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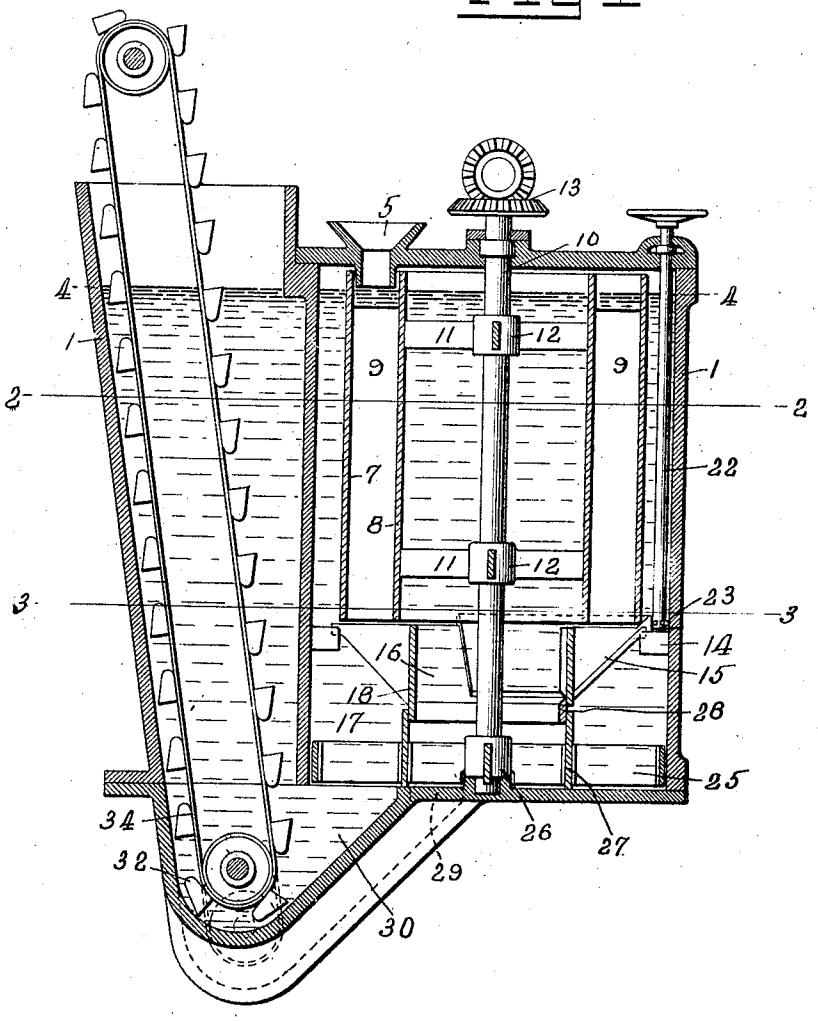
APPARATUS FOR SEPARATING MATERIALS OF DIFFERENT SPECIFIC GRAVITY.

APPLICATION FILED NOV. 1, 1909.

1,046,447. **Patented Dec. 10, 1912.**

2 SHEETS—SHEET 1.

Fig 1



Witnesses

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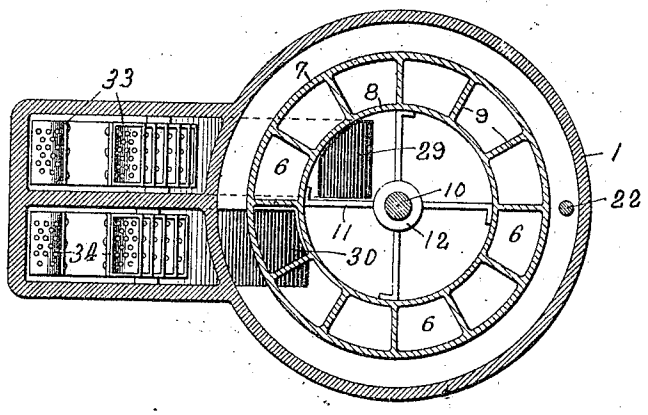
2 SHEETS—SHEET 2.

Fig 2



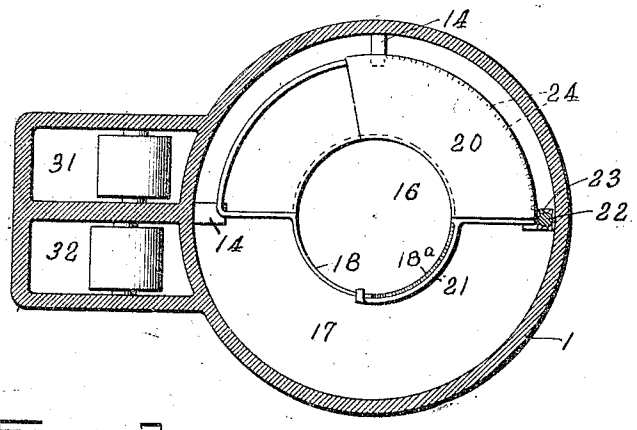


Fig 3

Witnesses

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UNITED STATES PATENT OFFICE.

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APPARATUS FOR SEPARATING MATERIALS OF DIFFERENT SPECIFIC GRAVITY.

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To all whom it may concern:

Be it known that I, GEORGE R. DELAMATER, a citizen of the United States, residing at Strong, in the county of Huerfano and State of Colorado, have invented new and useful Improvements in Apparatus for Separating Materials of Different Specific Gravity, of which the following is a specification.

This invention relates to improvements in apparatus for separating materials of different specific gravity. The chief use contemplated therefor is in coal washing, but it may be employed for concentrating ore, and for separating other materials, and is claimed for all the uses of which it is capable.

As illustrative of the value of the machine: the present general practice of coal-washing involves the employment of an immense quantity of water, an objection which is a very material one, especially in some parts of the United States. Furthermore such coal washing machines require an expenditure of a great deal of power for their operation, and sludge tanks are used for reclaiming the washed coal and refuse from the water employed. In washing coal the object is to save the lighter material and discard the heavier; for instance, the specific gravity of the best grade bituminous coal is from 1.27 to 1.35. Bone coal or coal running quite high in ash is of a specific gravity ranging from substantially 1.35 up to possibly 1.60. Above, say, the specific gravity 1.60 up to 2.50 the material is what is termed slate. Above the specific gravity 2.50 there is rock, iron pyrites, etc. The most general method of separation of these various material is by the utilization of a jig in which the coal is delivered on screens submerged in water. The water is given a pulsating movement upward through the screen by means of plungers, or pulsometer pumps or compressed air, which operate to lift the material on the screen, lifting the lighter material higher than it does the heavier. When the pulsation stops the material settles in water, the heavier material settling faster and reaching the screen first. The heavier materials at the bottom are removed by suitable mechanical means and the lighter materials are carried away by the water to sludge tanks, or similar arrangements, where the coal is elevated from the water, and the water, as a general rule, pumped back into the machine. This is a brief description of a type of ore washing machine in general use, involving the employment of a very large body of water for carrying out the operation. The machine also requires the expenditure of great power for operation, and sludge tanks are utilized.

The object of the present invention is to provide a machine for separation of materials according to their specific gravities, which is simple in construction and mode of operation, requiring but a small body of water for effecting the purpose, which can be operated with a minimum expenditure of power, and which does away altogether with the heretofore usual sludge tanks.

Having these objects in view the invention resides in a machine embodying the features hereinafter described and shown in the accompanying drawings.

That which is new is set forth in the claims appended to the description.

In the accompanying drawings:—Figure 1 is a vertical sectional view through the machine. Fig. 2 is a horizontal sectional view on the line 2—2 of Fig. 1. Fig. 3 is a horizontal sectional view on the line 3—3 of Fig. 1.

In said drawings, the reference numeral 1 designates a vessel filled to the dotted line 4—4 with water, or other suitable liquid of less specific gravity than the material to be separated, and into which leads a hopper 5 for the introduction of material to be separated.

The numerals 6 designate a series of vertically arranged open-ended settling chambers filled with a substantially quiescent column of the liquid in the tank to the line 4—4, through which liquid in said chambers the material to be separated gravitates, and in so doing the heavier material moves with greater facility than the lighter material. The series of settling chambers 6 are caused to pass, in succession, beneath the feed hopper 5 to receive their charges of material to be separated.

The invention may be realized by moving the settling-chambers in a rectilinear path while the material is gravitating therethrough, but I prefer that they move through a circuit path so that the operation

may be continuous, and, therefore, in the drawing have shown an arrangement wherein there is a circuit of such settling-chambers, as also best shown in Fig. 2. In the organization illustrated in the drawing, the settling chambers are constructed of separated vertical cylinders 7, 8, the annular space between the cylinders being divided at suitable intervals by means of partitions 9, whereby a circular series of settling-chambers are provided. The chambers are connected to a shaft 10 arranged in the vessel 1, in any suitable way, such as by means of spiders 11, radiating from hubs 12 secured to said shaft and connected to the inner cylinder 7. This shaft may be rotated by suitable gearing 13 from any desired source of power, and the chambers are thus caused to pass in succession beneath the feed-hopper 5 to receive their respective charges of material to be separated, and then moved to discharge the material, the heavier, first emerging, material being deposited at one place, and the lighter material coming after, at another. To direct the material as it emerges from said settling-chambers into different channels, the heavier material into one channel, and the lighter material into a different channel, I provide suitable means located beneath the settling-chambers and have illustrated that which I regard as the preferable arrangement for this purpose, and this means, as shown, is arranged to conform to the circularly arranged series of settling chambers.

Suitably supported in the tank 1, by means of lugs 14, is a shed 15, over which the series of settling chambers pass during, preferably, about one half of their circuit of movement. This shed, as shown, has a sloping or inclined surface leading to a central receptacle 16. The remaining space, over which the settling chambers pass, constitutes a receptacle 17, separated from the central one 16, by a vertical wall 18, so that material passing from the settling chambers during one part of the circuit of movement passes into the chamber 17 and during another part of the circuit of movement into the chamber 16. The wall 18 that separates the chambers 16 and 17 may be conveniently formed integral with the shed 15, as best shown in Fig. 3. According to the preferred arrangement shown, the heavier material as it passes from the settling chambers falls into the receptacle 17 and the lighter material falls upon the sloping shed 15 and is conducted thereby into the central chamber 16. It is obvious, however, that the arrangement may be reversed so that the shed will extend beneath the settling chambers during that portion of their movement in which the heavier material passes therefrom, in which event, the heavier material would be discharged into the central chamber, and the lighter material later on, pass into the chamber 17. The velocity of passage through the columns of water in the settling chambers of the materials of different specific gravity are known, and it is therefore merely a matter of calculation what shall be the extent or length of the shed 15 and the speed of movement of the settling chambers to insure that the heavier material shall pass into its appropriate receptacle and the lighter material into its appropriate receptacle.

To meet possible conditions in the use of the machine, for example if it be desired that bone-coal shall go with bituminous coal, I have arranged that the shed 15 may cover a greater area, and one suitable way to accomplish this is shown in the drawing, wherein an extensible shed-section 20 rests upon the shed 15 and is capable of being projected from one end thereof to increase the length of the shed leading into the central chamber 16, and correspondingly reduce the effective length of the receptacle 17. When such adjustable shed section is embodied in the machine, the vertical wall 18 separating the receptacle 16 from the receptacle 17 is cut away, as best shown at 18^a in Fig. 3, through an area corresponding to the inner edge of the adjustable shed-section, in order that said section, when projected, may lead material falling thereon into the central receptacle. That the division between the receptacles 16 and 17 may be complete when the extensible or adjustable shed section is not in use as a prolongation of the shed, a movable wall 21 is connected to the extensible shed-section (Fig. 3) to cover the cut-away portion of the wall 18. The movable shed section may be projected and retracted by any suitable means. I have shown one such as consisting of a spindle 22, provided with teeth 23 to engage in recesses 24 in the edge of the shed section 20.

At the bottom of the receptacles 16 and 17 is arranged a discharge device to discharge heavier material in the receptacle 17 and the lighter material in the central receptacle 16 out of the machine through separate passages. A suitable, and that which I regard as preferable, discharge device, consists of arms 25 extending radially from a hub 26 secured to and rotating with the shaft 10 and provided with a sleeve 27 which overlaps the division walls and the movable wall-section 21, if the latter be used, and a ring 28, Fig. 1, carried by the wall 18′ to completely separate the receptacles 16 and 17. This discharge device, upon rotation of the arms, carries the material in the respective receptacles to and discharges the same into separate passages 29 and 30 leading from the machine. As shown these passages lead into the boots 31, 32, of elevators, by which the material is conveyed away, if desired, to

bins. The elevators may be of the bucket type, and are shown conventionally in the drawing, and numbered 33 and 34. Since the elevator boots are filled with water to the line 4—4 the buckets, preferably, are perforated so that the water will discharge therefrom into the body of water in the elevator boots.

The machine is very simple in respect of the principle of separation employed, is economical of water, requiring only that amount necessary to fill the apparatus, the operation of separation is carried on while the water is in a quiescent state, dispensing altogether with water-moving power and appliances, and with sludge tanks.

In operation, referring to the preferred embodiment of the invention illustrated, the tank 1 is substantially filled with water, material to be separated is introduced into the bodies of water contained in the several settling chambers, as they come successively into material receiving position. The settling-chambers are revolved slowly, probably not exceeding fifty revolutions per minute, and in the moving, within themselves quiescent, bodies of water therein the material settles by gravity, the heavier material sinking more rapidly than the lighter, and passing from the settling chambers in advance of the lighter material. The heavier material falls into one receptacle and farther on in the travel of the settling-chambers the lighter material passes therefrom into a separate receptacle, from which receptacles the separated material is discharged from the machine through separate channels. Throughout the operation water is not permitted to overflow from the machine at any point, and the water in the tank and in the settling-chambers is not disturbed by the movement of the chambers, but is quiescent, allowing the separation, by settling, to take place without any disturbing influence. No water is lost except possibly such small amount that may adhere to the material removed by the elevators, and by arranging that the bins into which the elevators deliver shall return the drippings to the machine, the loss of water will be comparatively negligible.

Having thus described the invention, what I claim is:—

1. In a machine for separating materials of different specific gravities, a tank, a circuit of settling chambers therein, arranged in and substantially filled with quiescent liquid of less specific gravity than such material, means for feeding material to said chambers, means for moving said chambers, a receptacle in communication with said chambers during one part of the movement thereof, a receptacle in communication with said chambers during another part of the movement thereof, and means for varying the area of said receptacles in the direction of travel of said chambers.

2. In a machine for separating materials of different specific gravities, a tank, a circuit of non-communicating settling chambers therein arranged in and substantially filled with a quiescent and non-circulating liquid of less specific gravity than said materials, means for feeding materials to said chambers, means for moving said chambers below said feeding means, a central receptacle beneath said chambers, and a sloping shed interposed between said chambers and a part of the receptacle to receive a separated portion of the materials and direct the same to the central receptacle.

3. In a machine for separating materials of different specific gravities, a tank, a circuit of settling chambers therein, arranged in and substantially filled with liquid of less specific gravity than such material, means for feeding material to said chambers, means for revolving said chambers, a central and a concentrically arranged annular receptacle beneath said chambers, a sloping shed interposed between said chambers and a part of the annular receptacle and leading to the central receptacle, and an extensible shed section adapted to be projected to enlarge the shed and decrease the effective extent of the annular receptacle.

4. In a machine for separating materials of different specific gravities, a tank, a circuit of non-communicating settling chambers arranged therein and substantially filled with a quiescent non-circulating liquid of less specific gravity than said materials, means for feeding the materials to said chambers, a plurality of receptacles located beneath said chambers, means for moving said chambers with relation to said feeding means and said receptacles to discharge the separated materials in the order of their specific gravities into said receptacles, and an adjustable shed section adapted to vary the proportionate areas of the surfaces on which the separated materials fall.

5. In a machine for separating materials of different specific gravities, a receptacle having separate compartments to receive the separated materials and an adjustable shed section adapted to vary the proportionate areas of the surfaces on which the separated materials fall.

6. In a machine for separating materials of different specific gravities, a tank, a circuit of non-communicating settling chambers arranged therein and substantially filled with a quiescent and non-circulating liquid of less specific gravity than said materials, means for feeding the materials to said chambers, a plurality of receptacles located beneath said chambers, means for moving said chambers with relation to said feeding means and said receptacles to dis-

charge the separated materials in the order of their specific gravities into said receptacles, elevator boots communicating respectively with said receptacles, and means operated by the movement of the chambers for removing the separated materials from said receptacles into the elevator boots.

In testimony whereof I have hereunto set my hand in presence of two subscribing witnesses.

GEORGE R. DELAMATER.

Witnesses:

ALBERT G. GRIESBACH,

CHAS. D. FRIDRICH.