United States Patent [19]

Graham et al.

[11] **3,910,564**

[45] **Oct. 7, 1975**

[54] **STRUCTURE FOR FOUNDRY SLURRY VISCOSITY REDUCTION**

[75] Inventors: **Alexander L. Graham**, Livonia; **Robert L. Cleland**, Albion, both of Mich.

[73] Assignee: **Harry W. Dietert Co.**, Detroit, Mich.

[22] Filed: **Apr. 17, 1972**

[21] Appl. No.: **244,420**

[52] **U.S. Cl.** **259/154**

[51] **Int. Cl.²** **B28C 7/04**

[58] **Field of Search** 259/154, 149, 161, 162, 259/163, 164, 165, 166, 168

[56] **References Cited**

UNITED STATES PATENTS

3,110,421	11/1963	Matthias	259/154
3,448,967	6/1969	Seanor	259/154
3,463,461	8/1969	Kirk	259/154
3,719,214	3/1973	Erndt	259/154

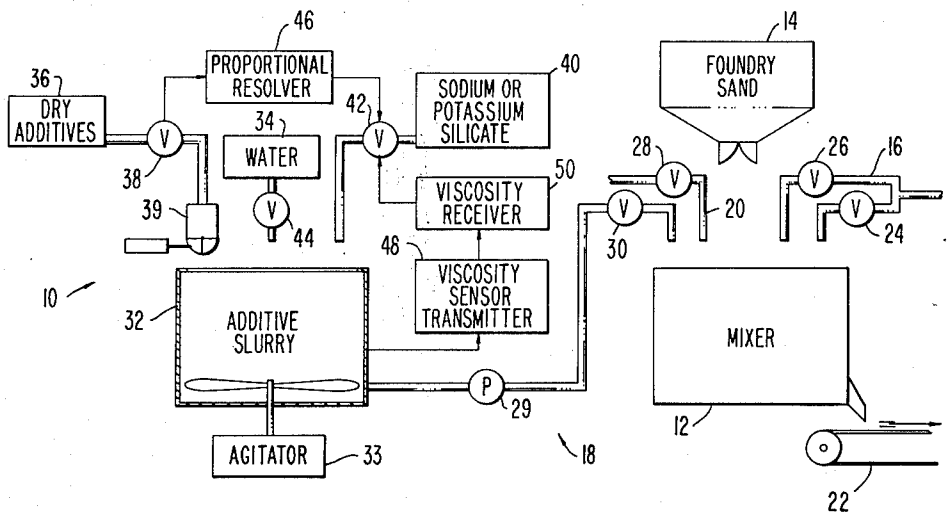
Primary Examiner—Robert W. Jenkins

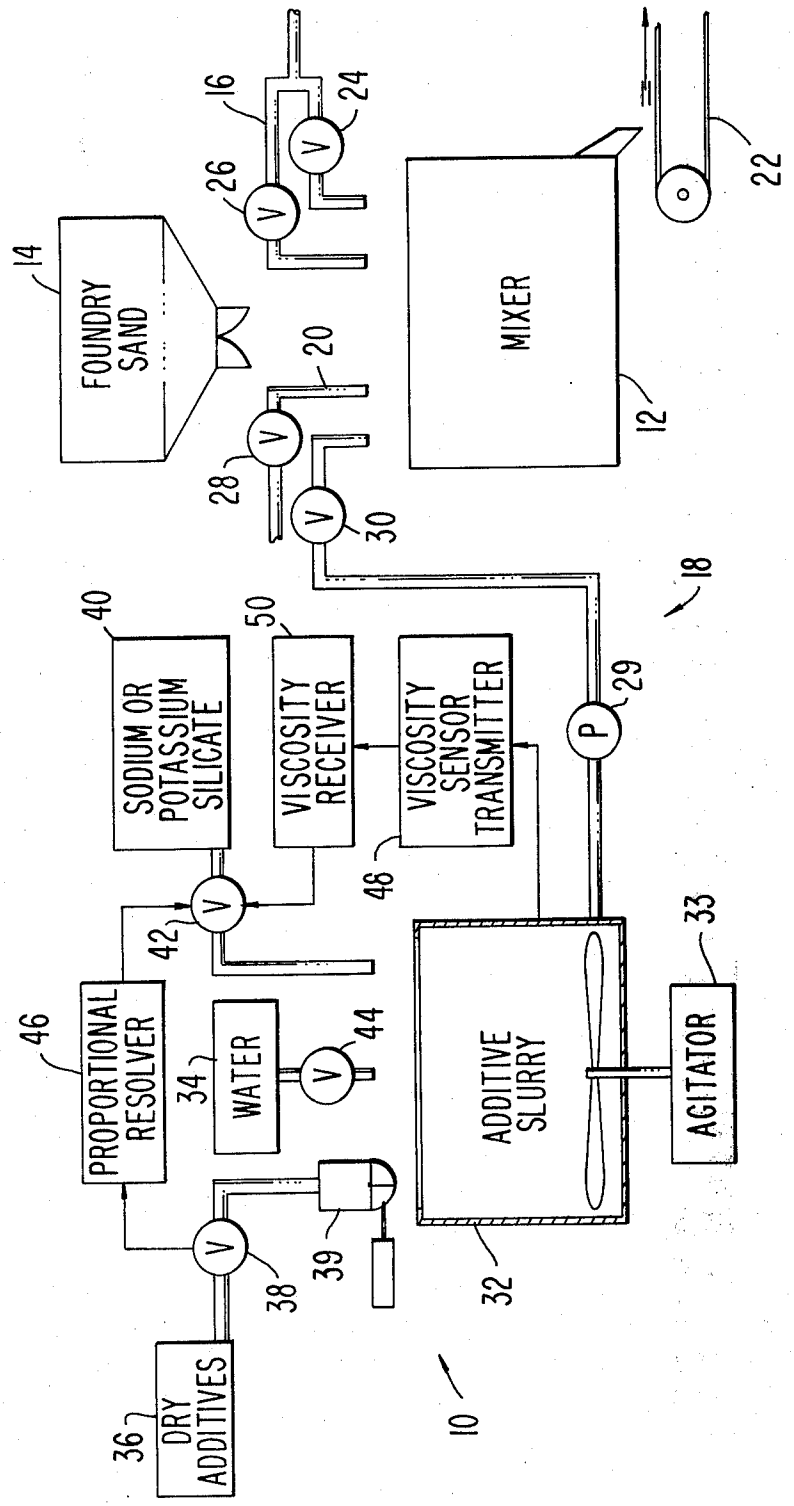
Attorney, Agent, or Firm—Whittemore, Hulbert & Belknap

[57] **ABSTRACT**

Structure for and the method of decreasing the viscosity of foundry sand additive slurries by the use of up to 3 percent of sodium silicate or potassium silicate in the foundry sand additive slurries to provide a workable slurry having a high percentage of solids therein for foundry sand requiring a high ratio of additives to water for proper tempering and rebonding thereof.

9 Claims, 1 Drawing Figure




FOUNDRY SAND
14
16
24
26
20
28
30
MIXER
12
22
18
40
SODIUM OR POTASSIUM SILICATE
50
VISCOSITY RECEIVER
VISCOSITY SENSOR TRANSMITTER
48
29
P
42
46
PROPORTIONAL RESOLVER
34
WATER
44
ADDITIVE SLURRY
33
AGITATOR
38
39
32
36
DRY ADDITIVES
10

STRUCTURE FOR FOUNDRY SLURRY VISCOSITY REDUCTION

BACKGROUND OF THE INVENTION

1. Field of the Invention

The invention relates to tempering and rebonding of foundry sand and refers more specifically to structure for and a method of tempering and rebonding foundry sand with additives in a water slurry to which a viscosity reducing agent has been added whereby the solids to liquids ratio of a pumpable slurry may be increased.

2. Description of the Prior Art

In the past, tempering and rebonding of foundry sand has often been accomplished by the use of dry additives such as bentonites, seacoal and cellulose flour in addition to water which have been separately placed in a foundry sand mixer. It has been found that if the additives are mixed with the tempering water prior to their introduction into the foundry sand mixer so that the additives are allowed to presoak, the rehydration of the additive clay so accomplished is beneficial in the tempering operation. The use of such a slurry in particular reduces the loss of dry additives and fines due to ventilation of the mixer during the cooling cycle.

It has, however, in the past been found that slurry sand conditioning systems are faced with limitations. Thus, for example, with western bentonite additives a clay level of about 9 percent by weight in the slurry can produce a slurry viscosity too high to permit convenient handling. So-called high viscosity bentonites can form thixotropic gels at clay levels as low as 8 percent.

Also, foundry sand being conditioned may require an addition of as much as 0.2 to 0.3 percent of clay, while requiring only a small amount of water to allow for evaporation while the sand is being cooled and to bring the moisture content of the mixed sand back to the required level. It is necessary, therefore, that a slurry be provided having a high enough solids-to-water ratio to satisfy the additive need without exceeding the water requirement of the sand to be conditioned.

Some slurries with high viscosity and low solids content are incapable of fully conditioning foundry sand under specific conditions because of the low solids-to-water ratio, and the slurry must be supplemented with dry additives. To make slurry systems more widely applicable and to make present slurry systems more practical, it is desirable to reduce the slurry viscosity so that higher solids-to-water ratios are possible.

SUMMARY OF THE INVENTION

In accordance with the present invention, sodium silicate and/or potassium silicate are used as viscosity control agents for foundry slurries. Up to 3 percent of the sodium silicate and/or potassium silicate are dispersed in the water which is then mixed with sand additives such as sodium and calcium bentonites to effect a solids-to-water ratio increase of up to 22 percent.

In a practical application, an additive slurry having a high solid-to-water ratio is prepared by mixing dry additives with water to which 1 percent by weight of the dry additives of sodium or potassium silicate has been added, after which the viscosity of the slurry so produced is sensed and an additional amount of sodium or potassium silicate up to for example another 2 percent by weight of the dry additives is added to the slurry in accordance with the sensed viscosity of the slurry.

BRIEF DESCRIPTION OF THE DRAWING

The drawing is a diagrammatic representation of sand conditioning structure including a slurry additive system constructed in accordance with the invention for practicing the method of the invention.

DESCRIPTION OF THE PREFERRED EMBODIMENT

As shown in the drawing, the sand conditioning structure **10** includes a mixer **12** for mixing foundry sand, water and additives to condition the foundry sand, a source **14** of the foundry sand to be conditioned, a source of tempering water **16** including metering valves **24** and **26,** a slurry additive system **18** including metering valve **30** and slurry pump **29** and, if desired, additional additive structure **20** including valve **28.** As shown, the conditioned sand from the mixer **12** may be removed from the area of the mixer on the conveyor **22.**

The mixer **12,** foundry sand source **14** and tempering water source **16** are known structure and will not therefore be considered in detail herein. Similarly, the additional additive structure **20** and the conveyor **22** may be of any convenient design known in the foundry industry.

The slurry additive system **18,** however, in accordance with the invention includes the slurry tank **32** in which dry additives, water and viscosity reducing agents are mixed by agitator **33** in accordance with the invention.

Water is supplied to the additive slurry tank **32** from a conventional water source **34** through metering valve **44.** Sodium or potassium silicate is added to the tank **32** from the sodium or potassium silicate source **40** through the metering valve **42.** Similarly, dry additives such as sodium and/or calcium bentonites are added to the slurry tank **32** from the dry additive source **36** through metering valve **38** and holding tank or hopper **39.**

It will be understood that valves **38** and **42** as well as the water valve **44** may be manually actuated if desired.

In accordance with the invention it is desirable to add up to for example 3 percent of sodium or potassium silicate for a western bentonite dry additive to produce an additive slurry having a workable viscosity with up to 22 percent more solids therein than is possible without the addition of the sodium or potassium silicate.

While the sodium and potassium silicate may be added to the slurry by manual operation of the valve **42,** for example, if desired, proportional resolvers are available which will meter a predetermined percent of the dry additives passing through valve **38** of the sodium or potassium silicate through the valve **42.**

Further, it has been found that it is desirable to first add for example a fixed percentage as for example 1 percent by weight of the dry additives of sodium or potassium silicate to the water before the additives are dispersed in the water to form the sluffy and to subsequently add an additional amount as for example another 2 percent of the dry additives by weight of the sodium or potassium silicate to the slurry in accordance with the viscosity of the slurry produced by the addition of the first 1 percent of sodium or potassium silicate to the dry additive and water slurry.

If the dry additives are added to the water before the first 1 percent of sodium or potassium silicate, the re-

sulting mixture may become sticky and mixing of the sodium and potassium silicate therewith at a later date may become difficult or impossible. After the addition of the first 1 percent of the silicate to the water, the resulting mixture including the dry additives readily accepts the additional silicates.

Accordingly, a viscosity sensor transmitter **48** is shown in conjunction with the slurry tank **32** for sensing the viscosity of the slurry in the tank **18** and a viscosity receiver **50** is shown connected between the viscosity sensor transmitter and the valve **42** for controlling the valve **42** in accordance with the viscosity sensed by the viscosity sensor transmitter.

In one particular embodiment of the invention a Milton Roy controlled volume pump was used as the valve **42,** which pump was manually set for the percentage of silicate to be added and the pump operation automatically timed based on the weight of bentonite to be added to the slurry tank by the operation of the proportional resolver **46.** The pre-measured additives were then released from the hopper **39** into the slurry tank **32** after the entry of the silicate into the tank.

In the same embodiment the controlled volume pump was automatically adjusted in accordance with the viscosity of the slurry in tank **32** by the use of a Brookfield Viscometran Capacitance Viscosity Transmitter and a Foxboro Viscosity Receiver which controlled the air pressure supplied to the controlled volume pump actuator.

While specific commercially available structure is thus recited for the proportional resolver **46,** the viscosity sensor and transmitter **48,** viscosity receiver **50** and the pump **42,** it will be understood that other commercially available equipment, and indeed equipment which it is within the skill of the art to design which is not commercially available, may be used to practice the invention.

In overall operation of the sand conditioning structure **10** illustrated, the foundry sand from the foundry sand source **14** is tested to determine the amount of additives and water required to temper the sand in the mixer. The dry additives and water from the sources **36** and **34** are added to the additive slurry tank **32** through the valves **38** and **44** and the hopper **39** either manually or automatically following a predetermined percent of sodium or potassium silicate added to tank **32** from the source **40** through the valve **42.**

Particularly if the addition of the sodium or potassium silicate is automatic, 1 percent by weight of the dry additives of the sodium or potassium silicate is first added to the water in the slurry tank **32** under for example the control of the proportion resolver **36,** followed by the release of the premeasured additives in the holding hopper **39.** The viscosity of the slurry in the tank **32** is then sensed and an additional amount of sodium or potassium silicate is added to the additive slurry in the tank **32** in accordance with the sensed viscosity of the slurry to produce a slurry having a particularly high solids content.

When the additional sodium or potassium silicate is added automatically, the viscosity of the slurry in the tank **32** is sensed by means of the viscosity sensor transmitter **48** and the valve **42** is controlled by the viscosity receiver **50** connected between the transmitter **48** and valve **42.**

While one embodiment of the present invention has been considered in detail, it will be understood that other embodiments and modifications thereof are contemplated. It is the intention to include all such embodiments and modifications within the scope of the invention as are defined by the appended claims.

What we claim as our invention is:

1. Structure for producing foundry sand additive slurry comprising an additive slurry tank, means operably associated with the slurry tank for first adding water to the slurry tank, means operably associated with the slurry tank for determining the amount of a viscosity reducing agent to be initially added to the water in the additive slurry tank as a proportion of dry additive to be added to the water in the additive slurry tank, means for then metering the viscosity reducing agent into the water in the additive slurry tank, and means for feeding the amount of dry additives into the additive slurry tank.

2. Structure for producing foundry sand additive slurry comprising an additive slurry tank, means operably associated with the slurry tank for adding water to the slurry tank, means operably associated with the slurry tank for adding a dry additive to the slurry tank, means operably associated with the slurry tank for metering a viscosity reducing agent for the dry additive and water in the slurry tank into the tank, and means operably associated with the slurry tank and the means for adding a dry additive to the slurry tank for adding a first fixed percentage of the dry additive by weight of the viscosity reducing agent to the water in the slurry tank before the dry additive enters the water in the slurry tank so that a high percentage of solids may be present in the slurry in the tank for a given slurry viscosity and tempering of foundry sand or the like may be accomplished with the slurry even though the foundry sand may require a high percentage of additives in relation to the tempering water required thereby.

3. Structure as set forth in claim **2** wherein the dry additive is a bentonite and the viscosity reducing agent is one of sodium and potassium silicate.

4. Structure for producing foundy sand additive slurry comprising an additive slurry tank, means operably associated with the slurry tank for adding water to the slurry tank, means operably associated with the slurry tank for adding a dry additive to the slurry tank, means operably associated with the slurry tank for metering a viscosity reducing agent for the dry additive and water in the slurry tank into the tank, means for adding a first fixed percentage of the dry additive by weight of the viscosity reducing agent to the water in the slurry tank before the dry additive enters the water in the slurry tank, and means for subsequently adding an additional amount of viscosity reducing agent to the slurry in accordance with the viscosity of the slurry having the first fixed percentage of the viscosity agent added thereto.

5. Structure as set forth in claim **4** wherein the dry additive is a bentonite and the viscosity reducing agent is one of sodium and potassium silicate.

6. Structure as set forth in claim **4** wherein the means for adding an additional amount of sodium or potassium silicate to the slurry comprises a viscosity sensor transmitter for providing a signal proportional to the viscosity of the slurry and a viscosity receiver for controlling the additional amount of sodium or potassium silicate in accordance with the sensed viscosity of the slurry.

7. Structure for producing foundry sand additive slurry comprising an additive slurry tank, means operably associated with the slurry tank for adding water to the slurry tank, means operably associated with the slurry tank for adding a dry additive to the slurry tank, means operably associated with the slurry tank for metering a viscosity reducing agent for the dry additive and water in the slurry tank into the tank, and means for first adding 1 percent by weight of the dry additive of the viscosity reducing agent to the water used in forming the additive slurry and means for subsequently adding an additional amount up to 2 percent of the viscosity reducing agent to the additive slurry in accordance with the viscosity of the additive slurry to which the initial 1 percent of the viscosity reducing agent has been added so that a high percentage of solids may be present in the slurry in the tank for a given slurry viscosity and tempering of foundry sand or the like may be accomplished with the slurry even though the foundry sand may require a high percentage of additives in relation to the tempering water required thereby.

8. Structure as set forth in claim 7 wherein the dry additive is at least one of sodium and calcium bentonite and the viscosity reducing agent is one of sodium and potassium silicate.

9. Structure for producing foundry sand additive slurry comprising an additive slurry tank, means operably associated with the slurry tank for first adding water to the slurry tank, means operably associated with the slurry tank for determining the amount of viscosity reducing agent to be initially added to the water in the slurry tank as a proportion of the dry additive to be added to the water in the additive slurry tank, means for then metering the viscosity reducing agent into the water in the additive slurry tank, means for feeding the amount of dry additives into the additive slurry tank, means for sensing the viscosity of the mixed water, dry additive and viscosity reducing agent in the additive slurry tank operably associated with the additive slurry tank, and means operably associated with the viscosity sensing means for metering an additional amount of viscosity reducing agent into the additive slurry tank in accordance with the viscosity of the slurry in the slurry tank up to a maximum of 2 percent by weight of the dry additive.

* * * * *