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DISPENSING MACHINE FOR THE METERED DELIVERY AND  
CONTINUOUS HOMOGENIZATION OF FINISHED PAINT PRODUCTS

Technical Field

The present invention concerns a dispensing machine for  
5 the metered delivery of fluid products, especially fluid  
ingredients that make up finished products such as  
varnishes, paints, inks, enamels, textile dyes and  
similar products.

Background Art

10 In order to obtain the finished products given above as  
examples, it is known to add one or more colorant fluid  
products to a base fluid, such as white or transparent,  
in predetermined proportions according to specific  
formulas. Known machines used in the above industry  
15 deliver known amounts of colorants into cans,  
containers, tins or bins of a predetermined capacity,  
into which the base fluid products have previously been  
placed. These known machines must ensure high precision  
in determining the amount of colorant product to  
20 dispense, since even slight differences in the  
relative proportions among the various colorant  
products or between these and the base fluid product  
may lead to finished products having a color that does  
not match the desired result. At any rate, after  
25 delivery by traditional dispensing machines, the  
distribution of colorant products in the mass of base  
fluid product is not homogeneous, and it is therefore  
necessary to shake the can more or less vigorously.  
This necessary shaking phase is obviously a burden on  
30 the production process for finished products using the  
so-called tinting systems as it leads to additional  
manual labor- often difficult due to the size and weight  
of the cans- or the use of specialized mixing machines,  
thereby increasing system costs. In any case, however,  
35 mixing also considerably increases the production time



of finished products.

Thus, at the state of the art today, the homogenization stage is on the bottleneck in terms of the productivity of a rapid dispensing machine, and in any case limits the use of tinting systems to products with good fluidity, and does not allow the use of highly viscous products of those containing large amounts of solid or plastic particles.

#### Disclosure of the Invention

10 The purpose of the present invention is to resolve the above difficulties, in particular to provide a dispensing machine of the type indicate in the preamble of the present description that allows metered delivery and continuous homogenization of finished painting products.

The primary object of the invention is to obtain a finished, colored painting product at the machine outlet that does not require any further blending.

Another purpose of the present invention is to eliminate the mixing machines traditionally combined with dispensing machines to increase the productivity of a tinting system.

A further purpose of the invention is to integrate and automate the various production phases of finished paint products, expanding the range of component products that may be used in a tinting system.

In order to achieve the above objects, the invention regards a dispensing machine of the type indicate in the preamble to this description, with the features set forth in the attached claims.

#### Brief description of the Drawings

Additional features and advantages shall become apparent from the following description of one preferred embodiment, with reference to the enclosed figures, provided solely as non-limiting examples, wherein:

- figure 1 is a schematic plan view of a dispensing machine built according to the invention, from which the upper covering panels have been removed for clarity,
- figure 2 is a plan view of the dispensing unit of the machine in figure 1,
- figure 3 is a longitudinal cross-section of the dispensing unit according to line III-III in figure 2,
- figure 4 is an enlarged plan view of the dispensing head in figure 2,
- 10 - figure 5 is a longitudinal cross-section of the dispensing head according to line V-V in figure 4, and
- figure 6 is a diagram of the washing system of the dispensing head in figures 4 and 5.

#### **Best Mode of Carrying out the Invention**

- 15 With reference now to the figures, reference number 1 indicates generally a dispensing machine comprising multiple motor pump units 2, preferably housed in modular frames 3, to allow the machine to be easily expanded according to the number and variety of component products
- 20 to be dispensed. Each motor pump unit includes a motor 4, preferably but not limitatively a brushless electric motor, whose operation is controlled independently from that of the motors of the other motor pump units by means of a control circuit of known type, preferably interfaced
- 25 with a computer. In particular, the control circuits regulate the rotation speed of the motors 4, each of which is connected to the shaft of a corresponding positive-displacement pump 5 provided with inlet openings 6 and outlet openings 7. The inlet openings 6 are
- 30 connected to reservoirs (not shown in the figure) of component products-bases, colorants, various types of additives, etc. The outlet openings are instead connected to distribution lines 10 (the path of which is shown by the dashed line in figures 2 and 3), with the
- 35 interposition of three-way, two-position recirculation

valves 11a, 11b, from which the recirculation lines also branch out to return the component products to their respective reservoirs. The distribution lines 10 are conveyed to a dispensing unit 8, located in the upper portion of a central dispensing module 9, which also preferably contains the control electronics of the motor pump units 2 and the recirculation valves 11a, 11b associated with each reservoirs, as well as the computer. As can be seen more clearly in figures 2 and 3, the ends of the distribution lines 10 are closed by valve devices 12, preferably pin valves, which may open selectively to connect the distribution lines 10 to an axial bore 13a of a dispensing head 13, which opens to the outside through a dispensing nozzle 13b. A mixing device, for example a turbine 20, rotating around a substantially vertical axis Z-Z, is mounted inside the dispensing head 13. In particular, although not limitatively, the turbine 20 is attached to one end of a rotating shaft 14, a wheel or pulley 15 being keyed to the other end thereof which extends above the dispensing unit 8. The pulley 15 is connected to a pulley or drive wheel 17, attached to the shaft of a mixing motor 18, by means of a belt or chain 16. It is obviously possible to adopt different but functionally similar construction systems to transmit motion from the motor 18 to the mixing device 20, such as for example a gear transmission, a universal joint, or other functionally similar system.

Figures 2 and 3 show a sample configuration of the dispensing unit 8 of a dispensing machine adapted to dispense up to sixteen different bases and sixteen different colorants. The three-way valves 11a, which provide selective dispensing of bases or their recirculation to the corresponding reservoirs, are arranged in a semicircle around the dispensing head 13.

The three-way valves 11b, smaller because they are used to selectively dispense colorants, are arranged in arcs on both sides of the motor 18. The pin valves 12, one for each three-way valve 11a, 11b, are arranged in a circle around the dispensing head 13. To keep the system compact, in the configuration shown the pin valves 12 are stacked vertically in pairs, as can be clearly seen in figures 3 and 5.

As can be more clearly seen in figures 4 and 5, the pin valves 12 are mounted on a ring support 40, wherein radial ducts 41 are provided in which the pins 42 of the valves 12 can move axially, selectively controlled by actuators 43.

Each radial duct 42 communicated with a corresponding inlet opening 44, to which a corresponding line 10 is connected as it arrives from the three-way valves 11a, 11b. The radial ducts 42 open into one or more shared chambers 45 which, in turn, communicates with the axial bore 13a of the dispensing head 13, upstream from the turbine 20.

Between dispensing a finished product having a certain formula and the next product, having a different formula, it is necessary to clean the shared nozzle 13 and the turbine 20. To this end, the machine 1 comprises a washing unit 21 illustrated schematically in figure 4.

The washing unit 21 comprises a pressure regulator 22, through which compressed air from a pneumatic infeed circuit 25 is delivered. The compressed air is sent through a non-return valve 23 to a tank 24 containing a solvent suited to the type of colorant products and bases used. The solvent is added to the tank 24 through a cap 26, after deactivating or closing the pneumatic infeed circuit 25. A safety valve 27 ensures that the pressure in the tank does not exceed a desired preset level. An outlet duct 28 connects the tank 24 to a

manifold 30, from which in turn leads a washing duct 29 that opens into the dispensing head 13, upstream from the turbine 20. Along the outlet duct 28 there are interposed a filter 31 and a solvent washing solenoid valve 32 that selectively enables entry of the solvent into the dispensing nozzle 13.

The compressed air coming from the pneumatic infeed circuit 25 is also used to feed the solenoid valves 11a, 11b through the ducts 47, after passing through a second pressure regulator 33. The air outlet duct from the second regulator 33 also communicates with the manifold 30, with the interposition of an air washing solenoid valve 34. A discharge duct 35 is also connected to the manifold 30, and is selectively closed by a discharge solenoid valve 36.

During operation of the dispensing machine 1, a predetermined formula defining the proportions of components products to make up a certain finished product is, for example, selected or entered by the user via the computer. A consent command enables transmission of data from the computer to the control systems of the motor pump units 2, which regulate the speed of the motors 4 and thus the flow rate of the pumps 5. Until the speed and throughput of all of the pumps 5 involved in the formula has stabilized, the solenoid valves 11a, 11b are kept in the recirculation position. When a steady condition is reached, the recirculation valves 11a, 11b and the pin valves 12 for the products required by the formula, generally comprising a base and one or more colorants, are opened simultaneously to convey said ingredients to the dispensing unit 8. The component products enter the chambers 45, then move into the dispensing head 13 in predetermined proportions in terms of amount per unit of time. The products are then immediately blended by the mixing turbine 20 powered by

the motor 18, which may be run at constant or variable speed depending on the component products, so as to provide the turbine 20 with a preferably high speed, sufficient to blend the component products perfectly.

5 Thus the finished product arrives at the outlet of the dispensing nozzle 13b, and only needs to be packaged in the desired containers.

The automatic washing unit 21 of the dispensing head 13 is activated upon a command sent by the computer at each  
10 formula change. The washing cycle takes place with the solenoid valves 11a, 11b in recirculation position, with all pin valves 12 closed, with the discharge solenoid valve 36 and air washing solenoid valve 34 closed, and with the turbine 20 activated. The solvent washing  
15 solenoid valve 32 opens to allow solvent to enter the dispensing head 13, upstream from the turbine 20. The solvent delivery phase lasts long enough to allow complete and thorough washing of the chambers 45, the dispensing head 13 and the mixing turbine 20. When this  
20 phase is complete by closing the solvent washing solenoid valve 32, a new phase begins in which air enters thanks to the opening of the air washing solenoid valve 34. This phase removes any residual solvent remaining inside the dispensing head 13 and in contact with the turbine 20.  
25 The washing cycle is completed by switching the air solenoid valve 34 to the closed position and by opening the discharge solenoid valve 36. This discharge valve 36 is also kept open while fluid products are dispensed, to avoid surge pressures in the dispensing nozzle.

30 To better understand the operating principle of the dispensing machine described above in one particular embodiment, a specific example of dispensing with details regarding machine parts, which must not be construed as restrictive in any way, is hereinbelow described.

35 Example 1

Pumps 5 have been selected having different specifications for dispensing bases and colorants.

For colorants, the pumps have a flow rate of 3 ml of product per revolution, and can achieve a maximum  
5 rotation speed of 150 rpm. For the bases, the pumps have a flow rate of 25 ml per revolution, and a maximum speed of 150 rpm.

Let us assume we wish to produce a finished paint product having a simple formula, in which a base B is diluted by  
10 1% of its volume with a colorant C. The finished product, having a known specific weight, should have a total weight corresponding to a volume of 1010 CC.

To produce the desired amount of product in the shortest possible time, the base pump B is set up to rotate at its  
15 maximum speed of 150 rpm, corresponding to a flow rate of 62.5 ml/s of base product. The time needed to dose 1000 cc of base product is therefore 16 seconds. The central computer thus calculates the flow rate of colorant C needed to dispense 10 cc in 16 seconds, so that the  
20 proportion between the base and colorant entering the dispensing nozzle is constant over time. Given the displacement of the colorant pump, the computer system calculates that the corresponding motor must run at a speed of 12.5 rpm. This information is sent to the  
25 control system of the motor 4, which brings the circulation flow in the recirculation circuit to the required cycle speed.

The two products involved in the formula, base B and colorant C, are thus sent to the dispensing head 13 and  
30 mixing device 20 at the above rates.

Within 16 seconds, the dispensing nozzle 13b releases the required amount of finished product, already dosed and blended.

The machine according to this invention may be built with  
35 fluid product reservoirs mounted directly on the machine,

or located in adjacent modules, or may have only the central structure 9 containing the distribution unit and a set of inlet openings to which one may connect fluid feed lines from external or remote reservoirs via  
5 generally know means, such as through a screw coupling or quick fitting.

Naturally, the principle of the invention remaining the same, the embodiments and development details may vary widely from those described and illustrated without  
10 exceeding the extent of the present invention.

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1. Dispensing machine for the metered delivery of fluid products, especially painting products, comprising a dispensing head (13) with a nozzle (13b), a plurality of delivery ducts (10) having ends which communicate with the dispensing head (13) to feed fluid products, mixing means (20) being mounted between the ends of the delivery ducts (10) and the dispensing nozzle (13b) to continuously mix the fluid products coming from different delivery ducts and simultaneously entering the dispensing head (13), characterized in that the mixing means includes a rotating turbine (20), the delivery ducts being radial ducts the ends of which communicate with one or more shared chambers (45) placed upstream from the mixing means (20) in relation to the dispensing nozzle (13b).

2. Dispensing machine according to claim 1, characterized in that it comprises a plurality of reservoirs for the fluid products to be dispensed, pumping means (5) being interposed on the ducts (10) to transfer the fluid products from the reservoirs to the dispensing head (13).

3. Dispensing machine according to claim 2, characterized in that the pumping means (5) are adjustable to transfer different fluid products at different flow rates.

4. Dispensing machine according to claim 1, characterized in that it includes interception means (11a, 11b, 12) interposed on the ducts (10) to selectively interrupt the transfer of fluid products from the reservoirs to the dispensing head.

5. Dispensing machine according to claim 4, characterized in that the interception means include open-close interception valves (12) disposed at the ends of the ducts (10) which communicate with the dispensing head (13).

6. Dispensing machine according to claim 4, characterized in that the interception means comprise three-way valves (11a, 11b) from which recirculation ducts branch off to selectively transfer the colorant products either to the dispensing head (13) or to the reservoirs.

7. Dispensing machine according to claims 5 and 6, characterized in that it comprises an even number of open-close interception valves (12) arranged circularly and in stacks of pairs around the dispensing head (13).

8. Dispensing machine according to any of the above claims, characterized in that it comprises a washing unit (21) having a solvent tank (24) to which a first solvent washing duct (28) is connected, a second air washing duct being connected to a source of compressed air (25), the first and second washing ducts communicating with the dispensing head (13) with the interposition of respective interception means (32, 34), selectively activable to open or close the communication between the washing ducts and the dispensing head (13).