May 31, 1960 E. A. HOBART 2,938,627

APPARATUS FOR DISTRIBUTING AND SEPARATING ORE

Filed Aug. 21, 1956 2 Sheets-Sheet 1

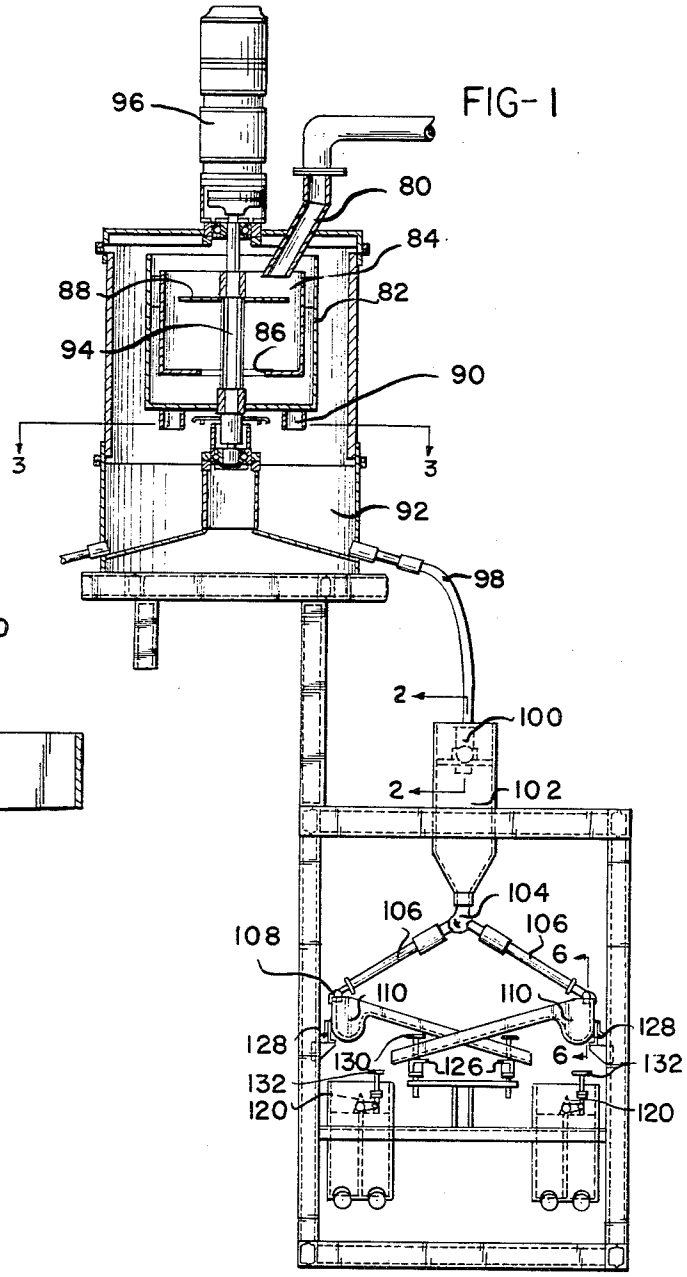


FIG-1

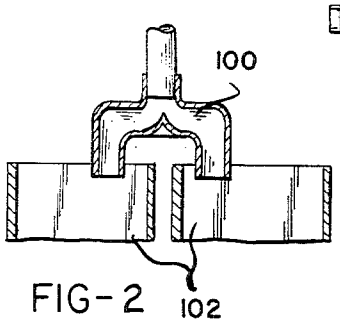


FIG-2

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FIG-3

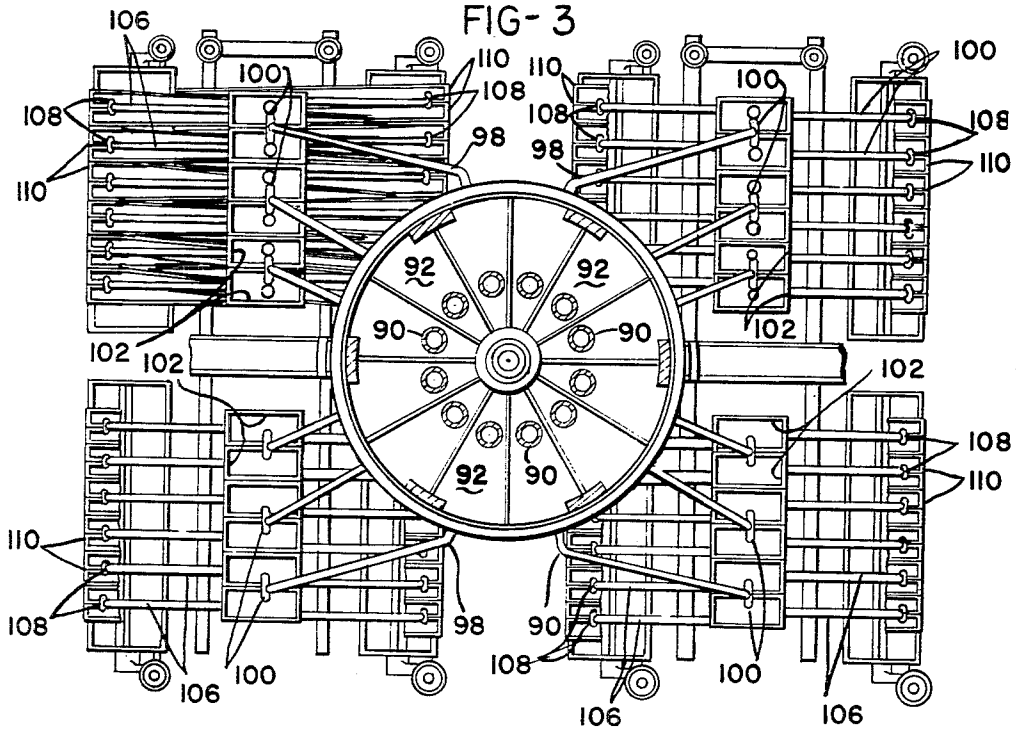
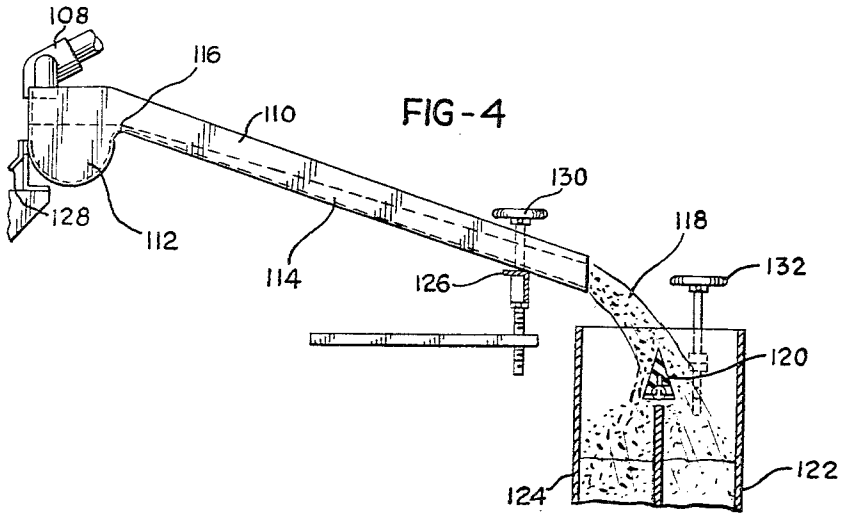


FIG-4



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United States Patent Office 2,938,627 Patented May 31, 1960

2,938,627

APPARATUS FOR DISTRIBUTING AND SEPARATING ORE

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Filed Aug. 21, 1956, Ser. No. 605,310

4 Claims. (Cl. 209—157)

This invention relates to an apparatus for separating ore, particularly finely divided ores such as are entrained in the sands of beaches.

It has been discovered that sand, particularly beach sand, has valuable minerals entrained therein which can be removed from the sand profitably where the volume of sand is sufficient to yield a relatively large return and where the sand can be handled economically and at a rapid rate.

A number of plants have been installed for recovering ore from beach sand and the like, but these plants are generally stationarily situated making it necessary to convey the sand to be processed to the plant and to haul the debris or tailings therefrom.

In the operation of such a plant certain variables must be taken into consideration, such as the feed rate of the sand, the density thereof, and the particular movement which the sand takes at the instant of separation.

In general, all plants, including the arrangement of the present invention, which handle finely divided ores or sand in bulk operate to effect an initial separation of the waste material from the ore bearing portion of the sand by a gravity concentration operation. Thereafter, the valuable content of the ore bearing concentrate can be separated from the bulk of the concentrate by utilizing a high voltage electric field, by utilizing a magnetic field, by further gravity treatment, or by other processes such as by flotation and the like.

It is with the gravity separation that the present invention is particularly concerned.

Due to the variables referred to above that affect the operation of the gravity separator, such separators heretofore, in order to attain a fair degree of efficiency, have been provided with multiple adjustments. It will be evident that with such multiple adjustments any change in the character of the sand being treated, or in the rate of flow thereof, will necessitate excessive readjustment of the device in order to maintain the operating efficiency thereof. Thus, in a plant of large capacity, either the speed of operation of the plant or the efficiency thereof will suffer if there is any variation whatsoever in the nature of the sand being handled or in the flow characteristics thereof.

Having the foregoing in mind, it is a primary object of the present invention to provide an ore concentrator or sand separator of the nature referred to which is rapid in operation and which can be retained in efficient operation without making multiple adjustments in the device.

A further object of the present invention is the provision in a gravity type ore separator of an arrangement insuring substantially uniform flow characteristics of the ore at all times thereby substantially eliminating one of the variables which affect the operation of the usual type gravity separator.

A still further object of the present invention is the provision of a gravity type ore separator which is so constructed that a minimum number of adjustments are required to maintain the separator operating efficiently at all times.

A still further object of the present invention is the provision of an apparatus for distributing the sand or ore and sand mixture to be separated or split into a plurality of separate channels so that the distribution of the ore is uniform to all of the said channels thereby providing for uniform operating conditions in the several channels.

These and other objects and advantages of this invention will become more apparent upon reference to the following specification taken in connection with the accompanying drawings, wherein:

Figure 1 is a vertical sectional view showing a distributing arrangement for ore according to this invention and the manner in which the ore then flows to the sluice;

Figure 2 is a sectional view indicated by line 2—2 on Figure 1 showing a T arrangement for separating the flow of ore from a conduit into two separate hoppers;

Figure 3 is a plan sectional view indicated by line 3—3 on Figure 1 showing the distributor mechanism according to this invention and the manner in which the ore flows therefrom to the several sluices; and

Figure 4 is a side elevational view showing one of the sluices and the divided compartment into which the sluice discharges and the divider member therein separating the discharge from the sluice and also showing the structure for adjusting a bank of sluices in unison.

Referring to the drawings somewhat more in detail, in the arrangement of the present invention, which is principally concerned with the act of separating granular material and the apparatus which specifically cooperates in carrying out this act, the preferred form in which the present invention is employed is that of a barge-type separator although the invention is equally applicable to stationary installation.

One of the particularly troublesome problems encountered in connection with gravity separation of sand is the distribution of the large volume of sand which must be handled to the multiple individual separating stations in such a manner that each of the separating stations will carry its proper load.

The finely divided ore or sand which is to be separated is picked up either from a beach or from beneath the water along a beach or wherever else there is a supply of the material containing sufficient valuable component parts to make it economical to separate the material. The material is first screened to remove rocks and other foreign material and is then delivered to the separating apparatus in the form of a sand-water slurry of a consistency that will permit ready flowability and handling of the material. Normally, the material is processed through a plurality of stages so that the heavy mineral content thereof is progressively concentrated until it reaches a degree of concentration that will permit economical processing of the material through refining stages. The distributing apparatus according to the present invention is useful in connection with all separating stages in an ore or sand separating device of the nature generally referred to.

The manner in which this is accomplished by the present invention, and which is one of the essential features of the disclosed arrangement, is illustrated in the drawings. In Figure 1, which is a section through a typical separating station, the incoming slurry of sand and water is delivered via discharge nozzle 80 into the upper end of a distributing arrangement which comprises a cylindrical vessel 82 within which is mounted a smaller cylindrical vessel 84 having an opening 86 in its bottom wall through which the slurry passes into vessel 82. A baffle plate 88 is positioned so that the slurry from the nozzle 80 must flow thereover, and thereby the slurry is maintained intimately admixed while it is passing through vessel 84 and out opening 86 in the bottom there-

of into vessel 82. Vessel 82 is provided with a plurality of circumferentially spaced discharge nozzles 90 through which the slurry passes so as to drop downwardly into a plurality of circumferentially spaced chambers 92.

In order to provide for uniform distribution of the slurry amongst the chambers 92, while at the same time maintaining the slurry admixed, the vessels 82 and 84 and the baffle plate 88 are connected together and mounted on a drive shaft 94 extending downwardly from a drive motor arrangement 96. Shaft 94 is journalled at its opposite ends in suitable bearing means, and by its rotation provides for absolutely uniform distribution of a uniform mixture of water and sand to the several compartments 92.

The compartments 92 are each provided with a discharge conduit 98, and each discharge conduit leads to a Y discharge fitting 100 (see Figure 2), the two discharge openings of which are arranged to discharge into the adjacently arranged hopper means 102. Since there are twelve of the chambers or compartments 92 it will be evident that there are 24 of the hoppers 102 associated with each distributor head. This will best be seen in Figure 3 wherein the said chambers or compartments and the receiving hoppers and the conduits leading thereto are clearly illustrated.

The hoppers 102 are each provided with discharge fittings 104 at the bottom ends thereof, and each said discharge fitting 104 divides the discharge from the pertaining hopper into two paths, and these are conveyed downwardly and outwardly through the conduits 106. At the lower outer end of each conduit 106 there is a still further flow dividing fitting 108, similar to the one illustrated in Figure 2, which splits the slurry flowing through the pertaining conduit into two paths and delivers this flow into the two adjacently arranged troughs 110.

The actual separation of the sand into its various fractions is now ready to commence. This actual separation is accomplished by causing the slurry of sand and water to flow along an elongated sluice, and during which travel the heavier fraction of the sand will tend to migrate toward the bottom of the stream and the lighter fraction of the sand will tend to migrate toward the upper portion of the stream.

When the stream of slurry is discharged from the sluice it tends to fan out and, by locating a dividing blade at the proper point, the heavier fractions in the stream drop to one side of the dividing blade and the lighter fraction will pass over to the other side whereby a division of the sand, according to weight, is accomplished.

This action, and the construction and arrangement of the sluices and the dividing blade associated therewith, will best be seen in Figure 4 considered in connection with Figure 1.

Each sluice 110 will be seen to comprise a relatively large basin portion 112 that receives the sand-water slurry from the divider fitting 108 toward the rear thereof so that, as the slurry is supplied to the sluice, there is a circulation thereof in the said basin portion that maintains the slurry admixed. Each sluice also comprises a downwardly extending spout portion 114 which, tapers inwardly toward the discharge end. The sand-water slurry overflows from the lip 116 at the forward edge of the basin and establishes a stream that flows downwardly through the spout 114 which narrows as it proceeds, and which narrowing of the stream tends to cause the fanning out thereof as the slurry discharges from the sluice, as indicated at 118.

As has been explained before, there is also a migration of the heavier portion of the sand toward the bottom of the stream and of the lighter portion toward the top of the stream so that, when the fanned out discharge from the sluice is engaged by the rubberlike separator blade 120, the lighter fraction passes over the blade to be received in a hopper 122, while the heavier fraction is delivered to the hopper 124 on the side of blade 120 nearest the sluice.

According to the present invention the distribution of the sand-water slurry and the arrangement of the sluices is such that individual adjustments of the sluices and of the blades 120 associated therewith is not necessary. Rather, it is sufficient for each bank of sluices to rest on an angle 126 adjacent their discharge ends and to be supported on a fixed supporting angle 128 adjacent their receiving ends, the angles 126 are vertically adjustable by the screw and handwheel arrangement 130 to provide for varying the angle of inclination of each bank of sluices as a unit.

Each bank of sluices has associated therewith two hoppers and in each hopper there is at least one dividing blade 120, and each thereof is provided with a screw and handwheel adjustment 132 so that a single adjustment is effective for varying the angle to which the blade 120 is tilted, and thus varying the exact manner in which the fanned-out slurry of sand and water is divided.

It has been found satisfactory to provide merely these two basic adjustments in connection with the apparatus illustrated, and this, of course, greatly simplifies the operation of the device and provides means whereby the character of the separation of the sand can quickly be modified to meet changing conditions, thus providing an arrangement whereby the apparatus is maintained in its highest degree of operating efficiency at all times.

It will be evident that the arrangement described above is adapted not only as a barge-mounted floating apparatus, but could also be employed with a stationary separating apparatus provided the additions for such are economical to deliver the sand to the apparatus to be separated while hauling therefrom the lighter waste fractions.

In any case, the particular advantages of the present invention will obtain that the sand-water slurry being separated could be distributed uniformly throughout the apparatus and maintained intimately admixed at all times, except during the separating operation, and that a minimum number of adjustments would be required for adjusting the apparatus to varying conditions.

It will be evident that most of the individual components of the apparatus, according to the present invention, are relatively small whereby repair, replacement, and modification of the apparatus is quite simple, and the manufacture thereof, the shipping, and the installation thereof is also made relatively easy since no extremely large and bulky components need to be handled.

It will be understood that this invention is susceptible to modification in order to adapt it to different usages and conditions, and accordingly it is desired to comprehend such modifications within this invention as may fall within the scope of the appended claims.

I claim:

1. In a sand separator; a plurality of inclined sluices, slurry supply pipe means leading downwardly to the upper ends of said sluices, a slurry chamber connected to the upper end of each supply pipe means for the gravity supply of slurry thereto, means for supplying an intimately admixed slurry to said chambers and at a uniform rate so the supply to all of the sluices is at the same uniform rate at all times, said slurry chambers being arranged in equally spaced relation adjacent each other in a circular path, the said means for supplying slurry to said chambers comprising a rotary distributor positioned above the chambers on the axis of said path and means for tilting said sluices in unison to vary the angle of inclination thereof and, therefore, the action of the slurry as it flows therealong.

2. In a sand separator; a plurality of inclined sluices

arranged in parallel, slurry chambers located above the sluices and supply pipes leading downwardly from the chambers to the upper ends of the sluices for a continuous supply of slurry thereto, said chambers being arranged in equally spaced relation adjacent each other in a circular path, a rotary distributor vessel positioned above the chambers on the axis of said path and having a plurality of uniformly circumferentially spaced discharge openings in the bottom thereof vertically above said chambers, means for supplying a slurry of sand and water to said vessel at the upper end thereof while simultaneously rotating the vessel whereby the slurry is distributed uniformly amongst the several said slurry chambers, and means for varying the angle of inclination of the sluices in unison to vary the action of the slurry flowing therealong.

3. In a sand separator; a plurality of inclined sluices arranged in parallel, slurry chambers located above the sluices and supply pipes leading from the chambers to the upper ends of the sluices for a continuous supply of slurry thereto, said chambers being arranged in equally spaced relation adjacent each other in a circular path, a rotary distributor vessel positioned above the chambers on the axis of said path and having a plurality of discharge openings in uniformly circumferentially spaced relation in the bottom thereof vertically above said slurry chambers, means for supplying a slurry of sand and water to said vessel at the upper end thereof while simultaneously rotating the vessel whereby the slurry is distributed uniformly amongst the several said slurry chambers, said vessel comprising an inner cylindrical member open at the top and having a bottom wall with an aperture in the center thereof, a circular baffle plate in said inner member adjacent the top thereof the periphery of which is spaced radially inwardly from said inner cylindrical member, said means for supplying the slurry of sand and water discharging against said baffle plate whereby the sand and water slurry is maintained intimately admixed at all times, a common supporting member for the lower ends of said sluices, and means at the ends of the supporting member for adjusting the member vertically in parallelism with itself whereby the angle of inclination of said sluices can be varied by moving the sluices as a single unit.

4. In combination in a sand separating mechanism; a plurality of groups of sluices, the sluice of each group being parallel with all others in said group, said sluices being inclined downwardly toward their one ends and being adapted for receiving a sand-water slurry at their

upper other ends, a plurality of supply hoppers positioned above the sluices, each hopper supplying two conduits at its lower end, each said conduit leading to a different bank of sluices and each conduit at the sluice end delivering to two adjacent sluices, a distributing mechanism located above the hoppers for supplying the sand-water slurry thereto, said distributing mechanism comprising a plurality of circumferentially arranged slurry chambers, a pipe leading from the bottom of each chamber and each pipe supplying two adjacent ones of said hoppers, a cylindrical distributing vessel in the distributing mechanism having a plurality of circumferentially spaced discharge openings located vertically above the slurry chambers, an inner cylindrical vessel inside the distributing vessel open at the top and having a bottom wall with a central aperture which is located radially inwardly from the said discharge openings, a central baffle in said inner vessel adjacent the upper end thereof extending radially outwardly beyond the said opening and spaced radially inwardly from the wall of the inner vessel, a supply conduit arranged to discharge slurry against the top of said baffle, a motor to drive said baffle and vessels in rotation whereby to get a uniform distribution of uniformly admixed slurry into the slurry chambers, and means for adjusting the angle of inclination of all of the sluices in each said bank of said sluices simultaneously and through equal angles.

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