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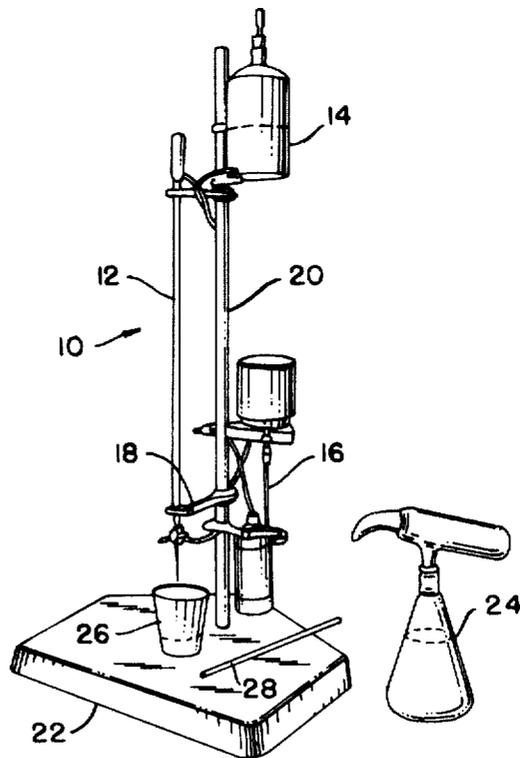
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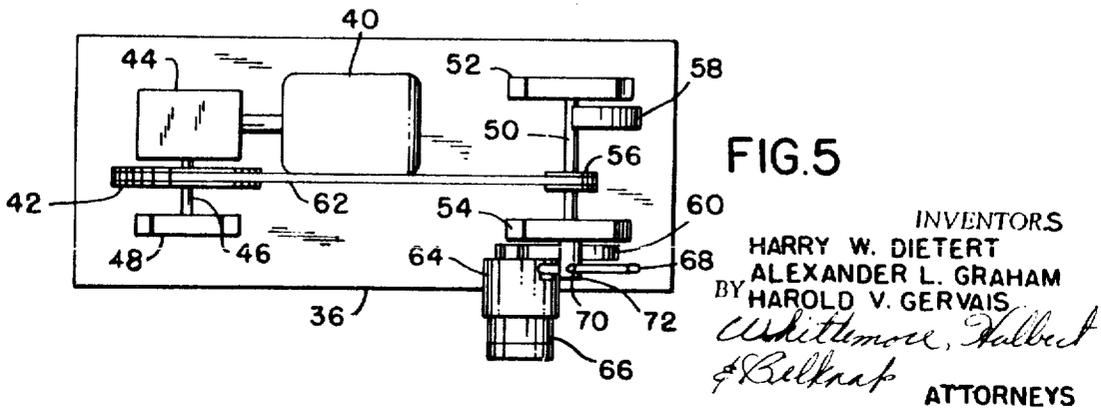
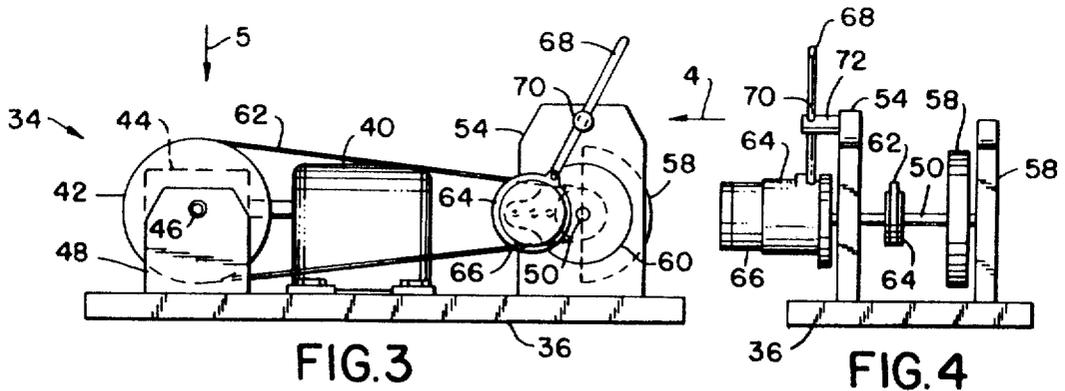
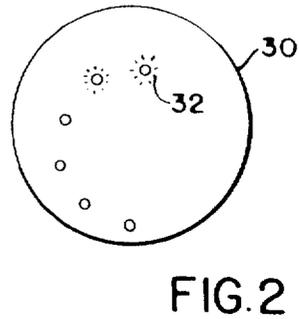
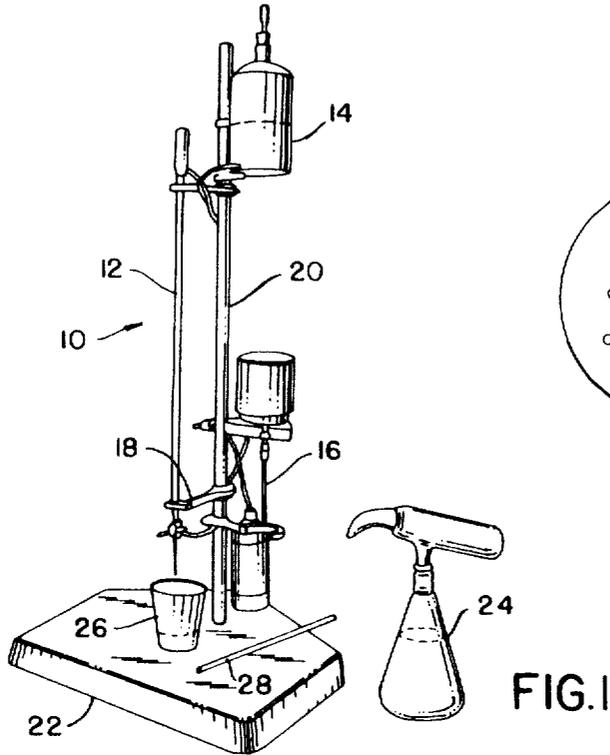
[54] **METHOD OF DETERMINING THE LIVE CLAY CONTENT OF FOUNDRY SAND**
8 Claims, 5 Drawing Figs.

- [52] U.S. Cl. **23/230 R,**
73/61, 164/4
- [51] Int. Cl. **G01n 1/04,**
G01n 31/22, G01n 33/24
- [50] Field of Search **23/230 R;**
73/53, 61; 164/4

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ABSTRACT: A 2 percent preliminary solution of tetrasodium pyrophosphate is added to foundry sand containing a blend of bentonites and the clay-bearing sand sample and preliminary solution are stirred lightly. The mixed sand sample and tetrasodium pyrophosphate are then titrated with methylene blue until a blue-green halo is left around a spot on a filter paper on which a drop of the titrated solution is placed. The quantity of methylene blue necessary for the titration is an accurate indication of the effective live clay content of the sand without regard to different base exchange capacities of different bentonites in the blend.





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METHOD OF DETERMINING THE LIVE CLAY CONTENT OF FOUNDRY SAND

If the sand is first abraded to expose all the live clay therein, the total live clay content of a sand sample may be determined. Then, by subtracting the effective live clay content of a batch of sand from the total live clay content of the sand, the latent live clay in the sand may be determined.

The sand sample may be abraded mechanically, in which case a unique structure is provided for moving a cylindrical container containing the sand sample and rods in a circle described by the axis of the container moving transversely and arcuately and for rocking the container angularly about the axis thereof. Alternatively, the sand sample may be abraded electronically.

BACKGROUND OF THE INVENTION

Field of the Invention

The invention relates to testing of foundry sand or the like to determine clay content thereof and refers more specifically to a method of and structure for determining the total, effective and latent live clay content of a foundry sand including a blend of calcium and sodium bentonites having different base exchange capacities.

Description of the Prior Art

In the past, it has been known to determine the surface area of clay by the amount of methylene blue solution absorbed by a sample of the clay. Further, it has been known to determine the percent of Baroid in a foundry sand by adding a sulphuric acid solution to the sand before titration with a methylene blue solution. However, in attempting to apply a methylene blue absorption test on foundry sands to determine the amount of live clay therein, it has been found that the methylene blue solution alone and with known preliminary solutions such as sulphuric acid added to the foundry sand, substantially different amounts of methylene blue solution are necessary in titrating foundry sands including bentonites from different areas as, for example, Western (sodium) bentonites and Southern (calcium) bentonites produced in the United States, due to their different base exchange capacities. Further, in foundry use it has been found that the percent of different bentonites present in returned foundry sand which is live varies so that a constant percentage initially calculated for methylene blue absorption of a blend of different bentonites will not give accurate indications of the live clay content of used foundry sand.

SUMMARY OF THE INVENTION

In accordance with the invention, a preliminary solution of 2 percent tetrasodium pyrophosphate is added to a sand sample containing a mixture of Southern bentonite and Western bentonite. The mixed sand sample and preliminary solution are stirred lightly and subsequently titrated with methylene blue. As a result of the use of the tetrasodium pyrophosphate preliminary solution, it is found that both Southern (calcium) bentonite and Western (sodium) bentonite provide substantially the same response to the methylene blue. Thus, by addition of the preliminary solution, it is possible to determine the effective live clay content of a sand including a blend of calcium and sodium bentonites.

In addition, if the sample of granular material is first abraded to expose substantially all of the live clay to the preliminary solution and methylene blue, the total live clay content may be obtained by the same method. The latent live clay in a sample of foundry sand may then be calculated by subtracting the effective live clay content from the total live clay content.

Abrading may be accomplished by mechanical or electronic means. When the abrading is mechanical, a rodmill and means for rotating and rocking a container containing the sand sample and rods simultaneously is disclosed.

BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 is a diagrammatic illustration of structure for determining the live clay content of foundry sand in accordance with the method of the invention.

FIG. 2 is a diagrammatic illustration of a filter paper used in the method of determining the live clay content of foundry sand of the invention.

FIG. 3 is a side elevation view of structure for abrading sand in performing the method of the invention to determine total live clay content of foundry sand.

FIG. 4 is an end view of the structure illustrated in FIG. 3 taken substantially in the direction of arrow 4 in FIG. 3.

FIG. 5 is a top view of the structure illustrated in FIG. 3 taken substantially in the direction of arrow 5 in FIG. 3.

DESCRIPTION OF THE PREFERRED EMBODIMENT

The structure 10 for determining the live clay content of foundry sand or the like illustrated in FIG. 1 includes a self-filling 50 milliliter buret 12, gravity fed from a storage bottle 14 mounted above the buret, and a motor-driven stirrer 16, all supported from brackets 18 on post 20 which post is held in a vertical position by base 22. A repeating pipetter 24 is provided in conjunction with the buret and stirrer for dispensing a predetermined quantity of a preliminary solution as will be seen subsequently. The beaker 26, glass rod 28 and filter paper 30 are also included in the structure for performing the method of the invention.

The method of determining live clay in sand systems using blends of bentonites having different base exchange capacities such as Western or sodium bentonite and Southern or calcium bentonite includes first taking a sample of, for example, 5 grams of the sand and placing it in a beaker 26. A predetermined quantity of, for example, 50 milliliters of a 2-percent solution of tetrasodium pyrophosphate is then added to the sand sample in the beaker 26 from the repeating pipetter 24. The sand sample and preliminary solution are then stirred lightly in the beaker 26 with the stirrer 16 for between 3½ and 5 minutes.

The mixed sand and preliminary solution are then placed beneath the buret 12 containing a methylene blue solution and the sand sample and preliminary solution in the beaker are titrated with the methylene blue solution until a drop of the titrated solution from the beaker 26 removed therefrom by means of the glass rod 28 and dropped on the filter paper 30 shows a blue-green halo 32. The appearance of the blue-green halo indicates that the live clay in the sand sample has absorbed all the methylene blue that it can and a slight excess of methylene blue is present to provide the halo.

In performing the titration it will, of course, be possible after some minor experimenting to place 80 to 90 percent of the methylene blue required for the titration directly into the beaker initially. The remaining amount of methylene blue necessary to complete the titration will then be added more slowly in the usual manner.

With the method outlined, it has been found that both Southern (calcium) and Western (sodium) bentonites and blends of the two absorb substantially the same quantity of methylene blue. In other words, the amount of methylene blue required for titration will be independent of the type of bentonite in the foundry sand. Thus, it is possible to accurately and repeatedly determine the live clay content of foundry sand even after use of the sand.

With light stirring of the sand sample and preliminary solution as indicated above, the effective clay content in a sand system may be determined. If it is desired to determine the total live clay in a sand system, the sample of sand is first abraded either mechanically or electronically to expose all of the live clay surfaces in the sand sample after which the above disclosed methylene blue absorption method is used to determine the total live clay content in the sand. When abrading the sand sample, a ballmill, rodmill or small sand mixer may be used to abrade the sand mechanically. A 50-watt ultrasonic

cleaner obtainable from Branson Instruments Company, Progress Drive, Stamford, Conn., may be used to abrade the sand electronically.

In accordance with the present invention, a mechanical rod-mill 34 or swinger is provided for mechanical abrasion of the sample of sand which has a particularly beneficial action in exposing the clay surfaces with a relatively short abrading time. The rodmill 34 illustrated in FIGS. 3, 4 and 5 includes a base 36 and a motor 40 for rotating a drive wheel 42 through a gearbox 44. The motor 40 and gearbox 44 are mounted on the base 36. Drive wheel 42 is supported on shaft 46 for rotation therewith. The shaft 46 is driven through the gearbox 44 and is rotatably mounted in the vertical plate 48.

A shaft 50 is rotatably supported by the vertical plates 52 and 54 at the opposite ends of the base 36 and carries thereon the driven wheel 56, a semicircular counterweight 58 and a disc 60 for rotation therewith. The driven wheel 56 is driven through belt means 62 by the drive wheel 42.

A hollow cylindrical retainer 64 is connected eccentrically to the disc 60 for rotation in a circle about the axis of the shaft 50 on rotation of the shaft 50. The retainer 64 receives a hollow cylindrical container 66 in which a sample of granular material and cylindrical rods (not shown) are positioned. The rods extend longitudinally of the container for substantially the entire length thereof.

A flat shaft 68 is rigidly secured to one side of the retainer adjacent the disc 60, as shown best in FIGS. 3 and 5, and extends through an opening 70 in a stud 72 rotatably secured in the vertical plate 54.

In operation of the rodmill or swinger 34, a sample of granular material and rods are positioned in the container 66 with the rods extending axially of the container for substantially the entire length thereof and the container 66 is placed in the retainer 64. The motor 40 is started and drives wheel 42 through the gearbox 44 to produce rotation of the shaft 50 through belt 62 and driven wheel 56.

On rotation of the shaft 50, the disc 60 will rotate to move the retainer 64 and container 66 in a circle described by the axis of the container 66 moving transversely and in a circular arc. As the container moves in this circle, it will be rocked angularly about its axis due to the movement of the flat rod 68 through the stud 72. The sand is thus abraded rapidly to expose the total live clay therein in the least possible time.

The latent live clay content of sand may then be found by taking a first sample of the sand and determining the effective live clay therein, taking a separate sample of the sand and determining the total live clay therein. Subtracting the effective live clay from the total live clay will determine the latent live clay in the sand.

Thus, there is disclosed a method of determining effective, total and latent live clay content of sand systems in which there is a blend of Western and Southern bentonites, as well as in systems having only one type of clay which can be used repeatedly with accuracy and without the use of acids. The determination of the live clay content is simple to accomplish in accordance with the invention and can be accomplished with standard laboratory equipment.

What we claim as our invention is:

1. A method of determining the amount of live clay in foundry sand systems in which the sand includes a blend of bentonites from different areas having different base exchange capacities comprising placing a sample of the sand in a container, adding a quantity of tetrasodium pyrophosphate

preliminary solution to the sand sample in the container, stirring the sand sample and preliminary solution and titrating the stirred sand sample and preliminary solution with a quantity of methylene blue just sufficient to provide a blue-green halo on a filter paper surrounding a spot of the titrated solution placed on the filter paper whereby the amount of methylene blue used in the titration will be proportional to and therefore determinate of the live clay in the sand substantially without regard to the blend of bentonites in the sand sample.

2. The method as set forth in claim 1 wherein the sand sample is approximately 5 grams, the preliminary solution is approximately 50 milliliters of a 2-percent solution of the tetrasodium pyrophosphate and the stirring is accomplished at a slow rate for 3½ to 5 minutes whereby the live clay content determined by the quantity of methylene blue required to titrate the stirred sand sample and preliminary solution is the effective live clay.

3. The method as set forth in claim 1 wherein the sand sample is approximately 5 grams, the preliminary solution is approximately 50 milliliters of a 2-percent solution of the tetrasodium pyrophosphate and wherein the sand sample is first abraded before mixing with the preliminary solution whereby the clay content determined by the quantity of methylene blue required to titrate the stirred sand sample and preliminary solution is the total live clay.

4. The method as set forth in claim 3 wherein the abrading of the sand sample is accomplished mechanically.

5. The method as set forth in claim 3 wherein the abrading of the sand sample is accomplished electronically.

6. The method of determining the latent live clay in a sand system comprising determining the total live clay in a sample of the sand, determining the effective live clay in a similar sample of the sand and taking the difference between the total live clay and effective live clay to determine the latent live clay in a similar sample of the sand.

7. The method as set forth in claim 6 wherein the effective live clay is determined by placing a sample of the sand in a container, adding a quantity of tetrasodium pyrophosphate preliminary solution to the sand sample in the container, lightly stirring the sand sample and preliminary solution and titrating the stirred sand sample and preliminary solution with a quantity of methylene blue just sufficient to provide a blue-green halo on a filter paper surrounding a spot of the titrated solution placed on the filter paper whereby the amount of methylene blue used in the titration will be proportional to and therefore determinate of the effective live clay in the sand substantially without regard to the blend of bentonites in the sand sample.

8. The method as set forth in claim 6 wherein the effective live clay is determined by first abrading a sample of the sand to expose all the live clay surfaces, placing the abraded sand sample in a container, adding a quantity of tetrasodium pyrophosphate preliminary solution to the sand sample in the container, lightly stirring the sand sample and preliminary solution and titrating the stirred sand sample and preliminary solution with a quantity of methylene blue just sufficient to provide a blue-green halo on a filter paper surrounding a spot of the titrated solution placed on the filter paper whereby the amount of methylene blue used in the titration will be proportional to and therefore determinate of the total live clay in the sand substantially without regard to the blend of bentonites in the sand sample.

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