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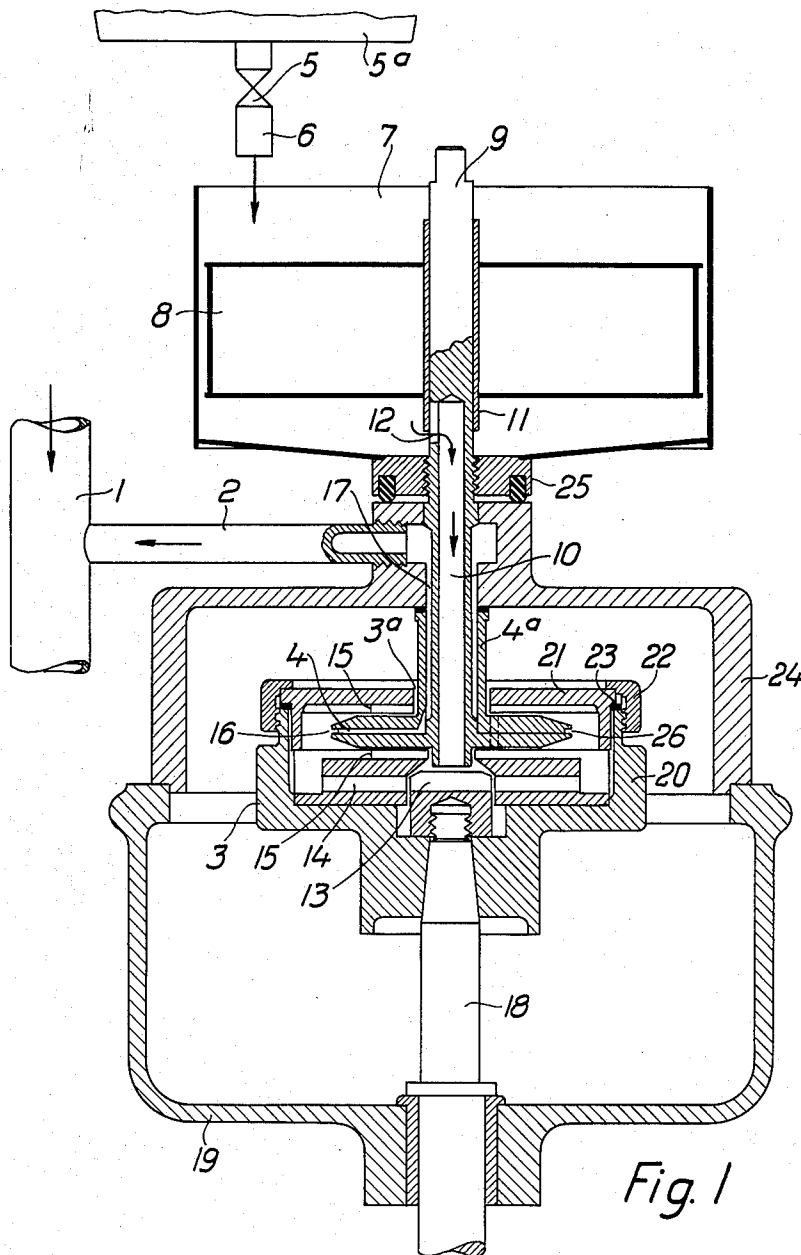
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DOSING METHOD AND DEVICE

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2 Sheets-Sheet 1



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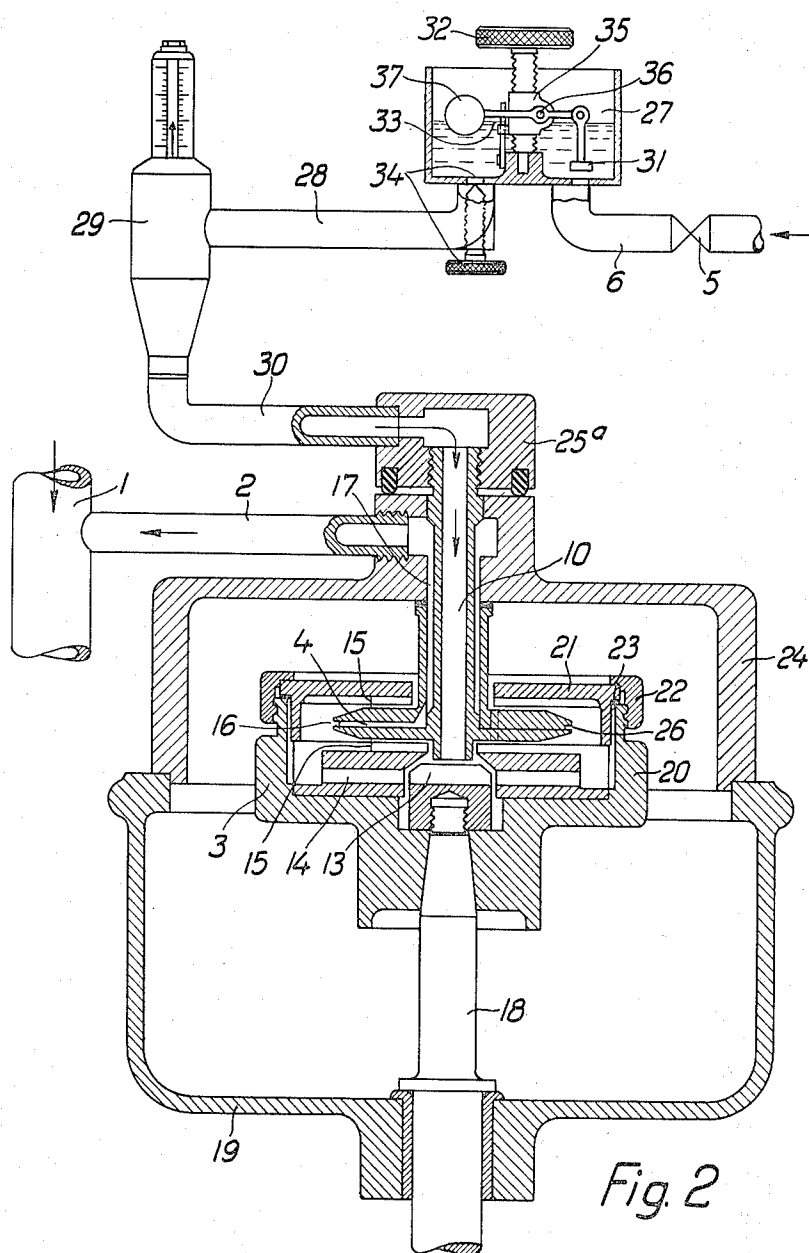
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DOSING METHOD AND DEVICE

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7 Claims. (Cl. 137—12)

This invention relates to dosage devices for continuously mixing a certain quantity of one liquid with another liquid.

There are numerous processes in which a liquid, often in a small quantity, must be continuously mixed with another liquid. This is called dosage and is usually carried out so that a continuous stream of the dosage medium is fed into a continuous stream of the other liquid. Thus, lye, for example, is mixed with vegetable oil to refine the latter. As the mixture of the liquids often takes place at super-atmospheric pressure, a pump is required to force the dosage medium into the other liquid. This pump must fulfill certain conditions which do not apply for ordinary pumps. Thus, the pump should not be fitted with a stuffing box, because generally the dosage liquid is corrosive and will damage the packing material. Furthermore, the pump must be able to exert a comparatively high pressure. It should also deliver liquid at a rate which is practically constant but capable of regulation within wide limits independently of the counter-pressure. The maximum pressure exerted by the pump must, on the other hand, be limited so that the pressure does not rise too much if the pressure pipe should become clogged. For this reason pumps of cog or screw type are unsuitable. Neither centrifugal nor gear pumps fulfill these requirements.

It is an object of the present invention to provide an improved dosage device which will meet these requirements.

According to the present invention, the problem is solved by the use of a pump with a rotating housing for the dosage, the liquid being expelled from this housing by means of a paring disc or other paring device which extends into the body of the rotating liquid. The liquid is led into the pump housing through a central channel and is then made to rotate with the pump housing by a vane or other suitable conveyor device. At first, the liquid forms a layer in the outer part of the pump housing. Then, as more liquid is passed into the pump housing, the free liquid level is displaced inward until it reaches the paring device which catches the liquid and leads it out of the pump through a discharge pipe. When a counter-pressure must be overcome, the liquid in the rotating pump housing must cover the paring device to a larger extent so that the pressure in the discharge channels is sufficient. The coverage is increased and the liquid level is thus displaced inward toward the axis of rotation until a pressure sufficient to overcome the counter-pressure has been reached. The pump now conveys the liquid via the discharge pipe into the other stream of liquid without changing the liquid level in the pump housing. Should the pressure in the pipe of the other stream of liquid rise or fall, this change in pressure is counteracted by an outward or inward displacement of the liquid level in the pump housing. The higher the counter-pressure, the more the liquid level in the pump housing is moved inward toward the rotation axis of the housing, and with falling counter-pressure the liquid

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level is displaced outward. The pump is thus capable of adapting itself to the changes in counter-pressure immediately.

The capacity of the pump is regulated in advance of the pump. As the liquid pressure at the inlet side of the pump can be kept very low, comparatively simple devices can be used for the adjustment and control of the capacity. Due to the low pressure there is no risk of the measuring instruments bursting. Pipe diameters and through-flow areas in valves can be kept large enough to prevent clogging. When regulation of the quantity of dosage liquid is effected on the pump outlet or pressure side, the pressure must be kept very high, so that the variations in pressure in the dosage liquid do not greatly influence the dosage, i. e. the quantity of dosage medium added. This requires very small valve openings and other flow-channels, which may cause clogging. If gear or screw pumps are used for the dosage, there will be an unlimited pressure rise during clogging, which may easily burst the measuring instruments. This risk is entirely eliminated when using a pump with a rotating housing, and the capacity is independent of the counter-pressure within satisfactory limits. Centrifugal pumps do not provide this protection.

During changes in the counter-pressure, the liquid level in the pump housing is displaced, as already mentioned, around the paring device. This causes a momentary increase or reduction of the quantity of dosage medium forced in per unit of time. As soon as the liquid level in the pump housing has reached a position corresponding to the new pressure, the throughput becomes normal again. In order to minimize the disturbance in capacity, the volume of liquid in the pump between the two levels should be as small as possible. The paring device should, therefore, be adapted to the pump housing with a minimum of play.

To regulate the capacity of the pump, i. e. the quantity of dosage medium conveyed by it per unit of time, it is preferable to use a regulating device operating at atmospheric or any other low pressure. The dosage medium can thus be kept in an open vessel or in a vessel at atmospheric or any other low pressure, the vessel being fitted with a controllable discharge pipe extending into a space under atmospheric pressure or the deviating pressure prevailing in the vessel. To regulate the capacity, a simple valve can be mounted on the discharge pipe. This last pipe may extend directly into the central part of the rotating pump housing. Alternatively, it may extend into a tank arranged in advance of the pump, the tank being connected to the pump housing and provided with a float valve which maintains a constant liquid level in the tank independent of the capacity.

As an alternative, the regulation may also be effected by means of a dosing device capable of more accurate regulation and having the form of a vessel provided with a vertically adjustable level overflow for excess liquid to be returned and with an outlet for the dosing liquid, which outlet is at a lower level and also capable of regulation. The liquid, the amount of which per unit of time is thus accurately fixed, is preferably fed to the inlet of the pump through a quantity meter in order to control the amount fixed.

For a better understanding of the invention, reference may be had to the accompanying drawings, in which—

Fig. 1 is a vertical sectional view of one embodiment of the invention, showing a dosage device with a simple valve placed in the outlet pipe of the vessel containing the dosage liquid, and

Fig. 2 is a similar view of another embodiment of the invention, showing a dosage device of a different type and also a quantity meter for controlling the dosing.

In pipe 1 there is a flow, under pressure, of a liquid,

such as vegetable oil which is to be refined. The refining agent, for example, lye, is brought into pipe 1 through a pipe 2 connected to a dosage pump having a pump housing 3. This housing rotates during operation and has a stationary paring device in the form of a paring disc 4. The dosage medium is delivered via the pump from a pipe 6 fitted with a regulating valve 5 and leading into a cup 7 provided with a float 8. The latter is movable vertically along an upright 9 enclosing a channel 10 extending into the lower part of the pump housing 3. The float has a sleeve 11 surrounding the upright 9, to cover the inlet opening 12 of the channel 10. By means of the float, a constant liquid level is maintained in the cup 7 so that air is prevented from entering the channel 10 and into pump housing 3. Below the outlet end of channel 10 is a conveyor 13, such as a vane or wing rotating with the pump housing and expelling the liquid through radial channels 14 into the outer part of the pump housing. The liquid finds its way around the paring disc 4 to a free liquid level 15, which represents an equilibrium position at which the liquid is forced into the paring disc at a pressure corresponding to the pressure in pipe 1. From the inflow channels 16 of the paring disc, the liquid is conducted through a system of channels 17 between the upright 9 and the surrounding neck 4a of the parer, to pipe 2 and into pipe 1.

To prevent air from getting into the paring disc at a small counter-pressure, when there is a small amount of liquid covering the disc, the latter may be provided with radial flanges 26 extending outwardly somewhat beyond the inlet openings of the paring disc.

The pump housing 3 is fixed on a spindle 18 supported in a frame 19 and driven by a power source (not shown). The pump housing is formed so that its bottom part 20 can be separated from its top part 21 by loosening a ring nut 22. Between these housing parts is a packing 23. The frame 19 is provided with a cover 24 wherein the upright 9, which supports the cup 7 and the paring disc 4, is mounted by means of a fixture 25.

It is important that the free liquid surfaces, formed at the level 15, are as small as possible. The play or radial clearance between the paring disc 4 and the pump housing should therefore be comparatively small. On the other hand, that part of the pump housing which is situated outside the paring disc should be spacious and form a large sludge space. From this standpoint, the design as illustrated is favorable, because the distance between the cover 21 and the bottom part of the pump housing is comparatively large. The channel 14 is enclosed in a part which extends as far as the vicinity of the paring disc 4 but leaves the sludge space free. In place of the part referred to above, the bottom part of the pump housing immediately in front of the level 15 can be widened in an upward direction to a corresponding degree and enclose the channel 14.

It will be understood that the valve 5 constitutes a means for regulating the rate of flow of the dosage medium through pipe 6, and therefore the rate at which the dosage medium is conveyed to pipe 1. The vessel 5a supplying the pipe 5 is under the same pressure as the space in the central part of the rotary housing 3. Thus, if the supply vessel 5a is at atmospheric pressure, as in the preferred case, the central space in the housing 3 is likewise at atmospheric pressure, by reason of its communication with atmosphere through the annular vent opening 3a between the neck 4a of the parer and the surrounding part of the cover 21.

In Fig. 2 I have shown a modified regulating device for the supply of dosage agent to the pump. By adjusting a dosing device 27, the amount of dosage agent supplied per unit of time is determined. This device communicates through a pipe 28 with a quantity or flow meter 29 which, in turn, is connected to the part 25a through a pipe 30. The dosage fixed by the device 27 is read on the meter 29.

The dosing device 27 comprises a float-actuated valve 31, arranged to keep in the device a liquid level 33, adjustable by means of the screw 32. The dosage liquid thus flows through the needle valve 34 at a fully fixed pressure into pipe 28. When it is desired to increase the amount of dosage liquid per unit of time, the screw 32 is turned to the right, so that a part 35 holding the screw 32 is raised and with it the shaft 36 on which the float 37 swings. The valve 31 is thereby opened until equilibrium is reached at a higher level, with higher liquid pressure at the port 34 and consequently a larger quantity of liquid. As an alternative, the regulation may be effected by means of the needle valve 34 and the screw 32 may then be dispensed with.

It will be understood that through the present invention the dosing of a stream of one liquid with a stream of a second liquid is effected by a method in which the pressure of the second or dosing liquid stream is automatically adjusted in accordance with pressure variations in the stream of liquid to be dosed. More particularly, the second liquid is fed at a rate controlled by valve 5 to the locus of centrifugal force in the rotary housing 3, where the centrifugal force maintains this liquid in an annulus against the peripheral wall of the housing. By means of the stationary paring disc 4, liquid is pared from a fixed point of this locus at the inner portion of the liquid annulus, since the disc 4 extends outwardly into this annulus from the rotation axis of housing 3. The liquid thus pared flows from this fixed point through the confined path formed by channels 17 and pipe 2 to the merging zone at the junction of pipes 2 and 1, this flow being under the pressure generated by the action of the centrifugal force on the liquid annulus in housing 3. The liquid to be dosed is forced through this merging zone in the confined path formed by pipe 1 at a substantially constant rate (as is the practice in the use of dosing devices), this rate being independent of the liquid flow through pipe 2. However, the pressure in pipe 1 may vary from time to time due to changes in the counter-pressure against which the liquid to be dosed is fed, as previously mentioned.

Assuming that the dosage device is in a state of equilibrium, it will be understood that when the pressure in pipe 1 is increased, the pressure difference between the inlet orifice of each paring channel 16 opening into the centrifugal locus of the rotating housing 3 and the discharge orifice of the pipe 2 opening into the pipe 1 is reduced. As a result of this, the throughput rate in the paring device is decreased. Since the rate of supply of liquid to the rotating housing 3 through pipe 10 is kept constant, there will thus be an accumulation of liquid in the rotating housing, and this accumulation necessarily results in the level 15 of the liquid annulus moving inwardly toward the rotation axis so that this level of the inner portion of the liquid annulus automatically increases relative to the paring disc 4. The level difference between the new liquid level 15 and the prior one corresponding to the equilibrium state represents a certain pressure which is added to the pressure which prevailed at the inlet of each channel 16 during the aforementioned state of equilibrium. Consequently, the throughput rate in the channels 16 and the paring device will increase, until a new equilibrium state is reached.

I claim:

1. A dosage device comprising a pipe for the dosage medium, means communicating with said pipe for regulating the rate of flow of the dosage medium therethrough, a rotary housing for receiving the dosage medium from the pipe, whereby the dosage medium forms a whirling annulus in the peripheral part of the housing, the housing having a vent opening communicating with the space within said annulus, a stationary paring device disposed in the housing and operable to pare liquid from said annulus, a second pipe in which the liquid to be mixed with the dosage medium flows under varying pressure at

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a substantially constant rate independent of the flow through the hereinafter specified flow connection, and a closed flow connection between the paring device and said second pipe.

2. A dosage device according to claim 1, comprising also a vessel for supplying the dosage medium to said first pipe, the rotary housing having a central space at substantially the same pressure as said vessel and communicating therewith through said first pipe.

3. A dosage device according to claim 1, comprising also a vessel for supplying the dosage medium to said first pipe, the rotary housing having a central space at substantially the same pressure as said vessel and communicating therewith through said first pipe, said space and vessel being under atmospheric pressure.

4. A dosage device according to claim 1, comprising also a stationary frame supporting the housing for rotation, an upright mounted on the frame and supporting at its lower end the paring device, the upright having an inlet channel for the dosage medium leading to the interior of the housing, a tank mounted on the upper end of the upright and through which the dosage medium is fed from said first pipe to the inlet channel, and a float in the tank for throttling the flow of said medium to the inlet channel to maintain a minimum liquid level in the tank.

5. A dosage device according to claim 1, comprising also a flow meter connected to said first pipe for indicating the rate of flow of the dosage medium as regulated by said means.

6. In combination with a pipe through which a liquid flows under varying pressure at a substantially constant rate, a device for feeding another liquid into said pipe at a substantially constant but regulatable rate irrespective of variations in said pressure, comprising a second pipe for conveying said other liquid, means communicating with said second pipe for regulating the flow rate there-through, a rotary housing for receiving the liquid from the second pipe, said last liquid forming a whirling annulus in the peripheral part of the housing, the housing having a vent opening communicating with the space within said annulus, a stationary paring device disposed in the housing

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and operable to pare liquid from said annulus, and a closed flow connection between the paring device and the first pipe, whereby said variations are operable through said flow connection to change the liquid level of said annulus relative to the paring device and thereby counteract said variations in their effect upon the rate of feed of said other liquid into the first pipe.

7. In the dosing of one liquid with a second liquid by merging separate streams of the respective liquids in a merging zone, the method which comprises feeding said second liquid at a controlled rate to a locus of centrifugal force, maintaining a variable annulus of the second liquid in said locus by centrifugal force, paring liquid from a fixed point of said locus at an inner portion of said annulus, flowing the pared liquid from said fixed point through a first confined path to said zone under pressure generated by the action of the centrifugal force on said annulus, and flowing said first liquid in a second confined path through said merging zone at a substantially constant rate independent of the liquid flow through said first confined path and against a varying pressure, whereby an increase in said last pressure automatically increases the pared liquid pressure in said first path by increasing the level of said inner portion of the annulus relative to said fixed point.

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