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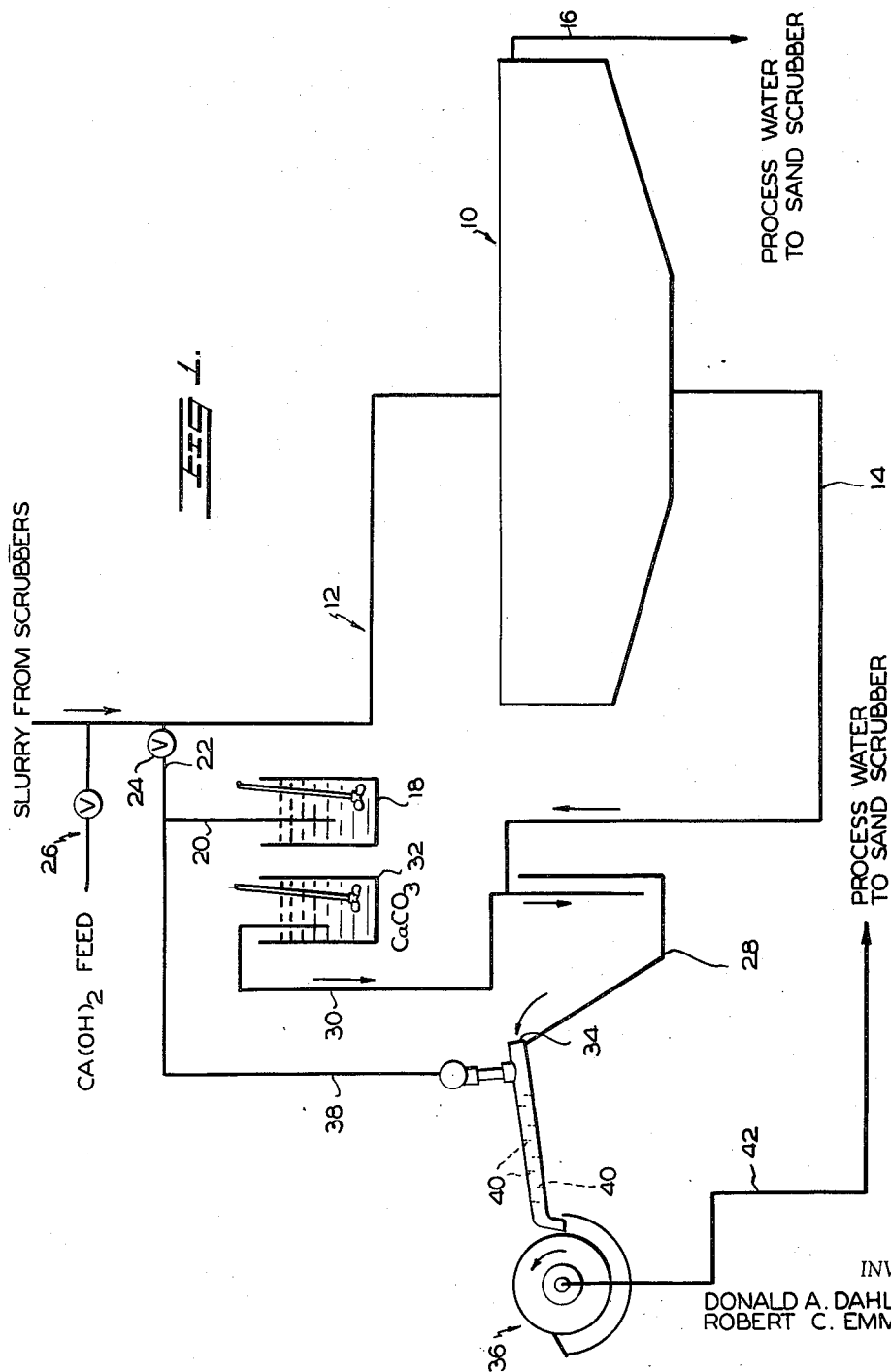
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2,941,942

METHOD OF DEWATERING FOUNDRY SAND SLIMES

Filed June 14, 1955

2 Sheets-Sheet 1



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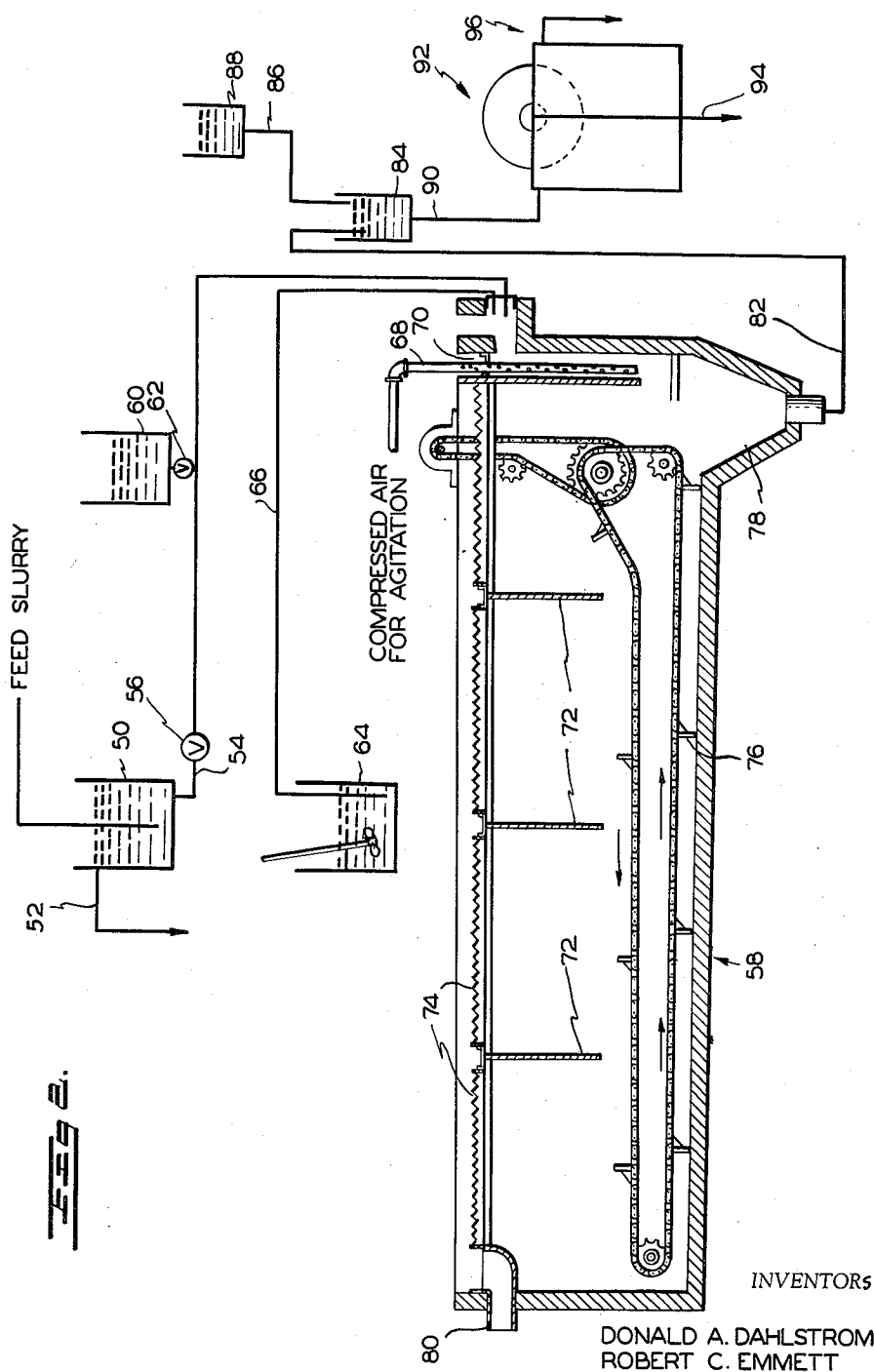
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METHOD OF DEWATERING FOUNDRY SAND SLIMES

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6 Claims. (Cl. 210—53)

This invention relates to improved filtration methods and in particular to improved processes for the disposal of waste products in foundry sand reclamation processes.

It is common foundry practice to use what is known as core sand for making cores for interior and exterior surfaces. The core usually consists of a mixture of sand and any one of several other green binding agents which retain the sand in place until the core is baked and a binding agent which gives the core strength and rigidity after baking and during the pouring operation. Due to the high cost of foundry sand and in particular where the foundry sand has to be shipped considerable distances to the foundry, many foundries have found it to be to their economic advantage to practice some type of sand reclamation. In general, the used core sand is scrubbed in a hydraulic medium and the runoff water is combined with the waste from the conventional wet dust collector, used in the sand recovery process. The resulting slurry generally comprises a mixture of bentonite, carbonaceous matter, and fine sand carried in suspension by the wash water from the sand scrubbers and separators. The concentration of this waste or slime is generally of the order of about 2000 to about 12,000 parts per million, yet because of the black color of the fluid and its tendency to deposit a carbon like layer upon most objects, the wash water cannot be disposed of in a convenient stream or river.

The problem of the disposal of these waste products has become of greater importance in recent years due to the impetus of more stringent pollution laws, local sewer ordinances and frequent economic necessity of recycling plant water. Straight settling methods for the disposal of these waste products have also been virtually excluded by the large volumes of wash water containing small volumes of suspended particulate material and due to the fine size of most of the particles which probably includes a high percentage of colloidal size material.

Similarly, the employment of standard filtering methods and apparatus for separating the slimes from foundry sand recovery water have not been entirely satisfactory due to the rapid blinding of the filter media by the fine suspended particles in the wash water.

It is, therefore, a primary object of the present invention to provide a filtration method for the treatment and disposal of slimes from foundry sand washing operations that gives very satisfactory results, is economically feasible, and may be employed on a wide variety of foundry core sand reclamation wastes.

It is a further object to provide such methods which do not substantially increase production costs and which may therefore be employed on relatively low rate of return products. These and other objects and advantages are obtained by the method of the invention which may be stated in general terms as consisting of the following steps:

Inoculating a slurry containing suspended particulate material with a flocculating agent of the polyelectrolyte or polysaccharide type, clarifying the flocculated slurry, reinoculating the thickened sludge after sedimentation

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with said flocculating agents or hydrated lime, and immediately filtering the reinoculated sludge on a filter apparatus.

The invention will be more generally described herein as shown in the embodiments illustrated in the accompanying drawings. However, it is to be understood that the illustrations are not intended to be limitations as to size, form and exact configuration of apparatus which may be used with the process of the invention, but such disclosures are illustrative examples of the advantageous application of the methods and principles constituting the present invention.

Referring now to the accompanying drawings in which like designations indicate similar parts throughout the several views:

Figure 1 is a diagrammatic view of one form of apparatus for use with the present invention; and

Figure 2 is a diagrammatic view of another form of apparatus for use of the present invention.

Referring to Figure 1 of the illustrated embodiments of the present invention 10 is a settling or clarifying tank into which the slurry from the foundry sand scrubbers or the like is conducted through conduit 12. The settling tank 10 is provided with two outlets. One of the outlets 14 is positioned in the bottom of the settling tank for the withdrawal of the thickened sludge and the other of the outlets 16 is positioned at the upper periphery of the tank for withdrawal of the clarified water, which may be returned to the sand scrubber or disposed of in any suitable manner.

In order to expedite the sedimentation of the slurry from the sand scrubber a flocculating agent is preferably added to the slurry in feed line or conduit 12 from the flocculating mixing tank 18 through conduits 20 and 22. A valve 24 may be positioned in conduit 22 to regulate the portion of the flocculating agent added to the slurry from the scrubbers. The flocculating agent added to the slurry from the scrubbers is preferably a synthetic polyelectrolyte, an acidic polyelectrolyte and its salts, or a polysaccharide. Particularly advantageous results have been obtained through the use of anionic polyelectrolytes, such as sodium polymethacrylate (for example, "Lytron" of Monsanto Chemical Company), and water-soluble natural polysaccharide gums, such as guar gum (for example, "Jaguar" of Stein, Hall & Co., Inc.). The amount of flocculating agent added to the clarifying tank depends to a large extent upon the particular slurry to be clarified and the pH of the solution. Very satisfactory results are obtained when the pH of the solution is from about 7 to about 8 which may be adjusted by the addition of calcium hydroxide to the slurry from the scrubbers. The calcium hydroxide may be added through a valved feed line generally designated 26.

With the slurry adjusted to a pH of about 7 or 8, the addition of about a 2% solution of sodium polymethacrylate to provide a concentration of about 1 to about 10 p.p.m. will give very satisfactory results. When the flocculating agent employed is guar gum, control of the pH of the slurry is not necessary and, in general, the addition of from about 5 to about 50 p.p.m. will give very satisfactory results.

After the initial flocculation and sedimentation of the slurry the thickened sludge is withdrawn from the tank 10 through conduit 14 and conveyed to a filter feed tank 28. Where a greater sludge density is desired, prior to the entry of the thickened sludge into the filter feed tank 28, calcium carbonate as limestone dust is added to the sludge to increase the filtration rate, to improve the filtrate clarity, and to facilitate the cake discharge from the filter apparatus. The amount of limestone dust added to the thickened slurry, as a filter aid, will vary depending upon the particular foundry

slimes being processed and the absence or presence of granular material therein. However, it has been found that the addition of from about 10 to 100 percent of the solids weight in the slurry provides very good results. The calcium carbonate is added to the thickened slurry through conduit 30 from a mixing tank 32.

The thickened sludge with or without the addition of calcium carbonate is withdrawn from the filter tank 28 through outlet 34 and conveyed to a standard vacuum or pressure type filter which is shown in Fig. 1 as a rotary drum vacuum type filter, and is designated 36.

Prior to the filtration of the thickened sludge it is reinoculated with the polyelectrolyte or polysaccharide flocculating agent or inoculated with hydrated lime through valved conduit 38. The conduit conveying the conditioned sludge to the filter 36 may be provided with baffles 40 to aid in the mixing of the flocculating agent or hydrated lime with the slurry. The amount of polyelectrolyte or polysaccharide flocculating agent added just prior to the filtration step may range from 5 to about 50 p.p.m. Where the added flocculating agent is hydrated lime, the amount required will vary from at least about 0.5% to about 5% of the weight of waste solids in the slurry. It has been found that hydrated lime in any of its common forms, such as waste carbide lime from the production of acetylene, will give satisfactory results.

To obtain the maximum benefit from the second flocculation step where polyelectrolyte or polysaccharide flocculating agent is used for reinoculation, the filtration of the slurry should be carried out during the time interval after ½ minute and preferably before 15 minutes has elapsed following the addition of the flocculating agent.

Where lime is employed as the reinoculating agent, it has been found that it is not necessary to carry out the filtration step within any prescribed time.

The filtrate leaves the filtering apparatus 36 through conduit 42 which may conduct the filtrate back to the foundry sand scrubber or to a suitable disposal means, while the substantially dried filter cake is removed from the outer surface of the filter drum for further treatment, sale, or disposal as is well known in the art.

In the process illustrated in Fig. 2, slurry from, for example, a foundry sand scrubber is initially settled in a settling tank 50 having a raw feed overflow 52 and a bottom slurry outlet conduit 54 which may be provided with a control valve 56 for conducting the slurry to a primary clarifier generally designated 58. Prior to the entry of the slurry into the clarifier 58 a 10% lime suspension may be added to the slurry from tank 60 and valved conduit 62. With a slurry feed containing about 3000 to about 5000 p.p.m. of suspended solids about 75 parts per million of the lime suspension may be added thereto. A flocculating agent, such as sodium polymethacrylate or guar gum, is added to the slurry feed as it enters the clarifier 58 from storage tank 64 through conduit 66.

The amount of guar gum added to the clarifier may

range from about 5 to about 50 parts per million. If sodium polymethacrylate is employed, about 1 to about 10 parts per million will give very satisfactory results.

As the flocculating agent and slurry enter the clarifier 58, they are mixed and agitated by means of a compressed air agitator 68 which projects into the opening 70 at the inlet end of the clarifying tank. Within the clarifier are a plurality of partitioning baffles 72 and adjustable weirs 74, and an endless chain type conveyor, provided with sludge collectors 76, moves across the bottom of the tank 58 in the direction shown by the arrows collecting and conveying the flocculated material into a sludge hopper 78. An overflow 80 for the process water is provided at the upper end of the clarifier 58. The run-off water may be conducted to the sand scrubber or to a suitable disposal system. The thickened sludge is removed from the sludge hopper 78 through conduit 82 through which it is conducted to a storage tank 84.

The thickened sludge in the storage tank 84 is reinoculated with any suitable polyelectrolyte or polysaccharide flocculating agent or hydrated lime through conduit 86 connected to the flocculating agent storage tank 88 as described with reference to Fig. 1 of the drawings. After the addition of the flocculating agent to the sludge contained in tank 84 the material is withdrawn therefrom through conduit 90 and passes to a filtration apparatus generally designated 92 within a short period of time. Actual experiments have shown that in order to obtain the greatest benefits from the process of the invention that the material should be passed to the filtering apparatus before the elapse of approximately 15 minutes after the sludge has been inoculated except where lime is employed as the inoculating agent.

The filtrate from the filtering apparatus is withdrawn through conduit 94 and may be disposed of in any suitable manner, while the filter cake is removed at 96 from where the filter cake may be conveyed for further treatment, sale, or disposal as is well known in the art.

Where the sludge formed in the clarifying tanks 10, Fig. 1, and 58 of Fig. 2, is not sufficiently concentrated to provide a desirable filter cake, it has been found to be advantageous to recycle the preliminary filter cake formed on the filtering apparatus 36 and 96 back into the sludge storage tanks 28 and 84 of Figs. 1 and 2, respectively. The recycling of the preliminary filter cake builds up the solids concentration in the filter feed whereby a more desirable filter cake is formed, which is more readily dischargeable from the filter apparatus.

Actual tests performed in accordance with the teachings of the present invention have shown that with this process increases of from about 25 to about 300% in filtration rate are readily obtainable.

The following tables set forth examples of the treatment and disposal of slimes from foundry sand washing operations carried out in accordance with the teachings of the present invention.

Table I

Solids Feed Composition	wt. per cent	Chem. Treatment	Reinoculation	Time before Filtration, min.
Dust and Sand.....	17.8	Sodium Polymethacrylate, 3.0 p.p.m.	10.0 p.p.m. Sodium Polymethacrylate.	5
Do.....	23.0	Sodium Polymethacrylate, 2.0 p.p.m.	20.0 p.p.m. Sodium Polymethacrylate.	5
Do.....	11.5	Sodium Polymethacrylate, 2.0 p.p.m.; Lime, 75 p.p.m.	15 p.p.m. Sodium Polymethacrylate.	5
Dust.....	9.0	Sodium Polymethacrylate, 3.0 p.p.m.; Lime, 75 p.p.m.	7 p. p. m. Sodium Polymethacrylate.	5

Table II

Solids Feed Composition	Type of Foundry	Thickened Slurry, Wt. Percent Solids	Hydrated lime added after settling, as percent of Slurry Solids Weight	Percent Increase in Filtration Rate
Sand Reclamation Waste...	Malleable Steel...	7	2	270
Do.....	Steel.....	7.8	3	300
Dust Collector Sludge.....	do.....	52	0.5	250

Table III

Solids Feed Composition	Slurry, Wt. Percent Solids	Chem. Treatment	Reinoculation	Percent Increase in Filtration Rate
Sand and Dust Foundry Steel.	6	Guar Gum 50 p.p.m.	2 Percent Lime as Percent of Slurry Solids Wt.	200
Sand Wastes Steel Foundry.	5	Guar Gum 6 p.p.m.	do.....	250

The treatments outlined gave cakes of good to excellent handleability and filtrate flow rates upwards of 2.5 gallons per hour per square foot of filter surface.

From the foregoing description it will be seen that the detailed aims, objects and advantages are fully accomplished by the present invention.

We claim:

1. The process of dewatering slurry of slimes from a foundry sand washing operation consisting of the steps: inoculating the slurry with a polyelectrolyte clarifying the flocculated slurry, inoculating the thickened sludge after settlement with hydrated lime, and then filtering the sludge.

2. The process of dewatering slimes from foundry sand washing operation consisting of the steps: adjusting the pH of a slurry of foundry sand slimes from about 7 to about 8, inoculating the slurry with a flocculating agent of the polyelectrolyte type at a concentration of from about 1 to about 10 p.p.m., clarifying the flocculated slurry, withdrawing the thickened sludge, inoculating the thickened sludge with hydrated lime at a concentration of from about 0.5 to about 5 percent of the solids weight in the sludge, and then filtering the sludge.

3. The process defined in claim 2 wherein the filtration step is carried out during the time interval after about ½ minute and before about 15 minutes has elapsed following the inoculation of the sludge.

4. The process defined in claim 2 wherein the polyelectrolyte is sodium polymethacrylate.

5. The process of dewatering slimes from a foundry sand washing operation consisting of the steps: inoculating a slurry of foundry sand slimes with a flocculating agent of the polysaccharide type at a concentration of from about 5 to about 50 p.p.m., clarifying the flocculated slurry, withdrawing the thickened sludge, inoculating the thickened sludge with hydrated lime, and then filtering the sludge.

6. The process defined in claim 5 wherein the polysaccharide is guar gum.

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UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 2,941,942

June 21, 1960

Donald A. Dahlstrom et al.

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction and that the said Letters Patent should read as corrected below.

Column 5, line 35, after "polyelectrolyte" insert a comma.

Signed and sealed this 4th day of April 1961.

(SEAL)

Attest: ERNEST W. SWIDER

~~XXXXXXXXXX~~

Attesting Officer

ARTHUR W. CROCKER
Acting Commissioner of Patents