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METHOD AND APPARATUS FOR MAKING PAINTS

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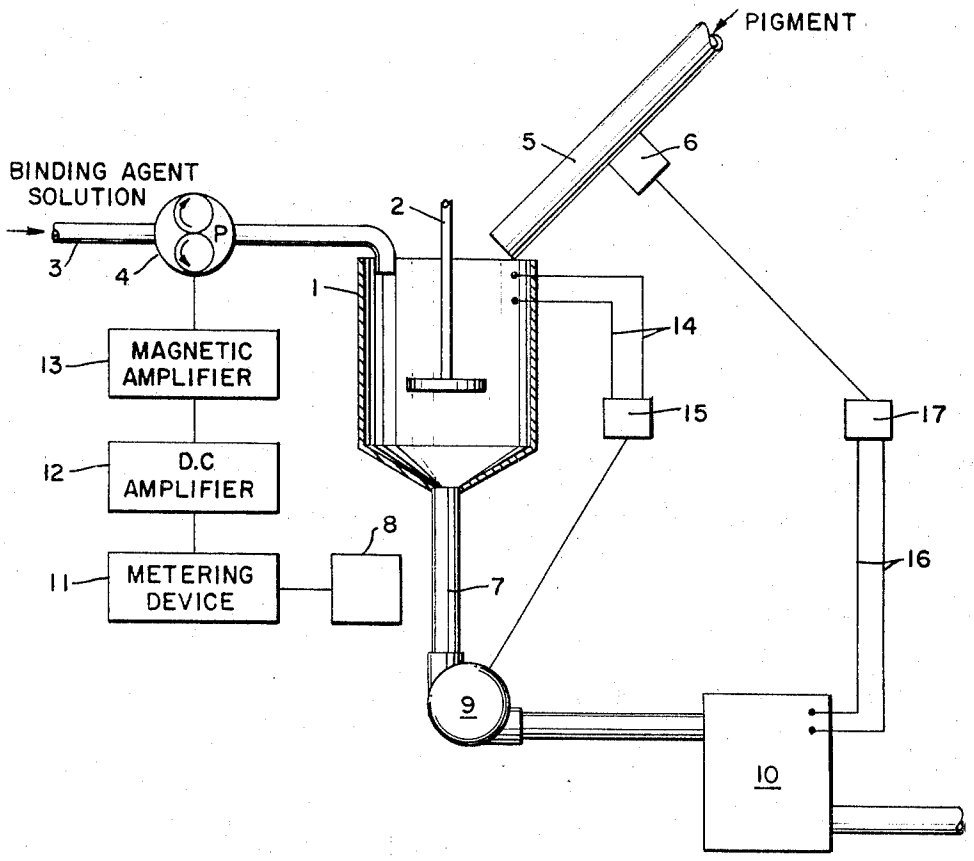

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METHOD AND APPARATUS FOR MAKING PAINTS

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ABSTRACT OF THE DISCLOSURE

A method and apparatus for the continuous mixing of liquids and particulate solids, in which the liquids and solids are fed separately in controlled amounts into the mixer. The feed of the liquid is controlled from the discharge of the mixer into a test section by a system which senses the ratio of solid to liquid within the test section by absorption of radiant energy, compares the sensed ratio with a predetermined desired ratio, and makes the necessary correction in liquid flow into the mixer. The level of mixture is controlled by sensors in the mixer which electrically control a discharge pump connected to the mixer. The discharge pump empties into a holding vessel. The admission of particulate solids into the mixer is controlled by level sensors in the holding vessel which actuate a relay to control a vibratory feed pipe used to convey the solids into the mixer.

The invention relates to a method and device for the continuous mixing of measured amounts of pigments and extenders with solutions of binding agents or other liquids as required for the manufacture of paints, printing inks and similar products. In these mixtures, an accurate proportion between solids and liquid components must be strictly maintained so that all methods known up to now are applying batch-type charging, since charging in measured amounts is the only way to guarantee the required ratio of the ingredients.

There is a possibility to automate batch type mixing and thereby to provide a connection between a continuous subsequent processing of the mixed paste, for instance, with finely dispersing devices, such as roller mills or stirrer-type ball mills. However, batch type mixers involve high technical expenditures, such as high costs of construction, high operating expenses, and large space requirements, while being limited to a comparatively small throughput. When such a plant is changed over to process another product, for instance, to change the shade of a produced color, considerable expenses for cleaning the equipment may become necessary.

It is therefore an object of the present invention to overcome the above-mentioned drawbacks by carrying out the mixing of pigments and extenders with solutions of binding agents or other liquids in order to produce paints, printing inks and similar products, in a simpler and cheaper way.

It is another object of the invention to provide a method for the continuous supply of components to be mixed in such a manner that the mixture will always have the accurate amounts required to maintain its composition.

It is a further object to provide a device for carrying out the above-mentioned method.

The various advantages of the present invention will be more clearly understood and will become more apparent from the detailed description now following.

According to the present invention, the continuously fed materials, namely pigments, extenders, solutions of binding agents, or other liquids as required, are combined in a mixing vessel of comparatively small capacity.

The materials are mixed intensely in this vessel and, after a short dwell time therein, are introduced into a test section in which the composition of the mixture is measured by absorption or backscattering, respectively, of high energy radiation. The actually measured value is a pulse rate, whose relationship to the ratio of the liquid and solid components is obtained by gauging.

The measured value is amplified electronically and so converted that it can be used to control the feeding of one component (e.g., the liquid) in a manner suitable to guarantee a constant composition or ratio of components in the mixed product.

After having passed the test section where measuring occurs, the mixed product flows through a pump further passing the product through the mixing device. To maintain the filling of the mixing vessel at all times on a level which is most effective for the mixing process, the delivery rate of the pump is controlled by means of filling level sensors arranged on the mixing vessel. The supply rate of the second component (e.g., the powder) is controlled by means of an appropriate device arranged at a compensating vessel before a further processing stage in such a manner that the quantity of mixture put through will be at an optimum for that stage.

The method and device according to the invention will now be described in greater detail by reference to the single flow-sheet.

The sheet illustrates a mixing vessel **1** of comparatively small capacity. Arranged in the vessel is a disc-type stirrer **2** driven by an electric motor (not shown). Binding agent solution is delivered to the mixing vessel **1** through a pipe **3** by means of a gear pump **4**, likewise driven by an electric motor (not shown). The pigment is supplied to the mixing vessel **1** through a pipe **5** under the controlling action of a vibrator **6**.

The mixture is fed to a compensating vessel **10** over a test section **7** by means of a pump **9**. The composition of the mixed product, i.e. the ratio of liquid and solid components, is determined by a measuring head **8**, using beta-ray backscattering, and is transmitted to a counting ratemeter **11** which is compared with the pre-set desired value in a D.C. amplifier **12**. A deviation, should any occur, will be amplified in a magnetic amplifier **13**, which in turn will cause a variation in the delivery rate of pump **4**. Thus, if the backscattering of beta-rays measured at the head **8** indicates that the amount of solids in the mixture is too high, this will cause by transmission through units **11**, **12** and **13**, the delivery rate of pump **4** to increase, so as to furnish more liquid to the mixture. If the backscattering at head **8** indicates that the amount of liquids is too high, the opposite will take place.

Mechanisms are further provided for the control of the filling level in vessel **1** and of the pigment supply. When the level in the mixing vessel **1** drops below a predetermined height, sensors **14** act on a relay **15** whereby the speed and delivery of pump **9** are reduced. Inversely, when the level in vessel **1** rises above a determined height, so that more mixture is available for withdrawal to the next processing stage, the rate of pump **9** will be increased.

Another pair of sensing members **16** controls the pigment supply by way of a relay **17** in dependence on the amount of mixture withdrawn from vessel **10** by the processing stage which follows.

Means are thus provided to control the amount of binding agent solution, i.e. liquid, to the mixture on the one hand, and to control the amount of pigment, i.e. solid, to the mixture, on the other hand, in order to maintain the appropriate ratio of liquid and solid in the mixture at all times to meet the requirements of the following processing step.

In the following an example will be given setting forth the operation of the device by way of illustration.

EXAMPLE

A mixture is to be produced which contains 60 parts by weight of TiO_2 and 40 parts by weight of a 50% solution of alkyd resin in test gasoline. Using a mixing vessel **1** having a capacity of approximately 3 liters which is provided with a stirrer **2** having approximately 250 watt power input, the feed of pigments is adjusted to about 120 kg./h. In order to obtain the desired composition, it is required to feed a solution of 80 kg./h. to the vessel. From the mixture of both components, approximately 110 liters of paste are obtained per hour. The components to be mixed remain in the mixer **1** approximately 1.6 minutes. The mixture subsequently flows through test section **7** and is tested for its proper composition by means of β-ray backscattering, said composition, for example, having a value of 6000 pulses/min.

If, for example, the feeding of pigments is reduced by approximately 2% due to adhesion of the TiO_2 in pipe **5**, the pigment content of the paste will become too low, and the measuring by means of β-backscattering will result in a decreased pulse rate of about 5960 pulses/min. Via amplifiers **12** and **13**, this will result in a considerable reduction of the delivery speed of pump **4**, and thus lead to a feed of alkyd-resin solution reduced by at least 40%, so that the correct composition of the mixture will be achieved again in a short time. In this manner, any changes in pigment feed of up to 50% will be compensated for by regulating the feed of solution to such an extent that the composition of the mixture will not be substantially changed. Should a sudden and substantial change occur in pigment feed, for example due to a blocking of pipe **5** by a considerable agglomeration of pigment, the feed of alkyd-resin solution is stopped entirely when the TiO_2-content of the mixture deviates by more than 8% from the determined composition. When the pigment feed fails completely, the filling level of mixing vessel **1** drops to such an extent that the two filling feelers or sensors **14** become free. This will switch off pump **9**. When the pigment feed starts once more, the filling level in mixing vessel **1** rises, and pump **9** can operate again. A mixture with a higher pigment content will arrive in the test section, and the desired composition of the mixture is obtained again after 2 minutes at the latest.

Should, due to an insufficient feed of pigment, say 100 kg./h., the output of the mixing device with 167 kg./h. no longer correspond to the throughput of the serially connected processing step of 200 kg./h., the filling level in compensating vessel **10** will drop and the lower or bottom sensor **16** becomes free. The latter then causes the vibrator **6**, by way of relay **17**, to switch the frequency from, for example, 40 Hz. to 70 Hz. Thereby, the pigment feed through pipe **5** into mixing vessel **1** is increased, for example, to 140 kg./h. When the mixture with the higher pigment content then reaches test section **7**, a higher pulse rate is measured there, which will result in an increase of the alkyd resin feed quantity, until the proper composition of the mixture is again obtained in test section **7**. In this way, the mixture through-feed is increased to approximately 233 kg./h. The filling level in the compensating vessel will now rise again, until the upper sensor **16** is reached, the latter then switching the vibrator, by way of the relay, back to the adjustment of 40 Hz.

The mixing of liquids with powders according to the present invention, for instance, the mixing of pigments with solutions of binding agents for producing paints provides great advantages compared with the methods hitherto known. By feeding the mixture continuously, it will be possible to supply a continuously operating device providing fine dispersion comprising only a single vessel, in which a stirrer works without interruptions. Since the material to be mixed is added to a process operating with its most efficient mixing effect, the mixing vessel and the stirrer can be made of substantially smaller size as compared to a discontinuously operating plant of the same

throughput. Using a mixing vessel having a capacity of about 3 liters, 200 kg. of high-concentrated pigment paste can be mixed per hour, sufficiently to produce 400 kg. of paint, compared to a required capacity of the mixing vessel of 150 to 200 liters in a discontinuously operating mixing plant. The means for the exact automatic proportioning can be provided very easily. For instance, the liquid supply may be regulated by means of a standard gear pump, the speed of its driving motor being controlled by the measured values of the components of the mixture. In a similar manner, the powder supply can be regulated. Any special dosing devices such as measuring pumps, balances, etc. are thus dispensable. The only requirement is that the feeding capacity of the devices designed to provide the supply of the materials can be controlled. This can be easily done, for instance, by variation of the amperage or voltage of the electric motors used as driving means. The measured values of the composition of the mixture can also be converted into variations of the feeding capacity by simple means, such as counting ratemeters, D.C. amplifiers, and magnetic amplifiers. The mixing of liquids wtih powders for the purpose of manufacturing paints or similar products can, therefore, be carried out with considerably reduced expenses, and a substantially smaller space is required as compared to the known methods.

Furthermore, considerable savings in energy and labor can be obtained and the device can be cleaned more easily and rapidly due to the small surfaces contacting the mixture contained therein.

A further advantage is achieved by the fact that the measured value controlling the amounts to be mixed is derived from the composition proper of the mixture. This means of measurement without contacting elements and simple control of the process ensures low operating costs and high reliability of the device according to the invention. The measured value may be transmitted to a recording device without any difficulty and it will also be easy to connect warning and safety devices responsive to any deviation from the specified operating conditions.

What is claimed is:

1. A method for the continuous, controlled mixing of pigments and extenders with solutions of binding agents or other liquids needed for the manufacture of paints, printing inks, and the like, which comprises feeding solid and liquid components into a flow-through mixing vessel in controlled amounts, said control comprising measurement of the ratio of liquid and solid components in the mixture after it has passed the mixing vessel, regulation of liquid feed in accordance with said measurement, and regulation of the feed of solids by separate control means.

2. The method according to claim **1**, wherein the ratio of liquid and solid components in the mixture is measured by absorption of radiation of high energy.

3. The method according to claim **1**, wherein the ratio of liquid and solid components in the mixture is measured by backscattering of beta rays.

4. The method according to claim **1**, wherein the feed of solid components is controlled by variation of the filling level in a compensating vessel arranged for cooperation with said mixing vessel.

5. The method according to claim **1**, wherein the filling level of the mixing vessel is controlled by the rate at which the mixture is withdrawn for further processing.

6. A device for the continuous, controlled mixing of pigments and extenders with solutions of binding agents or other liquids needed for the manufacture of paints, printing inks and the like, which comprises a vessel for effecting the mixture of said pigments and liquid components including stirring means, a plurality of conveying means for conveying the materials to be mixed and the mixture thereof into and out of the mixing vessel, respectively, separate feeding means for said solid and liquid components, a test section arranged in series with

the mixing vessel downstream therefrom for measuring the ratio of solids and liquids and thereby controlling the amount of liquid to be fed, and said feeding means for the solid components including sensing elements for determining the amount of the mixture wthdrawn from the system and regulating the amount of solids in accordance therewith.

7. The device as claimed in claim 6, further comprising a measuring head for measuring the backscattering or absorption of high energy radiation arranged for cooperation with said test section, and a plurality of measuring and amplifying units disposed between said measuring head and said delivery pump for controlling the delivery rate of said pump in response to the measured and amplified value for the ratio of solids and liquids in the mixture.

8. The device as claimed in claim 6, further comprising a line provided for conveying the mixture to another processing stage, a compensating vessel interposed between the mixing vessel and said line, pump means in series with the mixing vessel, for delivery of mixture to said compensating vessel, first sensing means on the mixing vessel for regulating the delivery rate of the pump in response to the level in the mixing vessel, second sensing means on the compensating vessel for determining the amount

of mixture therein, and a vibrator mounted for cooperation with said second sensing means to control the solid supply in accordance with the amount of mixture in the compensating vessel.

9. The device as claimed in claim 8, further comprising a plurality of relay means, wherein first relay means, responsive to said filling level sensing means of the mixing vessel, are operative in the control of the delivery rate of said pump means feeding mixture to the compensating vessel, and wherein second relay means responsive to the sensing means on the compensating vessel control the vibrating effect of said vibrator and thereby the rate of delivery of solids to the mixing vessel.

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