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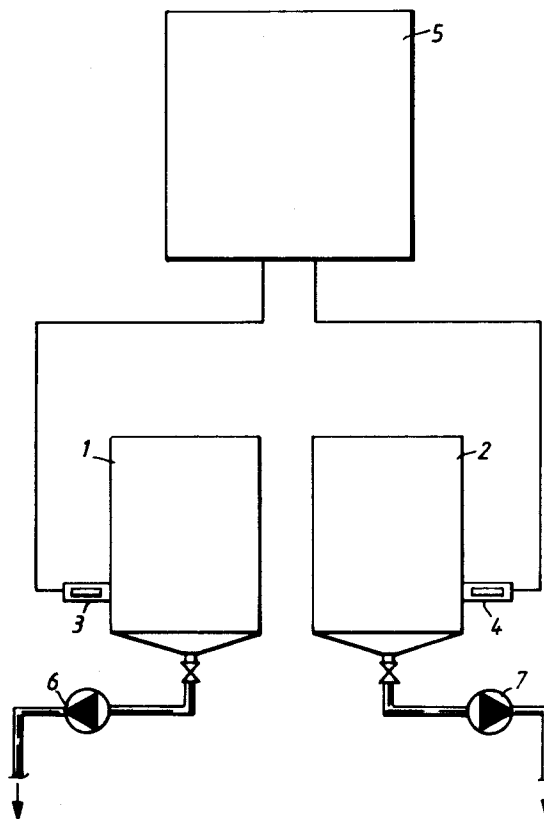
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54 **Method for proportioning glue components.**

57 The invention concerns a method for mixing binders using at least two components which are flowed from separate storage containers (1, 2) towards a common mixing point. The storage containers (1, 2) are continuously weighed, and their change of weight per unit of time is determined. Also, the invention concerns a device for implementing the method.



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The invention relates to a method for mixing binders using at least two components, 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.

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 preferably 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 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 flow ratio, and consequently also the actual mixing ratio of the components, can be

determined on the basis of the change of weight per unit of time of each container. Preferably, 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 implementing 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 transducers 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.

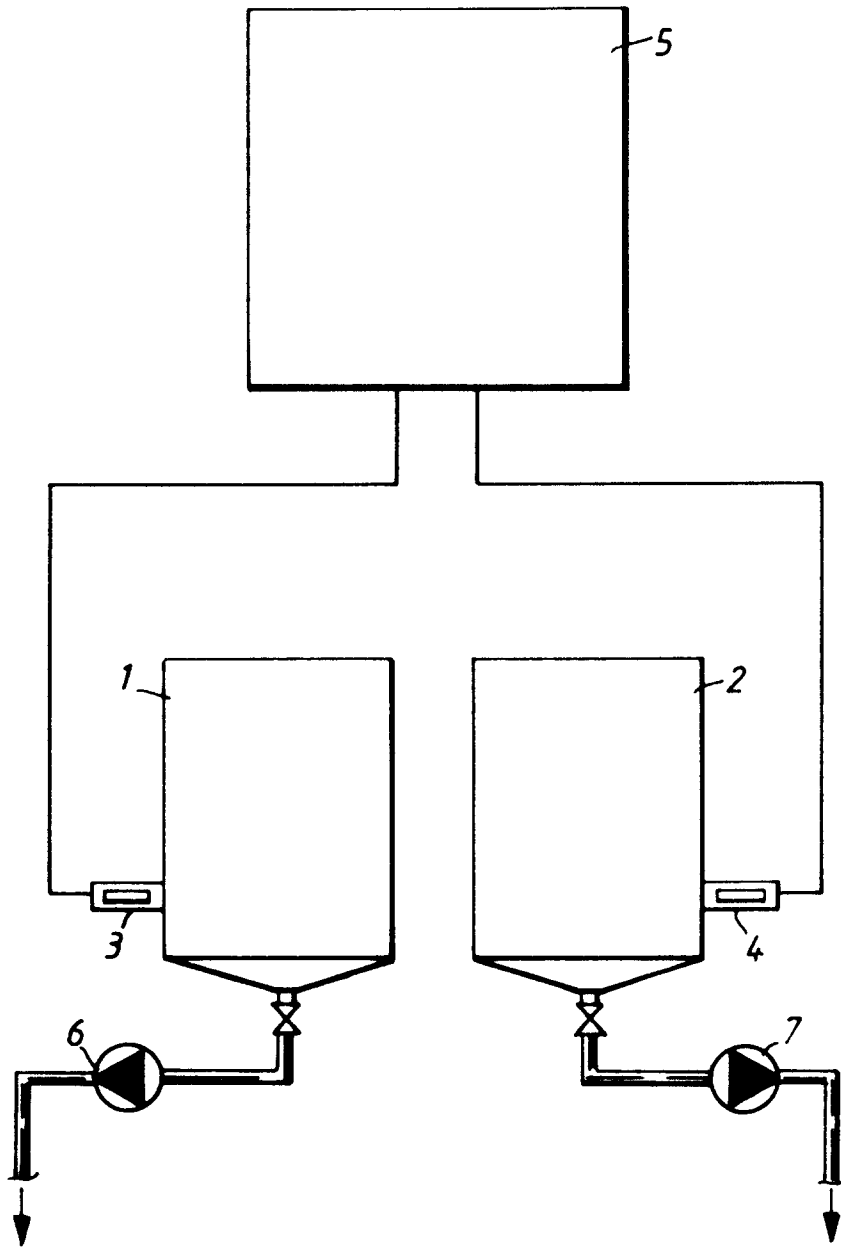
Claims

1. A method for mixing binders 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, **characterised** by continuously weighing the storage containers (1, 2) and determining their change of weight per unit of time.
2. A method as claimed in claim 1, **characterised** by 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).
3. A method as claimed in claim 2, **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.
4. A method as claimed in any one of claims 1-3, **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. 5

5. A method as claimed in any one of claims 1-4, **characterised** by suspending, for purposes of weighing, the storage containers from load transducers (3, 4) that transmit signals to the control unit (5). 10
6. A method as claimed in any one of claims 1-5, **characterised** by 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. 15
7. A device for implementing the method as claimed in any one of claims 1-6, **characterised** in that it comprises 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). 20
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8. A device as claimed in claim 7, **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). 30
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9. A device as claimed in claim 8, **characterised** in that the control unit (5) 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. 40
10. A device as claimed in any one of claims 7-9, **characterised** in that the device 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. 45
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EUROPEAN SEARCH REPORT

Application Number

EP 93 20 0571

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.5)
X	EP-A-0 170 322 (NATIONAL FORGE EUROPE) ----	1-10	B01F15/04
X	US-A-3 245 584 (LINVILLE) * column 3, paragraph 3; claim 1 * ----	1-10	
X	DE-A-2 152 533 (LIST) ----	1-10	
X	US-A-3 442 453 (WHITEHOUSE) ----	1-10	
X	US-A-3 638 916 (URSIC) ----	1-10	
A	US-A-4 525 071 (HORIWITZ) ----		
A	US-A-4 733 971 (PRATT) ----		
A	US-A-2 925 197 (FREBEL) ----- -----		
The present search report has been drawn up for all claims			TECHNICAL FIELDS SEARCHED (Int. Cl.5)
			B28C B01F B29B B27N
Place of search	Date of completion of the search	Examiner	
THE HAGUE	08 JULY 1993	PEETERS S.	
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