, as claimed in claim 9.

[0022] Two preferred embodiments are hereinafter disclosed for a better understanding of the present invention, by way of non-limitative examples and with reference to the accompanying drawings, in which:

- Figure 1 is a lateral view of a first embodiment of a washing machine for washing empty containers, according to the invention;
- Figure 2 is a lateral view in an enlarged scale of some components of the washing machine of Figure 1;
- Figure 3 is a lateral view of a second embodiment of a washing machine for washing empty containers, according to the invention; and
- Figure 4 is a lateral view in an enlarged scale of some components of the washing machine of Figure 3.

[0023] With reference to Figure 1, numeral 1 indicates a washing machine for washing containers 2, according

to a first embodiment of the invention.

[0024] In particular, containers 2 are defined by respective empty bottles intended to be filled with a pourable product.

[0025] As visible in Figure 2, each container 2 has an external surface 2a delimiting an inner volume 2b adapted to receive the pourable product and extends along an axis A (in particular, lying on a vertical plane) from a base portion 2c to a neck portion 2d.

[0026] The neck portion 2d is provided with an inlet opening 2f about axis A, which allow the filling of the inner volume 2b of the corresponding container 2.

[0027] Making again reference to Figure 1, washing machine 1 comprises:

- a washing tunnel 3, in which empty containers 2 are fed and accordingly washed; and
- a chain conveyor 4 for advancing containers 2 inside washing tunnel 3 along a closed loop path P, in particular lying on a vertical plane.

[0028] In detail, chain conveyor 4 comprises:

- a pair of chains 15 elongated parallel to path P and parallel to one another; and
- a plurality of subsequent conveying beams 16, which extend between chains 15 in a transversal and, more in detail, orthogonal manner to chains 15 and path P.

[0029] Specifically, each beam 16 comprises a row of pockets 17 aligned orthogonally to path P and adapted to receive corresponding containers 2.

[0030] In such a manner, containers 2 carried by a corresponding beam 16 are aligned orthogonally to path P and housed inside the respective pockets 17.

[0031] Washing machine 1 comprises also a feeding system 8 for feeding a sequence of empty containers 2 along a direction F and at an inlet station I of washing tunnel 3. In particular, containers 2 fed along direction F are arranged in rows orthogonal to path P.

[0032] Feeding system 8 comprises:

- a plurality of endless conveyors 103 (of which only one is schematically shown) configured to convey the rows of containers 2 towards the inlet station I;
- a motor (not shown), which drives conveyors 103; and
- a sequencing device 105, arranged between inlet station I and endless conveyors 103 and configured to receive a row of containers 2 at a time from conveyors 103 and to feed the received row to the chain conveyor 4 at inlet station I.

[0033] In particular, the most forward containers 2 of each row of containers 2 are transferred by sequencing device 105 to the respective pockets 17 of the beam 16 that is travelling at inlet station I.

[0034] The operation and construction of the sequencing device 105 in known as such and, therefore, not described further in detail.

[0035] Direction F is horizontal and orthogonal to axes A of containers 2 fed along the same direction F.

[0036] Washing machine 1 further comprises an outfeed conveyor 14, which receives rows of cleaned containers 2 from chain conveyor 4 at an outlet station 0 of washing tunnel 3.

[0037] In view of the above, path P comprises:

- a washing branch Q, which extends from inlet station I to outlet station 0 and along which containers 2 are advanced by chain conveyor 4; and
- a return branch R, which extends from outlet station 0 to inlet station I and defines a return zone R1, through which beams 16 return towards inlet station I without containers 2.

[0038] Furthermore, according to the advancing direction of the same containers 2, washing machine 1 comprises in sequence along washing branch Q:

- a prewash zone P1;
- a first cleaning zone C1;
- a second cleaning zone C2; and
- a final rinsing zone H1.

[0039] In the foregoing of the present disclosure, for the sake of clarity, terms like "upstream of" and "downstream of" are to be intended throughout the whole description with reference to such advancing direction of the containers 2 along path P.

[0040] Within prewash zone P1, washing machine 1 comprises a prewashing apparatus comprising, in turn, a bath 11 filled with a cleaning agent and a plurality of sprinkling devices 106 arranged in sequence along washing branch Q downstream of bath 11.

[0041] Sprinkling devices 106 deliver, in use, sprinkles of the above cleaning agent to external surfaces 2a and inner volumes 2b of containers 2, while the latter are advanced through the prewash zone P1 itself.

[0042] The cleaning agent within bath 11 and the cleaning agent ejected by sprinkling devices 106 are brought to a relatively high temperature, for instance between 45 °C and 60 °C, so that the encrusted dirt on containers 2 starts to dissolve as containers 2 themselves advance through prewash zone P1.

[0043] Within first cleaning zone C1 and second cleaning zone C2, washing machine 1 comprises respective baths 12, 13 filled with corresponding cleaning agents and defining a hot washing apparatus.

[0044] The cleaning agent within baths 12, 13 is brought to a higher temperature than that within bath 11, for instance between 65 °C and 80 °C, so that dirt on advancing containers 2 is fully removed together with possible labels arranged on the respective external surfaces 2a.

[0045] The above removed labels precipitate due to

gravity action and due to a pushing action exerted by the same advancing containers 2 toward the bottom of bath 12 or of bath 13, based on where containers 2 are immersed during the detachment of the labels from the respective external surfaces 2a.

[0046] In view of that, washing machine 1 comprises two suction apparatus SM, which are respectively arranged at the bottom of bath 12 and 13 and are both configured to suck the detached labels so as to remove the latter from the corresponding baths 12, 13.

[0047] Conveniently, the cleaning agents filling the respective baths 11, 12, 13 comprise corresponding basic aqueous solutions that include, in particular, sodium hydroxide.

[0048] Containers 2 come out from bath 13 cleaned and heated up to a temperature likely between 60 °C and 70 °C, so that the same containers 2 needs to be cooled down to environmental temperature before being discharged at outlet station 0.

[0049] Furthermore, containers 2 coming out from bath 13 present residuals of cleaning agent, which needs to be removed before the same containers 2 are discharged at outlet station 0.

[0050] In view of that, washing machine 1 comprises a rinsing apparatus 101, which is arranged within final rinsing zone H1 and is configured to cool and rinse containers 2 by bringing the same containers 2 in contact with a rinsing medium, in particular water, at a temperature lower than that of the cleaning agent within bath 13.

[0051] Specifically, rinsing apparatus 101 comprises a bath 70 filled with the rinsing medium and positioned such that beams 16 are conveyed by chains 15 through the same bath 70.

[0052] In such a manner, beams 16 and external surfaces 2a of containers 2 advancing through the bath 70 are fully in contact with such rinsing medium and, in particular, immersed therein.

[0053] Furthermore, rinsing apparatus 101 comprises an ejection assembly 77 arranged along washing branch Q downstream of bath 70.

[0054] Ejection assembly 77 comprises a plurality of sprinkling devices 78 arranged in sequence along washing branch Q for delivering sprinkles of the rinsing medium to external surfaces 2a and inner volumes 2b of containers 2, as well as to beams 16 carrying the same containers 2.

[0055] At least one of the sprinkling devices 78 is supplied by a source of rinsing medium; specifically washing machine 1 comprises a tank T4 defining the above source of rinsing medium.

[0056] In particular, tank T4 supplies only the last sprinkling device 78 of the respective sequence, according to the advancing direction of containers 2.

[0057] To supply all the other sprinkling devices 78, ejection assembly 77 comprises also a plurality of basins 79 respectively arranged in sequence below sprinkling devices 78 and fluidly connected thereto.

[0058] The last basin 79 in the respective sequence gathers the rinsing medium that is ejected by the corresponding sprinkling device 78, since the same ejected rinsing medium falls down from containers 2 and beams 16 that advance above the same last basin 79.

[0059] As it will be explained in the foregoing of the disclosure, the previously referred last basin 79 supplies, in use, all the other basins 79, which in turn supply the corresponding sprinkling devices 78.

[0060] In detail, as schematically illustrated in Figure 1 and according to the advancing direction of containers 2, each basin 79, with exception of the first of the respective sequence, comprises at the top a corresponding spillway 80 toward the immediately upstream basin 79.

[0061] Therefore, when a basin 79 (excluded the first one of the respective sequence) is completely filled with rinsing medium, a superficial portion of the latter falls by means of the spillway 80 into the immediately upstream basin 79.

[0062] The last basin 79 in the respective sequence is the first one that is completely filled since indirectly receiving rinsing medium from tank T4 via the corresponding sprinkling device 78; the other basins 79 are completely filled in succession according to a direction opposite to the advancing direction of containers 2.

[0063] Advantageously, washing machine 1 comprises an ultrasonic wave generator UG, which is coupled to bath 11 and configured to propagate ultrasonic waves through the cleaning agent within bath 11 itself, such that containers 2 may receive an ultrasonic cleaning treatment while advancing through bath 11.

[0064] More in detail, ultrasonic wave generator UG comprises a plurality of ultrasonic transducers 90 (Figure 2), which are conveniently plate-shaped, configured to convert electric power into ultrasounds, and sequentially arranged adjacent and parallel to each other along a stretch Q1, which is part of washing branch Q and extends through bath 11.

[0065] In particular, ultrasonic transducers 90 has a thickness between 70 mm and 110 mm and preferred planar dimensions about 500 mm x 300 mm.

[0066] Ultrasonic transducers 90 preferably emit ultrasonic waves having an action range of at least 350 mm and a frequency between 25 kHz and 28 kHz.

[0067] Specifically, ultrasonic transducers 90 are parallel to stretch Q1 and fixed with respect to bath 11, so as to be placed immediately below the advancing beams 16. In such a manner, ultrasonic transducers 90 face in close proximity the base portions 2c of the containers 2 advanced through bath 11.

[0068] In particular, ultrasonic transducers 90 have a maximum clearance from the bottom of base portions 2c that is equal to 10 mm, according to a direction orthogonal to stretch Q1. Possibly, a slight crawling between base portions 2c and ultrasonic transducers 90 may be tolerated.

[0069] Moreover, while beams 16 advance through stretch Q1, the same beams 16 have respective portions facing ultrasonic transducers 90 in close proximity.

[0070] In the first embodiment of the invention, stretch Q1 is rectilinear and horizontal. Moreover, stretch Q1 has a length conveniently between 0.5 m and 2 m.

[0071] Preferably, containers 2 are advanced throughout the whole stretch Q1 during a time interval between 20 s and 60 s, in order to have optimal performances of the ultrasonic cleaning treatment.

[0072] Washing machine 1 further comprises:

- an electric power generator EG connected to ultrasonic transducers 90; and
- a control unit ECU connected to the electric power generator EG and configured to control power supply of each ultrasonic transducer 90 by operating electric power generator EG.

[0073] In particular, control unit ECU controls the activation of ultrasonic transducers 90 in a periodic or discontinuous manner, e.g. for a duration of 30 s after each period of 420 working hours of the washing machine 1.

[0074] Moreover, control unit ECU is configured to inhibit emissions of ultrasonic waves during downtimes.

[0075] The operation of washing machine 1 is described in detail in the following.

[0076] Feeding system 8 advances a plurality of rows of containers 2 to be washed through conveyor 103 in a parallel manner to direction F.

[0077] The properly positioned containers 2 are arranged with respective axes A orthogonal to path P and with respective base portions 2c lying on conveyor 103.

[0078] Beams 16 of chain conveyor 4 withdraw respective rows of containers 2 at inlet station I from sequencing device 105, advance containers 2 inside washing tunnel 3 along the washing branch Q, discharge rows of cleaned containers 2 at outlet station 0 onto outfeed conveyor 14, and return along return branch R without containers 2.

[0079] In detail, containers 2 of each row are first carried by pockets 17 through prewash zone P1, where containers 2 are preliminary washed and heated through immersion within bath 11 and by means of sprinkling devices 106.

[0080] Containers 2 receive within bath 11 also a complete ultrasonic cleaning treatment by means of ultrasonic wave generator UG, with above described modes.

[0081] Hence, the same containers 2 are conveyed also through following baths 12, 13, respectively at cleaning zones C1, C2, so that containers 2 are completely cleaned and deprived of any labels attached thereon.

[0082] Here, both containers 2 and beams 16 receive heat from cleaning agent within baths 12, 13 up to reach elevated temperatures, for instance between 60 °C and 70° C.

[0083] Then, containers 2 are rinsed and cooled through the final rinsing zone H1 before the same containers 2 are discharged at outlet station 0.

[0084] With reference to Figure 3, numeral 1' indicates a washing machine for washing empty containers 2, according to a second embodiment of the invention.

[0085] Washing machine 1' is similar to washing machine 1 and will be described hereinafter only as far as it differs therefrom; corresponding or equivalent parts of washing machines 1, 1' will be indicated where possible by the same reference numerals.

[0086] In particular, washing machine 1' differs from washing machine 1 for comprising, in replacement of ultrasonic wave generator UG, an ultrasonic wave generator UG' coupled to bath 12 and configured to propagate ultrasonic waves through the cleaning agent within bath 12 itself, such that containers 2 may receive an ultrasonic cleaning treatment while advancing through bath 12.

[0087] More in detail, ultrasonic wave generator UG' comprises a plurality of ultrasonic transducers 90' (Figure 4), which are functionally and constructively similar to ultrasonic transducers 90.

[0088] Ultrasonic transducers 90' are sequentially arranged adjacent and parallel to each other along a stretch Q2, which is part of washing branch Q and extends through bath 12.

[0089] Ultrasonic transducers 90' are parallel to stretch Q2 and fixed with respect to bath 12 so as to face in close proximity the base portions 2c of the containers 2 advanced through bath 12.

[0090] In particular, ultrasonic transducers 90' have a maximum clearance from the bottom of base portions 2c that is equal to 10 mm, according to a direction orthogonal to stretch Q2.

[0091] In the second embodiment, stretch Q2 is rectilinear and vertical. Moreover, stretch Q2 has a length conveniently between 0.5 m and 2 m. In general, the vertical arrangement of flattened ultrasonic transducers 90' is convenient because dirt detached from containers 2 slips away from the ultrasonic transducers 90' themselves with easiness.

[0092] Preferably, containers 2 are advanced throughout the whole stretch Q2 during a time interval between 20 s and 60 s, in order to have optimal performances of the ultrasonic cleaning treatment.

[0093] Ultrasonic transducers 90' are connected to electric power generator EG in order to receive power supply therefrom under the control of control unit ECU. In particular, control unit ECU controls the activation of ultrasonic transducers 90' exactly in the same way ultrasonic transducers 90 are controlled.

[0094] Conveniently, ultrasonic transducers 90' are spaced apart from suction apparatus SM within bath 12, such that the action of the same ultrasonic transducers 90' does not interfere with that of suction apparatus SM itself. In other words, ultrasonic wave generator UG' and suction apparatus SM within bath 12 have respective action areas that are separated from one another.

[0095] In such a manner, turbulences inducted in the cleaning agent by suction apparatus SM do not affect cleaning effectiveness of ultrasonic waves. In fact, Applicant has found experimentally that cleaning effectiveness of ultrasonic waves dramatically drops if the latter are propagated through a disturbed fluid. Furthermore,

ultrasonic waves in a disturbed fluid are known to produce an intense high-amplitude noise, also colloquially recognized as "ultrasonic scream"

[0096] The operation of washing machine 1' is similar to that of washing machine 1 and is described only insofar as it differs therefrom.

[0097] In particular, the operation of washing machine 1' differs from that of washing machine 1 in that containers 2 receive the ultrasonic cleaning treatment while advancing through bath 12 in cleaning zone C1, instead of through bath 11 in prewash zone P1.

[0098] The cleaning effectiveness of the treatment within bath 12 is higher than that of the treatment within bath 11 due to the higher temperatures of the cleaning agent within bath 12 than that of the cleaning agent within bath 11.

[0099] From an analysis of the features of washing machines 1, 1' and of the method according to the invention, the advantages they allow to obtain are apparent.

[0100] In particular, ultrasonic generators UG, UG' have an extremely simplified structure and respectively integrate with easiness to baths 11, 12, which correspond to washing apparatus normally present in known washing machines.

[0101] Therefore, ultrasonic generators UG, UG' may be applied into already existent and operative washing machines, in order to increase efficiency of the latter.

[0102] It is evident that washing machines 1, 1' can be designed to have smaller dimensions than known washing machines, with significant cost savings. Indeed, a shorter washing branch Q is abundantly compensated by the increase of cleaning performances due to the use of ultrasounds.

[0103] The flattened shape of ultrasonic transducers 90, 90' allows a simple and compact arrangement of ultrasonic wave generators UG, UG' within the corresponding baths 11, 12 in close proximity to the base portions 2c of the containers 2, which advance along the corresponding stretches Q1, Q2.

[0104] The fact that ultrasonic transducers 90, 90' are immersed within the corresponding baths 11, 12, so as to be surrounded by a wave transmission medium, increases the cleaning performances of the emitted ultrasonic waves.

[0105] In particular, the reduced spacing between ultrasonic transducers 90, 90' and base portions 2c optimizes the effectiveness of the cleaning treatment of containers 2, since an increased amount of energy affects the limescale or encrusted dirt deposits on the base portions 2c themselves.

[0106] The energetic impact of the operation of ultrasonic wave generators UG, UG' is particularly limited thanks to the intelligent control performed by electronic control unit ECU, which selectively activate ultrasonic transducers 90, 90' according to a predetermined optimized period.

[0107] Finally, the lengths of stretches Q1, Q2 are chosen according to an optimized compromise between energetic expenditure and cleaning performances, as demonstrated by several experiments accomplished by the Applicant.

[0108] Clearly, changes may be made to washing machine 1 and to the method as described and illustrated herein without, however, departing from the scope of protection as defined in the accompanying claims.

[0109] In particular, the shape and arrangement of ultrasonic transducers 90, 90' may be different from what described and illustrated in the above disclosure. More in particular, stretch Q1 may be vertical, instead of horizontal, and stretch Q2 may be horizontal, instead of vertical.

[0110] In replacement or in addition to ultrasonic wave generator UG', another ultrasonic wave generator may be coupled to bath 13 for propagating ultrasonic waves through the cleaning agent contained therein.

[0111] Moreover, the two disclosed embodiments might be combined with each other.

Claims

1. A washing machine (1; 1') for washing empty containers (2), the washing machine comprising:

   - a conveyor device (4) configured to convey a plurality of said containers (2) along a washing path (Q); and
   - at least one bath (11; 12) suitable for holding a cleaning medium; said washing path (Q) extending through said bath (11; 12);

   characterized by further comprising at least one corresponding ultrasonic wave generator (UG; UG') coupled to said bath (11; 12) and configured to propagate ultrasonic waves through said cleaning medium, such that said containers (2) can receive an ultrasonic cleaning treatment during their advancement through said bath (11; 12).

2. The washing machine of claim 1, wherein said washing path (Q) comprises a prewash zone (P1) and a hot washing zone (C1) arranged downstream of said prewash zone (P1), according to an advancing direction of said containers (2) along said washing path (Q); said washing machine (1; 1') further comprising prewashing means (11, 106) and washing means (12, 13) respectively arranged within said prewash zone (P1) and said hot washing zone (C1) for cleaning said containers (2) correspondingly at lower and higher temperature; said bath (11; 12) being part of one of said prewashing means (11, 106) and said washing means (12, 13).

3. The washing machine of claim 2, wherein said bath (12) is part of said washing means (12, 13), said washing machine (1; 1') further comprising suction

means (SM) arranged within said bath (11; 12) and operable to remove from said bath (11; 12) labels detached from said containers (2) during their advancement through said bath (11; 12);
said suction means (SM) and said ultrasonic wave generator (UG; UG') having respective action areas spaced from one another.

4. The washing machine of any one of the foregoing claims, wherein said ultrasonic wave generator (UG; UG') comprises at least one ultrasonic transducer (90; 90') being plate-shaped, configured to convert electric power into ultrasounds, and arranged within said bath (11; 12) in such a manner to face respective base portions (2c) of said containers (2) in close proximity during the advancement of said containers (2) through said bath (11; 12).

5. The washing machine of claim 4, further comprising a control unit (ECU) connected to said ultrasonic transducer (90) and configured to control power supply of said ultrasonic transducer (90).

6. The washing machine of claim 5, wherein said control unit (ECU) is configured to activate said ultrasonic transducer (90; 90') according to a predetermined period and for a predetermined activation duration; said predetermined period and duration being, in particular, selected in view of an advancing velocity of said containers (2) to guarantee an optimized balance between cleaning performance of said ultrasonic cleaning treatment and energy expenditure.

7. The washing machine of any one of the foregoing claims, wherein said ultrasonic wave generator (UG; UG') comprises a plurality of ultrasonic transducers (90; 90') being plate-shaped, configured to convert electric power into ultrasounds, and sequentially arranged adjacent and parallel to each other along a stretch (Q1; Q2) of said washing path (Q); said stretch (Q1; Q2) extending within said bath (11; 12).

8. The washing machine of claim 7, wherein said stretch (Q1; Q2) has a length between 0.5 m and 2 m.

9. An operating method of a washing machine (1; 1') for washing empty containers, the method comprising the steps of:

i) advancing a plurality of said containers (2) along a washing path (Q); and
ii) filling a bath (11; 12) with a cleaning medium; said washing path (Q) extending through said bath (11; 12);

characterized by further comprising the step of:

iii) ultrasonic cleaning said containers (2) by propagating ultrasonic waves through said cleaning medium during the advancement of said containers (2) through said bath (11; 12).

10. The operating method of claim 9, further comprising the steps of:

iv) prewashing said containers (2) within a prewash zone (P1) of said washing path (Q); and
v) hot washing said containers (2) at an higher temperature with respect to said step iv) within a hot washing zone (C1) of said washing path (Q) downstream of said prewash zone (P1), according to an advancing direction of said containers (2) along said washing path (Q);

wherein one of said steps iv) and v) comprises the step of:

vi) advancing said containers (2) through said bath (11; 12).

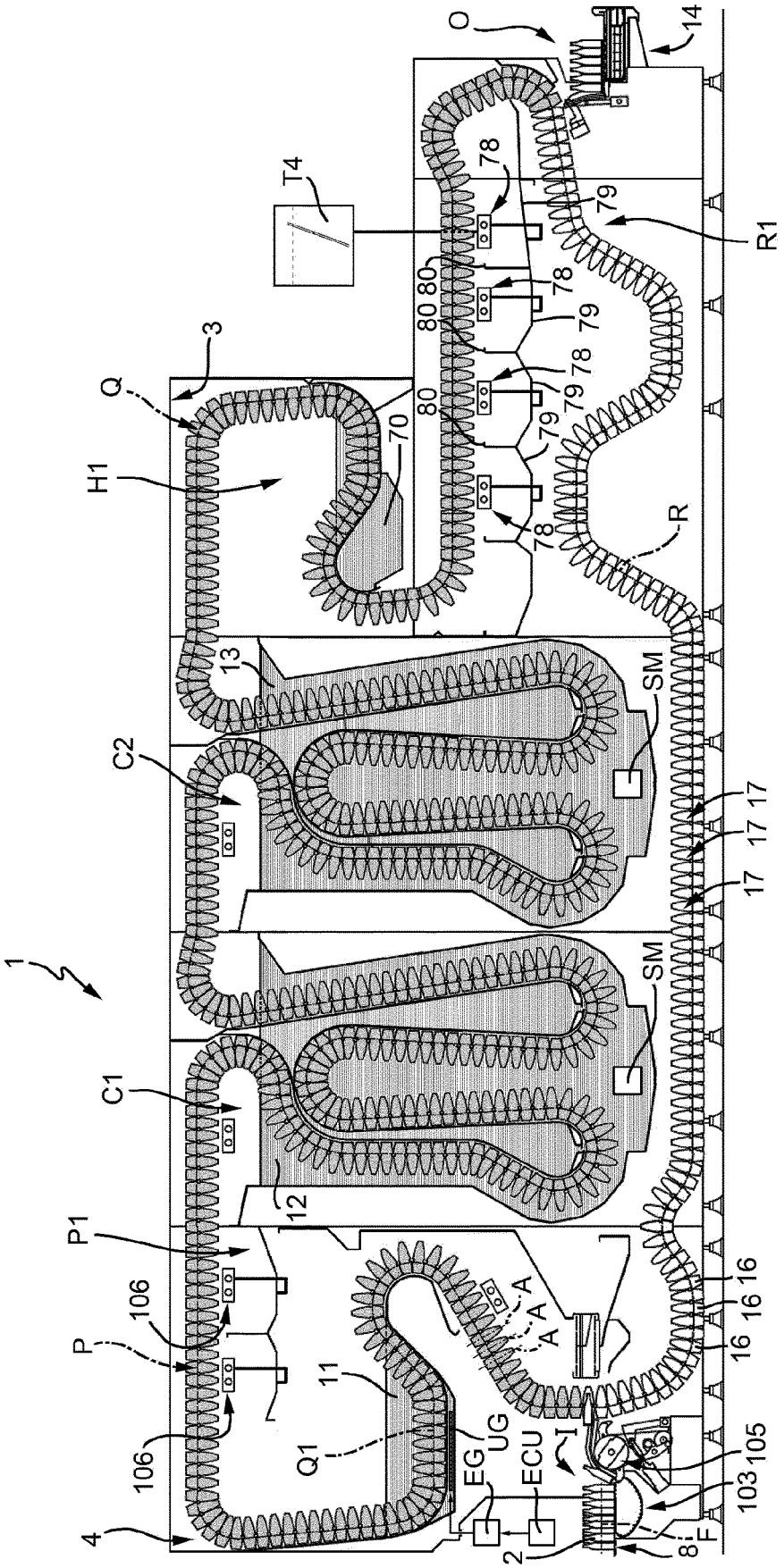
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FIG. 1

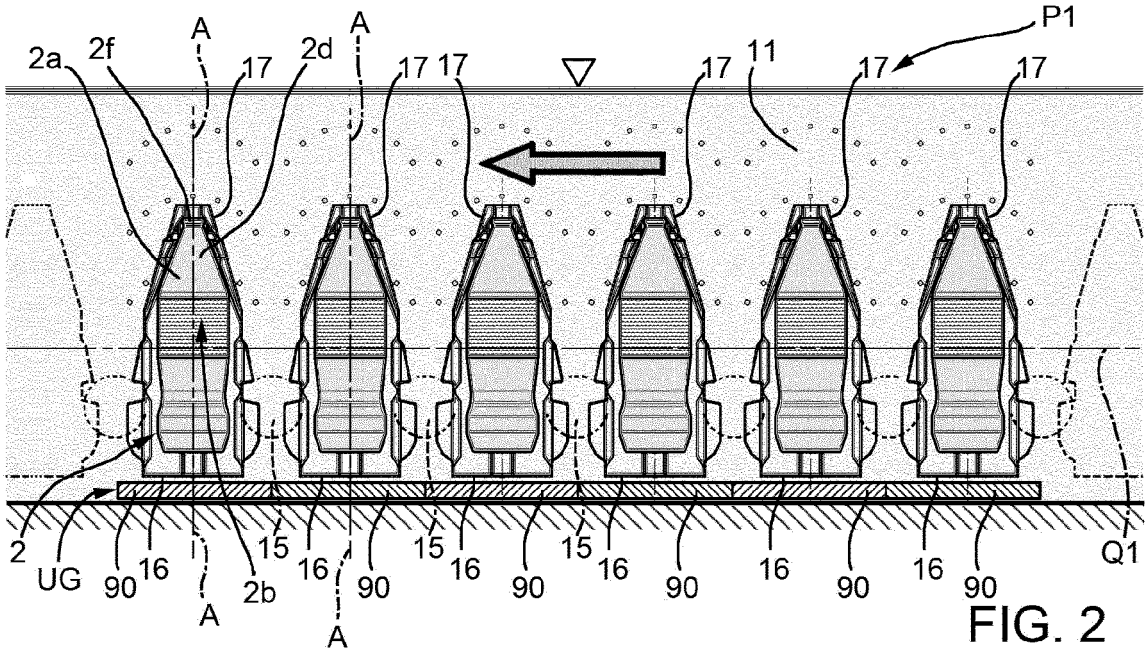
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FIG. 2

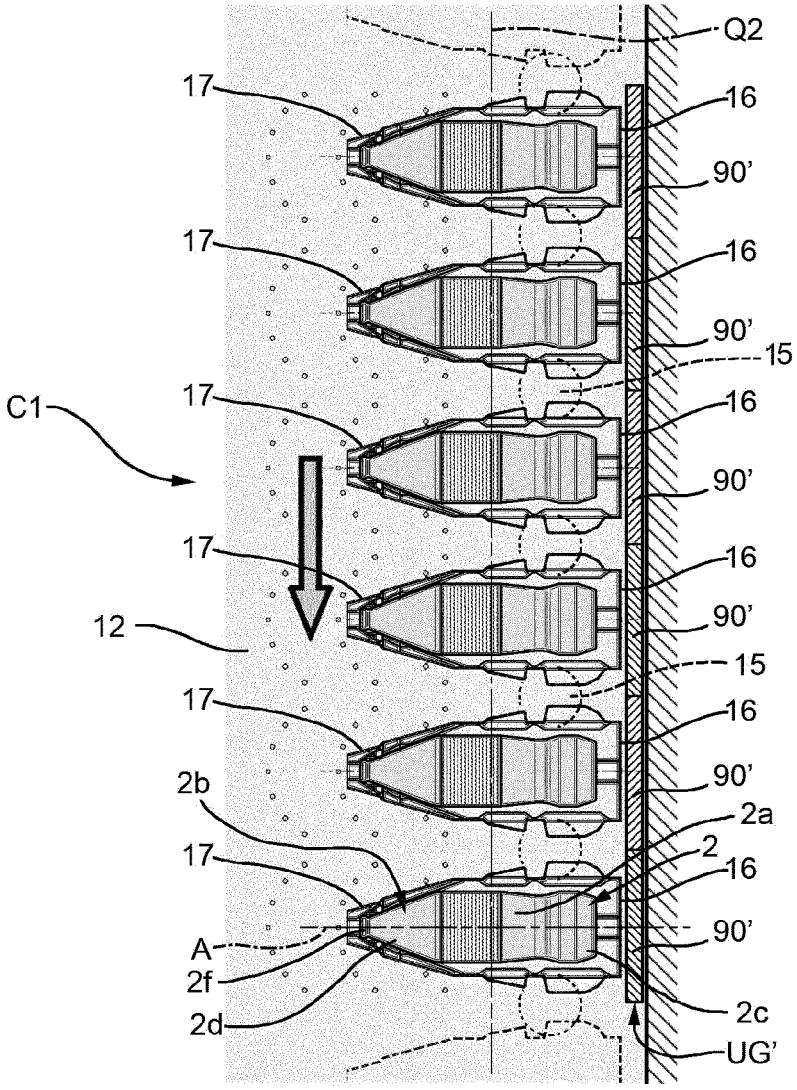
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FIG. 4

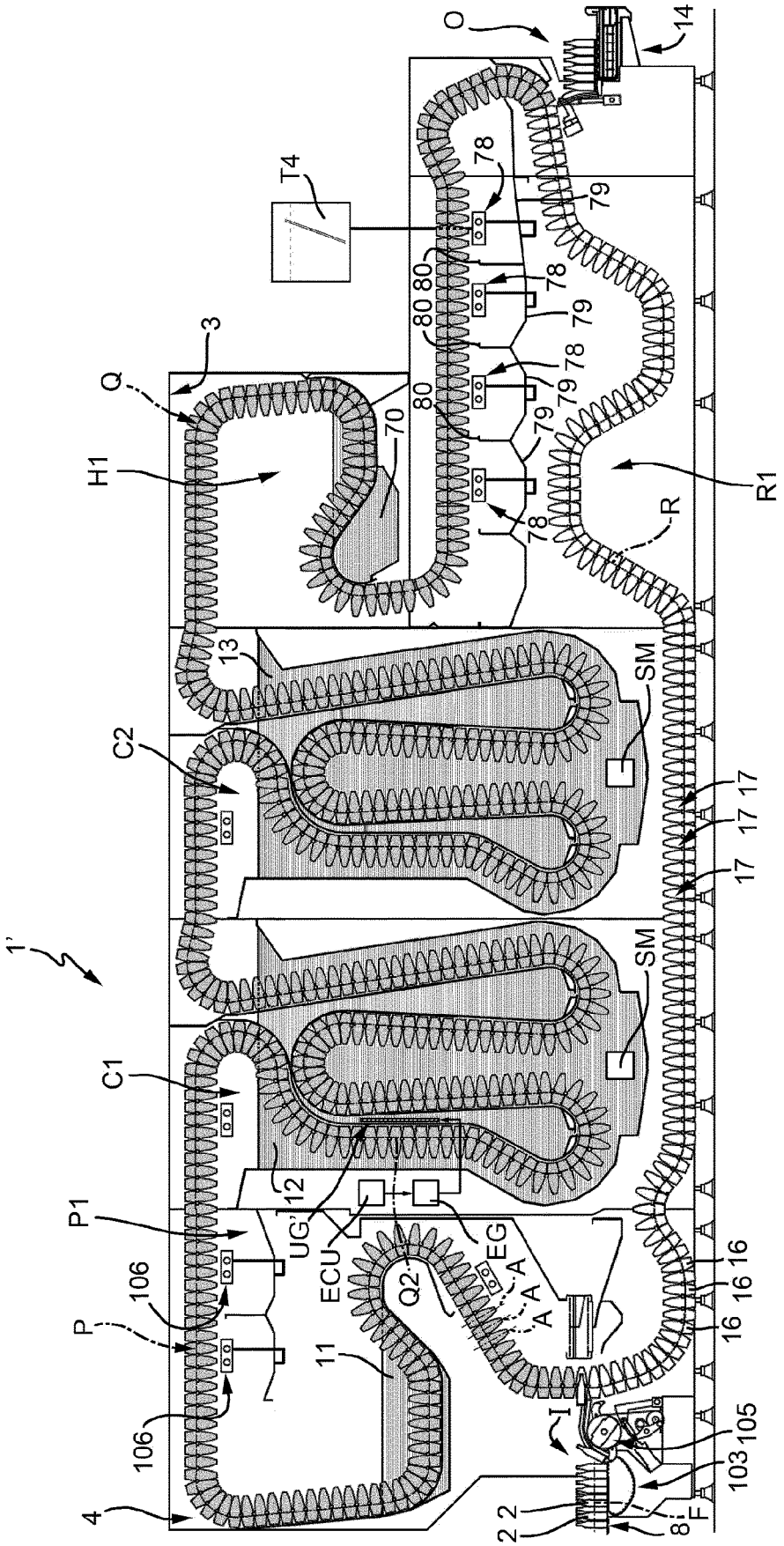
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FIG. 3

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EUROPEAN SEARCH REPORT

Application Number
EP 18 21 2338

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X Y	GB 1 171 652 A (SEITZ WERKE GMBH [DE]) 26 November 1969 (1969-11-26) * the whole document *	1,4,5, 7-9 2,3,6,10	INV. B08B3/12 B08B9/30
X Y	US 6 244 279 B1 (BOWDEN DONALD R [US]) 12 June 2001 (2001-06-12) * column 4, line 9 - column 7, line 36; figures 2,6 *	1,2,7-10 3	
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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	18 June 2019	Cassiat, Clément

CATEGORY OF CITED DOCUMENTS

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EPO FORM 1503 03.82 (P04C01)

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