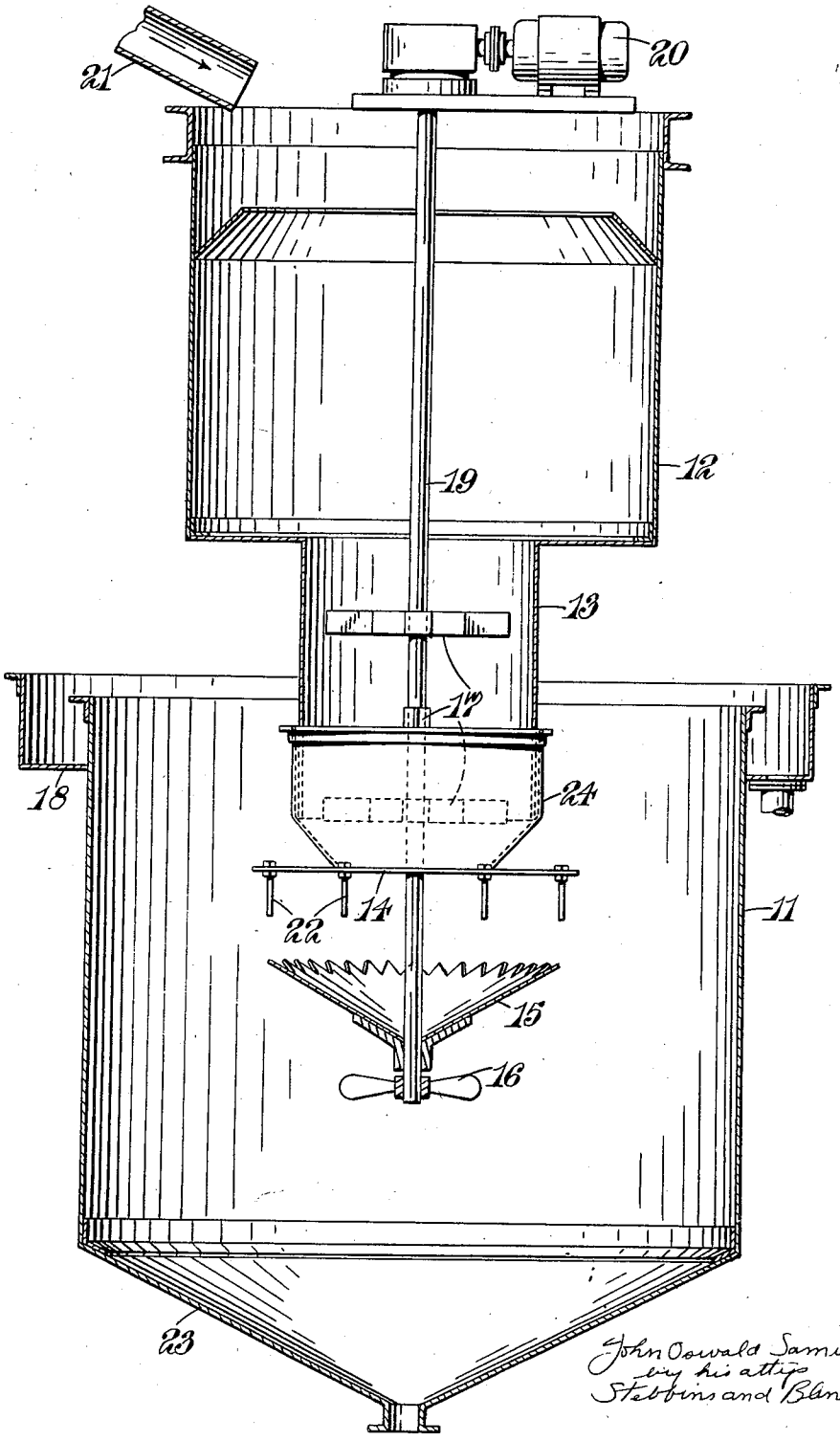
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WASHING OF SAND, GRAVEL, AND THE LIKE

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WASHING OF SAND, GRAVEL, AND THE LIKE

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7 Claims. (Cl. 209—159)

This invention is for improvements in or relating to the washing of sand, gravel and the like. This application corresponds to British application No. 10497/40 filed June 17, 1940.

It is an object of the present invention to clean sand, e. g. foundry sand, gravel or the like and to free them from impurities with which they may be associated. In the case of sand or gravel these impurities may include finely divided clay and other fines occurring with the sand and in its natural state and in the case of foundry sand, the impurities may include core oil or core gum, blacking, coal and coke dust and fine metal oxides or silicides.

It has been found that the amount of fines in used foundry sand tends to increase with use and in order to render this sand suitable for reuse it becomes necessary to remove dirt and fines.

The following analyses give mesh gradings of foundry sand (*a*) before and (*b*) after use and from these analyses it will be seen that the amount of the mesh fractions smaller than 90 IMM have increased:

Analysis (*a*)		Analysis (*b*)	
Mesh	Fraction	Mesh	Fraction
+20 IMM	4.8	+20 IMM	10.1
+30 IMM	14.4	+30 IMM	16.1
+40 IMM	27.5	+40 IMM	24.1
+60 IMM	33.9	+60 IMM	28.2
+90 IMM	16.2	+90 IMM	10.1
+120 IMM	2.6	+120 IMM	5.1
+200 IMM	0.4	+200 IMM	3.4
−200 IMM	0.2	−200 IMM	2.9

One method which has been previously proposed for the washing of such a sand involves screening with a very large volume of water and such a method is not particularly successful and is moreover expensive.

It is an object of the present invention to provide means for the removal of fines and dirt from sand, e. g. used foundry sand, with the use of a comparatively small volume of water.

The invention includes apparatus for washing sand, gravel and the like which apparatus comprises a washing vessel, a feed vessel to receive a mixture of water and of the same to be washed, a conduit leading from the bottom of the feed vessel into the washing vessel, a shaft mounted within the feed and washing vessels into the conduit joining them, at least one impeller within the conduit, a spinner and an impeller within the washing vessel, means for rotating the shaft at high speed and means for introducing a mixture of water and sand into the feed vessel and for collecting water and fines overflowing from the washing vessel and for withdrawing heavier particles from the bottom of the washing vessel.

The rate at which water is passed through the apparatus may be controlled so that the suspended matter in the effluent leaving the apparatus may be flocculated by the process described in British patent specification No. 435,126 or by the use of flocculating gels made in accordance with British patent specification No. 516,294, the clarified water being returned to the washing apparatus.

Again, means may be employed for deflocculation at the cleaning stage, for example the comparatively small amount of water used at the cleaning stage may contain a minute proportion of a deflocculating agent. The arrangement may therefore be that at the cleaning stage deflocculation is assisted whereas at the further stage, namely the treatment of the effluent flocculation agents may be used or means for assisting flocculation.

The accompanying drawing is a diagram in central vertical section of a sand washer embodying this invention.

11 is a cylindrical washing vessel with a conical bottom **23** (Spitzkasten). Around its upper periphery is a launder **18** having an outlet. Inside the vessel **11** and suitably supported therein is a small vessel or conduit **13** in the form of a cylinder or prism opening out at the top into a vessel **12** of larger diameter also in the form of a prism or cylinder and functioning as a feed vessel. At the open bottom of the vessel **13** is a frustoconical base **24** which conveniently takes the form of a partly cylindrical and partly conical vessel embracing the lower part of the vessel **13**. The lower edge of the frustoconical base-piece **24** is attached to an annular plate **14** to which are attached two annular sets of pegs **22** projecting downwardly and arranged in two concentric circles of unequal diameter. The whole of this plate **14** with the pegs **22** and the conical base-piece **24** is adjustable in relation to the vessel **13** and can be moved up or down. Below the pegs **22** is an inverted conical spinner **15** supported on the vertical spindle **19** which has bearings at appropriate positions in the apparatus. The conical spinner **15** has its periphery formed to create a disturbance between the two sets of pegs **22** during the rotation of the spinner **15**. Thus the upper periphery of the cone may have a toothed edge as shown. The conical

spinner 15 can be driven by appropriate means, for example the shaft 19 may be driven by bevel gearing (and reduction gear if desired) from a motor 20 or from other source of power. Mounted on the shaft 19 are radial impellers 17 designed to force the pulp of sand or water radially outwards. The impellers 17 may have curved radial blades shrouded above and/or below with annular plates. At the bottom of the shaft 19 is an impeller 16 so designed and arranged as to direct the liquid stream outwardly and upwardly so that the stream due to the impeller 16 tends to cut across the radially outward stream due to the rotation of the spinner 15. 21 is the inlet for the pulp of water and sand to be cleaned.

The method of working is as follows: The contaminated sand, such as used foundry sand, is mixed with water (preferably water which was used before and has been clarified). A freely flowing mixture is used, conveniently one containing about 0.1 to 0.5% of fines, i. e., of particles which will pass a 200 mesh sieve IMM. The mixture is introduced to the vessel 12 through the inlet 21 while the spindle 19 is revolving and the vessel is full of water. When the spinner 15 gets up to speed, the water is forced by the centrifugal action of the blades 17 against the inside of the conduit 13 and its level steadily rises in the vessel 12. It has been found that for the impellers 17 a peripheral speed of about 300 to 600 feet per minute is required. As the sand continues to enter the conduit 13 it is retained there by the centrifugal action until the falling power exceeds a certain figure when the sand discharges into the spinner 15. Here sand is violently thrown outwardly and upwardly between the pegs 22 and finally the washed sand settles out at the bottom of the tank 11 and is drawn out through the clean sand outlet at the bottom of 23, leaving the fines and impurities to overflow with the water at 18. Normally the volume of overflow would be between 50 and 300 gallons per hour for every square foot of surface. The peripheral speed of the spinner 15 may be of the order of 1100 feet per minute. The spindle 19 may have a speed variable between 50 and 400 R. P. M. In practice a speed of 120 R. P. M. for a spinner diameter of approximately 3 feet and a length for paddles 17 of 2 feet are suitable. The impeller 16 has two functions (1) It creates a swirl in the liquid in the vessel 11 so that the sand settling in 23 is in gentle motion and does not pack. (2) By arranging the impeller 16 to create an upward current the lateral or horizontal current created by the spinner 15 is to some extent neutralised. This upward current assists in ensuring the steady discharge of the fines and impurities to the launder 18.

By the use of the means described and illustrated a washed sand is obtained which has substantially the same characteristics of size and purity as the original sand.

I claim:

1. Apparatus for washing sand, gravel and the like which comprises a washing vessel, a feed vessel arranged above said washing vessel, a conduit connecting the bottom of said feed vessel with the washing vessel, a shaft mounted within the vessel and the conduit, at least one impeller in the conduit, a spinner consisting of a hollow inverted cone having a serrated edge mounted on the shaft in the washing vessel, means for rotating said shaft at high speed, means for admitting a mixture of sand and water to the feed vessel, means for collecting water and fines overflowing from the washing vessel and means for drawing off heavier particles from the said washing vessel.

2. Apparatus for washing sand, gravel and the like which comprises a washing vessel provided with a conical bottom, a feed vessel arranged above said washing vessel, a conduit connecting the bottom of said feed vessel with the washing vessel, a shaft mounted within the vessel and the conduit, at least one impeller in the conduit, a spinner consisting of a hollow inverted cone having a serrated edge mounted on the shaft and an impeller in the washing vessel, means for rotating said shaft at high speed, means for admitting a mixture of sand and water to the feed vessel, means for collecting water and fines overflowing from the washing vessel and means for drawing off heavier particles from the said washing vessel.

3. Apparatus for washing sand, gravel and the like which comprises a cylindrical washing vessel, having a conical bottom, a cylindrical feed vessel arranged above said washing vessel and coaxial therewith, a cylindrical conduit connecting the bottom of the feed vessel with the washing vessel, an annular plate secured at the end of said conduit, at least one circle of vertically disposed pins secured to said annular plate, a shaft mounted within the vessel and the conduit, at least one impeller in the conduit, a spinner in the washing vessel, said spinner consisting of a hollow inverted cone having a serrated edge and mounted on said shaft, means for rotating said shaft at high speed, means for admitting a mixture of sand and water to the feed vessel, means for collecting water and fines overflowing from the washing vessel and means for drawing off heavier particles from the said washing vessel.

4. Apparatus for washing sand, gravel and the like which comprises a washing vessel having a conical bottom and a launder for collecting liquid overflowing from the washing vessel, a feed vessel arranged above the washing vessel and connected thereto by means of a conduit having a frusto conical sleeve adjustably mounted on the end thereof, an annular plate secured to the lower end of said sleeve, two rings of pegs depending from said annular plate, a shaft mounted within the vessel and the conduit, at least one impeller in the conduit, a spinner in the washing vessel, said spinner consisting of a hollow inverted cone having a serrated edge and mounted on said shaft, means for rotating said shaft at high speed, means for admitting a mixture of sand and water to the feed vessel, means for collecting water and fines overflowing from the washing vessel and means for drawing off heavier particles from the said washing vessel.

5. Apparatus for washing sand, gravel and the like which comprises a washing vessel having a conical bottom, a feed vessel arranged above said washing vessel and connected thereto by means of a conduit, a frusto conical sleeve adjustably mounted on the lower end of said conduit, a shaft mounted vertically within washing and feed vessels and the conduit, two impellers mounted on said shaft within the conduit, an impeller mounted at the bottom of the shaft within the washing vessel, a spinner consisting of a hollow inverted cone having a serrated edge secured to the said shaft, means for rotating said shaft at high speed, at least two rings of pegs depending from an annular plate

secured to the lower end of a frusto conical sleeve adjustably mounted at the lower end of the conduit, means for admitting a mixture of sand and water to the feed vessel, means for collecting water and fines overflowing from the washing vessel and means for drawing off heavier particles from the said washing vessel.

6. Apparatus for washing sand, gravel and the like which comprises a cylindrical washing vessel having a conical bottom and a launder to receive liquid overflowing from said washing vessel, a cylindrical feed vessel coaxial with the washing vessel and arranged above said washing vessel, a conduit coaxial with said washing and feed vessels and connecting the feed vessel with the washing vessel, a frusto conical sleeve adjustably mounted at the lower end of said conduit, an annular plate secured at the lower end of said sleeve, two concentric rings of pegs depending from said annular plate, a shaft mounted axially in the washing and feed vessels and the conduit, two impellers mounted on said shaft within the conduit, a third impeller mounted at the lower end of the shaft above the conical bottom of the washing vessel, a spinner consisting of a hollow inverted cone having a serrated edge mounted on said shaft below the rings of pegs and means for rotating the shaft at high speed, means for collecting water and fines overflowing from the washing vessel and means for drawing off heavier particles from the said washing vessel.

7. Apparatus for washing sand, gravel and the like which comprises a washing vessel, a feed vessel arranged above said washing vessel, a conduit connecting the bottom of said feed vessel with the washing vessel, a shaft mounted within the vessel and the conduit, at least one impeller in the conduit, a spinner in the washing vessel, said spinner consisting of a hollow inverted cone having a serrated edge and mounted on said shaft, means for rotating said shaft at high speed so that the impellers have a peripheral speed of the order of 300 to 600 feet per minute and the spinner a peripheral speed of the order of 1100 feet per minute, means for admitting a mixture of sand and water to the feed vessel at a rate between 50 and 300 gallons per hour for every square foot of surface thereof, means for collecting water and fines overflowing from the washing vessel and means for drawing off heavier particles from the said washing vessel.

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