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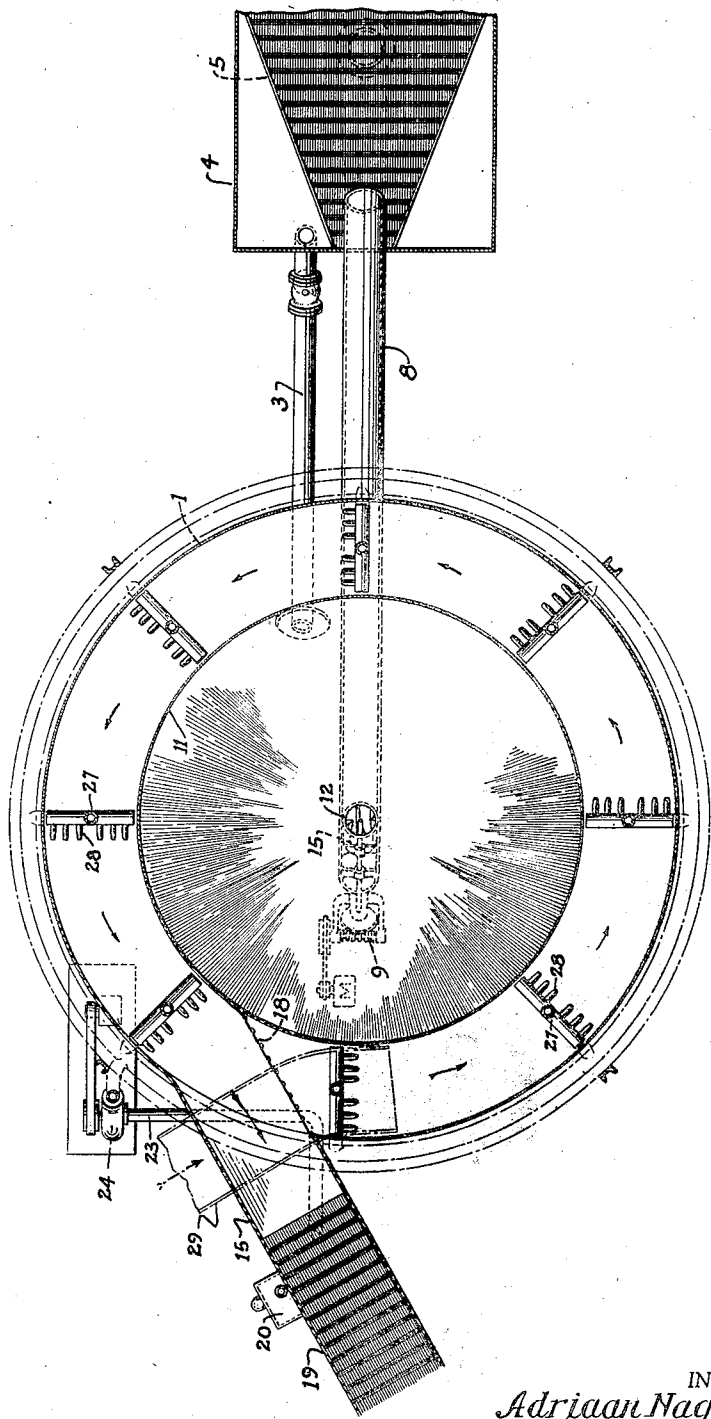
A. NAGELVOORT
CLASSIFICATION SYSTEM

2,228,014

Filed Dec. 13, 1938

4 Sheets-Sheet 1

Fig 1



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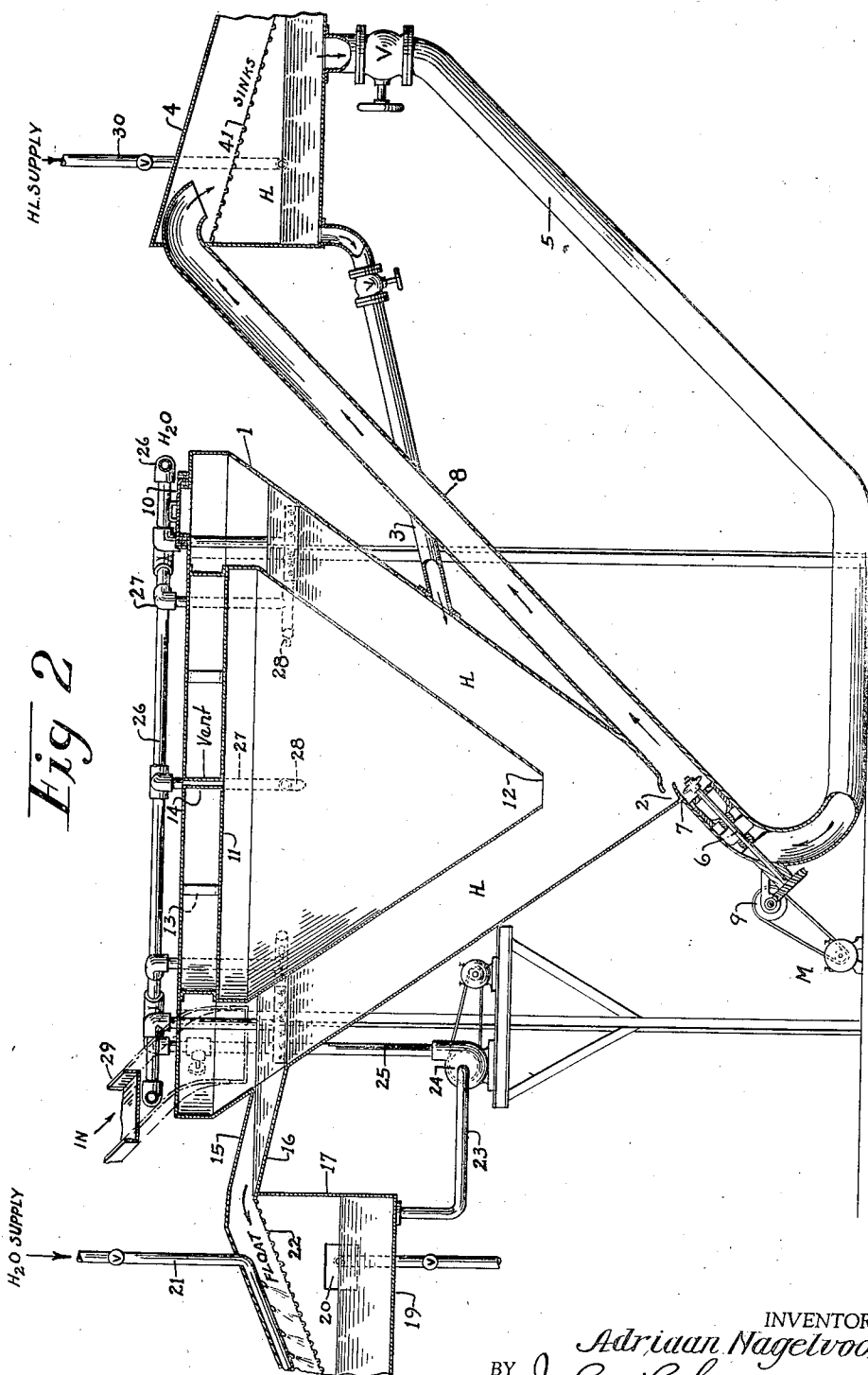
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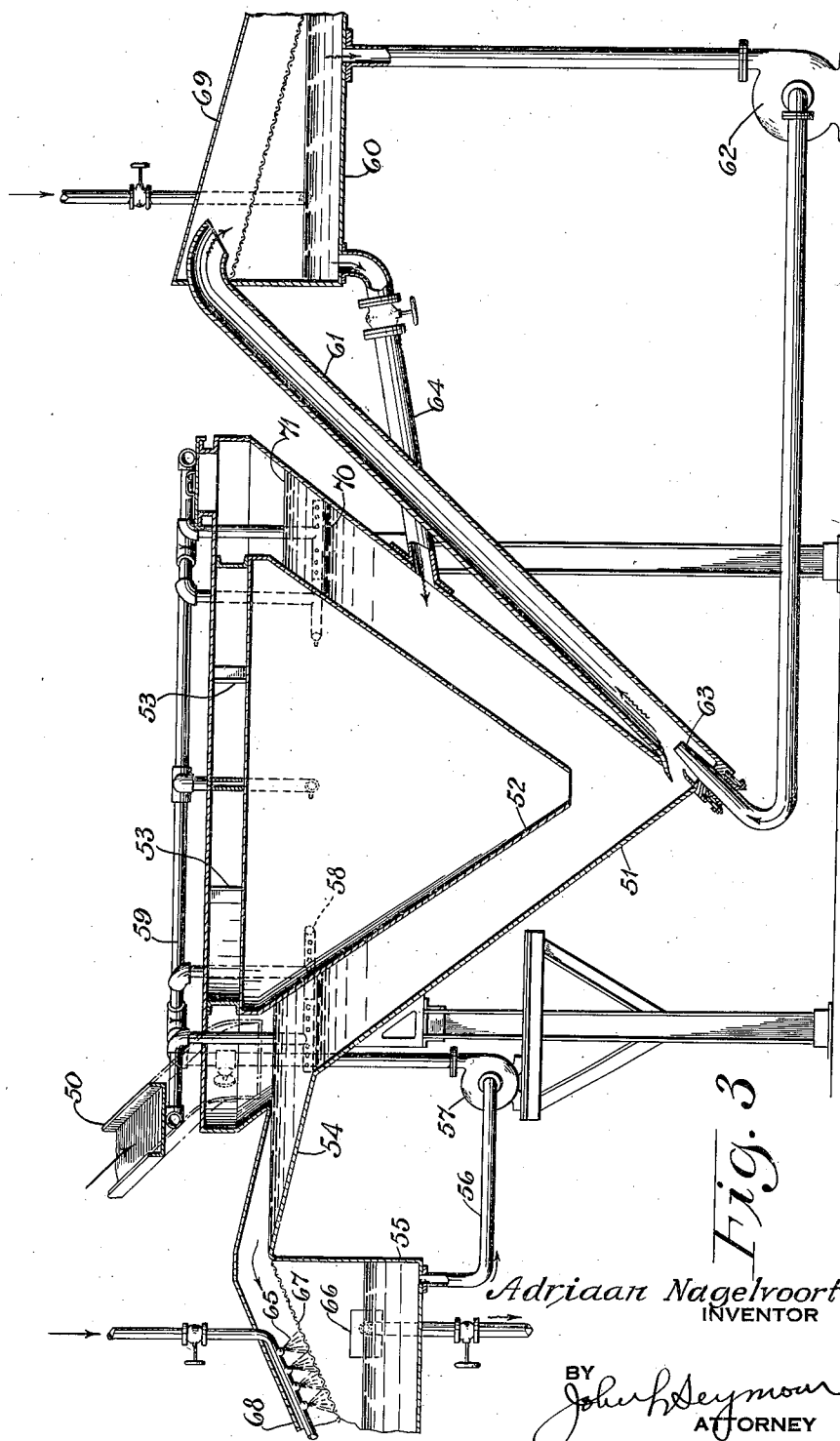
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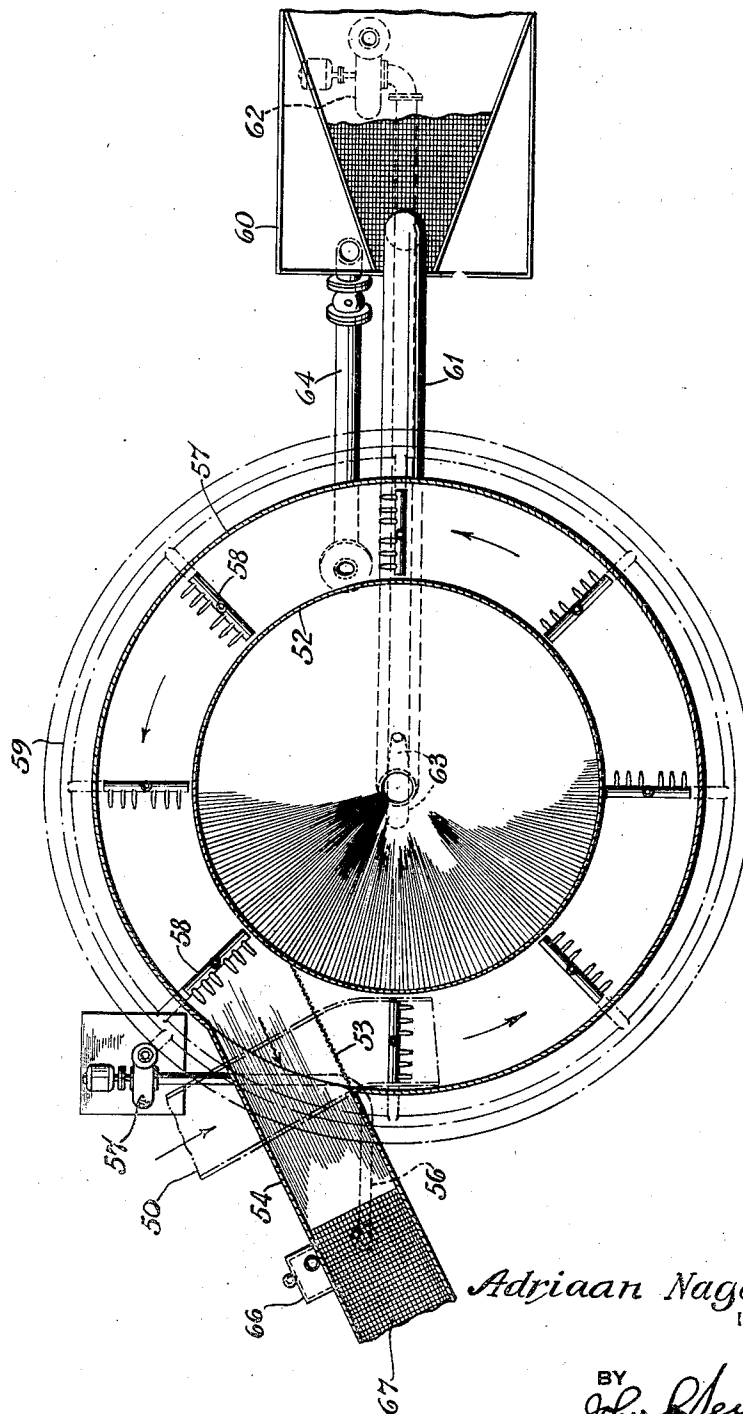
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4 Sheets-Sheet 4



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UNITED STATES PATENT OFFICE

2,228,014

CLASSIFICATION SYSTEM

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Application December 13, 1938, Serial No. 245,413

3 Claims. (Cl. 209—172)

This invention relates to an apparatus for the hydraulic classification of solids of different densities.

It is an object of the invention to separate solids of different specific gravities by the intermediation of a "parting liquid" of intermediate specific gravity and by an apparatus requiring a minimum of moving parts and upkeep.

The objects of the invention are accomplished by the process and apparatus hereinafter described with respect to the accompanying drawings, which are illustrative of the invention but not limitative thereof. The invention will be described in its relation to the separation of coal from slate but it is to be understood that that description is merely illustrative and that the invention can be applied with equal success to the separation of other minerals and other substances.

In the drawings Figure 1 is a plan view partly in section of an apparatus made in accordance with my invention; Figure 2 is a vertical cross section substantially through the center of the machine shown in Figure 1; Figure 3 is a plan view of a modified form of the invention; and Figure 4 is a vertical section substantially through the center of the machine of Figure 3.

Referring to the numerals on the drawings, 1 is a tank comprising an inverted cone; 2 is an opening in the apex of the cone; 3 is a pipe connecting the cone with the discharge tank 4; 41 is an inclined screen beneath the orifice of pipe 8 and above the surface of the liquid in tank 4; V is a valve in the said pipe; 5 is a pipe leading from discharge tank 4 to the pump 6; 7 is a curved perforated partition in the pipe forming in effect an extension of the side wall of the cone; 8 is a pipe connecting the orifice 2 and the pipe 5 with the tank 4; 9 and M are motor means for driving the pump 6, the construction of which is adequately shown in the drawings as a motor driving a worm and wheel through a belt connection, the wheel being carried by the end of a shaft which is mounted in the pipe and carries at its end an impeller. The tank 1 is preferably covered and is provided with water-sealed man-holes 10 at suitable points. 11 is a conical tank within the tank 1; 12 is an orifice connecting the inner and the outer tanks. The inner tank 11 is preferably carried by the outer tank through welded supports 13; 14 is a vent between the inner tank and the atmosphere; 15 is a chute in the side of the tank; 16 is the inclined bottom to the chute; 17 is the end wall of tank 19, the top of which meets the end of weir 16 at substan-

tially its outer extremity; 18 is a screen connecting the tank 11 with the tank 1 as a chord; 19 is a tank connected with the chute 15; 20 is an overflow box to maintain the liquid level in tank 19; 21 are sprays directed at the surface of the screen 22 above the liquid level of tank 19 and connected to the bottom 16 of the chute 15; 23—24—25 are a pump and pipe connecting the tank 19 with the spray system 26, which comprises a pipe 26 about the tank and pipes 27 having nozzles 28 arranged between the inner tank and the outer shell. 29 is a chute to admit solids to the space between the shells of the inner and outer tanks; 30 is a pipe for supplying the tank 4 with parting liquid.

The device functions as follows: Through pipe 30 parting liquid is admitted to the tank 4 and from the tank 4 passes through pipes 3 and 5 to the tank 1, and from thence through opening 12 into the tank 11 from which the air is expressed through the vent 14. The sprays 21 are started and the water is carried from the tank 19 to the sprays 28. The surface of the parting liquid is thereby covered with a layer of water. The parting liquid level is maintained in the system at about the lowest point of the weir 16. The sprays 28 operate at about that level. These sprays set up a circulation in the upper portion of the parting liquid and in the water layer thereabove. The solids which enter through the chute separate according to their gravities. The lighter portion floats and is carried by the moving current of water and the sprays around the circumference of the tank to the neighborhood of the weir 16 where it encounters the screen 18 and is washed over the weir 16 onto the screen 22 where it is subjected to drainage and to a vigorous spraying. The solids which are heavier than the parting liquid sink to the apex of the cone. The pump 6 continuously forces a supply of heavy liquid through the pipe 8 and this flow of fluid past the opening 2 acts as an aspirator into the pipe to force the solids into tank 4 where they are caught on the screen 41 and subsequently washed. The liquid level in the cone is maintained through pipe 3 from tank 4 which acts as a reservoir and by the liquid in interior reservoir 11 which is in connection therewith through orifice 12. In this way the level of the liquid is maintained substantially constant.

In Figures 3 and 4 is shown a number of modifications of the invention. 50 is an ore chute; 51 is a separating tank; 52 is the inner cone of the separating tank having not only an orifice but perforations in its sides; 53 is a baffle be-

tween the tanks; 54 is the concentrate delivery tube; 55 is the heavy liquid collecting tank; 56 is the heavy liquid return tube; 57 is the heavy liquid pump; 58 is the heavy liquid nozzle; 59 is the gangue delivery tube; 60 is the water collecting tank; 61 is the water return tube; 62 is the water pump; 63 is the water nozzle; 64 is the heavy liquid return tube to return to the system the heavy liquid which settles out of the water; 65 are the water sprays; 66 are the water overflow weirs; 67 are the mesh conveyor belts; 68 is the concentrate chute; 69 is the gangue chute; 70 is the heavy liquid level; 71 is the water level.

15 The operation of the modified form of the device is similar to that which was given before except that the liquid injector is used to remove the solids from the separating cone.

20 A particular advantage of the invention lies in the absence of mechanical parts. Another advantage of the invention is that the tanks for holding the heavy liquid can be built without a seam or joint so that leakage from such sources can be eliminated. The principles on which this apparatus works are set forth in the copending application of Alexander, Du Pont and Foulke, Serial No. 177,190. The heavy liquid is constantly circulated and can be cleaned of slimes and middlings by filter pressing or settling in the circuit. The whole can be operated on the surface or can be sealed in to keep fumes enclosed.

30 As many apparently widely different embodiments of this invention may be made without departing from the spirit and scope thereof, it is to be understood that I do not limit myself to the specific embodiments thereof except as defined in the appended claims.

I claim:

1. Apparatus for effecting the hydraulic classification of solids of varying densities which comprises; in combination; an outer conical member adapted to contain a heavy parting liquid; a water layer overlying said parting liquid; hydraulic means for ejecting solids from said outer conical member, said hydraulic ejection means including a pipe opening into the apex of said outer conical member and means to force liquid through said pipe; an inner conical member positioned within said outer conical member in such a manner as to permit communication through its apex between the space within said inner conical member and the space within said outer conical member between its external wall and the wall of said inner conical member; reservoir means to maintain the level of the parting liquid within said outer conical member, said reservoir means including a reservoir within said inner conical member in communication with said outer conical member through the apex of said inner conical member; means to introduce solids to be classified into said parting liquid; means for removing from the apparatus solids which float on said parting liquid, said removal means being arranged adjacent the periphery of said outer conical member and including a weir for removing solids which float on said parting liquid, said floating solids being suspended in said water layer and being adapted to pass over said weir and thence out of said apparatus; and hydraulic means positioned at the interface between said parting liquid and said overlying water layer for forcing solids which

float on said parting liquid out of said outer conical member and thence over said weir and out of said apparatus.

2. Apparatus for effecting the hydraulic classification of solids of varying densities which comprises; in combination; an outer conical member adapted to contain a heavy parting liquid; a water layer overlying said parting liquid; hydraulic means for ejecting solids from said outer conical member, said hydraulic ejection means including a conduit opening into the apex of said outer conical member and means to force liquid through said conduit; an inner conical member positioned within said outer conical member in such a manner as to permit communication through its apex between the space within said inner conical member and the space within said outer conical member between its external wall and the wall of said inner conical member; reservoir means to maintain the level of the parting liquid in said outer conical member, said reservoir means including storage space for heavy liquid within said inner conical member in communication with said outer conical member through the apex of said inner conical member; means to introduce solids to be classified through said overlying water layer into said parting liquid; means for removing from the apparatus solids which float on said parting liquid, said removal means being adapted to remove said floating solids from a point adjacent the periphery of said outer conical member to a point external of said apparatus, said removal means including a weir adjacent the periphery of said outer conical member over which water, together with the solids which float on said parting liquid suspended in said water, move out of said apparatus; and liquid spray means positioned at the interface between said parting liquid and said overlying water layer for forcing solids which float on said parting liquid peripherally of said conical members and thence out of said apparatus over said weir.

3. Apparatus for effecting the hydraulic classification of solids of varying densities which comprises; in combination; an outer conical member adapted to contain a heavy parting liquid; a water layer overlying said parting liquid; hydraulic means for ejecting solids from said outer conical member, said hydraulic ejection means including a conduit opening into the apex of said outer conical member and means to force liquid through said conduit; an inner conical member positioned within said outer conical member; means to introduce solids to be classified through said overlying water layer into said parting liquid; means for removing from the apparatus solids which float on said parting liquid, said removal means being adapted to remove said floating solids from a point adjacent the periphery of said outer conical member to a point external of said apparatus, said removal means including a weir adjacent the periphery of said outer conical member over which water, together with the solids which float on said parting liquid suspended in said water, move out of said apparatus; and liquid spray means positioned at the interface between said parting liquid and said overlying water layer for forcing solids which float on said parting liquid peripherally of said conical members and thence out of said apparatus over said weir.

ADRIAAN NAGELVOORT.