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(54) Method for proportioning glue components

Verfahren zum Dosieren von Leimkomponenten

Procédé pour proportionner des composants des adhésifs

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Description

The invention relates to a method for mixing binders for joining objects using at least two components including a resin and a curing agent which are flowed from separate storage containers towards a common mixing point. According to the invention, the storage containers are continuously weighed, and their change of weight per unit of time is determined. Also, the invention concerns a device for implementing the method.

When using curing adhesive systems, the resin and the curing agent must be kept in separate containers and should not be mixed until a short time before applying the glue. If the glue line is to be sufficiently strong, the mixing ratio of resin to curing agent has to be precise. This is especially important in the making of load-bearing constructions, such as beams, where a weak glue line may have disastrous consequences.

In devices where the resin and the curing agent are continuously flowed from separate storage containers to a common mixing point, it has been found difficult to maintain, for any substantial period of time, full control of the mixing ratio, which may mean that many of the glued objects will have to be scrapped. Above all, it is very difficult to measure the flow of resin, in that it has high viscosity which in addition varies considerably, both with age and with temperature. Therefore, it is also difficult to maintain a constant flow of resin, since this varies according to the viscosity also at a constant speed of the dosing pump. Measuring the level in the storage containers does not yield sufficiently accurate results, since the cross-sectional area of the containers mostly is comparatively large while the flows of resin and curing agent are comparatively small. In the case of functional trouble, causing objects to be joined with a binder of wrong composition, subsequent identification of these objects is very difficult. Today, it is possible to ensure adequate gluing quality only by continuous manual supervision and recurrent sampling, which requires a lot of personnel and is quite expensive.

EP-A- 170322 describes a method of mixing powder- and granule-like components of a body to be compressed. Weighing is used for controlling the mixing.

US-A- 3245584 describes an apparatus for mixing and blending batches of granular material. The apparatus comprises means for controlling the mixing by weighing the components.

US-A- 3442453 discloses a method for preparing a foamed or expanded material by mixing at least two liquid ingredients flowed from separate, weighed containers.

There is thus a great need for a method of controlling the mixing ratio of the different components in a curing adhesive system which method also should enable subsequent control. This need is satisfied by the present invention, which relates to a method as defined in the appended claims.

More specifically, the invention concerns a method

for mixing binders for joining objects using at least two components including a resin and a curing agent, which are flowed from separate storage containers towards a common mixing point. In the method, the storage containers are continuously weighed, and their change of weight per unit of time is determined. The actual mixing ratio of the components, is determined on the basis of the change of weight per unit of time of each container. The measured and/or determined values are stored in a form which enables subsequent control of the mixing ratio between the components at a certain point of time. The data may, for instance, be stored in a memory in the control unit, in other machine-readable form, or be printed directly on a paper. The control unit may also permit direct reading of all data on a display.

Suitably, the actual mixing ratio is compared with a set point determined according to the binder system used. If the deviation exceeds a predetermined value, for instance ranging from about 0.5% to about 10% depending on the binder system, an alarm can be given, calling the attention of an operator who can then correct the deviation by altering the flow of one or more of the components, e.g. by changing the speed of one or more of the dosing pumps. Suitably, the determination of the actual mixing ratio and the comparison with the set point are automatically performed in a control unit, which also makes it possible to allow the control unit to automatically control the flow of one or more of the components on the basis of the measured changes of weight per unit of time of each storage container, thereby substantially maintaining a set point for the mixing ratio of the components. If the components are a resin and a curing agent, it is generally sufficient that the control unit automatically controls the speed of one dosing pump for the curing agent.

Conveniently, the storage containers are weighed on scales transmitting signals to the control unit, which can be done e.g. by suspending the containers from preferably electronic load transducers. Preferably, the load transducers should be able to yield such accurate weighing results that the deviation is at the most about $\pm 5\%$, in particular at the most $\pm$ about 2% .

The method according to the invention is advantageous for all curing binder systems in which two or more components are to be mixed, for instance resorcinol-formaldehyde resin and formaldehyde curing agent, or urea resin and an acid curing agent, such as ammonium chloride. In general, it is enough that the method is applied to the mixing of resin and curing agent, but it is evident that also other common additives to binders, such as diluents (e.g. water or organic solvents), fillers and plasticisers, can be admixed to the binder in the same way. The components can be brought together and mixed by known methods, e.g. in closed vessels; on a plate, as in SE Patent 418,753; on a roller, as in SE Patent Application 9102874-6; or on the object to be coated with the binder, as in SE Patent 373,525.

The invention further concerns a device for imple-

menting the method. This device comprises separate storage containers and dosing pumps for each component, means for continuously weighing each storage container, and means for determining the change of weight of the storage containers per unit of time. Preferably, the storage containers are suspended from preferably electronic load transducers transmitting signals to a control unit capable of determining the change of weight per unit of time for each storage container. Preferably, the control unit is adapted to determine the actual mixing ratio of the components, compare this ratio with a set point, and give an alarm if the deviation exceeds a predetermined value. In one embodiment, the control unit is adapted to automatically control the flow of one or more of the components on the basis of the measured changes of weight per unit of time of the storage container of each component, thereby substantially maintaining a set point for the mixing ratio of the components. Preferably the device comprises means for storing the measured and/or determined values in a form enabling subsequent control of the mixing ratio between the components at a certain point of time.

By the invention, there is no need of continuous manual supervision for immediately detecting and adjusting deviations in the mixing ratio of resin to curing agent that may arise owing to alterations of the viscosity, clogging of the equipment, leakage, or quite simply by the emptying of a storage container. Thus, it is possible to accurately control the mixing ratio of resin to curing agent, which is a condition for obtaining glue lines of high and uniform quality. By storing all the data, one may afterwards check which objects may have been coated with a wrong binder composition in the case of functional trouble. The invention also makes it possible to control the total consumption of the binder and thereby optimise this amount.

In the following, the invention will be described in more detail with reference to the accompanying drawing schematically illustrating a device according to the invention. However, the invention is not restricted to the embodiment shown, but is defined by the scope of the appended claims only.

The drawing shows two storage tanks 1, 2 for resin and curing agent, respectively. To the tanks are connected dosing pumps 6, 7 which lead to a common mixing point (not shown). The tanks 1, 2 are suspended from electronic load transducers 3, 4 which are connected to a control unit 5. In one embodiment, the control unit 5 is adapted to control one or both of the dosing pumps 6, 7.

When the illustrated device is in use, the tanks 1, 2 contain liquid resin and liquid curing agent, respectively. Resin and curing agent are pumped to a common mixing point by the dosing pumps 6, 7. A suitable mixing ratio of resin to curing agent, e.g. ranging from about 1:1 to about 1:100 depending on the adhesive system and the degree of dilution, is set on the control unit 5 and then constitutes a set point. The electronic load trans-

ducers 3, 4 continuously transmit signals relating to the weight of the tanks 1, 2, to the control unit 5 which, at suitable time intervals, e.g. ranging from about 1 second to 5 minutes, records the weight and compares it with the preceding value, thereby determining the loss of weight of each tank 1, 2 per unit of time. On the basis of these values, the actual mixing ratio of resin to curing agent is determined. The measured and the determined values of the flow and the mixing ratio of the resin and the curing agent is stored in the control unit 5, and/or transmitted to a printer (not shown), thus enabling subsequent control of the actual mixing ratio at a certain point of time. Should the actual mixing ratio deviate too much from the set point, an alarm is given, calling the attention of an operator who may then check whether there is any serious malfunction, and optionally adjust the speed of e.g. the dosing pump for the curing agent, thereby establishing a suitable mixing ratio once again. In another embodiment, one or both of the dosing pumps 6, 7 are automatically controlled by the control unit, so as to maintain at all times a correct mixing ratio. An alarm is given only when the disturbances are so severe that they cannot be offset by adjusting the dosing pumps 6, 7, e.g. if the flow is completely stopped by clogging or if one of the tanks has become empty.

Claims

1. A method for mixing binders for joining objects using at least two components including a resin and a curing agent which are flowed from separate storage containers (1, 2) towards a common mixing point, comprising the steps of continuously weighing the storage containers (1, 2), determining their change of weight per unit of time, determining the actual mixing ratio of the components on the basis of the changes of weight per unit of time of the storage containers (1, 2), and storing the measured and/or the determined values in a form which enables subsequent control of the mixing ratio between the components at a certain point of time.
2. A method as claimed in claim 1, **characterised** by comparing the actual mixing ratio of the components with a set point, an alarm being given if the deviation exceeds a predetermined value.
3. A method as claimed in any one of claims 1-2, **characterised** by automatically controlling, by means of a control unit (5), the flow of one or more of the components on the basis of the measured changes of weight per unit of time of the storage containers (1, 2), thereby substantially maintaining a set point for the mixing ratio of the components.
4. A method as claimed in any one of claims 1-3, **characterised** by suspending, for purposes of weighing, the storage containers from load trans-

ducers (3, 4) that transmit signals to the control unit (5).

5. A device for implementing the method as claimed in any one of claims 1-4, comprising separate storage containers (1, 2) and dosing pumps (6, 7) for the components, means (3, 4) for continuously weighing the storage containers (1, 2), and means (5) for determining the change of weight per unit of time of the storage containers (1, 2) and the actual mixing ratio of the components, **characterised** in that it also comprises means for storing the measured and/or the determined values in a form which enables subsequent control of the mixing ratio between the components at a certain point of time.
6. A device as claimed in claim 5, **characterised** in that the storage containers are suspended from load cells (3, 4) transmitting signals to a control unit (5) which is capable of determining the change of weight per unit of time of each storage container (1, 2).
7. A device as claimed in claim 6, **characterised** in that the control unit (5) is adapted to determine the actual mixing ratio of the component, compare this ratio with a set point, and give an alarm if the deviation exceeds a predetermined value.

Patentansprüche

1. Verfahren zum Mischen von Bindemitteln für die Verbindung von Gegenständen unter Verwendung von mindestens zwei Komponenten einschließlich eines Harzes und eines Härters, welche von getrennten Speicherbehältern (1, 2) einem gemeinsamen Mischungspunkt zugeführt werden, mit den Schritten: Kontinuierliches Wiegen der Speicherbehälter (1, 2), Ermitteln von deren Gewichtsveränderung pro Zeiteinheit, Ermitteln des Ist-Mischungsverhältnisses der Komponenten auf der Basis der Gewichtsveränderung der Speicherbehälter (1, 2) pro Zeiteinheit und Speichern der gemessenen und/oder der ermittelten Werte in einer Form, welche eine anschließende Kontrolle des Mischungsverhältnisses zwischen den Komponenten zu einem bestimmten Zeitpunkt ermöglicht.
2. Verfahren nach Anspruch 1, gekennzeichnet durch das Vergleichen des Ist-Mischungsverhältnisses der Komponenten mit einem Sollwert, wobei ein Alarm gegeben wird, wenn die Abweichung einen vorbestimmten Wert überschreitet.
3. Verfahren nach einem der Ansprüche 1 bis 2, gekennzeichnet durch das automatische Steuern des Flusses von einer oder mehreren Komponenten

ten auf der Basis der gemessenen Gewichtsveränderungen der Speicherbehälter (1, 2) pro Zeiteinheit mittels einer Steuereinheit (5), wodurch im wesentlichen ein Sollwert für das Mischungsverhältnis der Komponenten aufrechterhalten wird.

4. Verfahren nach einem der Ansprüche 1 bis 3, gekennzeichnet durch das Aufhängen der Speicherbehälter an Lastmeßgebern (3, 4), welche Signale an die Steuereinheit (5) übertragen, zum Zwecke des Wiegens.
5. Vorrichtung zum Implementieren des Verfahrens gemäß einem der Ansprüche 1 bis 4, welche getrennte Speicherbehälter (1, 2) und Dosierpumpen (6, 7) für die Komponenten, Einrichtungen (3, 4) zum kontinuierlichen Wiegen der Speicherbehälter (1, 2) und eine Einrichtung (5) zum Ermitteln der Gewichtsveränderung der Speicherbehälter (1, 2) pro Zeiteinheit und des Ist-Mischungsverhältnisses der Komponenten aufweist, dadurch gekennzeichnet, daß sie auch eine Einrichtung zum Speichern der gemessenen und/oder ermittelten Werte in einer Form aufweist, welche eine anschließende Kontrolle des Mischungsverhältnisses zu einem bestimmten Zeitpunkt ermöglicht.
6. Vorrichtung nach Anspruch 5, dadurch gekennzeichnet, daß die Speicherbehälter an Lastzellen (3, 4) aufgehängt sind, die Signale an eine Steuereinheit (5) übertragen, welche die Gewichtsveränderung jedes Speicherbehälters (1, 2) pro Zeiteinheit ermitteln kann.
7. Vorrichtung nach Anspruch 6, dadurch gekennzeichnet, daß die Steuereinheit (5) dafür angepaßt ist, das Ist-Mischungsverhältnis der Komponenten zu ermitteln, dieses Verhältnis mit einem Sollwert zu vergleichen, und einen Alarm zu geben, wenn die Abweichung einen vorbestimmten Wert überschreitet.

Revendications

1. Procédé pour mélanger des liants destinés à unir des objets en utilisant au moins deux composants, comprenant une résine et un agent durcisseur, que l'on fait s'écouler de récipients de stockage séparés (1, 2) en direction d'un point de mélange commun, comprenant les étapes consistant: à peser de façon continue les récipients de stockage (1, 2), déterminer leurs changement de poids par unité de temps, déterminer le rapport instantané de mélange des composants en se basant sur les changements de poids des récipients de stockage (1, 2) par unité de temps, et stocker les valeurs mesurées et/ou déterminées, cela sous une forme qui permet un réglage subséquent du rapport de mélange entre les com-

posants à un certain moment.

2. Procédé selon la revendication 1, caractérisé en ce que l'on compare le rapport de mélange instantané des composants avec un point de consigne, une alarme étant émise si l'écart dépasse une valeur prédéterminée. 5

3. Procédé selon l'une quelconque des revendications 1-2, caractérisé en ce que l'on règle automatiquement, au moyen d'un dispositif de réglage (5), l'écoulement d'un ou plusieurs des composants en se basant sur les changements de poids des récipients de stockage (1, 2), mesurés par unité de temps, en maintenant ainsi effectivement un point de consigne pour le rapport de mélange des composants. 10 15

4. Procédé selon l'une quelconque des revendications 1-3, caractérisé en ce que l'on suspend, à des fins de pesage, les récipients de stockage à des éléments dynamométriques (3, 4) qui émettent des signaux vers le dispositif de réglage (5). 20

5. Dispositif pour mettre en oeuvre le procédé selon l'une quelconque des revendications 1-4, comprenant des récipients de stockage séparés (1, 2) et des pompes de dosage (6, 7) pour les composants, des moyens (3, 4) pour peser de façon continue les récipients de stockage (1, 2) et un moyen (5) pour déterminer le changement de poids par unité de temps des récipients de stockage (1, 2) et le rapport de mélange instantané des composants, caractérisé en ce qu'il comprend aussi des moyens pour stocker les valeurs mesurées et/ou les valeurs déterminées sous une forme qui permet un réglage ultérieur du rapport de mélange entre les composants à un certain moment. 25 30 35

6. Dispositif selon la revendication 5, caractérisé en ce que les récipients de stockage sont suspendus à des cellules dynamométriques (3, 4) émettant des signaux vers un dispositif de réglage (5) qui est capable de déterminer le changement de poids par unité de temps pour chaque récipient de stockage (1, 2). 40 45

7. Dispositif selon la revendication 6, caractérisé en ce que le dispositif de réglage (5) est adapté pour déterminer le rapport de mélange instantané des composants, comparer ce rapport avec un point de consigne, et émettre une alarme si l'écart dépasse une valeur prédéterminée. de stockage 50

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