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(71) Applicant: **IDROFILT S.R.L.**
44100 Ferrara (IT)

(72) Inventor: **Madonnini, Francesco**
20047 Brugherio - Milano (IT)

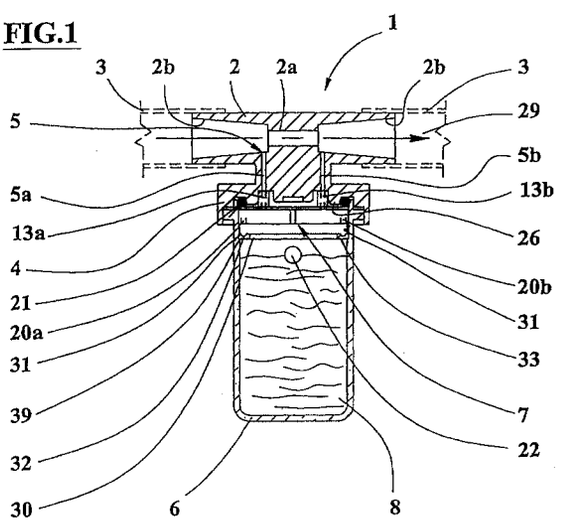
(74) Representative: **Negrini, Elena**
Agazzani & Associati S.r.l.
Via dell'Angelo Custode 11/6
40141 Bologna (IT)

(54) Dosing device for a solution

(57) A dosing device for a liquid (8) in a feeding fluid (29), particularly water, which flows into heating and/or vaporization circuits for sanitary or food use, both industrial and domestic, includes: a fitting (2), whose ends can be jointed to a feeding duct (3), provided with an inner throttling (2a) fit to create a depression in the fluid downstream the same duct; a closing element (4) associated to the fitting (2) and provided with a couple of regulating ducts (5) positioned in proximity of the opposite walls of said throttling (2a) and fit to connect the section of said fitting (2) with a container (6) of the liquid (8), provided with an upper opening removably closable by means of the closing element (4); diverter means (7), interposed between the closing element (4) and the container (6), fit to direct a predetermined fluid amount at first through an inlet path included between fitting (2) and container (6), through an inlet duct (5a), and afterwards to direct an equal amount of a mixture of fluid with liquid (8) through an outflow path included between the container (6) and the fitting (2), by means of an outflow flow (5b); a splashguard ring (30) below the diverter means (7) and fit to divert and to reduce the pressure force of the water spout coming from the inlet path of said diverter means (7) and directed towards the inside of the container (6).

The inlet and outflow paths of the diverter means (7) have a spiral shape, symmetrically and concentrically positioned and separated between them by means of a couple of spiral shaped coils (16) having a shared end.

FIG.1



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Description

[0001] The present invention refers to devices used in water and liquid treatments.

[0002] Particularly the invention refers to the realization of an enhanced dosing device for liquids, fit to be used in waterworks for the water heating and/or vaporization for industrial or domestic or sanitary uses; or however in the water circuits in which flows a fluid fit to be treated with a solution. Such dosing device can be used, for instance, in the circuits for feeding liquid to boilers, boilers for ironing machines, laundries and machines for making drinks, such as percolators.

[0003] It is known that the water heating and/or vaporization increases the limestone formation mainly due to the precipitation of calcium ions dissolved in the water in consequence of the heating of this latter.

[0004] The aggregation of said calcium ions produces the so-called limestone that sediments on the inner walls of the water piping, causing the progressive reduction of the internal section of this latter up to the undesired occlusion, and that causes the corrosion of the same piping.

[0005] Because of these limestone formations the heating and/or the vaporization waterworks need periodical maintenance that, if not executed, causes the rapid deterioration of the related water circuits, particularly of the small section piping. Furthermore, occlusions of possible safety valves, fit in said waterworks, may occur with the consequent reduction of the global safety factor of the waterworks up to constitute a danger for the operators.

[0006] In order to avoid, or at least to reduce, the limestone formation the water may be treated by using decalcifier agents, such as for instance the polyphosphates, particularly obtained by polymerization of the sodium monophosphates. Such polyphosphates, mixed with the water, react with the calcium ions, avoiding their aggregation and therefore the limestone formation, liberating sodium ions at the same time.

[0007] For this purpose, in the Italian patent application n. BO97A 000633 filed October 11 1997 in the name of the same applicant, it is described and claimed a dosing device for an anti-limestone solution fit to eliminate, or at least to reduce, the limestone formation and to make possible homogeneous and constant the water treatment, avoiding that any quantity of treated water can contain a polyphosphates percentage higher than the limits allowed by the laws in the matter.

[0008] The dosing device object of the Italian patent application n. BO97A 000633 is provided with a fitting, to be fit in series with the feeding piping of the circuit, and with a container of the solution which is dosed by virtue of the interposition of diverter means positioned between the fitting and the container.

[0009] Particularly, the fitting has a central throttling in order to realize a pressure difference between the upstream and downstream sections of said fitting. Immediately upstream the throttling, this fitting further has an offtake through which part of the fluid, which runs in the piping, flows and ends into the container through the diverter means, so mixing itself with the solution present inside said container.

[0010] At this point the mixture so obtained is sucked, because of the existing depression downstream the throttling, from the container to an offtake that is in the fitting immediately downstream the throttling, through a return path which the diverter means are provided with. Then the mixture is poured again in the remaining flow that normally runs in the piping helping the final mixing between the fluid and the solution.

[0011] The main drawback of the known dosing device consists in that the diverter means have a water inlet channel from the upstream offtake toward the inside of the container and an outflow channel of the mixture water- dosing liquid from the container toward the downstream offtake which have a very sinuous shape, so making extremely turbulent the fluid flow inside said channels.

[0012] Other drawback consists in that the opening/closing conditions of the hydraulic circuit in which the dosing device is fit for making particularly easy the trigger of a sudden and conspicuous increases of pressure inside the circuit ducts, said increases generating the so-called "water hammers". In this condition the water spout flowing into the container through the diverter means has a such intensity to arrive in proximity of the container bottom, causing a rapid dilution of the dosing liquid contained in its bottom and therefore a not uniform final dosing of the solution in the water.

[0013] The main object of the present invention is to propose an enhanced dosing device fit to avoid or at least minimize the slowdowns, the stagnation and the lack of homogeneities of the flow, occurring inside the diverter means.

[0014] Other object of the present invention is to propose a dosing device fit to avoid or at least to reduce the dilution of the dosing liquid of the container that follows the pressure increases of the fluid flowing in the hydraulic circuit in which is fit the dosing device, such as for instance the water hammers.

[0015] Another object is to propose a dosing device enabling an extremely homogeneous and constant water treatment, guaranteeing that the quantity of treated water always contains a polyphosphate percentage lower than the limits allowed by the legislation in force in the matter.

[0016] Further object is to propose a dosing device for liquids having a simple realization, an easy installation and maintenance, and a sure and precise use.

[0017] The object above described are achieved according to the claim content.

[0018] The characteristics of the present invention are underlined in the following with reference to the attached drawings, in which:

- figure 1 shows a section front view of the dosing device for liquids object of the invention;
- figures 2, 2A and 2B show detailed reduced views of the upper portion of a diverter disk of the dosing device of figure 1, respectively a part section front view, a top view and a bottom view;
- figures 3, 3A and 3B show detailed reduced views of the lower portion of the diverter disk of the dosing device of figure 1, respectively a partial section front view, a top view and a bottom view;
- figure 4 shows a schematic view of a water circuit having the dosing device of figure 1.

[0019] With reference to figure 1, numeral 1 indicates a dosing device for a dosing liquid 8 in a feeding fluid 29, particularly water, that flows in heating or vaporization waterworks for sanitary or alimentary use, both industrial and domestic.

[0020] The dosing device 1 essentially includes a fitting 2, a closing element 4, a container 6, a splashguard ring 30 and diverter means 7.

[0021] The fitting 2 has a throttling 2a of around 3 mm of the inner section centrally positioned, and whose ends can be jointed to a feeding duct 3, by means of truncated conical portions 2b starting from the throttling ends and whose biggest diameter is 8,5 mm, in correspondence of the duct 3, and whose smallest diameter is 8 mm in correspondence of the throttling 2a.

[0022] The closing element 4, associated to the fitting 2, is provided with a couple of regulating ducts 5, an inlet duct 5a and an outflow duct 5b, respectively positioned upstream and downstream the throttling 2a and precisely in proximity of the inlet and outlet sections of this latter, and fit for the flow communication between the inside of the fitting 2 with the inside of the container 6.

[0023] The container 6 of the dosing liquid 8, provided with an upper opening removably closable by the closing element 4, for instance by screwing or by means of a bayonet coupling, is tightly connected to said closing element 4 by interposing a gasket 21 positioned between the closing element 4 and the diverter means 7. Inside the container 6 there is indicator element 22, spherical shaped, having a specific weight slightly higher than the specific weight of the feeding fluid 29, but lower than that one of the dosing liquid 8.

[0024] The diverter means 7 are interposed between the closing element 4 and the container 6 and they are supported by. a raised external edge 31 of the splashguard ring 30 which is supported by a shoulder 39 carried out in the inner wall of the container 6 in proximity of its upper opening.

[0025] Said diverter means 7 are fit to direct predetermined quantity of the feeding fluid at first through an inlet path included between the fitting 2 and the container 6, through an inlet duct 5a, and afterwards to direct an equal amount of mixture of the feeding fluid with the dosing liquid 8 through an outflow path, included between the container 6 and the fitting 2, by means of an outflow duct 5b.

[0026] The splashguard ring 30 has a circular edge 33 protruding inside the container 6 and having a groove 32 fit to face the diverter means 7 in correspondence of a couple of holes 20a and 20b.

[0027] With reference to figures 2-3B, in the preferred embodiment the diverter means 7 include an upper element 10 including a circular shaped support base 14, from which two bent fins 12a and 12b protrude, each of said fins having a flat top on which are made a couple of holes, respectively 13a and 13b, connecting respectively the inlet duct 5a and the outflow duct 5b. The closing element 4 is internally provided with a circular crown 26 within which the holes 13a and 13b are positioned and around which the gasket 21 is arranged so that to realize a watertight coupling between the container 6 and the closing element 4.

[0028] The diverter means 7 further include a lower element 11 constituted by a circular shaped base 23 provided with a raised side edge 23a joinable, in a complementary and univocal way, with the support base 14. Said base 23 has the couple of holes 20a and 20b, which are diametrically opposed and fit for connecting respectively the holes 13a and 13b with the inside of the container 6, by interposing a couple of spiral shaped coils 16, concentrically positioned between them and having a shared end.

[0029] The coils 16 define a couple of channels, inlet 24a and outflow 24b, being respectively an inlet path into the container 6 for the feeding fluid 29 and an outflow path from the container 6 of the mixture of feeding fluid 29 and of dosing liquid 8.

[0030] Each of these channels 24a and 24b has a blind end, positioned in correspondence of the central portion of the base 23 while, in proximity of the other end there is the related hole 20a or 20b executed on the base 23.

The facing walls of a related coil, the support base 14 and the base 23 thus constitute these channels 24a and 24b.

[0031] The holes 13a and 13b are positioned on each of said channels, inlet 24a and outflow 24b, by virtue of the univocal coupling between the outflow elements, upper 10 and lower 11, carried out by means of a pin 17 protruding from the side edge 23a and lockable in a corresponding slot 18 on the external edge of the support base 14.

[0032] The operation of the dosing device 1 is simple because the feeding fluid 29, for instance water, coming from the portion of the feeding duct upstream the throttling 2a is forced to flow through this latter up to the downstream portion of the feeding duct 3.

[0033] The presence of the throttling 2a determines a pressure difference between the upstream section and the downstream section of said throttling, in correspondence of the sections of the regulating ducts 5 and precisely a upstream pressure greater than the downstream section.

[0034] This hydrodynamic phenomenon causes the piping of a water portion which flows into the portion of the feeding duct 3 upstream the throttling 2a toward the inlet duct 5a and therefore toward one or both of the holes 13a on the upper element 10 of the diverter means 7.

[0035] At the exit from these holes the water flows in the inlet channel 24a and therefore flows along the spiral path of this latter up to reach the hole 20a from which the water flows into the container 6 by interposing the splashguard ring 30.

[0036] Precisely, the water spout coming out from the hole 20a ends on the groove 32 of the splashguard ring 30 below and therefore its inlet trajectory into the container 6 is diverted toward the central portion of this latter and has a reduced intensity.

[0037] A same amount of mixture so obtained by mixing the water and the dosing liquid 8 follows the path in the reverse direction in comparison with the preceding direction, sucked by the existing depression downstream the throttling 2a, flowing in the outflow channel 24b through the hole 20b and therefore flowing into the outflow duct 5b through the two holes 13b until it flows into the portion of feeding duct 3 downstream the throttling 2a.

[0038] In such a way, the amount of mixture water-liquid 8 flows and disperses in the fluid flow, or better in the water flow, that flows downstream the throttling 2a, so making the water treatment.

[0039] Both the water flow inside the inlet channel 24a and the mixture flow inside the outflow channel 24b are characterized in that they are almost laminar or however not much turbulent by virtue of the spiral shape of the inlet and outflow channels. In this way the flow resistances are very low and a great uniformity of solution dosing inside the water can be achieved.

[0040] Furthermore it must be notice that the splashguard ring 30 is particularly effective in the opening/closing conditions of the hydraulic circuit in which the dosing device is fit, since these conditions might cause sudden and conspicuous pressure increases inside the circuit piping, which generate the so-called water hammers. When such condition happens the water spout flowing into the container 6 by means of the hole 20a has an high pressure force that is damped by means of the groove 32 of the ring 30 which diverts the water spout. In this way the water spout, even with a water hammer, does not reach the dosing liquid contained in proximity of the container bottom and therefore it does not dilute said dosing liquid, and consequently the splashguard ring guarantees a more uniform final dosing of the solution in the water.

[0041] Particularly the liquid 8 is constituted by a powder mixture based on sodium hexametaphosphate for food use, for instance diluted in water in the proportions of 33% of sodium hexametaphosphate and the remaining 66% of water. Said mixture has about 1,3 Kg/dm^3 specific weight.

[0042] It is advantageous to observe that the regulating ducts 5 have a diameter between 0,5 and 3,5 mm, preferably 3 mm, in order to optimize the regulation of the water and mixture amount flowing through said regulating ducts in order to avoid that the amount of polyphosphates in the mixture fluid-liquid, that is water and polyphosphates which is mixed with water downstream the throttling 2a, exceeds the limits settled at 5 mg/l allowed by the legislation in the matter.

[0043] The regulating ducts 5 have a diameter ranging from 1/12 to 1/3 of the internal diameter of the duct 2.

[0044] In the preferred embodiment the diameter of the throttling 2a is 3 mm and the diameter of the regulating ducts is 1 mm.

[0045] It is also advantageous to observe that the specific weight of the indicator element 22 is greater than the specific weight of said feeding fluid of a percentage quantity ranging from 1% to 5%. Particularly if the feeding fluid is water, then the specific weight of the indicator element 22 is ranging from 1,01 to 1,05 Kg/dm^3. This facilitates the progressive movement of the indicator element 22 toward the bottom of the container 6 because the mixture water-dosing liquid 8 becomes poor of the active element, the polyphosphate, while at the same time said mixture enriches in water causing a progressive decrease of the specific weight of said mixture up to reach a value close to the water value. In such condition the indicator element is positioned in proximity of the container bottom therefore acting like a display element of the concentration of the water-liquid mixture inside the container and the need of replacing its content with a new amount of dosing liquid 8.

[0046] With reference to figure 4 the replacement of the dosing liquid 8 inside the container can be facilitated if a check valve 15 is fit in the feeding water circuit upstream of the dosing device 1; said check valve, when activated, interrupts the water passage in the water circuit. In said circuit, downstream the dosing device 1, a vent valve is further fit, for the air eventually entered into the piping, particularly into the container 6, following the uncoupling and coupling operations of this latter with the closing element 4 of the dosing device 1, needed for substituting the dosing liquid 8 inside said container.

[0047] In order to avoid the limestone creation, the device 1 can be easily and advantageously fit upstream the feeding circuit of coffee machine, boilers for the steam production, for instance for irons, and boilers for the hot water production as well.

[0048] Therefore, the main advantage of the present invention is that to provide enhanced dosing device fit to avoid or at least minimize the flow losses inside the diverter means and thus the slowdowns, the stagnation and the lack of homogeneity of the flow.

[0049] Other advantage of the present invention is to provide a dosing device fit to avoid or at least to reduce the dilution of the dosing liquid of the container following the pressure increases of the fluid flowing in the hydraulic circuit in which the dosing device is fit, such as for

instance the water hammers.

[0050] Another advantage is to provide a dosing device that enables an extremely homogeneous and constant water treatment, guaranteeing that the amount of treated water contains a polyphosphate percentage always lower than the limits allowed by the legislation in force in the matter.

[0051] Further advantage is to provide a dosing device for liquids having a simple realization, an easy installation and maintenance, and a sure and precise use.

Claims

1. Dosing device for a dosing liquid (8) in a feeding fluid (29), particularly water, which flows into heating and/or vaporization circuits for sanitary or food use, both industrial and domestic, said dosing device (1) including:

   - a fitting (2) whose inner section has a throttling (2a), almost central, whose ends can be jointed to a feeding duct (3), with said throttling (2a) fit to create a depression in said fluid (29) downstream said latter;
   - a closing element (4) associated to said fitting (2) and provided with a couple of regulating ducts (5), an inlet duct (5a) and an outflow duct (5b), positioned in proximity of the opposite walls of said throttling (2a) and fit to connect the section of said fitting (2) with a container (6) of said dosing liquid (8), provided with an upper opening removably closable by means of said closing element (4);
   - diverter means (7), interposed between said closing element (4) and said container (6), fit to direct a predetermined quantity of said feeding fluid through an inlet path included between said fitting (2) and said container (6), through said inlet duct (5a), and fit to direct an equal amount of a mixture of said feeding fluid with said dosing liquid (8) through an outflow path between said container (6) and said fitting (2), by means of an outflow flow (5b); said path, inlet (5a) and outflow (5b), being unidirectional in consequence of the above mentioned depression of the fluid downstream said throttling (2a);

   with said diverter means (7) **characterized in that** include:

   - an upper element (10) constituted by a support base (14) from which at least two fins (12a, 12b) protrude, each of said fins is provided with at least a corresponding hole (13a, 13b) respectively in flow communication with said inlet duct (5a) and said outflow duct (5b);
   - a lower element (11) including a base (23), provided with a raised peripheral edge (23a) joinable, in a complementary and univocal way, with said support base (14) and a couple of holes (20a, 20b) diametrically opposed and fit for connecting respectively said holes (13a, 13b) with the inside of said container (6), by interposing a couple of spiral shaped coils (16) mutually symmetrically and concentrically positioned, each of said coils (16) having couple of channels, inlet channel (24a) and outflow channel (24b), each of these latter having a blind end while the other end has the related hole (20a, 20b), and it is defined by the faced walls of a related coil, by said support base (14) and by said base (23), said inlet (24a) and outflow (24b) channels being respectively fit to direct said feeding fluid (29) and said mixture of feeding fluid (29) and dosing liquid (8).

2. Dosing device according to claim 1 **characterized in that** said coils (16) have a shared end.

3. Dosing device according to claim 1 **characterized in that** further includes a splashguard ring (30) having a circular edge (33) fit to protrude inside said container (6) and having a grove (32) fit to face said diverter means (7) in correspondence of said couple of holes (20a, 20b).

4. Dosing device according to the claim 3 **characterized in that** said splashguard ring (30) has a raised peripheral edge (31) fit to support said diverter means (7).

5. Dosing device according to claim 3 **characterized in that** said splashguard ring (30) is supported by a shoulder (39) carried out in the inside wall of the container (6) in proximity of its upper opening.

6. Dosing device according to claim 1 **characterized in that** said upper element (10) and said lower element (11) are connectable by means of a pin (17) protruding from said peripheral edge (23a) which can be fix in a corresponding slot (18) at the external edge of said support base (14).

7. Dosing device for liquids according to claim 1 **characterized in that** said container (6) is tightly connected to said closing element (4) by interposing a gasket (21) positioned between said closing element (4) and said diverter means (7) in proximity of their peripheral edge.

8. Dosing device according to claim 1 **characterized in that** said regulating ducts (5) have a diameter ranging from 1/12 to 1/3 of the inner diameter of said fitting (2).

9. Dosing device according to claim 1 **characterized in that** said regulating ducts (5) have a diameter varying from 0,5 to 3,5 mm.

10. Dosing device according to claim 1 **characterized in that** includes inside said container (6) an indicator element (22) which have a specific weight slightly higher than the specific weight of said feeding fluid (29), but lower than the specific weight of said dosing liquid (8).

11. Dosing device according to claim 10 **characterized in that** the specific weight of said indicator element (22) is higher than the specific weight of said feeding fluid (29) of a percentage quantity ranging from 1% to 5%.

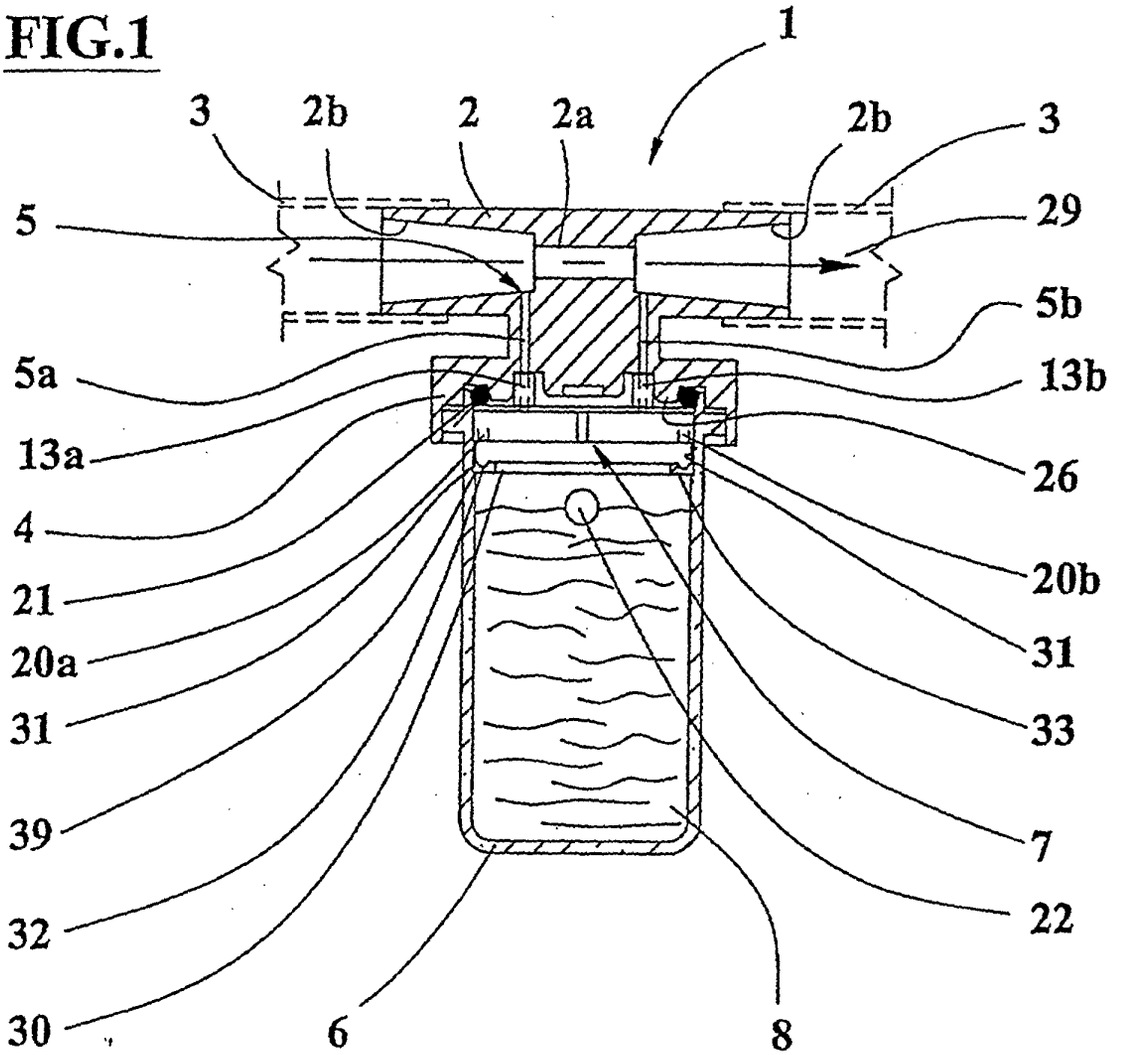
12. Dosing device according to claim 1 **characterized in that** said feeding fluid (29) is water and that said dosing liquid (8) is a powder mixture based on sodium hexametaphosphate for food use diluted in water.

13. Dosing device according to claim 12 **characterized in that** said mixture is constituted by 33% of sodium hexametaphosphate and the remaining 66% of water.

14. Dosing device according to claim 1 **characterized in that** said fitting (2) has two truncated conical portions (2b) connected at the ends of said throttling (2a).

15. Dosing device according to claim 14 **characterized in that** each truncated conical portion (2b) has a minimum diameter of 8 mm and a maximum diameter of 8,5 mm and that the throttling diameter is 3 mm.

FIG.1


1
3
2b
2
2a
2b
3
5
29
5b
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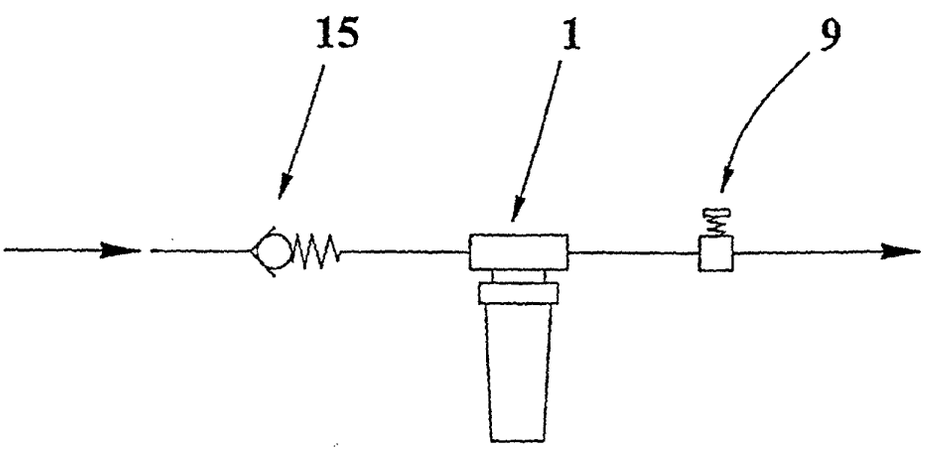
15
1
9

FIG.4

FIG.2A

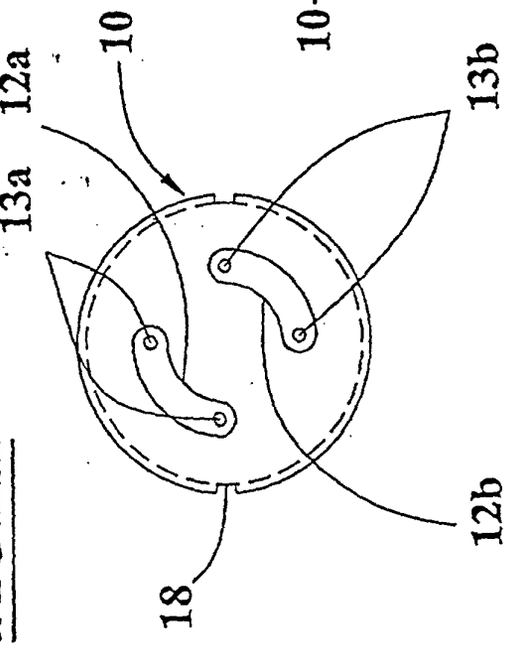

FIG.2

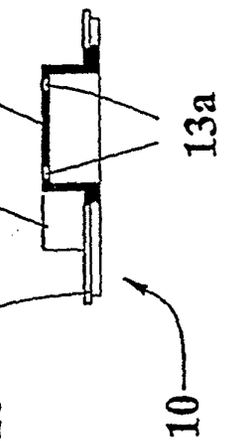

FIG.2B

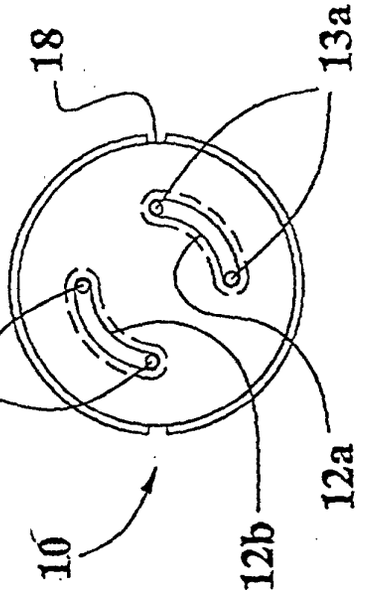

FIG.3A

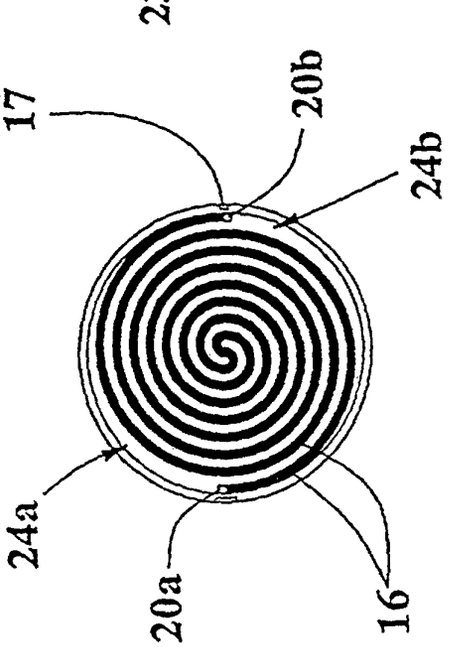

FIG.3

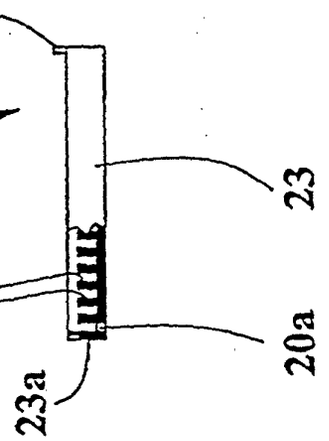

FIG.3B